The Nautical Almanac 2017

TheNauticalAlmanac.com

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Acknowledgment and Credits

Dr. Enno Rodegerdts

The Nautical Almanac *Daily Pages* and Sun Almanacs found on our site were originally created from PyAlmanac written by the great Norwegian sailor Enno Rodegerdts. PyAlmanac used PyEphem to generate the almanacs and LaTex provided the final formatting. Visit Dr. Rodegerdts site and learn of his voyages at https://sv-inua.net/

Without his work TheNauticalAlmanac.com wouldn't exist.

Andrew Bauer

Mr. Bauer has taken the initial work of Dr. Rodegerdts and improved it to the excellence found in the following Daily Pages. Attending foremost to the accuracy of data and then formatting Mr. Bauer created SkyAlmanac which draws from Brandon Rhodes work *Ephem* and *Skyfield* and provides a clear arrangement of figures required for celestial navigation. To that end his work was determined, tireless and efficient. In our mutual writing across many lines of longitude he has always been pleasant, friendly and most affable.

As he has said, *"The art of celestial navigation should be promoted, not discouraged, even in the modern day".*

To both of these men we all owe a large debt of gratitude and thanks

Disclaimer and Warning

Prior to use verify the accuracy of The Nautical Almanac or data you download from our site. They SHOULD NOT and MUST NOT be relied upon for celestial navigation work of any sorts or any purpose whatsoever. You use them at your own risk or peril.

Errors & Corrections

Contact us if you find any significant errors and describe the correction that should be made.

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Explanation of The Nautical Almanac *Daily Pages*

1	Date and Time based on GMT/UT
2	**Mer. pass**- meridian passage of Aries at the Prime Meridian- Greenwich- 0°. Time figure is GMT/UT.
3	Planet or Moon GHA **v** value and planet or Moon declination **d** value. **v**- "The change in hour angle arising from v of the body at the time of the sight observation is accounted for with the *v correction*." *Source- Bowditch 2017, Chapter 19- Sight Reduction p. 313.* The planet's **v** is positive unless preceeded by a minus sign which is sometimes the case with Venus. The sign of the Moon's **v** is positive. **d**- "The change in declination of the body at the time of the sight observation is accounted for with the *d correction*." *Source- Bowditch 2017, Chapter 19- Sight Reduction p. 313.* The sign of the Moon or planet's **d** correction is determined by the declination trend- positive if successive declination values increase and negative if they decrease. Corrections for both **v** and **d** are found in the Increments and Corrections pages of The Nautical Almanac. To find the correction for either **v** or **d** enter the Increments and Corrections pages for the minutes in time of the observation and find the value in the **v and d corr.** columns Find the **v**, or **d**, value in the left side of one of the three columns. To the right of that value is the **v**, or **d**, correction. Be sure to add or subtract the values depending upon the *sign* of the value as mentioned above.
	Example for v & d correction- June 10, 2020 GMT- 21:19:10 Body- Moon
	GHA= 247° 20.4′ ***v =*** 12.1′ GHA increment 4° 34.4′ ***v-*** correction for 12.1′ + 0° 03.9′ GHA= 251° 58.7′ Dec= S 17° 43.8′ **d**= 8.9′ **d-** correction for 8.9′ – 0° 02.9′ dec= S 17° 40.9′ *declination trend is decreasing so the sign of d correction is negative*
4	**m**- is the *magnitude* or brightness of the planet. A bright planet will have a *minus* sign beside the figure. A fainter planet will have no sign beside its magnitude figure.
5	**Stars**- **SHA**, *Sidereal Hour Angle*, and **Declination**. 59 stars are listed. Typically, only 57 stars are used for navigational purposes in both Northern and Southern Hemispheres. Here you'll also find Polaris and Scheat. In the Northern Hemisphere Polaris is often used for determination of latitude.
6	**Mer. pass**- planet meridian passage time at the Prime Meridian- Greenwich- 0°. Time figure is GMT/UT.
7	**SHA**- planet SHA. Planet SHA is calculated by subtracting Aries GHA from planet GHA. If planet GHA figure is less than Aries GHA, add 360° to planet GHA and then subtract Aries GHA.
8	**Horizontal parallax**- for Venus and Mars. Horizontal parallax is the angle subtended by half the Earth's diameter as viewed from the planet in minutes of arc.
9	**SD**- Semi-diameter of the Sun in minutes of arc. One half of the angular width of the Sun as observed on earth.

10	**d**- the daily average change, per hour, in the Sun's declination in minutes of arc.
11	**SD**- Semi-diameter of the Moon in minutes of arc. Semi-diameter is one half of the angular width of the Moon, as observed on earth.
12	**HP**- the angle between two lines, one from the center of the Moon to the center of the Earth, the other from the center of the Moon to the edge of the Earth. This angle is about 56', but it changes slightly from day to day as the distance to the Moon changes along its elliptical path around the Earth. *Source- starpath.com*
13	**Sun- Eqn. of Time**- Basically the Equation of Time (EoT) is the difference between clock time and time seen on a sundial. This is comparing "clock time", as a mechanical measurement of time, and the sundial being time determined by the position of the Sun at any given moment. The figures listed are for 00^h and 12^h. Using the EoT you can get fairly accurate determination of when Meridian Passage (Local Apparent Noon) occurs at your position. Unshaded EoT values are subtracted from 12:00 to get Meridian Passage. Shaded EoT values are added to 12:00 to get Meridian Passage. An Equation of Time chart (as a curve) is provided in each almanac on TheNauticalAlmanac.com **Example**- Meridian Passage on May 30, 2020 equals 12:00 – EoT of 2 minutes 21 seconds MP= 11:57:39 *Local Apparent Noon* **Example**- Meridian Passage on August 25, 2020 equals 12:00 + EoT of 1 minute 59 seconds MP= 12:01:59 *Local Apparent Noon*
14	**Sun- Mer. Pass** just to the right of the **Eqn. of Time** is the approximate GMT/UT when the Sun crosses The Prime Meridian (at Greenwich) for that specific date.
15	**Moon- Mer. Pass**- is the approximate GMT/UT when the Moon crosses The Prime Meridian (at Greenwich) or the 180° line of longitude. **Upper** means the GMT/UT when the Moon crosses The Prime Meridian (Greenwich). **Lower** means the GMT/UT when the Moon crosses the 180° line of longitude.
16	**Moon- Age**- this is the number of days past a new Moon. Typically, there are 29 days in a lunar month. Moon- %- the amount of the Moon's illumination. 100% would be a full moon. 49% would be about ½ of the Moon is illuminated. A 3 day range percentage is provided but only one graphic for the phase.
17* see notes at bottom	**(morning) Twilight- Naut.**- the approximate GMT/UT when morning Nautical Twilight begins. Nautical twilight is the time when the center of the sun is 12° below the horizon and the horizon is visible enough to be used for marine sextant observations. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(morning) Twilight- Civil-** the approximate GMT/UT of morning civil twilight starts when the geometric center of the sun is 6° below the horizon. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* *see* notes *at bottom*	**Sunrise**- the approximate GMT/UT when the Sun is 0° 50' (semi-diameter plus refraction) below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.

17* see notes at bottom	**Sunset**- the approximate GMT/UT when the Sun is 0° 50' (semi-diameter plus refraction) below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(evening) Twilight- Civil-** the approximate GMT/UT of evening civil twilight that ends when the geometric center of the sun is 6° below the horizon. First locate your approximate Latitude in the **Lat**. column and then follow across horizontally to the right to find the time.
17* see notes at bottom	**(evening) Twilight- Naut.**- the approximate GMT/UT of when evening Nautical Twilight ends. Nautical twilight is the time when the center of the sun is 12° below the horizon and the horizon is no longer visible enough to be used for sextant observations. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time.
18* see notes at bottom	**Moonrise**- the approximate GMT/UT when the Moon is about 0° 05' to 0° 10' below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time under the specific day.
18* see notes at bottom	**Moonset**- the approximate GMT/UT when the Moon is about 0° 05' to 0° 10' below the horizon. First locate your approximate Latitude in the Lat. column and then follow across horizontally to the right to find the time under the specific day.

* Note-

▭ means the Sun or Moon remains continuously above the horizon on that day.

–:– can also mean twilight lasts all night

▬ means the Sun or Moon remains continuously below the horizon on that day.

–:– means Moon does not rise or set on that day but may have risen or set the previous day or following day.

* **Note**- Time of Sunrise, Sunset, Moonrise, Moonset and twilight is based on GMT/UT of the event at 0° (Greenwich) and can be condsidered as approximate LMT (Local Mean Time) with a tolerance of +/- 30 minutes depending on where you are within a time zone.

January 01, 02 ,03 (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	100°32.5	181°58.1	S23°38.5	318°04.0	N18°45.1	131°37.2	S13°36.5	275°29.9	N00°18.5
1	115°35.0	196°57.1	38.4	333°06.8	45.4	146°39.2	36.4	290°32.3	18.5
2	130°37.4	211°56.1	38.3	348°09.6	45.6	161°41.2	36.2	305°34.7	18.5
3	145°39.9	226°55.1	·· 38.2	3°12.4	·· 45.8	176°43.2	·· 36.0	320°37.1	·· 18.5
4	160°42.4	241°54.2	38.1	18°15.2	46.0	191°45.1	35.8	335°39.5	18.5
5	175°44.8	256°53.2	38.0	33°18.1	46.2	206°47.1	35.7	350°41.9	18.5
6	190°47.3	271°52.2	S23°37.9	48°20.9	N18°46.5	221°49.1	S13°35.5	5°44.3	N00°18.5
7	205°49.8	286°51.3	37.8	63°23.7	46.7	236°51.1	35.3	20°46.7	18.5
8	220°52.2	301°50.3	37.7	78°26.5	46.9	251°53.0	35.1	35°49.2	18.5
9	235°54.7	316°49.3	·· 37.6	93°29.4	·· 47.1	266°55.0	·· 35.0	50°51.6	·· 18.4
10	250°57.2	331°48.4	37.5	108°32.2	47.3	281°57.0	34.8	65°54.0	18.4
11	265°59.6	346°47.4	37.4	123°35.0	47.6	296°59.0	34.6	80°56.4	18.4
12	281°02.1	1°46.4	S23°37.3	138°37.9	N18°47.8	312°00.9	S13°34.4	95°58.8	N00°18.4
13	296°04.5	16°45.5	37.2	153°40.7	48.0	327°02.9	34.3	111°01.2	18.4
14	311°07.0	31°44.5	37.1	168°43.5	48.2	342°04.9	34.1	126°03.6	18.4
15	326°09.5	46°43.5	·· 37.0	183°46.4	·· 48.5	357°06.8	·· 33.9	141°06.0	·· 18.4
16	341°11.9	61°42.6	36.9	198°49.2	48.7	12°08.8	33.7	156°08.4	18.4
17	356°14.4	76°41.6	36.8	213°52.0	48.9	27°10.8	33.6	171°10.8	18.4
18	11°16.9	91°40.6	S23°36.7	228°54.9	N18°49.1	42°12.8	S13°33.4	186°13.2	N00°18.3
19	26°19.3	106°39.6	36.5	243°57.7	49.4	57°14.7	33.2	201°15.7	18.3
20	41°21.8	121°38.7	36.4	259°00.6	49.6	72°16.7	33.0	216°18.1	18.3
21	56°24.3	136°37.7	·· 36.3	274°03.4	·· 49.8	87°18.7	·· 32.9	231°20.5	·· 18.3
22	71°26.7	151°36.7	36.2	289°06.3	50.0	102°20.7	32.7	246°22.9	18.3
23	86°29.2	166°35.8	36.1	304°09.1	50.3	117°22.6	32.5	261°25.3	18.3
Mer.pass.:17:14		v-1.0 d0.1 m-3.8		v2.8 d0.2 m-0.7		v2.0 d0.2 m-2.0		v2.4 d-0.0 m0.9	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	101°31.7	181°34.8	S23°36.0	319°12.0	N18°50.5	132°24.6	S13°32.3	276°27.7	N00°18.3
1	116°34.1	196°33.8	35.8	334°14.8	50.7	147°26.6	32.2	291°30.1	18.3
2	131°36.6	211°32.9	35.7	349°17.7	51.0	162°28.6	32.0	306°32.5	18.3
3	146°39.0	226°31.9	·· 35.6	4°20.5	·· 51.2	177°30.5	·· 31.8	321°34.9	·· 18.3
4	161°41.5	241°30.9	35.5	19°23.4	51.4	192°32.5	31.6	336°37.3	18.2
5	176°44.0	256°30.0	35.3	34°26.2	51.6	207°34.5	31.5	351°39.8	18.2
6	191°46.4	271°29.0	S23°35.2	49°29.1	N18°51.9	222°36.4	S13°31.3	6°42.2	N00°18.2
7	206°48.9	286°28.0	35.1	64°31.9	52.1	237°38.4	31.1	21°44.6	18.2
8	221°51.4	301°27.1	34.9	79°34.8	52.3	252°40.4	30.9	36°47.0	18.2
9	236°53.8	316°26.1	·· 34.8	94°37.7	·· 52.6	267°42.4	·· 30.8	51°49.4	·· 18.2
10	251°56.3	331°25.1	34.7	109°40.5	52.8	282°44.3	30.6	66°51.8	18.2
11	266°58.8	346°24.2	34.5	124°43.4	53.0	297°46.3	30.4	81°54.2	18.2
12	282°01.2	1°23.2	S23°34.4	139°46.3	N18°53.3	312°48.3	S13°30.2	96°56.6	N00°18.2
13	297°03.7	16°22.2	34.3	154°49.1	53.5	327°50.2	30.1	111°59.1	18.2
14	312°06.1	31°21.3	34.1	169°52.0	53.7	342°52.2	29.9	127°01.5	18.2
15	327°08.6	46°20.3	·· 34.0	184°54.9	·· 54.0	357°54.2	·· 29.7	142°03.9	·· 18.1
16	342°11.1	61°19.3	33.8	199°57.7	54.2	12°56.2	29.5	157°06.3	18.1
17	357°13.5	76°18.4	33.7	215°00.6	54.4	27°58.1	29.3	172°08.7	18.1
18	12°16.0	91°17.4	S23°33.6	230°03.5	N18°54.7	43°00.1	S13°29.2	187°11.1	N00°18.1
19	27°18.5	106°16.5	33.4	245°06.4	54.9	58°02.1	29.0	202°13.5	18.1
20	42°20.9	121°15.5	33.3	260°09.3	55.1	73°04.0	28.8	217°16.0	18.1
21	57°23.4	136°14.5	·· 33.1	275°12.1	·· 55.4	88°06.0	·· 28.6	232°18.4	·· 18.1
22	72°25.9	151°13.6	33.0	290°15.0	55.6	103°08.0	28.5	247°20.8	18.1
23	87°28.3	166°12.6	32.8	305°17.9	55.9	118°09.9	28.3	262°23.2	18.1
Mer.pass.:17:11		v-1.0 d0.1 m-3.8		v2.9 d0.2 m-0.8		v2.0 d0.2 m-1.9		v2.4 d-0.0 m0.9	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	102°30.8	181°11.6	S23°32.7	320°20.8	N18°56.1	133°11.9	S13°28.1	277°25.6	N00°18.1
1	117°33.3	196°10.7	32.5	335°23.7	56.3	148°13.9	27.9	292°28.0	18.1
2	132°35.7	211°09.7	32.4	350°26.6	56.6	163°15.9	27.8	307°30.4	18.1
3	147°38.2	226°08.7	·· 32.2	5°29.4	·· 56.8	178°17.8	·· 27.6	322°32.9	·· 18.0
4	162°40.6	241°07.8	32.0	20°32.3	57.0	193°19.8	27.4	337°35.3	18.0
5	177°43.1	256°06.8	31.9	35°35.2	57.3	208°21.8	27.2	352°37.7	18.0
6	192°45.6	271°05.8	S23°31.7	50°38.1	N18°57.5	223°23.7	S13°27.0	7°40.1	N00°18.0
7	207°48.0	286°04.9	31.6	65°41.0	57.8	238°25.7	26.9	22°42.5	18.0
8	222°50.5	301°03.9	31.4	80°43.9	58.0	253°27.7	26.7	37°44.9	18.0
9	237°53.0	316°03.0	·· 31.2	95°46.8	·· 58.2	268°29.6	·· 26.5	52°47.4	·· 18.0
10	252°55.4	331°02.0	31.1	110°49.7	58.5	283°31.6	26.3	67°49.8	18.0
11	267°57.9	346°01.0	30.9	125°52.6	58.7	298°33.6	26.2	82°52.2	18.0
12	283°00.4	1°00.1	S23°30.7	140°55.5	N18°59.0	313°35.5	S13°26.0	97°54.6	N00°18.0
13	298°02.8	15°59.1	30.6	155°58.4	59.2	328°37.5	25.8	112°57.0	18.0
14	313°05.3	30°58.1	30.4	171°01.3	59.5	343°39.5	25.6	127°59.4	18.0
15	328°07.8	45°57.2	·· 30.2	186°04.2	·· 59.7	358°41.4	·· 25.4	143°01.9	·· 18.0
16	343°10.2	60°56.2	30.1	201°07.1	18°59.9	13°43.4	25.3	158°04.3	17.9
17	358°12.7	75°55.3	29.9	216°10.0	19°00.2	28°45.4	25.1	173°06.7	17.9
18	13°15.1	90°54.3	S23°29.7	231°13.0	N19°00.4	43°47.3	S13°24.9	188°09.1	N00°17.9
19	28°17.6	105°53.3	29.5	246°15.9	00.7	58°49.3	24.7	203°11.5	17.9
20	43°20.1	120°52.4	29.4	261°18.8	00.9	73°51.3	24.6	218°13.9	17.9
21	58°22.5	135°51.4	·· 29.2	276°21.7	·· 01.2	88°53.3	·· 24.4	233°16.4	·· 17.9
22	73°25.0	150°50.4	29.0	291°24.6	01.4	103°55.2	24.2	248°18.8	17.9
23	88°27.5	165°49.5	28.8	306°27.5	01.7	118°57.2	24.0	263°21.2	17.9
Mer.pass.:17:07		v-1.0 d0.2 m-3.8		v2.9 d0.2 m-0.8		v2.0 d0.2 m-1.9		v2.4 d-0.0 m0.9	

Stars	SHA	Dec
Alpheratz	357°46.2	29°09.0
Ankaa	353°18.1	-42°15.2
Schedar	349°43.6	56°35.9
Diphda	348°58.3	-17°55.9
Achernar	335°28.3	-57°11.3
Hamal	328°03.5	23°30.8
Polaris	318°47.1	89°18.8
Akamar	315°19.9	-40°16.0
Menkar	314°17.5	4°07.8
Mirfak	308°43.7	49°54.0
Aldebaran	290°52.0	16°31.9
Rigel	281°14.1	-8°11.4
Capella	280°37.8	46°00.6
Bellatrix	278°34.4	6°21.5
Elnath	278°15.5	28°37.0
Alnilam	275°48.6	-1°11.7
Betelgeuse	271°03.7	7°24.5
Canopus	263°56.7	-52°42.1
Sirius	258°35.5	-16°43.6
Adara	255°14.1	-28°59.2
Procyon	245°01.9	5°12.0
Pollux	243°30.3	28°00.0
Avior	234°18.6	-59°32.4
Suhail	222°54.0	-43°28.3
Miaplacidus	221°39.7	-69°45.4
Alphard	217°58.3	-8°42.2
Regulus	207°45.9	11°54.9
Dubhe	193°54.2	61°41.4
Denebola	182°36.0	14°30.8
Gienah	175°54.9	-17°35.9
Acrux	173°12.3	-63°09.1
Gacrux	172°03.9	-57°10.0
Alioth	166°22.8	55°53.9
Spica	158°34.0	-11°12.9
Alcaid	153°00.9	49°15.4
Hadar	148°51.9	-60°25.1
Menkent	148°10.8	-36°25.1
Arcturus	145°58.0	19°07.9
Rigil Kent.	139°55.6	-60°52.4
Zubenelg.	137°08.4	-16°05.0
Kochab	137°20.2	74°06.5
Alphecca	126°13.4	26°40.7
Antares	112°29.7	-26°27.2
Atria	107°34.4	-69°02.6
Sabik	102°15.8	-15°44.3
Shaula	96°25.8	-37°06.6
Rasalhague	96°09.1	12°33.1
Eltanin	90°47.8	51°29.2
Kaus Aust.	83°47.5	-34°22.8
Vega	80°41.1	38°47.5
Nunki	76°01.8	-26°17.1
Altair	62°11.1	8°53.7
Peacock	53°23.6	-56°42.2
Deneb	49°33.7	45°19.1
Enif	33°49.9	9°55.4
Alnair	27°47.1	-46°54.8
Fomalhaut	15°26.9	-29°34.2
Scheat	13°56.1	28°08.4
Markab	13°41.0	15°15.7

Jan 01 Fri	SHA	Mer.pass
Venus	81°25.5	11:53
Mars	217°31.4	02:47
Jupiter	31°04.7	15:12
Saturn	174°57.4	05:37

Jan 02 Sat	SHA	Mer.pass
Venus	80°03.2	11:54
Mars	217°40.3	02:43
Jupiter	30°53.0	15:08
Saturn	174°56.1	05:33

Jan 03 Sun	SHA	Mer.pass
Venus	78°40.8	11:56
Mars	217°50.0	02:38
Jupiter	30°41.1	15:05
Saturn	174°54.8	05:29

Horizontal parallax	
Venus:	0.1
Mars:	0.2

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file date- June 16 2020

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2020 January 01 to Jan. 03

h	Sun		Moon				
Wed	GHA	Dec	GHA	v	Dec	d	HP
0	179° 13.7	S23° 03.5	110° 56.9	15.3′	S09° 58.5	10.7′	54.3′
1	194° 13.4	03.3	125° 31.3	15.4′	09° 47.8	10.7′	54.3′
2	209° 13.1	03.1	140° 05.7	15.4′	09° 37.1	10.7′	54.3′
3	224° 12.8	·· 03.0	154° 40.1	15.5′	09° 26.3	10.8′	54.3′
4	239° 12.5	02.8	169° 14.6	15.5′	09° 15.5	10.8′	54.3′
5	254° 12.2	02.6	183° 49.1	15.5′	09° 04.7	10.8′	54.2′
6	269° 11.9	S23° 02.4	198° 23.6	15.6′	S08° 53.8	10.9′	54.2′
7	284° 11.6	02.2	212° 58.2	15.6′	08° 42.9	10.9′	54.2′
8	299° 11.3	02.0	227° 32.8	15.6′	08° 32.0	10.9′	54.2′
9	314° 11.0	·· 01.8	242° 07.5	15.7′	08° 21.0	11.0′	54.2′
10	329° 10.7	01.6	256° 42.2	15.7′	08° 10.0	11.0′	54.2′
11	344° 10.4	01.4	271° 16.9	15.7′	07° 59.0	11.0′	54.2′
12	359° 10.1	S23° 01.2	285° 51.7	15.8′	S07° 48.0	11.1′	54.2′
13	14° 09.8	01.0	300° 26.4	15.8′	07° 36.9	11.1′	54.2′
14	29° 09.5	00.8	315° 01.2	15.8′	07° 25.8	11.1′	54.2′
15	44° 09.2	·· 00.6	329° 36.1	15.9′	07° 14.7	11.1′	54.2′
16	59° 08.9	00.4	344° 10.9	15.9′	07° 03.5	11.2′	54.2′
17	74° 08.6	00.2	358° 45.8	15.9′	06° 52.3	11.2′	54.2′
18	89° 08.3	S23° 00.0	13° 20.7	15.9′	S06° 41.1	11.2′	54.2′
19	104° 08.0	22° 59.7	27° 55.7	16.0′	06° 29.9	11.2′	54.2′
20	119° 07.7	59.5	42° 30.7	16.0′	06° 18.7	11.3′	54.2′
21	134° 07.5	·· 59.3	57° 05.6	16.0′	06° 07.4	11.3′	54.2′
22	149° 07.2	59.1	71° 40.6	16.0′	05° 56.1	11.3′	54.2′
23	164° 06.9	58.9	86° 15.7	16.0′	05° 44.8	11.3′	54.2′
	SD.=16.3	d=0.2	S.D.=14.8				

Thu	GHA	Dec	GHA	v	Dec	d	HP
0	179° 06.6	S22° 58.7	100° 50.7	16.1′	S05° 33.4	11.3′	54.2′
1	194° 06.3	58.5	115° 25.8	16.1′	05° 22.1	11.4′	54.2′
2	209° 06.0	58.3	130° 00.9	16.1′	05° 10.7	11.4′	54.2′
3	224° 05.7	·· 58.1	144° 36.0	16.1′	04° 59.3	11.4′	54.2′
4	239° 05.4	57.9	159° 11.1	16.1′	04° 47.9	11.4′	54.2′
5	254° 05.1	57.6	173° 46.3	16.1′	04° 36.5	11.4′	54.2′
6	269° 04.8	S22° 57.4	188° 21.4	16.2′	S04° 25.0	11.5′	54.2′
7	284° 04.5	57.2	202° 56.6	16.2′	04° 13.5	11.5′	54.2′
8	299° 04.2	57.0	217° 31.7	16.2′	04° 02.1	11.5′	54.2′
9	314° 03.9	·· 56.8	232° 06.9	16.2′	03° 50.6	11.5′	54.2′
10	329° 03.6	56.6	246° 42.1	16.2′	03° 39.0	11.5′	54.2′
11	344° 03.3	56.3	261° 17.3	16.2′	03° 27.5	11.5′	54.2′
12	359° 03.0	S22° 56.1	275° 52.6	16.2′	S03° 16.0	11.5′	54.2′
13	14° 02.8	55.9	290° 27.8	16.2′	03° 04.4	11.6′	54.2′
14	29° 02.5	55.7	305° 03.0	16.2′	02° 52.8	11.6′	54.2′
15	44° 02.2	·· 55.5	319° 38.3	16.2′	02° 41.3	11.6′	54.2′
16	59° 01.9	55.2	334° 13.5	16.2′	02° 29.7	11.6′	54.2′
17	74° 01.6	55.0	348° 48.8	16.3′	02° 18.1	11.6′	54.2′
18	89° 01.3	S22° 54.8	3° 24.0	16.3′	S02° 06.5	11.6′	54.2′
19	104° 01.0	54.6	17° 59.3	16.3′	01° 54.8	11.6′	54.2′
20	119° 00.7	54.3	32° 34.5	16.3′	01° 43.2	11.6′	54.2′
21	134° 00.4	·· 54.1	47° 09.8	16.3′	01° 31.6	11.6′	54.2′
22	149° 00.1	53.9	61° 45.0	16.3′	01° 19.9	11.7′	54.2′
23	163° 59.8	53.7	76° 20.3	16.3′	01° 08.2	11.7′	54.3′
	SD.=16.3	d=0.2	S.D.=14.8				

Fri	GHA	Dec	GHA	v	Dec	d	HP
0	178° 59.5	S22° 53.4	90° 55.5	16.2′	S00° 56.6	11.7′	54.3′
1	193° 59.3	53.2	105° 30.8	16.2′	00° 44.9	11.7′	54.3′
2	208° 59.0	53.0	120° 06.0	16.2′	00° 33.2	11.7′	54.3′
3	223° 58.7	·· 52.7	134° 41.3	16.2′	00° 21.5	11.7′	54.3′
4	238° 58.4	52.5	149° 16.5	16.2′	S00° 09.9	11.7′	54.3′
5	253° 58.1	52.3	163° 51.7	16.2′	N00° 01.8	11.7′	54.3′
6	268° 57.8	S22° 52.0	178° 26.9	16.2′	N00° 13.5	11.7′	54.3′
7	283° 57.5	51.8	193° 02.1	16.2′	00° 25.2	11.7′	54.3′
8	298° 57.2	51.6	207° 37.3	16.2′	00° 36.9	11.7′	54.3′
9	313° 56.9	·· 51.3	222° 12.5	16.2′	00° 48.6	11.7′	54.3′
10	328° 56.6	51.1	236° 47.7	16.2′	01° 00.3	11.7′	54.3′
11	343° 56.4	50.8	251° 22.8	16.1′	01° 12.0	11.7′	54.4′
12	358° 56.1	S22° 50.6	265° 58.0	16.1′	N01° 23.7	11.7′	54.4′
13	13° 55.8	50.4	280° 33.1	16.1′	01° 35.4	11.7′	54.4′
14	28° 55.5	50.1	295° 08.2	16.1′	01° 47.1	11.7′	54.4′
15	43° 55.2	·· 49.9	309° 43.3	16.1′	01° 58.8	11.7′	54.4′
16	58° 54.9	49.6	324° 18.4	16.1′	02° 10.5	11.7′	54.4′
17	73° 54.6	49.4	338° 53.4	16.0′	02° 22.2	11.7′	54.4′
18	88° 54.3	S22° 49.2	353° 28.4	16.0′	N02° 33.9	11.7′	54.4′
19	103° 54.0	48.9	8° 03.5	16.0′	02° 45.6	11.7′	54.4′
20	118° 53.8	48.7	22° 38.4	16.0′	02° 57.3	11.7′	54.5′
21	133° 53.5	·· 48.4	37° 13.4	16.0′	03° 09.0	11.7′	54.5′
22	148° 53.2	48.2	51° 48.4	15.9′	03° 20.6	11.7′	54.5′
23	163° 52.9	47.9	66° 23.3	15.9′	03° 32.3	11.7′	54.5′
	SD.=16.3	d=0.2	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:23	10:41	▬	▬	13:27	15:45
N 70°	08:05	09:49	▬	▬	14:19	16:03
68°	07:50	09:16	▬	▬	14:52	16:18
66°	07:37	08:53	10:27	13:41	15:15	16:31
64°	07:26	08:34	09:49	14:19	15:34	16:41
62°	07:17	08:18	09:23	14:45	15:49	16:51
60°	07:09	08:05	09:02	15:06	16:02	16:59
N 58°	07:02	07:54	08:45	15:23	16:14	17:06
56°	06:56	07:44	08:31	15:37	16:24	17:12
54°	06:50	07:35	08:19	15:49	16:32	17:18
52°	06:44	07:28	08:08	16:00	16:40	17:24
50°	06:39	07:20	07:58	16:09	16:47	17:29
45°	06:28	07:05	07:38	16:29	17:03	17:40
N 40°	06:18	06:52	07:22	16:46	17:16	17:50
35°	06:08	06:40	07:08	17:00	17:28	17:59
30°	06:00	06:30	06:56	17:12	17:38	18:08
20°	05:44	06:11	06:35	17:32	17:56	18:24
N 10°	05:28	05:54	06:17	17:50	18:13	18:40
0°	05:11	05:38	06:00	18:08	18:30	18:56
S 10°	04:53	05:20	05:43	18:25	18:48	19:15
20°	04:31	05:00	05:24	18:43	19:08	19:37
30°	04:02	04:35	05:03	19:05	19:32	20:05
35°	03:44	04:20	04:50	19:17	19:47	20:23
40°	03:21	04:03	04:35	19:32	20:05	20:46
45°	02:52	03:41	04:18	19:50	20:27	21:15
S 50°	02:08	03:12	03:56	20:11	20:55	21:59
52°	01:42	02:57	03:45	20:22	21:10	22:24
54°	01:02	02:40	03:33	20:34	21:27	23:03
56°	▭	02:19	03:20	20:47	21:48	▭
58°	▭	01:51	03:03	21:04	22:15	▭
S 60°	▭	01:08	02:44	21:23	22:58	▭

18

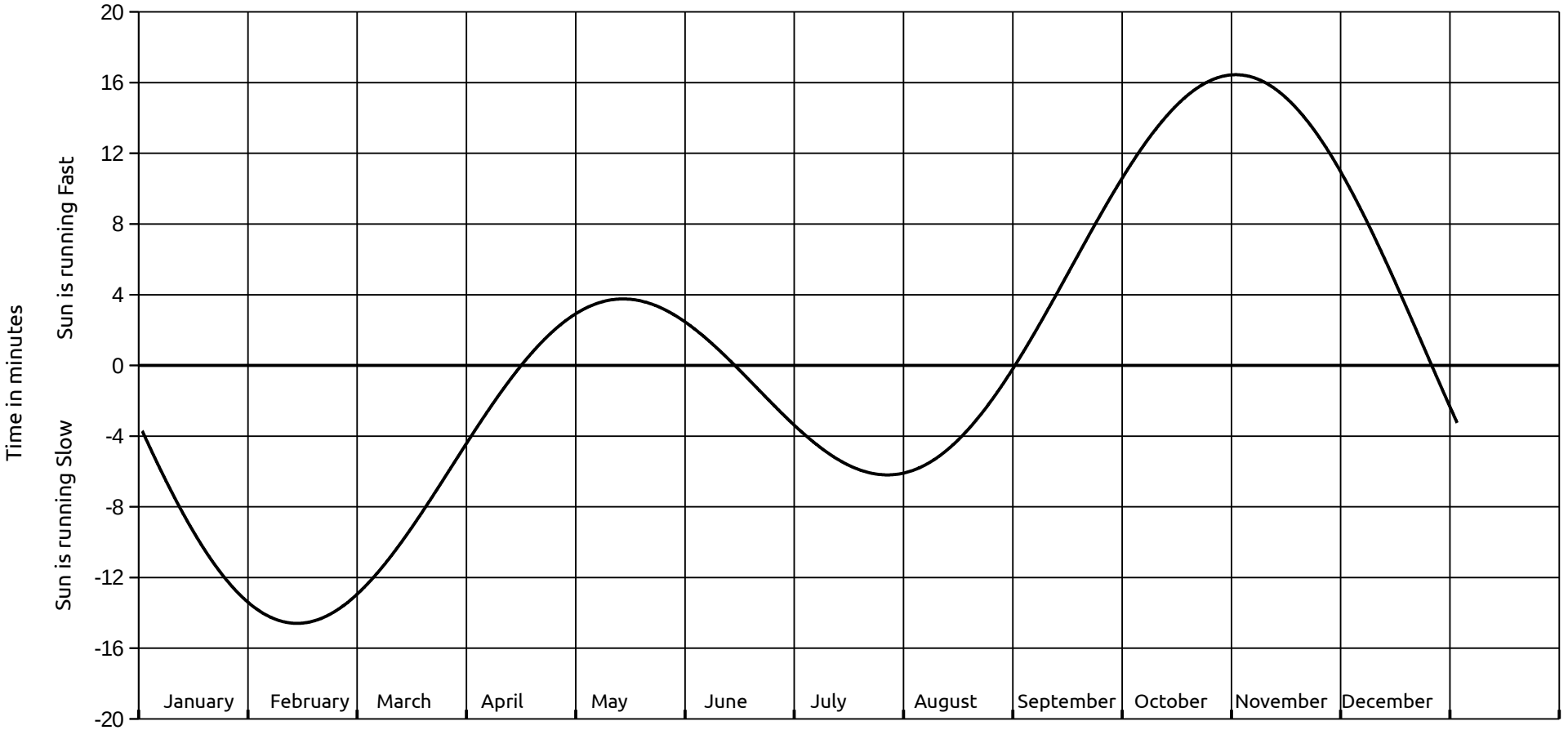
Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	12:37	12:18	12:00	21:58	23:43	–:–
N 70°	12:26	12:13	12:02	22:06	23:44	–:–
68°	12:17	12:10	12:03	22:14	23:45	–:–
66°	12:09	12:07	12:04	22:20	23:46	–:–
64°	12:02	12:04	12:05	22:25	23:47	–:–
62°	11:57	12:02	12:06	22:29	23:48	–:–
60°	11:52	12:00	12:07	22:33	23:49	–:–
N 58°	11:48	11:58	12:08	22:36	23:49	–:–
56°	11:44	11:56	12:08	22:39	23:50	–:–
54°	11:40	11:55	12:09	22:42	23:50	–:–
52°	11:37	11:54	12:10	22:44	23:51	–:–
50°	11:34	11:52	12:10	22:46	23:51	–:–
45°	11:28	11:50	12:11	22:51	23:52	–:–
N 40°	11:23	11:48	12:12	22:55	23:52	–:–
35°	11:18	11:46	12:13	22:58	23:53	–:–
30°	11:14	11:44	12:14	23:01	23:54	–:–
20°	11:07	11:41	12:15	23:06	23:54	–:–
N 10°	11:01	11:39	12:16	23:11	23:55	–:–
0°	10:55	11:36	12:17	23:15	23:56	–:–
S 10°	10:49	11:34	12:18	23:19	23:57	–:–
20°	10:43	11:31	12:19	23:24	23:57	–:–
30°	10:36	11:28	12:20	23:29	23:58	–:–
35°	10:32	11:26	12:21	23:31	23:59	–:–
40°	10:27	11:25	12:22	23:35	23:59	–:–
45°	10:21	11:22	12:23	23:38	–:–	00:00
S 50°	10:15	11:20	12:24	23:43	–:–	00:00
52°	10:12	11:18	12:25	23:45	–:–	00:01
54°	10:08	11:17	12:25	23:47	–:–	00:01
56°	10:05	11:15	12:26	23:49	–:–	00:01
58°	10:01	11:14	12:27	23:52	–:–	00:02
S 60°	09:56	11:12	12:28	23:55	–:–	00:02

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 6-8 34-53%
01	03:05	03:20	12:03	17:05	04:44	
02	03:34	03:48	12:04	17:46	05:26	
03	04:02	04:16	12:04	18:27	06:06	

9 10 3 11 3 12 13 14 15 16

file date- June 16 2020

Equation of Time
for the Sun



Equation_of_Time_Curve.odt

Celestial Navigation

useful Formulas

About Calculators

The Casio *fx-300ES Plus* is an inexpensive calculator at about 11 USD. It features *natural input* so you enter a formula just as it would be written on paper. Entering degrees, minutes and seconds is very simple. The Casio *fx-300ES Plus* has 9 memory locations and you can review many of the previous entries you make using a special key on the calculator.

Determine Hc using a calculator

The formula

Hc = asin[sin(**Declination**)*sin(**Latitude**) + cos(**Latitude**)*cos(**Declination**)*cos(**LHA**)]

As it would be entered into the Casio calculator Note- Sin^{-1} is the arc-sin key

Sin^{-1}(Sin(**Ap Latitude**) x Sin(**Declination**) + Cos(**Ap Latitude)** x Cos(**Declination**) x Cos(**LHA**)

Declination is the declination of the Celestial body you're observing. When the heavenly body's declination is *Contrary name* to your Ap Latitude enter a negative sign before it.

Latitude "The AP latitude is chosen to be the nearest whole degree in latitude to the DR latitude." *from Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310* Consider this to be where you are, think you are or where you would like to determine Hc for. Typically, you'll be using an *Assumed position Latitude* or *Ap Latitude* as it's called. *See Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310*

About LHA determination

Assumed Position longitude (***a* λ**) "The AP longitude is that nearest the DR longitude resulting in a whole degree of LHA for the observed body." *From Bowditch 2019 Vol. 1 Chapter 19 section 1902 p. 310*

In Western Longitudes *see Bowditch 2019 Vol. 1 Chapter 19 section 1905 p. 313*

LHA is the Local Hour Angle derived by subtracting your Assumed Longitude (***a* λ**) whole degree value from the whole degree ***GHA*** (Greenwich Hour Angle) value. If GHA is less than the ***a* λ** than the add 360° to it then subtract the ***a* λ.** *Ignore the arc minutes* of GHA and ***a* λ.**

Example when GHA is less than ***a* λ** **GHA**= 43° 25.2' ***a* λ**= W 55° 15.1'

360° + 43° = 403° Then....403° – 55° = 348° (LHA)

In Eastern Longitudes *see Bowditch 2019 Vol. 1 Chapter 19 section 1905 p. 313*

LHA**, in **Eastern Longitudes, is determined by adding the entire GHA figure (degrees and minutes) to the whole degree figure of the Assumed longitude (***a* λ**) *plus* the amount of arc minutes required to get to the next degree of the GHA. If the resulting LHA figure is greater than 360° then subtract 360° from the figure to obtain the LHA.

Example- **GHA**= 58° 01.2' ***a* λ**= E 9° 10.1' (ignore the 10.1')

Step 1- *get GHA degree difference;* 59° - 58° 01.2' = 0° 58.8'

Step 2- add *a* λ degrees to *difference* found in step 1; 9° + 0°58.8' = 9° 58.8' *a* λ

Step 3- *get LHA;* 58° 01.2 + 9° 58.8' = 68° (LHA)

Why would you want to determine Hc using a calculator?

It's faster than looking up in Pub. No. 249 and Pub. No. 229, highly accurate and you don't need a lot of printed out pages of Latitudes from Pub. No. 249 and Pub. No. 229. Pub. No. 249 Vol. 2 & 3 don't cover any declination greater than 29 degrees so you'd have to use Pub. No. 229 which is extremely large.

Celestial Navigation

Determine Z

Z = acos[(sin(**Declination**) – sin(**Ap Latitude)** x sin(**Hc**)) ÷ (cos(**Ap Latitude**) x cos(**Hc**))]

As it would be entered into the Casio calculator... Note- Cos^{-1} is the arc-cosine key

Cos^{-1}((Sin(**Declination**) – Sin(**AP Latitude**) x Sin(**Hc**)) ÷ (Cos(**AP Latitude**) x Cos(**Hc**)

If the heavenly body's declination is *Contrary name* to the Ap Latitude enter a negative sign before it.

To obtain Zn see the rules below for Northern and Southern latitudes.

Determine Z independent of Hc

$$Z = \tan^{-1}\left(\frac{\sin \mathrm{LHA}}{(\cos \mathrm{L} \tan \mathrm{d}) - (\sin \mathrm{L} \cos \mathrm{LHA})}\right)$$

"L" is latitude and "*d"* is declination. When the heavenly body's declination is *Contrary name* to your Ap Latitude enter a negative sign before it.

As it would be entered into the Casio calculator... Note- $\tan^{-1}$ is the arc-tangent key

Z = $\tan^{-1}$ ((sin (**LHA**) ÷ (cos(**AP latitude**) x tan(**declination**) – (sin(**AP latitude**) x cos(**LHA**))

The sign convention used in the calculation of this azimuth formula is as follows:
from *Bowditch Chapter 22 CALCULATIONS AND CONVERSIONS, page 331*

1) If latitude and declination are of contrary name, declination is treated as a negative quantity;
2) If the local hour angle is greater than 180°, it is treated as a negative quantity. If the azimuth angle as calculated is negative, add 180° to obtain the desired value.

To obtain Zn apply the following rules

In Northern Latitudes	**In Southern Latitudes**
LHA greater than 180°....Zn=Z	LHA greater than 180°....Zn= 180° – Z
LHA less than 180°.....Zn=360° – Z	LHA less than 180°.....Zn= 180° + Z

Determine Refraction 0.96 ÷ Tan of (Ha)
Gives good results down to about 8° from the horizon but not less.

Refraction (good overall formula from 90° to below 8° from the horizon)

$$R_0 = \cot\left(H_a + \frac{7.31}{H_a + 4.4}\right)$$

As it would be entered into the Casio calculator...

1 ÷ Tan((Ha + (7.31 ÷ (Ha + 4.4))

Both refraction formulas use the standard pressure and temperature of;

1010 mb 10° C
29.83 in 53° F

Determine Dip using feet 0.97 x (Square Root of *He* (Height of Eye) in feet)

Determine Dip using meters 1.76 x (Square Root of *He* (Height of eye) in meters)

Rules to Calculate Latitude using the Sun- *Noon-Sight*

1- Latitude and declination *Same name* but latitude is greater than declination:

Latitude= (90° – Ho) + declination

2- Latitude and declination *Same name* but declination greater than latitude:

Latitude= Declination – (90° – Ho)

3- Latitude and declination *Contrary name*:

Latitude= (90° – Ho) – Declination

To get AP longitude (needed for plotting the LOP)

In Western longitudes

Combine the DR Longitude figure with only the minutes (of arc) of the total GHA figure. The Ap λ figure will be used when plotting the LOP on the UPS.

In Eastern longitudes

In Eastern longitudes the Ap λ is determined as follows;

DR longitude + (0°60' *minus* GHA minutes of arc)

Example- E 075° + (0°60' – 0° 02')= 75° 58' Ap longitude

fair winds...clear skies and following seas
TheNauticalAlmanac.com

Formula Sheet added to NA.odt

Useful Information

Time Signals- by telephone

WWV 303-499-7111 **WWVH** 808-335-4363

CHU **English:** 613-745-1576 (CHU provides only Eastern time announcements)
French: 613-745-9426

Time signals- by Radio

WWV (Fort Collins, Colorado)	2.5, 5, 10, 15, 20 MHz (male voice)
WWVH (Kauai, Hawaii)	2.5, 5, 10, 15 MHz (female voice)
CHU (Ottawa, Canada)	3330, 7850, and 14,670 kHz (USB)

Bowditch *2017- The American Practical Navigator*

https://TheNauticalAlmanac.com/2017_Bowditch-_American_Practical_Navigator.html

Organized in a convenient and useful manner. Download the Chapters, Parts or Tables you want or the entire work.

The Terrestrial Almanac Annual calendar and day planner for the entire year.

https://TheNauticalAlmanac.com/TerrestrialAlmanac.html

Pub. No. 249 Download individual Latitudes or Volumes

https://TheNauticalAlmanac.com/Pub. No. 249.html

Pub. No. 229 Download individual Volumes covering a range of Latitudes

https://TheNauticalAlmanac.com/Pub. No. 229.html

Sight Reduction Forms & Methods

https://www.TheNauticalAlmanac.com/Methods.html

January 01, 02, 03 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	100°50.2	130°38.5	S13°41.9	119°24.8	S08°48.6	260°48.8	S07°03.6	200°08.3	S21°52.4
1	115°52.6	145°38.4	40.8	134°25.5	47.8	275°51.0	03.7	215°10.5	52.4
2	130°55.1	160°38.3	39.7	149°26.2	47.1	290°53.2	03.8	230°12.7	52.5
3	145°57.6	175°38.2	·· 38.6	164°27.0	·· 46.3	305°55.5	·· 03.9	245°14.8	·· 52.5
4	161°00.0	190°38.1	37.5	179°27.7	45.6	320°57.7	04.0	260°17.0	52.5
5	176°02.5	205°38.0	36.4	194°28.4	44.8	335°59.9	04.0	275°19.1	52.5
6	191°05.0	220°37.9	S13°35.3	209°29.1	S08°44.1	351°02.1	S07°04.1	290°21.3	S21°52.5
7	206°07.4	235°37.8	34.2	224°29.8	43.3	6°04.3	04.2	305°23.4	52.6
8	221°09.9	250°37.7	33.1	239°30.5	42.6	21°06.5	04.3	320°25.6	52.6
9	236°12.4	265°37.7	·· 32.0	254°31.2	·· 41.8	36°08.7	·· 04.4	335°27.8	·· 52.6
10	251°14.8	280°37.6	30.9	269°31.9	41.1	51°11.0	04.5	350°29.9	52.6
11	266°17.3	295°37.5	29.8	284°32.7	40.3	66°13.2	04.6	5°32.1	52.6
12	281°19.7	310°37.4	S13°28.7	299°33.4	S08°39.6	81°15.4	S07°04.7	20°34.2	S21°52.7
13	296°22.2	325°37.3	27.6	314°34.1	38.8	96°17.6	04.8	35°36.4	52.7
14	311°24.7	340°37.2	26.5	329°34.8	38.1	111°19.8	04.9	50°38.6	52.7
15	326°27.1	355°37.1	·· 25.4	344°35.5	·· 37.3	126°22.0	·· 04.9	65°40.7	·· 52.7
16	341°29.6	10°37.1	24.3	359°36.2	36.6	141°24.3	05.0	80°42.9	52.7
17	356°32.1	25°37.0	23.2	14°36.9	35.8	156°26.5	05.1	95°45.0	52.8
18	11°34.5	40°36.9	S13°22.1	29°37.6	S08°35.0	171°28.7	S07°05.2	110°47.2	S21°52.8
19	26°37.0	55°36.8	21.0	44°38.4	34.3	186°30.9	05.3	125°49.3	52.8
20	41°39.5	70°36.7	19.9	59°39.1	33.5	201°33.1	05.4	140°51.5	52.8
21	56°41.9	85°36.7	·· 18.8	74°39.8	·· 32.8	216°35.4	·· 05.5	155°53.7	·· 52.8
22	71°44.4	100°36.6	17.7	89°40.5	32.0	231°37.6	05.6	170°55.8	52.8
23	86°46.9	115°36.5	16.6	104°41.2	31.3	246°39.8	05.6	185°58.0	52.9
Mer.pass.:17:14		v-0.1 d1.1 m-4.2		v0.7 d0.8 m0.9		v2.2 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	101°49.3	130°36.4	S13°15.5	119°41.9	S08°30.5	261°42.0	S07°05.7	201°00.1	S21°52.9
1	116°51.8	145°36.4	14.4	134°42.6	29.8	276°44.2	05.8	216°02.3	52.9
2	131°54.2	160°36.3	13.3	149°43.3	29.0	291°46.5	05.9	231°04.5	52.9
3	146°56.7	175°36.2	·· 12.2	164°44.1	·· 28.3	306°48.7	·· 06.0	246°06.6	·· 52.9
4	161°59.2	190°36.1	11.1	179°44.8	27.5	321°50.9	06.1	261°08.8	53.0
5	177°01.6	205°36.1	10.0	194°45.5	26.8	336°53.1	06.2	276°10.9	53.0
6	192°04.1	220°36.0	S13°08.9	209°46.2	S08°26.0	351°55.3	S07°06.3	291°13.1	S21°53.0
7	207°06.6	235°35.9	07.8	224°46.9	25.2	6°57.6	06.3	306°15.3	53.0
8	222°09.0	250°35.9	06.7	239°47.6	24.5	21°59.8	06.4	321°17.4	53.0
9	237°11.5	265°35.8	·· 05.6	254°48.3	·· 23.7	37°02.0	·· 06.5	336°19.6	·· 53.1
10	252°14.0	280°35.7	04.5	269°49.1	23.0	52°04.2	06.6	351°21.7	53.1
11	267°16.4	295°35.7	03.4	284°49.8	22.2	67°06.5	06.7	6°23.9	53.1
12	282°18.9	310°35.6	S13°02.3	299°50.5	S08°21.5	82°08.7	S07°06.8	21°26.1	S21°53.1
13	297°21.4	325°35.5	01.2	314°51.2	20.7	97°10.9	06.9	36°28.2	53.1
14	312°23.8	340°35.5	13°00.1	329°51.9	20.0	112°13.1	07.0	51°30.4	53.1
15	327°26.3	355°35.4	12°59.0	344°52.6	·· 19.2	127°15.3	·· 07.0	66°32.5	·· 53.2
16	342°28.7	10°35.4	57.9	359°53.4	18.4	142°17.6	07.1	81°34.7	53.2
17	357°31.2	25°35.3	56.8	14°54.1	17.7	157°19.8	07.2	96°36.9	53.2
18	12°33.7	40°35.2	S12°55.6	29°54.8	S08°16.9	172°22.0	S07°07.3	111°39.0	S21°53.2
19	27°36.1	55°35.2	54.5	44°55.5	16.2	187°24.2	07.4	126°41.2	53.2
20	42°38.6	70°35.1	53.4	59°56.2	15.4	202°26.5	07.5	141°43.3	53.3
21	57°41.1	85°35.1	·· 52.3	74°56.9	·· 14.7	217°28.7	·· 07.6	156°45.5	·· 53.3
22	72°43.5	100°35.0	51.2	89°57.6	13.9	232°30.9	07.6	171°47.7	53.3
23	87°46.0	115°35.0	50.1	104°58.4	13.2	247°33.1	07.7	186°49.8	53.3
Mer.pass.:17:10		v-0.1 d1.1 m-4.2		v0.7 d0.8 m0.9		v2.2 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	102°48.5	130°34.9	S12°49.0	119°59.1	S08°12.4	262°35.4	S07°07.8	201°52.0	S21°53.3
1	117°50.9	145°34.9	47.9	134°59.8	11.6	277°37.6	07.9	216°54.1	53.3
2	132°53.4	160°34.8	46.8	150°00.5	10.9	292°39.8	08.0	231°56.3	53.4
3	147°55.8	175°34.8	·· 45.6	165°01.2	·· 10.1	307°42.0	·· 08.1	246°58.5	·· 53.4
4	162°58.3	190°34.7	44.5	180°01.9	09.4	322°44.3	08.1	262°00.6	53.4
5	178°00.8	205°34.7	43.4	195°02.7	08.6	337°46.5	08.2	277°02.8	53.4
6	193°03.2	220°34.6	S12°42.3	210°03.4	S08°07.9	352°48.7	S07°08.3	292°04.9	S21°53.4
7	208°05.7	235°34.6	41.2	225°04.1	07.1	7°50.9	08.4	307°07.1	53.5
8	223°08.2	250°34.5	40.1	240°04.8	06.3	22°53.2	08.5	322°09.3	53.5
9	238°10.6	265°34.5	·· 39.0	255°05.5	·· 05.6	37°55.4	·· 08.6	337°11.4	·· 53.5
10	253°13.1	280°34.4	37.8	270°06.3	04.8	52°57.6	08.7	352°13.6	53.5
11	268°15.6	295°34.4	36.7	285°07.0	04.1	67°59.9	08.7	7°15.8	53.5
12	283°18.0	310°34.4	S12°35.6	300°07.7	S08°03.3	83°02.1	S07°08.8	22°17.9	S21°53.6
13	298°20.5	325°34.3	34.5	315°08.4	02.6	98°04.3	08.9	37°20.1	53.6
14	313°23.0	340°34.3	33.4	330°09.1	01.8	113°06.5	09.0	52°22.2	53.6
15	328°25.4	355°34.2	·· 32.3	345°09.8	·· 01.0	128°08.8	·· 09.1	67°24.4	·· 53.6
16	343°27.9	10°34.2	31.1	0°10.6	08°00.3	143°11.0	09.2	82°26.6	53.6
17	358°30.3	25°34.2	30.0	15°11.3	07°59.5	158°13.2	09.2	97°28.7	53.6
18	13°32.8	40°34.1	S12°28.9	30°12.0	S07°58.8	173°15.5	S07°09.3	112°30.9	S21°53.7
19	28°35.3	55°34.1	27.8	45°12.7	58.0	188°17.7	09.4	127°33.0	53.7
20	43°37.7	70°34.1	26.7	60°13.4	57.2	203°19.9	09.5	142°35.2	53.7
21	58°40.2	85°34.0	·· 25.5	75°14.2	·· 56.5	218°22.2	·· 09.6	157°37.4	·· 53.7
22	73°42.7	100°34.0	24.4	90°14.9	55.7	233°24.4	09.7	172°39.5	53.7
23	88°45.1	115°34.0	23.3	105°15.6	55.0	248°26.6	09.7	187°41.7	53.8
Mer.pass.:17:06		v-0.1 d1.1 m-4.2		v0.7 d0.8 m0.9		v2.2 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°41.0	29°11.1
Ankaa	353°13.4	-42°13.1
Schedar	349°37.7	56°38.0
Diphda	348°53.5	-17°53.8
Achernar	335°25.0	-57°09.4
Hamal	327°57.9	23°32.5
Polaris	316°23.4	89°20.3
Acamar	315°16.3	-40°14.6
Menkar	314°12.3	4°09.2
Mirfak	308°36.5	49°55.3
Aldebaran	290°46.3	16°32.4
Rigel	281°09.4	-8°11.2
Capella	280°30.4	46°00.7
Bellatrix	278°29.1	6°21.7
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.7
Betelgeuse	270°58.4	7°24.4
Canopus	263°54.5	-52°42.5
Sirius	258°31.2	-16°44.6
Adhara	255°10.2	-28°59.9
Procyon	244°56.9	5°10.7
Pollux	243°24.5	27°58.8
Avior	234°16.3	-59°33.9
Suhail	222°50.2	-43°30.1
Miaplacidus	221°38.2	-69°47.1
Alphard	217°53.5	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°48.6	61°39.3
Denebola	182°31.2	14°28.5
Gienah	175°49.8	-17°38.0
Acrux	173°06.4	-63°11.2
Gacrux	171°58.1	-57°12.2
Alioth	166°18.7	55°51.8
Spica	158°28.8	-11°14.8
Alkaid	152°57.2	49°13.6
Hadar	148°44.6	-60°26.9
Menkent	148°04.8	-36°26.9
Arcturus	145°53.7	19°05.7
Rigil Kent.	139°48.7	-60°53.9
Kochab	137°21.0	74°05.0
Zuben'ubi	137°02.9	-16°06.5
Alphecca	126°09.3	26°39.5
Antares	112°23.6	-26°27.9
Atria	107°23.7	-69°03.1
Sabik	102°10.1	-15°44.5
Shaula	96°19.1	-37°06.7
Rasalhague	96°04.6	12°33.0
Eltanin	90°45.6	51°29.3
Kaus Aust.	83°41.1	-34°22.4
Vega	80°37.8	38°48.1
Nunki	75°55.7	-26°16.4
Altair	62°06.2	8°55.0
Peacock	53°16.1	-56°40.8
Deneb	49°30.2	45°20.7
Enif	33°45.0	9°57.3
Al Na'ir	27°41.1	-46°52.9
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.9

Jan 01 Sun	**SHA**	**Mer.pass**
Venus	29°48.3	15:18
Mars	18°34.6	16:02
Jupiter	159°58.6	06:36
Saturn	99°18.2	10:38

Jan 02 Mon	**SHA**	**Mer.pass**
Venus	28°47.1	15:18
Mars	17°52.6	16:00
Jupiter	159°52.7	06:32
Saturn	99°10.8	10:34

Jan 03 Tue	**SHA**	**Mer.pass**
Venus	27°46.5	15:18
Mars	17°10.6	15:59
Jupiter	159°46.9	06:29
Saturn	99°03.5	10:31

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.5913 sec ΔT = TT-UT1 = +68.5927 sec

2017 January 01 to Jan. 03 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°08.4	S22°59.9	147°06.1	11.1'	S15°20.2	6.2'	56.0'
1	194°08.1	59.7	161°36.2	11.1'	15°13.9	6.3'	56.0'
2	209°07.8	59.5	176°06.3	11.1'	15°07.6	6.4'	56.1'
3	224°07.5	·· 59.3	190°36.4	11.1'	15°01.2	6.5'	56.1'
4	239°07.2	59.1	205°06.5	11.1'	14°54.7	6.5'	56.1'
5	254°06.9	58.9	219°36.6	11.1'	14°48.1	6.6'	56.1'
6	269°06.6	S22°58.7	234°06.8	11.2'	S14°41.4	6.7'	56.1'
7	284°06.3	58.5	248°36.9	11.2'	14°34.7	6.8'	56.2'
8	299°06.0	58.3	263°07.1	11.2'	14°27.9	6.9'	56.2'
9	314°05.7	·· 58.1	277°37.3	11.2'	14°21.0	6.9'	56.2'
10	329°05.4	57.8	292°07.5	11.2'	14°14.0	7.0'	56.2'
11	344°05.1	57.6	306°37.7	11.2'	14°07.0	7.1'	56.2'
12	359°04.8	S22°57.4	321°07.9	11.2'	S13°59.9	7.2'	56.3'
13	14°04.5	57.2	335°38.1	11.2'	13°52.7	7.2'	56.3'
14	29°04.3	57.0	350°08.4	11.2'	13°45.4	7.3'	56.3'
15	44°04.0	·· 56.8	4°38.6	11.3'	13°38.0	7.4'	56.3'
16	59°03.7	56.6	19°08.9	11.3'	13°30.6	7.5'	56.4'
17	74°03.4	56.3	33°39.2	11.3'	13°23.1	7.5'	56.4'
18	89°03.1	S22°56.1	48°09.5	11.3'	S13°15.6	7.6'	56.4'
19	104°02.8	55.9	62°39.8	11.3'	13°07.9	7.7'	56.4'
20	119°02.5	55.7	77°10.1	11.3'	13°00.2	7.7'	56.4'
21	134°02.2	·· 55.5	91°40.4	11.3'	12°52.4	7.8'	56.5'
22	149°01.9	55.2	106°10.8	11.3'	12°44.6	7.9'	56.5'
23	164°01.6	55.0	120°41.1	11.4'	12°36.7	8.0'	56.5'
	SD.=16.3	d=0.2		S.D.=15.3			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°01.3	S22°54.8	135°11.5	11.4'	S12°28.7	8.0'	56.5'
1	194°01.0	54.6	149°41.9	11.4'	12°20.6	8.1'	56.5'
2	209°00.7	54.3	164°12.3	11.4'	12°12.5	8.2'	56.6'
3	224°00.4	·· 54.1	178°42.7	11.4'	12°04.3	8.2'	56.6'
4	239°00.2	53.9	193°13.1	11.4'	11°56.1	8.3'	56.6'
5	253°59.9	53.6	207°43.5	11.4'	11°47.7	8.4'	56.6'
6	268°59.6	S22°53.4	222°13.9	11.4'	S11°39.4	8.4'	56.7'
7	283°59.3	53.2	236°44.4	11.4'	11°30.9	8.5'	56.7'
8	298°59.0	53.0	251°14.8	11.5'	11°22.4	8.5'	56.7'
9	313°58.7	·· 52.7	265°45.3	11.5'	11°13.8	8.6'	56.7'
10	328°58.4	52.5	280°15.7	11.5'	11°05.2	8.7'	56.7'
11	343°58.1	52.3	294°46.2	11.5'	10°56.5	8.7'	56.8'
12	358°57.8	S22°52.0	309°16.7	11.5'	S10°47.7	8.8'	56.8'
13	13°57.5	51.8	323°47.2	11.5'	10°38.9	8.9'	56.8'
14	28°57.2	51.6	338°17.7	11.5'	10°30.0	8.9'	56.8'
15	43°57.0	·· 51.3	352°48.2	11.5'	10°21.0	9.0'	56.9'
16	58°56.7	51.1	7°18.7	11.5'	10°12.0	9.0'	56.9'
17	73°56.4	50.9	21°49.3	11.5'	10°03.0	9.1'	56.9'
18	88°56.1	S22°50.6	36°19.8	11.5'	S09°53.9	9.1'	56.9'
19	103°55.8	50.4	50°50.4	11.5'	09°44.7	9.2'	56.9'
20	118°55.5	50.1	65°20.9	11.6'	09°35.4	9.3'	57.0'
21	133°55.2	·· 49.9	79°51.5	11.6'	09°26.2	9.3'	57.0'
22	148°54.9	49.7	94°22.0	11.6'	09°16.8	9.4'	57.0'
23	163°54.6	49.4	108°52.6	11.6'	09°07.4	9.4'	57.0'
	SD.=16.3	d=0.2		S.D.=15.5			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°54.4	S22°49.2	123°23.2	11.6'	S08°58.0	9.5'	57.1'
1	193°54.1	48.9	137°53.8	11.6'	08°48.5	9.5'	57.1'
2	208°53.8	48.7	152°24.3	11.6'	08°38.9	9.6'	57.1'
3	223°53.5	·· 48.4	166°54.9	11.6'	08°29.3	9.6'	57.1'
4	238°53.2	48.2	181°25.5	11.6'	08°19.7	9.7'	57.1'
5	253°52.9	47.9	195°56.1	11.6'	08°10.0	9.7'	57.2'
6	268°52.6	S22°47.7	210°26.7	11.6'	S08°00.2	9.8'	57.2'
7	283°52.3	47.4	224°57.3	11.6'	07°50.4	9.8'	57.2'
8	298°52.1	47.2	239°27.9	11.6'	07°40.6	9.9'	57.2'
9	313°51.8	·· 46.9	253°58.5	11.6'	07°30.7	9.9'	57.3'
10	328°51.5	46.7	268°29.1	11.6'	07°20.8	10.0'	57.3'
11	343°51.2	46.4	282°59.7	11.6'	07°10.8	10.0'	57.3'
12	358°50.9	S22°46.2	297°30.3	11.6'	S07°00.8	10.0'	57.3'
13	13°50.6	45.9	312°00.9	11.6'	06°50.7	10.1'	57.4'
14	28°50.3	45.7	326°31.5	11.6'	06°40.6	10.1'	57.4'
15	43°50.0	·· 45.4	341°02.1	11.6'	06°30.4	10.2'	57.4'
16	58°49.8	45.2	355°32.7	11.6'	06°20.2	10.2'	57.4'
17	73°49.5	44.9	10°03.3	11.6'	06°10.0	10.3'	57.4'
18	88°49.2	S22°44.7	24°33.9	11.6'	S05°59.7	10.3'	57.5'
19	103°48.9	44.4	39°04.4	11.6'	05°49.4	10.3'	57.5'
20	118°48.6	44.1	53°35.0	11.6'	05°39.1	10.4'	57.5'
21	133°48.3	·· 43.9	68°05.6	11.6'	05°28.7	10.4'	57.5'
22	148°48.1	43.6	82°36.2	11.6'	05°18.3	10.4'	57.6'
23	163°47.8	43.4	97°06.7	11.6'	05°07.8	10.5'	57.6'
	SD.=16.3	d=0.2		S.D.=15.6			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:23	10:39	▬	▬	13:30	15:46
N 70°	08:04	09:48	▬	▬	14:21	16:05
68°	07:49	09:16	▬	▬	14:53	16:20
66°	07:37	08:52	10:25	13:43	15:17	16:32
64°	07:26	08:33	09:48	14:21	15:35	16:42
62°	07:17	08:18	09:22	14:47	15:50	16:52
60°	07:09	08:05	09:02	15:07	16:03	17:00
N 58°	07:02	07:54	08:45	15:24	16:15	17:07
56°	06:55	07:44	08:31	15:38	16:24	17:13
54°	06:50	07:35	08:19	15:50	16:33	17:19
52°	06:44	07:27	08:08	16:01	16:41	17:24
50°	06:39	07:20	07:58	16:10	16:48	17:29
45°	06:28	07:05	07:38	16:30	17:04	17:41
N 40°	06:18	06:52	07:22	16:46	17:17	17:51
35°	06:09	06:40	07:08	17:00	17:28	18:00
30°	06:00	06:30	06:56	17:12	17:38	18:08
20°	05:44	06:12	06:35	17:33	17:57	18:24
N 10°	05:28	05:55	06:17	17:51	18:14	18:40
0°	05:12	05:38	06:00	18:08	18:30	18:56
S 10°	04:53	05:20	05:43	18:25	18:48	19:15
20°	04:31	05:00	05:25	18:43	19:08	19:37
30°	04:03	04:36	05:03	19:05	19:32	20:05
35°	03:45	04:21	04:51	19:18	19:47	20:23
40°	03:22	04:03	04:36	19:32	20:05	20:46
45°	02:52	03:41	04:18	19:50	20:27	21:15
S 50°	02:09	03:13	03:57	20:11	20:55	21:58
52°	01:43	02:58	03:46	20:22	21:10	22:24
54°	01:04	02:41	03:34	20:34	21:27	23:02
56°	▭	02:20	03:20	20:47	21:47	▭
58°	▭	01:52	03:04	21:03	22:15	▭
S 60°	▭	01:10	02:45	21:22	22:56	▭

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	11:58	11:49	11:41	17:38	19:29	21:19
N 70°	11:30	11:31	11:31	18:04	19:45	21:27
68°	11:09	11:17	11:22	18:25	19:58	21:33
66°	10:52	11:05	11:15	18:40	20:09	21:39
64°	10:39	10:55	11:09	18:53	20:17	21:44
62°	10:27	10:47	11:04	19:04	20:25	21:48
60°	10:17	10:40	10:59	19:14	20:31	21:51
N 58°	10:08	10:34	10:55	19:22	20:37	21:54
56°	10:01	10:28	10:52	19:29	20:42	21:57
54°	09:54	10:23	10:49	19:35	20:46	21:59
52°	09:48	10:18	10:46	19:41	20:50	22:02
50°	09:42	10:14	10:43	19:46	20:54	22:04
45°	09:30	10:05	10:37	19:57	21:02	22:08
N 40°	09:20	09:57	10:32	20:06	21:08	22:12
35°	09:12	09:51	10:28	20:14	21:14	22:15
30°	09:04	09:45	10:24	20:21	21:19	22:17
20°	08:51	09:35	10:18	20:33	21:27	22:22
N 10°	08:40	09:26	10:12	20:43	21:35	22:26
0°	08:29	09:18	10:07	20:53	21:41	22:30
S 10°	08:18	09:10	10:01	21:02	21:48	22:34
20°	08:07	09:01	09:56	21:12	21:56	22:38
30°	07:54	08:51	09:49	21:24	22:04	22:42
35°	07:46	08:45	09:45	21:30	22:08	22:45
40°	07:37	08:38	09:41	21:38	22:14	22:48
45°	07:27	08:31	09:36	21:47	22:20	22:51
S 50°	07:15	08:21	09:30	21:57	22:27	22:55
52°	07:09	08:17	09:27	22:02	22:31	22:57
54°	07:03	08:12	09:24	22:07	22:34	22:59
56°	06:56	08:07	09:21	22:13	22:38	23:01
58°	06:48	08:01	09:17	22:20	22:43	23:04
S 60°	06:38	07:54	09:13	22:27	22:48	23:06

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 3-5 10-26%
01	03:26	03:41	12:04	14:41	02:16	
02	03:55	04:09	12:04	15:30	03:05	
03	04:23	04:36	12:05	16:18	03:54	

January 04, 05, 06 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	103°47.6	130°33.9	S12°22.2	120°16.3	S07°54.2	263°28.9	S07°09.8	202°43.8	S21°53.8
1	118°50.1	145°33.9	21.1	135°17.0	53.4	278°31.1	09.9	217°46.0	53.8
2	133°52.5	160°33.9	19.9	150°17.8	52.7	293°33.3	10.0	232°48.2	53.8
3	148°55.0	175°33.8	·· 18.8	165°18.5	·· 51.9	308°35.5	·· 10.1	247°50.3	·· 53.8
4	163°57.5	190°33.8	17.7	180°19.2	51.2	323°37.8	10.2	262°52.5	53.8
5	178°59.9	205°33.8	16.6	195°19.9	50.4	338°40.0	10.2	277°54.7	53.9
6	194°02.4	220°33.8	S12°15.5	210°20.6	S07°49.7	353°42.2	S07°10.3	292°56.8	S21°53.9
7	209°04.8	235°33.7	14.3	225°21.3	48.9	8°44.5	10.4	307°59.0	53.9
8	224°07.3	250°33.7	13.2	240°22.1	48.1	23°46.7	10.5	323°01.1	53.9
9	239°09.8	265°33.7	·· 12.1	255°22.8	·· 47.4	38°48.9	·· 10.6	338°03.3	·· 53.9
10	254°12.2	280°33.7	11.0	270°23.5	46.6	53°51.2	10.6	353°05.5	53.9
11	269°14.7	295°33.7	09.8	285°24.2	45.9	68°53.4	10.7	8°07.6	54.0
12	284°17.2	310°33.6	S12°08.7	300°25.0	S07°45.1	83°55.6	S07°10.8	23°09.8	S21°54.0
13	299°19.6	325°33.6	07.6	315°25.7	44.3	98°57.9	10.9	38°12.0	54.0
14	314°22.1	340°33.6	06.5	330°26.4	43.6	114°00.1	11.0	53°14.1	54.0
15	329°24.6	355°33.6	·· 05.3	345°27.1	·· 42.8	129°02.4	·· 11.0	68°16.3	·· 54.0
16	344°27.0	10°33.6	04.2	0°27.8	42.1	144°04.6	11.1	83°18.4	54.1
17	359°29.5	25°33.6	03.1	15°28.6	41.3	159°06.8	11.2	98°20.6	54.1
18	14°31.9	40°33.5	S12°01.9	30°29.3	S07°40.5	174°09.1	S07°11.3	113°22.8	S21°54.1
19	29°34.4	55°33.5	12°00.8	45°30.0	39.8	189°11.3	11.4	128°24.9	54.1
20	44°36.9	70°33.5	11°59.7	60°30.7	39.0	204°13.5	11.5	143°27.1	54.1
21	59°39.3	85°33.5	·· 58.6	75°31.4	·· 38.2	219°15.8	·· 11.5	158°29.3	·· 54.1
22	74°41.8	100°33.5	57.4	90°32.2	37.5	234°18.0	11.6	173°31.4	54.2
23	89°44.3	115°33.5	56.3	105°32.9	36.7	249°20.2	11.7	188°33.6	54.2
Mer.pass.:17:02		v-0.0 d1.1 m-4.2		v0.7 d0.8 m0.9		v2.2 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	104°46.7	130°33.5	S11°55.2	120°33.6	S07°36.0	264°22.5	S07°11.8	203°35.7	S21°54.2
1	119°49.2	145°33.5	54.0	135°34.3	35.2	279°24.7	11.9	218°37.9	54.2
2	134°51.7	160°33.5	52.9	150°35.1	34.4	294°27.0	11.9	233°40.1	54.2
3	149°54.1	175°33.5	·· 51.8	165°35.8	·· 33.7	309°29.2	·· 12.0	248°42.2	·· 54.2
4	164°56.6	190°33.5	50.6	180°36.5	32.9	324°31.4	12.1	263°44.4	54.3
5	179°59.1	205°33.5	49.5	195°37.2	32.2	339°33.7	12.2	278°46.6	54.3
6	195°01.5	220°33.5	S11°48.4	210°37.9	S07°31.4	354°35.9	S07°12.3	293°48.7	S21°54.3
7	210°04.0	235°33.5	47.2	225°38.7	30.6	9°38.2	12.3	308°50.9	54.3
8	225°06.4	250°33.5	46.1	240°39.4	29.9	24°40.4	12.4	323°53.0	54.3
9	240°08.9	265°33.5	·· 45.0	255°40.1	·· 29.1	39°42.6	·· 12.5	338°55.2	·· 54.4
10	255°11.4	280°33.5	43.8	270°40.8	28.3	54°44.9	12.6	353°57.4	54.4
11	270°13.8	295°33.5	42.7	285°41.6	27.6	69°47.1	12.6	8°59.5	54.4
12	285°16.3	310°33.5	S11°41.6	300°42.3	S07°26.8	84°49.4	S07°12.7	24°01.7	S21°54.4
13	300°18.8	325°33.5	40.4	315°43.0	26.1	99°51.6	12.8	39°03.9	54.4
14	315°21.2	340°33.5	39.3	330°43.7	25.3	114°53.8	12.9	54°06.0	54.4
15	330°23.7	355°33.5	·· 38.2	345°44.5	·· 24.5	129°56.1	·· 13.0	69°08.2	·· 54.5
16	345°26.2	10°33.5	37.0	0°45.2	23.8	144°58.3	13.0	84°10.4	54.5
17	0°28.6	25°33.5	35.9	15°45.9	23.0	160°00.6	13.1	99°12.5	54.5
18	15°31.1	40°33.5	S11°34.8	30°46.6	S07°22.2	175°02.8	S07°13.2	114°14.7	S21°54.5
19	30°33.5	55°33.5	33.6	45°47.3	21.5	190°05.0	13.3	129°16.8	54.5
20	45°36.0	70°33.5	32.5	60°48.1	20.7	205°07.3	13.4	144°19.0	54.5
21	60°38.5	85°33.5	·· 31.4	75°48.8	·· 20.0	220°09.5	·· 13.4	159°21.2	·· 54.6
22	75°40.9	100°33.5	30.2	90°49.5	19.2	235°11.8	13.5	174°23.3	54.6
23	90°43.4	115°33.6	29.1	105°50.2	18.4	250°14.0	13.6	189°25.5	54.6
Mer.pass.:16:58		v-0.0 d1.1 m-4.2		v0.7 d0.8 m0.9		v2.2 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	105°45.9	130°33.6	S11°27.9	120°51.0	S07°17.7	265°16.3	S07°13.7	204°27.7	S21°54.6
1	120°48.3	145°33.6	26.8	135°51.7	16.9	280°18.5	13.7	219°29.8	54.6
2	135°50.8	160°33.6	25.7	150°52.4	16.1	295°20.7	13.8	234°32.0	54.6
3	150°53.3	175°33.6	·· 24.5	165°53.1	·· 15.4	310°23.0	·· 13.9	249°34.2	·· 54.7
4	165°55.7	190°33.6	23.4	180°53.9	14.6	325°25.2	14.0	264°36.3	54.7
5	180°58.2	205°33.7	22.2	195°54.6	13.9	340°27.5	14.1	279°38.5	54.7
6	196°00.7	220°33.7	S11°21.1	210°55.3	S07°13.1	355°29.7	S07°14.1	294°40.7	S21°54.7
7	211°03.1	235°33.7	20.0	225°56.0	12.3	10°32.0	14.2	309°42.8	54.7
8	226°05.6	250°33.7	18.8	240°56.8	11.6	25°34.2	14.3	324°45.0	54.8
9	241°08.0	265°33.8	·· 17.7	255°57.5	·· 10.8	40°36.5	·· 14.4	339°47.2	·· 54.8
10	256°10.5	280°33.8	16.5	270°58.2	10.0	55°38.7	14.4	354°49.3	54.8
11	271°13.0	295°33.8	15.4	285°58.9	09.3	70°41.0	14.5	9°51.5	54.8
12	286°15.4	310°33.8	S11°14.3	300°59.7	S07°08.5	85°43.2	S07°14.6	24°53.6	S21°54.8
13	301°17.9	325°33.9	13.1	316°00.4	07.7	100°45.4	14.7	39°55.8	54.8
14	316°20.4	340°33.9	12.0	331°01.1	07.0	115°47.7	14.7	54°58.0	54.9
15	331°22.8	355°33.9	·· 10.8	346°01.9	·· 06.2	130°49.9	·· 14.8	70°00.1	·· 54.9
16	346°25.3	10°33.9	09.7	1°02.6	05.4	145°52.2	14.9	85°02.3	54.9
17	1°27.8	25°34.0	08.5	16°03.3	04.7	160°54.4	15.0	100°04.5	54.9
18	16°30.2	40°34.0	S11°07.4	31°04.0	S07°03.9	175°56.7	S07°15.0	115°06.6	S21°54.9
19	31°32.7	55°34.0	06.3	46°04.8	03.2	190°58.9	15.1	130°08.8	54.9
20	46°35.2	70°34.1	05.1	61°05.5	02.4	206°01.2	15.2	145°11.0	55.0
21	61°37.6	85°34.1	·· 04.0	76°06.2	·· 01.6	221°03.4	·· 15.3	160°13.1	·· 55.0
22	76°40.1	100°34.1	02.8	91°06.9	00.9	236°05.7	15.3	175°15.3	55.0
23	91°42.5	115°34.2	01.7	106°07.7	00.1	251°07.9	15.4	190°17.5	55.0
Mer.pass.:16:54		v0.0 d1.1 m-4.2		v0.7 d0.8 m0.9		v2.2 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°41.0	29°11.1
Ankaa	353°13.5	-42°13.1
Schedar	349°37.7	56°38.0
Diphda	348°53.5	-17°53.8
Achernar	335°25.0	-57°09.5
Hamal	327°57.9	23°32.5
Polaris	316°24.6	89°20.3
Acamar	315°16.3	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.5	49°55.3
Aldebaran	290°46.3	16°32.4
Rigel	281°09.4	-8°11.2
Capella	280°30.4	46°00.7
Bellatrix	278°29.1	6°21.7
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.7
Betelgeuse	270°58.4	7°24.4
Canopus	263°54.5	-52°42.5
Sirius	258°31.2	-16°44.6
Adhara	255°10.2	-28°59.9
Procyon	244°56.9	5°10.7
Pollux	243°24.5	27°58.8
Avior	234°16.3	-59°33.9
Suhail	222°50.2	-43°30.1
Miaplacidus	221°38.2	-69°47.1
Alphard	217°53.5	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°48.6	61°39.3
Denebola	182°31.1	14°28.5
Gienah	175°49.7	-17°38.1
Acrux	173°06.4	-63°11.2
Gacrux	171°58.0	-57°12.2
Alioth	166°18.7	55°51.8
Spica	158°28.7	-11°14.9
Alkaid	152°57.2	49°13.6
Hadar	148°44.5	-60°26.9
Menkent	148°04.8	-36°26.9
Arcturus	145°53.7	19°05.6
Rigil Kent.	139°48.6	-60°53.9
Kochab	137°20.9	74°05.0
Zuben'ubi	137°02.9	-16°06.5
Alphecca	126°09.2	26°39.5
Antares	112°23.6	-26°27.9
Atria	107°23.7	-69°03.1
Sabik	102°10.1	-15°44.5
Shaula	96°19.0	-37°06.7
Rasalhague	96°04.6	12°33.0
Eltanin	90°45.6	51°29.3
Kaus Aust.	83°41.0	-34°22.4
Vega	80°37.8	38°48.1
Nunki	75°55.7	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.8
Deneb	49°30.2	45°20.7
Enif	33°45.0	9°57.3
Al Na'ir	27°41.1	-46°52.9
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.9

Jan 04 Wed	**SHA**	**Mer.pass**
Venus	26°46.3	15:18
Mars	16°28.7	15:58
Jupiter	159°41.3	06:25
Saturn	98°56.3	10:28

Jan 05 Thu	**SHA**	**Mer.pass**
Venus	25°46.7	15:18
Mars	15°46.9	15:57
Jupiter	159°35.8	06:22
Saturn	98°49.0	10:24

Jan 06 Fri	**SHA**	**Mer.pass**
Venus	24°47.7	15:18
Mars	15°05.1	15:56
Jupiter	159°30.4	06:18
Saturn	98°41.8	10:21

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.5877 sec ΔT = TT-UT1 = +68.5963 sec

2017 January 04 to Jan. 06 UT

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Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°47.5	S22°43.1	111°37.3	11.5'	S04°57.4	10.5'	57.6'
1	193°47.2	42.8	126°07.8	11.5'	04°46.8	10.5'	57.6'
2	208°46.9	42.6	140°38.4	11.5'	04°36.3	10.6'	57.7'
3	223°46.6	·· 42.3	155°08.9	11.5'	04°25.7	10.6'	57.7'
4	238°46.3	42.0	169°39.4	11.5'	04°15.1	10.6'	57.7'
5	253°46.1	41.8	184°09.9	11.5'	04°04.4	10.7'	57.7'
6	268°45.8	S22°41.5	198°40.4	11.5'	S03°53.7	10.7'	57.8'
7	283°45.5	41.2	213°10.9	11.5'	03°43.0	10.7'	57.8'
8	298°45.2	41.0	227°41.4	11.5'	03°32.3	10.7'	57.8'
9	313°44.9	·· 40.7	242°11.8	11.5'	03°21.6	10.8'	57.8'
10	328°44.7	40.4	256°42.3	11.4'	03°10.8	10.8'	57.9'
11	343°44.4	40.2	271°12.7	11.4'	03°00.0	10.8'	57.9'
12	358°44.1	S22°39.9	285°43.1	11.4'	S02°49.1	10.8'	57.9'
13	13°43.8	39.6	300°13.5	11.4'	02°38.3	10.9'	57.9'
14	28°43.5	39.4	314°43.9	11.4'	02°27.4	10.9'	58.0'
15	43°43.2	·· 39.1	329°14.3	11.4'	02°16.5	10.9'	58.0'
16	58°43.0	38.8	343°44.6	11.3'	02°05.6	10.9'	58.0'
17	73°42.7	38.5	358°14.9	11.3'	01°54.6	11.0'	58.0'
18	88°42.4	S22°38.3	12°45.3	11.3'	S01°43.7	11.0'	58.1'
19	103°42.1	38.0	27°15.5	11.3'	01°32.7	11.0'	58.1'
20	118°41.8	37.7	41°45.8	11.3'	01°21.7	11.0'	58.1'
21	133°41.6	·· 37.4	56°16.1	11.2'	01°10.7	11.0'	58.1'
22	148°41.3	37.1	70°46.3	11.2'	00°59.7	11.0'	58.1'
23	163°41.0	36.9	85°16.5	11.2'	00°48.6	11.0'	58.2'
	SD.=16.3	d=0.3	S.D.=15.8				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°40.7	S22°36.6	99°46.7	11.2'	S00°37.6	11.1'	58.2'
1	193°40.4	36.3	114°16.8	11.1'	00°26.5	11.1'	58.2'
2	208°40.2	36.0	128°47.0	11.1'	00°15.4	11.1'	58.2'
3	223°39.9	·· 35.7	143°17.1	11.1'	S00°04.3	11.1'	58.3'
4	238°39.6	35.5	157°47.2	11.1'	N00°06.8	11.1'	58.3'
5	253°39.3	35.2	172°17.2	11.0'	00°17.9	11.1'	58.3'
6	268°39.0	S22°34.9	186°47.3	11.0'	N00°29.0	11.1'	58.3'
7	283°38.8	34.6	201°17.3	11.0'	00°40.1	11.1'	58.4'
8	298°38.5	34.3	215°47.2	11.0'	00°51.2	11.1'	58.4'
9	313°38.2	·· 34.0	230°17.2	10.9'	01°02.4	11.1'	58.4'
10	328°37.9	33.7	244°47.1	10.9'	01°13.5	11.1'	58.4'
11	343°37.7	33.4	259°16.9	10.9'	01°24.6	11.1'	58.5'
12	358°37.4	S22°33.2	273°46.8	10.8'	N01°35.8	11.1'	58.5'
13	13°37.1	32.9	288°16.6	10.8'	01°46.9	11.1'	58.5'
14	28°36.8	32.6	302°46.4	10.8'	01°58.0	11.1'	58.5'
15	43°36.6	·· 32.3	317°16.1	10.7'	02°09.2	11.1'	58.6'
16	58°36.3	32.0	331°45.8	10.7'	02°20.3	11.1'	58.6'
17	73°36.0	31.7	346°15.5	10.7'	02°31.4	11.1'	58.6'
18	88°35.7	S22°31.4	0°45.1	10.6'	N02°42.6	11.1'	58.6'
19	103°35.4	31.1	15°14.7	10.6'	02°53.7	11.1'	58.7'
20	118°35.2	30.8	29°44.3	10.5'	03°04.8	11.1'	58.7'
21	133°34.9	·· 30.5	44°13.8	10.5'	03°15.9	11.1'	58.7'
22	148°34.6	30.2	58°43.3	10.5'	03°27.0	11.1'	58.7'
23	163°34.3	29.9	73°12.8	10.4'	03°38.1	11.1'	58.8'
	SD.=16.3	d=0.3	S.D.=15.9				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°34.1	S22°29.6	87°42.2	10.4'	N03°49.2	11.1'	58.8'
1	193°33.8	29.3	102°11.5	10.3'	04°00.2	11.1'	58.8'
2	208°33.5	29.0	116°40.8	10.3'	04°11.3	11.0'	58.8'
3	223°33.2	·· 28.7	131°10.1	10.3'	04°22.3	11.0'	58.9'
4	238°33.0	28.4	145°39.3	10.2'	04°33.3	11.0'	58.9'
5	253°32.7	28.1	160°08.5	10.2'	04°44.3	11.0'	58.9'
6	268°32.4	S22°27.8	174°37.7	10.1'	N04°55.3	11.0'	58.9'
7	283°32.2	27.5	189°06.8	10.1'	05°06.3	11.0'	59.0'
8	298°31.9	27.2	203°35.8	10.0'	05°17.2	10.9'	59.0'
9	313°31.6	·· 26.9	218°04.8	10.0'	05°28.2	10.9'	59.0'
10	328°31.3	26.6	232°33.8	9.9'	05°39.1	10.9'	59.0'
11	343°31.1	26.3	247°02.7	9.9'	05°50.0	10.9'	59.0'
12	358°30.8	S22°26.0	261°31.5	9.8'	N06°00.8	10.8'	59.1'
13	13°30.5	25.7	276°00.4	9.8'	06°11.6	10.8'	59.1'
14	28°30.2	25.3	290°29.1	9.7'	06°22.5	10.8'	59.1'
15	43°30.0	·· 25.0	304°57.8	9.7'	06°33.2	10.8'	59.1'
16	58°29.7	24.7	319°26.5	9.6'	06°44.0	10.7'	59.2'
17	73°29.4	24.4	333°55.1	9.6'	06°54.7	10.7'	59.2'
18	88°29.2	S22°24.1	348°23.6	9.5'	N07°05.4	10.7'	59.2'
19	103°28.9	23.8	2°52.1	9.5'	07°16.1	10.6'	59.2'
20	118°28.6	23.5	17°20.6	9.4'	07°26.7	10.6'	59.3'
21	133°28.4	·· 23.2	31°49.0	9.4'	07°37.3	10.6'	59.3'
22	148°28.1	22.8	46°17.3	9.3'	07°47.8	10.5'	59.3'
23	163°27.8	22.5	60°45.6	9.3'	07°58.3	10.5'	59.3'
	SD.=16.3	d=0.3	S.D.=16.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:19	10:29	▬	▬	13:43	15:52
N 70°	08:01	09:42	▬	▬	14:29	16:10
68°	07:47	09:12	11:27	12:45	15:00	16:25
66°	07:35	08:49	10:19	13:52	15:22	16:37
64°	07:25	08:31	09:44	14:27	15:40	16:47
62°	07:16	08:16	09:19	14:52	15:55	16:56
60°	07:08	08:04	08:59	15:12	16:08	17:03
N 58°	07:01	07:53	08:43	15:28	16:18	17:10
56°	06:55	07:43	08:29	15:42	16:28	17:17
54°	06:49	07:35	08:18	15:54	16:37	17:22
52°	06:44	07:27	08:07	16:04	16:44	17:28
50°	06:39	07:20	07:58	16:13	16:51	17:32
45°	06:28	07:05	07:38	16:33	17:07	17:43
N 40°	06:18	06:52	07:22	16:49	17:19	17:53
35°	06:09	06:41	07:09	17:03	17:31	18:02
30°	06:01	06:31	06:57	17:14	17:41	18:10
20°	05:45	06:12	06:36	17:35	17:59	18:26
N 10°	05:30	05:56	06:19	17:53	18:15	18:41
0°	05:13	05:39	06:02	18:09	18:32	18:58
S 10°	04:55	05:22	05:45	18:26	18:49	19:16
20°	04:33	05:02	05:27	18:44	19:09	19:38
30°	04:05	04:38	05:05	19:05	19:32	20:05
35°	03:47	04:24	04:53	19:18	19:47	20:23
40°	03:25	04:06	04:39	19:32	20:04	20:45
45°	02:56	03:45	04:21	19:49	20:26	21:14
S 50°	02:14	03:16	04:00	20:11	20:54	21:56
52°	01:49	03:02	03:50	20:21	21:08	22:20
54°	01:13	02:46	03:38	20:32	21:24	22:55
56°	▭	02:25	03:25	20:46	21:45	▭
58°	▭	01:59	03:09	21:01	22:11	▭
S 60°	▭	01:20	02:50	21:20	22:48	▭

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	11:34	11:27	11:20	23:08	–:–	00:59
N 70°	11:30	11:29	11:28	23:09	–:–	00:53
68°	11:26	11:30	11:35	23:10	–:–	00:49
66°	11:24	11:32	11:41	23:11	–:–	00:45
64°	11:21	11:33	11:45	23:12	–:–	00:42
62°	11:19	11:34	11:49	23:12	–:–	00:39
60°	11:17	11:35	11:53	23:13	–:–	00:37
N 58°	11:16	11:35	11:56	23:13	–:–	00:34
56°	11:14	11:36	11:59	23:14	–:–	00:33
54°	11:13	11:37	12:02	23:14	–:–	00:31
52°	11:12	11:37	12:04	23:15	–:–	00:29
50°	11:10	11:38	12:06	23:15	–:–	00:28
45°	11:08	11:39	12:11	23:16	–:–	00:25
N 40°	11:06	11:40	12:15	23:16	–:–	00:22
35°	11:04	11:41	12:18	23:17	–:–	00:20
30°	11:03	11:41	12:21	23:17	–:–	00:18
20°	11:00	11:43	12:27	23:18	–:–	00:15
N 10°	10:58	11:44	12:31	23:18	–:–	00:12
0°	10:56	11:45	12:36	23:19	–:–	00:09
S 10°	10:53	11:46	12:40	23:20	–:–	00:06
20°	10:51	11:47	12:45	23:20	–:–	00:03
30°	10:48	11:49	12:51	23:21	–:–	00:00
35°	10:47	11:50	12:54	23:21	23:58	–:–
40°	10:45	11:51	12:58	23:21	23:55	–:–
45°	10:43	11:52	13:02	23:22	23:53	–:–
S 50°	10:41	11:53	13:07	23:22	23:50	–:–
52°	10:40	11:54	13:09	23:23	23:48	–:–
54°	10:38	11:54	13:12	23:23	23:47	–:–
56°	10:37	11:55	13:15	23:23	23:45	–:–
58°	10:36	11:56	13:18	23:23	23:43	–:–
S 60°	10:34	11:57	13:22	23:24	23:41	–:–

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 6-8 36-58%
04	04:50	05:04	12:05	17:07	04:43	
05	05:17	05:30	12:06	17:57	05:32	
06	05:44	05:57	12:06	18:48	06:22	

January 07, 08, 09 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	106°45.0	130°34.2	S11°00.5	121°08.4	S06°59.3	266°10.2	S07°15.5	205°19.6	S21°55.0
1	121°47.5	145°34.3	10°59.4	136°09.1	58.6	281°12.4	15.6	220°21.8	55.0
2	136°49.9	160°34.3	58.2	151°09.9	57.8	296°14.7	15.6	235°24.0	55.1
3	151°52.4	175°34.3	·· 57.1	166°10.6	·· 57.0	311°16.9	·· 15.7	250°26.1	·· 55.1
4	166°54.9	190°34.4	55.9	181°11.3	56.3	326°19.2	15.8	265°28.3	55.1
5	181°57.3	205°34.4	54.8	196°12.0	55.5	341°21.4	15.9	280°30.5	55.1
6	196°59.8	220°34.5	S10°53.6	211°12.8	S06°54.7	356°23.7	S07°15.9	295°32.6	S21°55.1
7	212°02.3	235°34.5	52.5	226°13.5	54.0	11°25.9	16.0	310°34.8	55.1
8	227°04.7	250°34.5	51.3	241°14.2	53.2	26°28.2	16.1	325°37.0	55.2
9	242°07.2	265°34.6	·· 50.2	256°14.9	·· 52.4	41°30.4	·· 16.2	340°39.1	·· 55.2
10	257°09.6	280°34.6	49.0	271°15.7	51.7	56°32.7	16.2	355°41.3	55.2
11	272°12.1	295°34.7	47.9	286°16.4	50.9	71°34.9	16.3	10°43.5	55.2
12	287°14.6	310°34.7	S10°46.7	301°17.1	S06°50.1	86°37.2	S07°16.4	25°45.6	S21°55.2
13	302°17.0	325°34.8	45.6	316°17.9	49.4	101°39.4	16.5	40°47.8	55.2
14	317°19.5	340°34.8	44.4	331°18.6	48.6	116°41.7	16.5	55°50.0	55.3
15	332°22.0	355°34.9	·· 43.3	346°19.3	·· 47.8	131°44.0	·· 16.6	70°52.1	·· 55.3
16	347°24.4	10°34.9	42.1	1°20.0	47.1	146°46.2	16.7	85°54.3	55.3
17	2°26.9	25°35.0	41.0	16°20.8	46.3	161°48.5	16.8	100°56.5	55.3
18	17°29.4	40°35.1	S10°39.8	31°21.5	S06°45.5	176°50.7	S07°16.8	115°58.6	S21°55.3
19	32°31.8	55°35.1	38.7	46°22.2	44.8	191°53.0	16.9	131°00.8	55.3
20	47°34.3	70°35.2	37.5	61°23.0	44.0	206°55.2	17.0	146°03.0	55.4
21	62°36.8	85°35.2	·· 36.4	76°23.7	·· 43.2	221°57.5	·· 17.0	161°05.1	·· 55.4
22	77°39.2	100°35.3	35.2	91°24.4	42.5	236°59.7	17.1	176°07.3	55.4
23	92°41.7	115°35.3	34.1	106°25.2	41.7	252°02.0	17.2	191°09.5	55.4
Mer.pass.:16:50		v0.0 d1.1 m-4.2		v0.7 d0.8 m0.9		v2.2 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	107°44.1	130°35.4	S10°32.9	121°25.9	S06°40.9	267°04.2	S07°17.3	206°11.6	S21°55.4
1	122°46.6	145°35.5	31.8	136°26.6	40.2	282°06.5	17.3	221°13.8	55.4
2	137°49.1	160°35.5	30.6	151°27.3	39.4	297°08.8	17.4	236°16.0	55.5
3	152°51.5	175°35.6	·· 29.5	166°28.1	·· 38.6	312°11.0	·· 17.5	251°18.1	·· 55.5
4	167°54.0	190°35.7	28.3	181°28.8	37.9	327°13.3	17.6	266°20.3	55.5
5	182°56.5	205°35.7	27.2	196°29.5	37.1	342°15.5	17.6	281°22.5	55.5
6	197°58.9	220°35.8	S10°26.0	211°30.3	S06°36.3	357°17.8	S07°17.7	296°24.6	S21°55.5
7	213°01.4	235°35.9	24.8	226°31.0	35.6	12°20.0	17.8	311°26.8	55.5
8	228°03.9	250°35.9	23.7	241°31.7	34.8	27°22.3	17.8	326°29.0	55.6
9	243°06.3	265°36.0	·· 22.5	256°32.5	·· 34.0	42°24.6	·· 17.9	341°31.1	·· 55.6
10	258°08.8	280°36.1	21.4	271°33.2	33.3	57°26.8	18.0	356°33.3	55.6
11	273°11.3	295°36.1	20.2	286°33.9	32.5	72°29.1	18.1	11°35.5	55.6
12	288°13.7	310°36.2	S10°19.1	301°34.7	S06°31.7	87°31.3	S07°18.1	26°37.6	S21°55.6
13	303°16.2	325°36.3	17.9	316°35.4	31.0	102°33.6	18.2	41°39.8	55.6
14	318°18.6	340°36.4	16.8	331°36.1	30.2	117°35.9	18.3	56°42.0	55.7
15	333°21.1	355°36.4	·· 15.6	346°36.8	·· 29.4	132°38.1	·· 18.3	71°44.1	·· 55.7
16	348°23.6	10°36.5	14.4	1°37.6	28.7	147°40.4	18.4	86°46.3	55.7
17	3°26.0	25°36.6	13.3	16°38.3	27.9	162°42.6	18.5	101°48.5	55.7
18	18°28.5	40°36.7	S10°12.1	31°39.0	S06°27.1	177°44.9	S07°18.6	116°50.6	S21°55.7
19	33°31.0	55°36.7	11.0	46°39.8	26.3	192°47.2	18.6	131°52.8	55.7
20	48°33.4	70°36.8	09.8	61°40.5	25.6	207°49.4	18.7	146°55.0	55.7
21	63°35.9	85°36.9	·· 08.6	76°41.2	·· 24.8	222°51.7	·· 18.8	161°57.1	·· 55.8
22	78°38.4	100°37.0	07.5	91°42.0	24.0	237°53.9	18.8	176°59.3	55.8
23	93°40.8	115°37.1	06.3	106°42.7	23.3	252°56.2	18.9	192°01.5	55.8
Mer.pass.:16:46		v0.1 d1.2 m-4.2		v0.7 d0.8 m0.9		v2.3 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	108°43.3	130°37.1	S10°05.2	121°43.4	S06°22.5	267°58.5	S07°19.0	207°03.7	S21°55.8
1	123°45.8	145°37.2	04.0	136°44.2	21.7	283°00.7	19.0	222°05.8	55.8
2	138°48.2	160°37.3	02.8	151°44.9	21.0	298°03.0	19.1	237°08.0	55.8
3	153°50.7	175°37.4	·· 01.7	166°45.6	·· 20.2	313°05.3	·· 19.2	252°10.2	·· 55.9
4	168°53.1	190°37.5	10°00.5	181°46.4	19.4	328°07.5	19.3	267°12.3	55.9
5	183°55.6	205°37.6	09°59.4	196°47.1	18.7	343°09.8	19.3	282°14.5	55.9
6	198°58.1	220°37.7	S09°58.2	211°47.8	S06°17.9	358°12.0	S07°19.4	297°16.7	S21°55.9
7	214°00.5	235°37.8	57.0	226°48.6	17.1	13°14.3	19.5	312°18.8	55.9
8	229°03.0	250°37.9	55.9	241°49.3	16.4	28°16.6	19.5	327°21.0	55.9
9	244°05.5	265°37.9	·· 54.7	256°50.0	·· 15.6	43°18.8	·· 19.6	342°23.2	·· 56.0
10	259°07.9	280°38.0	53.6	271°50.8	14.8	58°21.1	19.7	357°25.3	56.0
11	274°10.4	295°38.1	52.4	286°51.5	14.0	73°23.4	19.7	12°27.5	56.0
12	289°12.9	310°38.2	S09°51.2	301°52.2	S06°13.3	88°25.6	S07°19.8	27°29.7	S21°56.0
13	304°15.3	325°38.3	50.1	316°53.0	12.5	103°27.9	19.9	42°31.8	56.0
14	319°17.8	340°38.4	48.9	331°53.7	11.7	118°30.2	19.9	57°34.0	56.0
15	334°20.2	355°38.5	·· 47.7	346°54.4	·· 11.0	133°32.4	·· 20.0	72°36.2	·· 56.1
16	349°22.7	10°38.6	46.6	1°55.2	10.2	148°34.7	20.1	87°38.4	56.1
17	4°25.2	25°38.7	45.4	16°55.9	09.4	163°37.0	20.1	102°40.5	56.1
18	19°27.6	40°38.8	S09°44.2	31°56.6	S06°08.7	178°39.2	S07°20.2	117°42.7	S21°56.1
19	34°30.1	55°38.9	43.1	46°57.4	07.9	193°41.5	20.3	132°44.9	56.1
20	49°32.6	70°39.0	41.9	61°58.1	07.1	208°43.8	20.3	147°47.0	56.1
21	64°35.0	85°39.1	·· 40.8	76°58.8	·· 06.3	223°46.0	·· 20.4	162°49.2	·· 56.1
22	79°37.5	100°39.2	39.6	91°59.6	05.6	238°48.3	20.5	177°51.4	56.2
23	94°40.0	115°39.3	38.4	107°00.3	04.8	253°50.6	20.5	192°53.5	56.2
Mer.pass.:16:42		v0.1 d1.2 m-4.2		v0.7 d0.8 m1.0		v2.3 d-0.1 m-1.8		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.5	-42°13.1
Schedar	349°37.7	56°38.0
Diphda	348°53.5	-17°53.8
Achernar	335°25.0	-57°09.5
Hamal	327°57.9	23°32.5
Polaris	316°25.7	89°20.3
Acamar	315°16.4	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.5	49°55.3
Aldebaran	290°46.3	16°32.4
Rigel	281°09.4	-8°11.2
Capella	280°30.4	46°00.7
Bellatrix	278°29.1	6°21.6
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.7
Betelgeuse	270°58.4	7°24.4
Canopus	263°54.5	-52°42.6
Sirius	258°31.2	-16°44.6
Adhara	255°10.2	-28°59.9
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.8
Avior	234°16.3	-59°33.9
Suhail	222°50.2	-43°30.1
Miaplacidus	221°38.2	-69°47.2
Alphard	217°53.4	-8°44.1
Regulus	207°40.7	11°52.9
Dubhe	193°48.6	61°39.3
Denebola	182°31.1	14°28.5
Gienah	175°49.7	-17°38.1
Acrux	173°06.3	-63°11.3
Gacrux	171°58.0	-57°12.2
Alioth	166°18.7	55°51.8
Spica	158°28.7	-11°14.9
Alkaid	152°57.2	49°13.5
Hadar	148°44.5	-60°26.9
Menkent	148°04.8	-36°26.9
Arcturus	145°53.7	19°05.6
Rigil Kent.	139°48.6	-60°53.9
Kochab	137°20.8	74°05.0
Zuben'ubi	137°02.9	-16°06.5
Alphecca	126°09.2	26°39.5
Antares	112°23.6	-26°27.9
Atria	107°23.7	-69°03.1
Sabik	102°10.1	-15°44.5
Shaula	96°19.0	-37°06.7
Rasalhague	96°04.5	12°33.0
Eltanin	90°45.5	51°29.3
Kaus Aust.	83°41.0	-34°22.4
Vega	80°37.8	38°48.1
Nunki	75°55.7	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.8
Deneb	49°30.2	45°20.7
Enif	33°45.0	9°57.3
Al Na'ir	27°41.1	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.9

Jan 07 Sat	SHA	Mer.pass
Venus	23°49.2	15:18
Mars	14°23.4	15:55
Jupiter	159°25.2	06:14
Saturn	98°34.6	10:17

Jan 08 Sun	SHA	Mer.pass
Venus	22°51.3	15:18
Mars	13°41.7	15:53
Jupiter	159°20.1	06:11
Saturn	98°27.5	10:14

Jan 09 Mon	SHA	Mer.pass
Venus	21°53.9	15:17
Mars	13°00.2	15:52
Jupiter	159°15.2	06:07
Saturn	98°20.4	10:10

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.5841 sec ΔT = TT-UT1 = +68.5999 sec

2017 January 07 to Jan. 09 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°27.5	S22°22.2	75°13.8	9.2'	N08°08.8	10.5'	59.3'
1	193°27.3	21.9	89°42.0	9.1'	08°19.2	10.4'	59.4'
2	208°27.0	21.6	104°10.1	9.1'	08°29.6	10.4'	59.4'
3	223°26.7	·· 21.2	118°38.1	9.0'	08°40.0	10.3'	59.4'
4	238°26.5	20.9	133°06.1	9.0'	08°50.3	10.3'	59.4'
5	253°26.2	20.6	147°34.0	8.9'	09°00.6	10.2'	59.5'
6	268°25.9	S22°20.3	162°01.9	8.8'	N09°10.8	10.2'	59.5'
7	283°25.7	20.0	176°29.7	8.8'	09°21.0	10.1'	59.5'
8	298°25.4	19.6	190°57.5	8.7'	09°31.1	10.1'	59.5'
9	313°25.1	·· 19.3	205°25.2	8.7'	09°41.2	10.0'	59.5'
10	328°24.9	19.0	219°52.8	8.6'	09°51.2	10.0'	59.6'
11	343°24.6	18.7	234°20.4	8.5'	10°01.2	9.9'	59.6'
12	358°24.3	S22°18.3	248°47.9	8.5'	N10°11.1	9.9'	59.6'
13	13°24.1	18.0	263°15.4	8.4'	10°20.9	9.8'	59.6'
14	28°23.8	17.7	277°42.7	8.4'	10°30.7	9.8'	59.6'
15	43°23.5	·· 17.3	292°10.1	8.3'	10°40.5	9.7'	59.7'
16	58°23.3	17.0	306°37.3	8.2'	10°50.2	9.7'	59.7'
17	73°23.0	16.7	321°04.5	8.2'	10°59.8	9.6'	59.7'
18	88°22.7	S22°16.4	335°31.7	8.1'	N11°09.4	9.5'	59.7'
19	103°22.5	16.0	349°58.7	8.0'	11°18.9	9.5'	59.7'
20	118°22.2	15.7	4°25.8	8.0'	11°28.4	9.4'	59.8'
21	133°21.9	·· 15.4	18°52.7	7.9'	11°37.7	9.3'	59.8'
22	148°21.7	15.0	33°19.6	7.9'	11°47.1	9.3'	59.8'
23	163°21.4	14.7	47°46.4	7.8'	11°56.3	9.2'	59.8'
	SD.=16.3	d=0.3		S.D.=16.2			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°21.1	S22°14.4	62°13.2	7.7'	N12°05.5	9.1'	59.8'
1	193°20.9	14.0	76°39.9	7.7'	12°14.6	9.1'	59.8'
2	208°20.6	13.7	91°06.5	7.6'	12°23.6	9.0'	59.9'
3	223°20.4	·· 13.3	105°33.0	7.5'	12°32.6	8.9'	59.9'
4	238°20.1	13.0	119°59.5	7.5'	12°41.5	8.9'	59.9'
5	253°19.8	12.7	134°26.0	7.4'	12°50.3	8.8'	59.9'
6	268°19.6	S22°12.3	148°52.3	7.3'	N12°59.0	8.7'	59.9'
7	283°19.3	12.0	163°18.7	7.3'	13°07.7	8.6'	59.9'
8	298°19.0	11.6	177°44.9	7.2'	13°16.3	8.5'	60.0'
9	313°18.8	·· 11.3	192°11.1	7.1'	13°24.8	8.5'	60.0'
10	328°18.5	11.0	206°37.2	7.1'	13°33.2	8.4'	60.0'
11	343°18.3	10.6	221°03.2	7.0'	13°41.6	8.3'	60.0'
12	358°18.0	S22°10.3	235°29.2	7.0'	N13°49.8	8.2'	60.0'
13	13°17.7	09.9	249°55.1	6.9'	13°58.0	8.1'	60.0'
14	28°17.5	09.6	264°21.0	6.8'	14°06.1	8.0'	60.1'
15	43°17.2	·· 09.2	278°46.8	6.8'	14°14.1	8.0'	60.1'
16	58°17.0	08.9	293°12.5	6.7'	14°22.0	7.9'	60.1'
17	73°16.7	08.5	307°38.2	6.6'	14°29.8	7.8'	60.1'
18	88°16.4	S22°08.2	322°03.8	6.6'	N14°37.5	7.7'	60.1'
19	103°16.2	07.8	336°29.4	6.5'	14°45.2	7.6'	60.1'
20	118°15.9	07.5	350°54.8	6.5'	14°52.7	7.5'	60.1'
21	133°15.7	·· 07.1	5°20.3	6.4'	15°00.1	7.4'	60.1'
22	148°15.4	06.8	19°45.6	6.3'	15°07.5	7.3'	60.2'
23	163°15.1	06.4	34°10.9	6.3'	15°14.7	7.2'	60.2'
	SD.=16.3	d=0.3		S.D.=16.4			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°14.9	S22°06.1	48°36.2	6.2'	N15°21.9	7.1'	60.2'
1	193°14.6	05.7	63°01.4	6.2'	15°28.9	7.0'	60.2'
2	208°14.4	05.4	77°26.5	6.1'	15°35.9	6.9'	60.2'
3	223°14.1	·· 05.0	91°51.6	6.0'	15°42.7	6.8'	60.2'
4	238°13.8	04.6	106°16.6	6.0'	15°49.5	6.7'	60.2'
5	253°13.6	04.3	120°41.5	5.9'	15°56.1	6.6'	60.2'
6	268°13.3	S22°03.9	135°06.4	5.9'	N16°02.7	6.5'	60.2'
7	283°13.1	03.6	149°31.3	5.8'	16°09.1	6.4'	60.2'
8	298°12.8	03.2	163°56.1	5.8'	16°15.4	6.3'	60.3'
9	313°12.6	·· 02.8	178°20.8	5.7'	16°21.6	6.2'	60.3'
10	328°12.3	02.5	192°45.5	5.7'	16°27.8	6.1'	60.3'
11	343°12.1	02.1	207°10.1	5.6'	16°33.7	5.9'	60.3'
12	358°11.8	S22°01.8	221°34.7	5.6'	N16°39.6	5.8'	60.3'
13	13°11.5	01.4	235°59.3	5.5'	16°45.4	5.7'	60.3'
14	28°11.3	01.0	250°23.7	5.5'	16°51.1	5.6'	60.3'
15	43°11.0	·· 00.7	264°48.2	5.4'	16°56.6	5.5'	60.3'
16	58°10.8	22°00.3	279°12.6	5.4'	17°02.0	5.4'	60.3'
17	73°10.5	21°59.9	293°36.9	5.3'	17°07.3	5.3'	60.3'
18	88°10.3	S21°59.6	308°01.2	5.3'	N17°12.5	5.1'	60.3'
19	103°10.0	59.2	322°25.5	5.2'	17°17.6	5.0'	60.3'
20	118°09.8	58.8	336°49.7	5.2'	17°22.6	4.9'	60.3'
21	133°09.5	·· 58.5	351°13.8	5.1'	17°27.4	4.8'	60.3'
22	148°09.3	58.1	5°38.0	5.1'	17°32.1	4.7'	60.3'
23	163°09.0	57.7	20°02.1	5.1'	17°36.7	4.5'	60.3'
	SD.=16.3	d=0.4		S.D.=16.4			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:14	10:18	▬	▬	13:56	16:00
N 70°	07:57	09:36	▬	▬	14:39	16:17
68°	07:44	09:07	11:08	13:07	15:07	16:31
66°	07:32	08:46	10:12	14:02	15:29	16:42
64°	07:22	08:28	09:39	14:35	15:46	16:52
62°	07:14	08:14	09:15	14:59	16:00	17:00
60°	07:06	08:02	08:57	15:17	16:12	17:08
N 58°	07:00	07:51	08:41	15:33	16:23	17:14
56°	06:54	07:42	08:28	15:46	16:32	17:20
54°	06:48	07:33	08:16	15:58	16:40	17:26
52°	06:43	07:26	08:06	16:08	16:48	17:31
50°	06:38	07:19	07:57	16:17	16:55	17:36
45°	06:28	07:04	07:37	16:36	17:10	17:46
N 40°	06:18	06:52	07:22	16:52	17:22	17:56
35°	06:09	06:41	07:09	17:05	17:33	18:04
30°	06:01	06:31	06:57	17:17	17:43	18:12
20°	05:46	06:13	06:37	17:37	18:00	18:28
N 10°	05:31	05:57	06:20	17:54	18:17	18:43
0°	05:15	05:41	06:03	18:11	18:33	18:59
S 10°	04:57	05:24	05:47	18:27	18:50	19:17
20°	04:35	05:04	05:29	18:45	19:09	19:38
30°	04:08	04:41	05:08	19:06	19:33	20:05
35°	03:50	04:26	04:56	19:18	19:47	20:23
40°	03:29	04:09	04:41	19:32	20:04	20:44
45°	03:00	03:48	04:25	19:49	20:25	21:12
S 50°	02:20	03:21	04:04	20:09	20:52	21:53
52°	01:56	03:07	03:54	20:19	21:06	22:16
54°	01:23	02:51	03:42	20:31	21:22	22:48
56°	▭	02:31	03:29	20:43	21:41	▭
58°	▭	02:06	03:14	20:58	22:06	▭
S 60°	▭	01:31	02:56	21:16	22:40	▭

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	11:13	11:05	10:52	02:55	04:57	07:10
N 70°	11:29	11:30	11:36	02:41	04:33	06:27
68°	11:41	11:50	12:05	02:30	04:14	05:58
66°	11:51	12:06	12:27	02:22	04:00	05:37
64°	12:00	12:19	12:45	02:14	03:48	05:20
62°	12:07	12:30	13:00	02:08	03:37	05:06
60°	12:14	12:39	13:12	02:02	03:29	04:54
N 58°	12:20	12:48	13:23	01:57	03:21	04:44
56°	12:25	12:55	13:32	01:53	03:14	04:35
54°	12:29	13:01	13:41	01:49	03:08	04:27
52°	12:33	13:07	13:48	01:46	03:03	04:20
50°	12:37	13:13	13:55	01:43	02:58	04:13
45°	12:45	13:24	14:09	01:36	02:48	04:00
N 40°	12:52	13:34	14:21	01:30	02:39	03:48
35°	12:58	13:42	14:31	01:25	02:32	03:39
30°	13:04	13:50	14:40	01:21	02:25	03:30
20°	13:13	14:02	14:56	01:13	02:14	03:16
N 10°	13:21	14:14	15:10	01:07	02:04	03:03
0°	13:29	14:24	15:22	01:01	01:55	02:52
S 10°	13:36	14:35	15:35	00:54	01:46	02:40
20°	13:45	14:46	15:49	00:48	01:36	02:27
30°	13:54	14:59	16:05	00:41	01:25	02:13
35°	14:00	15:07	16:14	00:36	01:18	02:04
40°	14:06	15:16	16:25	00:31	01:11	01:55
45°	14:13	15:26	16:37	00:26	01:02	01:44
S 50°	14:22	15:38	16:52	00:19	00:52	01:31
52°	14:27	15:44	17:00	00:16	00:47	01:24
54°	14:31	15:50	17:08	00:13	00:42	01:17
56°	14:36	15:58	17:16	00:09	00:37	01:10
58°	14:42	16:06	17:27	00:05	00:30	01:01
S 60°	14:48	16:15	17:38	00:00	00:23	00:52

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 9-11 69-88%
07	06:10	06:23	12:06	19:42	07:15	
08	06:35	06:48	12:07	20:38	08:09	
09	07:00	07:13	12:07	21:37	09:07	

January 10, 11, 12 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	109°42.4	130°39.4	S09°37.3	122°01.1	S06°04.0	268°52.8	S07°20.6	207°55.7	S21°56.2
1	124°44.9	145°39.6	36.1	137°01.8	03.3	283°55.1	20.7	222°57.9	56.2
2	139°47.4	160°39.7	34.9	152°02.5	02.5	298°57.4	20.8	238°00.1	56.2
3	154°49.8	175°39.8	·· 33.8	167°03.3	·· 01.7	313°59.6	·· 20.8	253°02.2	·· 56.2
4	169°52.3	190°39.9	32.6	182°04.0	00.9	329°01.9	20.9	268°04.4	56.3
5	184°54.7	205°40.0	31.4	197°04.7	06°00.2	344°04.2	21.0	283°06.6	56.3
6	199°57.2	220°40.1	S09°30.3	212°05.5	S05°59.4	359°06.4	S07°21.0	298°08.7	S21°56.3
7	214°59.7	235°40.2	29.1	227°06.2	58.6	14°08.7	21.1	313°10.9	56.3
8	230°02.1	250°40.3	27.9	242°06.9	57.9	29°11.0	21.2	328°13.1	56.3
9	245°04.6	265°40.5	·· 26.8	257°07.7	·· 57.1	44°13.3	·· 21.2	343°15.2	·· 56.3
10	260°07.1	280°40.6	25.6	272°08.4	56.3	59°15.5	21.3	358°17.4	56.4
11	275°09.5	295°40.7	24.4	287°09.1	55.6	74°17.8	21.3	13°19.6	56.4
12	290°12.0	310°40.8	S09°23.2	302°09.9	S05°54.8	89°20.1	S07°21.4	28°21.8	S21°56.4
13	305°14.5	325°40.9	22.1	317°10.6	54.0	104°22.3	21.5	43°23.9	56.4
14	320°16.9	340°41.1	20.9	332°11.4	53.2	119°24.6	21.5	58°26.1	56.4
15	335°19.4	355°41.2	·· 19.7	347°12.1	·· 52.5	134°26.9	·· 21.6	73°28.3	·· 56.4
16	350°21.9	10°41.3	18.6	2°12.8	51.7	149°29.2	21.7	88°30.4	56.4
17	5°24.3	25°41.4	17.4	17°13.6	50.9	164°31.4	21.7	103°32.6	56.5
18	20°26.8	40°41.5	S09°16.2	32°14.3	S05°50.2	179°33.7	S07°21.8	118°34.8	S21°56.5
19	35°29.2	55°41.7	15.1	47°15.0	49.4	194°36.0	21.9	133°37.0	56.5
20	50°31.7	70°41.8	13.9	62°15.8	48.6	209°38.3	21.9	148°39.1	56.5
21	65°34.2	85°41.9	·· 12.7	77°16.5	·· 47.8	224°40.5	·· 22.0	163°41.3	·· 56.5
22	80°36.6	100°42.1	11.6	92°17.2	47.1	239°42.8	22.1	178°43.5	56.5
23	95°39.1	115°42.2	10.4	107°18.0	46.3	254°45.1	22.1	193°45.6	56.6
Mer.pass.:16:38		v0.1 d1.2 m-4.2		v0.7 d0.8 m1.0		v2.3 d-0.1 m-1.9		v2.2 d-0.0 m0.5	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	110°41.6	130°42.3	S09°09.2	122°18.7	S05°45.5	269°47.4	S07°22.2	208°47.8	S21°56.6
1	125°44.0	145°42.4	08.0	137°19.5	44.8	284°49.6	22.3	223°50.0	56.6
2	140°46.5	160°42.6	06.9	152°20.2	44.0	299°51.9	22.3	238°52.2	56.6
3	155°49.0	175°42.7	·· 05.7	167°20.9	·· 43.2	314°54.2	·· 22.4	253°54.3	·· 56.6
4	170°51.4	190°42.8	04.5	182°21.7	42.4	329°56.5	22.5	268°56.5	56.6
5	185°53.9	205°43.0	03.3	197°22.4	41.7	344°58.7	22.5	283°58.7	56.6
6	200°56.4	220°43.1	S09°02.2	212°23.2	S05°40.9	0°01.0	S07°22.6	299°00.8	S21°56.7
7	215°58.8	235°43.3	09°01.0	227°23.9	40.1	15°03.3	22.6	314°03.0	56.7
8	231°01.3	250°43.4	08°59.8	242°24.6	39.3	30°05.6	22.7	329°05.2	56.7
9	246°03.7	265°43.5	·· 58.7	257°25.4	·· 38.6	45°07.8	·· 22.8	344°07.4	·· 56.7
10	261°06.2	280°43.7	57.5	272°26.1	37.8	60°10.1	22.8	359°09.5	56.7
11	276°08.7	295°43.8	56.3	287°26.8	37.0	75°12.4	22.9	14°11.7	56.7
12	291°11.1	310°44.0	S08°55.1	302°27.6	S05°36.3	90°14.7	S07°23.0	29°13.9	S21°56.8
13	306°13.6	325°44.1	54.0	317°28.3	35.5	105°16.9	23.0	44°16.1	56.8
14	321°16.1	340°44.2	52.8	332°29.1	34.7	120°19.2	23.1	59°18.2	56.8
15	336°18.5	355°44.4	·· 51.6	347°29.8	·· 33.9	135°21.5	·· 23.2	74°20.4	·· 56.8
16	351°21.0	10°44.5	50.4	2°30.5	33.2	150°23.8	23.2	89°22.6	56.8
17	6°23.5	25°44.7	49.3	17°31.3	32.4	165°26.1	23.3	104°24.7	56.8
18	21°25.9	40°44.8	S08°48.1	32°32.0	S05°31.6	180°28.3	S07°23.3	119°26.9	S21°56.8
19	36°28.4	55°45.0	46.9	47°32.8	30.8	195°30.6	23.4	134°29.1	56.9
20	51°30.9	70°45.1	45.7	62°33.5	30.1	210°32.9	23.5	149°31.3	56.9
21	66°33.3	85°45.3	·· 44.6	77°34.2	·· 29.3	225°35.2	·· 23.5	164°33.4	·· 56.9
22	81°35.8	100°45.4	43.4	92°35.0	28.5	240°37.5	23.6	179°35.6	56.9
23	96°38.2	115°45.6	42.2	107°35.7	27.8	255°39.7	23.7	194°37.8	56.9
Mer.pass.:16:35		v0.1 d1.2 m-4.2		v0.7 d0.8 m1.0		v2.3 d-0.1 m-1.9		v2.2 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	111°40.7	130°45.7	S08°41.0	122°36.5	S05°27.0	270°42.0	S07°23.7	209°40.0	S21°56.9
1	126°43.2	145°45.9	39.9	137°37.2	26.2	285°44.3	23.8	224°42.1	57.0
2	141°45.6	160°46.1	38.7	152°37.9	25.4	300°46.6	23.8	239°44.3	57.0
3	156°48.1	175°46.2	·· 37.5	167°38.7	·· 24.7	315°48.9	·· 23.9	254°46.5	·· 57.0
4	171°50.6	190°46.4	36.3	182°39.4	23.9	330°51.2	24.0	269°48.7	57.0
5	186°53.0	205°46.5	35.2	197°40.2	23.1	345°53.4	24.0	284°50.8	57.0
6	201°55.5	220°46.7	S08°34.0	212°40.9	S05°22.3	0°55.7	S07°24.1	299°53.0	S21°57.0
7	216°58.0	235°46.9	32.8	227°41.6	21.6	15°58.0	24.1	314°55.2	57.0
8	232°00.4	250°47.0	31.6	242°42.4	20.8	31°00.3	24.2	329°57.3	57.1
9	247°02.9	265°47.2	·· 30.4	257°43.1	·· 20.0	46°02.6	·· 24.3	344°59.5	·· 57.1
10	262°05.4	280°47.3	29.3	272°43.9	19.2	61°04.9	24.3	0°01.7	57.1
11	277°07.8	295°47.5	28.1	287°44.6	18.5	76°07.1	24.4	15°03.9	57.1
12	292°10.3	310°47.7	S08°26.9	302°45.3	S05°17.7	91°09.4	S07°24.5	30°06.0	S21°57.1
13	307°12.7	325°47.8	25.7	317°46.1	16.9	106°11.7	24.5	45°08.2	57.1
14	322°15.2	340°48.0	24.6	332°46.8	16.2	121°14.0	24.6	60°10.4	57.1
15	337°17.7	355°48.2	·· 23.4	347°47.6	·· 15.4	136°16.3	·· 24.6	75°12.6	·· 57.2
16	352°20.1	10°48.4	22.2	2°48.3	14.6	151°18.6	24.7	90°14.7	57.2
17	7°22.6	25°48.5	21.0	17°49.0	13.8	166°20.8	24.8	105°16.9	57.2
18	22°25.1	40°48.7	S08°19.8	32°49.8	S05°13.1	181°23.1	S07°24.8	120°19.1	S21°57.2
19	37°27.5	55°48.9	18.7	47°50.5	12.3	196°25.4	24.9	135°21.3	57.2
20	52°30.0	70°49.0	17.5	62°51.3	11.5	211°27.7	24.9	150°23.4	57.2
21	67°32.5	85°49.2	·· 16.3	77°52.0	·· 10.7	226°30.0	·· 25.0	165°25.6	·· 57.2
22	82°34.9	100°49.4	15.1	92°52.8	10.0	241°32.3	25.1	180°27.8	57.3
23	97°37.4	115°49.6	13.9	107°53.5	09.2	256°34.6	25.1	195°30.0	57.3
Mer.pass.:16:31		v0.2 d1.2 m-4.3		v0.7 d0.8 m1.0		v2.3 d-0.1 m-1.9		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.5	-42°13.1
Schedar	349°37.7	56°38.0
Diphda	348°53.5	-17°53.8
Achernar	335°25.0	-57°09.5
Hamal	327°57.9	23°32.5
Polaris	316°26.8	89°20.3
Acamar	315°16.4	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.5	49°55.3
Aldebaran	290°46.3	16°32.4
Rigel	281°09.4	-8°11.2
Capella	280°30.4	46°00.7
Bellatrix	278°29.1	6°21.6
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.7
Betelgeuse	270°58.4	7°24.4
Canopus	263°54.5	-52°42.6
Sirius	258°31.2	-16°44.6
Adhara	255°10.2	-29°00.0
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.8
Avior	234°16.3	-59°33.9
Suhail	222°50.2	-43°30.1
Miaplacidus	221°38.1	-69°47.2
Alphard	217°53.4	-8°44.1
Regulus	207°40.7	11°52.9
Dubhe	193°48.5	61°39.3
Denebola	182°31.1	14°28.5
Gienah	175°49.7	-17°38.1
Acrux	173°06.3	-63°11.3
Gacrux	171°57.9	-57°12.2
Alioth	166°18.6	55°51.8
Spica	158°28.7	-11°14.9
Alkaid	152°57.1	49°13.5
Hadar	148°44.4	-60°26.9
Menkent	148°04.8	-36°26.9
Arcturus	145°53.6	19°05.6
Rigil Kent.	139°48.5	-60°53.9
Kochab	137°20.8	74°05.0
Zuben'ubi	137°02.9	-16°06.5
Alphecca	126°09.2	26°39.5
Antares	112°23.6	-26°27.9
Atria	107°23.6	-69°03.1
Sabik	102°10.1	-15°44.5
Shaula	96°19.0	-37°06.7
Rasalhague	96°04.5	12°33.0
Eltanin	90°45.5	51°29.3
Kaus Aust.	83°41.0	-34°22.4
Vega	80°37.7	38°48.1
Nunki	75°55.7	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.8
Deneb	49°30.2	45°20.6
Enif	33°45.0	9°57.3
Al Na'ir	27°41.1	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.9

Jan 10 Tue	**SHA**	**Mer.pass**
Venus	20°57.0	15:17
Mars	12°18.6	15:51
Jupiter	159°10.4	06:04
Saturn	98°13.3	10:07

Jan 11 Wed	**SHA**	**Mer.pass**
Venus	20°00.7	15:17
Mars	11°37.2	15:50
Jupiter	159°05.8	06:00
Saturn	98°06.2	10:03

Jan 12 Thu	**SHA**	**Mer.pass**
Venus	19°05.0	15:17
Mars	10°55.7	15:49
Jupiter	159°01.3	05:56
Saturn	97°59.2	10:00

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.5805 sec ΔT = TT-UT1 = +68.6035 sec

2017 January 10 to Jan. 12 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°08.8	S21°57.3	34°26.1	5.0′	N17°41.2	4.4′	60.3′
1	193°08.5	57.0	48°50.1	5.0′	17°45.5	4.3′	60.3′
2	208°08.2	56.6	63°14.1	5.0′	17°49.7	4.2′	60.3′
3	223°08.0	·· 56.2	77°38.0	4.9′	17°53.8	4.0′	60.4′
4	238°07.7	55.9	92°01.9	4.9′	17°57.8	3.9′	60.4′
5	253°07.5	55.5	106°25.8	4.9′	18°01.6	3.8′	60.4′
6	268°07.2	S21°55.1	120°49.7	4.8′	N18°05.4	3.7′	60.4′
7	283°07.0	54.7	135°13.5	4.8′	18°08.9	3.5′	60.4′
8	298°06.7	54.3	149°37.3	4.8′	18°12.4	3.4′	60.4′
9	313°06.5	·· 54.0	164°01.0	4.7′	18°15.7	3.3′	60.4′
10	328°06.2	53.6	178°24.8	4.7′	18°18.9	3.1′	60.4′
11	343°06.0	53.2	192°48.5	4.7′	18°22.0	3.0′	60.3′
12	358°05.7	S21°52.8	207°12.2	4.7′	N18°25.0	2.9′	60.3′
13	13°05.5	52.4	221°35.9	4.7′	18°27.8	2.7′	60.3′
14	28°05.2	52.1	235°59.5	4.6′	18°30.4	2.6′	60.3′
15	43°05.0	·· 51.7	250°23.1	4.6′	18°33.0	2.5′	60.3′
16	58°04.7	51.3	264°46.8	4.6′	18°35.4	2.4′	60.3′
17	73°04.5	50.9	279°10.4	4.6′	18°37.7	2.2′	60.3′
18	88°04.3	S21°50.5	293°33.9	4.6′	N18°39.8	2.1′	60.3′
19	103°04.0	50.1	307°57.5	4.6′	18°41.9	2.0′	60.3′
20	118°03.8	49.8	322°21.1	4.6′	18°43.8	1.8′	60.3′
21	133°03.5	·· 49.4	336°44.7	4.6′	18°45.5	1.7′	60.3′
22	148°03.3	49.0	351°08.2	4.5′	18°47.1	1.5′	60.3′
23	163°03.0	48.6	5°31.8	4.5′	18°48.6	1.4′	60.3′
	SD.=16.3	d=0.4	S.D.=16.4				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°02.8	S21°48.2	19°55.3	4.5′	N18°49.9	1.3′	60.3′
1	193°02.5	47.8	34°18.8	4.5′	18°51.2	1.1′	60.3′
2	208°02.3	47.4	48°42.4	4.5′	18°52.2	1.0′	60.3′
3	223°02.0	·· 47.0	63°05.9	4.5′	18°53.2	0.9′	60.3′
4	238°01.8	46.6	77°29.5	4.5′	18°54.0	0.7′	60.3′
5	253°01.5	46.2	91°53.0	4.6′	18°54.7	0.6′	60.2′
6	268°01.3	S21°45.8	106°16.6	4.6′	N18°55.2	0.5′	60.2′
7	283°01.1	45.5	120°40.1	4.6′	18°55.6	0.3′	60.2′
8	298°00.8	45.1	135°03.7	4.6′	18°55.9	0.2′	60.2′
9	313°00.6	·· 44.7	149°27.3	4.6′	18°56.0	0.1′	60.2′
10	328°00.3	44.3	163°50.9	4.6′	18°56.0	-0.1′	60.2′
11	343°00.1	43.9	178°14.5	4.6′	18°55.9	-0.2′	60.2′
12	357°59.8	S21°43.5	192°38.1	4.6′	N18°55.6	-0.3′	60.2′
13	12°59.6	43.1	207°01.8	4.7′	18°55.2	-0.5′	60.2′
14	27°59.3	42.7	221°25.4	4.7′	18°54.7	-0.6′	60.1′
15	42°59.1	·· 42.3	235°49.1	4.7′	18°54.0	-0.7′	60.1′
16	57°58.9	41.9	250°12.8	4.7′	18°53.2	-0.9′	60.1′
17	72°58.6	41.5	264°36.6	4.7′	18°52.3	-1.0′	60.1′
18	87°58.4	S21°41.1	279°00.3	4.8′	N18°51.2	-1.1′	60.1′
19	102°58.1	40.7	293°24.1	4.8′	18°50.0	-1.3′	60.1′
20	117°57.9	40.3	307°47.9	4.8′	18°48.7	-1.4′	60.1′
21	132°57.7	·· 39.8	322°11.8	4.9′	18°47.2	-1.5′	60.0′
22	147°57.4	39.4	336°35.6	4.9′	18°45.6	-1.7′	60.0′
23	162°57.2	39.0	350°59.5	4.9′	18°43.9	-1.8′	60.0′
	SD.=16.3	d=0.4	S.D.=16.4				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	177°56.9	S21°38.6	5°23.5	5.0′	N18°42.0	-1.9′	60.0′
1	192°56.7	38.2	19°47.5	5.0′	18°40.0	-2.1′	60.0′
2	207°56.5	37.8	34°11.5	5.0′	18°37.9	-2.2′	59.9′
3	222°56.2	·· 37.4	48°35.5	5.1′	18°35.7	-2.3′	59.9′
4	237°56.0	37.0	62°59.6	5.1′	18°33.3	-2.4′	59.9′
5	252°55.7	36.6	77°23.8	5.2′	18°30.8	-2.6′	59.9′
6	267°55.5	S21°36.2	91°48.0	5.2′	N18°28.2	-2.7′	59.9′
7	282°55.3	35.8	106°12.2	5.3′	18°25.4	-2.8′	59.9′
8	297°55.0	35.3	120°36.5	5.3′	18°22.5	-2.9′	59.8′
9	312°54.8	·· 34.9	135°00.8	5.3′	18°19.5	-3.1′	59.8′
10	327°54.5	34.5	149°25.1	5.4′	18°16.4	-3.2′	59.8′
11	342°54.3	34.1	163°49.6	5.4′	18°13.2	-3.3′	59.8′
12	357°54.1	S21°33.7	178°14.0	5.5′	N18°09.8	-3.4′	59.7′
13	12°53.8	33.3	192°38.6	5.6′	18°06.3	-3.6′	59.7′
14	27°53.6	32.9	207°03.2	5.6′	18°02.7	-3.7′	59.7′
15	42°53.4	·· 32.4	221°27.8	5.7′	17°59.0	-3.8′	59.7′
16	57°53.1	32.0	235°52.5	5.7′	17°55.1	-3.9′	59.7′
17	72°52.9	31.6	250°17.2	5.8′	17°51.2	-4.0′	59.6′
18	87°52.7	S21°31.2	264°42.0	5.8′	N17°47.1	-4.1′	59.6′
19	102°52.4	30.8	279°06.9	5.9′	17°42.9	-4.3′	59.6′
20	117°52.2	30.3	293°31.8	6.0′	17°38.6	-4.4′	59.6′
21	132°52.0	·· 29.9	307°56.8	6.0′	17°34.1	-4.5′	59.5′
22	147°51.7	29.5	322°21.9	6.1′	17°29.6	-4.6′	59.5′
23	162°51.5	29.1	336°47.0	6.2′	17°24.9	-4.7′	59.5′
	SD.=16.3	d=0.4	S.D.=16.3				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:09	10:07	▬	▬	14:10	16:08
N 70°	07:53	09:28	▬	▬	14:48	16:24
68°	07:40	09:01	10:51	13:25	15:15	16:37
66°	07:29	08:41	10:04	14:13	15:36	16:48
64°	07:20	08:25	09:34	14:43	15:52	16:57
62°	07:12	08:11	09:11	15:05	16:06	17:05
60°	07:04	07:59	08:53	15:23	16:17	17:12
N 58°	06:58	07:49	08:38	15:39	16:28	17:19
56°	06:52	07:40	08:25	15:51	16:37	17:24
54°	06:47	07:32	08:14	16:02	16:45	17:30
52°	06:42	07:25	08:04	16:12	16:52	17:35
50°	06:37	07:18	07:55	16:21	16:58	17:39
45°	06:27	07:03	07:36	16:40	17:13	17:49
N 40°	06:18	06:51	07:21	16:55	17:25	17:59
35°	06:09	06:41	07:08	17:08	17:36	18:07
30°	06:02	06:31	06:57	17:19	17:45	18:15
20°	05:47	06:14	06:37	17:39	18:02	18:30
N 10°	05:32	05:58	06:20	17:56	18:18	18:44
0°	05:16	05:42	06:04	18:12	18:34	19:00
S 10°	04:59	05:25	05:48	18:28	18:51	19:17
20°	04:38	05:06	05:31	18:45	19:09	19:38
30°	04:11	04:43	05:10	19:05	19:32	20:05
35°	03:54	04:29	04:58	19:17	19:46	20:22
40°	03:32	04:13	04:45	19:31	20:03	20:43
45°	03:05	03:52	04:28	19:47	20:23	21:10
S 50°	02:26	03:25	04:08	20:08	20:50	21:49
52°	02:04	03:12	03:58	20:17	21:03	22:11
54°	01:33	02:56	03:47	20:28	21:18	22:40
56°	00:34	02:38	03:34	20:41	21:37	23:33
58°	▭	02:14	03:20	20:55	22:00	▭
S 60°	▭	01:42	03:02	21:12	22:32	▭

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	▭	▭	▭	▭	▭	▭
N 70°	11:51	12:35	14:02	08:17	09:40	10:19
68°	12:33	13:24	14:42	07:35	08:51	09:38
66°	13:02	13:55	15:10	07:07	08:20	09:10
64°	13:24	14:19	15:31	06:45	07:56	08:49
62°	13:41	14:37	15:48	06:28	07:38	08:31
60°	13:56	14:53	16:02	06:14	07:22	08:17
N 58°	14:08	15:06	16:14	06:01	07:09	08:05
56°	14:19	15:17	16:24	05:51	06:58	07:54
54°	14:29	15:27	16:34	05:41	06:48	07:45
52°	14:37	15:35	16:42	05:33	06:39	07:36
50°	14:45	15:43	16:49	05:26	06:31	07:29
45°	15:01	16:00	17:05	05:10	06:15	07:12
N 40°	15:15	16:14	17:18	04:57	06:01	06:59
35°	15:26	16:26	17:29	04:45	05:49	06:48
30°	15:36	16:36	17:38	04:36	05:39	06:38
20°	15:53	16:53	17:55	04:19	05:21	06:21
N 10°	16:08	17:09	18:09	04:04	05:06	06:06
0°	16:22	17:23	18:23	03:51	04:51	05:52
S 10°	16:37	17:38	18:36	03:37	04:37	05:38
20°	16:52	17:53	18:51	03:23	04:22	05:23
30°	17:09	18:11	19:07	03:06	04:04	05:05
35°	17:20	18:21	19:17	02:56	03:53	04:55
40°	17:31	18:33	19:28	02:45	03:42	04:44
45°	17:45	18:47	19:40	02:32	03:28	04:30
S 50°	18:02	19:04	19:56	02:16	03:11	04:13
52°	18:10	19:12	20:03	02:09	03:03	04:05
54°	18:19	19:20	20:11	02:01	02:54	03:57
56°	18:29	19:30	20:20	01:51	02:44	03:47
58°	18:40	19:42	20:31	01:41	02:32	03:35
S 60°	18:53	19:55	20:42	01:29	02:19	03:22

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 12-14 94-100%
10	07:25	07:37	12:08	22:37	10:07	
11	07:49	08:01	12:08	23:38	11:07	◯
12	08:12	08:24	12:08	–:–	12:07	

January 13, 14, 15 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	112°39.8	130°49.7	S08°12.8	122°54.2	S05°08.4	271°36.9	S07°25.2	210°32.1	S21°57.3
1	127°42.3	145°49.9	11.6	137°55.0	07.6	286°39.1	25.2	225°34.3	57.3
2	142°44.8	160°50.1	10.4	152°55.7	06.9	301°41.4	25.3	240°36.5	57.3
3	157°47.2	175°50.3	·· 09.2	167°56.5	·· 06.1	316°43.7	·· 25.3	255°38.7	·· 57.3
4	172°49.7	190°50.5	08.0	182°57.2	05.3	331°46.0	25.4	270°40.8	57.4
5	187°52.2	205°50.7	06.9	197°58.0	04.5	346°48.3	25.5	285°43.0	57.4
6	202°54.6	220°50.8	S08°05.7	212°58.7	S05°03.8	1°50.6	S07°25.5	300°45.2	S21°57.4
7	217°57.1	235°51.0	04.5	227°59.4	03.0	16°52.9	25.6	315°47.4	57.4
8	232°59.6	250°51.2	03.3	243°00.2	02.2	31°55.2	25.6	330°49.5	57.4
9	248°02.0	265°51.4	·· 02.1	258°00.9	·· 01.4	46°57.5	·· 25.7	345°51.7	·· 57.4
10	263°04.5	280°51.6	08°01.0	273°01.7	05°00.7	61°59.7	25.8	0°53.9	57.4
11	278°07.0	295°51.8	07°59.8	288°02.4	04°59.9	77°02.0	25.8	15°56.1	57.5
12	293°09.4	310°52.0	S07°58.6	303°03.2	S04°59.1	92°04.3	S07°25.9	30°58.2	S21°57.5
13	308°11.9	325°52.2	57.4	318°03.9	58.3	107°06.6	25.9	46°00.4	57.5
14	323°14.3	340°52.3	56.2	333°04.6	57.6	122°08.9	26.0	61°02.6	57.5
15	338°16.8	355°52.5	·· 55.0	348°05.4	·· 56.8	137°11.2	·· 26.0	76°04.8	·· 57.5
16	353°19.3	10°52.7	53.9	3°06.1	56.0	152°13.5	26.1	91°06.9	57.5
17	8°21.7	25°52.9	52.7	18°06.9	55.2	167°15.8	26.2	106°09.1	57.5
18	23°24.2	40°53.1	S07°51.5	33°07.6	S04°54.5	182°18.1	S07°26.2	121°11.3	S21°57.6
19	38°26.7	55°53.3	50.3	48°08.4	53.7	197°20.4	26.3	136°13.5	57.6
20	53°29.1	70°53.5	49.1	63°09.1	52.9	212°22.7	26.3	151°15.6	57.6
21	68°31.6	85°53.7	·· 47.9	78°09.9	·· 52.1	227°25.0	·· 26.4	166°17.8	·· 57.6
22	83°34.1	100°53.9	46.8	93°10.6	51.4	242°27.2	26.4	181°20.0	57.6
23	98°36.5	115°54.1	45.6	108°11.3	50.6	257°29.5	26.5	196°22.2	57.6
Mer.pass.:16:27		v0.2 d1.2 m-4.3		v0.7 d0.8 m1.0		v2.3 d-0.1 m-1.9		v2.2 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	113°39.0	130°54.3	S07°44.4	123°12.1	S04°49.8	272°31.8	S07°26.6	211°24.4	S21°57.6
1	128°41.5	145°54.5	43.2	138°12.8	49.0	287°34.1	26.6	226°26.5	57.7
2	143°43.9	160°54.7	42.0	153°13.6	48.3	302°36.4	26.7	241°28.7	57.7
3	158°46.4	175°54.9	·· 40.8	168°14.3	·· 47.5	317°38.7	·· 26.7	256°30.9	·· 57.7
4	173°48.8	190°55.1	39.7	183°15.1	46.7	332°41.0	26.8	271°33.1	57.7
5	188°51.3	205°55.4	38.5	198°15.8	45.9	347°43.3	26.8	286°35.2	57.7
6	203°53.8	220°55.6	S07°37.3	213°16.6	S04°45.2	2°45.6	S07°26.9	301°37.4	S21°57.7
7	218°56.2	235°55.8	36.1	228°17.3	44.4	17°47.9	27.0	316°39.6	57.7
8	233°58.7	250°56.0	34.9	243°18.0	43.6	32°50.2	27.0	331°41.8	57.8
9	249°01.2	265°56.2	·· 33.7	258°18.8	·· 42.8	47°52.5	·· 27.1	346°43.9	·· 57.8
10	264°03.6	280°56.4	32.6	273°19.5	42.1	62°54.8	27.1	1°46.1	57.8
11	279°06.1	295°56.6	31.4	288°20.3	41.3	77°57.1	27.2	16°48.3	57.8
12	294°08.6	310°56.8	S07°30.2	303°21.0	S04°40.5	92°59.4	S07°27.2	31°50.5	S21°57.8
13	309°11.0	325°57.0	29.0	318°21.8	39.7	108°01.7	27.3	46°52.7	57.8
14	324°13.5	340°57.3	27.8	333°22.5	39.0	123°04.0	27.3	61°54.8	57.8
15	339°16.0	355°57.5	·· 26.6	348°23.3	·· 38.2	138°06.3	·· 27.4	76°57.0	·· 57.9
16	354°18.4	10°57.7	25.4	3°24.0	37.4	153°08.6	27.5	91°59.2	57.9
17	9°20.9	25°57.9	24.3	18°24.8	36.6	168°10.9	27.5	107°01.4	57.9
18	24°23.3	40°58.1	S07°23.1	33°25.5	S04°35.8	183°13.2	S07°27.6	122°03.5	S21°57.9
19	39°25.8	55°58.4	21.9	48°26.2	35.1	198°15.5	27.6	137°05.7	57.9
20	54°28.3	70°58.6	20.7	63°27.0	34.3	213°17.8	27.7	152°07.9	57.9
21	69°30.7	85°58.8	·· 19.5	78°27.7	·· 33.5	228°20.1	·· 27.7	167°10.1	·· 57.9
22	84°33.2	100°59.0	18.3	93°28.5	32.7	243°22.4	27.8	182°12.3	58.0
23	99°35.7	115°59.3	17.1	108°29.2	32.0	258°24.7	27.8	197°14.4	58.0
Mer.pass.:16:23		v0.2 d1.2 m-4.3		v0.7 d0.8 m1.0		v2.3 d-0.1 m-1.9		v2.2 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	114°38.1	130°59.5	S07°16.0	123°30.0	S04°31.2	273°27.0	S07°27.9	212°16.6	S21°58.0
1	129°40.6	145°59.7	14.8	138°30.7	30.4	288°29.3	27.9	227°18.8	58.0
2	144°43.1	160°59.9	13.6	153°31.5	29.6	303°31.6	28.0	242°21.0	58.0
3	159°45.5	176°00.2	·· 12.4	168°32.2	·· 28.9	318°33.9	·· 28.0	257°23.2	·· 58.0
4	174°48.0	191°00.4	11.2	183°33.0	28.1	333°36.2	28.1	272°25.3	58.0
5	189°50.4	206°00.6	10.0	198°33.7	27.3	348°38.5	28.2	287°27.5	58.0
6	204°52.9	221°00.9	S07°08.8	213°34.5	S04°26.5	3°40.8	S07°28.2	302°29.7	S21°58.1
7	219°55.4	236°01.1	07.6	228°35.2	25.8	18°43.1	28.3	317°31.9	58.1
8	234°57.8	251°01.3	06.5	243°36.0	25.0	33°45.4	28.3	332°34.0	58.1
9	250°00.3	266°01.6	·· 05.3	258°36.7	·· 24.2	48°47.7	·· 28.4	347°36.2	·· 58.1
10	265°02.8	281°01.8	04.1	273°37.4	23.4	63°50.0	28.4	2°38.4	58.1
11	280°05.2	296°02.0	02.9	288°38.2	22.6	78°52.3	28.5	17°40.6	58.1
12	295°07.7	311°02.3	S07°01.7	303°38.9	S04°21.9	93°54.6	S07°28.5	32°42.8	S21°58.1
13	310°10.2	326°02.5	07°00.5	318°39.7	21.1	108°56.9	28.6	47°44.9	58.2
14	325°12.6	341°02.8	06°59.3	333°40.4	20.3	123°59.2	28.6	62°47.1	58.2
15	340°15.1	356°03.0	·· 58.1	348°41.2	·· 19.5	139°01.5	·· 28.7	77°49.3	·· 58.2
16	355°17.6	11°03.2	56.9	3°41.9	18.8	154°03.8	28.7	92°51.5	58.2
17	10°20.0	26°03.5	55.8	18°42.7	18.0	169°06.1	28.8	107°53.7	58.2
18	25°22.5	41°03.7	S06°54.6	33°43.4	S04°17.2	184°08.4	S07°28.8	122°55.8	S21°58.2
19	40°24.9	56°04.0	53.4	48°44.2	16.4	199°10.7	28.9	137°58.0	58.2
20	55°27.4	71°04.2	52.2	63°44.9	15.7	214°13.0	28.9	153°00.2	58.3
21	70°29.9	86°04.5	·· 51.0	78°45.7	·· 14.9	229°15.4	·· 29.0	168°02.4	·· 58.3
22	85°32.3	101°04.7	49.8	93°46.4	14.1	244°17.7	29.0	183°04.6	58.3
23	100°34.8	116°05.0	48.6	108°47.2	13.3	259°20.0	29.1	198°06.7	58.3
Mer.pass.:16:19		v0.2 d1.2 m-4.3		v0.7 d0.8 m1.0		v2.3 d-0.1 m-1.9		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.5	-42°13.1
Schedar	349°37.7	56°38.0
Diphda	348°53.5	-17°53.8
Achernar	335°25.1	-57°09.5
Hamal	327°57.9	23°32.5
Polaris	316°28.0	89°20.4
Acamar	315°16.4	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.5	49°55.3
Aldebaran	290°46.3	16°32.4
Rigel	281°09.4	-8°11.2
Capella	280°30.4	46°00.8
Bellatrix	278°29.1	6°21.6
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.7
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.5	-52°42.6
Sirius	258°31.2	-16°44.7
Adhara	255°10.2	-29°00.0
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.8
Avior	234°16.3	-59°33.9
Suhail	222°50.2	-43°30.1
Miaplacidus	221°38.1	-69°47.2
Alphard	217°53.4	-8°44.1
Regulus	207°40.7	11°52.9
Dubhe	193°48.5	61°39.3
Denebola	182°31.1	14°28.5
Gienah	175°49.7	-17°38.1
Acrux	173°06.2	-63°11.3
Gacrux	171°57.9	-57°12.2
Alioth	166°18.6	55°51.8
Spica	158°28.7	-11°14.9
Alkaid	152°57.1	49°13.5
Hadar	148°44.4	-60°26.9
Menkent	148°04.7	-36°26.9
Arcturus	145°53.6	19°05.6
Rigil Kent.	139°48.5	-60°53.9
Kochab	137°20.7	74°05.0
Zuben'ubi	137°02.8	-16°06.5
Alphecca	126°09.2	26°39.5
Antares	112°23.5	-26°27.9
Atria	107°23.6	-69°03.1
Sabik	102°10.0	-15°44.5
Shaula	96°19.0	-37°06.7
Rasalhague	96°04.5	12°33.0
Eltanin	90°45.5	51°29.3
Kaus Aust.	83°41.0	-34°22.4
Vega	80°37.7	38°48.1
Nunki	75°55.7	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.7
Deneb	49°30.2	45°20.6
Enif	33°45.0	9°57.3
Al Na'ir	27°41.1	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.8

Jan 13 Fri	SHA	Mer.pass
Venus	18°09.9	15:16
Mars	10°14.4	15:48
Jupiter	158°57.0	05:53
Saturn	97°52.3	09:56

Jan 14 Sat	SHA	Mer.pass
Venus	17°15.3	15:16
Mars	9°33.1	15:46
Jupiter	158°52.8	05:49
Saturn	97°45.4	09:53

Jan 15 Sun	SHA	Mer.pass
Venus	16°21.4	15:16
Mars	8°51.8	15:45
Jupiter	158°48.8	05:45
Saturn	97°38.5	09:49

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.5769 sec ΔT = TT-UT1 = +68.6071 sec

2017 January 13 to Jan. 15 UT

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	177°51.3	S21°28.6	351°12.2	6.2′	N17°20.2	-4.8′	59.5′
1	192°51.0	28.2	5°37.4	6.3′	17°15.3	-4.9′	59.4′
2	207°50.8	27.8	20°02.8	6.4′	17°10.3	-5.0′	59.4′
3	222°50.6	·· 27.4	34°28.1	6.4′	17°05.2	-5.1′	59.4′
4	237°50.3	26.9	48°53.6	6.5′	17°00.0	-5.3′	59.4′
5	252°50.1	26.5	63°19.1	6.6′	16°54.7	-5.4′	59.3′
6	267°49.9	S21°26.1	77°44.7	6.6′	N16°49.3	-5.5′	59.3′
7	282°49.6	25.6	92°10.4	6.7′	16°43.8	-5.6′	59.3′
8	297°49.4	25.2	106°36.1	6.8′	16°38.2	-5.7′	59.2′
9	312°49.2	·· 24.8	121°01.9	6.8′	16°32.4	-5.8′	59.2′
10	327°48.9	24.4	135°27.8	6.9′	16°26.6	-5.9′	59.2′
11	342°48.7	23.9	149°53.8	7.0′	16°20.7	-6.0′	59.2′
12	357°48.5	S21°23.5	164°19.8	7.1′	N16°14.7	-6.1′	59.1′
13	12°48.2	23.1	178°45.9	7.1′	16°08.6	-6.2′	59.1′
14	27°48.0	22.6	193°12.1	7.2′	16°02.4	-6.3′	59.1′
15	42°47.8	·· 22.2	207°38.3	7.3′	15°56.1	-6.4′	59.0′
16	57°47.6	21.7	222°04.7	7.4′	15°49.7	-6.4′	59.0′
17	72°47.3	21.3	236°31.1	7.5′	15°43.2	-6.5′	59.0′
18	87°47.1	S21°20.9	250°57.6	7.5′	N15°36.6	-6.6′	58.9′
19	102°46.9	20.4	265°24.1	7.6′	15°29.9	-6.7′	58.9′
20	117°46.6	20.0	279°50.8	7.7′	15°23.2	-6.8′	58.9′
21	132°46.4	·· 19.6	294°17.5	7.8′	15°16.3	-6.9′	58.8′
22	147°46.2	19.1	308°44.3	7.8′	15°09.4	-7.0′	58.8′
23	162°46.0	18.7	323°11.2	7.9′	15°02.4	-7.1′	58.8′
	SD.=16.3	d=0.4	S.D.=16.1				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	177°45.7	S21°18.2	337°38.2	8.0′	N14°55.3	-7.1′	58.8′
1	192°45.5	17.8	352°05.2	8.1′	14°48.1	-7.2′	58.7′
2	207°45.3	17.3	6°32.3	8.2′	14°40.8	-7.3′	58.7′
3	222°45.1	·· 16.9	20°59.5	8.2′	14°33.5	-7.4′	58.7′
4	237°44.8	16.5	35°26.8	8.3′	14°26.1	-7.5′	58.6′
5	252°44.6	16.0	49°54.2	8.4′	14°18.6	-7.5′	58.6′
6	267°44.4	S21°15.6	64°21.6	8.5′	N14°11.0	-7.6′	58.6′
7	282°44.2	15.1	78°49.2	8.6′	14°03.3	-7.7′	58.5′
8	297°43.9	14.7	93°16.8	8.6′	13°55.6	-7.8′	58.5′
9	312°43.7	·· 14.2	107°44.5	8.7′	13°47.8	-7.8′	58.5′
10	327°43.5	13.8	122°12.2	8.8′	13°39.9	-7.9′	58.4′
11	342°43.3	13.3	136°40.1	8.9′	13°32.0	-8.0′	58.4′
12	357°43.0	S21°12.9	151°08.0	9.0′	N13°24.0	-8.0′	58.4′
13	12°42.8	12.4	165°36.0	9.1′	13°15.9	-8.1′	58.3′
14	27°42.6	12.0	180°04.1	9.1′	13°07.8	-8.2′	58.3′
15	42°42.4	·· 11.5	194°32.3	9.2′	12°59.5	-8.2′	58.2′
16	57°42.1	11.1	209°00.6	9.3′	12°51.3	-8.3′	58.2′
17	72°41.9	10.6	223°28.9	9.4′	12°42.9	-8.4′	58.2′
18	87°41.7	S21°10.2	237°57.3	9.5′	N12°34.5	-8.4′	58.1′
19	102°41.5	09.7	252°25.8	9.5′	12°26.1	-8.5′	58.1′
20	117°41.3	09.3	266°54.4	9.6′	12°17.6	-8.5′	58.1′
21	132°41.0	·· 08.8	281°23.0	9.7′	12°09.0	-8.6′	58.0′
22	147°40.8	08.3	295°51.8	9.8′	12°00.4	-8.7′	58.0′
23	162°40.6	07.9	310°20.6	9.9′	11°51.7	-8.7′	58.0′
	SD.=16.2	d=0.4	S.D.=15.9				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	177°40.4	S21°07.4	324°49.5	9.9′	N11°42.9	-8.8′	57.9′
1	192°40.1	07.0	339°18.5	10.0′	11°34.1	-8.8′	57.9′
2	207°39.9	06.5	353°47.5	10.1′	11°25.3	-8.9′	57.9′
3	222°39.7	·· 06.0	8°16.7	10.2′	11°16.4	-8.9′	57.8′
4	237°39.5	05.6	22°45.9	10.2′	11°07.4	-9.0′	57.8′
5	252°39.3	05.1	37°15.2	10.3′	10°58.4	-9.0′	57.8′
6	267°39.1	S21°04.7	51°44.5	10.4′	N10°49.4	-9.1′	57.7′
7	282°38.8	04.2	66°14.0	10.5′	10°40.3	-9.1′	57.7′
8	297°38.6	03.7	80°43.5	10.6′	10°31.2	-9.2′	57.6′
9	312°38.4	·· 03.3	95°13.1	10.6′	10°22.0	-9.2′	57.6′
10	327°38.2	02.8	109°42.7	10.7′	10°12.7	-9.2′	57.6′
11	342°38.0	02.3	124°12.5	10.8′	10°03.5	-9.3′	57.5′
12	357°37.7	S21°01.9	138°42.3	10.9′	N09°54.2	-9.3′	57.5′
13	12°37.5	01.4	153°12.2	10.9′	09°44.8	-9.4′	57.5′
14	27°37.3	00.9	167°42.2	11.0′	09°35.4	-9.4′	57.4′
15	42°37.1	·· 00.5	182°12.2	11.1′	09°26.0	-9.4′	57.4′
16	57°36.9	21°00.0	196°42.3	11.1′	09°16.6	-9.5′	57.4′
17	72°36.7	20°59.5	211°12.5	11.2′	09°07.1	-9.5′	57.3′
18	87°36.5	S20°59.0	225°42.8	11.3′	N08°57.5	-9.5′	57.3′
19	102°36.2	58.6	240°13.1	11.4′	08°48.0	-9.6′	57.3′
20	117°36.0	58.1	254°43.5	11.4′	08°38.4	-9.6′	57.2′
21	132°35.8	·· 57.6	269°13.9	11.5′	08°28.7	-9.6′	57.2′
22	147°35.6	57.2	283°44.5	11.6′	08°19.1	-9.7′	57.1′
23	162°35.4	56.7	298°15.1	11.6′	08°09.4	-9.7′	57.1′
	SD.=16.2	d=0.5	S.D.=15.7				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:02	09:55	▬	▬	14:24	16:17
N 70°	07:47	09:20	▬	▬	14:59	16:32
68°	07:35	08:55	10:37	13:42	15:24	16:44
66°	07:25	08:36	09:55	14:24	15:43	16:54
64°	07:16	08:20	09:27	14:52	15:59	17:03
62°	07:08	08:07	09:06	15:13	16:12	17:10
60°	07:02	07:56	08:49	15:30	16:23	17:17
N 58°	06:56	07:46	08:34	15:44	16:33	17:23
56°	06:50	07:37	08:22	15:57	16:41	17:29
54°	06:45	07:30	08:11	16:07	16:49	17:34
52°	06:40	07:23	08:02	16:17	16:56	17:38
50°	06:36	07:16	07:53	16:25	17:02	17:43
45°	06:26	07:02	07:35	16:43	17:16	17:53
N 40°	06:17	06:51	07:20	16:58	17:28	18:01
35°	06:09	06:40	07:08	17:11	17:38	18:09
30°	06:01	06:31	06:57	17:22	17:48	18:17
20°	05:47	06:14	06:38	17:41	18:04	18:31
N 10°	05:33	05:59	06:21	17:57	18:20	18:46
0°	05:17	05:43	06:05	18:13	18:35	19:01
S 10°	05:00	05:27	05:50	18:29	18:51	19:18
20°	04:40	05:09	05:33	18:45	19:10	19:38
30°	04:14	04:46	05:13	19:05	19:32	20:04
35°	03:57	04:32	05:01	19:17	19:45	20:21
40°	03:36	04:16	04:48	19:30	20:02	20:41
45°	03:10	03:56	04:32	19:46	20:21	21:08
S 50°	02:32	03:30	04:12	20:05	20:47	21:45
52°	02:11	03:17	04:03	20:15	21:00	22:05
54°	01:44	03:02	03:52	20:25	21:14	22:32
56°	00:58	02:45	03:40	20:37	21:32	23:14
58°	▭	02:22	03:26	20:51	21:54	▭
S 60°	▭	01:53	03:09	21:07	22:23	▭

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	15:08	17:14	19:08	11:14	11:02	10:54
N 70°	15:49	17:37	19:21	10:32	10:37	10:38
68°	16:17	17:56	19:32	10:04	10:17	10:26
66°	16:38	18:10	19:42	09:42	10:02	10:15
64°	16:54	18:22	19:49	09:25	09:49	10:07
62°	17:08	18:32	19:56	09:10	09:38	09:59
60°	17:20	18:41	20:01	08:58	09:29	09:53
N 58°	17:30	18:48	20:06	08:48	09:21	09:47
56°	17:38	18:55	20:10	08:39	09:14	09:42
54°	17:46	19:01	20:14	08:30	09:07	09:37
52°	17:53	19:06	20:18	08:23	09:01	09:33
50°	17:59	19:11	20:21	08:16	08:56	09:29
45°	18:13	19:21	20:28	08:02	08:45	09:21
N 40°	18:24	19:30	20:34	07:51	08:35	09:14
35°	18:33	19:37	20:39	07:40	08:27	09:08
30°	18:41	19:43	20:43	07:32	08:20	09:03
20°	18:56	19:55	20:51	07:16	08:07	08:54
N 10°	19:08	20:04	20:57	07:03	07:56	08:46
0°	19:20	20:13	21:04	06:50	07:46	08:38
S 10°	19:31	20:22	21:10	06:38	07:35	08:30
20°	19:44	20:32	21:17	06:24	07:24	08:22
30°	19:58	20:43	21:24	06:08	07:11	08:12
35°	20:06	20:50	21:28	05:59	07:04	08:07
40°	20:15	20:57	21:33	05:49	06:55	08:01
45°	20:26	21:05	21:39	05:37	06:45	07:53
S 50°	20:39	21:15	21:46	05:22	06:33	07:44
52°	20:45	21:20	21:49	05:15	06:27	07:40
54°	20:52	21:25	21:52	05:07	06:21	07:36
56°	21:00	21:31	21:56	04:58	06:14	07:31
58°	21:08	21:37	22:00	04:48	06:06	07:25
S 60°	21:17	21:44	22:05	04:37	05:57	07:19

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 15-17 99-89%
13	08:35	08:46	12:09	00:37	13:05	
14	08:57	09:08	12:09	01:33	14:00	
15	09:19	09:29	12:09	02:26	14:51	

January 16, 17, 18 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	115°37.3	131°05.2	S06°47.4	123°47.9	S04°12.5	274°22.3	S07°29.1	213°08.9	S21°58.3
1	130°39.7	146°05.5	46.2	138°48.7	11.8	289°24.6	29.2	228°11.1	58.3
2	145°42.2	161°05.7	45.1	153°49.4	11.0	304°26.9	29.2	243°13.3	58.3
3	160°44.7	176°06.0	·· 43.9	168°50.2	·· 10.2	319°29.2	·· 29.3	258°15.5	·· 58.3
4	175°47.1	191°06.2	42.7	183°50.9	09.4	334°31.5	29.4	273°17.6	58.4
5	190°49.6	206°06.5	41.5	198°51.7	08.7	349°33.8	29.4	288°19.8	58.4
6	205°52.1	221°06.8	S06°40.3	213°52.4	S04°07.9	4°36.1	S07°29.5	303°22.0	S21°58.4
7	220°54.5	236°07.0	39.1	228°53.2	07.1	19°38.4	29.5	318°24.2	58.4
8	235°57.0	251°07.3	37.9	243°53.9	06.3	34°40.7	29.6	333°26.4	58.4
9	250°59.4	266°07.5	·· 36.7	258°54.7	·· 05.5	49°43.0	·· 29.6	348°28.5	·· 58.4
10	266°01.9	281°07.8	35.5	273°55.4	04.8	64°45.4	29.7	3°30.7	58.4
11	281°04.4	296°08.1	34.4	288°56.2	04.0	79°47.7	29.7	18°32.9	58.5
12	296°06.8	311°08.3	S06°33.2	303°56.9	S04°03.2	94°50.0	S07°29.8	33°35.1	S21°58.5
13	311°09.3	326°08.6	32.0	318°57.7	02.4	109°52.3	29.8	48°37.3	58.5
14	326°11.8	341°08.9	30.8	333°58.4	01.7	124°54.6	29.9	63°39.5	58.5
15	341°14.2	356°09.1	·· 29.6	348°59.2	·· 00.9	139°56.9	·· 29.9	78°41.6	·· 58.5
16	356°16.7	11°09.4	28.4	3°59.9	04°00.1	154°59.2	30.0	93°43.8	58.5
17	11°19.2	26°09.7	27.2	19°00.7	03°59.3	170°01.5	30.0	108°46.0	58.5
18	26°21.6	41°09.9	S06°26.0	34°01.4	S03°58.5	185°03.9	S07°30.0	123°48.2	S21°58.5
19	41°24.1	56°10.2	24.8	49°02.2	57.8	200°06.2	30.1	138°50.4	58.6
20	56°26.5	71°10.5	23.6	64°02.9	57.0	215°08.5	30.1	153°52.5	58.6
21	71°29.0	86°10.7	·· 22.4	79°03.7	·· 56.2	230°10.8	·· 30.2	168°54.7	·· 58.6
22	86°31.5	101°11.0	21.3	94°04.4	55.4	245°13.1	30.2	183°56.9	58.6
23	101°33.9	116°11.3	20.1	109°05.2	54.7	260°15.4	30.3	198°59.1	58.6
Mer.pass.:16:15		v0.3 d1.2 m-4.3		v0.7 d0.8 m1.0		v2.3 d-0.1 m-1.9		v2.2 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	116°36.4	131°11.6	S06°18.9	124°05.9	S03°53.9	275°17.7	S07°30.3	214°01.3	S21°58.6
1	131°38.9	146°11.8	17.7	139°06.7	53.1	290°20.0	30.4	229°03.5	58.6
2	146°41.3	161°12.1	16.5	154°07.4	52.3	305°22.4	30.4	244°05.6	58.7
3	161°43.8	176°12.4	·· 15.3	169°08.2	·· 51.5	320°24.7	·· 30.5	259°07.8	·· 58.7
4	176°46.3	191°12.7	14.1	184°08.9	50.8	335°27.0	30.5	274°10.0	58.7
5	191°48.7	206°13.0	12.9	199°09.7	50.0	350°29.3	30.6	289°12.2	58.7
6	206°51.2	221°13.2	S06°11.7	214°10.4	S03°49.2	5°31.6	S07°30.6	304°14.4	S21°58.7
7	221°53.7	236°13.5	10.5	229°11.2	48.4	20°33.9	30.7	319°16.5	58.7
8	236°56.1	251°13.8	09.3	244°11.9	47.7	35°36.3	30.7	334°18.7	58.7
9	251°58.6	266°14.1	·· 08.2	259°12.7	·· 46.9	50°38.6	·· 30.8	349°20.9	·· 58.7
10	267°01.0	281°14.4	07.0	274°13.4	46.1	65°40.9	30.8	4°23.1	58.8
11	282°03.5	296°14.7	05.8	289°14.2	45.3	80°43.2	30.9	19°25.3	58.8
12	297°06.0	311°15.0	S06°04.6	304°14.9	S03°44.5	95°45.5	S07°30.9	34°27.5	S21°58.8
13	312°08.4	326°15.2	03.4	319°15.7	43.8	110°47.8	31.0	49°29.6	58.8
14	327°10.9	341°15.5	02.2	334°16.4	43.0	125°50.2	31.0	64°31.8	58.8
15	342°13.4	356°15.8	06°01.0	349°17.2	·· 42.2	140°52.5	·· 31.1	79°34.0	·· 58.8
16	357°15.8	11°16.1	05°59.8	4°17.9	41.4	155°54.8	31.1	94°36.2	58.8
17	12°18.3	26°16.4	58.6	19°18.7	40.7	170°57.1	31.1	109°38.4	58.9
18	27°20.8	41°16.7	S05°57.4	34°19.4	S03°39.9	185°59.4	S07°31.2	124°40.6	S21°58.9
19	42°23.2	56°17.0	56.2	49°20.2	39.1	201°01.8	31.2	139°42.7	58.9
20	57°25.7	71°17.3	55.0	64°20.9	38.3	216°04.1	31.3	154°44.9	58.9
21	72°28.2	86°17.6	·· 53.8	79°21.7	·· 37.5	231°06.4	·· 31.3	169°47.1	·· 58.9
22	87°30.6	101°17.9	52.7	94°22.4	36.8	246°08.7	31.4	184°49.3	58.9
23	102°33.1	116°18.2	51.5	109°23.2	36.0	261°11.0	31.4	199°51.5	58.9
Mer.pass.:16:11		v0.3 d1.2 m-4.3		v0.8 d0.8 m1.0		v2.3 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	117°35.5	131°18.5	S05°50.3	124°23.9	S03°35.2	276°13.4	S07°31.5	214°53.7	S21°58.9
1	132°38.0	146°18.8	49.1	139°24.7	34.4	291°15.7	31.5	229°55.8	59.0
2	147°40.5	161°19.1	47.9	154°25.4	33.6	306°18.0	31.6	244°58.0	59.0
3	162°42.9	176°19.4	·· 46.7	169°26.2	·· 32.9	321°20.3	·· 31.6	260°00.2	·· 59.0
4	177°45.4	191°19.7	45.5	184°26.9	32.1	336°22.6	31.7	275°02.4	59.0
5	192°47.9	206°20.0	44.3	199°27.7	31.3	351°25.0	31.7	290°04.6	59.0
6	207°50.3	221°20.3	S05°43.1	214°28.5	S03°30.5	6°27.3	S07°31.7	305°06.8	S21°59.0
7	222°52.8	236°20.6	41.9	229°29.2	29.8	21°29.6	31.8	320°09.0	59.0
8	237°55.3	251°20.9	40.7	244°30.0	29.0	36°31.9	31.8	335°11.1	59.0
9	252°57.7	266°21.2	·· 39.5	259°30.7	·· 28.2	51°34.3	·· 31.9	350°13.3	·· 59.1
10	268°00.2	281°21.6	38.3	274°31.5	27.4	66°36.6	31.9	5°15.5	59.1
11	283°02.6	296°21.9	37.2	289°32.2	26.6	81°38.9	32.0	20°17.7	59.1
12	298°05.1	311°22.2	S05°36.0	304°33.0	S03°25.9	96°41.2	S07°32.0	35°19.9	S21°59.1
13	313°07.6	326°22.5	34.8	319°33.7	25.1	111°43.5	32.1	50°22.1	59.1
14	328°10.0	341°22.8	33.6	334°34.5	24.3	126°45.9	32.1	65°24.2	59.1
15	343°12.5	356°23.1	·· 32.4	349°35.2	·· 23.5	141°48.2	·· 32.1	80°26.4	·· 59.1
16	358°15.0	11°23.4	31.2	4°36.0	22.7	156°50.5	32.2	95°28.6	59.1
17	13°17.4	26°23.8	30.0	19°36.7	22.0	171°52.8	32.2	110°30.8	59.2
18	28°19.9	41°24.1	S05°28.8	34°37.5	S03°21.2	186°55.2	S07°32.3	125°33.0	S21°59.2
19	43°22.4	56°24.4	27.6	49°38.2	20.4	201°57.5	32.3	140°35.2	59.2
20	58°24.8	71°24.7	26.4	64°39.0	19.6	216°59.8	32.4	155°37.4	59.2
21	73°27.3	86°25.0	·· 25.2	79°39.8	·· 18.8	232°02.2	·· 32.4	170°39.5	·· 59.2
22	88°29.8	101°25.4	24.0	94°40.5	18.1	247°04.5	32.4	185°41.7	59.2
23	103°32.2	116°25.7	22.8	109°41.3	17.3	262°06.8	32.5	200°43.9	59.2
Mer.pass.:16:07		v0.3 d1.2 m-4.3		v0.8 d0.8 m1.0		v2.3 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.5	-42°13.1
Schedar	349°37.8	56°38.0
Diphda	348°53.6	-17°53.8
Achernar	335°25.1	-57°09.5
Hamal	327°57.9	23°32.5
Polaris	316°29.5	89°20.4
Acamar	315°16.4	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.6	49°55.3
Aldebaran	290°46.3	16°32.4
Rigel	281°09.4	-8°11.2
Capella	280°30.4	46°00.8
Bellatrix	278°29.1	6°21.6
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.5	-52°42.6
Sirius	258°31.2	-16°44.7
Adhara	255°10.2	-29°00.0
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.0
Suhail	222°50.2	-43°30.1
Miaplacidus	221°38.1	-69°47.2
Alphard	217°53.4	-8°44.1
Regulus	207°40.7	11°52.9
Dubhe	193°48.4	61°39.3
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.1
Acrux	173°06.2	-63°11.3
Gacrux	171°57.9	-57°12.2
Alioth	166°18.5	55°51.8
Spica	158°28.6	-11°14.9
Alkaid	152°57.1	49°13.5
Hadar	148°44.4	-60°26.9
Menkent	148°04.7	-36°26.9
Arcturus	145°53.6	19°05.6
Rigil Kent.	139°48.4	-60°53.9
Kochab	137°20.7	74°04.9
Zuben'ubi	137°02.8	-16°06.5
Alphecca	126°09.2	26°39.4
Antares	112°23.5	-26°27.9
Atria	107°23.5	-69°03.1
Sabik	102°10.0	-15°44.5
Shaula	96°19.0	-37°06.7
Rasalhague	96°04.5	12°33.0
Eltanin	90°45.5	51°29.2
Kaus Aust.	83°41.0	-34°22.3
Vega	80°37.7	38°48.1
Nunki	75°55.7	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.7
Deneb	49°30.2	45°20.6
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.8

Jan 16 Mon	**SHA**	**Mer.pass**
Venus	15°28.0	15:15
Mars	8°10.7	15:44
Jupiter	158°45.0	05:42
Saturn	97°31.7	09:46

Jan 17 Tue	**SHA**	**Mer.pass**
Venus	14°35.2	15:15
Mars	7°29.5	15:43
Jupiter	158°41.3	05:38
Saturn	97°24.9	09:42

Jan 18 Wed	**SHA**	**Mer.pass**
Venus	13°42.9	15:14
Mars	6°48.4	15:42
Jupiter	158°37.8	05:34
Saturn	97°18.1	09:39

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.5733 sec ΔT = TT-UT1 = +68.6107 sec

2017 January 16 to Jan. 18 UT

h

Mon	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	177°35.2	S20°56.2	312°45.8	11.7'	N07°59.7	-9.7'	57.1'
1	192°35.0	55.7	327°16.5	11.8'	07°49.9	-9.8'	57.0'
2	207°34.7	55.2	341°47.3	11.8'	07°40.2	-9.8'	57.0'
3	222°34.5	·· 54.8	356°18.2	11.9'	07°30.4	-9.8'	57.0'
4	237°34.3	54.3	10°49.1	12.0'	07°20.5	-9.8'	56.9'
5	252°34.1	53.8	25°20.1	12.0'	07°10.7	-9.9'	56.9'
6	267°33.9	S20°53.3	39°51.2	12.1'	N07°00.8	-9.9'	56.9'
7	282°33.7	52.9	54°22.3	12.2'	06°51.0	-9.9'	56.8'
8	297°33.5	52.4	68°53.5	12.2'	06°41.0	-9.9'	56.8'
9	312°33.3	·· 51.9	83°24.8	12.3'	06°31.1	-9.9'	56.8'
10	327°33.1	51.4	97°56.1	12.3'	06°21.2	-10.0'	56.7'
11	342°32.8	50.9	112°27.4	12.4'	06°11.2	-10.0'	56.7'
12	357°32.6	S20°50.4	126°58.9	12.5'	N06°01.2	-10.0'	56.7'
13	12°32.4	50.0	141°30.4	12.5'	05°51.2	-10.0'	56.6'
14	27°32.2	49.5	156°01.9	12.6'	05°41.2	-10.0'	56.6'
15	42°32.0	·· 49.0	170°33.5	12.6'	05°31.2	-10.0'	56.6'
16	57°31.8	48.5	185°05.2	12.7'	05°21.2	-10.0'	56.5'
17	72°31.6	48.0	199°36.9	12.8'	05°11.1	-10.1'	56.5'
18	87°31.4	S20°47.5	214°08.7	12.8'	N05°01.0	-10.1'	56.5'
19	102°31.2	47.0	228°40.5	12.9'	04°51.0	-10.1'	56.4'
20	117°31.0	46.5	243°12.4	12.9'	04°40.9	-10.1'	56.4'
21	132°30.8	·· 46.1	257°44.4	13.0'	04°30.8	-10.1'	56.4'
22	147°30.6	45.6	272°16.4	13.0'	04°20.7	-10.1'	56.3'
23	162°30.3	45.1	286°48.4	13.1'	04°10.6	-10.1'	56.3'
	SD.=16.2	d=0.5		S.D.=15.4			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	177°30.1	S20°44.6	301°20.5	13.1'	N04°00.5	-10.1'	56.3'
1	192°29.9	44.1	315°52.7	13.2'	03°50.3	-10.1'	56.2'
2	207°29.7	43.6	330°24.8	13.2'	03°40.2	-10.1'	56.2'
3	222°29.5	·· 43.1	344°57.1	13.3'	03°30.1	-10.1'	56.2'
4	237°29.3	42.6	359°29.4	13.3'	03°19.9	-10.1'	56.1'
5	252°29.1	42.1	14°01.7	13.4'	03°09.8	-10.1'	56.1'
6	267°28.9	S20°41.6	28°34.1	13.4'	N02°59.7	-10.1'	56.1'
7	282°28.7	41.1	43°06.5	13.5'	02°49.5	-10.1'	56.0'
8	297°28.5	40.6	57°39.0	13.5'	02°39.4	-10.1'	56.0'
9	312°28.3	·· 40.1	72°11.5	13.5'	02°29.2	-10.1'	56.0'
10	327°28.1	39.6	86°44.1	13.6'	02°19.1	-10.1'	55.9'
11	342°27.9	39.1	101°16.7	13.6'	02°09.0	-10.1'	55.9'
12	357°27.7	S20°38.6	115°49.3	13.7'	N01°58.8	-10.1'	55.9'
13	12°27.5	38.1	130°22.0	13.7'	01°48.7	-10.1'	55.8'
14	27°27.3	37.6	144°54.8	13.7'	01°38.6	-10.1'	55.8'
15	42°27.1	·· 37.1	159°27.5	13.8'	01°28.4	-10.1'	55.8'
16	57°26.9	36.6	174°00.3	13.8'	01°18.3	-10.1'	55.8'
17	72°26.7	36.1	188°33.2	13.9'	01°08.2	-10.1'	55.7'
18	87°26.5	S20°35.6	203°06.0	13.9'	N00°58.1	-10.1'	55.7'
19	102°26.3	35.1	217°39.0	13.9'	00°48.0	-10.1'	55.7'
20	117°26.1	34.6	232°11.9	14.0'	00°37.9	-10.1'	55.6'
21	132°25.9	·· 34.1	246°44.9	14.0'	00°27.8	-10.1'	55.6'
22	147°25.7	33.6	261°17.9	14.0'	00°17.7	-10.1'	55.6'
23	162°25.5	33.1	275°51.0	14.1'	00°07.7	-10.1'	55.6'
	SD.=16.2	d=0.5		S.D.=15.2			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	177°25.3	S20°32.6	290°24.0	14.1'	S00°02.4	-10.1'	55.5'
1	192°25.1	32.1	304°57.2	14.1'	00°12.4	-10.0'	55.5'
2	207°24.9	31.5	319°30.3	14.2'	00°22.5	-10.0'	55.5'
3	222°24.7	·· 31.0	334°03.5	14.2'	00°32.5	-10.0'	55.4'
4	237°24.5	30.5	348°36.7	14.2'	00°42.5	-10.0'	55.4'
5	252°24.3	30.0	3°09.9	14.2'	00°52.5	-10.0'	55.4'
6	267°24.1	S20°29.5	17°43.2	14.3'	S01°02.5	-10.0'	55.4'
7	282°23.9	29.0	32°16.4	14.3'	01°12.4	-10.0'	55.3'
8	297°23.7	28.5	46°49.8	14.3'	01°22.4	-9.9'	55.3'
9	312°23.5	·· 28.0	61°23.1	14.3'	01°32.3	-9.9'	55.3'
10	327°23.3	27.4	75°56.4	14.4'	01°42.2	-9.9'	55.3'
11	342°23.1	26.9	90°29.8	14.4'	01°52.1	-9.9'	55.2'
12	357°22.9	S20°26.4	105°03.2	14.4'	S02°02.0	-9.9'	55.2'
13	12°22.7	25.9	119°36.6	14.4'	02°11.9	-9.9'	55.2'
14	27°22.5	25.4	134°10.1	14.5'	02°21.7	-9.8'	55.2'
15	42°22.3	·· 24.9	148°43.6	14.5'	02°31.6	-9.8'	55.1'
16	57°22.1	24.3	163°17.0	14.5'	02°41.4	-9.8'	55.1'
17	72°21.9	23.8	177°50.5	14.5'	02°51.2	-9.8'	55.1'
18	87°21.8	S20°23.3	192°24.1	14.5'	S03°00.9	-9.8'	55.1'
19	102°21.6	22.8	206°57.6	14.5'	03°10.7	-9.7'	55.0'
20	117°21.4	22.3	221°31.2	14.6'	03°20.4	-9.7'	55.0'
21	132°21.2	·· 21.7	236°04.7	14.6'	03°30.1	-9.7'	55.0'
22	147°21.0	21.2	250°38.3	14.6'	03°39.8	-9.7'	55.0'
23	162°20.8	20.7	265°11.9	14.6'	03°49.4	-9.6'	55.0'
	SD.=16.2	d=0.5		S.D.=15.0			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:55	09:42	▬	▬	14:39	16:26
N 70°	07:41	09:11	11:37	12:44	15:10	16:40
68°	07:30	08:48	10:22	13:59	15:33	16:51
66°	07:20	08:30	09:46	14:35	15:51	17:01
64°	07:12	08:15	09:20	15:01	16:06	17:09
62°	07:05	08:03	09:00	15:21	16:18	17:16
60°	06:58	07:52	08:44	15:37	16:29	17:22
N 58°	06:53	07:43	08:30	15:51	16:38	17:28
56°	06:47	07:34	08:19	16:02	16:46	17:33
54°	06:43	07:27	08:08	16:13	16:54	17:38
52°	06:38	07:20	07:59	16:22	17:00	17:43
50°	06:34	07:14	07:51	16:30	17:07	17:47
45°	06:25	07:01	07:33	16:47	17:20	17:56
N 40°	06:16	06:49	07:19	17:02	17:31	18:04
35°	06:09	06:40	07:07	17:14	17:41	18:12
30°	06:01	06:31	06:56	17:24	17:50	18:19
20°	05:47	06:14	06:38	17:43	18:06	18:33
N 10°	05:33	05:59	06:22	17:59	18:21	18:47
0°	05:19	05:44	06:07	18:14	18:36	19:02
S 10°	05:02	05:29	05:51	18:29	18:52	19:18
20°	04:42	05:11	05:35	18:46	19:09	19:38
30°	04:17	04:49	05:15	19:05	19:31	20:03
35°	04:00	04:35	05:04	19:16	19:44	20:19
40°	03:40	04:20	04:51	19:29	20:00	20:39
45°	03:15	04:00	04:36	19:44	20:19	21:05
S 50°	02:39	03:35	04:17	20:03	20:44	21:40
52°	02:19	03:23	04:08	20:12	20:56	21:59
54°	01:54	03:09	03:57	20:22	21:10	22:24
56°	01:16	02:52	03:46	20:33	21:27	23:00
58°	▭	02:31	03:32	20:46	21:47	▭
S 60°	▭	02:04	03:17	21:02	22:13	▭

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	20:54	22:35	–:–	10:47	10:40	10:34
N 70°	21:00	22:35	–:–	10:38	10:37	10:36
68°	21:06	22:35	–:–	10:31	10:35	10:38
66°	21:10	22:35	23:58	10:25	10:33	10:40
64°	21:14	22:35	23:54	10:20	10:31	10:42
62°	21:17	22:35	23:51	10:16	10:30	10:43
60°	21:20	22:35	23:49	10:12	10:29	10:44
N 58°	21:22	22:35	23:47	10:09	10:27	10:45
56°	21:24	22:35	23:45	10:05	10:26	10:46
54°	21:26	22:36	23:43	10:03	10:25	10:47
52°	21:28	22:36	23:41	10:00	10:25	10:48
50°	21:29	22:36	23:40	09:58	10:24	10:48
45°	21:33	22:36	23:37	09:53	10:22	10:50
N 40°	21:36	22:36	23:34	09:49	10:21	10:51
35°	21:38	22:36	23:32	09:45	10:19	10:52
30°	21:41	22:36	23:30	09:42	10:18	10:53
20°	21:45	22:36	23:26	09:36	10:16	10:55
N 10°	21:48	22:36	23:23	09:31	10:15	10:56
0°	21:51	22:36	23:20	09:27	10:13	10:58
S 10°	21:54	22:36	23:17	09:22	10:11	10:59
20°	21:58	22:37	23:14	09:17	10:10	11:00
30°	22:02	22:37	23:11	09:11	10:07	11:02
35°	22:04	22:37	23:09	09:08	10:06	11:03
40°	22:06	22:37	23:07	09:04	10:05	11:04
45°	22:09	22:37	23:05	08:59	10:03	11:05
S 50°	22:13	22:37	23:02	08:54	10:01	11:07
52°	22:14	22:38	23:00	08:52	10:00	11:07
54°	22:16	22:38	22:59	08:49	10:00	11:08
56°	22:18	22:38	22:57	08:46	09:58	11:09
58°	22:20	22:38	22:55	08:42	09:57	11:10
S 60°	22:22	22:38	22:53	08:39	09:56	11:11

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 18-20 81-64%
16	09:39	09:49	12:10	03:15	15:39	
17	09:59	10:09	12:10	04:02	16:25	
18	10:19	10:28	12:10	04:47	17:09	

January 19, 20, 21 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	118°34.7	131°26.0	S05°21.6	124°42.0	S03°16.5	277°09.1	S07°32.5	215°46.1	S21°59.2
1	133°37.1	146°26.4	20.4	139°42.8	15.7	292°11.5	32.6	230°48.3	59.3
2	148°39.6	161°26.7	19.3	154°43.5	15.0	307°13.8	32.6	245°50.5	59.3
3	163°42.1	176°27.0	·· 18.1	169°44.3	·· 14.2	322°16.1	·· 32.7	260°52.7	·· 59.3
4	178°44.5	191°27.3	16.9	184°45.0	13.4	337°18.4	32.7	275°54.8	59.3
5	193°47.0	206°27.7	15.7	199°45.8	12.6	352°20.8	32.7	290°57.0	59.3
6	208°49.5	221°28.0	S05°14.5	214°46.5	S03°11.8	7°23.1	S07°32.8	305°59.2	S21°59.3
7	223°51.9	236°28.3	13.3	229°47.3	11.1	22°25.4	32.8	321°01.4	59.3
8	238°54.4	251°28.7	12.1	244°48.0	10.3	37°27.8	32.9	336°03.6	59.3
9	253°56.9	266°29.0	·· 10.9	259°48.8	·· 09.5	52°30.1	·· 32.9	351°05.8	·· 59.4
10	268°59.3	281°29.3	09.7	274°49.6	08.7	67°32.4	33.0	6°08.0	59.4
11	284°01.8	296°29.7	08.5	289°50.3	07.9	82°34.8	33.0	21°10.2	59.4
12	299°04.2	311°30.0	S05°07.3	304°51.1	S03°07.2	97°37.1	S07°33.0	36°12.3	S21°59.4
13	314°06.7	326°30.4	06.1	319°51.8	06.4	112°39.4	33.1	51°14.5	59.4
14	329°09.2	341°30.7	04.9	334°52.6	05.6	127°41.8	33.1	66°16.7	59.4
15	344°11.6	356°31.0	·· 03.7	349°53.3	·· 04.8	142°44.1	·· 33.2	81°18.9	·· 59.4
16	359°14.1	11°31.4	02.6	4°54.1	04.0	157°46.4	33.2	96°21.1	59.4
17	14°16.6	26°31.7	01.4	19°54.8	03.3	172°48.7	33.2	111°23.3	59.5
18	29°19.0	41°32.1	S05°00.2	34°55.6	S03°02.5	187°51.1	S07°33.3	126°25.5	S21°59.5
19	44°21.5	56°32.4	04°59.0	49°56.4	01.7	202°53.4	33.3	141°27.7	59.5
20	59°24.0	71°32.8	57.8	64°57.1	00.9	217°55.7	33.4	156°29.8	59.5
21	74°26.4	86°33.1	·· 56.6	79°57.9	03°00.1	232°58.1	·· 33.4	171°32.0	·· 59.5
22	89°28.9	101°33.5	55.4	94°58.6	02°59.4	248°00.4	33.4	186°34.2	59.5
23	104°31.4	116°33.8	54.2	109°59.4	58.6	263°02.8	33.5	201°36.4	59.5
Mer.pass.:16:03		v0.3 d1.2 m-4.3		v0.8 d0.8 m1.0		v2.3 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	119°33.8	131°34.2	S04°53.0	125°00.1	S02°57.8	278°05.1	S07°33.5	216°38.6	S21°59.5
1	134°36.3	146°34.5	51.8	140°00.9	57.0	293°07.4	33.6	231°40.8	59.6
2	149°38.7	161°34.9	50.6	155°01.6	56.2	308°09.8	33.6	246°43.0	59.6
3	164°41.2	176°35.2	·· 49.4	170°02.4	·· 55.5	323°12.1	·· 33.6	261°45.2	·· 59.6
4	179°43.7	191°35.6	48.2	185°03.2	54.7	338°14.4	33.7	276°47.3	59.6
5	194°46.1	206°35.9	47.0	200°03.9	53.9	353°16.8	33.7	291°49.5	59.6
6	209°48.6	221°36.3	S04°45.8	215°04.7	S02°53.1	8°19.1	S07°33.8	306°51.7	S21°59.6
7	224°51.1	236°36.7	44.7	230°05.4	52.3	23°21.4	33.8	321°53.9	59.6
8	239°53.5	251°37.0	43.5	245°06.2	51.6	38°23.8	33.8	336°56.1	59.6
9	254°56.0	266°37.4	·· 42.3	260°06.9	·· 50.8	53°26.1	·· 33.9	351°58.3	·· 59.6
10	269°58.5	281°37.7	41.1	275°07.7	50.0	68°28.4	33.9	7°00.5	59.7
11	285°00.9	296°38.1	39.9	290°08.4	49.2	83°30.8	34.0	22°02.7	59.7
12	300°03.4	311°38.5	S04°38.7	305°09.2	S02°48.4	98°33.1	S07°34.0	37°04.9	S21°59.7
13	315°05.9	326°38.8	37.5	320°10.0	47.7	113°35.5	34.0	52°07.0	59.7
14	330°08.3	341°39.2	36.3	335°10.7	46.9	128°37.8	34.1	67°09.2	59.7
15	345°10.8	356°39.6	·· 35.1	350°11.5	·· 46.1	143°40.1	·· 34.1	82°11.4	·· 59.7
16	0°13.2	11°39.9	33.9	5°12.2	45.3	158°42.5	34.2	97°13.6	59.7
17	15°15.7	26°40.3	32.7	20°13.0	44.6	173°44.8	34.2	112°15.8	59.7
18	30°18.2	41°40.7	S04°31.5	35°13.7	S02°43.8	188°47.2	S07°34.2	127°18.0	S21°59.8
19	45°20.6	56°41.1	30.3	50°14.5	43.0	203°49.5	34.3	142°20.2	59.8
20	60°23.1	71°41.4	29.1	65°15.3	42.2	218°51.8	34.3	157°22.4	59.8
21	75°25.6	86°41.8	·· 28.0	80°16.0	·· 41.4	233°54.2	·· 34.3	172°24.6	·· 59.8
22	90°28.0	101°42.2	26.8	95°16.8	40.7	248°56.5	34.4	187°26.8	59.8
23	105°30.5	116°42.6	25.6	110°17.5	39.9	263°58.9	34.4	202°28.9	59.8
Mer.pass.:15:59		v0.4 d1.2 m-4.3		v0.8 d0.8 m1.0		v2.3 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	120°33.0	131°42.9	S04°24.4	125°18.3	S02°39.1	279°01.2	S07°34.5	217°31.1	S21°59.8
1	135°35.4	146°43.3	23.2	140°19.0	38.3	294°03.5	34.5	232°33.3	59.8
2	150°37.9	161°43.7	22.0	155°19.8	37.5	309°05.9	34.5	247°35.5	59.8
3	165°40.3	176°44.1	·· 20.8	170°20.6	·· 36.8	324°08.2	·· 34.6	262°37.7	·· 59.9
4	180°42.8	191°44.5	19.6	185°21.3	36.0	339°10.6	34.6	277°39.9	59.9
5	195°45.3	206°44.8	18.4	200°22.1	35.2	354°12.9	34.6	292°42.1	59.9
6	210°47.7	221°45.2	S04°17.2	215°22.8	S02°34.4	9°15.3	S07°34.7	307°44.3	S21°59.9
7	225°50.2	236°45.6	16.0	230°23.6	33.6	24°17.6	34.7	322°46.5	59.9
8	240°52.7	251°46.0	14.8	245°24.3	32.9	39°19.9	34.8	337°48.7	59.9
9	255°55.1	266°46.4	·· 13.6	260°25.1	·· 32.1	54°22.3	·· 34.8	352°50.8	·· 59.9
10	270°57.6	281°46.8	12.4	275°25.9	31.3	69°24.6	34.8	7°53.0	21°59.9
11	286°00.1	296°47.2	11.3	290°26.6	30.5	84°27.0	34.9	22°55.2	22°00.0
12	301°02.5	311°47.6	S04°10.1	305°27.4	S02°29.7	99°29.3	S07°34.9	37°57.4	S22°00.0
13	316°05.0	326°47.9	08.9	320°28.1	29.0	114°31.7	34.9	52°59.6	00.0
14	331°07.5	341°48.3	07.7	335°28.9	28.2	129°34.0	35.0	68°01.8	00.0
15	346°09.9	356°48.7	·· 06.5	350°29.6	·· 27.4	144°36.4	·· 35.0	83°04.0	·· 00.0
16	1°12.4	11°49.1	05.3	5°30.4	26.6	159°38.7	35.0	98°06.2	00.0
17	16°14.8	26°49.5	04.1	20°31.2	25.8	174°41.1	35.1	113°08.4	00.0
18	31°17.3	41°49.9	S04°02.9	35°31.9	S02°25.1	189°43.4	S07°35.1	128°10.6	S22°00.0
19	46°19.8	56°50.3	01.7	50°32.7	24.3	204°45.7	35.1	143°12.8	00.0
20	61°22.2	71°50.7	04°00.5	65°33.4	23.5	219°48.1	35.2	158°15.0	00.1
21	76°24.7	86°51.1	03°59.3	80°34.2	·· 22.7	234°50.4	·· 35.2	173°17.1	·· 00.1
22	91°27.2	101°51.5	58.1	95°35.0	21.9	249°52.8	35.2	188°19.3	00.1
23	106°29.6	116°51.9	57.0	110°35.7	21.2	264°55.1	35.3	203°21.5	00.1
Mer.pass.:15:55		v0.4 d1.2 m-4.3		v0.8 d0.8 m1.1		v2.3 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.5	-42°13.1
Schedar	349°37.8	56°38.0
Diphda	348°53.6	-17°53.8
Achernar	335°25.1	-57°09.5
Hamal	327°57.9	23°32.5
Polaris	316°30.8	89°20.4
Acamar	315°16.4	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.6	49°55.3
Aldebaran	290°46.3	16°32.4
Rigel	281°09.5	-8°11.2
Capella	280°30.5	46°00.8
Bellatrix	278°29.1	6°21.6
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.5	-52°42.6
Sirius	258°31.2	-16°44.7
Adhara	255°10.2	-29°00.0
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.0
Suhail	222°50.2	-43°30.2
Miaplacidus	221°38.1	-69°47.2
Alphard	217°53.4	-8°44.1
Regulus	207°40.7	11°52.9
Dubhe	193°48.4	61°39.3
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.1
Acrux	173°06.2	-63°11.3
Gacrux	171°57.8	-57°12.2
Alioth	166°18.5	55°51.8
Spica	158°28.6	-11°14.9
Alkaid	152°57.0	49°13.5
Hadar	148°44.3	-60°26.9
Menkent	148°04.7	-36°26.9
Arcturus	145°53.6	19°05.6
Rigil Kent.	139°48.4	-60°53.9
Kochab	137°20.6	74°04.9
Zuben'ubi	137°02.8	-16°06.6
Alphecca	126°09.1	26°39.4
Antares	112°23.5	-26°27.9
Atria	107°23.5	-69°03.0
Sabik	102°10.0	-15°44.5
Shaula	96°18.9	-37°06.7
Rasalhague	96°04.5	12°33.0
Eltanin	90°45.5	51°29.2
Kaus Aust.	83°41.0	-34°22.3
Vega	80°37.7	38°48.0
Nunki	75°55.7	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.7
Deneb	49°30.2	45°20.6
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.8

Jan 19 Thu	SHA	Mer.pass
Venus	12°51.3	15:14
Mars	6°07.3	15:40
Jupiter	158°34.5	05:31
Saturn	97°11.4	09:36

Jan 20 Fri	SHA	Mer.pass
Venus	12°00.4	15:13
Mars	5°26.3	15:39
Jupiter	158°31.3	05:27
Saturn	97°04.8	09:32

Jan 21 Sat	SHA	Mer.pass
Venus	11°10.0	15:13
Mars	4°45.3	15:38
Jupiter	158°28.2	05:23
Saturn	96°58.2	09:29

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.5698 sec ΔT = TT-UT1 = +68.6142 sec

2017 January 19 to Jan. 21 UT

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Thu	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	177°20.6	S20°20.2	279°45.5	14.6'	S03°59.1	-9.6'	54.9'
1	192°20.4	19.6	294°19.1	14.6'	04°08.7	-9.6'	54.9'
2	207°20.2	19.1	308°52.8	14.6'	04°18.3	-9.6'	54.9'
3	222°20.0	·· 18.6	323°26.4	14.7'	04°27.8	-9.5'	54.9'
4	237°19.8	18.1	338°00.1	14.7'	04°37.3	-9.5'	54.8'
5	252°19.6	17.5	352°33.7	14.7'	04°46.8	-9.5'	54.8'
6	267°19.5	S20°17.0	7°07.4	14.7'	S04°56.3	-9.5'	54.8'
7	282°19.3	16.5	21°41.1	14.7'	05°05.8	-9.4'	54.8'
8	297°19.1	15.9	36°14.8	14.7'	05°15.2	-9.4'	54.8'
9	312°18.9	·· 15.4	50°48.5	14.7'	05°24.6	-9.4'	54.7'
10	327°18.7	14.9	65°22.2	14.7'	05°33.9	-9.3'	54.7'
11	342°18.5	14.4	79°55.9	14.7'	05°43.3	-9.3'	54.7'
12	357°18.3	S20°13.8	94°29.6	14.7'	S05°52.6	-9.3'	54.7'
13	12°18.1	13.3	109°03.3	14.7'	06°01.8	-9.3'	54.7'
14	27°18.0	12.8	123°37.0	14.7'	06°11.1	-9.2'	54.7'
15	42°17.8	·· 12.2	138°10.7	14.7'	06°20.3	-9.2'	54.6'
16	57°17.6	11.7	152°44.5	14.7'	06°29.4	-9.2'	54.6'
17	72°17.4	11.1	167°18.2	14.7'	06°38.6	-9.1'	54.6'
18	87°17.2	S20°10.6	181°51.9	14.7'	S06°47.7	-9.1'	54.6'
19	102°17.0	10.1	196°25.6	14.7'	06°56.8	-9.1'	54.6'
20	117°16.8	09.5	210°59.3	14.7'	07°05.8	-9.0'	54.6'
21	132°16.6	·· 09.0	225°33.1	14.7'	07°14.8	-9.0'	54.5'
22	147°16.5	08.5	240°06.8	14.7'	07°23.8	-9.0'	54.5'
23	162°16.3	07.9	254°40.5	14.7'	07°32.7	-8.9'	54.5'
	SD.=16.2	d=0.5		S.D.=14.9			

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	177°16.1	S20°07.4	269°14.2	14.7'	S07°41.6	-8.9'	54.5'
1	192°15.9	06.8	283°47.9	14.7'	07°50.5	-8.8'	54.5'
2	207°15.7	06.3	298°21.6	14.7'	07°59.3	-8.8'	54.5'
3	222°15.5	·· 05.8	312°55.3	14.7'	08°08.1	-8.8'	54.5'
4	237°15.4	05.2	327°29.0	14.7'	08°16.8	-8.7'	54.4'
5	252°15.2	04.7	342°02.6	14.7'	08°25.5	-8.7'	54.4'
6	267°15.0	S20°04.1	356°36.3	14.7'	S08°34.2	-8.7'	54.4'
7	282°14.8	03.6	11°10.0	14.7'	08°42.8	-8.6'	54.4'
8	297°14.6	03.0	25°43.6	14.6'	08°51.4	-8.6'	54.4'
9	312°14.5	·· 02.5	40°17.2	14.6'	09°00.0	-8.5'	54.4'
10	327°14.3	01.9	54°50.9	14.6'	09°08.5	-8.5'	54.4'
11	342°14.1	01.4	69°24.5	14.6'	09°17.0	-8.4'	54.4'
12	357°13.9	S20°00.8	83°58.1	14.6'	S09°25.4	-8.4'	54.3'
13	12°13.7	20°00.3	98°31.7	14.6'	09°33.8	-8.4'	54.3'
14	27°13.6	19°59.7	113°05.3	14.6'	09°42.1	-8.3'	54.3'
15	42°13.4	·· 59.2	127°38.8	14.6'	09°50.4	-8.3'	54.3'
16	57°13.2	58.6	142°12.4	14.5'	09°58.7	-8.2'	54.3'
17	72°13.0	58.1	156°45.9	14.5'	10°06.9	-8.2'	54.3'
18	87°12.8	S19°57.5	171°19.4	14.5'	S10°15.1	-8.1'	54.3'
19	102°12.7	57.0	185°53.0	14.5'	10°23.2	-8.1'	54.3'
20	117°12.5	56.4	200°26.4	14.5'	10°31.2	-8.1'	54.3'
21	132°12.3	·· 55.9	214°59.9	14.5'	10°39.3	-8.0'	54.3'
22	147°12.1	55.3	229°33.4	14.4'	10°47.3	-8.0'	54.3'
23	162°11.9	54.8	244°06.8	14.4'	10°55.2	-7.9'	54.2'
	SD.=16.2	d=0.5		S.D.=14.8			

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	177°11.8	S19°54.2	258°40.2	14.4'	S11°03.1	-7.9'	54.2'
1	192°11.6	53.7	273°13.6	14.4'	11°10.9	-7.8'	54.2'
2	207°11.4	53.1	287°47.0	14.4'	11°18.7	-7.8'	54.2'
3	222°11.2	·· 52.5	302°20.4	14.3'	11°26.5	-7.7'	54.2'
4	237°11.1	52.0	316°53.7	14.3'	11°34.1	-7.7'	54.2'
5	252°10.9	51.4	331°27.0	14.3'	11°41.8	-7.6'	54.2'
6	267°10.7	S19°50.9	346°00.3	14.3'	S11°49.4	-7.6'	54.2'
7	282°10.5	50.3	0°33.6	14.3'	11°56.9	-7.5'	54.2'
8	297°10.4	49.7	15°06.8	14.2'	12°04.4	-7.5'	54.2'
9	312°10.2	·· 49.2	29°40.0	14.2'	12°11.9	-7.4'	54.2'
10	327°10.0	48.6	44°13.2	14.2'	12°19.2	-7.4'	54.2'
11	342°09.9	48.1	58°46.4	14.2'	12°26.6	-7.3'	54.2'
12	357°09.7	S19°47.5	73°19.6	14.1'	S12°33.9	-7.3'	54.2'
13	12°09.5	46.9	87°52.7	14.1'	12°41.1	-7.2'	54.2'
14	27°09.3	46.4	102°25.8	14.1'	12°48.3	-7.1'	54.2'
15	42°09.2	·· 45.8	116°58.9	14.1'	12°55.4	-7.1'	54.2'
16	57°09.0	45.2	131°31.9	14.0'	13°02.4	-7.0'	54.2'
17	72°08.8	44.7	146°05.0	14.0'	13°09.5	-7.0'	54.2'
18	87°08.7	S19°44.1	160°37.9	14.0'	S13°16.4	-6.9'	54.2'
19	102°08.5	43.5	175°10.9	14.0'	13°23.3	-6.9'	54.2'
20	117°08.3	43.0	189°43.9	13.9'	13°30.1	-6.8'	54.2'
21	132°08.1	·· 42.4	204°16.8	13.9'	13°36.9	-6.8'	54.2'
22	147°08.0	41.8	218°49.6	13.9'	13°43.7	-6.7'	54.2'
23	162°07.8	41.2	233°22.5	13.8'	13°50.3	-6.6'	54.2'
	SD.=16.2	d=0.6		S.D.=14.8			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:47	09:30	▬	▬	14:53	16:36
N 70°	07:34	09:01	11:03	13:20	15:22	16:49
68°	07:24	08:40	10:09	14:14	15:43	16:59
66°	07:15	08:23	09:36	14:46	16:00	17:08
64°	07:07	08:10	09:13	15:10	16:13	17:16
62°	07:01	07:58	08:54	15:29	16:25	17:22
60°	06:55	07:48	08:39	15:44	16:35	17:28
N 58°	06:49	07:39	08:26	15:57	16:44	17:33
56°	06:45	07:31	08:15	16:08	16:52	17:38
54°	06:40	07:24	08:05	16:18	16:59	17:43
52°	06:36	07:18	07:56	16:27	17:05	17:47
50°	06:32	07:12	07:48	16:35	17:11	17:51
45°	06:23	06:59	07:31	16:51	17:24	18:00
N 40°	06:15	06:48	07:18	17:05	17:34	18:07
35°	06:08	06:39	07:06	17:17	17:44	18:15
30°	06:01	06:30	06:56	17:27	17:52	18:22
20°	05:47	06:14	06:38	17:45	18:08	18:35
N 10°	05:34	06:00	06:22	18:00	18:22	18:48
0°	05:20	05:45	06:07	18:15	18:37	19:02
S 10°	05:04	05:30	05:53	18:29	18:52	19:18
20°	04:44	05:13	05:37	18:45	19:09	19:37
30°	04:20	04:52	05:18	19:04	19:30	20:02
35°	04:04	04:39	05:07	19:15	19:43	20:18
40°	03:45	04:23	04:55	19:27	19:58	20:37
45°	03:20	04:05	04:40	19:42	20:16	21:01
S 50°	02:46	03:41	04:21	20:00	20:40	21:35
52°	02:27	03:29	04:13	20:08	20:52	21:53
54°	02:04	03:16	04:03	20:18	21:05	22:15
56°	01:32	03:00	03:52	20:29	21:21	22:47
58°	▭	02:40	03:39	20:41	21:40	▭
S 60°	▭	02:15	03:24	20:56	22:04	▭

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	00:13	01:50	03:28	10:27	10:20	10:13
N 70°	00:07	01:37	03:07	10:35	10:34	10:34
68°	00:02	01:27	02:52	10:42	10:46	10:51
66°	–:–	01:19	02:39	10:47	10:55	11:05
64°	–:–	01:12	02:28	10:52	11:03	11:17
62°	–:–	01:06	02:19	10:56	11:10	11:26
60°	–:–	01:01	02:11	11:00	11:16	11:35
N 58°	–:–	00:56	02:04	11:03	11:21	11:42
56°	–:–	00:52	01:58	11:05	11:26	11:49
54°	–:–	00:49	01:53	11:08	11:30	11:54
52°	–:–	00:45	01:48	11:10	11:34	12:00
50°	–:–	00:42	01:44	11:12	11:38	12:05
45°	–:–	00:36	01:35	11:17	11:45	12:15
N 40°	–:–	00:31	01:27	11:21	11:51	12:24
35°	–:–	00:26	01:20	11:24	11:57	12:31
30°	–:–	00:22	01:14	11:27	12:02	12:38
20°	–:–	00:15	01:04	11:32	12:10	12:49
N 10°	–:–	00:09	00:55	11:37	12:18	12:59
0°	–:–	00:04	00:47	11:41	12:24	13:08
S 10°	23:58	–:–	00:39	11:45	12:31	13:18
20°	23:52	–:–	00:30	11:50	12:39	13:28
30°	23:45	–:–	00:20	11:55	12:47	13:39
35°	23:41	–:–	00:15	11:58	12:52	13:46
40°	23:37	–:–	00:08	12:01	12:58	13:54
45°	23:32	–:–	00:01	12:05	13:04	14:02
S 50°	23:26	23:52	–:–	12:10	13:12	14:13
52°	23:23	23:48	–:–	12:12	13:16	14:18
54°	23:20	23:43	–:–	12:15	13:20	14:24
56°	23:17	23:38	–:–	12:17	13:24	14:30
58°	23:13	23:33	23:55	12:20	13:29	14:36
S 60°	23:09	23:27	23:47	12:23	13:35	14:44

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 21-23 54-35%
19	10:38	10:47	12:11	05:31	17:52	
20	10:56	11:04	12:11	06:14	18:36	
21	11:13	11:21	12:11	06:58	19:20	

January 22, 23, 24 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	121°32.1	131°52.3	S03°55.8	125°36.5	S02°20.4	279°57.5	S07°35.3	218°23.7	S22°00.1
1	136°34.6	146°52.7	54.6	140°37.2	19.6	294°59.8	35.4	233°25.9	00.1
2	151°37.0	161°53.1	53.4	155°38.0	18.8	310°02.2	35.4	248°28.1	00.1
3	166°39.5	176°53.6	·· 52.2	170°38.7	·· 18.0	325°04.5	·· 35.4	263°30.3	·· 00.1
4	181°42.0	191°54.0	51.0	185°39.5	17.3	340°06.9	35.5	278°32.5	00.2
5	196°44.4	206°54.4	49.8	200°40.3	16.5	355°09.2	35.5	293°34.7	00.2
6	211°46.9	221°54.8	S03°48.6	215°41.0	S02°15.7	10°11.6	S07°35.5	308°36.9	S22°00.2
7	226°49.3	236°55.2	47.4	230°41.8	14.9	25°13.9	35.6	323°39.1	00.2
8	241°51.8	251°55.6	46.2	245°42.5	14.1	40°16.3	35.6	338°41.3	00.2
9	256°54.3	266°56.0	·· 45.0	260°43.3	·· 13.4	55°18.6	·· 35.6	353°43.5	·· 00.2
10	271°56.7	281°56.4	43.8	275°44.1	12.6	70°21.0	35.7	8°45.6	00.2
11	286°59.2	296°56.9	42.7	290°44.8	11.8	85°23.3	35.7	23°47.8	00.2
12	302°01.7	311°57.3	S03°41.5	305°45.6	S02°11.0	100°25.7	S07°35.7	38°50.0	S22°00.2
13	317°04.1	326°57.7	40.3	320°46.3	10.2	115°28.0	35.8	53°52.2	00.3
14	332°06.6	341°58.1	39.1	335°47.1	09.5	130°30.4	35.8	68°54.4	00.3
15	347°09.1	356°58.5	·· 37.9	350°47.9	·· 08.7	145°32.7	·· 35.8	83°56.6	·· 00.3
16	2°11.5	11°59.0	36.7	5°48.6	07.9	160°35.1	35.9	98°58.8	00.3
17	17°14.0	26°59.4	35.5	20°49.4	07.1	175°37.5	35.9	114°01.0	00.3
18	32°16.5	41°59.8	S03°34.3	35°50.1	S02°06.3	190°39.8	S07°35.9	129°03.2	S22°00.3
19	47°18.9	57°00.2	33.1	50°50.9	05.6	205°42.2	36.0	144°05.4	00.3
20	62°21.4	72°00.7	31.9	65°51.7	04.8	220°44.5	36.0	159°07.6	00.3
21	77°23.8	87°01.1	·· 30.8	80°52.4	·· 04.0	235°46.9	·· 36.0	174°09.8	·· 00.3
22	92°26.3	102°01.5	29.6	95°53.2	03.2	250°49.2	36.0	189°12.0	00.4
23	107°28.8	117°01.9	28.4	110°53.9	02.4	265°51.6	36.1	204°14.2	00.4
Mer.pass.:15:51		v0.4 d1.2 m-4.3		v0.8 d0.8 m1.1		v2.3 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	122°31.2	132°02.4	S03°27.2	125°54.7	S02°01.7	280°53.9	S07°36.1	219°16.4	S22°00.4
1	137°33.7	147°02.8	26.0	140°55.5	00.9	295°56.3	36.1	234°18.6	00.4
2	152°36.2	162°03.2	24.8	155°56.2	02°00.1	310°58.6	36.2	249°20.7	00.4
3	167°38.6	177°03.7	·· 23.6	170°57.0	01°59.3	326°01.0	·· 36.2	264°22.9	·· 00.4
4	182°41.1	192°04.1	22.4	185°57.7	58.5	341°03.4	36.2	279°25.1	00.4
5	197°43.6	207°04.5	21.2	200°58.5	57.8	356°05.7	36.3	294°27.3	00.4
6	212°46.0	222°05.0	S03°20.0	215°59.3	S01°57.0	11°08.1	S07°36.3	309°29.5	S22°00.4
7	227°48.5	237°05.4	18.9	231°00.0	56.2	26°10.4	36.3	324°31.7	00.5
8	242°50.9	252°05.9	17.7	246°00.8	55.4	41°12.8	36.4	339°33.9	00.5
9	257°53.4	267°06.3	·· 16.5	261°01.5	·· 54.6	56°15.1	·· 36.4	354°36.1	·· 00.5
10	272°55.9	282°06.8	15.3	276°02.3	53.9	71°17.5	36.4	9°38.3	00.5
11	287°58.3	297°07.2	14.1	291°03.1	53.1	86°19.9	36.5	24°40.5	00.5
12	303°00.8	312°07.6	S03°12.9	306°03.8	S01°52.3	101°22.2	S07°36.5	39°42.7	S22°00.5
13	318°03.3	327°08.1	11.7	321°04.6	51.5	116°24.6	36.5	54°44.9	00.5
14	333°05.7	342°08.5	10.5	336°05.3	50.7	131°26.9	36.5	69°47.1	00.5
15	348°08.2	357°09.0	·· 09.3	351°06.1	·· 50.0	146°29.3	·· 36.6	84°49.3	·· 00.5
16	3°10.7	12°09.4	08.2	6°06.9	49.2	161°31.7	36.6	99°51.5	00.5
17	18°13.1	27°09.9	07.0	21°07.6	48.4	176°34.0	36.6	114°53.7	00.6
18	33°15.6	42°10.3	S03°05.8	36°08.4	S01°47.6	191°36.4	S07°36.7	129°55.9	S22°00.6
19	48°18.1	57°10.8	04.6	51°09.1	46.8	206°38.7	36.7	144°58.1	00.6
20	63°20.5	72°11.2	03.4	66°09.9	46.1	221°41.1	36.7	160°00.3	00.6
21	78°23.0	87°11.7	·· 02.2	81°10.7	·· 45.3	236°43.5	·· 36.7	175°02.5	·· 00.6
22	93°25.4	102°12.2	03°01.0	96°11.4	44.5	251°45.8	36.8	190°04.7	00.6
23	108°27.9	117°12.6	02°59.8	111°12.2	43.7	266°48.2	36.8	205°06.9	00.6
Mer.pass.:15:47		v0.4 d1.2 m-4.3		v0.8 d0.8 m1.1		v2.4 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	123°30.4	132°13.1	S02°58.6	126°13.0	S01°42.9	281°50.6	S07°36.8	220°09.1	S22°00.6
1	138°32.8	147°13.5	57.5	141°13.7	42.2	296°52.9	36.9	235°11.2	00.6
2	153°35.3	162°14.0	56.3	156°14.5	41.4	311°55.3	36.9	250°13.4	00.7
3	168°37.8	177°14.5	·· 55.1	171°15.2	·· 40.6	326°57.6	·· 36.9	265°15.6	·· 00.7
4	183°40.2	192°14.9	53.9	186°16.0	39.8	342°00.0	36.9	280°17.8	00.7
5	198°42.7	207°15.4	52.7	201°16.8	39.0	357°02.4	37.0	295°20.0	00.7
6	213°45.2	222°15.8	S02°51.5	216°17.5	S01°38.3	12°04.7	S07°37.0	310°22.2	S22°00.7
7	228°47.6	237°16.3	50.3	231°18.3	37.5	27°07.1	37.0	325°24.4	00.7
8	243°50.1	252°16.8	49.2	246°19.0	36.7	42°09.5	37.1	340°26.6	00.7
9	258°52.6	267°17.3	·· 48.0	261°19.8	·· 35.9	57°11.8	·· 37.1	355°28.8	·· 00.7
10	273°55.0	282°17.7	46.8	276°20.6	35.1	72°14.2	37.1	10°31.0	00.7
11	288°57.5	297°18.2	45.6	291°21.3	34.4	87°16.6	37.1	25°33.2	00.8
12	303°59.9	312°18.7	S02°44.4	306°22.1	S01°33.6	102°18.9	S07°37.2	40°35.4	S22°00.8
13	319°02.4	327°19.1	43.2	321°22.9	32.8	117°21.3	37.2	55°37.6	00.8
14	334°04.9	342°19.6	42.0	336°23.6	32.0	132°23.7	37.2	70°39.8	00.8
15	349°07.3	357°20.1	·· 40.8	351°24.4	·· 31.2	147°26.0	·· 37.3	85°42.0	·· 00.8
16	4°09.8	12°20.6	39.7	6°25.1	30.5	162°28.4	37.3	100°44.2	00.8
17	19°12.3	27°21.0	38.5	21°25.9	29.7	177°30.8	37.3	115°46.4	00.8
18	34°14.7	42°21.5	S02°37.3	36°26.7	S01°28.9	192°33.1	S07°37.3	130°48.6	S22°00.8
19	49°17.2	57°22.0	36.1	51°27.4	28.1	207°35.5	37.4	145°50.8	00.8
20	64°19.7	72°22.5	34.9	66°28.2	27.3	222°37.9	37.4	160°53.0	00.8
21	79°22.1	87°23.0	·· 33.7	81°28.9	·· 26.6	237°40.2	·· 37.4	175°55.2	·· 00.9
22	94°24.6	102°23.5	32.5	96°29.7	25.8	252°42.6	37.4	190°57.4	00.9
23	109°27.1	117°23.9	31.4	111°30.5	25.0	267°45.0	37.5	205°59.6	00.9
Mer.pass.:15:43		v0.5 d1.2 m-4.3		v0.8 d0.8 m1.1		v2.4 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.5	-42°13.1
Schedar	349°37.8	56°38.0
Diphda	348°53.6	-17°53.8
Achernar	335°25.1	-57°09.5
Hamal	327°58.0	23°32.5
Polaris	316°32.1	89°20.4
Acamar	315°16.4	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.6	49°55.3
Aldebaran	290°46.3	16°32.4
Rigel	281°09.5	-8°11.2
Capella	280°30.5	46°00.8
Bellatrix	278°29.1	6°21.6
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.6	-52°42.6
Sirius	258°31.2	-16°44.7
Adhara	255°10.2	-29°00.0
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.0
Suhail	222°50.2	-43°30.2
Miaplacidus	221°38.1	-69°47.3
Alphard	217°53.4	-8°44.1
Regulus	207°40.6	11°52.9
Dubhe	193°48.4	61°39.3
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.1
Acrux	173°06.1	-63°11.3
Gacrux	171°57.8	-57°12.2
Alioth	166°18.5	55°51.8
Spica	158°28.6	-11°14.9
Alkaid	152°57.0	49°13.5
Hadar	148°44.3	-60°26.9
Menkent	148°04.6	-36°26.9
Arcturus	145°53.5	19°05.6
Rigil Kent.	139°48.4	-60°53.9
Kochab	137°20.5	74°04.9
Zuben'ubi	137°02.8	-16°06.6
Alphecca	126°09.1	26°39.4
Antares	112°23.5	-26°27.9
Atria	107°23.4	-69°03.0
Sabik	102°10.0	-15°44.5
Shaula	96°18.9	-37°06.7
Rasalhague	96°04.5	12°33.0
Eltanin	90°45.5	51°29.2
Kaus Aust.	83°40.9	-34°22.3
Vega	80°37.7	38°48.0
Nunki	75°55.7	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.7
Deneb	49°30.2	45°20.6
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.8

Jan 22 Sun	**SHA**	**Mer.pass**
Venus	10°20.2	15:12
Mars	4°04.4	15:37
Jupiter	158°25.4	05:19
Saturn	96°51.6	09:25

Jan 23 Mon	**SHA**	**Mer.pass**
Venus	9°31.1	15:11
Mars	3°23.5	15:36
Jupiter	158°22.7	05:16
Saturn	96°45.1	09:22

Jan 24 Tue	**SHA**	**Mer.pass**
Venus	8°42.7	15:11
Mars	2°42.6	15:34
Jupiter	158°20.2	05:12
Saturn	96°38.7	09:18

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.5662 sec ΔT = TT-UT1 = +68.6178 sec

2017 January 22 to Jan. 24 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	177°07.6	S19°40.7	247°55.3	13.8′	S13°56.9	-6.6′	54.2′
1	192°07.5	40.1	262°28.1	13.8′	14°03.5	-6.5′	54.2′
2	207°07.3	39.5	277°00.9	13.7′	14°10.0	-6.5′	54.2′
3	222°07.1	·· 39.0	291°33.6	13.7′	14°16.4	-6.4′	54.2′
4	237°07.0	38.4	306°06.3	13.7′	14°22.8	-6.3′	54.2′
5	252°06.8	37.8	320°39.0	13.7′	14°29.1	-6.3′	54.2′
6	267°06.6	S19°37.2	335°11.6	13.6′	S14°35.3	-6.2′	54.2′
7	282°06.5	36.7	349°44.2	13.6′	14°41.5	-6.2′	54.2′
8	297°06.3	36.1	4°16.8	13.6′	14°47.6	-6.1′	54.2′
9	312°06.1	·· 35.5	18°49.3	13.5′	14°53.7	-6.0′	54.2′
10	327°06.0	34.9	33°21.8	13.5′	14°59.7	-6.0′	54.2′
11	342°05.8	34.3	47°54.3	13.5′	15°05.6	-5.9′	54.2′
12	357°05.6	S19°33.8	62°26.7	13.4′	S15°11.4	-5.8′	54.2′
13	12°05.5	33.2	76°59.1	13.4′	15°17.2	-5.8′	54.2′
14	27°05.3	32.6	91°31.5	13.4′	15°23.0	-5.7′	54.2′
15	42°05.1	·· 32.0	106°03.9	13.3′	15°28.6	-5.6′	54.2′
16	57°05.0	31.4	120°36.2	13.3′	15°34.2	-5.6′	54.2′
17	72°04.8	30.9	135°08.4	13.3′	15°39.8	-5.5′	54.2′
18	87°04.7	S19°30.3	149°40.7	13.2′	S15°45.2	-5.4′	54.2′
19	102°04.5	29.7	164°12.9	13.2′	15°50.6	-5.4′	54.2′
20	117°04.3	29.1	178°45.0	13.1′	15°56.0	-5.3′	54.2′
21	132°04.2	·· 28.5	193°17.2	13.1′	16°01.2	-5.2′	54.2′
22	147°04.0	27.9	207°49.3	13.1′	16°06.4	-5.2′	54.2′
23	162°03.8	27.4	222°21.3	13.0′	16°11.5	-5.1′	54.2′
	SD.=16.2	d=0.6	S.D.=14.8				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	177°03.7	S19°26.8	236°53.3	13.0′	S16°16.6	-5.0′	54.2′
1	192°03.5	26.2	251°25.3	13.0′	16°21.6	-4.9′	54.2′
2	207°03.4	25.6	265°57.3	12.9′	16°26.5	-4.9′	54.2′
3	222°03.2	·· 25.0	280°29.2	12.9′	16°31.3	-4.8′	54.2′
4	237°03.0	24.4	295°01.1	12.9′	16°36.1	-4.7′	54.3′
5	252°02.9	23.8	309°32.9	12.8′	16°40.8	-4.7′	54.3′
6	267°02.7	S19°23.2	324°04.7	12.8′	S16°45.4	-4.6′	54.3′
7	282°02.6	22.6	338°36.5	12.8′	16°49.9	-4.5′	54.3′
8	297°02.4	22.1	353°08.2	12.7′	16°54.4	-4.4′	54.3′
9	312°02.3	·· 21.5	7°39.9	12.7′	16°58.8	-4.4′	54.3′
10	327°02.1	20.9	22°11.6	12.6′	17°03.1	-4.3′	54.3′
11	342°01.9	20.3	36°43.2	12.6′	17°07.4	-4.2′	54.3′
12	357°01.8	S19°19.7	51°14.8	12.6′	S17°11.5	-4.1′	54.3′
13	12°01.6	19.1	65°46.3	12.5′	17°15.6	-4.1′	54.3′
14	27°01.5	18.5	80°17.9	12.5′	17°19.6	-4.0′	54.3′
15	42°01.3	·· 17.9	94°49.3	12.5′	17°23.6	-3.9′	54.4′
16	57°01.2	17.3	109°20.8	12.4′	17°27.4	-3.8′	54.4′
17	72°01.0	16.7	123°52.2	12.4′	17°31.2	-3.7′	54.4′
18	87°00.8	S19°16.1	138°23.6	12.4′	S17°34.9	-3.7′	54.4′
19	102°00.7	15.5	152°54.9	12.3′	17°38.5	-3.6′	54.4′
20	117°00.5	14.9	167°26.2	12.3′	17°42.1	-3.5′	54.4′
21	132°00.4	·· 14.3	181°57.4	12.2′	17°45.6	-3.4′	54.4′
22	147°00.2	13.7	196°28.7	12.2′	17°48.9	-3.3′	54.4′
23	162°00.1	13.1	210°59.9	12.2′	17°52.2	-3.3′	54.4′
	SD.=16.2	d=0.6	S.D.=14.8				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	176°59.9	S19°12.5	225°31.0	12.1′	S17°55.5	-3.2′	54.5′
1	191°59.8	11.9	240°02.1	12.1′	17°58.6	-3.1′	54.5′
2	206°59.6	11.3	254°33.2	12.1′	18°01.7	-3.0′	54.5′
3	221°59.5	·· 10.7	269°04.3	12.0′	18°04.6	-2.9′	54.5′
4	236°59.3	10.1	283°35.3	12.0′	18°07.5	-2.9′	54.5′
5	251°59.2	09.5	298°06.2	12.0′	18°10.3	-2.8′	54.5′
6	266°59.0	S19°08.9	312°37.2	11.9′	S18°13.1	-2.7′	54.5′
7	281°58.9	08.3	327°08.1	11.9′	18°15.7	-2.6′	54.5′
8	296°58.7	07.7	341°39.0	11.9′	18°18.3	-2.5′	54.6′
9	311°58.6	·· 07.1	356°09.8	11.8′	18°20.7	-2.4′	54.6′
10	326°58.4	06.5	10°40.6	11.8′	18°23.1	-2.3′	54.6′
11	341°58.3	05.9	25°11.4	11.8′	18°25.4	-2.3′	54.6′
12	356°58.1	S19°05.2	39°42.1	11.7′	S18°27.6	-2.2′	54.6′
13	11°58.0	04.6	54°12.8	11.7′	18°29.8	-2.1′	54.6′
14	26°57.8	04.0	68°43.5	11.7′	18°31.8	-2.0′	54.6′
15	41°57.7	·· 03.4	83°14.1	11.6′	18°33.8	-1.9′	54.7′
16	56°57.5	02.8	97°44.7	11.6′	18°35.6	-1.8′	54.7′
17	71°57.4	02.2	112°15.3	11.6′	18°37.4	-1.7′	54.7′
18	86°57.2	S19°01.6	126°45.8	11.5′	S18°39.1	-1.6′	54.7′
19	101°57.1	01.0	141°16.4	11.5′	18°40.7	-1.6′	54.7′
20	116°56.9	19°00.4	155°46.8	11.5′	18°42.2	-1.5′	54.7′
21	131°56.8	18°59.7	170°17.3	11.4′	18°43.7	-1.4′	54.8′
22	146°56.6	59.1	184°47.7	11.4′	18°45.0	-1.3′	54.8′
23	161°56.5	58.5	199°18.1	11.4′	18°46.2	-1.2′	54.8′
	SD.=16.2	d=0.6	S.D.=14.9				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:38	09:17	▬	▬	15:08	16:47
N 70°	07:27	08:51	10:39	13:46	15:33	16:58
68°	07:17	08:32	09:55	14:29	15:53	17:07
66°	07:09	08:16	09:27	14:58	16:08	17:15
64°	07:02	08:03	09:05	15:20	16:21	17:22
62°	06:56	07:53	08:47	15:37	16:32	17:28
60°	06:51	07:43	08:33	15:51	16:41	17:34
N 58°	06:46	07:35	08:21	16:04	16:50	17:39
56°	06:41	07:27	08:10	16:14	16:57	17:43
54°	06:37	07:21	08:01	16:24	17:04	17:47
52°	06:33	07:15	07:52	16:32	17:10	17:51
50°	06:29	07:09	07:45	16:39	17:15	17:55
45°	06:21	06:57	07:29	16:55	17:27	18:03
N 40°	06:14	06:46	07:16	17:08	17:38	18:11
35°	06:07	06:37	07:04	17:20	17:47	18:17
30°	06:00	06:29	06:55	17:30	17:55	18:24
20°	05:47	06:14	06:37	17:46	18:10	18:37
N 10°	05:35	06:00	06:22	18:01	18:24	18:49
0°	05:21	05:46	06:08	18:15	18:37	19:03
S 10°	05:05	05:32	05:54	18:30	18:52	19:18
20°	04:47	05:15	05:39	18:45	19:09	19:37
30°	04:23	04:54	05:21	19:03	19:29	20:00
35°	04:08	04:42	05:10	19:13	19:41	20:15
40°	03:49	04:27	04:58	19:25	19:56	20:34
45°	03:25	04:09	04:44	19:39	20:13	20:57
S 50°	02:53	03:47	04:26	19:56	20:36	21:29
52°	02:36	03:35	04:18	20:05	20:47	21:46
54°	02:14	03:22	04:09	20:14	21:00	22:07
56°	01:46	03:07	03:58	20:24	21:15	22:34
58°	00:57	02:49	03:46	20:36	21:32	23:19
S 60°	▭	02:26	03:32	20:50	21:55	▭

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	05:11	07:04	▬	10:02	09:45	▬
N 70°	04:38	06:09	07:36	10:36	10:40	10:51
68°	04:15	05:37	06:52	11:00	11:13	11:36
66°	03:57	05:13	06:23	11:18	11:37	12:06
64°	03:43	04:54	06:00	11:34	11:56	12:28
62°	03:30	04:39	05:43	11:46	12:12	12:46
60°	03:20	04:26	05:28	11:57	12:25	13:01
N 58°	03:11	04:15	05:16	12:07	12:36	13:13
56°	03:03	04:06	05:05	12:15	12:46	13:24
54°	02:56	03:57	04:56	12:22	12:55	13:34
52°	02:50	03:50	04:47	12:29	13:03	13:42
50°	02:44	03:43	04:40	12:35	13:10	13:50
45°	02:32	03:29	04:24	12:48	13:25	14:06
N 40°	02:22	03:17	04:10	12:58	13:37	14:20
35°	02:14	03:07	03:59	13:08	13:48	14:31
30°	02:06	02:58	03:49	13:16	13:57	14:41
20°	01:53	02:43	03:33	13:30	14:13	14:58
N 10°	01:42	02:29	03:18	13:42	14:27	15:14
0°	01:31	02:17	03:04	13:53	14:40	15:28
S 10°	01:21	02:05	02:51	14:05	14:53	15:42
20°	01:10	01:52	02:36	14:17	15:07	15:57
30°	00:57	01:37	02:20	14:31	15:23	16:14
35°	00:50	01:28	02:10	14:39	15:32	16:24
40°	00:42	01:18	01:59	14:49	15:43	16:35
45°	00:32	01:07	01:46	14:59	15:55	16:49
S 50°	00:20	00:53	01:30	15:13	16:10	17:05
52°	00:15	00:46	01:23	15:19	16:18	17:13
54°	00:09	00:39	01:15	15:26	16:25	17:22
56°	00:03	00:31	01:06	15:33	16:34	17:31
58°	–:–	00:22	00:55	15:42	16:44	17:42
S 60°	–:–	00:12	00:44	15:52	16:56	17:55

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 24-26 27-12%
22	11:29	11:37	12:12	07:42	20:05	
23	11:45	11:53	12:12	08:28	20:52	
24	12:00	12:08	12:12	09:16	21:40	

January 25, 26, 27 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	124°29.5	132°24.4	S02°30.2	126°31.2	S01°24.2	282°47.4	S07°37.5	221°01.8	S22°00.9
1	139°32.0	147°24.9	29.0	141°32.0	23.4	297°49.7	37.5	236°04.0	00.9
2	154°34.4	162°25.4	27.8	156°32.8	22.7	312°52.1	37.5	251°06.2	00.9
3	169°36.9	177°25.9	·· 26.6	171°33.5	·· 21.9	327°54.5	·· 37.6	266°08.4	·· 00.9
4	184°39.4	192°26.4	25.4	186°34.3	21.1	342°56.8	37.6	281°10.6	00.9
5	199°41.8	207°26.9	24.3	201°35.0	20.3	357°59.2	37.6	296°12.8	00.9
6	214°44.3	222°27.4	S02°23.1	216°35.8	S01°19.5	13°01.6	S07°37.6	311°15.0	S22°01.0
7	229°46.8	237°27.9	21.9	231°36.6	18.8	28°03.9	37.7	326°17.2	01.0
8	244°49.2	252°28.4	20.7	246°37.3	18.0	43°06.3	37.7	341°19.4	01.0
9	259°51.7	267°28.9	·· 19.5	261°38.1	·· 17.2	58°08.7	·· 37.7	356°21.6	·· 01.0
10	274°54.2	282°29.4	18.3	276°38.9	16.4	73°11.1	37.7	11°23.8	01.0
11	289°56.6	297°29.9	17.2	291°39.6	15.6	88°13.4	37.8	26°26.0	01.0
12	304°59.1	312°30.4	S02°16.0	306°40.4	S01°14.9	103°15.8	S07°37.8	41°28.2	S22°01.0
13	320°01.5	327°30.9	14.8	321°41.2	14.1	118°18.2	37.8	56°30.4	01.0
14	335°04.0	342°31.4	13.6	336°41.9	13.3	133°20.6	37.8	71°32.6	01.0
15	350°06.5	357°31.9	·· 12.4	351°42.7	·· 12.5	148°22.9	·· 37.9	86°34.8	·· 01.0
16	5°08.9	12°32.4	11.2	6°43.4	11.7	163°25.3	37.9	101°37.0	01.1
17	20°11.4	27°32.9	10.1	21°44.2	11.0	178°27.7	37.9	116°39.2	01.1
18	35°13.9	42°33.4	S02°08.9	36°45.0	S01°10.2	193°30.1	S07°37.9	131°41.4	S22°01.1
19	50°16.3	57°33.9	07.7	51°45.7	09.4	208°32.4	38.0	146°43.6	01.1
20	65°18.8	72°34.4	06.5	66°46.5	08.6	223°34.8	38.0	161°45.8	01.1
21	80°21.3	87°34.9	·· 05.3	81°47.3	·· 07.8	238°37.2	·· 38.0	176°48.0	·· 01.1
22	95°23.7	102°35.4	04.2	96°48.0	07.1	253°39.6	38.0	191°50.2	01.1
23	110°26.2	117°36.0	03.0	111°48.8	06.3	268°41.9	38.1	206°52.4	01.1
Mer.pass.:15:39		v0.5 d1.2 m-4.3		v0.8 d0.8 m1.1		v2.4 d-0.0 m-1.9		v2.2 d-0.0 m0.5	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	125°28.7	132°36.5	S02°01.8	126°49.5	S01°05.5	283°44.3	S07°38.1	221°54.6	S22°01.1
1	140°31.1	147°37.0	02°00.6	141°50.3	04.7	298°46.7	38.1	236°56.8	01.1
2	155°33.6	162°37.5	01°59.4	156°51.1	03.9	313°49.1	38.1	251°59.0	01.2
3	170°36.0	177°38.0	·· 58.2	171°51.8	·· 03.2	328°51.5	·· 38.2	267°01.2	·· 01.2
4	185°38.5	192°38.6	57.1	186°52.6	02.4	343°53.8	38.2	282°03.4	01.2
5	200°41.0	207°39.1	55.9	201°53.4	01.6	358°56.2	38.2	297°05.6	01.2
6	215°43.4	222°39.6	S01°54.7	216°54.1	S01°00.8	13°58.6	S07°38.2	312°07.8	S22°01.2
7	230°45.9	237°40.1	53.5	231°54.9	01°00.0	29°01.0	38.2	327°10.0	01.2
8	245°48.4	252°40.6	52.3	246°55.7	00°59.3	44°03.3	38.3	342°12.2	01.2
9	260°50.8	267°41.2	·· 51.2	261°56.4	·· 58.5	59°05.7	·· 38.3	357°14.4	·· 01.2
10	275°53.3	282°41.7	50.0	276°57.2	57.7	74°08.1	38.3	12°16.6	01.2
11	290°55.8	297°42.2	48.8	291°58.0	56.9	89°10.5	38.3	27°18.8	01.2
12	305°58.2	312°42.8	S01°47.6	306°58.7	S00°56.2	104°12.9	S07°38.3	42°21.0	S22°01.3
13	321°00.7	327°43.3	46.4	321°59.5	55.4	119°15.2	38.4	57°23.2	01.3
14	336°03.2	342°43.8	45.3	337°00.2	54.6	134°17.6	38.4	72°25.4	01.3
15	351°05.6	357°44.4	·· 44.1	352°01.0	·· 53.8	149°20.0	·· 38.4	87°27.6	·· 01.3
16	6°08.1	12°44.9	42.9	7°01.8	53.0	164°22.4	38.4	102°29.8	01.3
17	21°10.5	27°45.4	41.7	22°02.5	52.3	179°24.8	38.5	117°32.0	01.3
18	36°13.0	42°46.0	S01°40.6	37°03.3	S00°51.5	194°27.2	S07°38.5	132°34.2	S22°01.3
19	51°15.5	57°46.5	39.4	52°04.1	50.7	209°29.5	38.5	147°36.4	01.3
20	66°17.9	72°47.0	38.2	67°04.8	49.9	224°31.9	38.5	162°38.6	01.3
21	81°20.4	87°47.6	·· 37.0	82°05.6	·· 49.1	239°34.3	·· 38.5	177°40.8	·· 01.3
22	96°22.9	102°48.1	35.8	97°06.4	48.4	254°36.7	38.6	192°43.1	01.4
23	111°25.3	117°48.7	34.7	112°07.1	47.6	269°39.1	38.6	207°45.3	01.4
Mer.pass.:15:36		v0.5 d1.2 m-4.3		v0.8 d0.8 m1.1		v2.4 d-0.0 m-2.0		v2.2 d-0.0 m0.6	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	126°27.8	132°49.2	S01°33.5	127°07.9	S00°46.8	284°41.5	S07°38.6	222°47.5	S22°01.4
1	141°30.3	147°49.8	32.3	142°08.7	46.0	299°43.8	38.6	237°49.7	01.4
2	156°32.7	162°50.3	31.1	157°09.4	45.2	314°46.2	38.6	252°51.9	01.4
3	171°35.2	177°50.9	·· 30.0	172°10.2	·· 44.5	329°48.6	·· 38.7	267°54.1	·· 01.4
4	186°37.7	192°51.4	28.8	187°10.9	43.7	344°51.0	38.7	282°56.3	01.4
5	201°40.1	207°52.0	27.6	202°11.7	42.9	359°53.4	38.7	297°58.5	01.4
6	216°42.6	222°52.5	S01°26.4	217°12.5	S00°42.1	14°55.8	S07°38.7	313°00.7	S22°01.4
7	231°45.0	237°53.1	25.3	232°13.2	41.3	29°58.2	38.7	328°02.9	01.4
8	246°47.5	252°53.6	24.1	247°14.0	40.6	45°00.5	38.8	343°05.1	01.5
9	261°50.0	267°54.2	·· 22.9	262°14.8	·· 39.8	60°02.9	·· 38.8	358°07.3	·· 01.5
10	276°52.4	282°54.7	21.7	277°15.5	39.0	75°05.3	38.8	13°09.5	01.5
11	291°54.9	297°55.3	20.6	292°16.3	38.2	90°07.7	38.8	28°11.7	01.5
12	306°57.4	312°55.9	S01°19.4	307°17.1	S00°37.5	105°10.1	S07°38.8	43°13.9	S22°01.5
13	321°59.8	327°56.4	18.2	322°17.8	36.7	120°12.5	38.9	58°16.1	01.5
14	337°02.3	342°57.0	17.0	337°18.6	35.9	135°14.9	38.9	73°18.3	01.5
15	352°04.8	357°57.5	·· 15.9	352°19.4	·· 35.1	150°17.3	·· 38.9	88°20.5	·· 01.5
16	7°07.2	12°58.1	14.7	7°20.1	34.3	165°19.6	38.9	103°22.7	01.5
17	22°09.7	27°58.7	13.5	22°20.9	33.6	180°22.0	38.9	118°24.9	01.5
18	37°12.1	42°59.2	S01°12.3	37°21.7	S00°32.8	195°24.4	S07°38.9	133°27.1	S22°01.5
19	52°14.6	57°59.8	11.2	52°22.4	32.0	210°26.8	39.0	148°29.3	01.6
20	67°17.1	73°00.4	10.0	67°23.2	31.2	225°29.2	39.0	163°31.6	01.6
21	82°19.5	88°01.0	·· 08.8	82°24.0	·· 30.4	240°31.6	·· 39.0	178°33.8	·· 01.6
22	97°22.0	103°01.5	07.6	97°24.7	29.7	255°34.0	39.0	193°36.0	01.6
23	112°24.5	118°02.1	06.5	112°25.5	28.9	270°36.4	39.0	208°38.2	01.6
Mer.pass.:15:32		v0.5 d1.2 m-4.4		v0.8 d0.8 m1.1		v2.4 d-0.0 m-2.0		v2.2 d-0.0 m0.6	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.6	-42°13.1
Schedar	349°37.8	56°38.0
Diphda	348°53.6	-17°53.8
Achernar	335°25.2	-57°09.4
Hamal	327°58.0	23°32.5
Polaris	316°33.4	89°20.4
Acamar	315°16.4	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.6	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.5	-8°11.2
Capella	280°30.5	46°00.8
Bellatrix	278°29.1	6°21.6
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.6	-52°42.6
Sirius	258°31.2	-16°44.7
Adhara	255°10.2	-29°00.0
Procyon	244°56.8	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.0
Suhail	222°50.1	-43°30.2
Miaplacidus	221°38.1	-69°47.3
Alphard	217°53.4	-8°44.1
Regulus	207°40.6	11°52.8
Dubhe	193°48.3	61°39.3
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.1
Acrux	173°06.1	-63°11.3
Gacrux	171°57.8	-57°12.2
Alioth	166°18.4	55°51.8
Spica	158°28.6	-11°14.9
Alkaid	152°57.0	49°13.5
Hadar	148°44.2	-60°26.9
Menkent	148°04.6	-36°26.9
Arcturus	145°53.5	19°05.6
Rigil Kent.	139°48.3	-60°53.9
Kochab	137°20.5	74°04.9
Zuben'ubi	137°02.7	-16°06.6
Alphecca	126°09.1	26°39.4
Antares	112°23.4	-26°27.9
Atria	107°23.4	-69°03.0
Sabik	102°10.0	-15°44.5
Shaula	96°18.9	-37°06.7
Rasalhague	96°04.4	12°32.9
Eltanin	90°45.4	51°29.2
Kaus Aust.	83°40.9	-34°22.3
Vega	80°37.7	38°48.0
Nunki	75°55.6	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.7
Deneb	49°30.2	45°20.6
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.8

Jan 25 Wed	SHA	Mer.pass
Venus	7°54.9	15:10
Mars	2°01.7	15:33
Jupiter	158°17.8	05:08
Saturn	96°32.3	09:15

Jan 26 Thu	SHA	Mer.pass
Venus	7°07.8	15:09
Mars	1°20.9	15:32
Jupiter	158°15.7	05:04
Saturn	96°25.9	09:11

Jan 27 Fri	SHA	Mer.pass
Venus	6°21.4	15:08
Mars	0°40.1	15:31
Jupiter	158°13.7	05:00
Saturn	96°19.7	09:07

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.5626 sec ΔT = TT-UT1 = +68.6214 sec

2017 January 25 to Jan. 27 UT

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°56.4	S18°57.9	213°48.5	11.3'	S18°47.4	-1.1'	54.8'
1	191°56.2	57.3	228°18.8	11.3'	18°48.4	-1.0'	54.8'
2	206°56.1	56.7	242°49.1	11.3'	18°49.4	-0.9'	54.8'
3	221°55.9	·· 56.0	257°19.4	11.3'	18°50.3	-0.8'	54.9'
4	236°55.8	55.4	271°49.6	11.2'	18°51.1	-0.7'	54.9'
5	251°55.6	54.8	286°19.8	11.2'	18°51.8	-0.7'	54.9'
6	266°55.5	S18°54.2	300°50.0	11.2'	S18°52.4	-0.6'	54.9'
7	281°55.4	53.6	315°20.2	11.1'	18°52.9	-0.5'	54.9'
8	296°55.2	52.9	329°50.3	11.1'	18°53.3	-0.4'	54.9'
9	311°55.1	·· 52.3	344°20.4	11.1'	18°53.7	-0.3'	55.0'
10	326°54.9	51.7	358°50.5	11.1'	18°53.9	-0.2'	55.0'
11	341°54.8	51.1	13°20.5	11.0'	18°54.0	-0.1'	55.0'
12	356°54.7	S18°50.5	27°50.6	11.0'	S18°54.1	-0.0'	55.0'
13	11°54.5	49.8	42°20.6	11.0'	18°54.0	0.1'	55.0'
14	26°54.4	49.2	56°50.6	11.0'	18°53.9	0.2'	55.0'
15	41°54.2	·· 48.6	71°20.5	11.0'	18°53.7	0.3'	55.1'
16	56°54.1	48.0	85°50.5	10.9'	18°53.3	0.4'	55.1'
17	71°54.0	47.3	100°20.4	10.9'	18°52.9	0.5'	55.1'
18	86°53.8	S18°46.7	114°50.3	10.9'	S18°52.4	0.6'	55.1'
19	101°53.7	46.1	129°20.2	10.9'	18°51.8	0.7'	55.1'
20	116°53.5	45.4	143°50.0	10.8'	18°51.1	0.8'	55.2'
21	131°53.4	·· 44.8	158°19.8	10.8'	18°50.3	0.8'	55.2'
22	146°53.3	44.2	172°49.7	10.8'	18°49.4	0.9'	55.2'
23	161°53.1	43.6	187°19.5	10.8'	18°48.4	1.0'	55.2'
	SD.=16.2	d=0.6	S.D.=15.0				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°53.0	S18°42.9	201°49.2	10.8'	S18°47.3	1.1'	55.2'
1	191°52.9	42.3	216°19.0	10.7'	18°46.1	1.2'	55.3'
2	206°52.7	41.7	230°48.7	10.7'	18°44.9	1.3'	55.3'
3	221°52.6	·· 41.0	245°18.4	10.7'	18°43.5	1.4'	55.3'
4	236°52.4	40.4	259°48.1	10.7'	18°42.0	1.5'	55.3'
5	251°52.3	39.8	274°17.8	10.7'	18°40.5	1.6'	55.3'
6	266°52.2	S18°39.1	288°47.5	10.7'	S18°38.8	1.7'	55.4'
7	281°52.0	38.5	303°17.2	10.6'	18°37.1	1.8'	55.4'
8	296°51.9	37.9	317°46.8	10.6'	18°35.2	1.9'	55.4'
9	311°51.8	·· 37.2	332°16.4	10.6'	18°33.3	2.0'	55.4'
10	326°51.6	36.6	346°46.0	10.6'	18°31.2	2.1'	55.4'
11	341°51.5	36.0	1°15.6	10.6'	18°29.1	2.2'	55.5'
12	356°51.4	S18°35.3	15°45.2	10.6'	S18°26.8	2.3'	55.5'
13	11°51.2	34.7	30°14.8	10.6'	18°24.5	2.4'	55.5'
14	26°51.1	34.0	44°44.4	10.6'	18°22.1	2.5'	55.5'
15	41°51.0	·· 33.4	59°13.9	10.5'	18°19.5	2.6'	55.5'
16	56°50.9	32.8	73°43.5	10.5'	18°16.9	2.7'	55.6'
17	71°50.7	32.1	88°13.0	10.5'	18°14.2	2.8'	55.6'
18	86°50.6	S18°31.5	102°42.5	10.5'	S18°11.4	2.9'	55.6'
19	101°50.5	30.8	117°12.1	10.5'	18°08.5	3.0'	55.6'
20	116°50.3	30.2	131°41.6	10.5'	18°05.5	3.1'	55.7'
21	131°50.2	·· 29.6	146°11.1	10.5'	18°02.4	3.1'	55.7'
22	146°50.1	28.9	160°40.6	10.5'	17°59.2	3.2'	55.7'
23	161°49.9	28.3	175°10.0	10.5'	17°55.9	3.3'	55.7'
	SD.=16.2	d=0.6	S.D.=15.1				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	176°49.8	S18°27.6	189°39.5	10.5'	S17°52.5	3.4'	55.7'
1	191°49.7	27.0	204°09.0	10.5'	17°49.0	3.5'	55.8'
2	206°49.6	26.3	218°38.5	10.5'	17°45.5	3.6'	55.8'
3	221°49.4	·· 25.7	233°07.9	10.5'	17°41.8	3.7'	55.8'
4	236°49.3	25.0	247°37.4	10.5'	17°38.0	3.8'	55.8'
5	251°49.2	24.4	262°06.9	10.5'	17°34.2	3.9'	55.8'
6	266°49.1	S18°23.7	276°36.3	10.5'	S17°30.2	4.0'	55.9'
7	281°48.9	23.1	291°05.8	10.5'	17°26.2	4.1'	55.9'
8	296°48.8	22.4	305°35.2	10.4'	17°22.0	4.2'	55.9'
9	311°48.7	·· 21.8	320°04.7	10.4'	17°17.8	4.3'	55.9'
10	326°48.6	21.1	334°34.1	10.4'	17°13.5	4.4'	56.0'
11	341°48.4	20.5	349°03.6	10.4'	17°09.1	4.5'	56.0'
12	356°48.3	S18°19.8	3°33.0	10.4'	S17°04.5	4.6'	56.0'
13	11°48.2	19.2	18°02.4	10.4'	16°59.9	4.7'	56.0'
14	26°48.1	18.5	32°31.9	10.4'	16°55.2	4.7'	56.0'
15	41°47.9	·· 17.9	47°01.3	10.4'	16°50.5	4.8'	56.1'
16	56°47.8	17.2	61°30.8	10.5'	16°45.6	4.9'	56.1'
17	71°47.7	16.6	76°00.2	10.5'	16°40.6	5.0'	56.1'
18	86°47.6	S18°15.9	90°29.7	10.5'	S16°35.5	5.1'	56.1'
19	101°47.5	15.3	104°59.2	10.5'	16°30.4	5.2'	56.2'
20	116°47.3	14.6	119°28.6	10.5'	16°25.1	5.3'	56.2'
21	131°47.2	·· 14.0	133°58.1	10.5'	16°19.8	5.4'	56.2'
22	146°47.1	13.3	148°27.5	10.5'	16°14.4	5.5'	56.2'
23	161°47.0	12.6	162°57.0	10.5'	16°08.9	5.6'	56.2'
	SD.=16.2	d=0.6	S.D.=15.3				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:29	09:04	11:34	12:53	15:22	16:57
N 70°	07:19	08:41	10:19	14:07	15:45	17:08
68°	07:10	08:23	09:42	14:44	16:03	17:16
66°	07:03	08:09	09:16	15:10	16:17	17:23
64°	06:57	07:57	08:56	15:30	16:29	17:29
62°	06:51	07:47	08:40	15:46	16:39	17:35
60°	06:46	07:38	08:27	15:59	16:48	17:40
N 58°	06:41	07:30	08:15	16:11	16:56	17:44
56°	06:37	07:23	08:05	16:21	17:03	17:49
54°	06:33	07:17	07:56	16:29	17:09	17:52
52°	06:30	07:11	07:49	16:37	17:15	17:56
50°	06:26	07:06	07:41	16:44	17:20	17:59
45°	06:19	06:54	07:26	17:00	17:31	18:07
N 40°	06:12	06:45	07:14	17:12	17:41	18:14
35°	06:05	06:36	07:03	17:23	17:50	18:20
30°	05:59	06:28	06:53	17:32	17:57	18:26
20°	05:47	06:14	06:37	17:48	18:12	18:38
N 10°	05:35	06:00	06:23	18:03	18:25	18:50
0°	05:22	05:47	06:09	18:16	18:38	19:03
S 10°	05:07	05:33	05:55	18:30	18:52	19:18
20°	04:49	05:17	05:41	18:44	19:08	19:36
30°	04:26	04:57	05:23	19:01	19:27	19:59
35°	04:11	04:45	05:13	19:11	19:39	20:13
40°	03:53	04:31	05:02	19:23	19:53	20:31
45°	03:31	04:14	04:48	19:36	20:10	20:53
S 50°	03:00	03:52	04:32	19:53	20:32	21:23
52°	02:44	03:42	04:24	20:00	20:42	21:39
54°	02:24	03:29	04:15	20:09	20:54	21:58
56°	01:59	03:15	04:05	20:19	21:08	22:23
58°	01:21	02:58	03:54	20:30	21:25	22:59
S 60°		02:37	03:40	20:43	21:45	

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°			10:36			13:03
N 70°	08:46	09:24	09:38	11:23	12:30	14:01
68°	07:54	08:37	09:03	12:15	13:16	14:35
66°	07:22	08:07	08:38	12:48	13:46	14:59
64°	06:58	07:44	08:19	13:11	14:08	15:18
62°	06:39	07:26	08:03	13:30	14:26	15:33
60°	06:24	07:11	07:50	13:46	14:41	15:46
N 58°	06:11	06:58	07:38	13:59	14:54	15:58
56°	05:59	06:47	07:28	14:10	15:05	16:07
54°	05:49	06:38	07:19	14:20	15:14	16:16
52°	05:41	06:29	07:12	14:29	15:23	16:23
50°	05:33	06:21	07:04	14:37	15:30	16:30
45°	05:16	06:05	06:49	14:54	15:47	16:45
N 40°	05:02	05:51	06:37	15:08	16:00	16:57
35°	04:50	05:39	06:26	15:19	16:11	17:07
30°	04:40	05:29	06:17	15:30	16:21	17:16
20°	04:22	05:12	06:00	15:47	16:38	17:32
N 10°	04:07	04:57	05:46	16:02	16:53	17:45
0°	03:53	04:43	05:33	16:17	17:07	17:57
S 10°	03:39	04:29	05:20	16:31	17:21	18:10
20°	03:23	04:13	05:06	16:46	17:35	18:23
30°	03:06	03:56	04:50	17:04	17:52	18:38
35°	02:56	03:46	04:40	17:14	18:02	18:47
40°	02:44	03:34	04:29	17:26	18:13	18:57
45°	02:31	03:21	04:17	17:39	18:26	19:09
S 50°	02:14	03:04	04:01	17:56	18:42	19:23
52°	02:06	02:57	03:54	18:04	18:49	19:29
54°	01:58	02:48	03:46	18:13	18:58	19:36
56°	01:48	02:38	03:37	18:22	19:07	19:44
58°	01:37	02:27	03:27	18:33	19:17	19:53
S 60°	01:24	02:14	03:15	18:46	19:29	20:04

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 27-29 6-0%
25	12:15	12:21	12:12	10:05	22:30	
26	12:28	12:34	12:13	10:55	23:20	
27	12:41	12:47	12:13	11:45	–:–	

January 28, 29, 30 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	127°26.9	133°02.7	S01°05.3	127°26.3	S00°28.1	285°38.8	S07°39.1	223°40.4	S22°01.6
1	142°29.4	148°03.3	04.1	142°27.0	27.3	300°41.2	39.1	238°42.6	01.6
2	157°31.9	163°03.8	03.0	157°27.8	26.6	315°43.6	39.1	253°44.8	01.6
3	172°34.3	178°04.4	·· 01.8	172°28.5	·· 25.8	330°46.0	·· 39.1	268°47.0	·· 01.6
4	187°36.8	193°05.0	01°00.6	187°29.3	25.0	345°48.3	39.1	283°49.2	01.6
5	202°39.3	208°05.6	00°59.4	202°30.1	24.2	0°50.7	39.1	298°51.4	01.7
6	217°41.7	223°06.2	S00°58.3	217°30.8	S00°23.4	15°53.1	S07°39.2	313°53.6	S22°01.7
7	232°44.2	238°06.7	57.1	232°31.6	22.7	30°55.5	39.2	328°55.8	01.7
8	247°46.6	253°07.3	55.9	247°32.4	21.9	45°57.9	39.2	343°58.0	01.7
9	262°49.1	268°07.9	·· 54.8	262°33.1	·· 21.1	61°00.3	·· 39.2	359°00.2	·· 01.7
10	277°51.6	283°08.5	53.6	277°33.9	20.3	76°02.7	39.2	14°02.4	01.7
11	292°54.0	298°09.1	52.4	292°34.7	19.5	91°05.1	39.2	29°04.7	01.7
12	307°56.5	313°09.7	S00°51.3	307°35.4	S00°18.8	106°07.5	S07°39.3	44°06.9	S22°01.7
13	322°59.0	328°10.3	50.1	322°36.2	18.0	121°09.9	39.3	59°09.1	01.7
14	338°01.4	343°10.9	48.9	337°37.0	17.2	136°12.3	39.3	74°11.3	01.7
15	353°03.9	358°11.5	·· 47.7	352°37.7	·· 16.4	151°14.7	·· 39.3	89°13.5	·· 01.7
16	8°06.4	13°12.1	46.6	7°38.5	15.7	166°17.1	39.3	104°15.7	01.8
17	23°08.8	28°12.7	45.4	22°39.3	14.9	181°19.5	39.3	119°17.9	01.8
18	38°11.3	43°13.3	S00°44.2	37°40.0	S00°14.1	196°21.9	S07°39.3	134°20.1	S22°01.8
19	53°13.8	58°13.9	43.1	52°40.8	13.3	211°24.3	39.4	149°22.3	01.8
20	68°16.2	73°14.5	41.9	67°41.6	12.5	226°26.7	39.4	164°24.5	01.8
21	83°18.7	88°15.1	·· 40.7	82°42.3	·· 11.8	241°29.1	·· 39.4	179°26.7	·· 01.8
22	98°21.1	103°15.7	39.6	97°43.1	11.0	256°31.5	39.4	194°28.9	01.8
23	113°23.6	118°16.3	38.4	112°43.9	10.2	271°33.9	39.4	209°31.1	01.8
Mer.pass.:15:28		v0.6 d1.2 m-4.4		v0.8 d0.8 m1.1		v2.4 d-0.0 m-2.0		v2.2 d-0.0 m0.6	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	128°26.1	133°16.9	S00°37.2	127°44.6	S00°09.4	286°36.3	S07°39.4	224°33.4	S22°01.8
1	143°28.5	148°17.5	36.1	142°45.4	08.7	301°38.7	39.4	239°35.6	01.8
2	158°31.0	163°18.1	34.9	157°46.2	07.9	316°41.1	39.5	254°37.8	01.8
3	173°33.5	178°18.7	·· 33.7	172°46.9	·· 07.1	331°43.5	·· 39.5	269°40.0	·· 01.9
4	188°35.9	193°19.3	32.6	187°47.7	06.3	346°45.9	39.5	284°42.2	01.9
5	203°38.4	208°19.9	31.4	202°48.5	05.5	1°48.3	39.5	299°44.4	01.9
6	218°40.9	223°20.5	S00°30.2	217°49.2	S00°04.8	16°50.7	S07°39.5	314°46.6	S22°01.9
7	233°43.3	238°21.2	29.1	232°50.0	04.0	31°53.1	39.5	329°48.8	01.9
8	248°45.8	253°21.8	27.9	247°50.8	03.2	46°55.5	39.5	344°51.0	01.9
9	263°48.2	268°22.4	·· 26.8	262°51.5	·· 02.4	61°57.9	·· 39.6	359°53.2	·· 01.9
10	278°50.7	283°23.0	25.6	277°52.3	01.7	77°00.3	39.6	14°55.4	01.9
11	293°53.2	298°23.6	24.4	292°53.1	00.9	92°02.7	39.6	29°57.7	01.9
12	308°55.6	313°24.3	S00°23.3	307°53.8	S00°00.1	107°05.1	S07°39.6	44°59.9	S22°01.9
13	323°58.1	328°24.9	22.1	322°54.6	N00°00.7	122°07.5	39.6	60°02.1	01.9
14	339°00.6	343°25.5	20.9	337°55.4	01.5	137°09.9	39.6	75°04.3	02.0
15	354°03.0	358°26.1	·· 19.8	352°56.1	·· 02.2	152°12.3	·· 39.6	90°06.5	·· 02.0
16	9°05.5	13°26.8	18.6	7°56.9	03.0	167°14.7	39.6	105°08.7	02.0
17	24°08.0	28°27.4	17.4	22°57.7	03.8	182°17.1	39.7	120°10.9	02.0
18	39°10.4	43°28.0	S00°16.3	37°58.4	N00°04.6	197°19.5	S07°39.7	135°13.1	S22°02.0
19	54°12.9	58°28.6	15.1	52°59.2	05.3	212°21.9	39.7	150°15.3	02.0
20	69°15.4	73°29.3	14.0	68°00.0	06.1	227°24.3	39.7	165°17.5	02.0
21	84°17.8	88°29.9	·· 12.8	83°00.7	·· 06.9	242°26.7	·· 39.7	180°19.8	·· 02.0
22	99°20.3	103°30.5	11.6	98°01.5	07.7	257°29.1	39.7	195°22.0	02.0
23	114°22.7	118°31.2	10.5	113°02.3	08.5	272°31.5	39.7	210°24.2	02.0
Mer.pass.:15:24		v0.6 d1.2 m-4.4		v0.8 d0.8 m1.1		v2.4 d-0.0 m-2.0		v2.2 d-0.0 m0.6	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	129°25.2	133°31.8	S00°09.3	128°03.0	N00°09.2	287°33.9	S07°39.7	225°26.4	S22°02.0
1	144°27.7	148°32.5	08.2	143°03.8	10.0	302°36.3	39.8	240°28.6	02.0
2	159°30.1	163°33.1	07.0	158°04.6	10.8	317°38.7	39.8	255°30.8	02.1
3	174°32.6	178°33.7	·· 05.8	173°05.3	·· 11.6	332°41.1	·· 39.8	270°33.0	·· 02.1
4	189°35.1	193°34.4	04.7	188°06.1	12.3	347°43.6	39.8	285°35.2	02.1
5	204°37.5	208°35.0	03.5	203°06.9	13.1	2°46.0	39.8	300°37.5	02.1
6	219°40.0	223°35.7	S00°02.4	218°07.7	N00°13.9	17°48.4	S07°39.8	315°39.7	S22°02.1
7	234°42.5	238°36.3	01.2	233°08.4	14.7	32°50.8	39.8	330°41.9	02.1
8	249°44.9	253°37.0	S00°00.0	248°09.2	15.4	47°53.2	39.8	345°44.1	02.1
9	264°47.4	268°37.6	N00°01.1	263°10.0	·· 16.2	62°55.6	·· 39.8	0°46.3	·· 02.1
10	279°49.9	283°38.3	02.3	278°10.7	17.0	77°58.0	39.9	15°48.5	02.1
11	294°52.3	298°38.9	03.4	293°11.5	17.8	93°00.4	39.9	30°50.7	02.1
12	309°54.8	313°39.6	N00°04.6	308°12.3	N00°18.6	108°02.8	S07°39.9	45°52.9	S22°02.1
13	324°57.2	328°40.2	05.7	323°13.0	19.3	123°05.2	39.9	60°55.1	02.2
14	339°59.7	343°40.9	06.9	338°13.8	20.1	138°07.6	39.9	75°57.4	02.2
15	355°02.2	358°41.6	·· 08.1	353°14.6	·· 20.9	153°10.1	·· 39.9	90°59.6	·· 02.2
16	10°04.6	13°42.2	09.2	8°15.3	21.7	168°12.5	39.9	106°01.8	02.2
17	25°07.1	28°42.9	10.4	23°16.1	22.4	183°14.9	39.9	121°04.0	02.2
18	40°09.6	43°43.5	N00°11.5	38°16.9	N00°23.2	198°17.3	S07°39.9	136°06.2	S22°02.2
19	55°12.0	58°44.2	12.7	53°17.6	24.0	213°19.7	39.9	151°08.4	02.2
20	70°14.5	73°44.9	13.8	68°18.4	24.8	228°22.1	39.9	166°10.6	02.2
21	85°17.0	88°45.5	·· 15.0	83°19.2	·· 25.5	243°24.5	·· 40.0	181°12.9	·· 02.2
22	100°19.4	103°46.2	16.1	98°19.9	26.3	258°26.9	40.0	196°15.1	02.2
23	115°21.9	118°46.9	17.3	113°20.7	27.1	273°29.4	40.0	211°17.3	02.2
Mer.pass.:15:20		v0.6 d1.2 m-4.4		v0.8 d0.8 m1.1		v2.4 d-0.0 m-2.0		v2.2 d-0.0 m0.6	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.6	-42°13.1
Schedar	349°37.9	56°38.0
Diphda	348°53.6	-17°53.8
Achernar	335°25.2	-57°09.4
Hamal	327°58.0	23°32.5
Polaris	316°34.9	89°20.4
Acamar	315°16.5	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.6	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.5	-8°11.3
Capella	280°30.5	46°00.8
Bellatrix	278°29.1	6°21.6
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.6	-52°42.7
Sirius	258°31.2	-16°44.7
Adhara	255°10.2	-29°00.0
Procyon	244°56.8	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.0
Suhail	222°50.1	-43°30.2
Miaplacidus	221°38.1	-69°47.3
Alphard	217°53.3	-8°44.1
Regulus	207°40.6	11°52.8
Dubhe	193°48.3	61°39.3
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.1
Acrux	173°06.0	-63°11.3
Gacrux	171°57.7	-57°12.3
Alioth	166°18.4	55°51.8
Spica	158°28.6	-11°14.9
Alkaid	152°56.9	49°13.5
Hadar	148°44.2	-60°26.9
Menkent	148°04.6	-36°27.0
Arcturus	145°53.5	19°05.6
Rigil Kent.	139°48.3	-60°53.9
Kochab	137°20.4	74°04.9
Zuben'ubi	137°02.7	-16°06.6
Alphecca	126°09.1	26°39.4
Antares	112°23.4	-26°27.9
Atria	107°23.3	-69°03.0
Sabik	102°09.9	-15°44.5
Shaula	96°18.9	-37°06.7
Rasalhague	96°04.4	12°32.9
Eltanin	90°45.4	51°29.2
Kaus Aust.	83°40.9	-34°22.3
Vega	80°37.7	38°48.0
Nunki	75°55.6	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.1	-56°40.7
Deneb	49°30.2	45°20.6
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.6
Markab	13°36.1	15°17.8

Jan 28 Sat	SHA	Mer.pass
Venus	5°35.7	15:07
Mars	359°59.3	15:29
Jupiter	158°11.8	04:57
Saturn	96°13.4	09:04

Jan 29 Sun	SHA	Mer.pass
Venus	4°50.8	15:06
Mars	359°18.6	15:28
Jupiter	158°10.2	04:53
Saturn	96°07.3	09:00

Jan 30 Mon	SHA	Mer.pass
Venus	4°06.6	15:05
Mars	358°37.8	15:27
Jupiter	158°08.7	04:49
Saturn	96°01.2	08:57

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.5590 sec ΔT = TT-UT1 = +68.6250 sec

2017 January 28 to Jan. 30 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	176°46.8	S18°12.0	177°26.5	10.5'	S16°03.3	5.6'	56.3'
1	191°46.7	11.3	191°56.0	10.5'	15°57.6	5.7'	56.3'
2	206°46.6	10.7	206°25.5	10.5'	15°51.8	5.8'	56.3'
3	221°46.5	·· 10.0	220°55.0	10.5'	15°45.9	5.9'	56.3'
4	236°46.4	09.3	235°24.5	10.5'	15°40.0	6.0'	56.4'
5	251°46.3	08.7	249°54.0	10.5'	15°34.0	6.1'	56.4'
6	266°46.1	S18°08.0	264°23.5	10.5'	S15°27.8	6.2'	56.4'
7	281°46.0	07.4	278°53.0	10.5'	15°21.6	6.3'	56.4'
8	296°45.9	06.7	293°22.5	10.5'	15°15.3	6.3'	56.4'
9	311°45.8	·· 06.0	307°52.1	10.5'	15°08.9	6.4'	56.5'
10	326°45.7	05.4	322°21.6	10.5'	15°02.5	6.5'	56.5'
11	341°45.6	04.7	336°51.2	10.6'	14°55.9	6.6'	56.5'
12	356°45.4	S18°04.0	351°20.7	10.6'	S14°49.3	6.7'	56.5'
13	11°45.3	03.4	5°50.3	10.6'	14°42.6	6.8'	56.6'
14	26°45.2	02.7	20°19.9	10.6'	14°35.8	6.8'	56.6'
15	41°45.1	·· 02.0	34°49.4	10.6'	14°28.9	6.9'	56.6'
16	56°45.0	01.4	49°19.0	10.6'	14°21.9	7.0'	56.6'
17	71°44.9	00.7	63°48.6	10.6'	14°14.9	7.1'	56.6'
18	86°44.8	S18°00.0	78°18.3	10.6'	S14°07.8	7.2'	56.7'
19	101°44.6	17°59.4	92°47.9	10.6'	14°00.6	7.2'	56.7'
20	116°44.5	58.7	107°17.5	10.6'	13°53.3	7.3'	56.7'
21	131°44.4	·· 58.0	121°47.2	10.7'	13°46.0	7.4'	56.7'
22	146°44.3	57.4	136°16.8	10.7'	13°38.5	7.5'	56.8'
23	161°44.2	56.7	150°46.5	10.7'	13°31.0	7.5'	56.8'
	SD.=16.2	d=0.7	S.D.=15.4				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°44.1	S17°56.0	165°16.2	10.7'	S13°23.4	7.6'	56.8'
1	191°44.0	55.3	179°45.9	10.7'	13°15.8	7.7'	56.8'
2	206°43.9	54.7	194°15.6	10.7'	13°08.0	7.8'	56.8'
3	221°43.7	·· 54.0	208°45.3	10.7'	13°00.2	7.8'	56.9'
4	236°43.6	53.3	223°15.0	10.7'	12°52.3	7.9'	56.9'
5	251°43.5	52.6	237°44.7	10.7'	12°44.4	8.0'	56.9'
6	266°43.4	S17°52.0	252°14.5	10.7'	S12°36.3	8.1'	56.9'
7	281°43.3	51.3	266°44.2	10.8'	12°28.2	8.1'	56.9'
8	296°43.2	50.6	281°14.0	10.8'	12°20.0	8.2'	57.0'
9	311°43.1	·· 49.9	295°43.8	10.8'	12°11.8	8.3'	57.0'
10	326°43.0	49.3	310°13.5	10.8'	12°03.5	8.3'	57.0'
11	341°42.9	48.6	324°43.3	10.8'	11°55.1	8.4'	57.0'
12	356°42.8	S17°47.9	339°13.2	10.8'	S11°46.7	8.5'	57.0'
13	11°42.7	47.2	353°43.0	10.8'	11°38.1	8.6'	57.1'
14	26°42.6	46.6	8°12.8	10.8'	11°29.5	8.6'	57.1'
15	41°42.5	·· 45.9	22°42.7	10.8'	11°20.9	8.7'	57.1'
16	56°42.3	45.2	37°12.5	10.9'	11°12.2	8.8'	57.1'
17	71°42.2	44.5	51°42.4	10.9'	11°03.4	8.8'	57.2'
18	86°42.1	S17°43.8	66°12.3	10.9'	S10°54.5	8.9'	57.2'
19	101°42.0	43.1	80°42.1	10.9'	10°45.6	8.9'	57.2'
20	116°41.9	42.5	95°12.0	10.9'	10°36.7	9.0'	57.2'
21	131°41.8	·· 41.8	109°42.0	10.9'	10°27.6	9.1'	57.2'
22	146°41.7	41.1	124°11.9	10.9'	10°18.5	9.1'	57.3'
23	161°41.6	40.4	138°41.8	10.9'	10°09.4	9.2'	57.3'
	SD.=16.2	d=0.7	S.D.=15.5				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°41.5	S17°39.7	153°11.7	10.9'	S10°00.2	9.2'	57.3'
1	191°41.4	39.0	167°41.7	11.0'	09°50.9	9.3'	57.3'
2	206°41.3	38.4	182°11.7	11.0'	09°41.6	9.4'	57.3'
3	221°41.2	·· 37.7	196°41.6	11.0'	09°32.2	9.4'	57.4'
4	236°41.1	37.0	211°11.6	11.0'	09°22.7	9.5'	57.4'
5	251°41.0	36.3	225°41.6	11.0'	09°13.2	9.5'	57.4'
6	266°40.9	S17°35.6	240°11.6	11.0'	S09°03.7	9.6'	57.4'
7	281°40.8	34.9	254°41.6	11.0'	08°54.1	9.6'	57.4'
8	296°40.7	34.2	269°11.6	11.0'	08°44.4	9.7'	57.5'
9	311°40.6	·· 33.5	283°41.6	11.0'	08°34.7	9.7'	57.5'
10	326°40.5	32.8	298°11.7	11.0'	08°25.0	9.8'	57.5'
11	341°40.4	32.2	312°41.7	11.0'	08°15.1	9.8'	57.5'
12	356°40.3	S17°31.5	327°11.7	11.0'	S08°05.3	9.9'	57.5'
13	11°40.2	30.8	341°41.8	11.1'	07°55.4	9.9'	57.5'
14	26°40.1	30.1	356°11.8	11.1'	07°45.4	10.0'	57.6'
15	41°40.0	·· 29.4	10°41.9	11.1'	07°35.4	10.0'	57.6'
16	56°39.9	28.7	25°12.0	11.1'	07°25.4	10.1'	57.6'
17	71°39.8	28.0	39°42.1	11.1'	07°15.3	10.1'	57.6'
18	86°39.7	S17°27.3	54°12.1	11.1'	S07°05.1	10.2'	57.6'
19	101°39.6	26.6	68°42.2	11.1'	06°55.0	10.2'	57.7'
20	116°39.5	25.9	83°12.3	11.1'	06°44.7	10.2'	57.7'
21	131°39.4	·· 25.2	97°42.4	11.1'	06°34.5	10.3'	57.7'
22	146°39.3	24.5	112°12.5	11.1'	06°24.2	10.3'	57.7'
23	161°39.3	23.8	126°42.6	11.1'	06°13.8	10.4'	57.7'
	SD.=16.2	d=0.7	S.D.=15.7				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:19	08:51	10:53	13:35	15:37	17:09
N 70°	07:10	08:30	10:01	14:26	15:57	17:17
68°	07:03	08:14	09:29	14:58	16:13	17:25
66°	06:56	08:01	09:06	15:21	16:26	17:31
64°	06:50	07:50	08:48	15:39	16:37	17:37
62°	06:45	07:40	08:33	15:54	16:47	17:42
60°	06:41	07:32	08:20	16:07	16:55	17:46
N 58°	06:37	07:25	08:09	16:18	17:02	17:50
56°	06:33	07:18	08:00	16:27	17:09	17:54
54°	06:30	07:13	07:52	16:35	17:14	17:57
52°	06:26	07:07	07:44	16:43	17:20	18:01
50°	06:23	07:02	07:37	16:49	17:25	18:04
45°	06:16	06:52	07:23	17:04	17:35	18:11
N 40°	06:10	06:42	07:11	17:16	17:44	18:17
35°	06:04	06:34	07:01	17:26	17:53	18:23
30°	05:58	06:27	06:52	17:35	18:00	18:29
20°	05:47	06:13	06:36	17:50	18:13	18:40
N 10°	05:35	06:01	06:23	18:04	18:26	18:51
0°	05:23	05:48	06:10	18:17	18:38	19:04
S 10°	05:08	05:34	05:57	18:30	18:52	19:18
20°	04:51	05:19	05:42	18:44	19:07	19:35
30°	04:29	05:00	05:26	19:00	19:26	19:57
35°	04:15	04:49	05:16	19:09	19:37	20:11
40°	03:58	04:35	05:06	19:20	19:50	20:27
45°	03:36	04:19	04:53	19:33	20:06	20:49
S 50°	03:07	03:58	04:37	19:49	20:27	21:17
52°	02:52	03:48	04:29	19:56	20:37	21:32
54°	02:34	03:37	04:21	20:04	20:48	21:50
56°	02:11	03:23	04:12	20:13	21:01	22:12
58°	01:40	03:08	04:01	20:24	21:17	22:42
S 60°	00:30	02:48	03:49	20:36	21:35	23:38

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	10:16	10:06	09:57	15:08	17:04	18:55
N 70°	09:43	09:45	09:45	15:41	17:23	19:06
68°	09:19	09:28	09:35	16:04	17:38	19:15
66°	09:00	09:15	09:26	16:22	17:51	19:22
64°	08:44	09:04	09:19	16:37	18:01	19:28
62°	08:32	08:54	09:12	16:49	18:10	19:33
60°	08:21	08:46	09:07	16:59	18:17	19:38
N 58°	08:11	08:39	09:02	17:08	18:24	19:42
56°	08:03	08:32	08:58	17:16	18:29	19:45
54°	07:55	08:27	08:54	17:23	18:34	19:48
52°	07:49	08:21	08:50	17:29	18:39	19:51
50°	07:43	08:17	08:47	17:35	18:43	19:54
45°	07:30	08:06	08:40	17:47	18:52	19:59
N 40°	07:19	07:58	08:34	17:57	19:00	20:04
35°	07:10	07:51	08:29	18:06	19:06	20:08
30°	07:02	07:44	08:25	18:13	19:12	20:11
20°	06:48	07:33	08:17	18:26	19:22	20:17
N 10°	06:35	07:23	08:10	18:37	19:30	20:23
0°	06:24	07:14	08:04	18:48	19:38	20:28
S 10°	06:12	07:05	07:57	18:58	19:46	20:32
20°	06:00	06:55	07:51	19:09	19:54	20:38
30°	05:46	06:44	07:43	19:22	20:04	20:43
35°	05:37	06:37	07:38	19:29	20:09	20:47
40°	05:28	06:30	07:33	19:37	20:15	20:50
45°	05:17	06:21	07:27	19:47	20:22	20:55
S 50°	05:04	06:10	07:20	19:59	20:31	21:00
52°	04:58	06:06	07:17	20:04	20:35	21:02
54°	04:51	06:00	07:13	20:10	20:39	21:05
56°	04:43	05:54	07:09	20:16	20:44	21:08
58°	04:34	05:48	07:04	20:24	20:49	21:11
S 60°	04:24	05:40	06:59	20:32	20:55	21:14

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 0-2 0-7%
28	12:53	12:58	12:13	12:36	00:11	
29	13:04	13:09	12:13	13:26	01:01	
30	13:14	13:19	12:13	14:16	01:51	

January 31, 01, 02 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	130°24.3	133°47.6	N00°18.4	128°21.5	N00°27.9	288°31.8	S07°40.0	226°19.5	S22°02.2
1	145°26.8	148°48.2	19.6	143°22.2	28.6	303°34.2	40.0	241°21.7	02.3
2	160°29.3	163°48.9	20.7	158°23.0	29.4	318°36.6	40.0	256°23.9	02.3
3	175°31.7	178°49.6	·· 21.9	173°23.8	·· 30.2	333°39.0	·· 40.0	271°26.1	·· 02.3
4	190°34.2	193°50.3	23.1	188°24.5	31.0	348°41.4	40.0	286°28.4	02.3
5	205°36.7	208°50.9	24.2	203°25.3	31.8	3°43.8	40.0	301°30.6	02.3
6	220°39.1	223°51.6	N00°25.4	218°26.1	N00°32.5	18°46.3	S07°40.0	316°32.8	S22°02.3
7	235°41.6	238°52.3	26.5	233°26.9	33.3	33°48.7	40.0	331°35.0	02.3
8	250°44.1	253°53.0	27.7	248°27.6	34.1	48°51.1	40.0	346°37.2	02.3
9	265°46.5	268°53.7	·· 28.8	263°28.4	·· 34.9	63°53.5	·· 40.1	1°39.4	·· 02.3
10	280°49.0	283°54.3	30.0	278°29.2	35.6	78°55.9	40.1	16°41.6	02.3
11	295°51.5	298°55.0	31.1	293°29.9	36.4	93°58.3	40.1	31°43.9	02.3
12	310°53.9	313°55.7	N00°32.3	308°30.7	N00°37.2	109°00.8	S07°40.1	46°46.1	S22°02.3
13	325°56.4	328°56.4	33.4	323°31.5	38.0	124°03.2	40.1	61°48.3	02.4
14	340°58.8	343°57.1	34.6	338°32.2	38.7	139°05.6	40.1	76°50.5	02.4
15	356°01.3	358°57.8	·· 35.7	353°33.0	·· 39.5	154°08.0	·· 40.1	91°52.7	·· 02.4
16	11°03.8	13°58.5	36.9	8°33.8	40.3	169°10.4	40.1	106°54.9	02.4
17	26°06.2	28°59.2	38.0	23°34.5	41.1	184°12.9	40.1	121°57.1	02.4
18	41°08.7	43°59.9	N00°39.1	38°35.3	N00°41.8	199°15.3	S07°40.1	136°59.4	S22°02.4
19	56°11.2	59°00.6	40.3	53°36.1	42.6	214°17.7	40.1	152°01.6	02.4
20	71°13.6	74°01.3	41.4	68°36.8	43.4	229°20.1	40.1	167°03.8	02.4
21	86°16.1	89°02.0	·· 42.6	83°37.6	·· 44.2	244°22.5	·· 40.1	182°06.0	·· 02.4
22	101°18.6	104°02.7	43.7	98°38.4	44.9	259°24.9	40.1	197°08.2	02.4
23	116°21.0	119°03.4	44.9	113°39.2	45.7	274°27.4	40.1	212°10.4	02.4
Mer.pass.:15:16		v0.7 d1.2 m-4.4		v0.8 d0.8 m1.1		v2.4 d-0.0 m-2.0		v2.2 d-0.0 m0.6	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	131°23.5	134°04.1	N00°46.0	128°39.9	N00°46.5	289°29.8	S07°40.2	227°12.7	S22°02.4
1	146°26.0	149°04.8	47.2	143°40.7	47.3	304°32.2	40.2	242°14.9	02.5
2	161°28.4	164°05.5	48.3	158°41.5	48.0	319°34.6	40.2	257°17.1	02.5
3	176°30.9	179°06.2	·· 49.5	173°42.2	·· 48.8	334°37.1	·· 40.2	272°19.3	·· 02.5
4	191°33.3	194°06.9	50.6	188°43.0	49.6	349°39.5	40.2	287°21.5	02.5
5	206°35.8	209°07.6	51.8	203°43.8	50.4	4°41.9	40.2	302°23.7	02.5
6	221°38.3	224°08.3	N00°52.9	218°44.5	N00°51.1	19°44.3	S07°40.2	317°26.0	S22°02.5
7	236°40.7	239°09.1	54.0	233°45.3	51.9	34°46.7	40.2	332°28.2	02.5
8	251°43.2	254°09.8	55.2	248°46.1	52.7	49°49.2	40.2	347°30.4	02.5
9	266°45.7	269°10.5	·· 56.3	263°46.8	·· 53.5	64°51.6	·· 40.2	2°32.6	·· 02.5
10	281°48.1	284°11.2	57.5	278°47.6	54.2	79°54.0	40.2	17°34.8	02.5
11	296°50.6	299°11.9	58.6	293°48.4	55.0	94°56.4	40.2	32°37.0	02.5
12	311°53.1	314°12.7	N00°59.7	308°49.2	N00°55.8	109°58.9	S07°40.2	47°39.3	S22°02.5
13	326°55.5	329°13.4	01°00.9	323°49.9	56.6	125°01.3	40.2	62°41.5	02.6
14	341°58.0	344°14.1	02.0	338°50.7	57.3	140°03.7	40.2	77°43.7	02.6
15	357°00.4	359°14.8	·· 03.2	353°51.5	·· 58.1	155°06.1	·· 40.2	92°45.9	·· 02.6
16	12°02.9	14°15.6	04.3	8°52.2	58.9	170°08.6	40.2	107°48.1	02.6
17	27°05.4	29°16.3	05.5	23°53.0	00°59.7	185°11.0	40.2	122°50.4	02.6
18	42°07.8	44°17.0	N01°06.6	38°53.8	N01°00.4	200°13.4	S07°40.2	137°52.6	S22°02.6
19	57°10.3	59°17.8	07.7	53°54.5	01.2	215°15.8	40.2	152°54.8	02.6
20	72°12.8	74°18.5	08.9	68°55.3	02.0	230°18.3	40.2	167°57.0	02.6
21	87°15.2	89°19.2	·· 10.0	83°56.1	·· 02.8	245°20.7	·· 40.2	182°59.2	·· 02.6
22	102°17.7	104°20.0	11.1	98°56.9	03.5	260°23.1	40.3	198°01.4	02.6
23	117°20.2	119°20.7	12.3	113°57.6	04.3	275°25.6	40.3	213°03.7	02.6
Mer.pass.:15:12		v0.7 d1.1 m-4.4		v0.8 d0.8 m1.1		v2.4 d-0.0 m-2.0		v2.2 d-0.0 m0.6	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	132°22.6	134°21.4	N01°13.4	128°58.4	N01°05.1	290°28.0	S07°40.3	228°05.9	S22°02.6
1	147°25.1	149°22.2	14.6	143°59.2	05.9	305°30.4	40.3	243°08.1	02.6
2	162°27.6	164°22.9	15.7	158°59.9	06.6	320°32.8	40.3	258°10.3	02.7
3	177°30.0	179°23.7	·· 16.8	174°00.7	·· 07.4	335°35.3	·· 40.3	273°12.5	·· 02.7
4	192°32.5	194°24.4	18.0	189°01.5	08.2	350°37.7	40.3	288°14.8	02.7
5	207°34.9	209°25.2	19.1	204°02.2	08.9	5°40.1	40.3	303°17.0	02.7
6	222°37.4	224°25.9	N01°20.2	219°03.0	N01°09.7	20°42.6	S07°40.3	318°19.2	S22°02.7
7	237°39.9	239°26.7	21.4	234°03.8	10.5	35°45.0	40.3	333°21.4	02.7
8	252°42.3	254°27.4	22.5	249°04.5	11.3	50°47.4	40.3	348°23.6	02.7
9	267°44.8	269°28.2	·· 23.6	264°05.3	·· 12.0	65°49.9	·· 40.3	3°25.9	·· 02.7
10	282°47.3	284°28.9	24.8	279°06.1	12.8	80°52.3	40.3	18°28.1	02.7
11	297°49.7	299°29.7	25.9	294°06.9	13.6	95°54.7	40.3	33°30.3	02.7
12	312°52.2	314°30.4	N01°27.0	309°07.6	N01°14.4	110°57.2	S07°40.3	48°32.5	S22°02.7
13	327°54.7	329°31.2	28.2	324°08.4	15.1	125°59.6	40.3	63°34.7	02.7
14	342°57.1	344°32.0	29.3	339°09.2	15.9	141°02.0	40.3	78°37.0	02.7
15	357°59.6	359°32.7	·· 30.4	354°09.9	·· 16.7	156°04.5	·· 40.3	93°39.2	·· 02.8
16	13°02.0	14°33.5	31.6	9°10.7	17.5	171°06.9	40.3	108°41.4	02.8
17	28°04.5	29°34.3	32.7	24°11.5	18.2	186°09.3	40.3	123°43.6	02.8
18	43°07.0	44°35.0	N01°33.8	39°12.3	N01°19.0	201°11.8	S07°40.3	138°45.9	S22°02.8
19	58°09.4	59°35.8	35.0	54°13.0	19.8	216°14.2	40.3	153°48.1	02.8
20	73°11.9	74°36.6	36.1	69°13.8	20.5	231°16.6	40.3	168°50.3	02.8
21	88°14.4	89°37.3	·· 37.2	84°14.6	·· 21.3	246°19.1	·· 40.3	183°52.5	·· 02.8
22	103°16.8	104°38.1	38.3	99°15.3	22.1	261°21.5	40.3	198°54.7	02.8
23	118°19.3	119°38.9	39.5	114°16.1	22.9	276°23.9	40.3	213°57.0	02.8
Mer.pass.:15:08		v0.7 d1.1 m-4.4		v0.8 d0.8 m1.1		v2.4 d-0.0 m-2.0		v2.2 d-0.0 m0.6	

Stars

	SHA	**Dec**
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.6	-42°13.1
Schedar	349°37.9	56°38.0
Diphda	348°53.6	-17°53.8
Achernar	335°25.2	-57°09.4
Hamal	327°58.0	23°32.5
Polaris	316°36.4	89°20.4
Acamar	315°16.5	-40°14.6
Menkar	314°12.4	4°09.2
Mirfak	308°36.7	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.5	-8°11.3
Capella	280°30.5	46°00.8
Bellatrix	278°29.1	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.6	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.6	-52°42.7
Sirius	258°31.3	-16°44.7
Adhara	255°10.2	-29°00.1
Procyon	244°56.8	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.0
Suhail	222°50.1	-43°30.2
Miaplacidus	221°38.1	-69°47.3
Alphard	217°53.3	-8°44.1
Regulus	207°40.6	11°52.8
Dubhe	193°48.3	61°39.3
Denebola	182°30.9	14°28.5
Gienah	175°49.5	-17°38.2
Acrux	173°06.0	-63°11.4
Gacrux	171°57.7	-57°12.3
Alioth	166°18.4	55°51.8
Spica	158°28.5	-11°14.9
Alkaid	152°56.9	49°13.5
Hadar	148°44.2	-60°26.9
Menkent	148°04.6	-36°27.0
Arcturus	145°53.5	19°05.6
Rigil Kent.	139°48.2	-60°53.9
Kochab	137°20.3	74°04.9
Zuben'ubi	137°02.7	-16°06.6
Alphecca	126°09.0	26°39.4
Antares	112°23.4	-26°27.9
Atria	107°23.3	-69°03.0
Sabik	102°09.9	-15°44.6
Shaula	96°18.9	-37°06.7
Rasalhague	96°04.4	12°32.9
Eltanin	90°45.4	51°29.2
Kaus Aust.	83°40.9	-34°22.3
Vega	80°37.6	38°48.0
Nunki	75°55.6	-26°16.3
Altair	62°06.2	8°54.9
Peacock	53°16.0	-56°40.7
Deneb	49°30.2	45°20.5
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.2	28°10.5
Markab	13°36.1	15°17.8

Jan 31 Tue	**SHA**	**Mer.pass**
Venus	3°23.2	15:04
Mars	357°57.1	15:26
Jupiter	158°07.4	04:45
Saturn	95°55.1	08:53

Feb 01 Wed	**SHA**	**Mer.pass**
Venus	2°40.6	15:03
Mars	357°16.4	15:25
Jupiter	158°06.3	04:41
Saturn	95°49.2	08:50

Feb 02 Thu	**SHA**	**Mer.pass**
Venus	1°58.8	15:02
Mars	356°35.8	15:23
Jupiter	158°05.4	04:37
Saturn	95°43.3	08:46

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.5554 sec ΔT = TT-UT1 = +68.6286 sec

2017 January 31 to Feb. 02 UT

h

Tue	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	176°39.2	S17°23.1	141°12.7	11.1'	S06°03.4	10.4'	57.8'
1	191°39.1	22.4	155°42.8	11.1'	05°53.0	10.4'	57.8'
2	206°39.0	21.7	170°13.0	11.1'	05°42.6	10.5'	57.8'
3	221°38.9	·· 21.0	184°43.1	11.1'	05°32.1	10.5'	57.8'
4	236°38.8	20.3	199°13.2	11.1'	05°21.6	10.5'	57.8'
5	251°38.7	19.6	213°43.3	11.1'	05°11.0	10.6'	57.8'
6	266°38.6	S17°18.9	228°13.4	11.1'	S05°00.4	10.6'	57.9'
7	281°38.5	18.2	242°43.5	11.1'	04°49.8	10.6'	57.9'
8	296°38.4	17.5	257°13.7	11.1'	04°39.1	10.7'	57.9'
9	311°38.3	·· 16.8	271°43.8	11.1'	04°28.4	10.7'	57.9'
10	326°38.2	16.1	286°13.9	11.1'	04°17.7	10.7'	57.9'
11	341°38.2	15.4	300°44.0	11.1'	04°07.0	10.8'	58.0'
12	356°38.1	S17°14.7	315°14.1	11.1'	S03°56.2	10.8'	58.0'
13	11°38.0	14.0	329°44.2	11.1'	03°45.4	10.8'	58.0'
14	26°37.9	13.3	344°14.3	11.1'	03°34.6	10.8'	58.0'
15	41°37.8	·· 12.6	358°44.4	11.1'	03°23.7	10.9'	58.0'
16	56°37.7	11.9	13°14.5	11.1'	03°12.9	10.9'	58.0'
17	71°37.6	11.2	27°44.6	11.1'	03°02.0	10.9'	58.1'
18	86°37.5	S17°10.5	42°14.7	11.1'	S02°51.1	10.9'	58.1'
19	101°37.4	09.8	56°44.8	11.1'	02°40.1	10.9'	58.1'
20	116°37.4	09.1	71°14.9	11.1'	02°29.2	11.0'	58.1'
21	131°37.3	·· 08.3	85°44.9	11.1'	02°18.2	11.0'	58.1'
22	146°37.2	07.6	100°15.0	11.1'	02°07.2	11.0'	58.1'
23	161°37.1	06.9	114°45.1	11.0'	01°56.2	11.0'	58.2'
	SD.=16.2	d=0.7		S.D.=15.8			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°37.0	S17°06.2	129°15.1	11.0'	S01°45.2	11.0'	58.2'
1	191°36.9	05.5	143°45.1	11.0'	01°34.2	11.0'	58.2'
2	206°36.8	04.8	158°15.2	11.0'	01°23.1	11.1'	58.2'
3	221°36.8	·· 04.1	172°45.2	11.0'	01°12.0	11.1'	58.2'
4	236°36.7	03.4	187°15.2	11.0'	01°01.0	11.1'	58.2'
5	251°36.6	02.7	201°45.2	11.0'	00°49.9	11.1'	58.2'
6	266°36.5	S17°01.9	216°15.2	11.0'	S00°38.8	11.1'	58.3'
7	281°36.4	01.2	230°45.1	11.0'	00°27.7	11.1'	58.3'
8	296°36.3	17°00.5	245°15.1	10.9'	00°16.6	11.1'	58.3'
9	311°36.3	16°59.8	259°45.0	10.9'	S00°05.5	11.1'	58.3'
10	326°36.2	59.1	274°14.9	10.9'	N00°05.7	11.1'	58.3'
11	341°36.1	58.4	288°44.9	10.9'	00°16.8	11.1'	58.3'
12	356°36.0	S16°57.6	303°14.7	10.9'	N00°27.9	11.1'	58.4'
13	11°35.9	56.9	317°44.6	10.9'	00°39.0	11.1'	58.4'
14	26°35.9	56.2	332°14.5	10.9'	00°50.2	11.1'	58.4'
15	41°35.8	·· 55.5	346°44.3	10.8'	01°01.3	11.1'	58.4'
16	56°35.7	54.8	1°14.2	10.8'	01°12.4	11.1'	58.4'
17	71°35.6	54.1	15°44.0	10.8'	01°23.6	11.1'	58.4'
18	86°35.5	S16°53.3	30°13.8	10.8'	N01°34.7	11.1'	58.4'
19	101°35.5	52.6	44°43.5	10.8'	01°45.8	11.1'	58.5'
20	116°35.4	51.9	59°13.3	10.7'	01°56.9	11.1'	58.5'
21	131°35.3	·· 51.2	73°43.0	10.7'	02°08.0	11.1'	58.5'
22	146°35.2	50.5	88°12.7	10.7'	02°19.2	11.1'	58.5'
23	161°35.1	49.7	102°42.4	10.7'	02°30.3	11.1'	58.5'
	SD.=16.2	d=0.7		S.D.=15.9			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°35.1	S16°49.0	117°12.0	10.6'	N02°41.3	11.1'	58.5'
1	191°35.0	48.3	131°41.7	10.6'	02°52.4	11.1'	58.5'
2	206°34.9	47.6	146°11.3	10.6'	03°03.5	11.1'	58.6'
3	221°34.8	·· 46.8	160°40.9	10.6'	03°14.5	11.0'	58.6'
4	236°34.8	46.1	175°10.4	10.5'	03°25.6	11.0'	58.6'
5	251°34.7	45.4	189°40.0	10.5'	03°36.6	11.0'	58.6'
6	266°34.6	S16°44.7	204°09.5	10.5'	N03°47.6	11.0'	58.6'
7	281°34.5	43.9	218°39.0	10.5'	03°58.6	11.0'	58.6'
8	296°34.5	43.2	233°08.4	10.4'	04°09.6	11.0'	58.6'
9	311°34.4	·· 42.5	247°37.8	10.4'	04°20.6	11.0'	58.7'
10	326°34.3	41.7	262°07.2	10.4'	04°31.5	10.9'	58.7'
11	341°34.3	41.0	276°36.6	10.4'	04°42.4	10.9'	58.7'
12	356°34.2	S16°40.3	291°05.9	10.3'	N04°53.3	10.9'	58.7'
13	11°34.1	39.6	305°35.2	10.3'	05°04.2	10.9'	58.7'
14	26°34.0	38.8	320°04.5	10.3'	05°15.0	10.8'	58.7'
15	41°34.0	·· 38.1	334°33.8	10.2'	05°25.9	10.8'	58.7'
16	56°33.9	37.4	349°03.0	10.2'	05°36.7	10.8'	58.7'
17	71°33.8	36.6	3°32.1	10.2'	05°47.4	10.8'	58.8'
18	86°33.8	S16°35.9	18°01.3	10.1'	N05°58.2	10.7'	58.8'
19	101°33.7	35.2	32°30.4	10.1'	06°08.9	10.7'	58.8'
20	116°33.6	34.4	46°59.5	10.1'	06°19.6	10.7'	58.8'
21	131°33.5	·· 33.7	61°28.5	10.0'	06°30.2	10.6'	58.8'
22	146°33.5	33.0	75°57.5	10.0'	06°40.9	10.6'	58.8'
23	161°33.4	32.2	90°26.5	9.9'	06°51.4	10.6'	58.8'
	SD.=16.2	d=0.7		S.D.=16.0			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:09	08:37	10:25	14:03	15:51	17:20
N 70°	07:01	08:19	09:44	14:44	16:09	17:28
68°	06:54	08:05	09:16	15:12	16:24	17:34
66°	06:49	07:53	08:55	15:33	16:36	17:40
64°	06:44	07:42	08:39	15:49	16:46	17:44
62°	06:39	07:34	08:25	16:03	16:54	17:49
60°	06:36	07:26	08:13	16:15	17:02	17:53
N 58°	06:32	07:19	08:03	16:25	17:09	17:56
56°	06:29	07:13	07:55	16:33	17:15	17:59
54°	06:25	07:08	07:47	16:41	17:20	18:03
52°	06:22	07:03	07:40	16:48	17:25	18:05
50°	06:20	06:59	07:33	16:54	17:29	18:08
45°	06:13	06:48	07:20	17:08	17:39	18:14
N 40°	06:07	06:40	07:08	17:19	17:48	18:20
35°	06:02	06:32	06:59	17:29	17:55	18:26
30°	05:57	06:25	06:50	17:37	18:02	18:31
20°	05:46	06:12	06:35	17:52	18:15	18:41
N 10°	05:35	06:01	06:22	18:05	18:27	18:52
0°	05:23	05:48	06:10	18:17	18:39	19:04
S 10°	05:10	05:36	05:58	18:29	18:51	19:17
20°	04:53	05:21	05:44	18:43	19:06	19:34
30°	04:32	05:03	05:29	18:58	19:24	19:54
35°	04:19	04:52	05:20	19:07	19:35	20:08
40°	04:02	04:39	05:09	19:17	19:47	20:24
45°	03:42	04:24	04:57	19:29	20:03	20:44
S 50°	03:15	04:04	04:42	19:44	20:22	21:11
52°	03:01	03:54	04:35	19:51	20:31	21:25
54°	02:44	03:44	04:27	19:59	20:42	21:41
56°	02:23	03:31	04:18	20:08	20:54	22:01
58°	01:56	03:17	04:08	20:17	21:08	22:27
S 60°	01:12	02:59	03:57	20:29	21:26	23:07

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	09:50	09:44	09:37	20:46	22:37	–:–
N 70°	09:44	09:44	09:43	20:49	22:33	–:–
68°	09:39	09:43	09:48	20:52	22:31	–:–
66°	09:35	09:43	09:52	20:55	22:28	–:–
64°	09:32	09:43	09:55	20:57	22:26	23:57
62°	09:28	09:43	09:58	20:58	22:25	23:52
60°	09:26	09:43	10:01	21:00	22:23	23:48
N 58°	09:23	09:43	10:04	21:01	22:22	23:44
56°	09:21	09:43	10:06	21:02	22:21	23:40
54°	09:19	09:43	10:08	21:04	22:20	23:37
52°	09:17	09:43	10:09	21:05	22:19	23:34
50°	09:16	09:43	10:11	21:05	22:18	23:32
45°	09:12	09:43	10:14	21:07	22:16	23:26
N 40°	09:09	09:43	10:17	21:09	22:15	23:22
35°	09:06	09:43	10:20	21:10	22:14	23:18
30°	09:04	09:43	10:22	21:12	22:12	23:14
20°	09:00	09:43	10:26	21:14	22:10	23:08
N 10°	08:57	09:43	10:30	21:15	22:09	23:03
0°	08:53	09:43	10:33	21:17	22:07	22:58
S 10°	08:50	09:43	10:37	21:19	22:05	22:53
20°	08:47	09:43	10:40	21:20	22:03	22:47
30°	08:43	09:43	10:44	21:22	22:01	22:41
35°	08:40	09:43	10:47	21:23	22:00	22:38
40°	08:38	09:43	10:50	21:25	21:59	22:34
45°	08:35	09:43	10:53	21:26	21:57	22:29
S 50°	08:31	09:44	10:57	21:28	21:55	22:24
52°	08:29	09:44	10:59	21:28	21:54	22:21
54°	08:28	09:44	11:01	21:29	21:53	22:18
56°	08:26	09:44	11:03	21:30	21:52	22:15
58°	08:23	09:44	11:05	21:31	21:51	22:12
S 60°	08:21	09:44	11:08	21:32	21:50	22:08

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 3-5 13-32%
31	13:23	13:28	12:13	15:05	02:40	
01	13:32	13:36	12:14	15:55	03:30	
02	13:40	13:43	12:14	16:45	04:20	

February 03, 04, 05 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	133°21.8	134°39.7	N01°40.6	129°16.9	N01°23.6	291°26.4	S07°40.3	228°59.2	S22°02.8
1	148°24.2	149°40.4	41.7	144°17.6	24.4	306°28.8	40.3	244°01.4	02.8
2	163°26.7	164°41.2	42.9	159°18.4	25.2	321°31.2	40.3	259°03.6	02.8
3	178°29.2	179°42.0	·· 44.0	174°19.2	·· 26.0	336°33.7	·· 40.3	274°05.8	·· 02.8
4	193°31.6	194°42.8	45.1	189°20.0	26.7	351°36.1	40.3	289°08.1	02.9
5	208°34.1	209°43.6	46.2	204°20.7	27.5	6°38.5	40.3	304°10.3	02.9
6	223°36.5	224°44.4	N01°47.4	219°21.5	N01°28.3	21°41.0	S07°40.3	319°12.5	S22°02.9
7	238°39.0	239°45.1	48.5	234°22.3	29.0	36°43.4	40.3	334°14.7	02.9
8	253°41.5	254°45.9	49.6	249°23.0	29.8	51°45.9	40.3	349°17.0	02.9
9	268°43.9	269°46.7	·· 50.7	264°23.8	·· 30.6	66°48.3	·· 40.3	4°19.2	·· 02.9
10	283°46.4	284°47.5	51.9	279°24.6	31.4	81°50.7	40.3	19°21.4	02.9
11	298°48.9	299°48.3	53.0	294°25.3	32.1	96°53.2	40.3	34°23.6	02.9
12	313°51.3	314°49.1	N01°54.1	309°26.1	N01°32.9	111°55.6	S07°40.3	49°25.9	S22°02.9
13	328°53.8	329°49.9	55.2	324°26.9	33.7	126°58.1	40.3	64°28.1	02.9
14	343°56.3	344°50.7	56.4	339°27.7	34.5	142°00.5	40.3	79°30.3	02.9
15	358°58.7	359°51.5	·· 57.5	354°28.4	·· 35.2	157°02.9	·· 40.3	94°32.5	·· 02.9
16	14°01.2	14°52.3	58.6	9°29.2	36.0	172°05.4	40.3	109°34.7	02.9
17	29°03.7	29°53.1	01°59.7	24°30.0	36.8	187°07.8	40.3	124°37.0	02.9
18	44°06.1	44°53.9	N02°00.8	39°30.7	N01°37.5	202°10.3	S07°40.3	139°39.2	S22°03.0
19	59°08.6	59°54.7	02.0	54°31.5	38.3	217°12.7	40.3	154°41.4	03.0
20	74°11.0	74°55.5	03.1	69°32.3	39.1	232°15.1	40.3	169°43.6	03.0
21	89°13.5	89°56.3	·· 04.2	84°33.1	·· 39.9	247°17.6	·· 40.3	184°45.9	·· 03.0
22	104°16.0	104°57.1	05.3	99°33.8	40.6	262°20.0	40.3	199°48.1	03.0
23	119°18.4	119°58.0	06.4	114°34.6	41.4	277°22.5	40.3	214°50.3	03.0
Mer.pass.:15:04		v0.8 d1.1 m-4.4		v0.8 d0.8 m1.1		v2.4 d0.0 m-2.0		v2.2 d-0.0 m0.6	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	134°20.9	134°58.8	N02°07.6	129°35.4	N01°42.2	292°24.9	S07°40.3	229°52.5	S22°03.0
1	149°23.4	149°59.6	08.7	144°36.1	42.9	307°27.4	40.2	244°54.8	03.0
2	164°25.8	165°00.4	09.8	159°36.9	43.7	322°29.8	40.2	259°57.0	03.0
3	179°28.3	180°01.2	·· 10.9	174°37.7	·· 44.5	337°32.2	·· 40.2	274°59.2	·· 03.0
4	194°30.8	195°02.0	12.0	189°38.5	45.3	352°34.7	40.2	290°01.4	03.0
5	209°33.2	210°02.9	13.1	204°39.2	46.0	7°37.1	40.2	305°03.7	03.0
6	224°35.7	225°03.7	N02°14.3	219°40.0	N01°46.8	22°39.6	S07°40.2	320°05.9	S22°03.0
7	239°38.1	240°04.5	15.4	234°40.8	47.6	37°42.0	40.2	335°08.1	03.0
8	254°40.6	255°05.3	16.5	249°41.5	48.3	52°44.5	40.2	350°10.3	03.1
9	269°43.1	270°06.2	·· 17.6	264°42.3	·· 49.1	67°46.9	·· 40.2	5°12.6	·· 03.1
10	284°45.5	285°07.0	18.7	279°43.1	49.9	82°49.4	40.2	20°14.8	03.1
11	299°48.0	300°07.8	19.8	294°43.9	50.7	97°51.8	40.2	35°17.0	03.1
12	314°50.5	315°08.7	N02°20.9	309°44.6	N01°51.4	112°54.3	S07°40.2	50°19.2	S22°03.1
13	329°52.9	330°09.5	22.0	324°45.4	52.2	127°56.7	40.2	65°21.5	03.1
14	344°55.4	345°10.3	23.2	339°46.2	53.0	142°59.2	40.2	80°23.7	03.1
15	359°57.9	0°11.2	·· 24.3	354°46.9	·· 53.7	158°01.6	·· 40.2	95°25.9	·· 03.1
16	15°00.3	15°12.0	25.4	9°47.7	54.5	173°04.0	40.2	110°28.2	03.1
17	30°02.8	30°12.8	26.5	24°48.5	55.3	188°06.5	40.2	125°30.4	03.1
18	45°05.3	45°13.7	N02°27.6	39°49.3	N01°56.0	203°08.9	S07°40.2	140°32.6	S22°03.1
19	60°07.7	60°14.5	28.7	54°50.0	56.8	218°11.4	40.2	155°34.8	03.1
20	75°10.2	75°15.4	29.8	69°50.8	57.6	233°13.8	40.2	170°37.1	03.1
21	90°12.6	90°16.2	·· 30.9	84°51.6	·· 58.4	248°16.3	·· 40.2	185°39.3	·· 03.1
22	105°15.1	105°17.1	32.0	99°52.3	59.1	263°18.7	40.2	200°41.5	03.2
23	120°17.6	120°17.9	33.1	114°53.1	59.9	278°21.2	40.1	215°43.7	03.2
Mer.pass.:15:00		v0.8 d1.1 m-4.4		v0.8 d0.8 m1.1		v2.4 d0.0 m-2.0		v2.2 d-0.0 m0.6	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	135°20.0	135°18.8	N02°34.3	129°53.9	N02°00.7	293°23.6	S07°40.1	230°46.0	S22°03.2
1	150°22.5	150°19.6	35.4	144°54.7	01.4	308°26.1	40.1	245°48.2	03.2
2	165°25.0	165°20.5	36.5	159°55.4	02.2	323°28.5	40.1	260°50.4	03.2
3	180°27.4	180°21.4	·· 37.6	174°56.2	·· 03.0	338°31.0	·· 40.1	275°52.7	·· 03.2
4	195°29.9	195°22.2	38.7	189°57.0	03.8	353°33.5	40.1	290°54.9	03.2
5	210°32.4	210°23.1	39.8	204°57.7	04.5	8°35.9	40.1	305°57.1	03.2
6	225°34.8	225°23.9	N02°40.9	219°58.5	N02°05.3	23°38.4	S07°40.1	320°59.3	S22°03.2
7	240°37.3	240°24.8	42.0	234°59.3	06.1	38°40.8	40.1	336°01.6	03.2
8	255°39.8	255°25.7	43.1	250°00.1	06.8	53°43.3	40.1	351°03.8	03.2
9	270°42.2	270°26.5	·· 44.2	265°00.8	·· 07.6	68°45.7	·· 40.1	6°06.0	·· 03.2
10	285°44.7	285°27.4	45.3	280°01.6	08.4	83°48.2	40.1	21°08.3	03.2
11	300°47.1	300°28.3	46.4	295°02.4	09.1	98°50.6	40.1	36°10.5	03.2
12	315°49.6	315°29.1	N02°47.5	310°03.1	N02°09.9	113°53.1	S07°40.1	51°12.7	S22°03.2
13	330°52.1	330°30.0	48.6	325°03.9	10.7	128°55.5	40.1	66°14.9	03.3
14	345°54.5	345°30.9	49.7	340°04.7	11.4	143°58.0	40.0	81°17.2	03.3
15	0°57.0	0°31.8	·· 50.8	355°05.5	·· 12.2	159°00.4	·· 40.0	96°19.4	·· 03.3
16	15°59.5	15°32.7	51.9	10°06.2	13.0	174°02.9	40.0	111°21.6	03.3
17	31°01.9	30°33.5	53.0	25°07.0	13.8	189°05.4	40.0	126°23.9	03.3
18	46°04.4	45°34.4	N02°54.1	40°07.8	N02°14.5	204°07.8	S07°40.0	141°26.1	S22°03.3
19	61°06.9	60°35.3	55.2	55°08.5	15.3	219°10.3	40.0	156°28.3	03.3
20	76°09.3	75°36.2	56.3	70°09.3	16.1	234°12.7	40.0	171°30.5	03.3
21	91°11.8	90°37.1	·· 57.4	85°10.1	·· 16.8	249°15.2	·· 40.0	186°32.8	·· 03.3
22	106°14.2	105°38.0	58.5	100°10.9	17.6	264°17.6	40.0	201°35.0	03.3
23	121°16.7	120°38.9	59.6	115°11.6	18.4	279°20.1	40.0	216°37.2	03.3
Mer.pass.:14:56		v0.9 d1.1 m-4.4		v0.8 d0.8 m1.1		v2.5 d0.0 m-2.0		v2.2 d-0.0 m0.6	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.6	-42°13.1
Schedar	349°37.9	56°38.0
Diphda	348°53.6	-17°53.8
Achernar	335°25.2	-57°09.4
Hamal	327°58.0	23°32.5
Polaris	316°37.8	89°20.4
Acamar	315°16.5	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.7	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.5	-8°11.3
Capella	280°30.5	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.6	-52°42.7
Sirius	258°31.3	-16°44.7
Adhara	255°10.2	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.1
Suhail	222°50.1	-43°30.3
Miaplacidus	221°38.1	-69°47.3
Alphard	217°53.3	-8°44.1
Regulus	207°40.6	11°52.8
Dubhe	193°48.3	61°39.3
Denebola	182°30.9	14°28.5
Gienah	175°49.5	-17°38.2
Acrux	173°06.0	-63°11.4
Gacrux	171°57.7	-57°12.3
Alioth	166°18.3	55°51.8
Spica	158°28.5	-11°14.9
Alkaid	152°56.9	49°13.5
Hadar	148°44.1	-60°26.9
Menkent	148°04.5	-36°27.0
Arcturus	145°53.5	19°05.6
Rigil Kent.	139°48.2	-60°53.9
Kochab	137°20.3	74°04.9
Zuben'ubi	137°02.7	-16°06.6
Alphecca	126°09.0	26°39.4
Antares	112°23.4	-26°27.9
Atria	107°23.2	-69°03.0
Sabik	102°09.9	-15°44.6
Shaula	96°18.8	-37°06.7
Rasalhague	96°04.4	12°32.9
Eltanin	90°45.4	51°29.1
Kaus Aust.	83°40.9	-34°22.3
Vega	80°37.6	38°48.0
Nunki	75°55.6	-26°16.3
Altair	62°06.1	8°54.9
Peacock	53°16.0	-56°40.7
Deneb	49°30.2	45°20.5
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.8
Fomalhaut	15°21.6	-29°32.1
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.8

Feb 03 Fri	SHA	Mer.pass
Venus	1°17.9	15:01
Mars	355°55.1	15:22
Jupiter	158°04.6	04:33
Saturn	95°37.4	08:43

Feb 04 Sat	SHA	Mer.pass
Venus	0°37.9	14:59
Mars	355°14.5	15:21
Jupiter	158°04.0	04:30
Saturn	95°31.6	08:39

Feb 05 Sun	SHA	Mer.pass
Venus	359°58.7	14:58
Mars	354°33.8	15:20
Jupiter	158°03.6	04:26
Saturn	95°25.9	08:36

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.5515 sec ΔT = TT-UT1 = +68.6325 sec

2017 February 03 to Feb. 05 UT

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	176°33.3	S16°31.5	104°55.4	9.9′	N07°02.0	10.5′	58.8′
1	191°33.3	30.8	119°24.3	9.9′	07°12.5	10.5′	58.9′
2	206°33.2	30.0	133°53.1	9.8′	07°23.0	10.5′	58.9′
3	221°33.1	·· 29.3	148°21.9	9.8′	07°33.4	10.4′	58.9′
4	236°33.1	28.6	162°50.7	9.8′	07°43.8	10.4′	58.9′
5	251°33.0	27.8	177°19.4	9.7′	07°54.2	10.3′	58.9′
6	266°32.9	S16°27.1	191°48.1	9.7′	N08°04.5	10.3′	58.9′
7	281°32.9	26.3	206°16.8	9.6′	08°14.8	10.3′	58.9′
8	296°32.8	25.6	220°45.4	9.6′	08°25.0	10.2′	58.9′
9	311°32.7	·· 24.9	235°13.9	9.5′	08°35.2	10.2′	59.0′
10	326°32.7	24.1	249°42.5	9.5′	08°45.3	10.1′	59.0′
11	341°32.6	23.4	264°11.0	9.5′	08°55.4	10.1′	59.0′
12	356°32.5	S16°22.6	278°39.4	9.4′	N09°05.5	10.0′	59.0′
13	11°32.5	21.9	293°07.8	9.4′	09°15.5	10.0′	59.0′
14	26°32.4	21.2	307°36.1	9.3′	09°25.4	9.9′	59.0′
15	41°32.4	·· 20.4	322°04.4	9.3′	09°35.3	9.9′	59.0′
16	56°32.3	19.7	336°32.7	9.2′	09°45.2	9.8′	59.0′
17	71°32.2	18.9	351°00.9	9.2′	09°55.0	9.8′	59.0′
18	86°32.2	S16°18.2	5°29.1	9.1′	N10°04.7	9.7′	59.0′
19	101°32.1	17.4	19°57.2	9.1′	10°14.4	9.7′	59.1′
20	116°32.1	16.7	34°25.3	9.1′	10°24.0	9.6′	59.1′
21	131°32.0	·· 16.0	48°53.3	9.0′	10°33.6	9.5′	59.1′
22	146°31.9	15.2	63°21.3	9.0′	10°43.1	9.5′	59.1′
23	161°31.9	14.5	77°49.3	8.9′	10°52.5	9.4′	59.1′
	SD.=16.2	d=0.7	S.D.=16.1				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	176°31.8	S16°13.7	92°17.2	8.9′	N11°01.9	9.4′	59.1′
1	191°31.8	13.0	106°45.0	8.8′	11°11.2	9.3′	59.1′
2	206°31.7	12.2	121°12.8	8.8′	11°20.5	9.2′	59.1′
3	221°31.6	·· 11.5	135°40.5	8.7′	11°29.7	9.2′	59.1′
4	236°31.6	10.7	150°08.2	8.7′	11°38.8	9.1′	59.1′
5	251°31.5	10.0	164°35.9	8.6′	11°47.9	9.0′	59.2′
6	266°31.5	S16°09.2	179°03.5	8.6′	N11°56.8	9.0′	59.2′
7	281°31.4	08.5	193°31.0	8.5′	12°05.8	8.9′	59.2′
8	296°31.4	07.7	207°58.6	8.5′	12°14.6	8.8′	59.2′
9	311°31.3	·· 07.0	222°26.0	8.4′	12°23.4	8.7′	59.2′
10	326°31.2	06.2	236°53.4	8.4′	12°32.1	8.7′	59.2′
11	341°31.2	05.5	251°20.8	8.3′	12°40.8	8.6′	59.2′
12	356°31.1	S16°04.7	265°48.1	8.3′	N12°49.3	8.5′	59.2′
13	11°31.1	04.0	280°15.3	8.2′	12°57.8	8.4′	59.2′
14	26°31.0	03.2	294°42.5	8.2′	13°06.2	8.4′	59.2′
15	41°31.0	·· 02.4	309°09.7	8.1′	13°14.5	8.3′	59.2′
16	56°30.9	01.7	323°36.8	8.1′	13°22.8	8.2′	59.2′
17	71°30.9	00.9	338°03.8	8.0′	13°31.0	8.1′	59.3′
18	86°30.8	S16°00.2	352°30.8	8.0′	N13°39.1	8.1′	59.3′
19	101°30.8	15°59.4	6°57.8	7.9′	13°47.1	8.0′	59.3′
20	116°30.7	58.7	21°24.7	7.9′	13°55.0	7.9′	59.3′
21	131°30.7	·· 57.9	35°51.6	7.8′	14°02.9	7.8′	59.3′
22	146°30.6	57.2	50°18.4	7.8′	14°10.6	7.7′	59.3′
23	161°30.5	56.4	64°45.1	7.7′	14°18.3	7.6′	59.3′
	SD.=16.2	d=0.7	S.D.=16.1				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	176°30.5	S15°55.6	79°11.8	7.7′	N14°25.9	7.5′	59.3′
1	191°30.4	54.9	93°38.5	7.6′	14°33.4	7.5′	59.3′
2	206°30.4	54.1	108°05.1	7.6′	14°40.8	7.4′	59.3′
3	221°30.3	·· 53.4	122°31.6	7.5′	14°48.1	7.3′	59.3′
4	236°30.3	52.6	136°58.2	7.5′	14°55.3	7.2′	59.3′
5	251°30.2	51.8	151°24.6	7.4′	15°02.5	7.1′	59.3′
6	266°30.2	S15°51.1	165°51.0	7.4′	N15°09.5	7.0′	59.3′
7	281°30.2	50.3	180°17.4	7.3′	15°16.5	6.9′	59.3′
8	296°30.1	49.6	194°43.7	7.3′	15°23.3	6.8′	59.4′
9	311°30.1	·· 48.8	209°10.0	7.2′	15°30.1	6.7′	59.4′
10	326°30.0	48.0	223°36.2	7.2′	15°36.8	6.6′	59.4′
11	341°30.0	47.3	238°02.4	7.2′	15°43.3	6.5′	59.4′
12	356°29.9	S15°46.5	252°28.5	7.1′	N15°49.8	6.4′	59.4′
13	11°29.9	45.7	266°54.6	7.1′	15°56.2	6.3′	59.4′
14	26°29.8	45.0	281°20.6	7.0′	16°02.4	6.2′	59.4′
15	41°29.8	·· 44.2	295°46.6	7.0′	16°08.6	6.1′	59.4′
16	56°29.7	43.4	310°12.6	6.9′	16°14.7	6.0′	59.4′
17	71°29.7	42.7	324°38.5	6.9′	16°20.6	5.9′	59.4′
18	86°29.6	S15°41.9	339°04.3	6.8′	N16°26.5	5.8′	59.4′
19	101°29.6	41.1	353°30.1	6.8′	16°32.2	5.7′	59.4′
20	116°29.6	40.4	7°55.9	6.8′	16°37.9	5.6′	59.4′
21	131°29.5	·· 39.6	22°21.7	6.7′	16°43.4	5.5′	59.4′
22	146°29.5	38.8	36°47.3	6.7′	16°48.8	5.4′	59.4′
23	161°29.4	38.1	51°13.0	6.6′	16°54.2	5.3′	59.4′
	SD.=16.2	d=0.8	S.D.=16.2				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:58	08:24	10:02	14:27	16:05	17:32
N 70°	06:51	08:08	09:28	15:01	16:21	17:38
68°	06:46	07:55	09:04	15:25	16:34	17:43
66°	06:41	07:44	08:45	15:44	16:45	17:48
64°	06:37	07:35	08:30	15:59	16:54	17:52
62°	06:33	07:27	08:17	16:12	17:02	17:56
60°	06:30	07:20	08:06	16:23	17:09	17:59
N 58°	06:27	07:14	07:57	16:32	17:15	18:02
56°	06:24	07:08	07:49	16:40	17:21	18:05
54°	06:21	07:03	07:41	16:47	17:25	18:08
52°	06:18	06:59	07:35	16:54	17:30	18:10
50°	06:16	06:54	07:29	17:00	17:34	18:13
45°	06:10	06:45	07:16	17:12	17:43	18:18
N 40°	06:05	06:37	07:05	17:23	17:51	18:24
35°	06:00	06:30	06:56	17:32	17:58	18:28
30°	05:55	06:23	06:48	17:40	18:05	18:33
20°	05:45	06:12	06:34	17:54	18:17	18:43
N 10°	05:35	06:00	06:22	18:06	18:28	18:53
0°	05:24	05:49	06:10	18:17	18:39	19:04
S 10°	05:11	05:37	05:59	18:29	18:51	19:17
20°	04:55	05:23	05:46	18:42	19:05	19:32
30°	04:35	05:06	05:31	18:56	19:22	19:52
35°	04:22	04:55	05:23	19:05	19:32	20:05
40°	04:07	04:43	05:13	19:14	19:44	20:20
45°	03:47	04:28	05:01	19:26	19:58	20:39
S 50°	03:22	04:10	04:47	19:40	20:17	21:04
52°	03:09	04:01	04:41	19:46	20:25	21:17
54°	02:53	03:51	04:33	19:53	20:35	21:32
56°	02:34	03:39	04:25	20:01	20:47	21:51
58°	02:10	03:26	04:16	20:10	21:00	22:14
S 60°	01:36	03:10	04:05	20:21	21:16	22:46

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	09:30	09:23	09:13	00:30	02:27	04:32
N 70°	09:43	09:44	09:48	00:19	02:07	03:58
68°	09:53	10:01	10:13	00:10	01:52	03:33
66°	10:02	10:14	10:33	00:03	01:39	03:15
64°	10:09	10:26	10:48	–:–	01:29	02:59
62°	10:15	10:36	11:02	–:–	01:20	02:47
60°	10:21	10:44	11:13	–:–	01:13	02:36
N 58°	10:26	10:51	11:23	–:–	01:06	02:27
56°	10:30	10:58	11:31	–:–	01:00	02:19
54°	10:34	11:04	11:39	–:–	00:55	02:12
52°	10:37	11:09	11:46	–:–	00:50	02:05
50°	10:41	11:14	11:52	–:–	00:46	01:59
45°	10:48	11:24	12:05	–:–	00:37	01:47
N 40°	10:54	11:33	12:16	–:–	00:29	01:37
35°	10:59	11:40	12:26	–:–	00:22	01:28
30°	11:03	11:47	12:34	–:–	00:17	01:20
20°	11:11	11:58	12:49	–:–	00:07	01:07
N 10°	11:18	12:09	13:02	23:58	–:–	00:55
0°	11:25	12:18	13:14	23:50	–:–	00:44
S 10°	11:31	12:28	13:26	23:42	–:–	00:33
20°	11:39	12:38	13:38	23:33	–:–	00:22
30°	11:47	12:50	13:53	23:23	–:–	00:09
35°	11:51	12:57	14:02	23:18	–:–	00:01
40°	11:57	13:05	14:12	23:11	23:52	–:–
45°	12:03	13:14	14:23	23:04	23:42	–:–
S 50°	12:11	13:25	14:38	22:55	23:30	–:–
52°	12:14	13:30	14:44	22:51	23:24	–:–
54°	12:18	13:36	14:52	22:46	23:18	23:57
56°	12:23	13:42	15:00	22:41	23:11	23:48
58°	12:27	13:49	15:09	22:35	23:03	23:38
S 60°	12:33	13:57	15:20	22:29	22:55	23:27

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 6-8 42-65%
03	13:47	13:50	12:14	17:37	05:11	
04	13:53	13:55	12:14	18:31	06:04	
05	13:58	14:00	12:14	19:27	06:59	

February 06, 07, 08 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	136°19.2	135°39.8	N03°00.7	130°12.4	N02°19.1	294°22.6	S07°40.0	231°39.5	S22°03.3
1	151°21.6	150°40.6	01.8	145°13.2	19.9	309°25.0	40.0	246°41.7	03.3
2	166°24.1	165°41.5	02.9	160°14.0	20.7	324°27.5	39.9	261°43.9	03.3
3	181°26.6	180°42.4	·· 04.0	175°14.7	·· 21.4	339°29.9	·· 39.9	276°46.2	·· 03.3
4	196°29.0	195°43.3	05.1	190°15.5	22.2	354°32.4	39.9	291°48.4	03.4
5	211°31.5	210°44.2	06.2	205°16.3	23.0	9°34.8	39.9	306°50.6	03.4
6	226°34.0	225°45.1	N03°07.3	220°17.0	N02°23.7	24°37.3	S07°39.9	321°52.9	S22°03.4
7	241°36.4	240°46.1	08.3	235°17.8	24.5	39°39.8	39.9	336°55.1	03.4
8	256°38.9	255°47.0	09.4	250°18.6	25.3	54°42.2	39.9	351°57.3	03.4
9	271°41.4	270°47.9	·· 10.5	265°19.4	·· 26.0	69°44.7	·· 39.9	6°59.5	·· 03.4
10	286°43.8	285°48.8	11.6	280°20.1	26.8	84°47.1	39.9	22°01.8	03.4
11	301°46.3	300°49.7	12.7	295°20.9	27.6	99°49.6	39.9	37°04.0	03.4
12	316°48.7	315°50.6	N03°13.8	310°21.7	N02°28.3	114°52.1	S07°39.9	52°06.2	S22°03.4
13	331°51.2	330°51.5	14.9	325°22.4	29.1	129°54.5	39.8	67°08.5	03.4
14	346°53.7	345°52.4	16.0	340°23.2	29.9	144°57.0	39.8	82°10.7	03.4
15	1°56.1	0°53.4	·· 17.1	355°24.0	·· 30.7	159°59.5	·· 39.8	97°12.9	·· 03.4
16	16°58.6	15°54.3	18.2	10°24.8	31.4	175°01.9	39.8	112°15.2	03.4
17	32°01.1	30°55.2	19.2	25°25.5	32.2	190°04.4	39.8	127°17.4	03.4
18	47°03.5	45°56.1	N03°20.3	40°26.3	N02°33.0	205°06.8	S07°39.8	142°19.6	S22°03.4
19	62°06.0	60°57.0	21.4	55°27.1	33.7	220°09.3	39.8	157°21.9	03.4
20	77°08.5	75°58.0	22.5	70°27.9	34.5	235°11.8	39.8	172°24.1	03.5
21	92°10.9	90°58.9	·· 23.6	85°28.6	·· 35.3	250°14.2	·· 39.8	187°26.3	·· 03.5
22	107°13.4	105°59.8	24.7	100°29.4	36.0	265°16.7	39.7	202°28.6	03.5
23	122°15.9	121°00.8	25.7	115°30.2	36.8	280°19.2	39.7	217°30.8	03.5
Mer.pass.:14:52		v0.9 d1.1 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.0		v2.2 d-0.0 m0.6	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	137°18.3	136°01.7	N03°26.8	130°30.9	N02°37.6	295°21.6	S07°39.7	232°33.0	S22°03.5
1	152°20.8	151°02.6	27.9	145°31.7	38.3	310°24.1	39.7	247°35.3	03.5
2	167°23.2	166°03.6	29.0	160°32.5	39.1	325°26.6	39.7	262°37.5	03.5
3	182°25.7	181°04.5	·· 30.1	175°33.3	·· 39.9	340°29.0	·· 39.7	277°39.7	·· 03.5
4	197°28.2	196°05.5	31.2	190°34.0	40.6	355°31.5	39.7	292°42.0	03.5
5	212°30.6	211°06.4	32.2	205°34.8	41.4	10°34.0	39.7	307°44.2	03.5
6	227°33.1	226°07.3	N03°33.3	220°35.6	N02°42.2	25°36.4	S07°39.6	322°46.4	S22°03.5
7	242°35.6	241°08.3	34.4	235°36.4	42.9	40°38.9	39.6	337°48.7	03.5
8	257°38.0	256°09.2	35.5	250°37.1	43.7	55°41.4	39.6	352°50.9	03.5
9	272°40.5	271°10.2	·· 36.6	265°37.9	·· 44.5	70°43.8	·· 39.6	7°53.1	·· 03.5
10	287°43.0	286°11.1	37.6	280°38.7	45.2	85°46.3	39.6	22°55.4	03.5
11	302°45.4	301°12.1	38.7	295°39.4	46.0	100°48.8	39.6	37°57.6	03.5
12	317°47.9	316°13.1	N03°39.8	310°40.2	N02°46.7	115°51.2	S07°39.6	52°59.8	S22°03.6
13	332°50.4	331°14.0	40.9	325°41.0	47.5	130°53.7	39.6	68°02.1	03.6
14	347°52.8	346°15.0	41.9	340°41.8	48.3	145°56.2	39.5	83°04.3	03.6
15	2°55.3	1°15.9	·· 43.0	355°42.5	·· 49.0	160°58.7	·· 39.5	98°06.6	·· 03.6
16	17°57.7	16°16.9	44.1	10°43.3	49.8	176°01.1	39.5	113°08.8	03.6
17	33°00.2	31°17.9	45.2	25°44.1	50.6	191°03.6	39.5	128°11.0	03.6
18	48°02.7	46°18.8	N03°46.2	40°44.9	N02°51.3	206°06.1	S07°39.5	143°13.3	S22°03.6
19	63°05.1	61°19.8	47.3	55°45.6	52.1	221°08.5	39.5	158°15.5	03.6
20	78°07.6	76°20.8	48.4	70°46.4	52.9	236°11.0	39.5	173°17.7	03.6
21	93°10.1	91°21.7	·· 49.5	85°47.2	·· 53.6	251°13.5	·· 39.5	188°20.0	·· 03.6
22	108°12.5	106°22.7	50.5	100°47.9	54.4	266°16.0	39.4	203°22.2	03.6
23	123°15.0	121°23.7	51.6	115°48.7	55.2	281°18.4	39.4	218°24.4	03.6
Mer.pass.:14:48		v0.9 d1.1 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.0		v2.2 d-0.0 m0.6	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	138°17.5	136°24.7	N03°52.7	130°49.5	N02°55.9	296°20.9	S07°39.4	233°26.7	S22°03.6
1	153°19.9	151°25.6	53.7	145°50.3	56.7	311°23.4	39.4	248°28.9	03.6
2	168°22.4	166°26.6	54.8	160°51.0	57.5	326°25.8	39.4	263°31.1	03.6
3	183°24.9	181°27.6	·· 55.9	175°51.8	·· 58.2	341°28.3	·· 39.4	278°33.4	·· 03.6
4	198°27.3	196°28.6	56.9	190°52.6	59.0	356°30.8	39.3	293°35.6	03.7
5	213°29.8	211°29.6	58.0	205°53.4	02°59.8	11°33.3	39.3	308°37.9	03.7
6	228°32.2	226°30.6	N03°59.1	220°54.1	N03°00.5	26°35.7	S07°39.3	323°40.1	S22°03.7
7	243°34.7	241°31.6	04°00.1	235°54.9	01.3	41°38.2	39.3	338°42.3	03.7
8	258°37.2	256°32.6	01.2	250°55.7	02.0	56°40.7	39.3	353°44.6	03.7
9	273°39.6	271°33.6	·· 02.3	265°56.4	·· 02.8	71°43.2	·· 39.3	8°46.8	·· 03.7
10	288°42.1	286°34.5	03.3	280°57.2	03.6	86°45.6	39.3	23°49.0	03.7
11	303°44.6	301°35.5	04.4	295°58.0	04.3	101°48.1	39.2	38°51.3	03.7
12	318°47.0	316°36.5	N04°05.5	310°58.8	N03°05.1	116°50.6	S07°39.2	53°53.5	S22°03.7
13	333°49.5	331°37.5	06.5	325°59.5	05.9	131°53.1	39.2	68°55.8	03.7
14	348°52.0	346°38.6	07.6	341°00.3	06.6	146°55.6	39.2	83°58.0	03.7
15	3°54.4	1°39.6	·· 08.6	356°01.1	·· 07.4	161°58.0	·· 39.2	99°00.2	·· 03.7
16	18°56.9	16°40.6	09.7	11°01.9	08.2	177°00.5	39.2	114°02.5	03.7
17	33°59.3	31°41.6	10.8	26°02.6	08.9	192°03.0	39.1	129°04.7	03.7
18	49°01.8	46°42.6	N04°11.8	41°03.4	N03°09.7	207°05.5	S07°39.1	144°07.0	S22°03.7
19	64°04.3	61°43.6	12.9	56°04.2	10.4	222°07.9	39.1	159°09.2	03.7
20	79°06.7	76°44.6	13.9	71°05.0	11.2	237°10.4	39.1	174°11.4	03.7
21	94°09.2	91°45.6	·· 15.0	86°05.7	·· 12.0	252°12.9	·· 39.1	189°13.7	·· 03.8
22	109°11.7	106°46.6	16.1	101°06.5	12.7	267°15.4	39.1	204°15.9	03.8
23	124°14.1	121°47.7	17.1	116°07.3	13.5	282°17.9	39.0	219°18.1	03.8
Mer.pass.:14:44		v1.0 d1.1 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.0		v2.2 d-0.0 m0.6	

Stars

	SHA	**Dec**
Alpheratz	357°41.1	29°11.1
Ankaa	353°13.6	-42°13.1
Schedar	349°37.9	56°38.0
Diphda	348°53.6	-17°53.8
Achernar	335°25.3	-57°09.4
Hamal	327°58.0	23°32.5
Polaris	316°39.1	89°20.4
Acamar	315°16.5	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.7	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.5	-8°11.3
Capella	280°30.5	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.6	-52°42.7
Sirius	258°31.3	-16°44.7
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.1
Suhail	222°50.1	-43°30.3
Miaplacidus	221°38.1	-69°47.4
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.2	61°39.3
Denebola	182°30.9	14°28.5
Gienah	175°49.5	-17°38.2
Acrux	173°05.9	-63°11.4
Gacrux	171°57.6	-57°12.3
Alioth	166°18.3	55°51.8
Spica	158°28.5	-11°15.0
Alkaid	152°56.9	49°13.5
Hadar	148°44.1	-60°26.9
Menkent	148°04.5	-36°27.0
Arcturus	145°53.4	19°05.5
Rigil Kent.	139°48.1	-60°53.9
Kochab	137°20.2	74°04.9
Zuben'ubi	137°02.6	-16°06.6
Alphecca	126°09.0	26°39.4
Antares	112°23.3	-26°27.9
Atria	107°23.2	-69°03.0
Sabik	102°09.9	-15°44.6
Shaula	96°18.8	-37°06.7
Rasalhague	96°04.4	12°32.9
Eltanin	90°45.4	51°29.1
Kaus Aust.	83°40.8	-34°22.3
Vega	80°37.6	38°48.0
Nunki	75°55.6	-26°16.3
Altair	62°06.1	8°54.9
Peacock	53°16.0	-56°40.7
Deneb	49°30.2	45°20.5
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.8
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.8

Feb 06 Mon	**SHA**	**Mer.pass**
Venus	359°20.6	14:56
Mars	353°53.2	15:18
Jupiter	158°03.4	04:22
Saturn	95°20.3	08:32

Feb 07 Tue	**SHA**	**Mer.pass**
Venus	358°43.4	14:55
Mars	353°12.6	15:17
Jupiter	158°03.3	04:18
Saturn	95°14.7	08:29

Feb 08 Wed	**SHA**	**Mer.pass**
Venus	358°07.2	14:53
Mars	352°32.0	15:16
Jupiter	158°03.4	04:14
Saturn	95°09.2	08:25

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.5475 sec ΔT = TT-UT1 = +68.6365 sec

2017 February 06 to Feb. 08 UT

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°29.4	S15°37.3	65°38.6	6.6′	N16°59.4	5.2′	59.4′
1	191°29.3	36.5	80°04.2	6.6′	17°04.5	5.1′	59.4′
2	206°29.3	35.8	94°29.7	6.5′	17°09.5	4.9′	59.4′
3	221°29.3	·· 35.0	108°55.2	6.5′	17°14.4	4.8′	59.4′
4	236°29.2	34.2	123°20.7	6.4′	17°19.1	4.7′	59.4′
5	251°29.2	33.4	137°46.1	6.4′	17°23.8	4.6′	59.4′
6	266°29.1	S15°32.7	152°11.5	6.4′	N17°28.3	4.5′	59.4′
7	281°29.1	31.9	166°36.8	6.3′	17°32.8	4.4′	59.4′
8	296°29.1	31.1	181°02.1	6.3′	17°37.1	4.3′	59.4′
9	311°29.0	·· 30.4	195°27.4	6.3′	17°41.3	4.1′	59.4′
10	326°29.0	29.6	209°52.7	6.2′	17°45.4	4.0′	59.4′
11	341°28.9	28.8	224°17.9	6.2′	17°49.4	3.9′	59.4′
12	356°28.9	S15°28.0	238°43.1	6.2′	N17°53.2	3.8′	59.4′
13	11°28.9	27.3	253°08.2	6.1′	17°56.9	3.7′	59.4′
14	26°28.8	26.5	267°33.4	6.1′	18°00.6	3.6′	59.4′
15	41°28.8	·· 25.7	281°58.5	6.1′	18°04.1	3.4′	59.4′
16	56°28.8	24.9	296°23.5	6.1′	18°07.4	3.3′	59.4′
17	71°28.7	24.1	310°48.6	6.0′	18°10.7	3.2′	59.4′
18	86°28.7	S15°23.4	325°13.6	6.0′	N18°13.8	3.1′	59.4′
19	101°28.7	22.6	339°38.6	6.0′	18°16.8	3.0′	59.4′
20	116°28.6	21.8	354°03.6	6.0′	18°19.7	2.8′	59.4′
21	131°28.6	·· 21.0	8°28.6	5.9′	18°22.5	2.7′	59.4′
22	146°28.6	20.2	22°53.5	5.9′	18°25.2	2.6′	59.4′
23	161°28.5	19.5	37°18.4	5.9′	18°27.7	2.5′	59.4′
	SD.=16.2	d=0.8		S.D.=16.2			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	176°28.5	S15°18.7	51°43.3	5.9′	N18°30.1	2.3′	59.4′
1	191°28.5	17.9	66°08.2	5.9′	18°32.4	2.2′	59.4′
2	206°28.4	17.1	80°33.1	5.9′	18°34.5	2.1′	59.4′
3	221°28.4	·· 16.3	94°57.9	5.8′	18°36.6	2.0′	59.4′
4	236°28.4	15.6	109°22.7	5.8′	18°38.5	1.8′	59.4′
5	251°28.3	14.8	123°47.6	5.8′	18°40.2	1.7′	59.4′
6	266°28.3	S15°14.0	138°12.4	5.8′	N18°41.9	1.6′	59.4′
7	281°28.3	13.2	152°37.2	5.8′	18°43.4	1.5′	59.4′
8	296°28.2	12.4	167°02.0	5.8′	18°44.8	1.3′	59.4′
9	311°28.2	·· 11.6	181°26.8	5.8′	18°46.1	1.2′	59.4′
10	326°28.2	10.9	195°51.5	5.8′	18°47.3	1.1′	59.4′
11	341°28.1	10.1	210°16.3	5.8′	18°48.3	1.0′	59.4′
12	356°28.1	S15°09.3	224°41.1	5.8′	N18°49.2	0.8′	59.4′
13	11°28.1	08.5	239°05.9	5.8′	18°50.0	0.7′	59.4′
14	26°28.1	07.7	253°30.6	5.8′	18°50.6	0.6′	59.4′
15	41°28.0	·· 06.9	267°55.4	5.8′	18°51.2	0.5′	59.4′
16	56°28.0	06.1	282°20.2	5.8′	18°51.6	0.3′	59.4′
17	71°28.0	05.4	296°44.9	5.8′	18°51.8	0.2′	59.4′
18	86°27.9	S15°04.6	311°09.7	5.8′	N18°52.0	0.1′	59.4′
19	101°27.9	03.8	325°34.5	5.8′	18°52.0	-0.0′	59.3′
20	116°27.9	03.0	339°59.3	5.8′	18°51.9	-0.2′	59.3′
21	131°27.9	·· 02.2	354°24.0	5.8′	18°51.7	-0.3′	59.3′
22	146°27.8	01.4	8°48.8	5.8′	18°51.3	-0.4′	59.3′
23	161°27.8	00.6	23°13.6	5.8′	18°50.8	-0.5′	59.3′
	SD.=16.2	d=0.8		S.D.=16.2			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.8	S14°59.8	37°38.5	5.8′	N18°50.2	-0.7′	59.3′
1	191°27.8	59.0	52°03.3	5.8′	18°49.5	-0.8′	59.3′
2	206°27.7	58.2	66°28.1	5.9′	18°48.6	-0.9′	59.3′
3	221°27.7	·· 57.4	80°53.0	5.9′	18°47.6	-1.1′	59.3′
4	236°27.7	56.7	95°17.9	5.9′	18°46.5	-1.2′	59.3′
5	251°27.7	55.9	109°42.8	5.9′	18°45.3	-1.3′	59.3′
6	266°27.6	S14°55.1	124°07.7	5.9′	N18°43.9	-1.4′	59.3′
7	281°27.6	54.3	138°32.6	5.9′	18°42.4	-1.5′	59.2′
8	296°27.6	53.5	152°57.6	6.0′	18°40.8	-1.7′	59.2′
9	311°27.6	·· 52.7	167°22.5	6.0′	18°39.1	-1.8′	59.2′
10	326°27.6	51.9	181°47.5	6.0′	18°37.2	-1.9′	59.2′
11	341°27.5	51.1	196°12.5	6.0′	18°35.2	-2.0′	59.2′
12	356°27.5	S14°50.3	210°37.6	6.1′	N18°33.1	-2.2′	59.2′
13	11°27.5	49.5	225°02.7	6.1′	18°30.9	-2.3′	59.2′
14	26°27.5	48.7	239°27.8	6.1′	18°28.6	-2.4′	59.2′
15	41°27.4	·· 47.9	253°52.9	6.1′	18°26.1	-2.5′	59.2′
16	56°27.4	47.1	268°18.1	6.2′	18°23.5	-2.6′	59.2′
17	71°27.4	46.3	282°43.3	6.2′	18°20.8	-2.8′	59.1′
18	86°27.4	S14°45.5	297°08.5	6.2′	N18°18.0	-2.9′	59.1′
19	101°27.4	44.7	311°33.7	6.3′	18°15.0	-3.0′	59.1′
20	116°27.4	43.9	325°59.0	6.3′	18°12.0	-3.1′	59.1′
21	131°27.3	·· 43.1	340°24.4	6.3′	18°08.8	-3.2′	59.1′
22	146°27.3	42.3	354°49.7	6.4′	18°05.5	-3.4′	59.1′
23	161°27.3	41.5	9°15.1	6.4′	18°02.1	-3.5′	59.1′
	SD.=16.2	d=0.8		S.D.=16.1			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:46	08:10	09:42	14:48	16:19	17:44
N 70°	06:41	07:56	09:12	15:17	16:34	17:49
68°	06:37	07:44	08:51	15:39	16:45	17:53
66°	06:33	07:35	08:34	15:55	16:55	17:57
64°	06:29	07:26	08:20	16:09	17:03	18:00
62°	06:26	07:19	08:09	16:21	17:10	18:03
60°	06:23	07:13	07:59	16:30	17:16	18:06
N 58°	06:21	07:08	07:50	16:39	17:22	18:08
56°	06:18	07:03	07:42	16:47	17:27	18:11
54°	06:16	06:58	07:36	16:53	17:31	18:13
52°	06:14	06:54	07:30	16:59	17:35	18:15
50°	06:12	06:50	07:24	17:05	17:39	18:17
45°	06:07	06:41	07:12	17:17	17:47	18:22
N 40°	06:02	06:34	07:02	17:26	17:55	18:27
35°	05:58	06:28	06:54	17:35	18:01	18:31
30°	05:53	06:21	06:46	17:42	18:07	18:36
20°	05:44	06:10	06:33	17:55	18:18	18:44
N 10°	05:35	06:00	06:22	18:07	18:28	18:54
0°	05:24	05:49	06:11	18:18	18:39	19:04
S 10°	05:12	05:38	06:00	18:29	18:50	19:16
20°	04:57	05:25	05:48	18:40	19:03	19:30
30°	04:38	05:09	05:34	18:54	19:19	19:49
35°	04:26	04:59	05:26	19:02	19:29	20:01
40°	04:11	04:47	05:17	19:11	19:40	20:16
45°	03:53	04:33	05:06	19:22	19:54	20:34
S 50°	03:29	04:16	04:53	19:35	20:11	20:58
52°	03:17	04:07	04:46	19:41	20:19	21:10
54°	03:02	03:58	04:40	19:47	20:29	21:24
56°	02:45	03:47	04:32	19:55	20:39	21:40
58°	02:24	03:35	04:23	20:03	20:52	22:01
S 60°	01:55	03:20	04:13	20:13	21:06	22:28

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	08:52	▭	▭	06:51	▭	▭
N 70°	09:58	10:26	11:32	05:46	07:20	08:17
68°	10:34	11:13	12:17	05:10	06:33	07:32
66°	11:00	11:43	12:46	04:45	06:03	07:02
64°	11:20	12:06	13:09	04:25	05:40	06:39
62°	11:37	12:24	13:27	04:09	05:22	06:21
60°	11:50	12:40	13:41	03:56	05:07	06:06
N 58°	12:02	12:52	13:54	03:44	04:54	05:53
56°	12:12	13:04	14:05	03:34	04:43	05:42
54°	12:22	13:13	14:14	03:25	04:33	05:33
52°	12:30	13:22	14:23	03:18	04:25	05:24
50°	12:37	13:30	14:31	03:11	04:17	05:16
45°	12:53	13:47	14:47	02:55	04:00	05:00
N 40°	13:05	14:00	15:00	02:43	03:47	04:46
35°	13:16	14:12	15:12	02:33	03:35	04:34
30°	13:26	14:22	15:22	02:23	03:25	04:24
20°	13:43	14:40	15:39	02:07	03:08	04:07
N 10°	13:57	14:55	15:54	01:54	02:53	03:52
0°	14:11	15:09	16:08	01:41	02:39	03:37
S 10°	14:25	15:24	16:22	01:28	02:24	03:23
20°	14:39	15:39	16:37	01:14	02:09	03:08
30°	14:56	15:57	16:54	00:58	01:52	02:50
35°	15:06	16:07	17:04	00:49	01:42	02:40
40°	15:17	16:19	17:15	00:38	01:30	02:28
45°	15:31	16:33	17:29	00:26	01:17	02:14
S 50°	15:47	16:50	17:45	00:11	01:00	01:57
52°	15:54	16:58	17:52	00:04	00:52	01:49
54°	16:03	17:07	18:01	–:–	00:44	01:40
56°	16:12	17:17	18:10	–:–	00:34	01:30
58°	16:23	17:28	18:21	–:–	00:23	01:19
S 60°	16:36	17:41	18:34	–:–	00:10	01:06

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 9-11 76-92%
06	14:02	14:04	12:14	20:25	07:56	
07	14:06	14:08	12:14	21:23	08:54	
08	14:09	14:10	12:14	22:22	09:53	

February 09, 10, 11 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	139°16.6	136°48.7	N04°18.2	131°08.0	N03°14.3	297°20.3	S07°39.0	234°20.4	S22°03.8
1	154°19.1	151°49.7	19.2	146°08.8	15.0	312°22.8	39.0	249°22.6	03.8
2	169°21.5	166°50.7	20.3	161°09.6	15.8	327°25.3	39.0	264°24.9	03.8
3	184°24.0	181°51.8	·· 21.3	176°10.4	·· 16.6	342°27.8	·· 39.0	279°27.1	·· 03.8
4	199°26.5	196°52.8	22.4	191°11.1	17.3	357°30.3	39.0	294°29.3	03.8
5	214°28.9	211°53.8	23.4	206°11.9	18.1	12°32.7	38.9	309°31.6	03.8
6	229°31.4	226°54.9	N04°24.5	221°12.7	N03°18.8	27°35.2	S07°38.9	324°33.8	S22°03.8
7	244°33.8	241°55.9	25.5	236°13.5	19.6	42°37.7	38.9	339°36.1	03.8
8	259°36.3	256°56.9	26.6	251°14.2	20.4	57°40.2	38.9	354°38.3	03.8
9	274°38.8	271°58.0	·· 27.6	266°15.0	·· 21.1	72°42.7	·· 38.9	9°40.5	·· 03.8
10	289°41.2	286°59.0	28.7	281°15.8	21.9	87°45.2	38.8	24°42.8	03.8
11	304°43.7	302°00.1	29.7	296°16.5	22.7	102°47.6	38.8	39°45.0	03.8
12	319°46.2	317°01.1	N04°30.8	311°17.3	N03°23.4	117°50.1	S07°38.8	54°47.3	S22°03.8
13	334°48.6	332°02.2	31.8	326°18.1	24.2	132°52.6	38.8	69°49.5	03.8
14	349°51.1	347°03.2	32.9	341°18.9	24.9	147°55.1	38.8	84°51.8	03.8
15	4°53.6	2°04.3	·· 33.9	356°19.6	·· 25.7	162°57.6	·· 38.7	99°54.0	·· 03.9
16	19°56.0	17°05.3	35.0	11°20.4	26.5	178°00.1	38.7	114°56.2	03.9
17	34°58.5	32°06.4	36.0	26°21.2	27.2	193°02.6	38.7	129°58.5	03.9
18	50°01.0	47°07.4	N04°37.1	41°22.0	N03°28.0	208°05.0	S07°38.7	145°00.7	S22°03.9
19	65°03.4	62°08.5	38.1	56°22.7	28.7	223°07.5	38.7	160°03.0	03.9
20	80°05.9	77°09.5	39.2	71°23.5	29.5	238°10.0	38.7	175°05.2	03.9
21	95°08.3	92°10.6	·· 40.2	86°24.3	·· 30.3	253°12.5	·· 38.6	190°07.4	·· 03.9
22	110°10.8	107°11.7	41.2	101°25.1	31.0	268°15.0	38.6	205°09.7	03.9
23	125°13.3	122°12.7	42.3	116°25.8	31.8	283°17.5	38.6	220°11.9	03.9
Mer.pass.:14:40		v1.0 d1.1 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.0		v2.2 d-0.0 m0.6	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	140°15.7	137°13.8	N04°43.3	131°26.6	N03°32.6	298°20.0	S07°38.6	235°14.2	S22°03.9
1	155°18.2	152°14.9	44.4	146°27.4	33.3	313°22.4	38.6	250°16.4	03.9
2	170°20.7	167°15.9	45.4	161°28.1	34.1	328°24.9	38.5	265°18.7	03.9
3	185°23.1	182°17.0	·· 46.4	176°28.9	·· 34.8	343°27.4	·· 38.5	280°20.9	·· 03.9
4	200°25.6	197°18.1	47.5	191°29.7	35.6	358°29.9	38.5	295°23.1	03.9
5	215°28.1	212°19.2	48.5	206°30.5	36.4	13°32.4	38.5	310°25.4	03.9
6	230°30.5	227°20.3	N04°49.6	221°31.2	N03°37.1	28°34.9	S07°38.4	325°27.6	S22°03.9
7	245°33.0	242°21.3	50.6	236°32.0	37.9	43°37.4	38.4	340°29.9	03.9
8	260°35.5	257°22.4	51.6	251°32.8	38.6	58°39.9	38.4	355°32.1	03.9
9	275°37.9	272°23.5	·· 52.7	266°33.6	·· 39.4	73°42.4	·· 38.4	10°34.4	·· 04.0
10	290°40.4	287°24.6	53.7	281°34.3	40.2	88°44.9	38.4	25°36.6	04.0
11	305°42.8	302°25.7	54.7	296°35.1	40.9	103°47.3	38.3	40°38.8	04.0
12	320°45.3	317°26.8	N04°55.8	311°35.9	N03°41.7	118°49.8	S07°38.3	55°41.1	S22°04.0
13	335°47.8	332°27.9	56.8	326°36.7	42.4	133°52.3	38.3	70°43.3	04.0
14	350°50.2	347°29.0	57.8	341°37.4	43.2	148°54.8	38.3	85°45.6	04.0
15	5°52.7	2°30.1	·· 58.9	356°38.2	·· 44.0	163°57.3	·· 38.3	100°47.8	·· 04.0
16	20°55.2	17°31.2	04°59.9	11°39.0	44.7	178°59.8	38.2	115°50.1	04.0
17	35°57.6	32°32.3	05°00.9	26°39.8	45.5	194°02.3	38.2	130°52.3	04.0
18	51°00.1	47°33.4	N05°01.9	41°40.5	N03°46.2	209°04.8	S07°38.2	145°54.6	S22°04.0
19	66°02.6	62°34.5	03.0	56°41.3	47.0	224°07.3	38.2	160°56.8	04.0
20	81°05.0	77°35.6	04.0	71°42.1	47.8	239°09.8	38.1	175°59.0	04.0
21	96°07.5	92°36.7	·· 05.0	86°42.8	·· 48.5	254°12.3	·· 38.1	191°01.3	·· 04.0
22	111°09.9	107°37.8	06.1	101°43.6	49.3	269°14.8	38.1	206°03.5	04.0
23	126°12.4	122°38.9	07.1	116°44.4	50.0	284°17.3	38.1	221°05.8	04.0
Mer.pass.:14:37		v1.1 d1.0 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.1		v2.2 d-0.0 m0.6	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	141°14.9	137°40.0	N05°08.1	131°45.2	N03°50.8	299°19.8	S07°38.0	236°08.0	S22°04.0
1	156°17.3	152°41.2	09.1	146°45.9	51.5	314°22.3	38.0	251°10.3	04.0
2	171°19.8	167°42.3	10.1	161°46.7	52.3	329°24.7	38.0	266°12.5	04.0
3	186°22.3	182°43.4	·· 11.2	176°47.5	·· 53.1	344°27.2	·· 38.0	281°14.8	·· 04.0
4	201°24.7	197°44.5	12.2	191°48.3	53.8	359°29.7	38.0	296°17.0	04.1
5	216°27.2	212°45.7	13.2	206°49.0	54.6	14°32.2	37.9	311°19.3	04.1
6	231°29.7	227°46.8	N05°14.2	221°49.8	N03°55.3	29°34.7	S07°37.9	326°21.5	S22°04.1
7	246°32.1	242°47.9	15.3	236°50.6	56.1	44°37.2	37.9	341°23.7	04.1
8	261°34.6	257°49.0	16.3	251°51.4	56.9	59°39.7	37.9	356°26.0	04.1
9	276°37.1	272°50.2	·· 17.3	266°52.1	·· 57.6	74°42.2	·· 37.8	11°28.2	·· 04.1
10	291°39.5	287°51.3	18.3	281°52.9	58.4	89°44.7	37.8	26°30.5	04.1
11	306°42.0	302°52.5	19.3	296°53.7	59.1	104°47.2	37.8	41°32.7	04.1
12	321°44.4	317°53.6	N05°20.3	311°54.4	N03°59.9	119°49.7	S07°37.8	56°35.0	S22°04.1
13	336°46.9	332°54.7	21.4	326°55.2	04°00.6	134°52.2	37.7	71°37.2	04.1
14	351°49.4	347°55.9	22.4	341°56.0	01.4	149°54.7	37.7	86°39.5	04.1
15	6°51.8	2°57.0	·· 23.4	356°56.8	·· 02.2	164°57.2	·· 37.7	101°41.7	·· 04.1
16	21°54.3	17°58.2	24.4	11°57.5	02.9	179°59.7	37.7	116°44.0	04.1
17	36°56.8	32°59.3	25.4	26°58.3	03.7	195°02.2	37.6	131°46.2	04.1
18	51°59.2	48°00.5	N05°26.4	41°59.1	N04°04.4	210°04.7	S07°37.6	146°48.5	S22°04.1
19	67°01.7	63°01.6	27.4	56°59.9	05.2	225°07.2	37.6	161°50.7	04.1
20	82°04.2	78°02.8	28.4	72°00.6	05.9	240°09.7	37.6	176°53.0	04.1
21	97°06.6	93°04.0	·· 29.5	87°01.4	·· 06.7	255°12.2	·· 37.5	191°55.2	·· 04.1
22	112°09.1	108°05.1	30.5	102°02.2	07.5	270°14.7	37.5	206°57.5	04.1
23	127°11.6	123°06.3	31.5	117°03.0	08.2	285°17.2	37.5	221°59.7	04.1
Mer.pass.:14:33		v1.1 d1.0 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.1		v2.2 d-0.0 m0.6	

Stars

	SHA	**Dec**
Alpheratz	357°41.2	29°11.1
Ankaa	353°13.6	-42°13.1
Schedar	349°37.9	56°37.9
Diphda	348°53.6	-17°53.8
Achernar	335°25.3	-57°09.4
Hamal	327°58.0	23°32.5
Polaris	316°40.5	89°20.4
Acamar	315°16.5	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.7	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.5	-8°11.3
Capella	280°30.5	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.6	-52°42.7
Sirius	258°31.3	-16°44.7
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.1
Suhail	222°50.1	-43°30.3
Miaplacidus	221°38.1	-69°47.4
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.2	61°39.3
Denebola	182°30.9	14°28.5
Gienah	175°49.5	-17°38.2
Acrux	173°05.9	-63°11.4
Gacrux	171°57.6	-57°12.3
Alioth	166°18.3	55°51.8
Spica	158°28.5	-11°15.0
Alkaid	152°56.8	49°13.5
Hadar	148°44.0	-60°27.0
Menkent	148°04.5	-36°27.0
Arcturus	145°53.4	19°05.5
Rigil Kent.	139°48.1	-60°53.9
Kochab	137°20.1	74°04.9
Zuben'ubi	137°02.6	-16°06.6
Alphecca	126°09.0	26°39.4
Antares	112°23.3	-26°27.9
Atria	107°23.1	-69°03.0
Sabik	102°09.8	-15°44.6
Shaula	96°18.8	-37°06.7
Rasalhague	96°04.3	12°32.9
Eltanin	90°45.3	51°29.1
Kaus Aust.	83°40.8	-34°22.3
Vega	80°37.6	38°47.9
Nunki	75°55.5	-26°16.3
Altair	62°06.1	8°54.9
Peacock	53°16.0	-56°40.6
Deneb	49°30.2	45°20.5
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.8

Feb 09 Thu	**SHA**	**Mer.pass**
Venus	357°32.1	14:52
Mars	351°51.4	15:15
Jupiter	158°03.7	04:10
Saturn	95°03.8	08:21

Feb 10 Fri	**SHA**	**Mer.pass**
Venus	356°58.1	14:50
Mars	351°10.9	15:13
Jupiter	158°04.2	04:06
Saturn	94°58.4	08:18

Feb 11 Sat	**SHA**	**Mer.pass**
Venus	356°25.2	14:48
Mars	350°30.3	15:12
Jupiter	158°04.9	04:02
Saturn	94°53.1	08:14

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.5435 sec ΔT = TT-UT1 = +68.6405 sec

2017 February 09 to Feb. 11 UT

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.3	S14°40.7	23°40.6	6.5'	N17°58.5	-3.6'	59.0'
1	191°27.3	39.9	38°06.1	6.5'	17°54.9	-3.7'	59.0'
2	206°27.3	39.1	52°31.6	6.5'	17°51.1	-3.8'	59.0'
3	221°27.2	·· 38.3	66°57.2	6.6'	17°47.3	-3.9'	59.0'
4	236°27.2	37.5	81°22.8	6.6'	17°43.3	-4.0'	59.0'
5	251°27.2	36.7	95°48.4	6.7'	17°39.2	-4.2'	59.0'
6	266°27.2	S14°35.9	110°14.2	6.7'	N17°35.0	-4.3'	59.0'
7	281°27.2	35.1	124°39.9	6.8'	17°30.6	-4.4'	58.9'
8	296°27.2	34.3	139°05.7	6.8'	17°26.2	-4.5'	58.9'
9	311°27.1	·· 33.5	153°31.5	6.9'	17°21.7	-4.6'	58.9'
10	326°27.1	32.7	167°57.4	6.9'	17°17.0	-4.7'	58.9'
11	341°27.1	31.9	182°23.4	7.0'	17°12.2	-4.8'	58.9'
12	356°27.1	S14°31.0	196°49.4	7.0'	N17°07.4	-4.9'	58.9'
13	11°27.1	30.2	211°15.4	7.1'	17°02.4	-5.0'	58.8'
14	26°27.1	29.4	225°41.5	7.1'	16°57.3	-5.1'	58.8'
15	41°27.1	·· 28.6	240°07.7	7.2'	16°52.1	-5.2'	58.8'
16	56°27.1	27.8	254°33.9	7.2'	16°46.9	-5.3'	58.8'
17	71°27.1	27.0	269°00.1	7.3'	16°41.5	-5.4'	58.8'
18	86°27.0	S14°26.2	283°26.5	7.3'	N16°36.0	-5.5'	58.8'
19	101°27.0	25.4	297°52.8	7.4'	16°30.4	-5.6'	58.7'
20	116°27.0	24.6	312°19.2	7.5'	16°24.7	-5.7'	58.7'
21	131°27.0	·· 23.8	326°45.7	7.5'	16°18.9	-5.8'	58.7'
22	146°27.0	23.0	341°12.3	7.6'	16°13.0	-5.9'	58.7'
23	161°27.0	22.1	355°38.9	7.6'	16°07.0	-6.0'	58.7'
	SD.=16.2	d=0.8	S.D.=16.0				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.0	S14°21.3	10°05.5	7.7'	N16°01.0	-6.1'	58.6'
1	191°27.0	20.5	24°32.3	7.7'	15°54.8	-6.2'	58.6'
2	206°27.0	19.7	38°59.0	7.8'	15°48.5	-6.3'	58.6'
3	221°27.0	·· 18.9	53°25.9	7.9'	15°42.2	-6.4'	58.6'
4	236°27.0	18.1	67°52.8	7.9'	15°35.7	-6.5'	58.6'
5	251°26.9	17.3	82°19.7	8.0'	15°29.2	-6.6'	58.5'
6	266°26.9	S14°16.5	96°46.8	8.1'	N15°22.5	-6.7'	58.5'
7	281°26.9	15.6	111°13.9	8.1'	15°15.8	-6.8'	58.5'
8	296°26.9	14.8	125°41.0	8.2'	15°09.0	-6.9'	58.5'
9	311°26.9	·· 14.0	140°08.2	8.2'	15°02.1	-6.9'	58.5'
10	326°26.9	13.2	154°35.5	8.3'	14°55.1	-7.0'	58.4'
11	341°26.9	12.4	169°02.8	8.4'	14°48.1	-7.1'	58.4'
12	356°26.9	S14°11.6	183°30.3	8.4'	N14°40.9	-7.2'	58.4'
13	11°26.9	10.7	197°57.7	8.5'	14°33.7	-7.3'	58.4'
14	26°26.9	09.9	212°25.3	8.6'	14°26.4	-7.3'	58.3'
15	41°26.9	·· 09.1	226°52.9	8.6'	14°19.0	-7.4'	58.3'
16	56°26.9	08.3	241°20.5	8.7'	14°11.5	-7.5'	58.3'
17	71°26.9	07.5	255°48.3	8.8'	14°04.0	-7.6'	58.3'
18	86°26.9	S14°06.7	270°16.1	8.8'	N13°56.4	-7.7'	58.2'
19	101°26.9	05.8	284°43.9	8.9'	13°48.7	-7.7'	58.2'
20	116°26.9	05.0	299°11.9	9.0'	13°40.9	-7.8'	58.2'
21	131°26.9	·· 04.2	313°39.9	9.0'	13°33.1	-7.9'	58.2'
22	146°26.9	03.4	328°07.9	9.1'	13°25.1	-8.0'	58.2'
23	161°26.9	02.6	342°36.1	9.2'	13°17.2	-8.0'	58.1'
	SD.=16.2	d=0.8	S.D.=15.9				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°26.9	S14°01.7	357°04.3	9.2'	N13°09.1	-8.1'	58.1'
1	191°26.9	00.9	11°32.5	9.3'	13°01.0	-8.2'	58.1'
2	206°26.9	14°00.1	26°00.8	9.4'	12°52.8	-8.2'	58.1'
3	221°26.9	13°59.3	40°29.2	9.4'	12°44.5	-8.3'	58.0'
4	236°26.9	58.4	54°57.7	9.5'	12°36.2	-8.4'	58.0'
5	251°26.9	57.6	69°26.2	9.6'	12°27.8	-8.4'	58.0'
6	266°26.9	S13°56.8	83°54.8	9.6'	N12°19.4	-8.5'	58.0'
7	281°26.9	56.0	98°23.5	9.7'	12°10.9	-8.5'	57.9'
8	296°26.9	55.1	112°52.2	9.8'	12°02.3	-8.6'	57.9'
9	311°26.9	·· 54.3	127°21.0	9.8'	11°53.7	-8.7'	57.9'
10	326°26.9	53.5	141°49.9	9.9'	11°45.0	-8.7'	57.8'
11	341°26.9	52.7	156°18.8	10.0'	11°36.2	-8.8'	57.8'
12	356°26.9	S13°51.8	170°47.8	10.0'	N11°27.4	-8.8'	57.8'
13	11°26.9	51.0	185°16.9	10.1'	11°18.6	-8.9'	57.8'
14	26°26.9	50.2	199°46.0	10.2'	11°09.6	-8.9'	57.7'
15	41°26.9	·· 49.4	214°15.2	10.2'	11°00.7	-9.0'	57.7'
16	56°26.9	48.5	228°44.5	10.3'	10°51.7	-9.0'	57.7'
17	71°26.9	47.7	243°13.8	10.4'	10°42.6	-9.1'	57.7'
18	86°26.9	S13°46.9	257°43.2	10.4'	N10°33.5	-9.1'	57.6'
19	101°26.9	46.0	272°12.7	10.5'	10°24.3	-9.2'	57.6'
20	116°26.9	45.2	286°42.2	10.6'	10°15.1	-9.2'	57.6'
21	131°26.9	·· 44.4	301°11.8	10.6'	10°05.8	-9.3'	57.6'
22	146°26.9	43.6	315°41.4	10.7'	09°56.5	-9.3'	57.5'
23	161°27.0	42.7	330°11.1	10.7'	09°47.2	-9.4'	57.5'
	SD.=16.2	d=0.8	S.D.=15.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:35	07:57	09:22	15:08	16:33	17:56
N 70°	06:31	07:44	08:57	15:32	16:46	18:00
68°	06:27	07:34	08:38	15:51	16:56	18:03
66°	06:24	07:25	08:23	16:07	17:04	18:06
64°	06:22	07:18	08:11	16:19	17:12	18:08
62°	06:19	07:12	08:00	16:29	17:18	18:11
60°	06:17	07:06	07:51	16:38	17:23	18:13
N 58°	06:15	07:01	07:43	16:46	17:28	18:15
56°	06:13	06:57	07:36	16:53	17:33	18:17
54°	06:11	06:53	07:30	16:59	17:37	18:19
52°	06:09	06:49	07:24	17:05	17:40	18:20
50°	06:07	06:45	07:19	17:10	17:44	18:22
45°	06:03	06:38	07:08	17:21	17:51	18:26
N 40°	05:59	06:31	06:59	17:30	17:58	18:30
35°	05:55	06:25	06:51	17:38	18:04	18:34
30°	05:51	06:19	06:44	17:45	18:09	18:38
20°	05:43	06:09	06:32	17:57	18:20	18:46
N 10°	05:34	05:59	06:21	18:08	18:29	18:54
0°	05:25	05:49	06:11	18:18	18:39	19:04
S 10°	05:13	05:39	06:00	18:28	18:50	19:15
20°	04:59	05:26	05:49	18:39	19:02	19:29
30°	04:41	05:11	05:36	18:52	19:17	19:47
35°	04:30	05:02	05:29	18:59	19:26	19:58
40°	04:16	04:51	05:20	19:07	19:36	20:12
45°	03:58	04:38	05:10	19:17	19:49	20:29
S 50°	03:36	04:22	04:58	19:29	20:05	20:51
52°	03:24	04:14	04:52	19:35	20:13	21:02
54°	03:11	04:05	04:46	19:41	20:22	21:15
56°	02:56	03:55	04:39	19:48	20:32	21:30
58°	02:36	03:43	04:31	19:56	20:43	21:49
S 60°	02:12	03:30	04:22	20:05	20:56	22:12

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	12:14	14:26	16:24	09:35	09:19	09:10
N 70°	13:09	14:56	16:42	08:39	08:47	08:50
68°	13:43	15:19	16:57	08:05	08:24	08:34
66°	14:07	15:36	17:08	07:41	08:05	08:22
64°	14:26	15:51	17:18	07:21	07:50	08:11
62°	14:41	16:03	17:26	07:05	07:38	08:02
60°	14:54	16:13	17:33	06:52	07:27	07:54
N 58°	15:05	16:21	17:40	06:41	07:18	07:47
56°	15:15	16:29	17:45	06:31	07:10	07:41
54°	15:23	16:36	17:50	06:22	07:02	07:35
52°	15:31	16:42	17:55	06:14	06:56	07:30
50°	15:37	16:48	17:59	06:07	06:50	07:26
45°	15:52	17:00	18:07	05:52	06:37	07:16
N 40°	16:04	17:09	18:14	05:39	06:26	07:08
35°	16:14	17:18	18:21	05:28	06:17	07:01
30°	16:23	17:25	18:26	05:19	06:09	06:54
20°	16:39	17:38	18:35	05:03	05:55	06:43
N 10°	16:52	17:49	18:44	04:49	05:43	06:34
0°	17:05	17:59	18:51	04:35	05:31	06:25
S 10°	17:17	18:10	18:59	04:22	05:20	06:16
20°	17:31	18:21	19:07	04:07	05:07	06:06
30°	17:46	18:34	19:17	03:51	04:53	05:54
35°	17:55	18:41	19:22	03:41	04:45	05:48
40°	18:05	18:49	19:28	03:30	04:35	05:41
45°	18:17	18:59	19:35	03:17	04:24	05:32
S 50°	18:31	19:10	19:43	03:01	04:10	05:21
52°	18:38	19:16	19:47	02:54	04:04	05:16
54°	18:45	19:22	19:52	02:46	03:57	05:11
56°	18:54	19:28	19:56	02:36	03:49	05:05
58°	19:03	19:36	20:02	02:26	03:40	04:58
S 60°	19:14	19:44	20:07	02:13	03:30	04:51

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 12-14 97-100%
09	14:11	14:12	12:14	23:18	10:50	
10	14:12	14:12	12:14	–:–	11:45	
11	14:12	14:12	12:14	00:12	12:38	

February 12, 13, 14 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	142°14.0	138°07.5	N05°32.5	132°03.7	N04°09.0	300°19.7	S07°37.5	237°02.0	S22°04.2
1	157°16.5	153°08.6	33.5	147°04.5	09.7	315°22.2	37.4	252°04.2	04.2
2	172°18.9	168°09.8	34.5	162°05.3	10.5	330°24.7	37.4	267°06.5	04.2
3	187°21.4	183°11.0	·· 35.5	177°06.1	·· 11.2	345°27.2	·· 37.4	282°08.7	·· 04.2
4	202°23.9	198°12.1	36.5	192°06.8	12.0	0°29.7	37.4	297°11.0	04.2
5	217°26.3	213°13.3	37.5	207°07.6	12.7	15°32.2	37.3	312°13.2	04.2
6	232°28.8	228°14.5	N05°38.5	222°08.4	N04°13.5	30°34.8	S07°37.3	327°15.5	S22°04.2
7	247°31.3	243°15.7	39.5	237°09.1	14.3	45°37.3	37.3	342°17.7	04.2
8	262°33.7	258°16.9	40.5	252°09.9	15.0	60°39.8	37.2	357°20.0	04.2
9	277°36.2	273°18.0	·· 41.5	267°10.7	·· 15.8	75°42.3	·· 37.2	12°22.2	·· 04.2
10	292°38.7	288°19.2	42.5	282°11.5	16.5	90°44.8	37.2	27°24.5	04.2
11	307°41.1	303°20.4	43.5	297°12.2	17.3	105°47.3	37.2	42°26.7	04.2
12	322°43.6	318°21.6	N05°44.5	312°13.0	N04°18.0	120°49.8	S07°37.1	57°29.0	S22°04.2
13	337°46.0	333°22.8	45.5	327°13.8	18.8	135°52.3	37.1	72°31.2	04.2
14	352°48.5	348°24.0	46.5	342°14.6	19.5	150°54.8	37.1	87°33.5	04.2
15	7°51.0	3°25.2	·· 47.5	357°15.3	·· 20.3	165°57.3	·· 37.1	102°35.7	·· 04.2
16	22°53.4	18°26.4	48.5	12°16.1	21.1	180°59.8	37.0	117°38.0	04.2
17	37°55.9	33°27.6	49.5	27°16.9	21.8	196°02.3	37.0	132°40.2	04.2
18	52°58.4	48°28.8	N05°50.5	42°17.7	N04°22.6	211°04.8	S07°37.0	147°42.5	S22°04.2
19	68°00.8	63°30.0	51.5	57°18.4	23.3	226°07.3	36.9	162°44.7	04.2
20	83°03.3	78°31.2	52.5	72°19.2	24.1	241°09.8	36.9	177°47.0	04.3
21	98°05.8	93°32.4	·· 53.5	87°20.0	·· 24.8	256°12.4	·· 36.9	192°49.2	·· 04.3
22	113°08.2	108°33.6	54.5	102°20.7	25.6	271°14.9	36.9	207°51.5	04.3
23	128°10.7	123°34.9	55.4	117°21.5	26.3	286°17.4	36.8	222°53.7	04.3
Mer.pass.:14:29		v1.2 d1.0 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.1		v2.2 d-0.0 m0.6	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	143°13.2	138°36.1	N05°56.4	132°22.3	N04°27.1	301°19.9	S07°36.8	237°56.0	S22°04.3
1	158°15.6	153°37.3	57.4	147°23.1	27.8	316°22.4	36.8	252°58.2	04.3
2	173°18.1	168°38.5	58.4	162°23.8	28.6	331°24.9	36.7	268°00.5	04.3
3	188°20.5	183°39.7	05°59.4	177°24.6	·· 29.4	346°27.4	·· 36.7	283°02.7	·· 04.3
4	203°23.0	198°41.0	06°00.4	192°25.4	30.1	1°29.9	36.7	298°05.0	04.3
5	218°25.5	213°42.2	01.4	207°26.2	30.9	16°32.4	36.7	313°07.2	04.3
6	233°27.9	228°43.4	N06°02.4	222°26.9	N04°31.6	31°34.9	S07°36.6	328°09.5	S22°04.3
7	248°30.4	243°44.7	03.3	237°27.7	32.4	46°37.5	36.6	343°11.7	04.3
8	263°32.9	258°45.9	04.3	252°28.5	33.1	61°40.0	36.6	358°14.0	04.3
9	278°35.3	273°47.1	·· 05.3	267°29.3	·· 33.9	76°42.5	·· 36.5	13°16.2	·· 04.3
10	293°37.8	288°48.4	06.3	282°30.0	34.6	91°45.0	36.5	28°18.5	04.3
11	308°40.3	303°49.6	07.3	297°30.8	35.4	106°47.5	36.5	43°20.7	04.3
12	323°42.7	318°50.9	N06°08.3	312°31.6	N04°36.1	121°50.0	S07°36.4	58°23.0	S22°04.3
13	338°45.2	333°52.1	09.2	327°32.4	36.9	136°52.5	36.4	73°25.3	04.3
14	353°47.6	348°53.3	10.2	342°33.1	37.6	151°55.1	36.4	88°27.5	04.3
15	8°50.1	3°54.6	·· 11.2	357°33.9	·· 38.4	166°57.6	·· 36.4	103°29.8	·· 04.3
16	23°52.6	18°55.8	12.2	12°34.7	39.1	182°00.1	36.3	118°32.0	04.3
17	38°55.0	33°57.1	13.1	27°35.4	39.9	197°02.6	36.3	133°34.3	04.3
18	53°57.5	48°58.4	N06°14.1	42°36.2	N04°40.7	212°05.1	S07°36.3	148°36.5	S22°04.4
19	69°00.0	63°59.6	15.1	57°37.0	41.4	227°07.6	36.2	163°38.8	04.4
20	84°02.4	79°00.9	16.1	72°37.8	42.2	242°10.1	36.2	178°41.0	04.4
21	99°04.9	94°02.1	·· 17.0	87°38.5	·· 42.9	257°12.7	·· 36.2	193°43.3	·· 04.4
22	114°07.4	109°03.4	18.0	102°39.3	43.7	272°15.2	36.1	208°45.5	04.4
23	129°09.8	124°04.7	19.0	117°40.1	44.4	287°17.7	36.1	223°47.8	04.4
Mer.pass.:14:25		v1.2 d1.0 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.1		v2.3 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	144°12.3	139°05.9	N06°19.9	132°40.9	N04°45.2	302°20.2	S07°36.1	238°50.0	S22°04.4
1	159°14.8	154°07.2	20.9	147°41.6	45.9	317°22.7	36.0	253°52.3	04.4
2	174°17.2	169°08.5	21.9	162°42.4	46.7	332°25.2	36.0	268°54.6	04.4
3	189°19.7	184°09.8	·· 22.9	177°43.2	·· 47.4	347°27.8	·· 36.0	283°56.8	·· 04.4
4	204°22.1	199°11.1	23.8	192°44.0	48.2	2°30.3	35.9	298°59.1	04.4
5	219°24.6	214°12.3	24.8	207°44.7	48.9	17°32.8	35.9	314°01.3	04.4
6	234°27.1	229°13.6	N06°25.8	222°45.5	N04°49.7	32°35.3	S07°35.9	329°03.6	S22°04.4
7	249°29.5	244°14.9	26.7	237°46.3	50.4	47°37.8	35.8	344°05.8	04.4
8	264°32.0	259°16.2	27.7	252°47.0	51.2	62°40.4	35.8	359°08.1	04.4
9	279°34.5	274°17.5	·· 28.6	267°47.8	·· 51.9	77°42.9	·· 35.8	14°10.4	·· 04.4
10	294°36.9	289°18.8	29.6	282°48.6	52.7	92°45.4	35.7	29°12.6	04.4
11	309°39.4	304°20.1	30.6	297°49.4	53.4	107°47.9	35.7	44°14.9	04.4
12	324°41.9	319°21.4	N06°31.5	312°50.1	N04°54.2	122°50.4	S07°35.7	59°17.1	S22°04.4
13	339°44.3	334°22.7	32.5	327°50.9	54.9	137°53.0	35.7	74°19.4	04.4
14	354°46.8	349°24.0	33.4	342°51.7	55.7	152°55.5	35.6	89°21.6	04.4
15	9°49.2	4°25.3	·· 34.4	357°52.5	·· 56.4	167°58.0	·· 35.6	104°23.9	·· 04.4
16	24°51.7	19°26.6	35.4	12°53.2	57.2	183°00.5	35.5	119°26.1	04.4
17	39°54.2	34°27.9	36.3	27°54.0	57.9	198°03.0	35.5	134°28.4	04.5
18	54°56.6	49°29.2	N06°37.3	42°54.8	N04°58.7	213°05.6	S07°35.5	149°30.7	S22°04.5
19	69°59.1	64°30.5	38.2	57°55.6	04°59.4	228°08.1	35.4	164°32.9	04.5
20	85°01.6	79°31.8	39.2	72°56.3	05°00.2	243°10.6	35.4	179°35.2	04.5
21	100°04.0	94°33.1	·· 40.1	87°57.1	·· 00.9	258°13.1	·· 35.4	194°37.4	·· 04.5
22	115°06.5	109°34.5	41.1	102°57.9	01.7	273°15.7	35.3	209°39.7	04.5
23	130°09.0	124°35.8	42.0	117°58.6	02.4	288°18.2	35.3	224°42.0	04.5
Mer.pass.:14:21		v1.3 d1.0 m-4.4		v0.8 d0.8 m1.2		v2.5 d0.0 m-2.1		v2.3 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°41.2	29°11.1
Ankaa	353°13.6	-42°13.1
Schedar	349°38.0	56°37.9
Diphda	348°53.6	-17°53.8
Achernar	335°25.3	-57°09.4
Hamal	327°58.0	23°32.5
Polaris	316°42.0	89°20.4
Acamar	315°16.6	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.7	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.5	-8°11.3
Capella	280°30.5	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.7	-52°42.7
Sirius	258°31.3	-16°44.7
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.1
Suhail	222°50.1	-43°30.3
Miaplacidus	221°38.1	-69°47.4
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.2	61°39.3
Denebola	182°30.9	14°28.5
Gienah	175°49.5	-17°38.2
Acrux	173°05.9	-63°11.4
Gacrux	171°57.6	-57°12.3
Alioth	166°18.2	55°51.8
Spica	158°28.4	-11°15.0
Alkaid	152°56.8	49°13.5
Hadar	148°44.0	-60°27.0
Menkent	148°04.5	-36°27.0
Arcturus	145°53.4	19°05.5
Rigil Kent.	139°48.1	-60°53.9
Kochab	137°20.1	74°04.9
Zuben'ubi	137°02.6	-16°06.6
Alphecca	126°08.9	26°39.4
Antares	112°23.3	-26°27.9
Atria	107°23.0	-69°03.0
Sabik	102°09.8	-15°44.6
Shaula	96°18.7	-37°06.7
Rasalhague	96°04.3	12°32.9
Eltanin	90°45.3	51°29.1
Kaus Aust.	83°40.8	-34°22.3
Vega	80°37.6	38°47.9
Nunki	75°55.5	-26°16.3
Altair	62°06.1	8°54.8
Peacock	53°16.0	-56°40.6
Deneb	49°30.2	45°20.5
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.8

Feb 12 Sun	**SHA**	**Mer.pass**
Venus	355°53.4	14:46
Mars	349°49.7	15:11
Jupiter	158°05.7	03:58
Saturn	94°47.9	08:11

Feb 13 Mon	**SHA**	**Mer.pass**
Venus	355°22.9	14:44
Mars	349°09.1	15:10
Jupiter	158°06.7	03:54
Saturn	94°42.8	08:07

Feb 14 Tue	**SHA**	**Mer.pass**
Venus	354°53.7	14:42
Mars	348°28.6	15:08
Jupiter	158°07.9	03:50
Saturn	94°37.8	08:03

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.5395 sec ΔT = TT-UT1 = +68.6445 sec

2017 February 12 to Feb. 14 UT

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Sun	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	176°27.0	S13°41.9	344°40.9	10.8′	N09°37.8	-9.4′	57.5′
1	191°27.0	41.1	359°10.8	10.9′	09°28.4	-9.5′	57.4′
2	206°27.0	40.2	13°40.7	10.9′	09°18.9	-9.5′	57.4′
3	221°27.0	·· 39.4	28°10.6	11.0′	09°09.4	-9.5′	57.4′
4	236°27.0	38.6	42°40.6	11.1′	08°59.8	-9.6′	57.4′
5	251°27.0	37.7	57°10.7	11.1′	08°50.3	-9.6′	57.3′
6	266°27.0	S13°36.9	71°40.9	11.2′	N08°40.6	-9.6′	57.3′
7	281°27.0	36.1	86°11.1	11.2′	08°31.0	-9.7′	57.3′
8	296°27.0	35.2	100°41.4	11.3′	08°21.3	-9.7′	57.2′
9	311°27.0	·· 34.4	115°11.7	11.4′	08°11.6	-9.7′	57.2′
10	326°27.1	33.6	129°42.1	11.4′	08°01.8	-9.8′	57.2′
11	341°27.1	32.7	144°12.5	11.5′	07°52.0	-9.8′	57.2′
12	356°27.1	S13°31.9	158°43.1	11.5′	N07°42.2	-9.8′	57.1′
13	11°27.1	31.1	173°13.6	11.6′	07°32.4	-9.9′	57.1′
14	26°27.1	30.2	187°44.3	11.7′	07°22.5	-9.9′	57.1′
15	41°27.1	·· 29.4	202°14.9	11.7′	07°12.6	-9.9′	57.0′
16	56°27.1	28.5	216°45.7	11.8′	07°02.6	-9.9′	57.0′
17	71°27.1	27.7	231°16.5	11.8′	06°52.7	-10.0′	57.0′
18	86°27.1	S13°26.9	245°47.3	11.9′	N06°42.7	-10.0′	57.0′
19	101°27.2	26.0	260°18.2	11.9′	06°32.7	-10.0′	56.9′
20	116°27.2	25.2	274°49.2	12.0′	06°22.7	-10.0′	56.9′
21	131°27.2	·· 24.4	289°20.2	12.0′	06°12.7	-10.1′	56.9′
22	146°27.2	23.5	303°51.3	12.1′	06°02.6	-10.1′	56.8′
23	161°27.2	22.7	318°22.4	12.2′	05°52.5	-10.1′	56.8′
	SD.=16.2	d=0.8		S.D.=15.6			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.2	S13°21.8	332°53.6	12.2′	N05°42.4	-10.1′	56.8′
1	191°27.3	21.0	347°24.8	12.3′	05°32.3	-10.1′	56.8′
2	206°27.3	20.2	1°56.1	12.3′	05°22.2	-10.1′	56.7′
3	221°27.3	·· 19.3	16°27.4	12.4′	05°12.0	-10.2′	56.7′
4	236°27.3	18.5	30°58.8	12.4′	05°01.9	-10.2′	56.7′
5	251°27.3	17.6	45°30.2	12.5′	04°51.7	-10.2′	56.6′
6	266°27.3	S13°16.8	60°01.7	12.5′	N04°41.5	-10.2′	56.6′
7	281°27.4	15.9	74°33.3	12.6′	04°31.3	-10.2′	56.6′
8	296°27.4	15.1	89°04.8	12.6′	04°21.1	-10.2′	56.6′
9	311°27.4	·· 14.3	103°36.5	12.7′	04°10.9	-10.2′	56.5′
10	326°27.4	13.4	118°08.1	12.7′	04°00.6	-10.2′	56.5′
11	341°27.4	12.6	132°39.9	12.7′	03°50.4	-10.2′	56.5′
12	356°27.4	S13°11.7	147°11.6	12.8′	N03°40.2	-10.2′	56.4′
13	11°27.5	10.9	161°43.4	12.8′	03°29.9	-10.3′	56.4′
14	26°27.5	10.0	176°15.3	12.9′	03°19.6	-10.3′	56.4′
15	41°27.5	·· 09.2	190°47.2	12.9′	03°09.4	-10.3′	56.4′
16	56°27.5	08.3	205°19.1	13.0′	02°59.1	-10.3′	56.3′
17	71°27.5	07.5	219°51.1	13.0′	02°48.9	-10.3′	56.3′
18	86°27.6	S13°06.6	234°23.1	13.0′	N02°38.6	-10.3′	56.3′
19	101°27.6	05.8	248°55.2	13.1′	02°28.3	-10.3′	56.2′
20	116°27.6	04.9	263°27.3	13.1′	02°18.0	-10.3′	56.2′
21	131°27.6	·· 04.1	277°59.5	13.2′	02°07.8	-10.3′	56.2′
22	146°27.6	03.3	292°31.7	13.2′	01°57.5	-10.3′	56.2′
23	161°27.7	02.4	307°03.9	13.2′	01°47.2	-10.3′	56.1′
	SD.=16.2	d=0.8		S.D.=15.4			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.7	S13°01.6	321°36.2	13.3′	N01°37.0	-10.3′	56.1′
1	191°27.7	13°00.7	336°08.5	13.3′	01°26.7	-10.3′	56.1′
2	206°27.7	12°59.9	350°40.8	13.4′	01°16.5	-10.3′	56.0′
3	221°27.8	·· 59.0	5°13.2	13.4′	01°06.2	-10.2′	56.0′
4	236°27.8	58.2	19°45.6	13.4′	00°56.0	-10.2′	56.0′
5	251°27.8	57.3	34°18.0	13.5′	00°45.7	-10.2′	56.0′
6	266°27.8	S12°56.5	48°50.5	13.5′	N00°35.5	-10.2′	55.9′
7	281°27.9	55.6	63°23.0	13.5′	00°25.3	-10.2′	55.9′
8	296°27.9	54.7	77°55.6	13.6′	00°15.1	-10.2′	55.9′
9	311°27.9	·· 53.9	92°28.1	13.6′	N00°04.9	-10.2′	55.9′
10	326°27.9	53.0	107°00.8	13.6′	S00°05.3	-10.2′	55.8′
11	341°28.0	52.2	121°33.4	13.7′	00°15.5	-10.2′	55.8′
12	356°28.0	S12°51.3	136°06.1	13.7′	S00°25.7	-10.2′	55.8′
13	11°28.0	50.5	150°38.8	13.7′	00°35.9	-10.2′	55.7′
14	26°28.0	49.6	165°11.5	13.7′	00°46.0	-10.1′	55.7′
15	41°28.1	·· 48.8	179°44.3	13.8′	00°56.1	-10.1′	55.7′
16	56°28.1	47.9	194°17.0	13.8′	01°06.2	-10.1′	55.7′
17	71°28.1	47.1	208°49.9	13.8′	01°16.3	-10.1′	55.6′
18	86°28.2	S12°46.2	223°22.7	13.9′	S01°26.4	-10.1′	55.6′
19	101°28.2	45.3	237°55.6	13.9′	01°36.5	-10.1′	55.6′
20	116°28.2	44.5	252°28.4	13.9′	01°46.6	-10.0′	55.6′
21	131°28.2	·· 43.6	267°01.4	13.9′	01°56.6	-10.0′	55.5′
22	146°28.3	42.8	281°34.3	13.9′	02°06.6	-10.0′	55.5′
23	161°28.3	41.9	296°07.2	14.0′	02°16.6	-10.0′	55.5′
	SD.=16.2	d=0.8		S.D.=15.2			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:22	07:43	09:04	15:26	16:47	18:08
N 70°	06:20	07:32	08:42	15:47	16:58	18:11
68°	06:17	07:23	08:26	16:04	17:07	18:13
66°	06:15	07:16	08:12	16:17	17:14	18:15
64°	06:13	07:09	08:01	16:29	17:20	18:16
62°	06:12	07:04	07:51	16:38	17:26	18:18
60°	06:10	06:59	07:43	16:46	17:31	18:20
N 58°	06:08	06:54	07:36	16:53	17:35	18:21
56°	06:07	06:50	07:29	17:00	17:39	18:23
54°	06:05	06:47	07:24	17:05	17:42	18:24
52°	06:04	06:43	07:19	17:11	17:46	18:25
50°	06:02	06:40	07:14	17:15	17:49	18:27
45°	05:59	06:33	07:04	17:25	17:56	18:30
N 40°	05:56	06:27	06:55	17:34	18:01	18:33
35°	05:52	06:22	06:48	17:41	18:07	18:37
30°	05:49	06:17	06:41	17:47	18:12	18:40
20°	05:42	06:08	06:30	17:58	18:21	18:47
N 10°	05:34	05:59	06:20	18:08	18:30	18:55
0°	05:25	05:50	06:11	18:18	18:39	19:03
S 10°	05:14	05:40	06:01	18:27	18:49	19:14
20°	05:01	05:28	05:51	18:37	19:00	19:27
30°	04:44	05:14	05:39	18:49	19:14	19:44
35°	04:33	05:05	05:32	18:56	19:23	19:54
40°	04:20	04:55	05:24	19:04	19:32	20:07
45°	04:04	04:43	05:15	19:13	19:45	20:23
S 50°	03:43	04:28	05:03	19:24	20:00	20:44
52°	03:32	04:20	04:58	19:29	20:07	20:54
54°	03:20	04:12	04:52	19:35	20:15	21:06
56°	03:06	04:03	04:46	19:41	20:24	21:20
58°	02:48	03:52	04:38	19:49	20:34	21:37
S 60°	02:27	03:40	04:30	19:57	20:46	21:58

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	18:15	19:59	21:40	09:03	08:56	08:50
N 70°	18:24	20:02	21:37	08:51	08:51	08:50
68°	18:32	20:05	21:34	08:41	08:46	08:50
66°	18:39	20:07	21:32	08:33	08:42	08:50
64°	18:45	20:09	21:30	08:26	08:39	08:50
62°	18:49	20:10	21:29	08:20	08:36	08:50
60°	18:54	20:12	21:28	08:15	08:33	08:50
N 58°	18:57	20:13	21:26	08:11	08:31	08:50
56°	19:01	20:14	21:25	08:07	08:29	08:50
54°	19:03	20:15	21:24	08:03	08:27	08:50
52°	19:06	20:16	21:24	08:00	08:26	08:50
50°	19:09	20:17	21:23	07:57	08:24	08:50
45°	19:14	20:18	21:21	07:50	08:21	08:50
N 40°	19:18	20:20	21:20	07:45	08:18	08:50
35°	19:22	20:21	21:19	07:40	08:16	08:50
30°	19:25	20:22	21:18	07:35	08:14	08:50
20°	19:31	20:24	21:16	07:28	08:10	08:49
N 10°	19:36	20:26	21:14	07:21	08:06	08:49
0°	19:41	20:27	21:13	07:15	08:03	08:49
S 10°	19:45	20:29	21:11	07:09	08:00	08:49
20°	19:50	20:31	21:10	07:02	07:57	08:49
30°	19:56	20:33	21:08	06:55	07:53	08:49
35°	19:59	20:34	21:07	06:50	07:51	08:49
40°	20:03	20:35	21:06	06:45	07:48	08:49
45°	20:07	20:37	21:05	06:39	07:45	08:49
S 50°	20:12	20:39	21:03	06:32	07:41	08:49
52°	20:15	20:39	21:03	06:29	07:40	08:48
54°	20:17	20:40	21:02	06:25	07:38	08:48
56°	20:20	20:41	21:01	06:21	07:36	08:48
58°	20:23	20:42	21:00	06:17	07:33	08:48
S 60°	20:27	20:44	20:59	06:12	07:31	08:48

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 15-17 97-87%
12	14:12	14:12	12:14	01:03	13:28	
13	14:11	14:10	12:14	01:52	14:15	
14	14:09	14:08	12:14	02:38	15:01	

February 15, 16, 17 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	145°11.4	139°37.1	N06°43.0	132°59.4	N05°03.2	303°20.7	S07°35.3	239°44.2	S22°04.5
1	160°13.9	154°38.4	43.9	148°00.2	03.9	318°23.2	35.2	254°46.5	04.5
2	175°16.4	169°39.8	44.9	163°01.0	04.7	333°25.8	35.2	269°48.7	04.5
3	190°18.8	184°41.1	·· 45.8	178°01.7	·· 05.4	348°28.3	·· 35.2	284°51.0	·· 04.5
4	205°21.3	199°42.4	46.8	193°02.5	06.2	3°30.8	35.1	299°53.2	04.5
5	220°23.7	214°43.8	47.7	208°03.3	06.9	18°33.3	35.1	314°55.5	04.5
6	235°26.2	229°45.1	N06°48.7	223°04.1	N05°07.7	33°35.9	S07°35.1	329°57.8	S22°04.5
7	250°28.7	244°46.5	49.6	238°04.8	08.4	48°38.4	35.0	345°00.0	04.5
8	265°31.1	259°47.8	50.6	253°05.6	09.2	63°40.9	35.0	0°02.3	04.5
9	280°33.6	274°49.2	·· 51.5	268°06.4	·· 09.9	78°43.4	·· 35.0	15°04.5	·· 04.5
10	295°36.1	289°50.5	52.4	283°07.1	10.7	93°46.0	34.9	30°06.8	04.5
11	310°38.5	304°51.9	53.4	298°07.9	11.4	108°48.5	34.9	45°09.1	04.5
12	325°41.0	319°53.2	N06°54.3	313°08.7	N05°12.2	123°51.0	S07°34.9	60°11.3	S22°04.5
13	340°43.5	334°54.6	55.3	328°09.5	12.9	138°53.6	34.8	75°13.6	04.5
14	355°45.9	349°55.9	56.2	343°10.2	13.7	153°56.1	34.8	90°15.8	04.5
15	10°48.4	4°57.3	·· 57.1	358°11.0	·· 14.4	168°58.6	·· 34.7	105°18.1	·· 04.5
16	25°50.9	19°58.6	58.1	13°11.8	15.1	184°01.1	34.7	120°20.4	04.5
17	40°53.3	35°00.0	59.0	28°12.6	15.9	199°03.7	34.7	135°22.6	04.5
18	55°55.8	50°01.4	N06°59.9	43°13.3	N05°16.6	214°06.2	S07°34.6	150°24.9	S22°04.6
19	70°58.2	65°02.7	07°00.9	58°14.1	17.4	229°08.7	34.6	165°27.1	04.6
20	86°00.7	80°04.1	01.8	73°14.9	18.1	244°11.3	34.6	180°29.4	04.6
21	101°03.2	95°05.5	·· 02.7	88°15.6	·· 18.9	259°13.8	·· 34.5	195°31.7	·· 04.6
22	116°05.6	110°06.9	03.7	103°16.4	19.6	274°16.3	34.5	210°33.9	04.6
23	131°08.1	125°08.2	04.6	118°17.2	20.4	289°18.9	34.5	225°36.2	04.6
Mer.pass.:14:17		v1.3 d0.9 m-4.4		v0.8 d0.7 m1.2		v2.5 d0.0 m-2.1		v2.3 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	146°10.6	140°09.6	N07°05.5	133°18.0	N05°21.1	304°21.4	S07°34.4	240°38.5	S22°04.6
1	161°13.0	155°11.0	06.5	148°18.7	21.9	319°23.9	34.4	255°40.7	04.6
2	176°15.5	170°12.4	07.4	163°19.5	22.6	334°26.5	34.3	270°43.0	04.6
3	191°18.0	185°13.8	·· 08.3	178°20.3	·· 23.4	349°29.0	·· 34.3	285°45.2	·· 04.6
4	206°20.4	200°15.2	09.2	193°21.1	24.1	4°31.5	34.3	300°47.5	04.6
5	221°22.9	215°16.6	10.2	208°21.8	24.9	19°34.1	34.2	315°49.8	04.6
6	236°25.3	230°18.0	N07°11.1	223°22.6	N05°25.6	34°36.6	S07°34.2	330°52.0	S22°04.6
7	251°27.8	245°19.4	12.0	238°23.4	26.3	49°39.1	34.1	345°54.3	04.6
8	266°30.3	260°20.8	12.9	253°24.1	27.1	64°41.7	34.1	0°56.6	04.6
9	281°32.7	275°22.2	·· 13.9	268°24.9	·· 27.8	79°44.2	·· 34.1	15°58.8	·· 04.6
10	296°35.2	290°23.6	14.8	283°25.7	28.6	94°46.7	34.0	31°01.1	04.6
11	311°37.7	305°25.0	15.7	298°26.5	29.3	109°49.3	34.0	46°03.3	04.6
12	326°40.1	320°26.4	N07°16.6	313°27.2	N05°30.1	124°51.8	S07°34.0	61°05.6	S22°04.6
13	341°42.6	335°27.8	17.5	328°28.0	30.8	139°54.3	33.9	76°07.9	04.6
14	356°45.1	350°29.2	18.4	343°28.8	31.6	154°56.9	33.9	91°10.1	04.6
15	11°47.5	5°30.7	·· 19.4	358°29.6	·· 32.3	169°59.4	·· 33.8	106°12.4	·· 04.6
16	26°50.0	20°32.1	20.3	13°30.3	33.0	185°01.9	33.8	121°14.7	04.6
17	41°52.5	35°33.5	21.2	28°31.1	33.8	200°04.5	33.8	136°16.9	04.6
18	56°54.9	50°34.9	N07°22.1	43°31.9	N05°34.5	215°07.0	S07°33.7	151°19.2	S22°04.6
19	71°57.4	65°36.4	23.0	58°32.6	35.3	230°09.6	33.7	166°21.4	04.6
20	86°59.8	80°37.8	23.9	73°33.4	36.0	245°12.1	33.6	181°23.7	04.7
21	102°02.3	95°39.2	·· 24.8	88°34.2	·· 36.8	260°14.6	·· 33.6	196°26.0	·· 04.7
22	117°04.8	110°40.7	25.7	103°35.0	37.5	275°17.2	33.6	211°28.2	04.7
23	132°07.2	125°42.1	26.6	118°35.7	38.3	290°19.7	33.5	226°30.5	04.7
Mer.pass.:14:13		v1.4 d0.9 m-4.5		v0.8 d0.7 m1.2		v2.5 d0.0 m-2.1		v2.3 d-0.0 m0.5	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	147°09.7	140°43.5	N07°27.6	133°36.5	N05°39.0	305°22.2	S07°33.5	241°32.8	S22°04.7
1	162°12.2	155°45.0	28.5	148°37.3	39.7	320°24.8	33.4	256°35.0	04.7
2	177°14.6	170°46.4	29.4	163°38.1	40.5	335°27.3	33.4	271°37.3	04.7
3	192°17.1	185°47.9	·· 30.3	178°38.8	·· 41.2	350°29.9	·· 33.4	286°39.6	·· 04.7
4	207°19.6	200°49.3	31.2	193°39.6	42.0	5°32.4	33.3	301°41.8	04.7
5	222°22.0	215°50.8	32.1	208°40.4	42.7	20°34.9	33.3	316°44.1	04.7
6	237°24.5	230°52.2	N07°33.0	223°41.1	N05°43.5	35°37.5	S07°33.2	331°46.4	S22°04.7
7	252°26.9	245°53.7	33.9	238°41.9	44.2	50°40.0	33.2	346°48.6	04.7
8	267°29.4	260°55.2	34.8	253°42.7	44.9	65°42.6	33.2	1°50.9	04.7
9	282°31.9	275°56.6	·· 35.7	268°43.5	·· 45.7	80°45.1	·· 33.1	16°53.2	·· 04.7
10	297°34.3	290°58.1	36.6	283°44.2	46.4	95°47.7	33.1	31°55.4	04.7
11	312°36.8	305°59.6	37.5	298°45.0	47.2	110°50.2	33.0	46°57.7	04.7
12	327°39.3	321°01.0	N07°38.4	313°45.8	N05°47.9	125°52.7	S07°33.0	62°00.0	S22°04.7
13	342°41.7	336°02.5	39.2	328°46.5	48.7	140°55.3	33.0	77°02.2	04.7
14	357°44.2	351°04.0	40.1	343°47.3	49.4	155°57.8	32.9	92°04.5	04.7
15	12°46.7	6°05.5	·· 41.0	358°48.1	·· 50.1	171°00.4	·· 32.9	107°06.8	·· 04.7
16	27°49.1	21°06.9	41.9	13°48.9	50.9	186°02.9	32.8	122°09.0	04.7
17	42°51.6	36°08.4	42.8	28°49.6	51.6	201°05.5	32.8	137°11.3	04.7
18	57°54.1	51°09.9	N07°43.7	43°50.4	N05°52.4	216°08.0	S07°32.7	152°13.6	S22°04.7
19	72°56.5	66°11.4	44.6	58°51.2	53.1	231°10.6	32.7	167°15.8	04.7
20	87°59.0	81°12.9	45.5	73°51.9	53.9	246°13.1	32.7	182°18.1	04.7
21	103°01.4	96°14.4	·· 46.4	88°52.7	·· 54.6	261°15.6	·· 32.6	197°20.4	·· 04.7
22	118°03.9	111°15.9	47.2	103°53.5	55.3	276°18.2	32.6	212°22.6	04.7
23	133°06.4	126°17.4	48.1	118°54.3	56.1	291°20.7	32.5	227°24.9	04.7
Mer.pass.:14:09		v1.4 d0.9 m-4.5		v0.8 d0.7 m1.2		v2.5 d0.0 m-2.1		v2.3 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.6	-42°13.1
Schedar	349°38.0	56°37.9
Diphda	348°53.7	-17°53.8
Achernar	335°25.3	-57°09.4
Hamal	327°58.1	23°32.5
Polaris	316°43.5	89°20.4
Acamar	315°16.6	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.8	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.5	-8°11.3
Capella	280°30.6	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.7	-52°42.7
Sirius	258°31.3	-16°44.7
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.3	-59°34.1
Suhail	222°50.1	-43°30.3
Miaplacidus	221°38.1	-69°47.4
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.2	61°39.4
Denebola	182°30.9	14°28.5
Gienah	175°49.5	-17°38.2
Acrux	173°05.9	-63°11.4
Gacrux	171°57.6	-57°12.3
Alioth	166°18.2	55°51.8
Spica	158°28.4	-11°15.0
Alkaid	152°56.8	49°13.5
Hadar	148°44.0	-60°27.0
Menkent	148°04.4	-36°27.0
Arcturus	145°53.4	19°05.5
Rigil Kent.	139°48.0	-60°53.9
Kochab	137°20.0	74°04.9
Zuben'ubi	137°02.6	-16°06.6
Alphecca	126°08.9	26°39.4
Antares	112°23.3	-26°27.9
Atria	107°23.0	-69°03.0
Sabik	102°09.8	-15°44.6
Shaula	96°18.7	-37°06.7
Rasalhague	96°04.3	12°32.9
Eltanin	90°45.3	51°29.1
Kaus Aust.	83°40.8	-34°22.3
Vega	80°37.6	38°47.9
Nunki	75°55.5	-26°16.3
Altair	62°06.1	8°54.8
Peacock	53°16.0	-56°40.6
Deneb	49°30.2	45°20.5
Enif	33°45.0	9°57.2
Al Na'ir	27°41.2	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.8

Feb 15 Wed	**SHA**	**Mer.pass**
Venus	354°25.7	14:40
Mars	347°48.0	15:07
Jupiter	158°09.3	03:46
Saturn	94°32.8	08:00

Feb 16 Thu	**SHA**	**Mer.pass**
Venus	353°59.1	14:38
Mars	347°07.4	15:06
Jupiter	158°10.8	03:42
Saturn	94°27.9	07:56

Feb 17 Fri	**SHA**	**Mer.pass**
Venus	353°33.8	14:36
Mars	346°26.8	15:05
Jupiter	158°12.5	03:38
Saturn	94°23.1	07:53

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.5355 sec ΔT = TT-UT1 = +68.6485 sec

2017 February 15 to Feb. 17 UT

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°28.3	S12°41.1	310°40.2	14.0'	S02°26.6	-10.0'	55.5'
1	191°28.4	40.2	325°13.2	14.0'	02°36.5	-9.9'	55.4'
2	206°28.4	39.3	339°46.3	14.0'	02°46.5	-9.9'	55.4'
3	221°28.4	·· 38.5	354°19.3	14.1'	02°56.4	-9.9'	55.4'
4	236°28.5	37.6	8°52.4	14.1'	03°06.3	-9.9'	55.4'
5	251°28.5	36.8	23°25.4	14.1'	03°16.1	-9.9'	55.3'
6	266°28.5	S12°35.9	37°58.5	14.1'	S03°26.0	-9.8'	55.3'
7	281°28.6	35.0	52°31.7	14.1'	03°35.8	-9.8'	55.3'
8	296°28.6	34.2	67°04.8	14.1'	03°45.6	-9.8'	55.3'
9	311°28.6	·· 33.3	81°37.9	14.2'	03°55.4	-9.8'	55.3'
10	326°28.6	32.5	96°11.1	14.2'	04°05.1	-9.7'	55.2'
11	341°28.7	31.6	110°44.3	14.2'	04°14.8	-9.7'	55.2'
12	356°28.7	S12°30.7	125°17.5	14.2'	S04°24.5	-9.7'	55.2'
13	11°28.8	29.9	139°50.7	14.2'	04°34.2	-9.6'	55.2'
14	26°28.8	29.0	154°23.9	14.2'	04°43.8	-9.6'	55.1'
15	41°28.8	·· 28.1	168°57.1	14.2'	04°53.4	-9.6'	55.1'
16	56°28.9	27.3	183°30.4	14.2'	05°03.0	-9.6'	55.1'
17	71°28.9	26.4	198°03.6	14.3'	05°12.5	-9.5'	55.1'
18	86°28.9	S12°25.6	212°36.9	14.3'	S05°22.0	-9.5'	55.1'
19	101°29.0	24.7	227°10.2	14.3'	05°31.5	-9.5'	55.0'
20	116°29.0	23.8	241°43.5	14.3'	05°41.0	-9.4'	55.0'
21	131°29.0	·· 23.0	256°16.7	14.3'	05°50.4	-9.4'	55.0'
22	146°29.1	22.1	270°50.0	14.3'	05°59.8	-9.4'	55.0'
23	161°29.1	21.2	285°23.3	14.3'	06°09.1	-9.3'	55.0'
	SD.=16.2	d=0.9	S.D.=15.0				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°29.1	S12°20.4	299°56.7	14.3'	S06°18.5	-9.3'	54.9'
1	191°29.2	19.5	314°30.0	14.3'	06°27.7	-9.3'	54.9'
2	206°29.2	18.6	329°03.3	14.3'	06°37.0	-9.2'	54.9'
3	221°29.3	·· 17.8	343°36.6	14.3'	06°46.2	-9.2'	54.9'
4	236°29.3	16.9	358°10.0	14.3'	06°55.4	-9.2'	54.9'
5	251°29.3	16.0	12°43.3	14.3'	07°04.5	-9.1'	54.8'
6	266°29.4	S12°15.2	27°16.6	14.3'	S07°13.6	-9.1'	54.8'
7	281°29.4	14.3	41°50.0	14.3'	07°22.7	-9.0'	54.8'
8	296°29.5	13.4	56°23.3	14.3'	07°31.7	-9.0'	54.8'
9	311°29.5	·· 12.6	70°56.7	14.3'	07°40.7	-9.0'	54.8'
10	326°29.5	11.7	85°30.0	14.3'	07°49.7	-8.9'	54.7'
11	341°29.6	10.8	100°03.3	14.3'	07°58.6	-8.9'	54.7'
12	356°29.6	S12°09.9	114°36.7	14.3'	S08°07.5	-8.9'	54.7'
13	11°29.7	09.1	129°10.0	14.3'	08°16.3	-8.8'	54.7'
14	26°29.7	08.2	143°43.4	14.3'	08°25.1	-8.8'	54.7'
15	41°29.7	·· 07.3	158°16.7	14.3'	08°33.8	-8.7'	54.7'
16	56°29.8	06.5	172°50.0	14.3'	08°42.5	-8.7'	54.6'
17	71°29.8	05.6	187°23.3	14.3'	08°51.2	-8.6'	54.6'
18	86°29.9	S12°04.7	201°56.7	14.3'	S08°59.8	-8.6'	54.6'
19	101°29.9	03.8	216°30.0	14.3'	09°08.4	-8.6'	54.6'
20	116°30.0	03.0	231°03.3	14.3'	09°16.9	-8.5'	54.6'
21	131°30.0	·· 02.1	245°36.6	14.3'	09°25.4	-8.5'	54.6'
22	146°30.0	01.2	260°09.9	14.3'	09°33.9	-8.4'	54.6'
23	161°30.1	00.3	274°43.2	14.3'	09°42.3	-8.4'	54.5'
	SD.=16.2	d=0.9	S.D.=14.9				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	176°30.1	S11°59.5	289°16.5	14.3'	S09°50.6	-8.3'	54.5'
1	191°30.2	58.6	303°49.8	14.3'	09°58.9	-8.3'	54.5'
2	206°30.2	57.7	318°23.0	14.3'	10°07.2	-8.2'	54.5'
3	221°30.3	·· 56.8	332°56.3	14.3'	10°15.4	-8.2'	54.5'
4	236°30.3	56.0	347°29.5	14.2'	10°23.6	-8.1'	54.5'
5	251°30.4	55.1	2°02.8	14.2'	10°31.7	-8.1'	54.5'
6	266°30.4	S11°54.2	16°36.0	14.2'	S10°39.7	-8.0'	54.5'
7	281°30.5	53.3	31°09.2	14.2'	10°47.8	-8.0'	54.4'
8	296°30.5	52.5	45°42.4	14.2'	10°55.7	-7.9'	54.4'
9	311°30.6	·· 51.6	60°15.6	14.2'	11°03.6	-7.9'	54.4'
10	326°30.6	50.7	74°48.8	14.2'	11°11.5	-7.8'	54.4'
11	341°30.6	49.8	89°21.9	14.2'	11°19.3	-7.8'	54.4'
12	356°30.7	S11°48.9	103°55.1	14.1'	S11°27.1	-7.7'	54.4'
13	11°30.7	48.1	118°28.2	14.1'	11°34.8	-7.7'	54.4'
14	26°30.8	47.2	133°01.3	14.1'	11°42.5	-7.6'	54.4'
15	41°30.8	·· 46.3	147°34.4	14.1'	11°50.1	-7.6'	54.4'
16	56°30.9	45.4	162°07.5	14.1'	11°57.6	-7.5'	54.4'
17	71°30.9	44.5	176°40.6	14.1'	12°05.1	-7.5'	54.3'
18	86°31.0	S11°43.7	191°13.6	14.0'	S12°12.6	-7.4'	54.3'
19	101°31.0	42.8	205°46.7	14.0'	12°20.0	-7.4'	54.3'
20	116°31.1	41.9	220°19.7	14.0'	12°27.3	-7.3'	54.3'
21	131°31.1	·· 41.0	234°52.7	14.0'	12°34.6	-7.3'	54.3'
22	146°31.2	40.1	249°25.7	14.0'	12°41.8	-7.2'	54.3'
23	161°31.2	39.3	263°58.6	14.0'	12°49.0	-7.1'	54.3'
	SD.=16.2	d=0.9	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:09	07:29	08:47	15:43	17:01	18:21
N 70°	06:08	07:20	08:28	16:02	17:10	18:22
68°	06:07	07:12	08:13	16:16	17:17	18:23
66°	06:06	07:06	08:01	16:28	17:24	18:24
64°	06:05	07:00	07:51	16:38	17:29	18:25
62°	06:04	06:56	07:42	16:47	17:34	18:26
60°	06:03	06:51	07:35	16:54	17:38	18:27
N 58°	06:02	06:47	07:28	17:01	17:42	18:28
56°	06:01	06:44	07:23	17:06	17:45	18:28
54°	06:00	06:41	07:17	17:11	17:48	18:29
52°	05:59	06:38	07:13	17:16	17:51	18:30
50°	05:58	06:35	07:08	17:20	17:54	18:31
45°	05:55	06:29	06:59	17:29	18:00	18:34
N 40°	05:52	06:24	06:51	17:37	18:05	18:37
35°	05:49	06:19	06:45	17:44	18:10	18:39
30°	05:46	06:14	06:39	17:50	18:14	18:42
20°	05:40	06:06	06:29	18:00	18:22	18:48
N 10°	05:33	05:58	06:19	18:09	18:30	18:55
0°	05:25	05:49	06:11	18:17	18:39	19:03
S 10°	05:15	05:40	06:02	18:26	18:48	19:13
20°	05:03	05:30	05:52	18:36	18:58	19:25
30°	04:47	05:16	05:41	18:46	19:11	19:41
35°	04:37	05:08	05:35	18:53	19:19	19:51
40°	04:24	04:59	05:27	19:00	19:28	20:03
45°	04:09	04:48	05:19	19:08	19:40	20:18
S 50°	03:49	04:33	05:08	19:19	19:54	20:37
52°	03:40	04:27	05:04	19:23	20:00	20:47
54°	03:28	04:19	04:58	19:28	20:08	20:58
56°	03:15	04:10	04:52	19:34	20:16	21:10
58°	03:00	04:01	04:46	19:41	20:26	21:26
S 60°	02:40	03:49	04:38	19:48	20:37	21:44

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	23:18	–:–	00:57	08:43	08:37	08:30
N 70°	23:09	–:–	00:40	08:49	08:48	08:48
68°	23:02	–:–	00:27	08:53	08:57	09:02
66°	22:55	–:–	00:17	08:57	09:05	09:14
64°	22:50	–:–	00:08	09:00	09:11	09:24
62°	22:45	–:–	00:00	09:03	09:17	09:32
60°	22:41	23:53	–:–	09:05	09:22	09:40
N 58°	22:38	23:48	–:–	09:08	09:26	09:46
56°	22:35	23:42	–:–	09:10	09:30	09:52
54°	22:32	23:38	–:–	09:11	09:33	09:57
52°	22:29	23:34	–:–	09:13	09:36	10:01
50°	22:27	23:30	–:–	09:14	09:39	10:06
45°	22:22	23:22	–:–	09:17	09:46	10:15
N 40°	22:18	23:15	–:–	09:20	09:51	10:23
35°	22:15	23:09	–:–	09:22	09:55	10:29
30°	22:11	23:04	23:57	09:24	09:59	10:35
20°	22:06	22:56	23:45	09:28	10:06	10:45
N 10°	22:01	22:48	23:35	09:31	10:12	10:54
0°	21:57	22:41	23:25	09:34	10:18	11:02
S 10°	21:53	22:34	23:16	09:37	10:24	11:11
20°	21:48	22:26	23:06	09:40	10:30	11:19
30°	21:43	22:18	22:54	09:44	10:37	11:30
35°	21:40	22:13	22:48	09:46	10:41	11:36
40°	21:36	22:07	22:40	09:48	10:46	11:42
45°	21:33	22:01	22:31	09:51	10:51	11:50
S 50°	21:28	21:53	22:21	09:54	10:58	12:00
52°	21:26	21:50	22:16	09:55	11:00	12:04
54°	21:24	21:46	22:11	09:57	11:04	12:09
56°	21:21	21:42	22:05	09:59	11:07	12:14
58°	21:18	21:37	21:58	10:01	11:11	12:20
S 60°	21:15	21:32	21:51	10:03	11:16	12:27

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 18-20 80-62%
15	14:07	14:05	12:14	03:23	15:46	
16	14:03	14:02	12:14	04:08	16:30	
17	13:59	13:57	12:14	04:52	17:14	

February 18, 19, 20 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	148°08.8	141°18.9	N07°49.0	133°55.0	N05°56.8	306°23.3	S07°32.5	242°27.2	S22°04.8
1	163°11.3	156°20.4	49.9	148°55.8	57.6	321°25.8	32.4	257°29.4	04.8
2	178°13.8	171°21.9	50.8	163°56.6	58.3	336°28.4	32.4	272°31.7	04.8
3	193°16.2	186°23.4	·· 51.7	178°57.4	·· 59.0	351°30.9	·· 32.4	287°34.0	·· 04.8
4	208°18.7	201°24.9	52.5	193°58.1	05°59.8	6°33.5	32.3	302°36.3	04.8
5	223°21.2	216°26.4	53.4	208°58.9	06°00.5	21°36.0	32.3	317°38.5	04.8
6	238°23.6	231°28.0	N07°54.3	223°59.7	N06°01.3	36°38.6	S07°32.2	332°40.8	S22°04.8
7	253°26.1	246°29.5	55.2	239°00.4	02.0	51°41.1	32.2	347°43.1	04.8
8	268°28.6	261°31.0	56.0	254°01.2	02.7	66°43.7	32.1	2°45.3	04.8
9	283°31.0	276°32.5	·· 56.9	269°02.0	·· 03.5	81°46.2	·· 32.1	17°47.6	·· 04.8
10	298°33.5	291°34.1	57.8	284°02.8	04.2	96°48.8	32.1	32°49.9	04.8
11	313°35.9	306°35.6	58.7	299°03.5	05.0	111°51.3	32.0	47°52.1	04.8
12	328°38.4	321°37.1	N07°59.5	314°04.3	N06°05.7	126°53.9	S07°32.0	62°54.4	S22°04.8
13	343°40.9	336°38.7	08°00.4	329°05.1	06.4	141°56.4	31.9	77°56.7	04.8
14	358°43.3	351°40.2	01.3	344°05.8	07.2	156°59.0	31.9	92°58.9	04.8
15	13°45.8	6°41.7	·· 02.1	359°06.6	·· 07.9	172°01.5	·· 31.8	108°01.2	·· 04.8
16	28°48.3	21°43.3	03.0	14°07.4	08.7	187°04.1	31.8	123°03.5	04.8
17	43°50.7	36°44.8	03.9	29°08.2	09.4	202°06.6	31.7	138°05.8	04.8
18	58°53.2	51°46.4	N08°04.7	44°08.9	N06°10.1	217°09.2	S07°31.7	153°08.0	S22°04.8
19	73°55.7	66°47.9	05.6	59°09.7	10.9	232°11.7	31.6	168°10.3	04.8
20	88°58.1	81°49.5	06.5	74°10.5	11.6	247°14.3	31.6	183°12.6	04.8
21	104°00.6	96°51.0	·· 07.3	89°11.2	·· 12.4	262°16.8	·· 31.6	198°14.8	·· 04.8
22	119°03.0	111°52.6	08.2	104°12.0	13.1	277°19.4	31.5	213°17.1	04.8
23	134°05.5	126°54.2	09.0	119°12.8	13.8	292°21.9	31.5	228°19.4	04.8
Mer.pass.:14:05		v1.5 d0.9 m-4.5		v0.8 d0.7 m1.2		v2.5 d0.0 m-2.1		v2.3 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	149°08.0	141°55.7	N08°09.9	134°13.6	N06°14.6	307°24.5	S07°31.4	243°21.7	S22°04.8
1	164°10.4	156°57.3	10.8	149°14.3	15.3	322°27.0	31.4	258°23.9	04.8
2	179°12.9	171°58.9	11.6	164°15.1	16.0	337°29.6	31.3	273°26.2	04.8
3	194°15.4	187°00.4	·· 12.5	179°15.9	·· 16.8	352°32.1	·· 31.3	288°28.5	·· 04.8
4	209°17.8	202°02.0	13.3	194°16.6	17.5	7°34.7	31.2	303°30.7	04.8
5	224°20.3	217°03.6	14.2	209°17.4	18.3	22°37.3	31.2	318°33.0	04.8
6	239°22.8	232°05.2	N08°15.0	224°18.2	N06°19.0	37°39.8	S07°31.1	333°35.3	S22°04.8
7	254°25.2	247°06.8	15.9	239°19.0	19.7	52°42.4	31.1	348°37.6	04.9
8	269°27.7	262°08.3	16.7	254°19.7	20.5	67°44.9	31.1	3°39.8	04.9
9	284°30.2	277°09.9	·· 17.6	269°20.5	·· 21.2	82°47.5	·· 31.0	18°42.1	·· 04.9
10	299°32.6	292°11.5	18.4	284°21.3	21.9	97°50.0	31.0	33°44.4	04.9
11	314°35.1	307°13.1	19.3	299°22.0	22.7	112°52.6	30.9	48°46.7	04.9
12	329°37.5	322°14.7	N08°20.1	314°22.8	N06°23.4	127°55.2	S07°30.9	63°48.9	S22°04.9
13	344°40.0	337°16.3	20.9	329°23.6	24.2	142°57.7	30.8	78°51.2	04.9
14	359°42.5	352°17.9	21.8	344°24.3	24.9	158°00.3	30.8	93°53.5	04.9
15	14°44.9	7°19.5	·· 22.6	359°25.1	·· 25.6	173°02.8	·· 30.7	108°55.8	·· 04.9
16	29°47.4	22°21.1	23.5	14°25.9	26.4	188°05.4	30.7	123°58.0	04.9
17	44°49.9	37°22.8	24.3	29°26.7	27.1	203°07.9	30.6	139°00.3	04.9
18	59°52.3	52°24.4	N08°25.2	44°27.4	N06°27.8	218°10.5	S07°30.6	154°02.6	S22°04.9
19	74°54.8	67°26.0	26.0	59°28.2	28.6	233°13.1	30.5	169°04.9	04.9
20	89°57.3	82°27.6	26.8	74°29.0	29.3	248°15.6	30.5	184°07.1	04.9
21	104°59.7	97°29.2	·· 27.7	89°29.7	·· 30.0	263°18.2	·· 30.4	199°09.4	·· 04.9
22	120°02.2	112°30.9	28.5	104°30.5	30.8	278°20.7	30.4	214°11.7	04.9
23	135°04.7	127°32.5	29.3	119°31.3	31.5	293°23.3	30.3	229°14.0	04.9
Mer.pass.:14:01		v1.6 d0.9 m-4.5		v0.8 d0.7 m1.2		v2.6 d0.0 m-2.1		v2.3 d-0.0 m0.5	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	150°07.1	142°34.1	N08°30.2	134°32.1	N06°32.2	308°25.9	S07°30.3	244°16.2	S22°04.9
1	165°09.6	157°35.7	31.0	149°32.8	33.0	323°28.4	30.2	259°18.5	04.9
2	180°12.0	172°37.4	31.8	164°33.6	33.7	338°31.0	30.2	274°20.8	04.9
3	195°14.5	187°39.0	·· 32.6	179°34.4	·· 34.4	353°33.5	·· 30.1	289°23.1	·· 04.9
4	210°17.0	202°40.7	33.5	194°35.1	35.2	8°36.1	30.1	304°25.3	04.9
5	225°19.4	217°42.3	34.3	209°35.9	35.9	23°38.7	30.0	319°27.6	04.9
6	240°21.9	232°44.0	N08°35.1	224°36.7	N06°36.7	38°41.2	S07°30.0	334°29.9	S22°04.9
7	255°24.4	247°45.6	35.9	239°37.4	37.4	53°43.8	30.0	349°32.2	04.9
8	270°26.8	262°47.3	36.8	254°38.2	38.1	68°46.4	29.9	4°34.4	04.9
9	285°29.3	277°48.9	·· 37.6	269°39.0	·· 38.9	83°48.9	·· 29.9	19°36.7	·· 04.9
10	300°31.8	292°50.6	38.4	284°39.8	39.6	98°51.5	29.8	34°39.0	04.9
11	315°34.2	307°52.2	39.2	299°40.5	40.3	113°54.1	29.8	49°41.3	04.9
12	330°36.7	322°53.9	N08°40.1	314°41.3	N06°41.1	128°56.6	S07°29.7	64°43.5	S22°04.9
13	345°39.1	337°55.6	40.9	329°42.1	41.8	143°59.2	29.7	79°45.8	04.9
14	0°41.6	352°57.2	41.7	344°42.8	42.5	159°01.7	29.6	94°48.1	04.9
15	15°44.1	7°58.9	·· 42.5	359°43.6	·· 43.3	174°04.3	·· 29.6	109°50.4	·· 04.9
16	30°46.5	23°00.6	43.3	14°44.4	44.0	189°06.9	29.5	124°52.7	04.9
17	45°49.0	38°02.3	44.1	29°45.1	44.7	204°09.4	29.5	139°54.9	05.0
18	60°51.5	53°03.9	N08°44.9	44°45.9	N06°45.5	219°12.0	S07°29.4	154°57.2	S22°05.0
19	75°53.9	68°05.6	45.7	59°46.7	46.2	234°14.6	29.4	169°59.5	05.0
20	90°56.4	83°07.3	46.6	74°47.5	46.9	249°17.1	29.3	185°01.8	05.0
21	105°58.9	98°09.0	·· 47.4	89°48.2	·· 47.6	264°19.7	·· 29.2	200°04.0	·· 05.0
22	121°01.3	113°10.7	48.2	104°49.0	48.4	279°22.3	29.2	215°06.3	05.0
23	136°03.8	128°12.4	49.0	119°49.8	49.1	294°24.8	29.1	230°08.6	05.0
Mer.pass.:13:57		v1.6 d0.8 m-4.4		v0.8 d0.7 m1.2		v2.6 d0.0 m-2.1		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.6	-42°13.1
Schedar	349°38.0	56°37.9
Diphda	348°53.7	-17°53.8
Achernar	335°25.3	-57°09.4
Hamal	327°58.1	23°32.5
Polaris	316°44.8	89°20.4
Acamar	315°16.6	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.8	49°55.3
Aldebaran	290°46.4	16°32.4
Rigel	281°09.6	-8°11.3
Capella	280°30.6	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.7	-52°42.7
Sirius	258°31.3	-16°44.8
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.4	-59°34.2
Suhail	222°50.1	-43°30.3
Miaplacidus	221°38.1	-69°47.4
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.4
Denebola	182°30.9	14°28.5
Gienah	175°49.4	-17°38.2
Acrux	173°05.8	-63°11.4
Gacrux	171°57.5	-57°12.4
Alioth	166°18.2	55°51.8
Spica	158°28.4	-11°15.0
Alkaid	152°56.7	49°13.5
Hadar	148°43.9	-60°27.0
Menkent	148°04.4	-36°27.0
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°48.0	-60°54.0
Kochab	137°19.9	74°04.9
Zuben'ubi	137°02.6	-16°06.6
Alphecca	126°08.9	26°39.4
Antares	112°23.2	-26°27.9
Atria	107°22.9	-69°03.0
Sabik	102°09.8	-15°44.6
Shaula	96°18.7	-37°06.7
Rasalhague	96°04.3	12°32.9
Eltanin	90°45.2	51°29.1
Kaus Aust.	83°40.8	-34°22.3
Vega	80°37.5	38°47.9
Nunki	75°55.5	-26°16.3
Altair	62°06.1	8°54.8
Peacock	53°15.9	-56°40.6
Deneb	49°30.2	45°20.5
Enif	33°45.0	9°57.2
Al Na'ir	27°41.1	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.8

Feb 18 Sat	SHA	Mer.pass
Venus	353°10.0	14:33
Mars	345°46.2	15:04
Jupiter	158°14.4	03:34
Saturn	94°18.3	07:49

Feb 19 Sun	SHA	Mer.pass
Venus	352°47.7	14:31
Mars	345°05.6	15:02
Jupiter	158°16.5	03:30
Saturn	94°13.7	07:45

Feb 20 Mon	SHA	Mer.pass
Venus	352°27.0	14:28
Mars	344°24.9	15:01
Jupiter	158°18.7	03:26
Saturn	94°09.1	07:42

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.5316 sec ΔT = TT-UT1 = +68.6524 sec

2017 February 18 to Feb. 20 UT

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°31.3	S11°38.4	278°31.6	13.9'	S12°56.1	-7.1'	54.3'
1	191°31.3	37.5	293°04.5	13.9'	13°03.2	-7.0'	54.3'
2	206°31.4	36.6	307°37.4	13.9'	13°10.2	-7.0'	54.3'
3	221°31.5	·· 35.7	322°10.3	13.9'	13°17.1	-6.9'	54.3'
4	236°31.5	34.8	336°43.2	13.8'	13°24.0	-6.9'	54.3'
5	251°31.6	34.0	351°16.0	13.8'	13°30.8	-6.8'	54.3'
6	266°31.6	S11°33.1	5°48.8	13.8'	S13°37.6	-6.7'	54.3'
7	281°31.7	32.2	20°21.6	13.8'	13°44.3	-6.7'	54.3'
8	296°31.7	31.3	34°54.4	13.8'	13°50.9	-6.6'	54.2'
9	311°31.8	·· 30.4	49°27.1	13.7'	13°57.5	-6.6'	54.2'
10	326°31.8	29.5	63°59.8	13.7'	14°04.0	-6.5'	54.2'
11	341°31.9	28.7	78°32.5	13.7'	14°10.5	-6.4'	54.2'
12	356°31.9	S11°27.8	93°05.2	13.7'	S14°16.9	-6.4'	54.2'
13	11°32.0	26.9	107°37.9	13.6'	14°23.2	-6.3'	54.2'
14	26°32.1	26.0	122°10.5	13.6'	14°29.5	-6.2'	54.2'
15	41°32.1	·· 25.1	136°43.1	13.6'	14°35.7	-6.2'	54.2'
16	56°32.2	24.2	151°15.7	13.6'	14°41.8	-6.1'	54.2'
17	71°32.2	23.3	165°48.2	13.5'	14°47.9	-6.0'	54.2'
18	86°32.3	S11°22.4	180°20.7	13.5'	S14°53.9	-6.0'	54.2'
19	101°32.3	21.6	194°53.2	13.5'	14°59.9	-5.9'	54.2'
20	116°32.4	20.7	209°25.7	13.5'	15°05.8	-5.9'	54.2'
21	131°32.4	·· 19.8	223°58.2	13.4'	15°11.6	-5.8'	54.2'
22	146°32.5	18.9	238°30.6	13.4'	15°17.3	-5.7'	54.2'
23	161°32.6	18.0	253°03.0	13.4'	15°23.0	-5.7'	54.2'
	SD.=16.2	d=0.9	S.D.=14.8				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°32.6	S11°17.1	267°35.3	13.3'	S15°28.7	-5.6'	54.2'
1	191°32.7	16.2	282°07.6	13.3'	15°34.2	-5.5'	54.2'
2	206°32.7	15.3	296°40.0	13.3'	15°39.7	-5.4'	54.2'
3	221°32.8	·· 14.4	311°12.2	13.3'	15°45.1	-5.4'	54.2'
4	236°32.9	13.5	325°44.5	13.2'	15°50.4	-5.3'	54.2'
5	251°32.9	12.7	340°16.7	13.2'	15°55.7	-5.2'	54.2'
6	266°33.0	S11°11.8	354°48.9	13.2'	S16°00.9	-5.2'	54.2'
7	281°33.0	10.9	9°21.0	13.1'	16°06.1	-5.1'	54.2'
8	296°33.1	10.0	23°53.2	13.1'	16°11.1	-5.0'	54.2'
9	311°33.2	·· 09.1	38°25.3	13.1'	16°16.1	-5.0'	54.2'
10	326°33.2	08.2	52°57.3	13.1'	16°21.1	-4.9'	54.2'
11	341°33.3	07.3	67°29.4	13.0'	16°25.9	-4.8'	54.3'
12	356°33.3	S11°06.4	82°01.4	13.0'	S16°30.7	-4.7'	54.3'
13	11°33.4	05.5	96°33.3	13.0'	16°35.4	-4.7'	54.3'
14	26°33.5	04.6	111°05.3	12.9'	16°40.0	-4.6'	54.3'
15	41°33.5	·· 03.7	125°37.2	12.9'	16°44.6	-4.5'	54.3'
16	56°33.6	02.8	140°09.1	12.9'	16°49.1	-4.4'	54.3'
17	71°33.7	01.9	154°40.9	12.8'	16°53.5	-4.4'	54.3'
18	86°33.7	S11°01.0	169°12.7	12.8'	S16°57.8	-4.3'	54.3'
19	101°33.8	11°00.1	183°44.5	12.8'	17°02.1	-4.2'	54.3'
20	116°33.9	10°59.2	198°16.3	12.7'	17°06.3	-4.1'	54.3'
21	131°33.9	·· 58.3	212°48.0	12.7'	17°10.4	-4.1'	54.3'
22	146°34.0	57.4	227°19.7	12.7'	17°14.4	-4.0'	54.3'
23	161°34.0	56.6	241°51.4	12.6'	17°18.4	-3.9'	54.3'
	SD.=16.2	d=0.9	S.D.=14.8				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°34.1	S10°55.7	256°23.0	12.6'	S17°22.3	-3.8'	54.3'
1	191°34.2	54.8	270°54.6	12.6'	17°26.1	-3.8'	54.3'
2	206°34.2	53.9	285°26.2	12.5'	17°29.8	-3.7'	54.3'
3	221°34.3	·· 53.0	299°57.7	12.5'	17°33.4	-3.6'	54.4'
4	236°34.4	52.1	314°29.2	12.5'	17°37.0	-3.5'	54.4'
5	251°34.4	51.2	329°00.7	12.5'	17°40.5	-3.4'	54.4'
6	266°34.5	S10°50.3	343°32.1	12.4'	S17°43.9	-3.4'	54.4'
7	281°34.6	49.4	358°03.5	12.4'	17°47.2	-3.3'	54.4'
8	296°34.6	48.5	12°34.9	12.4'	17°50.5	-3.2'	54.4'
9	311°34.7	·· 47.6	27°06.2	12.3'	17°53.6	-3.1'	54.4'
10	326°34.8	46.7	41°37.5	12.3'	17°56.7	-3.0'	54.4'
11	341°34.9	45.8	56°08.8	12.3'	17°59.7	-3.0'	54.4'
12	356°34.9	S10°44.9	70°40.0	12.2'	S18°02.6	-2.9'	54.5'
13	11°35.0	44.0	85°11.2	12.2'	18°05.5	-2.8'	54.5'
14	26°35.1	43.1	99°42.4	12.2'	18°08.2	-2.7'	54.5'
15	41°35.1	·· 42.2	114°13.6	12.1'	18°10.9	-2.6'	54.5'
16	56°35.2	41.3	128°44.7	12.1'	18°13.5	-2.6'	54.5'
17	71°35.3	40.4	143°15.8	12.1'	18°16.0	-2.5'	54.5'
18	86°35.3	S10°39.5	157°46.8	12.0'	S18°18.4	-2.4'	54.5'
19	101°35.4	38.6	172°17.8	12.0'	18°20.8	-2.3'	54.5'
20	116°35.5	37.6	186°48.8	12.0'	18°23.0	-2.2'	54.6'
21	131°35.5	·· 36.7	201°19.8	11.9'	18°25.2	-2.1'	54.6'
22	146°35.6	35.8	215°50.7	11.9'	18°27.3	-2.0'	54.6'
23	161°35.7	34.9	230°21.6	11.9'	18°29.3	-2.0'	54.6'
	SD.=16.2	d=0.9	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:56	07:15	08:30	15:59	17:15	18:34
N 70°	05:56	07:07	08:13	16:16	17:22	18:33
68°	05:56	07:01	08:01	16:28	17:28	18:33
66°	05:56	06:56	07:50	16:39	17:33	18:33
64°	05:56	06:51	07:41	16:48	17:38	18:33
62°	05:56	06:47	07:33	16:55	17:42	18:33
60°	05:55	06:44	07:27	17:02	17:45	18:34
N 58°	05:55	06:40	07:21	17:08	17:48	18:34
56°	05:54	06:37	07:16	17:13	17:51	18:34
54°	05:54	06:35	07:11	17:17	17:54	18:35
52°	05:53	06:32	07:07	17:22	17:56	18:36
50°	05:52	06:30	07:03	17:25	17:59	18:36
45°	05:50	06:25	06:55	17:34	18:04	18:38
N 40°	05:48	06:20	06:48	17:41	18:08	18:40
35°	05:46	06:16	06:41	17:47	18:12	18:42
30°	05:44	06:12	06:36	17:52	18:16	18:44
20°	05:38	06:04	06:27	18:01	18:23	18:49
N 10°	05:32	05:57	06:18	18:09	18:31	18:55
0°	05:25	05:49	06:10	18:17	18:38	19:03
S 10°	05:16	05:41	06:02	18:25	18:46	19:11
20°	05:05	05:31	05:54	18:34	18:56	19:23
30°	04:50	05:19	05:44	18:43	19:08	19:37
35°	04:40	05:11	05:38	18:49	19:15	19:47
40°	04:29	05:03	05:31	18:56	19:24	19:58
45°	04:14	04:52	05:23	19:03	19:34	20:12
S 50°	03:56	04:39	05:14	19:13	19:47	20:30
52°	03:47	04:33	05:09	19:17	19:53	20:39
54°	03:36	04:26	05:04	19:22	20:00	20:49
56°	03:24	04:18	04:59	19:27	20:08	21:01
58°	03:10	04:09	04:53	19:33	20:17	21:15
S 60°	02:53	03:58	04:46	19:40	20:27	21:31

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	02:38	04:25	06:37	08:21	08:09	07:33
N 70°	02:12	03:43	05:11	08:48	08:51	08:59
68°	01:52	03:14	04:33	09:09	09:20	09:38
66°	01:36	02:53	04:06	09:26	09:42	10:06
64°	01:23	02:36	03:45	09:39	09:59	10:26
62°	01:13	02:23	03:28	09:51	10:14	10:43
60°	01:03	02:11	03:15	10:00	10:26	10:57
N 58°	00:55	02:01	03:03	10:09	10:36	11:10
56°	00:48	01:52	02:53	10:16	10:45	11:20
54°	00:42	01:44	02:43	10:23	10:53	11:29
52°	00:36	01:37	02:35	10:29	11:01	11:37
50°	00:31	01:31	02:28	10:35	11:07	11:45
45°	00:20	01:17	02:13	10:46	11:21	12:01
N 40°	00:11	01:06	02:00	10:56	11:33	12:14
35°	00:03	00:57	01:49	11:05	11:43	12:25
30°	–:–	00:49	01:40	11:12	11:52	12:35
20°	–:–	00:34	01:24	11:25	12:07	12:51
N 10°	–:–	00:22	01:10	11:36	12:20	13:06
0°	–:–	00:10	00:57	11:47	12:33	13:19
S 10°	23:59	–:–	00:44	11:57	12:45	13:33
20°	23:47	–:–	00:30	12:09	12:58	13:48
30°	23:33	–:–	00:14	12:22	13:13	14:04
35°	23:24	–:–	00:04	12:29	13:22	14:14
40°	23:15	23:54	–:–	12:38	13:32	14:25
45°	23:05	23:42	–:–	12:48	13:44	14:38
S 50°	22:52	23:27	–:–	13:00	13:59	14:54
52°	22:46	23:20	–:–	13:06	14:05	15:02
54°	22:39	23:12	23:51	13:12	14:13	15:10
56°	22:32	23:03	23:42	13:19	14:21	15:20
58°	22:23	22:54	23:31	13:27	14:31	15:30
S 60°	22:14	22:42	23:18	13:36	14:41	15:42

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 21-23 53-34%
18	13:55	13:52	12:14	05:36	17:59	
19	13:50	13:47	12:14	06:21	18:45	
20	13:44	13:40	12:14	07:08	19:32	

February 21, 22, 23 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	151°06.3	143°14.1	N08°49.8	134°50.5	N06°49.8	309°27.4	S07°29.1	245°10.9	S22°05.0
1	166°08.7	158°15.8	50.6	149°51.3	50.6	324°30.0	29.0	260°13.2	05.0
2	181°11.2	173°17.5	51.4	164°52.1	51.3	339°32.6	29.0	275°15.4	05.0
3	196°13.6	188°19.2	·· 52.2	179°52.8	·· 52.0	354°35.1	·· 28.9	290°17.7	·· 05.0
4	211°16.1	203°20.9	53.0	194°53.6	52.8	9°37.7	28.9	305°20.0	05.0
5	226°18.6	218°22.6	53.8	209°54.4	53.5	24°40.3	28.8	320°22.3	05.0
6	241°21.0	233°24.3	N08°54.6	224°55.2	N06°54.2	39°42.8	S07°28.8	335°24.6	S22°05.0
7	256°23.5	248°26.1	55.4	239°55.9	55.0	54°45.4	28.7	350°26.8	05.0
8	271°26.0	263°27.8	56.2	254°56.7	55.7	69°48.0	28.7	5°29.1	05.0
9	286°28.4	278°29.5	·· 57.0	269°57.5	·· 56.4	84°50.5	·· 28.6	20°31.4	·· 05.0
10	301°30.9	293°31.2	57.7	284°58.2	57.2	99°53.1	28.6	35°33.7	05.0
11	316°33.4	308°33.0	58.5	299°59.0	57.9	114°55.7	28.5	50°36.0	05.0
12	331°35.8	323°34.7	N08°59.3	314°59.8	N06°58.6	129°58.3	S07°28.5	65°38.2	S22°05.0
13	346°38.3	338°36.4	09°00.1	330°00.5	06°59.3	145°00.8	28.4	80°40.5	05.0
14	1°40.8	353°38.2	00.9	345°01.3	07°00.1	160°03.4	28.4	95°42.8	05.0
15	16°43.2	8°39.9	·· 01.7	0°02.1	·· 00.8	175°06.0	·· 28.3	110°45.1	·· 05.0
16	31°45.7	23°41.7	02.5	15°02.8	01.5	190°08.5	28.3	125°47.4	05.0
17	46°48.1	38°43.4	03.3	30°03.6	02.3	205°11.1	28.2	140°49.6	05.0
18	61°50.6	53°45.2	N09°04.0	45°04.4	N07°03.0	220°13.7	S07°28.2	155°51.9	S22°05.0
19	76°53.1	68°46.9	04.8	60°05.2	03.7	235°16.3	28.1	170°54.2	05.0
20	91°55.5	83°48.7	05.6	75°05.9	04.5	250°18.8	28.1	185°56.5	05.0
21	106°58.0	98°50.4	·· 06.4	90°06.7	·· 05.2	265°21.4	·· 28.0	200°58.8	·· 05.0
22	122°00.5	113°52.2	07.2	105°07.5	05.9	280°24.0	27.9	216°01.1	05.0
23	137°02.9	128°54.0	07.9	120°08.2	06.6	295°26.6	27.9	231°03.3	05.0
Mer.pass.:13:53		v1.7 d0.8 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.1		v2.3 d-0.0 m0.5	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	152°05.4	143°55.7	N09°08.7	135°09.0	N07°07.4	310°29.1	S07°27.8	246°05.6	S22°05.0
1	167°07.9	158°57.5	09.5	150°09.8	08.1	325°31.7	27.8	261°07.9	05.0
2	182°10.3	173°59.3	10.3	165°10.5	08.8	340°34.3	27.7	276°10.2	05.0
3	197°12.8	189°01.1	·· 11.0	180°11.3	·· 09.6	355°36.9	·· 27.7	291°12.5	·· 05.0
4	212°15.3	204°02.8	11.8	195°12.1	10.3	10°39.4	27.6	306°14.7	05.0
5	227°17.7	219°04.6	12.6	210°12.8	11.0	25°42.0	27.6	321°17.0	05.0
6	242°20.2	234°06.4	N09°13.3	225°13.6	N07°11.7	40°44.6	S07°27.5	336°19.3	S22°05.0
7	257°22.6	249°08.2	14.1	240°14.4	12.5	55°47.2	27.5	351°21.6	05.1
8	272°25.1	264°10.0	14.9	255°15.2	13.2	70°49.8	27.4	6°23.9	05.1
9	287°27.6	279°11.8	·· 15.6	270°15.9	·· 13.9	85°52.3	·· 27.3	21°26.2	·· 05.1
10	302°30.0	294°13.6	16.4	285°16.7	14.7	100°54.9	27.3	36°28.4	05.1
11	317°32.5	309°15.4	17.1	300°17.5	15.4	115°57.5	27.2	51°30.7	05.1
12	332°35.0	324°17.2	N09°17.9	315°18.2	N07°16.1	131°00.1	S07°27.2	66°33.0	S22°05.1
13	347°37.4	339°19.0	18.7	330°19.0	16.8	146°02.6	27.1	81°35.3	05.1
14	2°39.9	354°20.8	19.4	345°19.8	17.6	161°05.2	27.1	96°37.6	05.1
15	17°42.4	9°22.6	·· 20.2	0°20.5	·· 18.3	176°07.8	·· 27.0	111°39.9	·· 05.1
16	32°44.8	24°24.4	20.9	15°21.3	19.0	191°10.4	27.0	126°42.2	05.1
17	47°47.3	39°26.3	21.7	30°22.1	19.7	206°13.0	26.9	141°44.4	05.1
18	62°49.7	54°28.1	N09°22.4	45°22.8	N07°20.5	221°15.5	S07°26.8	156°46.7	S22°05.1
19	77°52.2	69°29.9	23.2	60°23.6	21.2	236°18.1	26.8	171°49.0	05.1
20	92°54.7	84°31.7	23.9	75°24.4	21.9	251°20.7	26.7	186°51.3	05.1
21	107°57.1	99°33.6	·· 24.7	90°25.1	·· 22.6	266°23.3	·· 26.7	201°53.6	·· 05.1
22	122°59.6	114°35.4	25.4	105°25.9	23.4	281°25.9	26.6	216°55.9	05.1
23	138°02.1	129°37.2	26.2	120°26.7	24.1	296°28.4	26.6	231°58.2	05.1
Mer.pass.:13:49		v1.8 d0.8 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.1		v2.3 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	153°04.5	144°39.1	N09°26.9	135°27.4	N07°24.8	311°31.0	S07°26.5	247°00.4	S22°05.1
1	168°07.0	159°40.9	27.7	150°28.2	25.5	326°33.6	26.5	262°02.7	05.1
2	183°09.5	174°42.8	28.4	165°29.0	26.3	341°36.2	26.4	277°05.0	05.1
3	198°11.9	189°44.6	·· 29.1	180°29.8	·· 27.0	356°38.8	·· 26.3	292°07.3	·· 05.1
4	213°14.4	204°46.5	29.9	195°30.5	27.7	11°41.4	26.3	307°09.6	05.1
5	228°16.9	219°48.3	30.6	210°31.3	28.4	26°43.9	26.2	322°11.9	05.1
6	243°19.3	234°50.2	N09°31.4	225°32.1	N07°29.2	41°46.5	S07°26.2	337°14.2	S22°05.1
7	258°21.8	249°52.0	32.1	240°32.8	29.9	56°49.1	26.1	352°16.4	05.1
8	273°24.2	264°53.9	32.8	255°33.6	30.6	71°51.7	26.1	7°18.7	05.1
9	288°26.7	279°55.8	·· 33.6	270°34.4	·· 31.3	86°54.3	·· 26.0	22°21.0	·· 05.1
10	303°29.2	294°57.7	34.3	285°35.1	32.1	101°56.9	25.9	37°23.3	05.1
11	318°31.6	309°59.5	35.0	300°35.9	32.8	116°59.5	25.9	52°25.6	05.1
12	333°34.1	325°01.4	N09°35.7	315°36.7	N07°33.5	132°02.0	S07°25.8	67°27.9	S22°05.1
13	348°36.6	340°03.3	36.5	330°37.4	34.2	147°04.6	25.8	82°30.2	05.1
14	3°39.0	355°05.2	37.2	345°38.2	35.0	162°07.2	25.7	97°32.5	05.1
15	18°41.5	10°07.1	·· 37.9	0°39.0	·· 35.7	177°09.8	·· 25.6	112°34.7	·· 05.1
16	33°44.0	25°08.9	38.6	15°39.7	36.4	192°12.4	25.6	127°37.0	05.1
17	48°46.4	40°10.8	39.4	30°40.5	37.1	207°15.0	25.5	142°39.3	05.1
18	63°48.9	55°12.7	N09°40.1	45°41.3	N07°37.9	222°17.6	S07°25.5	157°41.6	S22°05.1
19	78°51.4	70°14.6	40.8	60°42.0	38.6	237°20.2	25.4	172°43.9	05.1
20	93°53.8	85°16.5	41.5	75°42.8	39.3	252°22.7	25.4	187°46.2	05.1
21	108°56.3	100°18.4	·· 42.2	90°43.6	·· 40.0	267°25.3	·· 25.3	202°48.5	·· 05.1
22	123°58.7	115°20.4	43.0	105°44.3	40.7	282°27.9	25.2	217°50.8	05.1
23	139°01.2	130°22.3	43.7	120°45.1	41.5	297°30.5	25.2	232°53.1	05.1
Mer.pass.:13:45		v1.8 d0.7 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.1		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.6	-42°13.0
Schedar	349°38.0	56°37.9
Diphda	348°53.7	-17°53.8
Achernar	335°25.4	-57°09.4
Hamal	327°58.1	23°32.5
Polaris	316°46.1	89°20.4
Acamar	315°16.6	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.8	49°55.3
Aldebaran	290°46.5	16°32.4
Rigel	281°09.6	-8°11.3
Capella	280°30.6	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.4	7°24.3
Canopus	263°54.7	-52°42.7
Sirius	258°31.3	-16°44.8
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.4	-59°34.2
Suhail	222°50.1	-43°30.3
Miaplacidus	221°38.1	-69°47.4
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.4
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.2
Acrux	173°05.8	-63°11.5
Gacrux	171°57.5	-57°12.4
Alioth	166°18.2	55°51.8
Spica	158°28.4	-11°15.0
Alkaid	152°56.7	49°13.5
Hadar	148°43.9	-60°27.0
Menkent	148°04.4	-36°27.0
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°48.0	-60°54.0
Kochab	137°19.9	74°04.9
Zuben'ubi	137°02.5	-16°06.6
Alphecca	126°08.9	26°39.4
Antares	112°23.2	-26°27.9
Atria	107°22.9	-69°03.0
Sabik	102°09.8	-15°44.6
Shaula	96°18.7	-37°06.7
Rasalhague	96°04.3	12°32.9
Eltanin	90°45.2	51°29.1
Kaus Aust.	83°40.7	-34°22.3
Vega	80°37.5	38°47.9
Nunki	75°55.5	-26°16.3
Altair	62°06.1	8°54.8
Peacock	53°15.9	-56°40.6
Deneb	49°30.2	45°20.4
Enif	33°45.0	9°57.2
Al Na'ir	27°41.1	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.8

Feb 21 Tue	**SHA**	**Mer.pass**
Venus	352°07.8	14:25
Mars	343°44.3	15:00
Jupiter	158°21.2	03:22
Saturn	94°04.6	07:38

Feb 22 Wed	**SHA**	**Mer.pass**
Venus	351°50.3	14:23
Mars	343°03.6	14:59
Jupiter	158°23.7	03:17
Saturn	94°00.2	07:34

Feb 23 Thu	**SHA**	**Mer.pass**
Venus	351°34.5	14:20
Mars	342°22.9	14:57
Jupiter	158°26.5	03:13
Saturn	93°55.9	07:31

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.5276 sec ΔT = TT-UT1 = +68.6564 sec

2017 February 21 to Feb. 23 UT

h

Tue	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	176°35.8	S10°34.0	244°52.5	11.8'	S18°31.2	-1.9'	54.6'
1	191°35.8	33.1	259°23.3	11.8'	18°33.0	-1.8'	54.6'
2	206°35.9	32.2	273°54.1	11.8'	18°34.8	-1.7'	54.6'
3	221°36.0	· · 31.3	288°24.9	11.8'	18°36.4	-1.6'	54.7'
4	236°36.1	30.4	302°55.6	11.7'	18°38.0	-1.5'	54.7'
5	251°36.1	29.5	317°26.3	11.7'	18°39.5	-1.4'	54.7'
6	266°36.2	S10°28.6	331°57.0	11.7'	S18°40.9	-1.3'	54.7'
7	281°36.3	27.7	346°27.6	11.6'	18°42.2	-1.3'	54.7'
8	296°36.3	26.8	0°58.2	11.6'	18°43.4	-1.2'	54.7'
9	311°36.4	· · 25.9	15°28.8	11.6'	18°44.5	-1.1'	54.8'
10	326°36.5	25.0	29°59.4	11.5'	18°45.5	-1.0'	54.8'
11	341°36.6	24.1	44°29.9	11.5'	18°46.5	-0.9'	54.8'
12	356°36.6	S10°23.2	59°00.4	11.5'	S18°47.3	-0.8'	54.8'
13	11°36.7	22.3	73°30.9	11.5'	18°48.1	-0.7'	54.8'
14	26°36.8	21.3	88°01.4	11.4'	18°48.8	-0.6'	54.8'
15	41°36.9	· · 20.4	102°31.8	11.4'	18°49.4	-0.5'	54.9'
16	56°37.0	19.5	117°02.2	11.4'	18°49.9	-0.4'	54.9'
17	71°37.0	18.6	131°32.5	11.3'	18°50.3	-0.4'	54.9'
18	86°37.1	S10°17.7	146°02.9	11.3'	S18°50.6	-0.3'	54.9'
19	101°37.2	16.8	160°33.2	11.3'	18°50.8	-0.2'	54.9'
20	116°37.3	15.9	175°03.4	11.3'	18°50.9	-0.1'	55.0'
21	131°37.3	· · 15.0	189°33.7	11.2'	18°50.9	0.0'	55.0'
22	146°37.4	14.1	204°03.9	11.2'	18°50.9	0.1'	55.0'
23	161°37.5	13.2	218°34.1	11.2'	18°50.7	0.2'	55.0'
	SD.=16.2	d=0.9	S.D.=14.9				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°37.6	S10°12.2	233°04.3	11.2'	S18°50.5	0.3'	55.0'
1	191°37.7	11.3	247°34.5	11.1'	18°50.2	0.4'	55.1'
2	206°37.7	10.4	262°04.6	11.1'	18°49.7	0.5'	55.1'
3	221°37.8	· · 09.5	276°34.7	11.1'	18°49.2	0.6'	55.1'
4	236°37.9	08.6	291°04.8	11.1'	18°48.6	0.7'	55.1'
5	251°38.0	07.7	305°34.8	11.0'	18°47.9	0.8'	55.1'
6	266°38.0	S10°06.8	320°04.8	11.0'	S18°47.1	0.9'	55.2'
7	281°38.1	05.9	334°34.9	11.0'	18°46.2	0.9'	55.2'
8	296°38.2	04.9	349°04.8	11.0'	18°45.2	1.0'	55.2'
9	311°38.3	· · 04.0	3°34.8	11.0'	18°44.1	1.1'	55.2'
10	326°38.4	03.1	18°04.7	10.9'	18°42.9	1.2'	55.3'
11	341°38.5	02.2	32°34.7	10.9'	18°41.6	1.3'	55.3'
12	356°38.5	S10°01.3	47°04.6	10.9'	S18°40.3	1.4'	55.3'
13	11°38.6	10°00.4	61°34.4	10.9'	18°38.8	1.5'	55.3'
14	26°38.7	09°59.5	76°04.3	10.8'	18°37.2	1.6'	55.4'
15	41°38.8	· · 58.5	90°34.1	10.8'	18°35.6	1.7'	55.4'
16	56°38.9	57.6	105°03.9	10.8'	18°33.8	1.8'	55.4'
17	71°38.9	56.7	119°33.7	10.8'	18°32.0	1.9'	55.4'
18	86°39.0	S09°55.8	134°03.5	10.8'	S18°30.1	2.0'	55.4'
19	101°39.1	54.9	148°33.3	10.7'	18°28.0	2.1'	55.5'
20	116°39.2	54.0	163°03.0	10.7'	18°25.9	2.2'	55.5'
21	131°39.3	· · 53.1	177°32.7	10.7'	18°23.7	2.3'	55.5'
22	146°39.4	52.1	192°02.4	10.7'	18°21.3	2.4'	55.5'
23	161°39.4	51.2	206°32.1	10.7'	18°18.9	2.5'	55.6'
	SD.=16.2	d=0.9	S.D.=15.1				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°39.5	S09°50.3	221°01.8	10.7'	S18°16.4	2.6'	55.6'
1	191°39.6	49.4	235°31.4	10.6'	18°13.8	2.7'	55.6'
2	206°39.7	48.5	250°01.1	10.6'	18°11.1	2.8'	55.6'
3	221°39.8	· · 47.5	264°30.7	10.6'	18°08.3	2.9'	55.7'
4	236°39.9	46.6	279°00.3	10.6'	18°05.4	2.9'	55.7'
5	251°40.0	45.7	293°29.9	10.6'	18°02.4	3.0'	55.7'
6	266°40.0	S09°44.8	307°59.4	10.6'	S17°59.3	3.1'	55.7'
7	281°40.1	43.9	322°29.0	10.6'	17°56.1	3.2'	55.8'
8	296°40.2	43.0	336°58.5	10.5'	17°52.8	3.3'	55.8'
9	311°40.3	· · 42.0	351°28.1	10.5'	17°49.4	3.4'	55.8'
10	326°40.4	41.1	5°57.6	10.5'	17°46.0	3.5'	55.9'
11	341°40.5	40.2	20°27.1	10.5'	17°42.4	3.6'	55.9'
12	356°40.6	S09°39.3	34°56.6	10.5'	S17°38.7	3.7'	55.9'
13	11°40.7	38.4	49°26.1	10.5'	17°35.0	3.8'	55.9'
14	26°40.7	37.4	63°55.6	10.5'	17°31.1	3.9'	56.0'
15	41°40.8	· · 36.5	78°25.0	10.5'	17°27.2	4.0'	56.0'
16	56°40.9	35.6	92°54.5	10.4'	17°23.1	4.1'	56.0'
17	71°41.0	34.7	107°23.9	10.4'	17°19.0	4.2'	56.0'
18	86°41.1	S09°33.7	121°53.4	10.4'	S17°14.8	4.3'	56.1'
19	101°41.2	32.8	136°22.8	10.4'	17°10.4	4.4'	56.1'
20	116°41.3	31.9	150°52.2	10.4'	17°06.0	4.5'	56.1'
21	131°41.4	· · 31.0	165°21.6	10.4'	17°01.5	4.6'	56.2'
22	146°41.5	30.1	179°51.0	10.4'	16°56.9	4.7'	56.2'
23	161°41.5	29.1	194°20.4	10.4'	16°52.2	4.8'	56.2'
	SD.=16.2	d=0.9	S.D.=15.2				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:43	07:01	08:13	16:15	17:28	18:47
N 70°	05:44	06:55	07:59	16:29	17:34	18:45
68°	05:45	06:50	07:48	16:40	17:39	18:43
66°	05:46	06:45	07:39	16:50	17:43	18:42
64°	05:47	06:42	07:31	16:57	17:47	18:42
62°	05:47	06:39	07:24	17:04	17:50	18:41
60°	05:47	06:36	07:18	17:10	17:52	18:41
N 58°	05:48	06:33	07:13	17:15	17:55	18:41
56°	05:47	06:31	07:08	17:19	17:57	18:41
54°	05:47	06:28	07:04	17:23	18:00	18:41
52°	05:47	06:26	07:01	17:27	18:02	18:41
50°	05:47	06:24	06:57	17:31	18:03	18:41
45°	05:46	06:20	06:50	17:38	18:08	18:42
N 40°	05:45	06:16	06:43	17:44	18:11	18:43
35°	05:43	06:12	06:38	17:49	18:15	18:44
30°	05:41	06:09	06:33	17:54	18:18	18:46
20°	05:37	06:02	06:25	18:02	18:25	18:50
N 10°	05:31	05:56	06:17	18:10	18:31	18:56
0°	05:25	05:49	06:10	18:17	18:38	19:02
S 10°	05:17	05:41	06:03	18:24	18:45	19:10
20°	05:06	05:32	05:55	18:32	18:54	19:20
30°	04:52	05:21	05:46	18:41	19:05	19:34
35°	04:43	05:14	05:41	18:46	19:12	19:43
40°	04:33	05:06	05:35	18:52	19:20	19:53
45°	04:19	04:57	05:27	18:59	19:29	20:06
S 50°	04:02	04:45	05:19	19:07	19:41	20:23
52°	03:54	04:39	05:15	19:11	19:47	20:31
54°	03:44	04:32	05:11	19:15	19:53	20:41
56°	03:33	04:25	05:06	19:20	20:00	20:51
58°	03:21	04:17	05:00	19:25	20:08	21:04
S 60°	03:05	04:08	04:54	19:31	20:17	21:19

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	▬	▬	09:12	▬	▬	10:05
N 70°	06:30	07:22	07:45	09:20	10:10	11:32
68°	05:41	06:32	07:05	10:09	11:00	12:11
66°	05:09	06:01	06:38	10:41	11:31	12:38
64°	04:46	05:37	06:17	11:04	11:55	12:59
62°	04:28	05:19	06:00	11:23	12:13	13:15
60°	04:13	05:03	05:46	11:38	12:28	13:29
N 58°	04:00	04:50	05:34	11:51	12:41	13:41
56°	03:49	04:39	05:23	12:02	12:52	13:51
54°	03:39	04:29	05:14	12:12	13:02	14:00
52°	03:30	04:20	05:06	12:21	13:11	14:09
50°	03:22	04:13	04:58	12:29	13:19	14:16
45°	03:06	03:56	04:42	12:45	13:35	14:31
N 40°	02:52	03:42	04:29	12:59	13:49	14:44
35°	02:41	03:30	04:18	13:11	14:01	14:55
30°	02:31	03:20	04:08	13:21	14:11	15:04
20°	02:13	03:03	03:52	13:38	14:28	15:20
N 10°	01:58	02:47	03:37	13:54	14:43	15:34
0°	01:44	02:33	03:23	14:08	14:57	15:47
S 10°	01:30	02:19	03:09	14:22	15:11	16:01
20°	01:15	02:04	02:55	14:37	15:26	16:15
30°	00:58	01:46	02:38	14:55	15:43	16:30
35°	00:48	01:36	02:28	15:05	15:53	16:40
40°	00:37	01:25	02:17	15:16	16:05	16:50
45°	00:24	01:11	02:04	15:30	16:18	17:02
S 50°	00:07	00:54	01:48	15:47	16:34	17:17
52°	00:00	00:46	01:41	15:54	16:42	17:24
54°	–:–	00:38	01:32	16:03	16:51	17:32
56°	–:–	00:28	01:23	16:13	17:00	17:41
58°	–:–	00:17	01:12	16:24	17:11	17:50
S 60°	–:–	00:04	01:00	16:37	17:23	18:01

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 24-26 26-11%
21	13:37	13:33	12:14	07:56	20:20	
22	13:30	13:26	12:13	08:45	21:10	
23	13:22	13:18	12:13	09:35	22:01	

February 24, 25, 26 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	154°03.7	145°24.2	N09°44.4	135°45.9	N07°42.2	312°33.1	S07°25.1	247°55.4	S22°05.1
1	169°06.1	160°26.1	45.1	150°46.6	42.9	327°35.7	25.1	262°57.6	05.1
2	184°08.6	175°28.0	45.8	165°47.4	43.6	342°38.3	25.0	277°59.9	05.1
3	199°11.1	190°29.9	·· 46.5	180°48.2	·· 44.4	357°40.9	·· 24.9	293°02.2	·· 05.2
4	214°13.5	205°31.9	47.2	195°48.9	45.1	12°43.5	24.9	308°04.5	05.2
5	229°16.0	220°33.8	47.9	210°49.7	45.8	27°46.0	24.8	323°06.8	05.2
6	244°18.5	235°35.7	N09°48.6	225°50.5	N07°46.5	42°48.6	S07°24.8	338°09.1	S22°05.2
7	259°20.9	250°37.7	49.3	240°51.2	47.2	57°51.2	24.7	353°11.4	05.2
8	274°23.4	265°39.6	50.0	255°52.0	48.0	72°53.8	24.6	8°13.7	05.2
9	289°25.8	280°41.6	·· 50.7	270°52.8	·· 48.7	87°56.4	·· 24.6	23°16.0	·· 05.2
10	304°28.3	295°43.5	51.4	285°53.5	49.4	102°59.0	24.5	38°18.3	05.2
11	319°30.8	310°45.5	52.1	300°54.3	50.1	118°01.6	24.5	53°20.5	05.2
12	334°33.2	325°47.4	N09°52.8	315°55.1	N07°50.8	133°04.2	S07°24.4	68°22.8	S22°05.2
13	349°35.7	340°49.4	53.5	330°55.8	51.6	148°06.8	24.3	83°25.1	05.2
14	4°38.2	355°51.3	54.2	345°56.6	52.3	163°09.4	24.3	98°27.4	05.2
15	19°40.6	10°53.3	·· 54.9	0°57.4	·· 53.0	178°12.0	·· 24.2	113°29.7	·· 05.2
16	34°43.1	25°55.3	55.6	15°58.1	53.7	193°14.6	24.2	128°32.0	05.2
17	49°45.6	40°57.2	56.3	30°58.9	54.4	208°17.2	24.1	143°34.3	05.2
18	64°48.0	55°59.2	N09°57.0	45°59.7	N07°55.2	223°19.7	S07°24.0	158°36.6	S22°05.2
19	79°50.5	71°01.2	57.6	61°00.4	55.9	238°22.3	24.0	173°38.9	05.2
20	94°53.0	86°03.2	58.3	76°01.2	56.6	253°24.9	23.9	188°41.2	05.2
21	109°55.4	101°05.1	·· 59.0	91°02.0	·· 57.3	268°27.5	·· 23.9	203°43.5	·· 05.2
22	124°57.9	116°07.1	09°59.7	106°02.7	58.0	283°30.1	23.8	218°45.8	05.2
23	140°00.3	131°09.1	10°00.4	121°03.5	58.8	298°32.7	23.7	233°48.1	05.2
Mer.pass.:13:42		v1.9 d0.7 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.1		v2.3 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	155°02.8	146°11.1	N10°01.0	136°04.3	N07°59.5	313°35.3	S07°23.7	248°50.4	S22°05.2
1	170°05.3	161°13.1	01.7	151°05.0	08°00.2	328°37.9	23.6	263°52.6	05.2
2	185°07.7	176°15.1	02.4	166°05.8	00.9	343°40.5	23.5	278°54.9	05.2
3	200°10.2	191°17.1	·· 03.1	181°06.6	·· 01.6	358°43.1	·· 23.5	293°57.2	·· 05.2
4	215°12.7	206°19.1	03.7	196°07.3	02.3	13°45.7	23.4	308°59.5	05.2
5	230°15.1	221°21.1	04.4	211°08.1	03.1	28°48.3	23.4	324°01.8	05.2
6	245°17.6	236°23.1	N10°05.1	226°08.9	N08°03.8	43°50.9	S07°23.3	339°04.1	S22°05.2
7	260°20.1	251°25.1	05.7	241°09.6	04.5	58°53.5	23.2	354°06.4	05.2
8	275°22.5	266°27.2	06.4	256°10.4	05.2	73°56.1	23.2	9°08.7	05.2
9	290°25.0	281°29.2	·· 07.1	271°11.2	·· 05.9	88°58.7	·· 23.1	24°11.0	·· 05.2
10	305°27.5	296°31.2	07.7	286°11.9	06.6	104°01.3	23.0	39°13.3	05.2
11	320°29.9	311°33.2	08.4	301°12.7	07.4	119°03.9	23.0	54°15.6	05.2
12	335°32.4	326°35.3	N10°09.1	316°13.5	N08°08.1	134°06.5	S07°22.9	69°17.9	S22°05.2
13	350°34.8	341°37.3	09.7	331°14.2	08.8	149°09.1	22.9	84°20.2	05.2
14	5°37.3	356°39.3	10.4	346°15.0	09.5	164°11.7	22.8	99°22.5	05.2
15	20°39.8	11°41.4	·· 11.0	1°15.8	·· 10.2	179°14.3	·· 22.7	114°24.8	·· 05.2
16	35°42.2	26°43.4	11.7	16°16.5	10.9	194°16.9	22.7	129°27.1	05.2
17	50°44.7	41°45.5	12.3	31°17.3	11.7	209°19.5	22.6	144°29.4	05.2
18	65°47.2	56°47.5	N10°13.0	46°18.1	N08°12.4	224°22.1	S07°22.5	159°31.7	S22°05.2
19	80°49.6	71°49.6	13.6	61°18.8	13.1	239°24.7	22.5	174°34.0	05.2
20	95°52.1	86°51.6	14.3	76°19.6	13.8	254°27.3	22.4	189°36.3	05.2
21	110°54.6	101°53.7	·· 14.9	91°20.3	·· 14.5	269°29.9	·· 22.3	204°38.5	·· 05.2
22	125°57.0	116°55.8	15.6	106°21.1	15.2	284°32.5	22.3	219°40.8	05.2
23	140°59.5	131°57.8	16.2	121°21.9	16.0	299°35.1	22.2	234°43.1	05.2
Mer.pass.:13:38		v2.0 d0.7 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	156°01.9	146°59.9	N10°16.9	136°22.6	N08°16.7	314°37.7	S07°22.2	249°45.4	S22°05.2
1	171°04.4	162°02.0	17.5	151°23.4	17.4	329°40.3	22.1	264°47.7	05.2
2	186°06.9	177°04.1	18.1	166°24.2	18.1	344°42.9	22.0	279°50.0	05.2
3	201°09.3	192°06.1	·· 18.8	181°24.9	·· 18.8	359°45.5	·· 22.0	294°52.3	·· 05.2
4	216°11.8	207°08.2	19.4	196°25.7	19.5	14°48.1	21.9	309°54.6	05.2
5	231°14.3	222°10.3	20.0	211°26.5	20.2	29°50.7	21.8	324°56.9	05.2
6	246°16.7	237°12.4	N10°20.7	226°27.2	N08°21.0	44°53.3	S07°21.8	339°59.2	S22°05.2
7	261°19.2	252°14.5	21.3	241°28.0	21.7	59°55.9	21.7	355°01.5	05.2
8	276°21.7	267°16.6	21.9	256°28.8	22.4	74°58.6	21.6	10°03.8	05.3
9	291°24.1	282°18.7	·· 22.6	271°29.5	·· 23.1	90°01.2	·· 21.6	25°06.1	·· 05.3
10	306°26.6	297°20.8	23.2	286°30.3	23.8	105°03.8	21.5	40°08.4	05.3
11	321°29.1	312°22.9	23.8	301°31.1	24.5	120°06.4	21.4	55°10.7	05.3
12	336°31.5	327°25.0	N10°24.4	316°31.8	N08°25.2	135°09.0	S07°21.4	70°13.0	S22°05.3
13	351°34.0	342°27.1	25.1	331°32.6	26.0	150°11.6	21.3	85°15.3	05.3
14	6°36.4	357°29.3	25.7	346°33.3	26.7	165°14.2	21.2	100°17.6	05.3
15	21°38.9	12°31.4	·· 26.3	1°34.1	·· 27.4	180°16.8	·· 21.2	115°19.9	·· 05.3
16	36°41.4	27°33.5	26.9	16°34.9	28.1	195°19.4	21.1	130°22.2	05.3
17	51°43.8	42°35.6	27.5	31°35.6	28.8	210°22.0	21.0	145°24.5	05.3
18	66°46.3	57°37.8	N10°28.2	46°36.4	N08°29.5	225°24.6	S07°21.0	160°26.8	S22°05.3
19	81°48.8	72°39.9	28.8	61°37.2	30.2	240°27.2	20.9	175°29.1	05.3
20	96°51.2	87°42.0	29.4	76°37.9	30.9	255°29.8	20.8	190°31.4	05.3
21	111°53.7	102°44.2	·· 30.0	91°38.7	·· 31.6	270°32.4	·· 20.8	205°33.7	·· 05.3
22	126°56.2	117°46.3	30.6	106°39.5	32.4	285°35.1	20.7	220°36.0	05.3
23	141°58.6	132°48.5	31.2	121°40.2	33.1	300°37.7	20.6	235°38.3	05.3
Mer.pass.:13:34		v2.1 d0.6 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.6	-42°13.0
Schedar	349°38.0	56°37.9
Diphda	348°53.7	-17°53.8
Achernar	335°25.4	-57°09.4
Hamal	327°58.1	23°32.5
Polaris	316°47.5	89°20.4
Acamar	315°16.6	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.8	49°55.3
Aldebaran	290°46.5	16°32.4
Rigel	281°09.6	-8°11.3
Capella	280°30.6	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.5	7°24.3
Canopus	263°54.8	-52°42.8
Sirius	258°31.3	-16°44.8
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.4	-59°34.2
Suhail	222°50.1	-43°30.4
Miaplacidus	221°38.1	-69°47.5
Alphard	217°53.3	-8°44.2
Regulus	207°40.5	11°52.8
Dubhe	193°48.1	61°39.4
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.2
Acrux	173°05.8	-63°11.5
Gacrux	171°57.5	-57°12.4
Alioth	166°18.1	55°51.9
Spica	158°28.4	-11°15.0
Alkaid	152°56.7	49°13.5
Hadar	148°43.9	-60°27.0
Menkent	148°04.4	-36°27.0
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°47.9	-60°54.0
Kochab	137°19.8	74°04.9
Zuben'ubi	137°02.5	-16°06.6
Alphecca	126°08.8	26°39.3
Antares	112°23.2	-26°28.0
Atria	107°22.8	-69°03.0
Sabik	102°09.7	-15°44.6
Shaula	96°18.6	-37°06.7
Rasalhague	96°04.2	12°32.9
Eltanin	90°45.2	51°29.1
Kaus Aust.	83°40.7	-34°22.3
Vega	80°37.5	38°47.9
Nunki	75°55.4	-26°16.3
Altair	62°06.0	8°54.8
Peacock	53°15.9	-56°40.6
Deneb	49°30.1	45°20.4
Enif	33°45.0	9°57.2
Al Na'ir	27°41.1	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.8

Feb 24 Fri	SHA	Mer.pass
Venus	351°20.5	14:17
Mars	341°42.2	14:56
Jupiter	158°29.4	03:09
Saturn	93°51.7	07:27

Feb 25 Sat	SHA	Mer.pass
Venus	351°08.3	14:13
Mars	341°01.5	14:55
Jupiter	158°32.5	03:05
Saturn	93°47.5	07:24

Feb 26 Sun	SHA	Mer.pass
Venus	350°58.0	14:10
Mars	340°20.7	14:54
Jupiter	158°35.8	03:01
Saturn	93°43.5	07:20

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.5236 sec ΔT = TT-UT1 = +68.6604 sec

2017 February 24 to Feb. 26 UT

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	176°41.6	S09°28.2	208°49.8	10.4′	S16°47.4	4.8′	56.2′
1	191°41.7	27.3	223°19.1	10.4′	16°42.5	4.9′	56.3′
2	206°41.8	26.4	237°48.5	10.4′	16°37.5	5.0′	56.3′
3	221°41.9	·· 25.4	252°17.9	10.4′	16°32.4	5.1′	56.3′
4	236°42.0	24.5	266°47.2	10.4′	16°27.3	5.2′	56.3′
5	251°42.1	23.6	281°16.6	10.3′	16°22.0	5.3′	56.4′
6	266°42.2	S09°22.7	295°45.9	10.3′	S16°16.7	5.4′	56.4′
7	281°42.3	21.7	310°15.2	10.3′	16°11.2	5.5′	56.4′
8	296°42.4	20.8	324°44.6	10.3′	16°05.7	5.6′	56.5′
9	311°42.5	·· 19.9	339°13.9	10.3′	16°00.0	5.7′	56.5′
10	326°42.6	19.0	353°43.2	10.3′	15°54.3	5.8′	56.5′
11	341°42.7	18.0	8°12.6	10.3′	15°48.5	5.9′	56.5′
12	356°42.8	S09°17.1	22°41.9	10.3′	S15°42.6	5.9′	56.6′
13	11°42.8	16.2	37°11.2	10.3′	15°36.6	6.0′	56.6′
14	26°42.9	15.3	51°40.5	10.3′	15°30.6	6.1′	56.6′
15	41°43.0	·· 14.3	66°09.8	10.3′	15°24.4	6.2′	56.7′
16	56°43.1	13.4	80°39.1	10.3′	15°18.1	6.3′	56.7′
17	71°43.2	12.5	95°08.4	10.3′	15°11.8	6.4′	56.7′
18	86°43.3	S09°11.5	109°37.7	10.3′	S15°05.4	6.5′	56.7′
19	101°43.4	10.6	124°07.0	10.3′	14°58.8	6.6′	56.8′
20	116°43.5	09.7	138°36.3	10.3′	14°52.2	6.6′	56.8′
21	131°43.6	·· 08.8	153°05.6	10.3′	14°45.6	6.7′	56.8′
22	146°43.7	07.8	167°34.9	10.3′	14°38.8	6.8′	56.9′
23	161°43.8	06.9	182°04.2	10.3′	14°31.9	6.9′	56.9′
	SD.=16.1	d=0.9	S.D.=15.4				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°43.9	S09°06.0	196°33.5	10.3′	S14°25.0	7.0′	56.9′
1	191°44.0	05.0	211°02.8	10.3′	14°17.9	7.1′	56.9′
2	206°44.1	04.1	225°32.1	10.3′	14°10.8	7.2′	57.0′
3	221°44.2	·· 03.2	240°01.4	10.3′	14°03.6	7.2′	57.0′
4	236°44.3	02.2	254°30.7	10.3′	13°56.3	7.3′	57.0′
5	251°44.4	01.3	269°00.0	10.3′	13°49.0	7.4′	57.1′
6	266°44.5	S09°00.4	283°29.3	10.3′	S13°41.5	7.5′	57.1′
7	281°44.6	08°59.5	297°58.6	10.3′	13°34.0	7.6′	57.1′
8	296°44.7	58.5	312°27.9	10.3′	13°26.4	7.6′	57.1′
9	311°44.8	·· 57.6	326°57.2	10.3′	13°18.7	7.7′	57.2′
10	326°44.9	56.7	341°26.5	10.3′	13°10.9	7.8′	57.2′
11	341°45.0	55.7	355°55.8	10.3′	13°03.1	7.9′	57.2′
12	356°45.1	S08°54.8	10°25.1	10.3′	S12°55.1	8.0′	57.3′
13	11°45.2	53.9	24°54.4	10.3′	12°47.1	8.0′	57.3′
14	26°45.3	52.9	39°23.7	10.3′	12°39.1	8.1′	57.3′
15	41°45.4	·· 52.0	53°53.0	10.3′	12°30.9	8.2′	57.3′
16	56°45.5	51.1	68°22.3	10.3′	12°22.7	8.3′	57.4′
17	71°45.6	50.1	82°51.6	10.3′	12°14.4	8.3′	57.4′
18	86°45.7	S08°49.2	97°20.9	10.3′	S12°06.0	8.4′	57.4′
19	101°45.8	48.3	111°50.2	10.3′	11°57.5	8.5′	57.4′
20	116°45.9	47.3	126°19.5	10.3′	11°49.0	8.6′	57.5′
21	131°46.0	·· 46.4	140°48.9	10.3′	11°40.4	8.6′	57.5′
22	146°46.1	45.5	155°18.2	10.3′	11°31.7	8.7′	57.5′
23	161°46.2	44.5	169°47.5	10.3′	11°23.0	8.8′	57.6′
	SD.=16.1	d=0.9	S.D.=15.6				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°46.3	S08°43.6	184°16.8	10.3′	S11°14.1	8.9′	57.6′
1	191°46.4	42.7	198°46.2	10.3′	11°05.3	8.9′	57.6′
2	206°46.5	41.7	213°15.5	10.3′	10°56.3	9.0′	57.6′
3	221°46.6	·· 40.8	227°44.8	10.3′	10°47.3	9.1′	57.7′
4	236°46.7	39.9	242°14.2	10.3′	10°38.2	9.1′	57.7′
5	251°46.8	38.9	256°43.5	10.3′	10°29.0	9.2′	57.7′
6	266°46.9	S08°38.0	271°12.8	10.3′	S10°19.8	9.3′	57.7′
7	281°47.0	37.0	285°42.2	10.3′	10°10.5	9.3′	57.8′
8	296°47.1	36.1	300°11.5	10.3′	10°01.2	9.4′	57.8′
9	311°47.2	·· 35.2	314°40.9	10.3′	09°51.8	9.4′	57.8′
10	326°47.3	34.2	329°10.2	10.3′	09°42.3	9.5′	57.8′
11	341°47.4	33.3	343°39.6	10.3′	09°32.7	9.6′	57.9′
12	356°47.5	S08°32.4	358°08.9	10.4′	S09°23.1	9.6′	57.9′
13	11°47.7	31.4	12°38.3	10.4′	09°13.5	9.7′	57.9′
14	26°47.8	30.5	27°07.6	10.4′	09°03.8	9.7′	57.9′
15	41°47.9	·· 29.5	41°37.0	10.4′	08°54.0	9.8′	58.0′
16	56°48.0	28.6	56°06.3	10.4′	08°44.1	9.9′	58.0′
17	71°48.1	27.7	70°35.7	10.4′	08°34.3	9.9′	58.0′
18	86°48.2	S08°26.7	85°05.1	10.4′	S08°24.3	10.0′	58.0′
19	101°48.3	25.8	99°34.4	10.4′	08°14.3	10.0′	58.1′
20	116°48.4	24.8	114°03.8	10.4′	08°04.3	10.1′	58.1′
21	131°48.5	·· 23.9	128°33.1	10.4′	07°54.2	10.1′	58.1′
22	146°48.6	23.0	143°02.5	10.4′	07°44.0	10.2′	58.1′
23	161°48.7	22.0	157°31.8	10.4′	07°33.8	10.2′	58.2′
	SD.=16.1	d=0.9	S.D.=15.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:29	06:46	07:57	16:31	17:42	19:00
N 70°	05:32	06:42	07:45	16:43	17:46	18:57
68°	05:34	06:38	07:35	16:52	17:50	18:54
66°	05:36	06:35	07:27	17:00	17:53	18:52
64°	05:37	06:32	07:21	17:07	17:55	18:50
62°	05:39	06:30	07:15	17:12	17:58	18:49
60°	05:39	06:27	07:10	17:17	18:00	18:48
N 58°	05:40	06:25	07:05	17:22	18:02	18:47
56°	05:41	06:23	07:01	17:26	18:04	18:47
54°	05:41	06:22	06:57	17:29	18:05	18:46
52°	05:41	06:20	06:54	17:33	18:07	18:46
50°	05:41	06:19	06:51	17:36	18:08	18:46
45°	05:41	06:15	06:45	17:42	18:12	18:46
N 40°	05:40	06:12	06:39	17:47	18:15	18:46
35°	05:39	06:09	06:34	17:52	18:18	18:47
30°	05:38	06:06	06:30	17:56	18:20	18:48
20°	05:35	06:00	06:23	18:04	18:26	18:52
N 10°	05:30	05:55	06:16	18:10	18:31	18:56
0°	05:24	05:49	06:10	18:16	18:37	19:02
S 10°	05:17	05:42	06:03	18:23	18:44	19:09
20°	05:08	05:34	05:56	18:29	18:52	19:18
30°	04:55	05:24	05:48	18:37	19:02	19:31
35°	04:47	05:17	05:43	18:42	19:08	19:39
40°	04:37	05:10	05:38	18:47	19:15	19:48
45°	04:24	05:01	05:32	18:53	19:24	20:00
S 50°	04:09	04:50	05:24	19:01	19:35	20:16
52°	04:01	04:45	05:21	19:04	19:40	20:24
54°	03:52	04:39	05:17	19:08	19:45	20:32
56°	03:42	04:32	05:12	19:12	19:52	20:42
58°	03:30	04:25	05:08	19:17	19:59	20:53
S 60°	03:16	04:16	05:02	19:22	20:07	21:07

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	08:35	08:22	08:13	12:28	14:27	16:22
N 70°	07:53	07:56	07:57	13:09	14:52	16:36
68°	07:25	07:37	07:44	13:37	15:10	16:48
66°	07:03	07:21	07:34	13:57	15:25	16:57
64°	06:46	07:08	07:25	14:14	15:37	17:05
62°	06:32	06:57	07:18	14:28	15:47	17:11
60°	06:20	06:48	07:11	14:39	15:56	17:17
N 58°	06:10	06:40	07:05	14:49	16:03	17:22
56°	06:01	06:32	07:00	14:58	16:10	17:26
54°	05:52	06:26	06:55	15:06	16:16	17:30
52°	05:45	06:20	06:51	15:12	16:21	17:34
50°	05:39	06:15	06:47	15:19	16:26	17:37
45°	05:25	06:03	06:39	15:32	16:37	17:44
N 40°	05:13	05:54	06:32	15:43	16:45	17:50
35°	05:03	05:46	06:26	15:52	16:53	17:55
30°	04:54	05:38	06:21	16:00	16:59	17:59
20°	04:39	05:26	06:11	16:15	17:10	18:07
N 10°	04:26	05:15	06:03	16:27	17:20	18:14
0°	04:14	05:05	05:56	16:38	17:29	18:20
S 10°	04:01	04:54	05:48	16:50	17:38	18:26
20°	03:48	04:43	05:40	17:02	17:48	18:32
30°	03:33	04:31	05:30	17:15	17:58	18:40
35°	03:24	04:24	05:25	17:23	18:05	18:44
40°	03:14	04:15	05:19	17:32	18:12	18:49
45°	03:03	04:05	05:12	17:43	18:20	18:54
S 50°	02:48	03:54	05:03	17:56	18:30	19:01
52°	02:41	03:48	04:59	18:01	18:34	19:04
54°	02:34	03:42	04:55	18:08	18:39	19:07
56°	02:26	03:35	04:50	18:15	18:45	19:10
58°	02:16	03:28	04:44	18:23	18:51	19:14
S 60°	02:06	03:19	04:38	18:32	18:58	19:19

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 27-0 5-0%
24	13:13	13:09	12:13	10:26	22:51	
25	13:04	13:00	12:13	11:17	23:42	
26	12:55	12:50	12:13	12:08	–:–	

February 27, 28, 01 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	157°01.1	147°50.6	N10°31.8	136°41.0	N08°33.8	315°40.3	S07°20.6	250°40.6	S22°05.3
1	172°03.6	162°52.8	32.4	151°41.8	34.5	330°42.9	20.5	265°42.9	05.3
2	187°06.0	177°54.9	33.0	166°42.5	35.2	345°45.5	20.4	280°45.2	05.3
3	202°08.5	192°57.1	·· 33.6	181°43.3	·· 35.9	0°48.1	·· 20.4	295°47.5	·· 05.3
4	217°10.9	207°59.3	34.2	196°44.0	36.6	15°50.7	20.3	310°49.8	05.3
5	232°13.4	223°01.4	34.8	211°44.8	37.3	30°53.3	20.2	325°52.1	05.3
6	247°15.9	238°03.6	N10°35.4	226°45.6	N08°38.0	45°55.9	S07°20.2	340°54.4	S22°05.3
7	262°18.3	253°05.8	36.0	241°46.3	38.8	60°58.6	20.1	355°56.7	05.3
8	277°20.8	268°08.0	36.6	256°47.1	39.5	76°01.2	20.0	10°59.0	05.3
9	292°23.3	283°10.2	·· 37.2	271°47.9	·· 40.2	91°03.8	·· 20.0	26°01.3	·· 05.3
10	307°25.7	298°12.4	37.8	286°48.6	40.9	106°06.4	19.9	41°03.6	05.3
11	322°28.2	313°14.5	38.3	301°49.4	41.6	121°09.0	19.8	56°05.9	05.3
12	337°30.7	328°16.7	N10°38.9	316°50.2	N08°42.3	136°11.6	S07°19.8	71°08.2	S22°05.3
13	352°33.1	343°18.9	39.5	331°50.9	43.0	151°14.2	19.7	86°10.5	05.3
14	7°35.6	358°21.1	40.1	346°51.7	43.7	166°16.8	19.6	101°12.9	05.3
15	22°38.0	13°23.3	·· 40.7	1°52.4	·· 44.4	181°19.5	·· 19.6	116°15.2	·· 05.3
16	37°40.5	28°25.5	41.3	16°53.2	45.1	196°22.1	19.5	131°17.5	05.3
17	52°43.0	43°27.8	41.8	31°54.0	45.8	211°24.7	19.4	146°19.8	05.3
18	67°45.4	58°30.0	N10°42.4	46°54.7	N08°46.6	226°27.3	S07°19.4	161°22.1	S22°05.3
19	82°47.9	73°32.2	43.0	61°55.5	47.3	241°29.9	19.3	176°24.4	05.3
20	97°50.4	88°34.4	43.6	76°56.3	48.0	256°32.5	19.2	191°26.7	05.3
21	112°52.8	103°36.6	·· 44.1	91°57.0	·· 48.7	271°35.1	·· 19.1	206°29.0	·· 05.3
22	127°55.3	118°38.9	44.7	106°57.8	49.4	286°37.8	19.1	221°31.3	05.3
23	142°57.8	133°41.1	45.3	121°58.5	50.1	301°40.4	19.0	236°33.6	05.3
Mer.pass.:13:30		v2.2 d0.6 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	158°00.2	148°43.3	N10°45.8	136°59.3	N08°50.8	316°43.0	S07°18.9	251°35.9	S22°05.3
1	173°02.7	163°45.6	46.4	152°00.1	51.5	331°45.6	18.9	266°38.2	05.3
2	188°05.2	178°47.8	46.9	167°00.8	52.2	346°48.2	18.8	281°40.5	05.3
3	203°07.6	193°50.1	·· 47.5	182°01.6	·· 52.9	1°50.8	·· 18.7	296°42.8	·· 05.3
4	218°10.1	208°52.3	48.1	197°02.4	53.6	16°53.5	18.7	311°45.1	05.3
5	233°12.5	223°54.6	48.6	212°03.1	54.3	31°56.1	18.6	326°47.4	05.3
6	248°15.0	238°56.8	N10°49.2	227°03.9	N08°55.0	46°58.7	S07°18.5	341°49.7	S22°05.3
7	263°17.5	253°59.1	49.7	242°04.6	55.7	62°01.3	18.4	356°52.0	05.3
8	278°19.9	269°01.4	50.3	257°05.4	56.5	77°03.9	18.4	11°54.3	05.3
9	293°22.4	284°03.6	·· 50.8	272°06.2	·· 57.2	92°06.6	·· 18.3	26°56.6	·· 05.3
10	308°24.9	299°05.9	51.4	287°06.9	57.9	107°09.2	18.2	41°59.0	05.3
11	323°27.3	314°08.2	51.9	302°07.7	58.6	122°11.8	18.2	57°01.3	05.3
12	338°29.8	329°10.5	N10°52.5	317°08.5	N08°59.3	137°14.4	S07°18.1	72°03.6	S22°05.3
13	353°32.3	344°12.7	53.0	332°09.2	09°00.0	152°17.0	18.0	87°05.9	05.3
14	8°34.7	359°15.0	53.6	347°10.0	00.7	167°19.7	18.0	102°08.2	05.3
15	23°37.2	14°17.3	·· 54.1	2°10.7	·· 01.4	182°22.3	·· 17.9	117°10.5	·· 05.3
16	38°39.6	29°19.6	54.6	17°11.5	02.1	197°24.9	17.8	132°12.8	05.3
17	53°42.1	44°21.9	55.2	32°12.3	02.8	212°27.5	17.7	147°15.1	05.3
18	68°44.6	59°24.2	N10°55.7	47°13.0	N09°03.5	227°30.1	S07°17.7	162°17.4	S22°05.3
19	83°47.0	74°26.5	56.2	62°13.8	04.2	242°32.8	17.6	177°19.7	05.3
20	98°49.5	89°28.8	56.8	77°14.6	04.9	257°35.4	17.5	192°22.0	05.3
21	113°52.0	104°31.1	·· 57.3	92°15.3	·· 05.6	272°38.0	·· 17.5	207°24.3	·· 05.3
22	128°54.4	119°33.4	57.8	107°16.1	06.3	287°40.6	17.4	222°26.6	05.3
23	143°56.9	134°35.8	58.3	122°16.8	07.0	302°43.2	17.3	237°28.9	05.3
Mer.pass.:13:26		v2.2 d0.6 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	158°59.4	149°38.1	N10°58.9	137°17.6	N09°07.7	317°45.9	S07°17.2	252°31.3	S22°05.3
1	174°01.8	164°40.4	59.4	152°18.4	08.4	332°48.5	17.2	267°33.6	05.3
2	189°04.3	179°42.7	10°59.9	167°19.1	09.1	347°51.1	17.1	282°35.9	05.3
3	204°06.8	194°45.1	11°00.4	182°19.9	·· 09.8	2°53.7	·· 17.0	297°38.2	·· 05.3
4	219°09.2	209°47.4	00.9	197°20.6	10.5	17°56.4	16.9	312°40.5	05.3
5	234°11.7	224°49.7	01.5	212°21.4	11.2	32°59.0	16.9	327°42.8	05.3
6	249°14.1	239°52.1	N11°02.0	227°22.2	N09°11.9	48°01.6	S07°16.8	342°45.1	S22°05.3
7	264°16.6	254°54.4	02.5	242°22.9	12.6	63°04.2	16.7	357°47.4	05.3
8	279°19.1	269°56.8	03.0	257°23.7	13.4	78°06.9	16.7	12°49.7	05.3
9	294°21.5	284°59.1	·· 03.5	272°24.5	·· 14.1	93°09.5	·· 16.6	27°52.0	·· 05.3
10	309°24.0	300°01.5	04.0	287°25.2	14.8	108°12.1	16.5	42°54.4	05.4
11	324°26.5	315°03.9	04.5	302°26.0	15.5	123°14.7	16.4	57°56.7	05.4
12	339°28.9	330°06.2	N11°05.0	317°26.7	N09°16.2	138°17.4	S07°16.4	72°59.0	S22°05.4
13	354°31.4	345°08.6	05.5	332°27.5	16.9	153°20.0	16.3	88°01.3	05.4
14	9°33.9	0°11.0	06.0	347°28.3	17.6	168°22.6	16.2	103°03.6	05.4
15	24°36.3	15°13.3	·· 06.5	2°29.0	·· 18.3	183°25.2	·· 16.1	118°05.9	·· 05.4
16	39°38.8	30°15.7	07.0	17°29.8	19.0	198°27.9	16.1	133°08.2	05.4
17	54°41.2	45°18.1	07.5	32°30.5	19.7	213°30.5	16.0	148°10.5	05.4
18	69°43.7	60°20.5	N11°08.0	47°31.3	N09°20.4	228°33.1	S07°15.9	163°12.8	S22°05.4
19	84°46.2	75°22.9	08.5	62°32.1	21.1	243°35.8	15.8	178°15.2	05.4
20	99°48.6	90°25.3	09.0	77°32.8	21.8	258°38.4	15.8	193°17.5	05.4
21	114°51.1	105°27.7	·· 09.5	92°33.6	·· 22.5	273°41.0	·· 15.7	208°19.8	·· 05.4
22	129°53.6	120°30.1	09.9	107°34.3	23.2	288°43.6	15.6	223°22.1	05.4
23	144°56.0	135°32.5	10.4	122°35.1	23.9	303°46.3	15.6	238°24.4	05.4
Mer.pass.:13:22		v2.3 d0.5 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.7	-42°13.0
Schedar	349°38.0	56°37.9
Diphda	348°53.7	-17°53.8
Achernar	335°25.4	-57°09.4
Hamal	327°58.1	23°32.4
Polaris	316°49.0	89°20.4
Acamar	315°16.6	-40°14.6
Menkar	314°12.5	4°09.1
Mirfak	308°36.8	49°55.3
Aldebaran	290°46.5	16°32.4
Rigel	281°09.6	-8°11.3
Capella	280°30.6	46°00.8
Bellatrix	278°29.2	6°21.6
Elnath	278°09.4	28°37.1
Alnilam	275°43.7	-1°11.8
Betelgeuse	270°58.5	7°24.3
Canopus	263°54.8	-52°42.8
Sirius	258°31.3	-16°44.8
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.4	-59°34.2
Suhail	222°50.2	-43°30.4
Miaplacidus	221°38.2	-69°47.5
Alphard	217°53.3	-8°44.2
Regulus	207°40.5	11°52.8
Dubhe	193°48.1	61°39.4
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.3
Acrux	173°05.8	-63°11.5
Gacrux	171°57.5	-57°12.4
Alioth	166°18.1	55°51.9
Spica	158°28.4	-11°15.0
Alkaid	152°56.7	49°13.5
Hadar	148°43.8	-60°27.0
Menkent	148°04.3	-36°27.1
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°47.9	-60°54.0
Kochab	137°19.8	74°04.9
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.8	26°39.3
Antares	112°23.2	-26°28.0
Atria	107°22.8	-69°03.0
Sabik	102°09.7	-15°44.6
Shaula	96°18.6	-37°06.7
Rasalhague	96°04.2	12°32.9
Eltanin	90°45.2	51°29.1
Kaus Aust.	83°40.7	-34°22.3
Vega	80°37.5	38°47.9
Nunki	75°55.4	-26°16.3
Altair	62°06.0	8°54.8
Peacock	53°15.9	-56°40.6
Deneb	49°30.1	45°20.4
Enif	33°45.0	9°57.2
Al Na'ir	27°41.1	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.7

Feb 27 Mon	SHA	Mer.pass
Venus	350°49.5	14:07
Mars	339°39.9	14:53
Jupiter	158°39.2	02:57
Saturn	93°39.5	07:16

Feb 28 Tue	SHA	Mer.pass
Venus	350°43.1	14:03
Mars	338°59.1	14:51
Jupiter	158°42.8	02:53
Saturn	93°35.7	07:12

Mar 01 Wed	SHA	Mer.pass
Venus	350°38.7	13:59
Mars	338°18.2	14:50
Jupiter	158°46.5	02:48
Saturn	93°31.9	07:09

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.5196 sec ΔT = TT-UT1 = +68.6644 sec

2017 February 27 to Mar. 01 UT

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°48.8	S08°21.1	172°01.2	10.4′	S07°23.5	10.3′	58.2′
1	191°48.9	20.2	186°30.6	10.4′	07°13.2	10.3′	58.2′
2	206°49.1	19.2	200°59.9	10.4′	07°02.9	10.4′	58.2′
3	221°49.2	·· 18.3	215°29.3	10.4′	06°52.5	10.4′	58.3′
4	236°49.3	17.3	229°58.6	10.4′	06°42.0	10.5′	58.3′
5	251°49.4	16.4	244°28.0	10.4′	06°31.5	10.5′	58.3′
6	266°49.5	S08°15.4	258°57.3	10.4′	S06°21.0	10.6′	58.3′
7	281°49.6	14.5	273°26.7	10.3′	06°10.4	10.6′	58.3′
8	296°49.7	13.6	287°56.0	10.3′	05°59.8	10.6′	58.4′
9	311°49.8	·· 12.6	302°25.4	10.3′	05°49.1	10.7′	58.4′
10	326°49.9	11.7	316°54.7	10.3′	05°38.4	10.7′	58.4′
11	341°50.0	10.7	331°24.1	10.3′	05°27.7	10.8′	58.4′
12	356°50.2	S08°09.8	345°53.4	10.3′	S05°16.9	10.8′	58.5′
13	11°50.3	08.8	0°22.7	10.3′	05°06.1	10.8′	58.5′
14	26°50.4	07.9	14°52.1	10.3′	04°55.2	10.9′	58.5′
15	41°50.5	·· 07.0	29°21.4	10.3′	04°44.4	10.9′	58.5′
16	56°50.6	06.0	43°50.7	10.3′	04°33.4	10.9′	58.5′
17	71°50.7	05.1	58°20.0	10.3′	04°22.5	11.0′	58.6′
18	86°50.8	S08°04.1	72°49.3	10.3′	S04°11.5	11.0′	58.6′
19	101°50.9	03.2	87°18.6	10.3′	04°00.5	11.0′	58.6′
20	116°51.1	02.2	101°47.9	10.3′	03°49.4	11.1′	58.6′
21	131°51.2	·· 01.3	116°17.2	10.3′	03°38.4	11.1′	58.6′
22	146°51.3	08°00.4	130°46.5	10.3′	03°27.3	11.1′	58.7′
23	161°51.4	07°59.4	145°15.8	10.3′	03°16.1	11.1′	58.7′
	SD.=16.1	d=0.9	S.D.=15.9				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	176°51.5	S07°58.5	159°45.1	10.3′	S03°05.0	11.2′	58.7′
1	191°51.6	57.5	174°14.3	10.3′	02°53.8	11.2′	58.7′
2	206°51.7	56.6	188°43.6	10.3′	02°42.6	11.2′	58.7′
3	221°51.9	·· 55.6	203°12.8	10.2′	02°31.4	11.2′	58.7′
4	236°52.0	54.7	217°42.1	10.2′	02°20.2	11.2′	58.8′
5	251°52.1	53.7	232°11.3	10.2′	02°08.9	11.3′	58.8′
6	266°52.2	S07°52.8	246°40.5	10.2′	S01°57.6	11.3′	58.8′
7	281°52.3	51.8	261°09.7	10.2′	01°46.3	11.3′	58.8′
8	296°52.4	50.9	275°38.9	10.2′	01°35.0	11.3′	58.8′
9	311°52.5	·· 49.9	290°08.1	10.2′	01°23.7	11.3′	58.8′
10	326°52.7	49.0	304°37.3	10.2′	01°12.4	11.3′	58.9′
11	341°52.8	48.1	319°06.5	10.2′	01°01.0	11.4′	58.9′
12	356°52.9	S07°47.1	333°35.6	10.1′	S00°49.7	11.4′	58.9′
13	11°53.0	46.2	348°04.8	10.1′	00°38.3	11.4′	58.9′
14	26°53.1	45.2	2°33.9	10.1′	00°26.9	11.4′	58.9′
15	41°53.2	·· 44.3	17°03.0	10.1′	00°15.5	11.4′	58.9′
16	56°53.4	43.3	31°32.1	10.1′	S00°04.1	11.4′	59.0′
17	71°53.5	42.4	46°01.2	10.1′	N00°07.3	11.4′	59.0′
18	86°53.6	S07°41.4	60°30.3	10.1′	N00°18.7	11.4′	59.0′
19	101°53.7	40.5	74°59.3	10.0′	00°30.1	11.4′	59.0′
20	116°53.8	39.5	89°28.4	10.0′	00°41.5	11.4′	59.0′
21	131°54.0	·· 38.6	103°57.4	10.0′	00°52.9	11.4′	59.0′
22	146°54.1	37.6	118°26.4	10.0′	01°04.3	11.4′	59.0′
23	161°54.2	36.7	132°55.4	10.0′	01°15.7	11.4′	59.1′
	SD.=16.1	d=0.9	S.D.=16.1				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°54.3	S07°35.7	147°24.4	10.0′	N01°27.1	11.4′	59.1′
1	191°54.4	34.8	161°53.3	9.9′	01°38.5	11.4′	59.1′
2	206°54.6	33.8	176°22.3	9.9′	01°49.9	11.4′	59.1′
3	221°54.7	·· 32.9	190°51.2	9.9′	02°01.3	11.4′	59.1′
4	236°54.8	31.9	205°20.1	9.9′	02°12.7	11.4′	59.1′
5	251°54.9	31.0	219°49.0	9.9′	02°24.0	11.4′	59.1′
6	266°55.0	S07°30.0	234°17.8	9.9′	N02°35.4	11.4′	59.1′
7	281°55.2	29.1	248°46.7	9.8′	02°46.7	11.3′	59.1′
8	296°55.3	28.1	263°15.5	9.8′	02°58.1	11.3′	59.2′
9	311°55.4	·· 27.2	277°44.3	9.8′	03°09.4	11.3′	59.2′
10	326°55.5	26.2	292°13.1	9.8′	03°20.7	11.3′	59.2′
11	341°55.6	25.3	306°41.8	9.7′	03°32.0	11.3′	59.2′
12	356°55.8	S07°24.3	321°10.5	9.7′	N03°43.3	11.3′	59.2′
13	11°55.9	23.4	335°39.3	9.7′	03°54.5	11.2′	59.2′
14	26°56.0	22.4	350°07.9	9.7′	04°05.8	11.2′	59.2′
15	41°56.1	·· 21.5	4°36.6	9.7′	04°17.0	11.2′	59.2′
16	56°56.3	20.5	19°05.2	9.6′	04°28.2	11.2′	59.2′
17	71°56.4	19.5	33°33.9	9.6′	04°39.4	11.2′	59.2′
18	86°56.5	S07°18.6	48°02.4	9.6′	N04°50.5	11.1′	59.3′
19	101°56.6	17.6	62°31.0	9.6′	05°01.6	11.1′	59.3′
20	116°56.8	16.7	76°59.5	9.5′	05°12.7	11.1′	59.3′
21	131°56.9	·· 15.7	91°28.1	9.5′	05°23.8	11.1′	59.3′
22	146°57.0	14.8	105°56.5	9.5′	05°34.8	11.0′	59.3′
23	161°57.1	13.8	120°25.0	9.4′	05°45.8	11.0′	59.3′
	SD.=16.1	d=1.0	S.D.=16.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:14	06:32	07:41	16:46	17:55	19:14
N 70°	05:19	06:29	07:31	16:56	17:58	19:09
68°	05:22	06:26	07:23	17:04	18:00	19:05
66°	05:25	06:24	07:16	17:10	18:02	19:02
64°	05:28	06:22	07:10	17:16	18:04	18:59
62°	05:30	06:21	07:05	17:21	18:06	18:57
60°	05:31	06:19	07:01	17:25	18:07	18:55
N 58°	05:32	06:18	06:57	17:29	18:09	18:54
56°	05:33	06:16	06:54	17:32	18:10	18:53
54°	05:34	06:15	06:51	17:35	18:11	18:52
52°	05:35	06:14	06:48	17:38	18:12	18:51
50°	05:35	06:13	06:45	17:41	18:13	18:51
45°	05:36	06:10	06:39	17:46	18:16	18:50
N 40°	05:36	06:08	06:35	17:51	18:18	18:49
35°	05:36	06:05	06:31	17:55	18:20	18:50
30°	05:35	06:03	06:27	17:58	18:22	18:50
20°	05:33	05:58	06:20	18:05	18:27	18:53
N 10°	05:29	05:54	06:15	18:10	18:32	18:56
0°	05:24	05:48	06:09	18:16	18:37	19:01
S 10°	05:18	05:42	06:04	18:21	18:42	19:07
20°	05:09	05:35	05:57	18:27	18:50	19:16
30°	04:57	05:26	05:50	18:34	18:58	19:27
35°	04:50	05:20	05:46	18:38	19:04	19:34
40°	04:41	05:14	05:41	18:43	19:10	19:43
45°	04:29	05:06	05:36	18:48	19:18	19:55
S 50°	04:15	04:56	05:29	18:55	19:28	20:09
52°	04:08	04:51	05:26	18:58	19:33	20:16
54°	04:00	04:46	05:23	19:01	19:38	20:24
56°	03:50	04:40	05:19	19:05	19:44	20:33
58°	03:40	04:33	05:15	19:09	19:50	20:43
S 60°	03:27	04:25	05:10	19:13	19:58	20:55

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	08:06	07:59	07:52	18:16	20:09	22:05
N 70°	07:57	07:57	07:56	18:22	20:09	21:56
68°	07:50	07:55	07:59	18:27	20:08	21:50
66°	07:44	07:53	08:02	18:31	20:07	21:44
64°	07:39	07:52	08:04	18:35	20:07	21:40
62°	07:35	07:50	08:06	18:38	20:06	21:36
60°	07:31	07:49	08:08	18:41	20:06	21:32
N 58°	07:28	07:48	08:09	18:43	20:06	21:29
56°	07:25	07:48	08:11	18:45	20:05	21:27
54°	07:22	07:47	08:12	18:47	20:05	21:24
52°	07:19	07:46	08:13	18:49	20:05	21:22
50°	07:17	07:46	08:14	18:50	20:05	21:20
45°	07:12	07:44	08:16	18:54	20:04	21:16
N 40°	07:08	07:43	08:18	18:56	20:04	21:12
35°	07:04	07:42	08:20	18:59	20:03	21:09
30°	07:01	07:41	08:21	19:01	20:03	21:06
20°	06:56	07:40	08:24	19:04	20:03	21:01
N 10°	06:51	07:38	08:26	19:08	20:02	20:57
0°	06:46	07:37	08:29	19:11	20:02	20:53
S 10°	06:42	07:36	08:31	19:13	20:01	20:49
20°	06:37	07:35	08:33	19:16	20:00	20:45
30°	06:31	07:33	08:36	19:20	20:00	20:40
35°	06:28	07:32	08:38	19:22	19:59	20:38
40°	06:25	07:32	08:40	19:24	19:59	20:35
45°	06:20	07:31	08:42	19:27	19:58	20:31
S 50°	06:15	07:29	08:44	19:30	19:58	20:27
52°	06:13	07:29	08:45	19:31	19:58	20:25
54°	06:10	07:28	08:47	19:32	19:57	20:23
56°	06:08	07:27	08:48	19:34	19:57	20:20
58°	06:04	07:27	08:50	19:36	19:57	20:18
S 60°	06:01	07:26	08:52	19:38	19:56	20:15

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 1-3 1-10%
27	12:45	12:39	12:13	12:58	00:33	
28	12:34	12:28	12:12	13:49	01:24	
01	12:23	12:17	12:12	14:41	02:15	

March 02, 03, 04 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	159°58.5	150°34.9	N11°10.9	137°35.9	N09°24.6	318°48.9	S07°15.5	253°26.7	S22°05.4
1	175°01.0	165°37.3	11.4	152°36.6	25.3	333°51.5	15.4	268°29.0	05.4
2	190°03.4	180°39.7	11.9	167°37.4	26.0	348°54.2	15.3	283°31.3	05.4
3	205°05.9	195°42.1	·· 12.3	182°38.1	·· 26.7	3°56.8	·· 15.3	298°33.7	·· 05.4
4	220°08.4	210°44.6	12.8	197°38.9	27.4	18°59.4	15.2	313°36.0	05.4
5	235°10.8	225°47.0	13.3	212°39.7	28.1	34°02.1	15.1	328°38.3	05.4
6	250°13.3	240°49.4	N11°13.7	227°40.4	N09°28.8	49°04.7	S07°15.0	343°40.6	S22°05.4
7	265°15.7	255°51.9	14.2	242°41.2	29.5	64°07.3	15.0	358°42.9	05.4
8	280°18.2	270°54.3	14.7	257°41.9	30.2	79°09.9	14.9	13°45.2	05.4
9	295°20.7	285°56.7	·· 15.1	272°42.7	·· 30.8	94°12.6	·· 14.8	28°47.5	·· 05.4
10	310°23.1	300°59.2	15.6	287°43.5	31.5	109°15.2	14.7	43°49.9	05.4
11	325°25.6	316°01.6	16.1	302°44.2	32.2	124°17.8	14.7	58°52.2	05.4
12	340°28.1	331°04.1	N11°16.5	317°45.0	N09°32.9	139°20.5	S07°14.6	73°54.5	S22°05.4
13	355°30.5	346°06.6	17.0	332°45.7	33.6	154°23.1	14.5	88°56.8	05.4
14	10°33.0	1°09.0	17.4	347°46.5	34.3	169°25.7	14.4	103°59.1	05.4
15	25°35.5	16°11.5	·· 17.9	2°47.3	·· 35.0	184°28.4	·· 14.3	119°01.4	·· 05.4
16	40°37.9	31°13.9	18.3	17°48.0	35.7	199°31.0	14.3	134°03.7	05.4
17	55°40.4	46°16.4	18.8	32°48.8	36.4	214°33.6	14.2	149°06.1	05.4
18	70°42.8	61°18.9	N11°19.2	47°49.5	N09°37.1	229°36.3	S07°14.1	164°08.4	S22°05.4
19	85°45.3	76°21.4	19.7	62°50.3	37.8	244°38.9	14.0	179°10.7	05.4
20	100°47.8	91°23.9	20.1	77°51.1	38.5	259°41.6	14.0	194°13.0	05.4
21	115°50.2	106°26.3	·· 20.6	92°51.8	·· 39.2	274°44.2	·· 13.9	209°15.3	·· 05.4
22	130°52.7	121°28.8	21.0	107°52.6	39.9	289°46.8	13.8	224°17.6	05.4
23	145°55.2	136°31.3	21.4	122°53.3	40.6	304°49.5	13.7	239°20.0	05.4
Mer.pass.:13:18		v2.4 d0.5 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	160°57.6	151°33.8	N11°21.9	137°54.1	N09°41.3	319°52.1	S07°13.7	254°22.3	S22°05.4
1	176°00.1	166°36.3	22.3	152°54.9	42.0	334°54.7	13.6	269°24.6	05.4
2	191°02.6	181°38.8	22.7	167°55.6	42.7	349°57.4	13.5	284°26.9	05.4
3	206°05.0	196°41.3	·· 23.2	182°56.4	·· 43.4	5°00.0	·· 13.4	299°29.2	·· 05.4
4	221°07.5	211°43.9	23.6	197°57.1	44.1	20°02.6	13.4	314°31.5	05.4
5	236°10.0	226°46.4	24.0	212°57.9	44.8	35°05.3	13.3	329°33.9	05.4
6	251°12.4	241°48.9	N11°24.4	227°58.7	N09°45.5	50°07.9	S07°13.2	344°36.2	S22°05.4
7	266°14.9	256°51.4	24.9	242°59.4	46.2	65°10.6	13.1	359°38.5	05.4
8	281°17.3	271°54.0	25.3	258°00.2	46.9	80°13.2	13.0	14°40.8	05.4
9	296°19.8	286°56.5	·· 25.7	273°00.9	·· 47.5	95°15.8	·· 13.0	29°43.1	·· 05.4
10	311°22.3	301°59.0	26.1	288°01.7	48.2	110°18.5	12.9	44°45.4	05.4
11	326°24.7	317°01.6	26.5	303°02.4	48.9	125°21.1	12.8	59°47.8	05.4
12	341°27.2	332°04.1	N11°26.9	318°03.2	N09°49.6	140°23.7	S07°12.7	74°50.1	S22°05.4
13	356°29.7	347°06.7	27.3	333°04.0	50.3	155°26.4	12.7	89°52.4	05.4
14	11°32.1	2°09.2	27.7	348°04.7	51.0	170°29.0	12.6	104°54.7	05.4
15	26°34.6	17°11.8	·· 28.1	3°05.5	·· 51.7	185°31.7	·· 12.5	119°57.0	·· 05.4
16	41°37.1	32°14.3	28.6	18°06.2	52.4	200°34.3	12.4	134°59.4	05.4
17	56°39.5	47°16.9	29.0	33°07.0	53.1	215°36.9	12.3	150°01.7	05.4
18	71°42.0	62°19.4	N11°29.4	48°07.8	N09°53.8	230°39.6	S07°12.3	165°04.0	S22°05.4
19	86°44.5	77°22.0	29.8	63°08.5	54.5	245°42.2	12.2	180°06.3	05.4
20	101°46.9	92°24.6	30.1	78°09.3	55.2	260°44.9	12.1	195°08.6	05.4
21	116°49.4	107°27.2	·· 30.5	93°10.0	·· 55.9	275°47.5	·· 12.0	210°11.0	·· 05.4
22	131°51.8	122°29.7	30.9	108°10.8	56.5	290°50.1	11.9	225°13.3	05.4
23	146°54.3	137°32.3	31.3	123°11.5	57.2	305°52.8	11.9	240°15.6	05.4
Mer.pass.:13:14		v2.5 d0.4 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	161°56.8	152°34.9	N11°31.7	138°12.3	N09°57.9	320°55.4	S07°11.8	255°17.9	S22°05.4
1	176°59.2	167°37.5	32.1	153°13.1	58.6	335°58.1	11.7	270°20.2	05.4
2	192°01.7	182°40.1	32.5	168°13.8	09°59.3	351°00.7	11.6	285°22.6	05.4
3	207°04.2	197°42.7	·· 32.9	183°14.6	10°00.0	6°03.4	·· 11.5	300°24.9	·· 05.4
4	222°06.6	212°45.3	33.2	198°15.3	00.7	21°06.0	11.5	315°27.2	05.4
5	237°09.1	227°47.9	33.6	213°16.1	01.4	36°08.6	11.4	330°29.5	05.4
6	252°11.6	242°50.5	N11°34.0	228°16.8	N10°02.1	51°11.3	S07°11.3	345°31.8	S22°05.4
7	267°14.0	257°53.2	34.4	243°17.6	02.8	66°13.9	11.2	0°34.2	05.4
8	282°16.5	272°55.8	34.7	258°18.4	03.5	81°16.6	11.1	15°36.5	05.4
9	297°18.9	287°58.4	·· 35.1	273°19.1	·· 04.1	96°19.2	·· 11.1	30°38.8	·· 05.4
10	312°21.4	303°01.0	35.5	288°19.9	04.8	111°21.9	11.0	45°41.1	05.4
11	327°23.9	318°03.7	35.8	303°20.6	05.5	126°24.5	10.9	60°43.5	05.4
12	342°26.3	333°06.3	N11°36.2	318°21.4	N10°06.2	141°27.2	S07°10.8	75°45.8	S22°05.4
13	357°28.8	348°08.9	36.6	333°22.1	06.9	156°29.8	10.7	90°48.1	05.4
14	12°31.3	3°11.6	36.9	348°22.9	07.6	171°32.4	10.7	105°50.4	05.4
15	27°33.7	18°14.2	·· 37.3	3°23.7	·· 08.3	186°35.1	·· 10.6	120°52.7	·· 05.4
16	42°36.2	33°16.9	37.6	18°24.4	09.0	201°37.7	10.5	135°55.1	05.4
17	57°38.7	48°19.5	38.0	33°25.2	09.7	216°40.4	10.4	150°57.4	05.4
18	72°41.1	63°22.2	N11°38.3	48°25.9	N10°10.3	231°43.0	S07°10.3	165°59.7	S22°05.4
19	87°43.6	78°24.8	38.7	63°26.7	11.0	246°45.7	10.3	181°02.0	05.4
20	102°46.1	93°27.5	39.0	78°27.4	11.7	261°48.3	10.2	196°04.4	05.4
21	117°48.5	108°30.2	·· 39.4	93°28.2	·· 12.4	276°51.0	·· 10.1	211°06.7	·· 05.4
22	132°51.0	123°32.8	39.7	108°29.0	13.1	291°53.6	10.0	226°09.0	05.4
23	147°53.4	138°35.5	40.1	123°29.7	13.8	306°56.3	09.9	241°11.3	05.4
Mer.pass.:13:10		v2.6 d0.4 m-4.4		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.7	-42°13.0
Schedar	349°38.1	56°37.9
Diphda	348°53.7	-17°53.8
Achernar	335°25.4	-57°09.4
Hamal	327°58.1	23°32.4
Polaris	316°50.3	89°20.4
Acamar	315°16.7	-40°14.6
Menkar	314°12.6	4°09.1
Mirfak	308°36.9	49°55.3
Aldebaran	290°46.5	16°32.4
Rigel	281°09.6	-8°11.3
Capella	280°30.7	46°00.8
Bellatrix	278°29.3	6°21.6
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.8
Betelgeuse	270°58.5	7°24.3
Canopus	263°54.8	-52°42.8
Sirius	258°31.4	-16°44.8
Adhara	255°10.3	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.4	27°58.9
Avior	234°16.4	-59°34.2
Suhail	222°50.2	-43°30.4
Miaplacidus	221°38.2	-69°47.5
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.4
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.3
Acrux	173°05.7	-63°11.5
Gacrux	171°57.5	-57°12.4
Alioth	166°18.1	55°51.9
Spica	158°28.3	-11°15.0
Alkaid	152°56.6	49°13.5
Hadar	148°43.8	-60°27.0
Menkent	148°04.3	-36°27.1
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°47.9	-60°54.0
Kochab	137°19.7	74°04.9
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.8	26°39.3
Antares	112°23.1	-26°28.0
Atria	107°22.7	-69°03.0
Sabik	102°09.7	-15°44.6
Shaula	96°18.6	-37°06.7
Rasalhague	96°04.2	12°32.9
Eltanin	90°45.1	51°29.1
Kaus Aust.	83°40.7	-34°22.3
Vega	80°37.4	38°47.9
Nunki	75°55.4	-26°16.3
Altair	62°06.0	8°54.8
Peacock	53°15.8	-56°40.6
Deneb	49°30.1	45°20.4
Enif	33°45.0	9°57.2
Al Na'ir	27°41.1	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.5
Markab	13°36.1	15°17.7

Mar 02 Thu	**SHA**	**Mer.pass**
Venus	350°36.4	13:55
Mars	337°37.4	14:49
Jupiter	158°50.4	02:44
Saturn	93°28.2	07:05

Mar 03 Fri	**SHA**	**Mer.pass**
Venus	350°36.2	13:51
Mars	336°56.5	14:48
Jupiter	158°54.5	02:40
Saturn	93°24.6	07:01

Mar 04 Sat	**SHA**	**Mer.pass**
Venus	350°38.2	13:47
Mars	336°15.5	14:46
Jupiter	158°58.7	02:36
Saturn	93°21.1	06:58

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.5154 sec ΔT = TT-UT1 = +68.6686 sec

2017 March 02 to Mar. 04 UT

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°57.3	S07°12.9	134°53.4	9.4′	N05°56.8	11.0′	59.3′
1	191°57.4	11.9	149°21.8	9.4′	06°07.7	10.9′	59.3′
2	206°57.5	11.0	163°50.2	9.4′	06°18.6	10.9′	59.3′
3	221°57.6	·· 10.0	178°18.6	9.3′	06°29.5	10.9′	59.3′
4	236°57.8	09.1	192°46.9	9.3′	06°40.3	10.8′	59.3′
5	251°57.9	08.1	207°15.2	9.3′	06°51.1	10.8′	59.3′
6	266°58.0	S07°07.1	221°43.4	9.2′	N07°01.9	10.7′	59.3′
7	281°58.1	06.2	236°11.6	9.2′	07°12.6	10.7′	59.3′
8	296°58.3	05.2	250°39.8	9.2′	07°23.3	10.7′	59.3′
9	311°58.4	·· 04.3	265°08.0	9.2′	07°33.9	10.6′	59.3′
10	326°58.5	03.3	279°36.1	9.1′	07°44.5	10.6′	59.4′
11	341°58.6	02.4	294°04.3	9.1′	07°55.0	10.5′	59.4′
12	356°58.8	S07°01.4	308°32.3	9.1′	N08°05.5	10.5′	59.4′
13	11°58.9	07°00.4	323°00.4	9.0′	08°16.0	10.4′	59.4′
14	26°59.0	06°59.5	337°28.4	9.0′	08°26.4	10.4′	59.4′
15	41°59.2	·· 58.5	351°56.3	9.0′	08°36.8	10.3′	59.4′
16	56°59.3	57.6	6°24.3	8.9′	08°47.1	10.3′	59.4′
17	71°59.4	56.6	20°52.2	8.9′	08°57.3	10.2′	59.4′
18	86°59.5	S06°55.7	35°20.1	8.9′	N09°07.5	10.2′	59.4′
19	101°59.7	54.7	49°47.9	8.8′	09°17.6	10.1′	59.4′
20	116°59.8	53.7	64°15.7	8.8′	09°27.7	10.1′	59.4′
21	131°59.9	·· 52.8	78°43.5	8.8′	09°37.8	10.0′	59.4′
22	147°00.1	51.8	93°11.3	8.7′	09°47.7	9.9′	59.4′
23	162°00.2	50.9	107°39.0	8.7′	09°57.6	9.9′	59.4′
	SD.=16.1	d=1.0	S.D.=16.2				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	177°00.3	S06°49.9	122°06.6	8.7′	N10°07.5	9.8′	59.4′
1	192°00.4	49.0	136°34.3	8.6′	10°17.3	9.8′	59.4′
2	207°00.6	48.0	151°01.9	8.6′	10°27.0	9.7′	59.4′
3	222°00.7	·· 47.0	165°29.4	8.5′	10°36.7	9.6′	59.4′
4	237°00.8	46.1	179°57.0	8.5′	10°46.3	9.6′	59.4′
5	252°01.0	45.1	194°24.5	8.5′	10°55.8	9.5′	59.4′
6	267°01.1	S06°44.2	208°51.9	8.4′	N11°05.3	9.4′	59.4′
7	282°01.2	43.2	223°19.4	8.4′	11°14.7	9.4′	59.4′
8	297°01.4	42.2	237°46.7	8.4′	11°24.0	9.3′	59.4′
9	312°01.5	·· 41.3	252°14.1	8.3′	11°33.3	9.2′	59.4′
10	327°01.6	40.3	266°41.4	8.3′	11°42.5	9.2′	59.4′
11	342°01.8	39.4	281°08.7	8.3′	11°51.6	9.1′	59.4′
12	357°01.9	S06°38.4	295°35.9	8.2′	N12°00.7	9.0′	59.4′
13	12°02.0	37.4	310°03.1	8.2′	12°09.6	8.9′	59.4′
14	27°02.2	36.5	324°30.3	8.2′	12°18.5	8.9′	59.4′
15	42°02.3	·· 35.5	338°57.5	8.1′	12°27.3	8.8′	59.4′
16	57°02.4	34.6	353°24.6	8.1′	12°36.1	8.7′	59.4′
17	72°02.6	33.6	7°51.6	8.0′	12°44.8	8.6′	59.4′
18	87°02.7	S06°32.6	22°18.6	8.0′	N12°53.3	8.5′	59.4′
19	102°02.8	31.7	36°45.6	8.0′	13°01.8	8.5′	59.4′
20	117°03.0	30.7	51°12.6	7.9′	13°10.3	8.4′	59.4′
21	132°03.1	·· 29.8	65°39.5	7.9′	13°18.6	8.3′	59.4′
22	147°03.2	28.8	80°06.4	7.9′	13°26.9	8.2′	59.4′
23	162°03.4	27.8	94°33.2	7.8′	13°35.0	8.1′	59.4′
	SD.=16.1	d=1.0	S.D.=16.2				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	177°03.5	S06°26.9	109°00.1	7.8′	N13°43.1	8.0′	59.4′
1	192°03.6	25.9	123°26.8	7.8′	13°51.1	8.0′	59.4′
2	207°03.8	24.9	137°53.6	7.7′	13°59.0	7.9′	59.4′
3	222°03.9	·· 24.0	152°20.3	7.7′	14°06.9	7.8′	59.4′
4	237°04.0	23.0	166°47.0	7.7′	14°14.6	7.7′	59.4′
5	252°04.2	22.1	181°13.6	7.6′	14°22.2	7.6′	59.4′
6	267°04.3	S06°21.1	195°40.2	7.6′	N14°29.8	7.5′	59.4′
7	282°04.5	20.1	210°06.8	7.6′	14°37.3	7.4′	59.3′
8	297°04.6	19.2	224°33.3	7.5′	14°44.6	7.3′	59.3′
9	312°04.7	·· 18.2	238°59.8	7.5′	14°51.9	7.2′	59.3′
10	327°04.9	17.2	253°26.3	7.5′	14°59.1	7.1′	59.3′
11	342°05.0	16.3	267°52.7	7.4′	15°06.2	7.0′	59.3′
12	357°05.1	S06°15.3	282°19.1	7.4′	N15°13.2	6.9′	59.3′
13	12°05.3	14.3	296°45.5	7.4′	15°20.1	6.8′	59.3′
14	27°05.4	13.4	311°11.8	7.3′	15°26.9	6.7′	59.3′
15	42°05.6	·· 12.4	325°38.1	7.3′	15°33.5	6.6′	59.3′
16	57°05.7	11.5	340°04.4	7.3′	15°40.1	6.5′	59.3′
17	72°05.8	10.5	354°30.6	7.2′	15°46.6	6.4′	59.3′
18	87°06.0	S06°09.5	8°56.8	7.2′	N15°53.0	6.3′	59.3′
19	102°06.1	08.6	23°23.0	7.2′	15°59.3	6.2′	59.3′
20	117°06.2	07.6	37°49.2	7.1′	16°05.5	6.1′	59.3′
21	132°06.4	·· 06.6	52°15.3	7.1′	16°11.6	6.0′	59.3′
22	147°06.5	05.7	66°41.4	7.1′	16°17.6	5.9′	59.3′
23	162°06.7	04.7	81°07.5	7.1′	16°23.5	5.8′	59.3′
	SD.=16.1	d=1.0	S.D.=16.2				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:59	06:17	07:25	17:00	18:09	19:28
N 70°	05:05	06:16	07:17	17:08	18:10	19:21
68°	05:10	06:15	07:10	17:15	18:11	19:16
66°	05:14	06:13	07:05	17:21	18:12	19:11
64°	05:18	06:12	07:00	17:25	18:13	19:08
62°	05:20	06:11	06:56	17:29	18:14	19:05
60°	05:23	06:11	06:52	17:33	18:15	19:03
N 58°	05:24	06:10	06:49	17:36	18:15	19:01
56°	05:26	06:09	06:46	17:39	18:16	18:59
54°	05:27	06:08	06:44	17:41	18:17	18:58
52°	05:28	06:07	06:41	17:44	18:17	18:56
50°	05:29	06:07	06:39	17:46	18:18	18:55
45°	05:31	06:05	06:34	17:50	18:20	18:54
N 40°	05:32	06:03	06:30	17:54	18:21	18:53
35°	05:32	06:01	06:27	17:57	18:23	18:52
30°	05:32	06:00	06:24	18:01	18:24	18:52
20°	05:31	05:56	06:18	18:06	18:28	18:54
N 10°	05:28	05:52	06:13	18:11	18:32	18:56
0°	05:24	05:48	06:09	18:15	18:36	19:00
S 10°	05:18	05:43	06:04	18:20	18:41	19:06
20°	05:10	05:36	05:58	18:25	18:47	19:13
30°	05:00	05:28	05:52	18:31	18:55	19:23
35°	04:53	05:23	05:49	18:34	19:00	19:30
40°	04:44	05:17	05:45	18:38	19:06	19:38
45°	04:34	05:10	05:40	18:43	19:13	19:49
S 50°	04:21	05:01	05:34	18:48	19:22	20:02
52°	04:14	04:57	05:32	18:51	19:26	20:08
54°	04:07	04:52	05:29	18:54	19:30	20:15
56°	03:58	04:47	05:25	18:57	19:36	20:23
58°	03:49	04:41	05:22	19:00	19:41	20:33
S 60°	03:37	04:34	05:18	19:04	19:48	20:44

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	07:45	07:38	07:29	–:–	00:03	02:06
N 70°	07:56	07:56	07:59	23:46	–:–	01:37
68°	08:04	08:11	08:22	23:33	–:–	01:16
66°	08:11	08:23	08:39	23:22	–:–	00:59
64°	08:17	08:33	08:54	23:13	–:–	00:45
62°	08:22	08:42	09:06	23:05	–:–	00:34
60°	08:27	08:49	09:16	22:59	–:–	00:24
N 58°	08:31	08:56	09:25	22:53	–:–	00:16
56°	08:35	09:02	09:33	22:48	–:–	00:08
54°	08:38	09:07	09:40	22:43	–:–	00:01
52°	08:41	09:12	09:47	22:39	23:56	–:–
50°	08:44	09:16	09:53	22:36	23:50	–:–
45°	08:50	09:25	10:05	22:27	23:39	–:–
N 40°	08:55	09:33	10:16	22:21	23:29	–:–
35°	08:59	09:40	10:25	22:15	23:21	–:–
30°	09:03	09:46	10:32	22:10	23:14	–:–
20°	09:09	09:56	10:46	22:01	23:01	–:–
N 10°	09:15	10:06	10:58	21:53	22:51	23:49
0°	09:21	10:14	11:09	21:46	22:40	23:36
S 10°	09:26	10:23	11:21	21:39	22:30	23:24
20°	09:32	10:33	11:33	21:31	22:20	23:11
30°	09:39	10:43	11:47	21:23	22:07	22:56
35°	09:43	10:50	11:55	21:18	22:00	22:47
40°	09:48	10:57	12:05	21:12	21:52	22:37
45°	09:53	11:05	12:16	21:05	21:43	22:25
S 50°	10:00	11:15	12:29	20:57	21:32	22:11
52°	10:03	11:20	12:35	20:54	21:26	22:04
54°	10:06	11:25	12:42	20:50	21:21	21:57
56°	10:10	11:31	12:50	20:45	21:14	21:49
58°	10:14	11:37	12:58	20:41	21:07	21:40
S 60°	10:18	11:45	13:08	20:35	20:59	21:29

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 4-6 18-39%
02	12:11	12:05	12:12	15:33	03:07	
03	11:59	11:52	12:12	16:27	04:00	
04	11:46	11:39	12:12	17:23	04:55	

March 05, 06, 07 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	162°55.9	153°38.2	N11°40.4	138°30.5	N10°14.5	321°58.9	S07°09.9	256°13.7	S22°05.4
1	177°58.4	168°40.9	40.7	153°31.2	15.2	337°01.6	09.8	271°16.0	05.4
2	193°00.8	183°43.6	41.1	168°32.0	15.8	352°04.2	09.7	286°18.3	05.4
3	208°03.3	198°46.3	·· 41.4	183°32.7	·· 16.5	7°06.9	·· 09.6	301°20.6	·· 05.4
4	223°05.8	213°49.0	41.7	198°33.5	17.2	22°09.5	09.5	316°23.0	05.4
5	238°08.2	228°51.7	42.0	213°34.3	17.9	37°12.2	09.4	331°25.3	05.4
6	253°10.7	243°54.4	N11°42.4	228°35.0	N10°18.6	52°14.8	S07°09.4	346°27.6	S22°05.4
7	268°13.2	258°57.1	42.7	243°35.8	19.3	67°17.5	09.3	1°29.9	05.4
8	283°15.6	273°59.8	43.0	258°36.5	20.0	82°20.1	09.2	16°32.3	05.4
9	298°18.1	289°02.5	·· 43.3	273°37.3	·· 20.6	97°22.8	·· 09.1	31°34.6	·· 05.4
10	313°20.6	304°05.2	43.6	288°38.0	21.3	112°25.4	09.0	46°36.9	05.4
11	328°23.0	319°07.9	44.0	303°38.8	22.0	127°28.1	09.0	61°39.2	05.4
12	343°25.5	334°10.7	N11°44.3	318°39.5	N10°22.7	142°30.7	S07°08.9	76°41.6	S22°05.4
13	358°27.9	349°13.4	44.6	333°40.3	23.4	157°33.4	08.8	91°43.9	05.4
14	13°30.4	4°16.1	44.9	348°41.1	24.1	172°36.0	08.7	106°46.2	05.4
15	28°32.9	19°18.9	·· 45.2	3°41.8	·· 24.7	187°38.7	·· 08.6	121°48.5	·· 05.4
16	43°35.3	34°21.6	45.5	18°42.6	25.4	202°41.3	08.5	136°50.9	05.4
17	58°37.8	49°24.4	45.8	33°43.3	26.1	217°44.0	08.5	151°53.2	05.4
18	73°40.3	64°27.1	N11°46.1	48°44.1	N10°26.8	232°46.6	S07°08.4	166°55.5	S22°05.4
19	88°42.7	79°29.9	46.4	63°44.8	27.5	247°49.3	08.3	181°57.9	05.4
20	103°45.2	94°32.6	46.7	78°45.6	28.2	262°51.9	08.2	197°00.2	05.4
21	118°47.7	109°35.4	·· 47.0	93°46.3	·· 28.8	277°54.6	·· 08.1	212°02.5	·· 05.4
22	133°50.1	124°38.1	47.3	108°47.1	29.5	292°57.2	08.0	227°04.8	05.4
23	148°52.6	139°40.9	47.6	123°47.9	30.2	307°59.9	08.0	242°07.2	05.4
Mer.pass.:13:06		v2.7 d0.3 m-4.3		v0.8 d0.7 m1.3		v2.6 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	163°55.1	154°43.7	N11°47.9	138°48.6	N10°30.9	323°02.6	S07°07.9	257°09.5	S22°05.4
1	178°57.5	169°46.5	48.1	153°49.4	31.6	338°05.2	07.8	272°11.8	05.4
2	194°00.0	184°49.2	48.4	168°50.1	32.3	353°07.9	07.7	287°14.2	05.4
3	209°02.4	199°52.0	·· 48.7	183°50.9	·· 32.9	8°10.5	·· 07.6	302°16.5	·· 05.4
4	224°04.9	214°54.8	49.0	198°51.6	33.6	23°13.2	07.5	317°18.8	05.4
5	239°07.4	229°57.6	49.2	213°52.4	34.3	38°15.8	07.5	332°21.1	05.4
6	254°09.8	245°00.4	N11°49.5	228°53.1	N10°35.0	53°18.5	S07°07.4	347°23.5	S22°05.4
7	269°12.3	260°03.2	49.8	243°53.9	35.7	68°21.1	07.3	2°25.8	05.4
8	284°14.8	275°06.0	50.1	258°54.7	36.3	83°23.8	07.2	17°28.1	05.4
9	299°17.2	290°08.8	·· 50.3	273°55.4	·· 37.0	98°26.4	·· 07.1	32°30.5	·· 05.4
10	314°19.7	305°11.6	50.6	288°56.2	37.7	113°29.1	07.0	47°32.8	05.4
11	329°22.2	320°14.4	50.9	303°56.9	38.4	128°31.8	06.9	62°35.1	05.4
12	344°24.6	335°17.3	N11°51.1	318°57.7	N10°39.1	143°34.4	S07°06.9	77°37.4	S22°05.4
13	359°27.1	350°20.1	51.4	333°58.4	39.7	158°37.1	06.8	92°39.8	05.4
14	14°29.5	5°22.9	51.6	348°59.2	40.4	173°39.7	06.7	107°42.1	05.4
15	29°32.0	20°25.7	·· 51.9	3°59.9	·· 41.1	188°42.4	·· 06.6	122°44.4	·· 05.4
16	44°34.5	35°28.6	52.1	19°00.7	41.8	203°45.1	06.5	137°46.8	05.4
17	59°36.9	50°31.4	52.4	34°01.4	42.5	218°47.7	06.4	152°49.1	05.4
18	74°39.4	65°34.2	N11°52.6	49°02.2	N10°43.1	233°50.4	S07°06.4	167°51.4	S22°05.4
19	89°41.9	80°37.1	52.9	64°03.0	43.8	248°53.0	06.3	182°53.8	05.4
20	104°44.3	95°39.9	53.1	79°03.7	44.5	263°55.7	06.2	197°56.1	05.4
21	119°46.8	110°42.8	·· 53.3	94°04.5	·· 45.2	278°58.3	·· 06.1	212°58.4	·· 05.4
22	134°49.3	125°45.7	53.6	109°05.2	45.9	294°01.0	06.0	228°00.8	05.4
23	149°51.7	140°48.5	53.8	124°06.0	46.5	309°03.7	05.9	243°03.1	05.4
Mer.pass.:13:02		v2.8 d0.3 m-4.3		v0.8 d0.7 m1.3		v2.7 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	164°54.2	155°51.4	N11°54.1	139°06.7	N10°47.2	324°06.3	S07°05.8	258°05.4	S22°05.4
1	179°56.7	170°54.2	54.3	154°07.5	47.9	339°09.0	05.8	273°07.8	05.4
2	194°59.1	185°57.1	54.5	169°08.2	48.6	354°11.6	05.7	288°10.1	05.4
3	210°01.6	201°00.0	·· 54.7	184°09.0	·· 49.2	9°14.3	·· 05.6	303°12.4	·· 05.4
4	225°04.0	216°02.9	55.0	199°09.7	49.9	24°17.0	05.5	318°14.8	05.4
5	240°06.5	231°05.8	55.2	214°10.5	50.6	39°19.6	05.4	333°17.1	05.4
6	255°09.0	246°08.6	N11°55.4	229°11.2	N10°51.3	54°22.3	S07°05.3	348°19.4	S22°05.4
7	270°11.4	261°11.5	55.6	244°12.0	52.0	69°25.0	05.2	3°21.8	05.4
8	285°13.9	276°14.4	55.8	259°12.7	52.6	84°27.6	05.1	18°24.1	05.4
9	300°16.4	291°17.3	·· 56.0	274°13.5	·· 53.3	99°30.3	·· 05.1	33°26.4	·· 05.4
10	315°18.8	306°20.2	56.2	289°14.3	54.0	114°32.9	05.0	48°28.8	05.4
11	330°21.3	321°23.1	56.5	304°15.0	54.7	129°35.6	04.9	63°31.1	05.4
12	345°23.8	336°26.1	N11°56.7	319°15.8	N10°55.3	144°38.3	S07°04.8	78°33.4	S22°05.4
13	0°26.2	351°29.0	56.9	334°16.5	56.0	159°40.9	04.7	93°35.8	05.4
14	15°28.7	6°31.9	57.1	349°17.3	56.7	174°43.6	04.6	108°38.1	05.4
15	30°31.2	21°34.8	·· 57.3	4°18.0	·· 57.4	189°46.3	·· 04.5	123°40.4	·· 05.4
16	45°33.6	36°37.7	57.5	19°18.8	58.0	204°48.9	04.5	138°42.8	05.4
17	60°36.1	51°40.7	57.6	34°19.5	58.7	219°51.6	04.4	153°45.1	05.4
18	75°38.5	66°43.6	N11°57.8	49°20.3	N10°59.4	234°54.2	S07°04.3	168°47.4	S22°05.4
19	90°41.0	81°46.5	58.0	64°21.0	11°00.1	249°56.9	04.2	183°49.8	05.4
20	105°43.5	96°49.5	58.2	79°21.8	00.7	264°59.6	04.1	198°52.1	05.4
21	120°45.9	111°52.4	·· 58.4	94°22.5	·· 01.4	280°02.2	·· 04.0	213°54.4	·· 05.4
22	135°48.4	126°55.4	58.6	109°23.3	02.1	295°04.9	03.9	228°56.8	05.4
23	150°50.9	141°58.3	58.8	124°24.0	02.8	310°07.6	03.8	243°59.1	05.4
Mer.pass.:12:58		v2.9 d0.2 m-4.3		v0.8 d0.7 m1.3		v2.7 d0.1 m-2.2		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.7	-42°13.0
Schedar	349°38.1	56°37.9
Diphda	348°53.7	-17°53.8
Achernar	335°25.4	-57°09.3
Hamal	327°58.1	23°32.4
Polaris	316°51.3	89°20.3
Acamar	315°16.7	-40°14.6
Menkar	314°12.6	4°09.1
Mirfak	308°36.9	49°55.3
Aldebaran	290°46.5	16°32.4
Rigel	281°09.6	-8°11.3
Capella	280°30.7	46°00.8
Bellatrix	278°29.3	6°21.6
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.8
Betelgeuse	270°58.5	7°24.3
Canopus	263°54.8	-52°42.8
Sirius	258°31.4	-16°44.8
Adhara	255°10.4	-29°00.1
Procyon	244°56.9	5°10.6
Pollux	243°24.5	27°58.9
Avior	234°16.4	-59°34.2
Suhail	222°50.2	-43°30.4
Miaplacidus	221°38.2	-69°47.5
Alphard	217°53.3	-8°44.2
Regulus	207°40.5	11°52.8
Dubhe	193°48.1	61°39.4
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.3
Acrux	173°05.7	-63°11.5
Gacrux	171°57.5	-57°12.4
Alioth	166°18.1	55°51.9
Spica	158°28.3	-11°15.0
Alkaid	152°56.6	49°13.5
Hadar	148°43.8	-60°27.1
Menkent	148°04.3	-36°27.1
Arcturus	145°53.2	19°05.5
Rigil Kent.	139°47.8	-60°54.0
Kochab	137°19.6	74°04.9
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.8	26°39.3
Antares	112°23.1	-26°28.0
Atria	107°22.6	-69°03.0
Sabik	102°09.7	-15°44.6
Shaula	96°18.6	-37°06.7
Rasalhague	96°04.2	12°32.9
Eltanin	90°45.1	51°29.1
Kaus Aust.	83°40.6	-34°22.3
Vega	80°37.4	38°47.9
Nunki	75°55.4	-26°16.3
Altair	62°06.0	8°54.8
Peacock	53°15.8	-56°40.5
Deneb	49°30.1	45°20.4
Enif	33°45.0	9°57.2
Al Na'ir	27°41.1	-46°52.7
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.3	28°10.4
Markab	13°36.1	15°17.7

Mar 05 Sun	**SHA**	**Mer.pass**
Venus	350°42.3	13:43
Mars	335°34.6	14:45
Jupiter	159°03.0	02:32
Saturn	93°17.7	06:54

Mar 06 Mon	**SHA**	**Mer.pass**
Venus	350°48.6	13:39
Mars	334°53.6	14:44
Jupiter	159°07.5	02:27
Saturn	93°14.4	06:50

Mar 07 Tue	**SHA**	**Mer.pass**
Venus	350°57.2	13:34
Mars	334°12.5	14:43
Jupiter	159°12.1	02:23
Saturn	93°11.2	06:47

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.5109 sec ΔT = TT-UT1 = +68.6731 sec

2017 March 05 to Mar. 07 UT

h Sun Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	177°06.8	S06°03.7	95°33.5	7.0′	N16°29.2	5.7′	59.3′
1	192°06.9	02.8	109°59.5	7.0′	16°34.9	5.6′	59.3′
2	207°07.1	01.8	124°25.5	7.0′	16°40.4	5.5′	59.2′
3	222°07.2	06°00.8	138°51.4	6.9′	16°45.9	5.4′	59.2′
4	237°07.4	05°59.9	153°17.4	6.9′	16°51.2	5.3′	59.2′
5	252°07.5	58.9	167°43.3	6.9′	16°56.5	5.2′	59.2′
6	267°07.6	S05°57.9	182°09.2	6.9′	N17°01.6	5.1′	59.2′
7	282°07.8	57.0	196°35.0	6.8′	17°06.6	5.0′	59.2′
8	297°07.9	56.0	211°00.9	6.8′	17°11.5	4.8′	59.2′
9	312°08.1	·· 55.0	225°26.7	6.8′	17°16.3	4.7′	59.2′
10	327°08.2	54.1	239°52.5	6.8′	17°21.0	4.6′	59.2′
11	342°08.4	53.1	254°18.2	6.8′	17°25.5	4.5′	59.2′
12	357°08.5	S05°52.1	268°44.0	6.7′	N17°30.0	4.4′	59.2′
13	12°08.6	51.2	283°09.7	6.7′	17°34.3	4.3′	59.2′
14	27°08.8	50.2	297°35.4	6.7′	17°38.5	4.2′	59.2′
15	42°08.9	·· 49.2	312°01.1	6.7′	17°42.6	4.1′	59.1′
16	57°09.1	48.3	326°26.8	6.7′	17°46.6	3.9′	59.1′
17	72°09.2	47.3	340°52.5	6.7′	17°50.5	3.8′	59.1′
18	87°09.4	S05°46.3	355°18.1	6.6′	N17°54.3	3.7′	59.1′
19	102°09.5	45.4	9°43.8	6.6′	17°57.9	3.6′	59.1′
20	117°09.6	44.4	24°09.4	6.6′	18°01.4	3.5′	59.1′
21	132°09.8	·· 43.4	38°35.0	6.6′	18°04.8	3.4′	59.1′
22	147°09.9	42.4	53°00.6	6.6′	18°08.1	3.2′	59.1′
23	162°10.1	41.5	67°26.1	6.6′	18°11.3	3.1′	59.1′
	SD.=16.1	d=1.0		S.D.=16.1			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	177°10.2	S05°40.5	81°51.7	6.6′	N18°14.4	3.0′	59.1′
1	192°10.4	39.5	96°17.3	6.6′	18°17.3	2.9′	59.1′
2	207°10.5	38.6	110°42.8	6.5′	18°20.1	2.8′	59.0′
3	222°10.7	·· 37.6	125°08.4	6.5′	18°22.8	2.6′	59.0′
4	237°10.8	36.6	139°33.9	6.5′	18°25.4	2.5′	59.0′
5	252°10.9	35.7	153°59.4	6.5′	18°27.9	2.4′	59.0′
6	267°11.1	S05°34.7	168°24.9	6.5′	N18°30.2	2.3′	59.0′
7	282°11.2	33.7	182°50.4	6.5′	18°32.4	2.2′	59.0′
8	297°11.4	32.8	197°16.0	6.5′	18°34.5	2.0′	59.0′
9	312°11.5	·· 31.8	211°41.5	6.5′	18°36.5	1.9′	59.0′
10	327°11.7	30.8	226°07.0	6.5′	18°38.4	1.8′	59.0′
11	342°11.8	29.8	240°32.5	6.5′	18°40.1	1.7′	59.0′
12	357°12.0	S05°28.9	254°58.0	6.5′	N18°41.7	1.6′	58.9′
13	12°12.1	27.9	269°23.5	6.5′	18°43.2	1.4′	58.9′
14	27°12.3	26.9	283°49.0	6.5′	18°44.6	1.3′	58.9′
15	42°12.4	·· 26.0	298°14.5	6.5′	18°45.8	1.2′	58.9′
16	57°12.6	25.0	312°40.0	6.5′	18°47.0	1.1′	58.9′
17	72°12.7	24.0	327°05.5	6.5′	18°48.0	0.9′	58.9′
18	87°12.9	S05°23.0	341°31.1	6.5′	N18°48.9	0.8′	58.9′
19	102°13.0	22.1	355°56.6	6.5′	18°49.6	0.7′	58.9′
20	117°13.2	21.1	10°22.1	6.5′	18°50.3	0.6′	58.9′
21	132°13.3	·· 20.1	24°47.7	6.6′	18°50.8	0.5′	58.8′
22	147°13.4	19.2	39°13.2	6.6′	18°51.2	0.3′	58.8′
23	162°13.6	18.2	53°38.8	6.6′	18°51.5	0.2′	58.8′
	SD.=16.1	d=1.0		S.D.=16.1			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	177°13.7	S05°17.2	68°04.4	6.6′	N18°51.6	0.1′	58.8′
1	192°13.9	16.2	82°30.0	6.6′	18°51.7	-0.0′	58.8′
2	207°14.0	15.3	96°55.6	6.6′	18°51.6	-0.1′	58.8′
3	222°14.2	·· 14.3	111°21.2	6.6′	18°51.4	-0.3′	58.8′
4	237°14.3	13.3	125°46.8	6.6′	18°51.1	-0.4′	58.8′
5	252°14.5	12.4	140°12.5	6.7′	18°50.6	-0.5′	58.7′
6	267°14.6	S05°11.4	154°38.2	6.7′	N18°50.1	-0.6′	58.7′
7	282°14.8	10.4	169°03.8	6.7′	18°49.4	-0.7′	58.7′
8	297°14.9	09.4	183°29.5	6.7′	18°48.6	-0.9′	58.7′
9	312°15.1	·· 08.5	197°55.3	6.7′	18°47.6	-1.0′	58.7′
10	327°15.2	07.5	212°21.0	6.8′	18°46.6	-1.1′	58.7′
11	342°15.4	06.5	226°46.8	6.8′	18°45.4	-1.2′	58.7′
12	357°15.5	S05°05.5	241°12.6	6.8′	N18°44.2	-1.3′	58.7′
13	12°15.7	04.6	255°38.4	6.8′	18°42.8	-1.5′	58.6′
14	27°15.9	03.6	270°04.2	6.9′	18°41.2	-1.6′	58.6′
15	42°16.0	·· 02.6	284°30.1	6.9′	18°39.6	-1.7′	58.6′
16	57°16.2	01.6	298°56.0	6.9′	18°37.8	-1.8′	58.6′
17	72°16.3	05°00.7	313°21.9	6.9′	18°36.0	-1.9′	58.6′
18	87°16.5	S04°59.7	327°47.9	7.0′	N18°34.0	-2.0′	58.6′
19	102°16.6	58.7	342°13.8	7.0′	18°31.9	-2.2′	58.6′
20	117°16.8	57.7	356°39.8	7.0′	18°29.7	-2.3′	58.5′
21	132°16.9	·· 56.8	11°05.9	7.1′	18°27.3	-2.4′	58.5′
22	147°17.1	55.8	25°32.0	7.1′	18°24.9	-2.5′	58.5′
23	162°17.2	54.8	39°58.1	7.1′	18°22.3	-2.6′	58.5′
	SD.=16.1	d=1.0		S.D.=16.0			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:43	06:02	07:10	17:15	18:23	19:42
N 70°	04:51	06:02	07:03	17:21	18:22	19:34
68°	04:58	06:02	06:58	17:26	18:22	19:27
66°	05:03	06:02	06:53	17:31	18:22	19:22
64°	05:07	06:02	06:50	17:34	18:22	19:17
62°	05:11	06:02	06:46	17:37	18:22	19:13
60°	05:14	06:02	06:43	17:40	18:22	19:10
N 58°	05:16	06:02	06:41	17:43	18:22	19:08
56°	05:18	06:01	06:38	17:45	18:22	19:05
54°	05:20	06:01	06:36	17:47	18:22	19:03
52°	05:22	06:01	06:34	17:49	18:23	19:02
50°	05:23	06:01	06:33	17:51	18:23	19:00
45°	05:26	06:00	06:29	17:54	18:24	18:58
N 40°	05:27	05:59	06:26	17:57	18:24	18:56
35°	05:28	05:58	06:23	18:00	18:25	18:55
30°	05:29	05:56	06:20	18:03	18:26	18:54
20°	05:28	05:54	06:16	18:07	18:29	18:54
N 10°	05:26	05:51	06:12	18:11	18:32	18:56
0°	05:23	05:47	06:08	18:14	18:35	18:59
S 10°	05:18	05:43	06:04	18:18	18:39	19:04
20°	05:11	05:37	06:00	18:23	18:45	19:11
30°	05:02	05:30	05:54	18:27	18:52	19:20
35°	04:56	05:26	05:51	18:30	18:56	19:26
40°	04:48	05:21	05:48	18:34	19:01	19:33
45°	04:39	05:14	05:44	18:37	19:07	19:43
S 50°	04:26	05:06	05:39	18:42	19:15	19:55
52°	04:20	05:02	05:37	18:44	19:19	20:00
54°	04:14	04:58	05:35	18:47	19:23	20:07
56°	04:06	04:53	05:32	18:49	19:27	20:14
58°	03:57	04:48	05:29	18:52	19:33	20:23
S 60°	03:47	04:42	05:25	18:55	19:39	20:33

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	07:14	▭	▭	04:18	▭	▭
N 70°	08:07	08:26	09:17	03:27	05:06	06:15
68°	08:39	09:11	10:05	02:55	04:22	05:28
66°	09:03	09:40	10:35	02:31	03:53	04:57
64°	09:22	10:03	10:58	02:13	03:31	04:34
62°	09:38	10:20	11:16	01:58	03:13	04:16
60°	09:51	10:35	11:32	01:45	02:58	04:00
N 58°	10:02	10:48	11:44	01:34	02:46	03:48
56°	10:12	10:59	11:55	01:25	02:35	03:36
54°	10:20	11:08	12:05	01:16	02:26	03:27
52°	10:28	11:17	12:14	01:09	02:17	03:18
50°	10:35	11:25	12:22	01:02	02:10	03:10
45°	10:50	11:41	12:38	00:48	01:53	02:53
N 40°	11:03	11:55	12:52	00:36	01:40	02:40
35°	11:13	12:06	13:03	00:26	01:29	02:28
30°	11:23	12:16	13:14	00:17	01:19	02:18
20°	11:39	12:34	13:31	00:02	01:02	02:00
N 10°	11:53	12:49	13:46	–:–	00:47	01:45
0°	12:06	13:03	14:00	–:–	00:33	01:31
S 10°	12:19	13:17	14:15	–:–	00:19	01:16
20°	12:33	13:33	14:30	–:–	00:04	01:01
30°	12:50	13:50	14:47	23:47	–:–	00:43
35°	12:59	14:01	14:57	23:38	–:–	00:33
40°	13:10	14:12	15:09	23:26	–:–	00:21
45°	13:23	14:26	15:23	23:13	–:–	00:07
S 50°	13:39	14:43	15:39	22:57	23:50	–:–
52°	13:46	14:51	15:47	22:49	23:42	–:–
54°	13:54	15:00	15:56	22:41	23:33	–:–
56°	14:04	15:10	16:06	22:31	23:23	–:–
58°	14:14	15:21	16:17	22:21	23:12	–:–
S 60°	14:26	15:34	16:30	22:08	22:59	–:–

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 7-9 50-72%
05	11:33	11:26	12:11	18:20	05:51	
06	11:19	11:12	12:11	19:17	06:48	
07	11:05	10:58	12:11	20:14	07:45	

March 08, 09, 10 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	165°53.3	157°01.3	N11°58.9	139°24.8	N11°03.4	325°10.2	S07°03.7	259°01.5	S22°05.4
1	180°55.8	172°04.2	59.1	154°25.5	04.1	340°12.9	03.7	274°03.8	05.4
2	195°58.3	187°07.2	59.3	169°26.3	04.8	355°15.6	03.6	289°06.1	05.4
3	211°00.7	202°10.2	·· 59.5	184°27.1	·· 05.4	10°18.2	·· 03.5	304°08.5	·· 05.4
4	226°03.2	217°13.2	59.6	199°27.8	06.1	25°20.9	03.4	319°10.8	05.4
5	241°05.7	232°16.1	59.8	214°28.6	06.8	40°23.6	03.3	334°13.1	05.4
6	256°08.1	247°19.1	N11°59.9	229°29.3	N11°07.5	55°26.2	S07°03.2	349°15.5	S22°05.4
7	271°10.6	262°22.1	12°00.1	244°30.1	08.1	70°28.9	03.1	4°17.8	05.4
8	286°13.0	277°25.1	00.3	259°30.8	08.8	85°31.6	03.0	19°20.2	05.4
9	301°15.5	292°28.1	·· 00.4	274°31.6	·· 09.5	100°34.2	·· 03.0	34°22.5	·· 05.4
10	316°18.0	307°31.1	00.6	289°32.3	10.1	115°36.9	02.9	49°24.8	05.4
11	331°20.4	322°34.1	00.7	304°33.1	10.8	130°39.6	02.8	64°27.2	05.4
12	346°22.9	337°37.1	N12°00.9	319°33.8	N11°11.5	145°42.2	S07°02.7	79°29.5	S22°05.4
13	1°25.4	352°40.1	01.0	334°34.6	12.2	160°44.9	02.6	94°31.9	05.4
14	16°27.8	7°43.1	01.2	349°35.3	12.8	175°47.6	02.5	109°34.2	05.4
15	31°30.3	22°46.1	·· 01.3	4°36.1	·· 13.5	190°50.3	·· 02.4	124°36.5	·· 05.4
16	46°32.8	37°49.1	01.4	19°36.8	14.2	205°52.9	02.3	139°38.9	05.4
17	61°35.2	52°52.1	01.6	34°37.6	14.8	220°55.6	02.2	154°41.2	05.4
18	76°37.7	67°55.2	N12°01.7	49°38.3	N11°15.5	235°58.3	S07°02.2	169°43.5	S22°05.4
19	91°40.1	82°58.2	01.8	64°39.1	16.2	251°00.9	02.1	184°45.9	05.4
20	106°42.6	98°01.2	02.0	79°39.8	16.9	266°03.6	02.0	199°48.2	05.4
21	121°45.1	113°04.3	·· 02.1	94°40.6	·· 17.5	281°06.3	·· 01.9	214°50.6	·· 05.4
22	136°47.5	128°07.3	02.2	109°41.3	18.2	296°08.9	01.8	229°52.9	05.4
23	151°50.0	143°10.3	02.3	124°42.1	18.9	311°11.6	01.7	244°55.2	05.4
Mer.pass.:12:54		v3.0 d0.2 m-4.3		v0.8 d0.7 m1.4		v2.7 d0.1 m-2.2		v2.3 d0.0 m0.5	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	166°52.5	158°13.4	N12°02.5	139°42.8	N11°19.5	326°14.3	S07°01.6	259°57.6	S22°05.4
1	181°54.9	173°16.4	02.6	154°43.6	20.2	341°17.0	01.5	274°59.9	05.4
2	196°57.4	188°19.5	02.7	169°44.3	20.9	356°19.6	01.4	290°02.3	05.4
3	211°59.9	203°22.6	·· 02.8	184°45.1	·· 21.5	11°22.3	·· 01.3	305°04.6	·· 05.4
4	227°02.3	218°25.6	02.9	199°45.8	22.2	26°25.0	01.2	320°07.0	05.4
5	242°04.8	233°28.7	03.0	214°46.6	22.9	41°27.7	01.2	335°09.3	05.4
6	257°07.3	248°31.8	N12°03.1	229°47.3	N11°23.5	56°30.3	S07°01.1	350°11.6	S22°05.4
7	272°09.7	263°34.8	03.2	244°48.1	24.2	71°33.0	01.0	5°14.0	05.4
8	287°12.2	278°37.9	03.3	259°48.8	24.9	86°35.7	00.9	20°16.3	05.4
9	302°14.6	293°41.0	·· 03.4	274°49.6	·· 25.5	101°38.3	·· 00.8	35°18.7	·· 05.4
10	317°17.1	308°44.1	03.5	289°50.3	26.2	116°41.0	00.7	50°21.0	05.4
11	332°19.6	323°47.2	03.6	304°51.1	26.9	131°43.7	00.6	65°23.3	05.4
12	347°22.0	338°50.3	N12°03.7	319°51.8	N11°27.5	146°46.4	S07°00.5	80°25.7	S22°05.4
13	2°24.5	353°53.4	03.8	334°52.6	28.2	161°49.0	00.4	95°28.0	05.4
14	17°27.0	8°56.5	03.9	349°53.3	28.9	176°51.7	00.3	110°30.4	05.4
15	32°29.4	23°59.6	·· 04.0	4°54.1	·· 29.5	191°54.4	·· 00.2	125°32.7	·· 05.4
16	47°31.9	39°02.7	04.0	19°54.8	30.2	206°57.1	00.2	140°35.1	05.4
17	62°34.4	54°05.8	04.1	34°55.6	30.9	221°59.7	00.1	155°37.4	05.4
18	77°36.8	69°08.9	N12°04.2	49°56.3	N11°31.5	237°02.4	S07°00.0	170°39.8	S22°05.4
19	92°39.3	84°12.0	04.3	64°57.1	32.2	252°05.1	06°59.9	185°42.1	05.4
20	107°41.8	99°15.1	04.3	79°57.8	32.9	267°07.8	59.8	200°44.4	05.4
21	122°44.2	114°18.3	·· 04.4	94°58.6	·· 33.5	282°10.4	·· 59.7	215°46.8	·· 05.4
22	137°46.7	129°21.4	04.5	109°59.3	34.2	297°13.1	59.6	230°49.1	05.4
23	152°49.1	144°24.5	04.5	125°00.1	34.8	312°15.8	59.5	245°51.5	05.4
Mer.pass.:12:50		v3.1 d0.1 m-4.3		v0.8 d0.7 m1.4		v2.7 d0.1 m-2.2		v2.3 d0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	167°51.6	159°27.7	N12°04.6	140°00.8	N11°35.5	327°18.5	S06°59.4	260°53.8	S22°05.4
1	182°54.1	174°30.8	04.7	155°01.6	36.2	342°21.2	59.3	275°56.2	05.4
2	197°56.5	189°34.0	04.7	170°02.3	36.8	357°23.8	59.2	290°58.5	05.4
3	212°59.0	204°37.1	·· 04.8	185°03.1	·· 37.5	12°26.5	·· 59.1	306°00.9	·· 05.4
4	228°01.5	219°40.3	04.8	200°03.8	38.2	27°29.2	59.1	321°03.2	05.4
5	243°03.9	234°43.4	04.9	215°04.6	38.8	42°31.9	59.0	336°05.5	05.4
6	258°06.4	249°46.6	N12°04.9	230°05.3	N11°39.5	57°34.5	S06°58.9	351°07.9	S22°05.4
7	273°08.9	264°49.7	05.0	245°06.1	40.2	72°37.2	58.8	6°10.2	05.4
8	288°11.3	279°52.9	05.0	260°06.8	40.8	87°39.9	58.7	21°12.6	05.4
9	303°13.8	294°56.1	·· 05.0	275°07.6	·· 41.5	102°42.6	·· 58.6	36°14.9	·· 05.4
10	318°16.2	309°59.2	05.1	290°08.3	42.1	117°45.3	58.5	51°17.3	05.4
11	333°18.7	325°02.4	05.1	305°09.1	42.8	132°47.9	58.4	66°19.6	05.4
12	348°21.2	340°05.6	N12°05.1	320°09.8	N11°43.5	147°50.6	S06°58.3	81°22.0	S22°05.4
13	3°23.6	355°08.8	05.2	335°10.6	44.1	162°53.3	58.2	96°24.3	05.4
14	18°26.1	10°12.0	05.2	350°11.3	44.8	177°56.0	58.1	111°26.7	05.4
15	33°28.6	25°15.2	·· 05.2	5°12.1	·· 45.4	192°58.7	·· 58.0	126°29.0	·· 05.4
16	48°31.0	40°18.4	05.2	20°12.8	46.1	208°01.3	57.9	141°31.4	05.4
17	63°33.5	55°21.6	05.2	35°13.6	46.8	223°04.0	57.8	156°33.7	05.4
18	78°36.0	70°24.8	N12°05.3	50°14.3	N11°47.4	238°06.7	S06°57.7	171°36.1	S22°05.4
19	93°38.4	85°28.0	05.3	65°15.1	48.1	253°09.4	57.7	186°38.4	05.4
20	108°40.9	100°31.2	05.3	80°15.8	48.7	268°12.1	57.6	201°40.7	05.4
21	123°43.4	115°34.4	·· 05.3	95°16.6	·· 49.4	283°14.7	·· 57.5	216°43.1	·· 05.4
22	138°45.8	130°37.6	05.3	110°17.3	50.1	298°17.4	57.4	231°45.4	05.4
23	153°48.3	145°40.8	05.3	125°18.1	50.7	313°20.1	57.3	246°47.8	05.4
Mer.pass.:12:46		v3.1 d0.1 m-4.2		v0.7 d0.7 m1.4		v2.7 d0.1 m-2.2		v2.3 d0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.7	-42°13.0
Schedar	349°38.1	56°37.8
Diphda	348°53.7	-17°53.8
Achernar	335°25.4	-57°09.3
Hamal	327°58.1	23°32.4
Polaris	316°52.5	89°20.3
Acamar	315°16.7	-40°14.6
Menkar	314°12.6	4°09.1
Mirfak	308°36.9	49°55.3
Aldebaran	290°46.5	16°32.4
Rigel	281°09.6	-8°11.3
Capella	280°30.7	46°00.8
Bellatrix	278°29.3	6°21.6
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.8
Betelgeuse	270°58.5	7°24.3
Canopus	263°54.9	-52°42.8
Sirius	258°31.4	-16°44.8
Adhara	255°10.4	-29°00.2
Procyon	244°56.9	5°10.6
Pollux	243°24.5	27°58.9
Avior	234°16.5	-59°34.2
Suhail	222°50.2	-43°30.4
Miaplacidus	221°38.2	-69°47.5
Alphard	217°53.3	-8°44.2
Regulus	207°40.5	11°52.8
Dubhe	193°48.1	61°39.4
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.3
Acrux	173°05.7	-63°11.6
Gacrux	171°57.4	-57°12.5
Alioth	166°18.1	55°51.9
Spica	158°28.3	-11°15.0
Alkaid	152°56.6	49°13.5
Hadar	148°43.7	-60°27.1
Menkent	148°04.3	-36°27.1
Arcturus	145°53.2	19°05.5
Rigil Kent.	139°47.8	-60°54.0
Kochab	137°19.6	74°04.9
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.3
Antares	112°23.1	-26°28.0
Atria	107°22.6	-69°03.0
Sabik	102°09.6	-15°44.6
Shaula	96°18.5	-37°06.7
Rasalhague	96°04.1	12°32.9
Eltanin	90°45.1	51°29.1
Kaus Aust.	83°40.6	-34°22.3
Vega	80°37.4	38°47.9
Nunki	75°55.4	-26°16.3
Altair	62°06.0	8°54.8
Peacock	53°15.8	-56°40.5
Deneb	49°30.1	45°20.4
Enif	33°44.9	9°57.1
Al Na'ir	27°41.1	-46°52.6
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Mar 08 Wed	SHA	Mer.pass
Venus	351°08.0	13:29
Mars	333°31.5	14:42
Jupiter	159°16.9	02:19
Saturn	93°08.1	06:43

Mar 09 Thu	SHA	Mer.pass
Venus	351°20.9	13:24
Mars	332°50.4	14:40
Jupiter	159°21.8	02:15
Saturn	93°05.1	06:39

Mar 10 Fri	SHA	Mer.pass
Venus	351°36.1	13:19
Mars	332°09.2	14:39
Jupiter	159°26.9	02:10
Saturn	93°02.2	06:35

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.5064 sec ΔT = TT-UT1 = +68.6776 sec

2017 March 08 to Mar. 10 UT

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	177°17.4	S04°53.9	54°24.2	7.2'	N18°19.6	-2.7'	58.5'
1	192°17.5	52.9	68°50.4	7.2'	18°16.9	-2.8'	58.5'
2	207°17.7	51.9	83°16.6	7.2'	18°14.0	-3.0'	58.5'
3	222°17.8	·· 50.9	97°42.8	7.3'	18°10.9	-3.1'	58.4'
4	237°18.0	50.0	112°09.1	7.3'	18°07.8	-3.2'	58.4'
5	252°18.1	49.0	126°35.4	7.3'	18°04.6	-3.3'	58.4'
6	267°18.3	S04°48.0	141°01.8	7.4'	N18°01.2	-3.4'	58.4'
7	282°18.5	47.0	155°28.2	7.4'	17°57.8	-3.5'	58.4'
8	297°18.6	46.0	169°54.6	7.5'	17°54.2	-3.6'	58.4'
9	312°18.8	·· 45.1	184°21.1	7.5'	17°50.5	-3.7'	58.4'
10	327°18.9	44.1	198°47.6	7.5'	17°46.7	-3.8'	58.3'
11	342°19.1	43.1	213°14.1	7.6'	17°42.8	-3.9'	58.3'
12	357°19.2	S04°42.1	227°40.7	7.6'	N17°38.8	-4.1'	58.3'
13	12°19.4	41.2	242°07.4	7.7'	17°34.7	-4.2'	58.3'
14	27°19.5	40.2	256°34.1	7.7'	17°30.5	-4.3'	58.3'
15	42°19.7	·· 39.2	271°00.8	7.8'	17°26.2	-4.4'	58.3'
16	57°19.8	38.2	285°27.6	7.8'	17°21.8	-4.5'	58.3'
17	72°20.0	37.3	299°54.4	7.8'	17°17.2	-4.6'	58.2'
18	87°20.2	S04°36.3	314°21.2	7.9'	N17°12.6	-4.7'	58.2'
19	102°20.3	35.3	328°48.2	7.9'	17°07.9	-4.8'	58.2'
20	117°20.5	34.3	343°15.1	8.0'	17°03.1	-4.9'	58.2'
21	132°20.6	·· 33.4	357°42.1	8.0'	16°58.1	-5.0'	58.2'
22	147°20.8	32.4	12°09.2	8.1'	16°53.1	-5.1'	58.2'
23	162°20.9	31.4	26°36.3	8.1'	16°48.0	-5.2'	58.1'
	SD.=16.1	d=1.0		S.D.=15.9			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	177°21.1	S04°30.4	41°03.4	8.2'	N16°42.7	-5.3'	58.1'
1	192°21.3	29.4	55°30.6	8.2'	16°37.4	-5.4'	58.1'
2	207°21.4	28.5	69°57.9	8.3'	16°32.0	-5.5'	58.1'
3	222°21.6	·· 27.5	84°25.2	8.3'	16°26.5	-5.6'	58.1'
4	237°21.7	26.5	98°52.6	8.4'	16°20.9	-5.7'	58.1'
5	252°21.9	25.5	113°20.0	8.4'	16°15.2	-5.8'	58.0'
6	267°22.0	S04°24.6	127°47.4	8.5'	N16°09.4	-5.8'	58.0'
7	282°22.2	23.6	142°15.0	8.5'	16°03.5	-5.9'	58.0'
8	297°22.4	22.6	156°42.5	8.6'	15°57.5	-6.0'	58.0'
9	312°22.5	·· 21.6	171°10.1	8.6'	15°51.4	-6.1'	58.0'
10	327°22.7	20.6	185°37.8	8.7'	15°45.3	-6.2'	58.0'
11	342°22.8	19.7	200°05.5	8.8'	15°39.0	-6.3'	57.9'
12	357°23.0	S04°18.7	214°33.3	8.8'	N15°32.7	-6.4'	57.9'
13	12°23.2	17.7	229°01.2	8.9'	15°26.2	-6.5'	57.9'
14	27°23.3	16.7	243°29.0	8.9'	15°19.7	-6.6'	57.9'
15	42°23.5	·· 15.8	257°57.0	9.0'	15°13.1	-6.6'	57.9'
16	57°23.6	14.8	272°25.0	9.0'	15°06.4	-6.7'	57.8'
17	72°23.8	13.8	286°53.0	9.1'	14°59.7	-6.8'	57.8'
18	87°24.0	S04°12.8	301°21.1	9.1'	N14°52.8	-6.9'	57.8'
19	102°24.1	11.8	315°49.3	9.2'	14°45.9	-7.0'	57.8'
20	117°24.3	10.9	330°17.5	9.2'	14°38.9	-7.0'	57.8'
21	132°24.4	·· 09.9	344°45.8	9.3'	14°31.8	-7.1'	57.8'
22	147°24.6	08.9	359°14.1	9.4'	14°24.6	-7.2'	57.7'
23	162°24.8	07.9	13°42.5	9.4'	14°17.4	-7.3'	57.7'
	SD.=16.1	d=1.0		S.D.=15.8			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	177°24.9	S04°06.9	28°11.0	9.5'	N14°10.1	-7.4'	57.7'
1	192°25.1	06.0	42°39.5	9.5'	14°02.7	-7.4'	57.7'
2	207°25.2	05.0	57°08.0	9.6'	13°55.2	-7.5'	57.7'
3	222°25.4	·· 04.0	71°36.7	9.6'	13°47.7	-7.6'	57.6'
4	237°25.6	03.0	86°05.3	9.7'	13°40.1	-7.7'	57.6'
5	252°25.7	02.0	100°34.1	9.8'	13°32.4	-7.7'	57.6'
6	267°25.9	S04°01.1	115°02.9	9.8'	N13°24.6	-7.8'	57.6'
7	282°26.0	04°00.1	129°31.7	9.9'	13°16.8	-7.9'	57.6'
8	297°26.2	03°59.1	144°00.6	9.9'	13°08.9	-7.9'	57.5'
9	312°26.4	·· 58.1	158°29.6	10.0'	13°00.9	-8.0'	57.5'
10	327°26.5	57.1	172°58.6	10.0'	12°52.9	-8.1'	57.5'
11	342°26.7	56.2	187°27.6	10.1'	12°44.8	-8.1'	57.5'
12	357°26.9	S03°55.2	201°56.8	10.2'	N12°36.6	-8.2'	57.5'
13	12°27.0	54.2	216°25.9	10.2'	12°28.4	-8.3'	57.4'
14	27°27.2	53.2	230°55.2	10.3'	12°20.1	-8.3'	57.4'
15	42°27.4	·· 52.2	245°24.5	10.3'	12°11.8	-8.4'	57.4'
16	57°27.5	51.3	259°53.8	10.4'	12°03.4	-8.4'	57.4'
17	72°27.7	50.3	274°23.2	10.4'	11°54.9	-8.5'	57.4'
18	87°27.8	S03°49.3	288°52.7	10.5'	N11°46.4	-8.6'	57.3'
19	102°28.0	48.3	303°22.2	10.5'	11°37.8	-8.6'	57.3'
20	117°28.2	47.3	317°51.8	10.6'	11°29.1	-8.7'	57.3'
21	132°28.3	·· 46.4	332°21.4	10.7'	11°20.4	-8.7'	57.3'
22	147°28.5	45.4	346°51.1	10.7'	11°11.7	-8.8'	57.3'
23	162°28.7	44.4	1°20.8	10.8'	11°02.9	-8.8'	57.2'
	SD.=16.1	d=1.0		S.D.=15.7			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:27	05:47	06:54	17:29	18:36	19:57
N 70°	04:37	05:49	06:49	17:34	18:34	19:47
68°	04:45	05:50	06:45	17:37	18:33	19:39
66°	04:51	05:51	06:42	17:41	18:32	19:32
64°	04:57	05:52	06:39	17:43	18:31	19:26
62°	05:01	05:53	06:37	17:46	18:30	19:22
60°	05:05	05:53	06:34	17:48	18:29	19:18
N 58°	05:08	05:53	06:32	17:50	18:29	19:14
56°	05:11	05:54	06:31	17:51	18:28	19:12
54°	05:13	05:54	06:29	17:53	18:28	19:09
52°	05:15	05:54	06:28	17:54	18:28	19:07
50°	05:17	05:54	06:26	17:55	18:28	19:05
45°	05:20	05:54	06:23	17:58	18:28	19:02
N 40°	05:23	05:54	06:21	18:01	18:28	18:59
35°	05:24	05:54	06:19	18:03	18:28	18:57
30°	05:25	05:53	06:17	18:05	18:28	18:56
20°	05:26	05:51	06:13	18:08	18:30	18:55
N 10°	05:25	05:49	06:10	18:11	18:32	18:56
0°	05:22	05:46	06:07	18:14	18:34	18:59
S 10°	05:18	05:43	06:04	18:17	18:38	19:02
20°	05:13	05:38	06:01	18:20	18:42	19:08
30°	05:04	05:32	05:56	18:24	18:48	19:16
35°	04:59	05:29	05:54	18:26	18:52	19:22
40°	04:52	05:24	05:51	18:29	18:56	19:28
45°	04:43	05:18	05:48	18:32	19:02	19:37
S 50°	04:32	05:11	05:44	18:36	19:08	19:48
52°	04:27	05:08	05:42	18:37	19:12	19:53
54°	04:21	05:04	05:40	18:39	19:15	19:59
56°	04:14	05:00	05:38	18:41	19:19	20:05
58°	04:06	04:55	05:36	18:44	19:24	20:13
S 60°	03:57	04:50	05:33	18:46	19:29	20:22

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	09:29	11:49	13:49	08:02	07:36	07:26
N 70°	10:44	12:27	14:11	06:46	06:57	07:02
68°	11:22	12:53	14:29	06:08	06:30	06:43
66°	11:48	13:13	14:43	05:41	06:10	06:28
64°	12:09	13:29	14:54	05:20	05:53	06:16
62°	12:25	13:42	15:04	05:04	05:39	06:05
60°	12:39	13:54	15:12	04:50	05:27	05:56
N 58°	12:50	14:03	15:19	04:38	05:17	05:48
56°	13:01	14:12	15:26	04:27	05:08	05:41
54°	13:10	14:19	15:32	04:18	05:00	05:35
52°	13:18	14:26	15:37	04:10	04:53	05:29
50°	13:25	14:32	15:41	04:02	04:47	05:24
45°	13:40	14:45	15:51	03:47	04:33	05:13
N 40°	13:53	14:56	16:00	03:33	04:21	05:04
35°	14:04	15:05	16:07	03:22	04:12	04:56
30°	14:13	15:13	16:13	03:13	04:03	04:49
20°	14:29	15:27	16:24	02:56	03:48	04:37
N 10°	14:43	15:39	16:34	02:41	03:35	04:26
0°	14:56	15:51	16:42	02:27	03:23	04:16
S 10°	15:10	16:02	16:51	02:13	03:10	04:05
20°	15:24	16:14	17:01	01:59	02:57	03:55
30°	15:40	16:28	17:11	01:42	02:42	03:42
35°	15:49	16:36	17:18	01:32	02:33	03:35
40°	16:00	16:45	17:25	01:20	02:23	03:26
45°	16:12	16:55	17:33	01:07	02:11	03:17
S 50°	16:27	17:08	17:42	00:51	01:56	03:05
52°	16:35	17:14	17:47	00:43	01:49	02:59
54°	16:42	17:20	17:52	00:34	01:42	02:53
56°	16:51	17:28	17:57	00:25	01:33	02:46
58°	17:01	17:36	18:04	00:14	01:24	02:39
S 60°	17:13	17:45	18:10	00:01	01:13	02:30

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 10-12 82-95%
08	10:50	10:43	12:11	21:10	08:42	
09	10:36	10:28	12:10	22:03	09:37	
10	10:20	10:13	12:10	22:54	10:29	

March 11, 12, 13 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	168°50.7	160°44.1	N12°05.3	140°18.8	N11°51.4	328°22.8	S06°57.2	261°50.1	S22°05.4
1	183°53.2	175°47.3	05.3	155°19.5	52.0	343°25.5	57.1	276°52.5	05.4
2	198°55.7	190°50.5	05.3	170°20.3	52.7	358°28.2	57.0	291°54.8	05.4
3	213°58.1	205°53.8	·· 05.3	185°21.0	·· 53.4	13°30.8	·· 56.9	306°57.2	·· 05.4
4	229°00.6	220°57.0	05.3	200°21.8	54.0	28°33.5	56.8	321°59.5	05.4
5	244°03.1	236°00.2	05.3	215°22.5	54.7	43°36.2	56.7	337°01.9	05.4
6	259°05.5	251°03.5	N12°05.2	230°23.3	N11°55.3	58°38.9	S06°56.6	352°04.2	S22°05.4
7	274°08.0	266°06.7	05.2	245°24.0	56.0	73°41.6	56.5	7°06.6	05.4
8	289°10.5	281°10.0	05.2	260°24.8	56.6	88°44.3	56.4	22°08.9	05.4
9	304°12.9	296°13.2	·· 05.2	275°25.5	·· 57.3	103°46.9	·· 56.3	37°11.3	·· 05.4
10	319°15.4	311°16.5	05.2	290°26.3	58.0	118°49.6	56.2	52°13.6	05.4
11	334°17.8	326°19.8	05.1	305°27.0	58.6	133°52.3	56.1	67°16.0	05.4
12	349°20.3	341°23.0	N12°05.1	320°27.8	N11°59.3	148°55.0	S06°56.0	82°18.3	S22°05.4
13	4°22.8	356°26.3	05.1	335°28.5	11°59.9	163°57.7	56.0	97°20.7	05.4
14	19°25.2	11°29.6	05.0	350°29.3	12°00.6	179°00.4	55.9	112°23.0	05.4
15	34°27.7	26°32.9	·· 05.0	5°30.0	·· 01.2	194°03.1	·· 55.8	127°25.4	·· 05.4
16	49°30.2	41°36.1	04.9	20°30.8	01.9	209°05.7	55.7	142°27.7	05.4
17	64°32.6	56°39.4	04.9	35°31.5	02.6	224°08.4	55.6	157°30.1	05.4
18	79°35.1	71°42.7	N12°04.9	50°32.2	N12°03.2	239°11.1	S06°55.5	172°32.5	S22°05.4
19	94°37.6	86°46.0	04.8	65°33.0	03.9	254°13.8	55.4	187°34.8	05.4
20	109°40.0	101°49.3	04.8	80°33.7	04.5	269°16.5	55.3	202°37.2	05.4
21	124°42.5	116°52.6	·· 04.7	95°34.5	·· 05.2	284°19.2	·· 55.2	217°39.5	·· 05.4
22	139°45.0	131°55.9	04.6	110°35.2	05.8	299°21.9	55.1	232°41.9	05.4
23	154°47.4	146°59.2	04.6	125°36.0	06.5	314°24.5	55.0	247°44.2	05.4
Mer.pass.:12:43		v3.2 d-0.0 m-4.2		v0.7 d0.7 m1.4		v2.7 d0.1 m-2.2		v2.3 d0.0 m0.5	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	169°49.9	162°02.5	N12°04.5	140°36.7	N12°07.1	329°27.2	S06°54.9	262°46.6	S22°05.4
1	184°52.3	177°05.8	04.5	155°37.5	07.8	344°29.9	54.8	277°48.9	05.4
2	199°54.8	192°09.1	04.4	170°38.2	08.4	359°32.6	54.7	292°51.3	05.4
3	214°57.3	207°12.5	·· 04.3	185°39.0	·· 09.1	14°35.3	·· 54.6	307°53.6	·· 05.4
4	229°59.7	222°15.8	04.3	200°39.7	09.7	29°38.0	54.5	322°56.0	05.4
5	245°02.2	237°19.1	04.2	215°40.5	10.4	44°40.7	54.4	337°58.3	05.4
6	260°04.7	252°22.4	N12°04.1	230°41.2	N12°11.1	59°43.4	S06°54.3	353°00.7	S22°05.4
7	275°07.1	267°25.8	04.0	245°41.9	11.7	74°46.0	54.2	8°03.0	05.4
8	290°09.6	282°29.1	03.9	260°42.7	12.4	89°48.7	54.1	23°05.4	05.4
9	305°12.1	297°32.4	·· 03.9	275°43.4	·· 13.0	104°51.4	·· 54.0	38°07.8	·· 05.4
10	320°14.5	312°35.8	03.8	290°44.2	13.7	119°54.1	53.9	53°10.1	05.4
11	335°17.0	327°39.1	03.7	305°44.9	14.3	134°56.8	53.8	68°12.5	05.4
12	350°19.5	342°42.5	N12°03.6	320°45.7	N12°15.0	149°59.5	S06°53.7	83°14.8	S22°05.4
13	5°21.9	357°45.8	03.5	335°46.4	15.6	165°02.2	53.6	98°17.2	05.4
14	20°24.4	12°49.2	03.4	350°47.2	16.3	180°04.9	53.5	113°19.5	05.4
15	35°26.8	27°52.6	·· 03.3	5°47.9	·· 16.9	195°07.6	·· 53.4	128°21.9	·· 05.4
16	50°29.3	42°55.9	03.2	20°48.7	17.6	210°10.3	53.3	143°24.2	05.4
17	65°31.8	57°59.3	03.1	35°49.4	18.2	225°13.0	53.3	158°26.6	05.4
18	80°34.2	73°02.7	N12°03.0	50°50.1	N12°18.9	240°15.6	S06°53.2	173°29.0	S22°05.4
19	95°36.7	88°06.0	02.9	65°50.9	19.5	255°18.3	53.1	188°31.3	05.4
20	110°39.2	103°09.4	02.7	80°51.6	20.2	270°21.0	53.0	203°33.7	05.4
21	125°41.6	118°12.8	·· 02.6	95°52.4	·· 20.8	285°23.7	·· 52.9	218°36.0	·· 05.4
22	140°44.1	133°16.2	02.5	110°53.1	21.5	300°26.4	52.8	233°38.4	05.4
23	155°46.6	148°19.6	02.4	125°53.9	22.1	315°29.1	52.7	248°40.7	05.4
Mer.pass.:12:39		v3.3 d-0.1 m-4.2		v0.7 d0.7 m1.4		v2.7 d0.1 m-2.2		v2.4 d0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	170°49.0	163°22.9	N12°02.3	140°54.6	N12°22.8	330°31.8	S06°52.6	263°43.1	S22°05.4
1	185°51.5	178°26.3	02.1	155°55.4	23.4	345°34.5	52.5	278°45.5	05.4
2	200°53.9	193°29.7	02.0	170°56.1	24.1	0°37.2	52.4	293°47.8	05.4
3	215°56.4	208°33.1	·· 01.9	185°56.8	·· 24.7	15°39.9	·· 52.3	308°50.2	·· 05.4
4	230°58.9	223°36.5	01.7	200°57.6	25.4	30°42.6	52.2	323°52.5	05.4
5	246°01.3	238°39.9	01.6	215°58.3	26.0	45°45.3	52.1	338°54.9	05.4
6	261°03.8	253°43.4	N12°01.5	230°59.1	N12°26.7	60°48.0	S06°52.0	353°57.2	S22°05.4
7	276°06.3	268°46.8	01.3	245°59.8	27.3	75°50.7	51.9	8°59.6	05.4
8	291°08.7	283°50.2	01.2	261°00.6	27.9	90°53.3	51.8	24°02.0	05.4
9	306°11.2	298°53.6	·· 01.0	276°01.3	·· 28.6	105°56.0	·· 51.7	39°04.3	·· 05.4
10	321°13.7	313°57.0	00.9	291°02.1	29.2	120°58.7	51.6	54°06.7	05.4
11	336°16.1	329°00.4	00.7	306°02.8	29.9	136°01.4	51.5	69°09.0	05.4
12	351°18.6	344°03.9	N12°00.6	321°03.5	N12°30.5	151°04.1	S06°51.4	84°11.4	S22°05.4
13	6°21.1	359°07.3	00.4	336°04.3	31.2	166°06.8	51.3	99°13.8	05.4
14	21°23.5	14°10.7	00.2	351°05.0	31.8	181°09.5	51.2	114°16.1	05.4
15	36°26.0	29°14.2	12°00.1	6°05.8	·· 32.5	196°12.2	·· 51.1	129°18.5	·· 05.4
16	51°28.4	44°17.6	11°59.9	21°06.5	33.1	211°14.9	51.0	144°20.8	05.4
17	66°30.9	59°21.1	59.7	36°07.3	33.8	226°17.6	50.9	159°23.2	05.4
18	81°33.4	74°24.5	N11°59.6	51°08.0	N12°34.4	241°20.3	S06°50.8	174°25.6	S22°05.4
19	96°35.8	89°28.0	59.4	66°08.7	35.1	256°23.0	50.7	189°27.9	05.4
20	111°38.3	104°31.4	59.2	81°09.5	35.7	271°25.7	50.6	204°30.3	05.4
21	126°40.8	119°34.9	·· 59.0	96°10.2	·· 36.3	286°28.4	·· 50.5	219°32.6	·· 05.4
22	141°43.2	134°38.3	58.9	111°11.0	37.0	301°31.1	50.4	234°35.0	05.4
23	156°45.7	149°41.8	58.7	126°11.7	37.6	316°33.8	50.3	249°37.4	05.4
Mer.pass.:12:35		v3.4 d-0.1 m-4.2		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.2		v2.4 d0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.7	-42°13.0
Schedar	349°38.1	56°37.8
Diphda	348°53.7	-17°53.8
Achernar	335°25.5	-57°09.3
Hamal	327°58.1	23°32.4
Polaris	316°53.8	89°20.3
Acamar	315°16.7	-40°14.6
Menkar	314°12.6	4°09.1
Mirfak	308°36.9	49°55.3
Aldebaran	290°46.5	16°32.4
Rigel	281°09.6	-8°11.3
Capella	280°30.7	46°00.8
Bellatrix	278°29.3	6°21.6
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.8
Betelgeuse	270°58.5	7°24.3
Canopus	263°54.9	-52°42.8
Sirius	258°31.4	-16°44.8
Adhara	255°10.4	-29°00.2
Procyon	244°56.9	5°10.6
Pollux	243°24.5	27°58.9
Avior	234°16.5	-59°34.2
Suhail	222°50.2	-43°30.4
Miaplacidus	221°38.3	-69°47.5
Alphard	217°53.3	-8°44.2
Regulus	207°40.5	11°52.8
Dubhe	193°48.1	61°39.5
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.3
Acrux	173°05.7	-63°11.6
Gacrux	171°57.4	-57°12.5
Alioth	166°18.0	55°51.9
Spica	158°28.3	-11°15.0
Alkaid	152°56.6	49°13.5
Hadar	148°43.7	-60°27.1
Menkent	148°04.3	-36°27.1
Arcturus	145°53.2	19°05.5
Rigil Kent.	139°47.8	-60°54.0
Kochab	137°19.5	74°05.0
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.3
Antares	112°23.1	-26°28.0
Atria	107°22.5	-69°03.0
Sabik	102°09.6	-15°44.6
Shaula	96°18.5	-37°06.7
Rasalhague	96°04.1	12°32.9
Eltanin	90°45.0	51°29.0
Kaus Aust.	83°40.6	-34°22.3
Vega	80°37.4	38°47.9
Nunki	75°55.3	-26°16.3
Altair	62°06.0	8°54.8
Peacock	53°15.7	-56°40.5
Deneb	49°30.1	45°20.4
Enif	33°44.9	9°57.1
Al Na'ir	27°41.1	-46°52.6
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Mar 11 Sat	**SHA**	**Mer.pass**
Venus	351°53.3	13:14
Mars	331°28.1	14:38
Jupiter	159°32.0	02:06
Saturn	92°59.4	06:32

Mar 12 Sun	**SHA**	**Mer.pass**
Venus	352°12.6	13:09
Mars	330°46.8	14:37
Jupiter	159°37.3	02:02
Saturn	92°56.7	06:28

Mar 13 Mon	**SHA**	**Mer.pass**
Venus	352°33.9	13:03
Mars	330°05.6	14:36
Jupiter	159°42.8	01:58
Saturn	92°54.1	06:24

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.5019 sec ΔT = TT-UT1 = +68.6821 sec

2017 March 11 to Mar. 13 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	177°28.8	S03°43.4	15°50.6	10.8'	N10°54.0	-8.9'	57.2'
1	192°29.0	42.4	30°20.5	10.9'	10°45.1	-8.9'	57.2'
2	207°29.2	41.4	44°50.4	10.9'	10°36.1	-9.0'	57.2'
3	222°29.3	·· 40.5	59°20.4	11.0'	10°27.1	-9.0'	57.2'
4	237°29.5	39.5	73°50.4	11.0'	10°18.0	-9.1'	57.1'
5	252°29.6	38.5	88°20.4	11.1'	10°08.9	-9.1'	57.1'
6	267°29.8	S03°37.5	102°50.5	11.1'	N09°59.8	-9.2'	57.1'
7	282°30.0	36.5	117°20.7	11.2'	09°50.6	-9.2'	57.1'
8	297°30.1	35.6	131°50.9	11.3'	09°41.3	-9.3'	57.1'
9	312°30.3	·· 34.6	146°21.2	11.3'	09°32.0	-9.3'	57.0'
10	327°30.5	33.6	160°51.5	11.4'	09°22.7	-9.4'	57.0'
11	342°30.6	32.6	175°21.9	11.4'	09°13.3	-9.4'	57.0'
12	357°30.8	S03°31.6	189°52.4	11.5'	N09°03.9	-9.4'	57.0'
13	12°31.0	30.6	204°22.8	11.5'	08°54.5	-9.5'	57.0'
14	27°31.1	29.7	218°53.4	11.6'	08°45.0	-9.5'	56.9'
15	42°31.3	·· 28.7	233°24.0	11.6'	08°35.4	-9.6'	56.9'
16	57°31.5	27.7	247°54.6	11.7'	08°25.9	-9.6'	56.9'
17	72°31.6	26.7	262°25.3	11.7'	08°16.3	-9.6'	56.9'
18	87°31.8	S03°25.7	276°56.0	11.8'	N08°06.6	-9.7'	56.8'
19	102°32.0	24.8	291°26.8	11.8'	07°56.9	-9.7'	56.8'
20	117°32.1	23.8	305°57.6	11.9'	07°47.2	-9.7'	56.8'
21	132°32.3	·· 22.8	320°28.5	11.9'	07°37.5	-9.8'	56.8'
22	147°32.5	21.8	334°59.4	11.9'	07°27.7	-9.8'	56.8'
23	162°32.6	20.8	349°30.4	12.0'	07°17.9	-9.8'	56.7'
	SD.=16.1	d=1.0		S.D.=15.5			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	177°32.8	S03°19.8	4°01.4	12.0'	N07°08.1	-9.8'	56.7'
1	192°33.0	18.9	18°32.5	12.1'	06°58.3	-9.9'	56.7'
2	207°33.1	17.9	33°03.6	12.1'	06°48.4	-9.9'	56.7'
3	222°33.3	·· 16.9	47°34.7	12.2'	06°38.5	-9.9'	56.6'
4	237°33.5	15.9	62°05.9	12.2'	06°28.5	-9.9'	56.6'
5	252°33.6	14.9	76°37.2	12.3'	06°18.6	-10.0'	56.6'
6	267°33.8	S03°13.9	91°08.5	12.3'	N06°08.6	-10.0'	56.6'
7	282°34.0	13.0	105°39.8	12.4'	05°58.6	-10.0'	56.6'
8	297°34.2	12.0	120°11.2	12.4'	05°48.6	-10.0'	56.5'
9	312°34.3	·· 11.0	134°42.6	12.4'	05°38.5	-10.1'	56.5'
10	327°34.5	10.0	149°14.1	12.5'	05°28.4	-10.1'	56.5'
11	342°34.7	09.0	163°45.6	12.5'	05°18.4	-10.1'	56.5'
12	357°34.8	S03°08.0	178°17.1	12.6'	N05°08.3	-10.1'	56.4'
13	12°35.0	07.0	192°48.7	12.6'	04°58.1	-10.1'	56.4'
14	27°35.2	06.1	207°20.3	12.6'	04°48.0	-10.1'	56.4'
15	42°35.3	·· 05.1	221°52.0	12.7'	04°37.8	-10.2'	56.4'
16	57°35.5	04.1	236°23.7	12.7'	04°27.7	-10.2'	56.4'
17	72°35.7	03.1	250°55.5	12.8'	04°17.5	-10.2'	56.3'
18	87°35.8	S03°02.1	265°27.2	12.8'	N04°07.3	-10.2'	56.3'
19	102°36.0	01.1	279°59.1	12.8'	03°57.1	-10.2'	56.3'
20	117°36.2	03°00.2	294°30.9	12.9'	03°46.9	-10.2'	56.3'
21	132°36.4	02°59.2	309°02.8	12.9'	03°36.7	-10.2'	56.2'
22	147°36.5	58.2	323°34.7	12.9'	03°26.4	-10.2'	56.2'
23	162°36.7	57.2	338°06.7	13.0'	03°16.2	-10.2'	56.2'
	SD.=16.1	d=1.0		S.D.=15.4			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	177°36.9	S02°56.2	352°38.7	13.0'	N03°05.9	-10.3'	56.2'
1	192°37.0	55.2	7°10.7	13.1'	02°55.7	-10.3'	56.2'
2	207°37.2	54.3	21°42.8	13.1'	02°45.4	-10.3'	56.1'
3	222°37.4	·· 53.3	36°14.9	13.1'	02°35.2	-10.3'	56.1'
4	237°37.6	52.3	50°47.0	13.2'	02°24.9	-10.3'	56.1'
5	252°37.7	51.3	65°19.2	13.2'	02°14.6	-10.3'	56.1'
6	267°37.9	S02°50.3	79°51.4	13.2'	N02°04.4	-10.3'	56.0'
7	282°38.1	49.3	94°23.6	13.2'	01°54.1	-10.3'	56.0'
8	297°38.2	48.3	108°55.9	13.3'	01°43.8	-10.3'	56.0'
9	312°38.4	·· 47.4	123°28.2	13.3'	01°33.5	-10.3'	56.0'
10	327°38.6	46.4	138°00.5	13.3'	01°23.3	-10.3'	56.0'
11	342°38.8	45.4	152°32.9	13.4'	01°13.0	-10.3'	55.9'
12	357°38.9	S02°44.4	167°05.3	13.4'	N01°02.7	-10.3'	55.9'
13	12°39.1	43.4	181°37.7	13.4'	00°52.5	-10.3'	55.9'
14	27°39.3	42.4	196°10.1	13.4'	00°42.2	-10.3'	55.9'
15	42°39.4	·· 41.4	210°42.6	13.5'	00°31.9	-10.3'	55.8'
16	57°39.6	40.5	225°15.1	13.5'	00°21.7	-10.2'	55.8'
17	72°39.8	39.5	239°47.6	13.5'	00°11.4	-10.2'	55.8'
18	87°40.0	S02°38.5	254°20.1	13.6'	N00°01.2	-10.2'	55.8'
19	102°40.1	37.5	268°52.7	13.6'	S00°09.0	-10.2'	55.8'
20	117°40.3	36.5	283°25.3	13.6'	00°19.2	-10.2'	55.7'
21	132°40.5	·· 35.5	297°57.9	13.6'	00°29.5	-10.2'	55.7'
22	147°40.6	34.5	312°30.5	13.6'	00°39.7	-10.2'	55.7'
23	162°40.8	33.6	327°03.2	13.7'	00°49.8	-10.2'	55.7'
	SD.=16.1	d=1.0		S.D.=15.2			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:10	05:32	06:39	17:43	18:50	20:13
N 70°	04:22	05:35	06:35	17:46	18:47	20:00
68°	04:32	05:38	06:33	17:48	18:44	19:50
66°	04:39	05:40	06:31	17:50	18:41	19:42
64°	04:46	05:42	06:29	17:52	18:40	19:36
62°	04:51	05:43	06:27	17:54	18:38	19:30
60°	04:56	05:44	06:25	17:55	18:37	19:25
N 58°	04:59	05:45	06:24	17:56	18:36	19:21
56°	05:03	05:46	06:23	17:58	18:35	19:18
54°	05:06	05:47	06:22	17:59	18:34	19:15
52°	05:08	05:47	06:21	17:59	18:33	19:12
50°	05:10	05:48	06:20	18:00	18:33	19:10
45°	05:15	05:49	06:18	18:02	18:31	19:06
N 40°	05:18	05:49	06:16	18:04	18:31	19:02
35°	05:20	05:50	06:15	18:05	18:30	19:00
30°	05:22	05:50	06:13	18:06	18:30	18:58
20°	05:23	05:49	06:11	18:09	18:31	18:56
N 10°	05:23	05:48	06:09	18:11	18:32	18:56
0°	05:22	05:46	06:06	18:13	18:34	18:58
S 10°	05:19	05:43	06:04	18:15	18:36	19:01
20°	05:14	05:39	06:01	18:18	18:40	19:05
30°	05:06	05:34	05:58	18:20	18:44	19:12
35°	05:01	05:31	05:57	18:22	18:48	19:17
40°	04:55	05:27	05:55	18:24	18:51	19:23
45°	04:47	05:23	05:52	18:26	18:56	19:31
S 50°	04:38	05:16	05:49	18:29	19:02	19:41
52°	04:33	05:14	05:48	18:31	19:05	19:45
54°	04:27	05:10	05:46	18:32	19:08	19:51
56°	04:21	05:07	05:45	18:34	19:11	19:57
58°	04:14	05:03	05:43	18:35	19:15	20:03
S 60°	04:06	04:58	05:41	18:37	19:20	20:11

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	15:40	17:26	19:08	07:18	07:11	07:04
N 70°	15:53	17:32	19:08	07:03	07:03	07:02
68°	16:04	17:37	19:08	06:51	06:56	07:00
66°	16:13	17:41	19:07	06:41	06:51	06:58
64°	16:20	17:44	19:07	06:32	06:46	06:57
62°	16:26	17:47	19:07	06:25	06:42	06:56
60°	16:32	17:50	19:07	06:19	06:38	06:55
N 58°	16:36	17:52	19:07	06:13	06:35	06:54
56°	16:40	17:54	19:06	06:08	06:32	06:53
54°	16:44	17:56	19:06	06:04	06:29	06:52
52°	16:48	17:58	19:06	06:00	06:27	06:51
50°	16:51	17:59	19:06	05:56	06:25	06:51
45°	16:57	18:02	19:06	05:48	06:20	06:49
N 40°	17:03	18:05	19:06	05:42	06:16	06:48
35°	17:08	18:07	19:06	05:36	06:12	06:47
30°	17:12	18:10	19:06	05:31	06:09	06:46
20°	17:19	18:13	19:05	05:22	06:04	06:44
N 10°	17:26	18:16	19:05	05:14	05:59	06:43
0°	17:32	18:19	19:05	05:06	05:55	06:41
S 10°	17:38	18:22	19:05	04:59	05:50	06:40
20°	17:44	18:25	19:05	04:51	05:45	06:38
30°	17:51	18:29	19:05	04:42	05:40	06:37
35°	17:56	18:31	19:05	04:36	05:37	06:36
40°	18:00	18:33	19:05	04:30	05:33	06:34
45°	18:06	18:36	19:05	04:23	05:29	06:33
S 50°	18:12	18:39	19:05	04:14	05:24	06:31
52°	18:15	18:41	19:04	04:10	05:21	06:31
54°	18:19	18:42	19:04	04:06	05:19	06:30
56°	18:22	18:44	19:04	04:01	05:16	06:29
58°	18:26	18:46	19:04	03:56	05:12	06:28
S 60°	18:31	18:48	19:04	03:50	05:09	06:27

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 13-15 99-99%
11	10:05	09:57	12:10	23:43	11:19	
12	09:49	09:41	12:10	–:–	12:07	
13	09:33	09:24	12:09	00:30	12:53	

March 14, 15, 16 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	171°48.2	164°45.3	N11°58.5	141°12.5	N12°38.3	331°36.5	S06°50.2	264°39.7	S22°05.4
1	186°50.6	179°48.7	58.3	156°13.2	38.9	346°39.2	50.1	279°42.1	05.4
2	201°53.1	194°52.2	58.1	171°13.9	39.6	1°41.9	50.0	294°44.4	05.4
3	216°55.5	209°55.7	·· 57.9	186°14.7	·· 40.2	16°44.6	·· 49.9	309°46.8	·· 05.4
4	231°58.0	224°59.2	57.7	201°15.4	40.8	31°47.3	49.8	324°49.2	05.4
5	247°00.5	240°02.6	57.5	216°16.2	41.5	46°50.0	49.7	339°51.5	05.4
6	262°02.9	255°06.1	N11°57.3	231°16.9	N12°42.1	61°52.7	S06°49.6	354°53.9	S22°05.4
7	277°05.4	270°09.6	57.1	246°17.7	42.8	76°55.4	49.5	9°56.3	05.4
8	292°07.9	285°13.1	56.9	261°18.4	43.4	91°58.1	49.4	24°58.6	05.4
9	307°10.3	300°16.6	·· 56.7	276°19.1	·· 44.1	107°00.8	·· 49.3	40°01.0	·· 05.4
10	322°12.8	315°20.1	56.5	291°19.9	44.7	122°03.5	49.2	55°03.3	05.4
11	337°15.3	330°23.6	56.3	306°20.6	45.3	137°06.2	49.1	70°05.7	05.4
12	352°17.7	345°27.1	N11°56.0	321°21.4	N12°46.0	152°08.9	S06°49.0	85°08.1	S22°05.4
13	7°20.2	0°30.6	55.8	336°22.1	46.6	167°11.6	48.9	100°10.4	05.4
14	22°22.7	15°34.1	55.6	351°22.8	47.3	182°14.3	48.8	115°12.8	05.4
15	37°25.1	30°37.6	·· 55.4	6°23.6	·· 47.9	197°17.0	·· 48.7	130°15.2	·· 05.4
16	52°27.6	45°41.1	55.1	21°24.3	48.5	212°19.7	48.6	145°17.5	05.3
17	67°30.0	60°44.6	54.9	36°25.1	49.2	227°22.4	48.5	160°19.9	05.3
18	82°32.5	75°48.2	N11°54.7	51°25.8	N12°49.8	242°25.1	S06°48.4	175°22.3	S22°05.3
19	97°35.0	90°51.7	54.4	66°26.6	50.5	257°27.8	48.3	190°24.6	05.3
20	112°37.4	105°55.2	54.2	81°27.3	51.1	272°30.5	48.2	205°27.0	05.3
21	127°39.9	120°58.7	·· 53.9	96°28.0	·· 51.7	287°33.2	·· 48.1	220°29.4	·· 05.3
22	142°42.4	136°02.3	53.7	111°28.8	52.4	302°35.9	48.0	235°31.7	05.3
23	157°44.8	151°05.8	53.5	126°29.5	53.0	317°38.6	47.9	250°34.1	05.3
Mer.pass.:12:31		v3.5 d-0.2 m-4.1		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.2		v2.4 d0.0 m0.5	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	172°47.3	166°09.3	N11°53.2	141°30.3	N12°53.7	332°41.3	S06°47.8	265°36.5	S22°05.3
1	187°49.8	181°12.9	52.9	156°31.0	54.3	347°44.0	47.7	280°38.8	05.3
2	202°52.2	196°16.4	52.7	171°31.7	54.9	2°46.7	47.6	295°41.2	05.3
3	217°54.7	211°20.0	·· 52.4	186°32.5	·· 55.6	17°49.4	·· 47.5	310°43.6	·· 05.3
4	232°57.1	226°23.5	52.2	201°33.2	56.2	32°52.1	47.4	325°45.9	05.3
5	247°59.6	241°27.1	51.9	216°34.0	56.8	47°54.8	47.3	340°48.3	05.3
6	263°02.1	256°30.6	N11°51.6	231°34.7	N12°57.5	62°57.5	S06°47.2	355°50.7	S22°05.3
7	278°04.5	271°34.2	51.4	246°35.4	58.1	78°00.2	47.1	10°53.0	05.3
8	293°07.0	286°37.7	51.1	261°36.2	58.8	93°02.9	47.0	25°55.4	05.3
9	308°09.5	301°41.3	·· 50.8	276°36.9	12°59.4	108°05.6	·· 46.9	40°57.8	·· 05.3
10	323°11.9	316°44.9	50.6	291°37.7	13°00.0	123°08.3	46.8	56°00.1	05.3
11	338°14.4	331°48.4	50.3	306°38.4	00.7	138°11.0	46.7	71°02.5	05.3
12	353°16.9	346°52.0	N11°50.0	321°39.1	N13°01.3	153°13.7	S06°46.5	86°04.9	S22°05.3
13	8°19.3	1°55.6	49.7	336°39.9	01.9	168°16.4	46.4	101°07.2	05.3
14	23°21.8	16°59.2	49.4	351°40.6	02.6	183°19.1	46.3	116°09.6	05.3
15	38°24.3	32°02.7	·· 49.1	6°41.4	·· 03.2	198°21.8	·· 46.2	131°12.0	·· 05.3
16	53°26.7	47°06.3	48.8	21°42.1	03.8	213°24.5	46.1	146°14.3	05.3
17	68°29.2	62°09.9	48.5	36°42.8	04.5	228°27.3	46.0	161°16.7	05.3
18	83°31.6	77°13.5	N11°48.2	51°43.6	N13°05.1	243°30.0	S06°45.9	176°19.1	S22°05.3
19	98°34.1	92°17.1	47.9	66°44.3	05.7	258°32.7	45.8	191°21.4	05.3
20	113°36.6	107°20.7	47.6	81°45.1	06.4	273°35.4	45.7	206°23.8	05.3
21	128°39.0	122°24.3	·· 47.3	96°45.8	·· 07.0	288°38.1	·· 45.6	221°26.2	·· 05.3
22	143°41.5	137°27.9	47.0	111°46.5	07.6	303°40.8	45.5	236°28.5	05.3
23	158°44.0	152°31.5	46.7	126°47.3	08.3	318°43.5	45.4	251°30.9	05.3
Mer.pass.:12:27		v3.5 d-0.3 m-4.1		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.2		v2.4 d0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	173°46.4	167°35.1	N11°46.4	141°48.0	N13°08.9	333°46.2	S06°45.3	266°33.3	S22°05.3
1	188°48.9	182°38.7	46.1	156°48.8	09.5	348°48.9	45.2	281°35.7	05.3
2	203°51.4	197°42.3	45.8	171°49.5	10.2	3°51.6	45.1	296°38.0	05.3
3	218°53.8	212°45.9	·· 45.4	186°50.2	·· 10.8	18°54.3	·· 45.0	311°40.4	·· 05.3
4	233°56.3	227°49.5	45.1	201°51.0	11.4	33°57.0	44.9	326°42.8	05.3
5	248°58.7	242°53.1	44.8	216°51.7	12.1	48°59.7	44.8	341°45.1	05.3
6	264°01.2	257°56.7	N11°44.5	231°52.4	N13°12.7	64°02.4	S06°44.7	356°47.5	S22°05.3
7	279°03.7	273°00.4	44.1	246°53.2	13.3	79°05.2	44.6	11°49.9	05.3
8	294°06.1	288°04.0	43.8	261°53.9	14.0	94°07.9	44.5	26°52.2	05.3
9	309°08.6	303°07.6	·· 43.5	276°54.7	·· 14.6	109°10.6	·· 44.4	41°54.6	·· 05.3
10	324°11.1	318°11.2	43.1	291°55.4	15.2	124°13.3	44.3	56°57.0	05.3
11	339°13.5	333°14.9	42.8	306°56.1	15.9	139°16.0	44.2	71°59.4	05.3
12	354°16.0	348°18.5	N11°42.4	321°56.9	N13°16.5	154°18.7	S06°44.1	87°01.7	S22°05.3
13	9°18.5	3°22.1	42.1	336°57.6	17.1	169°21.4	44.0	102°04.1	05.3
14	24°20.9	18°25.8	41.7	351°58.4	17.8	184°24.1	43.9	117°06.5	05.3
15	39°23.4	33°29.4	·· 41.4	6°59.1	·· 18.4	199°26.8	·· 43.8	132°08.9	·· 05.3
16	54°25.9	48°33.1	41.0	21°59.8	19.0	214°29.5	43.7	147°11.2	05.3
17	69°28.3	63°36.7	40.7	37°00.6	19.6	229°32.2	43.5	162°13.6	05.3
18	84°30.8	78°40.4	N11°40.3	52°01.3	N13°20.3	244°35.0	S06°43.4	177°16.0	S22°05.3
19	99°33.2	93°44.0	39.9	67°02.0	20.9	259°37.7	43.3	192°18.3	05.3
20	114°35.7	108°47.7	39.6	82°02.8	21.5	274°40.4	43.2	207°20.7	05.3
21	129°38.2	123°51.3	·· 39.2	97°03.5	·· 22.2	289°43.1	·· 43.1	222°23.1	·· 05.3
22	144°40.6	138°55.0	38.8	112°04.3	22.8	304°45.8	43.0	237°25.5	05.3
23	159°43.1	153°58.6	38.5	127°05.0	23.4	319°48.5	42.9	252°27.8	05.3
Mer.pass.:12:23		v3.6 d-0.3 m-4.1		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.7	-42°13.0
Schedar	349°38.1	56°37.8
Diphda	348°53.7	-17°53.8
Achernar	335°25.5	-57°09.3
Hamal	327°58.2	23°32.4
Polaris	316°54.9	89°20.3
Acamar	315°16.7	-40°14.6
Menkar	314°12.6	4°09.1
Mirfak	308°36.9	49°55.2
Aldebaran	290°46.6	16°32.4
Rigel	281°09.7	-8°11.3
Capella	280°30.7	46°00.8
Bellatrix	278°29.3	6°21.6
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.8
Betelgeuse	270°58.5	7°24.3
Canopus	263°54.9	-52°42.8
Sirius	258°31.4	-16°44.8
Adhara	255°10.4	-29°00.2
Procyon	244°56.9	5°10.6
Pollux	243°24.5	27°58.9
Avior	234°16.5	-59°34.3
Suhail	222°50.2	-43°30.4
Miaplacidus	221°38.3	-69°47.6
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.5
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.3
Acrux	173°05.7	-63°11.6
Gacrux	171°57.4	-57°12.5
Alioth	166°18.0	55°51.9
Spica	158°28.3	-11°15.0
Alkaid	152°56.6	49°13.6
Hadar	148°43.7	-60°27.1
Menkent	148°04.2	-36°27.1
Arcturus	145°53.2	19°05.5
Rigil Kent.	139°47.7	-60°54.1
Kochab	137°19.5	74°05.0
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.3
Antares	112°23.0	-26°28.0
Atria	107°22.5	-69°03.0
Sabik	102°09.6	-15°44.6
Shaula	96°18.5	-37°06.7
Rasalhague	96°04.1	12°32.9
Eltanin	90°45.0	51°29.0
Kaus Aust.	83°40.6	-34°22.3
Vega	80°37.3	38°47.9
Nunki	75°55.3	-26°16.3
Altair	62°05.9	8°54.8
Peacock	53°15.7	-56°40.5
Deneb	49°30.0	45°20.4
Enif	33°44.9	9°57.1
Al Na'ir	27°41.1	-46°52.6
Fomalhaut	15°21.6	-29°32.0
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Mar 14 Tue	**SHA**	**Mer.pass**
Venus	352°57.1	12:58
Mars	329°24.3	14:34
Jupiter	159°48.3	01:53
Saturn	92°51.6	06:20

Mar 15 Wed	**SHA**	**Mer.pass**
Venus	353°22.1	12:52
Mars	328°43.0	14:33
Jupiter	159°54.0	01:49
Saturn	92°49.2	06:17

Mar 16 Thu	**SHA**	**Mer.pass**
Venus	353°48.6	12:47
Mars	328°01.6	14:32
Jupiter	159°59.8	01:45
Saturn	92°46.9	06:13

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.4974 sec ΔT = TT-UT1 = +68.6866 sec

2017 March 14 to Mar. 16 UT

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	177°41.0	S02°32.6	341°35.8	13.7′	S01°00.0	-10.2′	55.6′
1	192°41.2	31.6	356°08.5	13.7′	01°10.2	-10.2′	55.6′
2	207°41.3	30.6	10°41.3	13.7′	01°20.3	-10.1′	55.6′
3	222°41.5	·· 29.6	25°14.0	13.8′	01°30.5	-10.1′	55.6′
4	237°41.7	28.6	39°46.8	13.8′	01°40.6	-10.1′	55.6′
5	252°41.9	27.6	54°19.6	13.8′	01°50.7	-10.1′	55.5′
6	267°42.0	S02°26.7	68°52.4	13.8′	S02°00.8	-10.1′	55.5′
7	282°42.2	25.7	83°25.2	13.8′	02°10.9	-10.1′	55.5′
8	297°42.4	24.7	97°58.0	13.8′	02°20.9	-10.0′	55.5′
9	312°42.6	·· 23.7	112°30.9	13.9′	02°31.0	-10.0′	55.5′
10	327°42.7	22.7	127°03.7	13.9′	02°41.0	-10.0′	55.4′
11	342°42.9	21.7	141°36.6	13.9′	02°51.0	-10.0′	55.4′
12	357°43.1	S02°20.7	156°09.5	13.9′	S03°00.9	-10.0′	55.4′
13	12°43.3	19.8	170°42.4	13.9′	03°10.9	-9.9′	55.4′
14	27°43.4	18.8	185°15.4	13.9′	03°20.8	-9.9′	55.4′
15	42°43.6	·· 17.8	199°48.3	13.9′	03°30.7	-9.9′	55.3′
16	57°43.8	16.8	214°21.3	14.0′	03°40.6	-9.9′	55.3′
17	72°44.0	15.8	228°54.2	14.0′	03°50.5	-9.9′	55.3′
18	87°44.1	S02°14.8	243°27.2	14.0′	S04°00.3	-9.8′	55.3′
19	102°44.3	13.8	258°00.2	14.0′	04°10.1	-9.8′	55.3′
20	117°44.5	12.8	272°33.2	14.0′	04°19.9	-9.8′	55.2′
21	132°44.7	·· 11.9	287°06.2	14.0′	04°29.7	-9.7′	55.2′
22	147°44.8	10.9	301°39.2	14.0′	04°39.4	-9.7′	55.2′
23	162°45.0	09.9	316°12.3	14.0′	04°49.1	-9.7′	55.2′
	SD.=16.1	d=1.0		S.D.=15.1			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	177°45.2	S02°08.9	330°45.3	14.0′	S04°58.8	-9.7′	55.2′
1	192°45.4	07.9	345°18.4	14.1′	05°08.5	-9.6′	55.1′
2	207°45.5	06.9	359°51.4	14.1′	05°18.1	-9.6′	55.1′
3	222°45.7	·· 05.9	14°24.5	14.1′	05°27.7	-9.6′	55.1′
4	237°45.9	05.0	28°57.6	14.1′	05°37.2	-9.5′	55.1′
5	252°46.1	04.0	43°30.6	14.1′	05°46.8	-9.5′	55.1′
6	267°46.2	S02°03.0	58°03.7	14.1′	S05°56.3	-9.5′	55.0′
7	282°46.4	02.0	72°36.8	14.1′	06°05.7	-9.4′	55.0′
8	297°46.6	01.0	87°09.9	14.1′	06°15.1	-9.4′	55.0′
9	312°46.8	02°00.0	101°43.0	14.1′	06°24.5	-9.4′	55.0′
10	327°46.9	01°59.0	116°16.1	14.1′	06°33.9	-9.3′	55.0′
11	342°47.1	58.0	130°49.2	14.1′	06°43.2	-9.3′	55.0′
12	357°47.3	S01°57.1	145°22.3	14.1′	S06°52.5	-9.3′	54.9′
13	12°47.5	56.1	159°55.4	14.1′	07°01.8	-9.2′	54.9′
14	27°47.7	55.1	174°28.5	14.1′	07°11.0	-9.2′	54.9′
15	42°47.8	·· 54.1	189°01.7	14.1′	07°20.2	-9.2′	54.9′
16	57°48.0	53.1	203°34.8	14.1′	07°29.3	-9.1′	54.9′
17	72°48.2	52.1	218°07.9	14.1′	07°38.4	-9.1′	54.8′
18	87°48.4	S01°51.1	232°41.0	14.1′	S07°47.5	-9.0′	54.8′
19	102°48.5	50.1	247°14.1	14.1′	07°56.5	-9.0′	54.8′
20	117°48.7	49.2	261°47.2	14.1′	08°05.5	-9.0′	54.8′
21	132°48.9	·· 48.2	276°20.3	14.1′	08°14.4	-8.9′	54.8′
22	147°49.1	47.2	290°53.4	14.1′	08°23.3	-8.9′	54.8′
23	162°49.3	46.2	305°26.5	14.1′	08°32.2	-8.8′	54.8′
	SD.=16.1	d=1.0		S.D.=15.0			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	177°49.4	S01°45.2	319°59.6	14.1′	S08°41.0	-8.8′	54.7′
1	192°49.6	44.2	334°32.7	14.1′	08°49.7	-8.8′	54.7′
2	207°49.8	43.2	349°05.8	14.1′	08°58.5	-8.7′	54.7′
3	222°50.0	·· 42.2	3°38.9	14.1′	09°07.2	-8.7′	54.7′
4	237°50.1	41.3	18°12.0	14.1′	09°15.8	-8.6′	54.7′
5	252°50.3	40.3	32°45.1	14.1′	09°24.4	-8.6′	54.7′
6	267°50.5	S01°39.3	47°18.2	14.1′	S09°32.9	-8.5′	54.6′
7	282°50.7	38.3	61°51.2	14.1′	09°41.4	-8.5′	54.6′
8	297°50.9	37.3	76°24.3	14.1′	09°49.9	-8.4′	54.6′
9	312°51.0	·· 36.3	90°57.3	14.1′	09°58.3	-8.4′	54.6′
10	327°51.2	35.3	105°30.4	14.0′	10°06.7	-8.3′	54.6′
11	342°51.4	34.3	120°03.4	14.0′	10°15.0	-8.3′	54.6′
12	357°51.6	S01°33.4	134°36.5	14.0′	S10°23.2	-8.2′	54.6′
13	12°51.8	32.4	149°09.5	14.0′	10°31.5	-8.2′	54.5′
14	27°51.9	31.4	163°42.5	14.0′	10°39.6	-8.1′	54.5′
15	42°52.1	·· 30.4	178°15.5	14.0′	10°47.7	-8.1′	54.5′
16	57°52.3	29.4	192°48.5	14.0′	10°55.8	-8.0′	54.5′
17	72°52.5	28.4	207°21.5	14.0′	11°03.8	-8.0′	54.5′
18	87°52.6	S01°27.4	221°54.4	14.0′	S11°11.8	-7.9′	54.5′
19	102°52.8	26.4	236°27.4	14.0′	11°19.7	-7.9′	54.5′
20	117°53.0	25.5	251°00.4	13.9′	11°27.5	-7.8′	54.5′
21	132°53.2	·· 24.5	265°33.3	13.9′	11°35.3	-7.8′	54.4′
22	147°53.4	23.5	280°06.2	13.9′	11°43.1	-7.7′	54.4′
23	162°53.5	22.5	294°39.1	13.9′	11°50.8	-7.7′	54.4′
	SD.=16.1	d=1.0		S.D.=14.9			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	03:52	05:16	06:23	17:57	19:04	20:29
N 70°	04:07	05:21	06:22	17:58	18:59	20:14
68°	04:18	05:25	06:20	17:59	18:55	20:03
66°	04:27	05:28	06:19	18:00	18:51	19:53
64°	04:35	05:31	06:18	18:01	18:49	19:45
62°	04:41	05:33	06:17	18:02	18:46	19:39
60°	04:46	05:35	06:16	18:03	18:44	19:33
N 58°	04:51	05:37	06:16	18:03	18:42	19:29
56°	04:55	05:38	06:15	18:04	18:41	19:25
54°	04:58	05:39	06:15	18:04	18:39	19:21
52°	05:01	05:40	06:14	18:05	18:38	19:18
50°	05:04	05:41	06:13	18:05	18:37	19:15
45°	05:09	05:43	06:12	18:06	18:35	19:10
N 40°	05:13	05:44	06:11	18:07	18:34	19:05
35°	05:16	05:45	06:11	18:08	18:33	19:02
30°	05:18	05:46	06:10	18:08	18:32	19:00
20°	05:21	05:46	06:08	18:10	18:32	18:57
N 10°	05:22	05:46	06:07	18:11	18:32	18:56
0°	05:21	05:45	06:06	18:12	18:33	18:57
S 10°	05:19	05:43	06:04	18:13	18:34	18:59
20°	05:15	05:40	06:02	18:15	18:37	19:03
30°	05:08	05:36	06:00	18:17	18:41	19:09
35°	05:04	05:34	05:59	18:18	18:43	19:13
40°	04:59	05:31	05:58	18:19	18:46	19:18
45°	04:52	05:27	05:56	18:21	18:50	19:25
S 50°	04:43	05:21	05:54	18:23	18:55	19:34
52°	04:39	05:19	05:53	18:24	18:57	19:38
54°	04:34	05:16	05:52	18:25	19:00	19:42
56°	04:28	05:13	05:51	18:26	19:03	19:48
58°	04:22	05:10	05:49	18:27	19:06	19:54
S 60°	04:14	05:06	05:48	18:28	19:10	20:01

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	20:48	22:28	–:–	06:58	06:51	06:44
N 70°	20:42	22:14	23:46	07:01	07:00	06:59
68°	20:36	22:03	23:29	07:04	07:07	07:12
66°	20:32	21:55	23:16	07:06	07:13	07:22
64°	20:28	21:47	23:04	07:08	07:18	07:30
62°	20:25	21:41	22:55	07:09	07:23	07:37
60°	20:22	21:35	22:47	07:10	07:26	07:44
N 58°	20:19	21:30	22:40	07:12	07:30	07:49
56°	20:17	21:26	22:33	07:13	07:33	07:54
54°	20:15	21:22	22:28	07:14	07:36	07:58
52°	20:13	21:19	22:23	07:15	07:38	08:03
50°	20:12	21:16	22:18	07:16	07:40	08:06
45°	20:08	21:09	22:08	07:17	07:45	08:14
N 40°	20:05	21:03	22:00	07:19	07:49	08:21
35°	20:03	20:58	21:53	07:20	07:53	08:27
30°	20:00	20:54	21:47	07:21	07:56	08:32
20°	19:56	20:47	21:37	07:23	08:02	08:41
N 10°	19:53	20:40	21:27	07:25	08:07	08:48
0°	19:50	20:34	21:19	07:27	08:11	08:56
S 10°	19:47	20:28	21:10	07:28	08:16	09:03
20°	19:43	20:22	21:01	07:30	08:21	09:11
30°	19:40	20:15	20:51	07:32	08:26	09:20
35°	19:38	20:11	20:45	07:33	08:30	09:25
40°	19:35	20:06	20:38	07:34	08:33	09:31
45°	19:32	20:01	20:30	07:36	08:37	09:38
S 50°	19:29	19:54	20:21	07:38	08:43	09:46
52°	19:28	19:51	20:17	07:39	08:45	09:50
54°	19:26	19:48	20:12	07:39	08:47	09:54
56°	19:24	19:45	20:07	07:40	08:50	09:59
58°	19:22	19:41	20:01	07:42	08:53	10:04
S 60°	19:20	19:36	19:54	07:43	08:57	10:10

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 16-18 96-86%
14	09:16	09:08	12:09	01:16	13:38	
15	08:59	08:51	12:09	02:01	14:23	
16	08:42	08:34	12:09	02:45	15:07	

March 17, 18, 19 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	174°45.6	169°02.3	N11°38.1	142°05.7	N13°24.0	334°51.2	S06°42.8	267°30.2	S22°05.3
1	189°48.0	184°06.0	37.7	157°06.5	24.7	349°53.9	42.7	282°32.6	05.3
2	204°50.5	199°09.6	37.3	172°07.2	25.3	4°56.7	42.6	297°35.0	05.3
3	219°53.0	214°13.3	·· 36.9	187°07.9	·· 25.9	19°59.4	·· 42.5	312°37.3	·· 05.3
4	234°55.4	229°17.0	36.6	202°08.7	26.6	35°02.1	42.4	327°39.7	05.3
5	249°57.9	244°20.6	36.2	217°09.4	27.2	50°04.8	42.3	342°42.1	05.3
6	265°00.4	259°24.3	N11°35.8	232°10.1	N13°27.8	65°07.5	S06°42.2	357°44.5	S22°05.3
7	280°02.8	274°28.0	35.4	247°10.9	28.4	80°10.2	42.1	12°46.8	05.3
8	295°05.3	289°31.7	35.0	262°11.6	29.1	95°12.9	42.0	27°49.2	05.3
9	310°07.7	304°35.3	·· 34.6	277°12.4	·· 29.7	110°15.6	·· 41.9	42°51.6	·· 05.3
10	325°10.2	319°39.0	34.2	292°13.1	30.3	125°18.4	41.8	57°54.0	05.3
11	340°12.7	334°42.7	33.8	307°13.8	30.9	140°21.1	41.7	72°56.3	05.3
12	355°15.1	349°46.4	N11°33.4	322°14.6	N13°31.6	155°23.8	S06°41.5	87°58.7	S22°05.3
13	10°17.6	4°50.1	33.0	337°15.3	32.2	170°26.5	41.4	103°01.1	05.3
14	25°20.1	19°53.8	32.6	352°16.0	32.8	185°29.2	41.3	118°03.5	05.3
15	40°22.5	34°57.5	·· 32.1	7°16.8	·· 33.4	200°31.9	·· 41.2	133°05.9	·· 05.3
16	55°25.0	50°01.2	31.7	22°17.5	34.1	215°34.6	41.1	148°08.2	05.3
17	70°27.5	65°04.9	31.3	37°18.2	34.7	230°37.4	41.0	163°10.6	05.3
18	85°29.9	80°08.6	N11°30.9	52°19.0	N13°35.3	245°40.1	S06°40.9	178°13.0	S22°05.3
19	100°32.4	95°12.3	30.5	67°19.7	35.9	260°42.8	40.8	193°15.4	05.3
20	115°34.8	110°16.0	30.0	82°20.4	36.6	275°45.5	40.7	208°17.7	05.3
21	130°37.3	125°19.7	·· 29.6	97°21.2	·· 37.2	290°48.2	·· 40.6	223°20.1	·· 05.3
22	145°39.8	140°23.4	29.2	112°21.9	37.8	305°50.9	40.5	238°22.5	05.3
23	160°42.2	155°27.1	28.7	127°22.7	38.4	320°53.6	40.4	253°24.9	05.3
Mer.pass.:12:19		v3.7 d-0.4 m-4.0		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	175°44.7	170°30.8	N11°28.3	142°23.4	N13°39.0	335°56.4	S06°40.3	268°27.3	S22°05.3
1	190°47.2	185°34.5	27.9	157°24.1	39.7	350°59.1	40.2	283°29.6	05.3
2	205°49.6	200°38.3	27.4	172°24.9	40.3	6°01.8	40.1	298°32.0	05.3
3	220°52.1	215°42.0	·· 27.0	187°25.6	·· 40.9	21°04.5	·· 40.0	313°34.4	·· 05.3
4	235°54.6	230°45.7	26.5	202°26.3	41.5	36°07.2	39.8	328°36.8	05.3
5	250°57.0	245°49.4	26.1	217°27.1	42.2	51°09.9	39.7	343°39.1	05.3
6	265°59.5	260°53.2	N11°25.6	232°27.8	N13°42.8	66°12.7	S06°39.6	358°41.5	S22°05.3
7	281°02.0	275°56.9	25.2	247°28.5	43.4	81°15.4	39.5	13°43.9	05.3
8	296°04.4	291°00.6	24.7	262°29.3	44.0	96°18.1	39.4	28°46.3	05.3
9	311°06.9	306°04.3	·· 24.3	277°30.0	·· 44.6	111°20.8	·· 39.3	43°48.7	·· 05.2
10	326°09.3	321°08.1	23.8	292°30.7	45.3	126°23.5	39.2	58°51.0	05.2
11	341°11.8	336°11.8	23.3	307°31.5	45.9	141°26.2	39.1	73°53.4	05.2
12	356°14.3	351°15.5	N11°22.9	322°32.2	N13°46.5	156°29.0	S06°39.0	88°55.8	S22°05.2
13	11°16.7	6°19.3	22.4	337°32.9	47.1	171°31.7	38.9	103°58.2	05.2
14	26°19.2	21°23.0	21.9	352°33.7	47.7	186°34.4	38.8	119°00.6	05.2
15	41°21.7	36°26.8	·· 21.4	7°34.4	·· 48.4	201°37.1	·· 38.7	134°03.0	·· 05.2
16	56°24.1	51°30.5	21.0	22°35.1	49.0	216°39.8	38.6	149°05.3	05.2
17	71°26.6	66°34.3	20.5	37°35.9	49.6	231°42.6	38.5	164°07.7	05.2
18	86°29.1	81°38.0	N11°20.0	52°36.6	N13°50.2	246°45.3	S06°38.3	179°10.1	S22°05.2
19	101°31.5	96°41.8	19.5	67°37.3	50.8	261°48.0	38.2	194°12.5	05.2
20	116°34.0	111°45.5	19.0	82°38.1	51.4	276°50.7	38.1	209°14.9	05.2
21	131°36.5	126°49.3	·· 18.5	97°38.8	·· 52.1	291°53.4	·· 38.0	224°17.2	·· 05.2
22	146°38.9	141°53.0	18.1	112°39.5	52.7	306°56.2	37.9	239°19.6	05.2
23	161°41.4	156°56.8	17.6	127°40.3	53.3	321°58.9	37.8	254°22.0	05.2
Mer.pass.:12:15		v3.7 d-0.4 m-4.0		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	176°43.8	172°00.5	N11°17.1	142°41.0	N13°53.9	337°01.6	S06°37.7	269°24.4	S22°05.2
1	191°46.3	187°04.3	16.6	157°41.7	54.5	352°04.3	37.6	284°26.8	05.2
2	206°48.8	202°08.0	16.1	172°42.5	55.1	7°07.0	37.5	299°29.2	05.2
3	221°51.2	217°11.8	·· 15.6	187°43.2	·· 55.8	22°09.8	·· 37.4	314°31.5	·· 05.2
4	236°53.7	232°15.6	15.1	202°43.9	56.4	37°12.5	37.3	329°33.9	05.2
5	251°56.2	247°19.3	14.5	217°44.7	57.0	52°15.2	37.2	344°36.3	05.2
6	266°58.6	262°23.1	N11°14.0	232°45.4	N13°57.6	67°17.9	S06°37.1	359°38.7	S22°05.2
7	282°01.1	277°26.9	13.5	247°46.1	58.2	82°20.6	36.9	14°41.1	05.2
8	297°03.6	292°30.6	13.0	262°46.9	58.8	97°23.4	36.8	29°43.5	05.2
9	312°06.0	307°34.4	·· 12.5	277°47.6	13°59.5	112°26.1	·· 36.7	44°45.8	·· 05.2
10	327°08.5	322°38.2	12.0	292°48.3	14°00.1	127°28.8	36.6	59°48.2	05.2
11	342°10.9	337°42.0	11.4	307°49.1	00.7	142°31.5	36.5	74°50.6	05.2
12	357°13.4	352°45.7	N11°10.9	322°49.8	N14°01.3	157°34.2	S06°36.4	89°53.0	S22°05.2
13	12°15.9	7°49.5	10.4	337°50.5	01.9	172°37.0	36.3	104°55.4	05.2
14	27°18.3	22°53.3	09.9	352°51.3	02.5	187°39.7	36.2	119°57.8	05.2
15	42°20.8	37°57.1	·· 09.3	7°52.0	·· 03.1	202°42.4	·· 36.1	135°00.2	·· 05.2
16	57°23.3	53°00.9	08.8	22°52.7	03.8	217°45.1	36.0	150°02.5	05.2
17	72°25.7	68°04.6	08.2	37°53.5	04.4	232°47.9	35.9	165°04.9	05.2
18	87°28.2	83°08.4	N11°07.7	52°54.2	N14°05.0	247°50.6	S06°35.7	180°07.3	S22°05.2
19	102°30.7	98°12.2	07.2	67°54.9	05.6	262°53.3	35.6	195°09.7	05.2
20	117°33.1	113°16.0	06.6	82°55.6	06.2	277°56.0	35.5	210°12.1	05.2
21	132°35.6	128°19.8	·· 06.1	97°56.4	·· 06.8	292°58.8	·· 35.4	225°14.5	·· 05.2
22	147°38.1	143°23.6	05.5	112°57.1	07.4	308°01.5	35.3	240°16.9	05.2
23	162°40.5	158°27.4	05.0	127°57.8	08.0	323°04.2	35.2	255°19.2	05.2
Mer.pass.:12:11		v3.8 d-0.5 m-4.0		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.7	-42°13.0
Schedar	349°38.1	56°37.8
Diphda	348°53.7	-17°53.8
Achernar	335°25.5	-57°09.3
Hamal	327°58.2	23°32.4
Polaris	316°55.9	89°20.3
Acamar	315°16.7	-40°14.6
Menkar	314°12.6	4°09.1
Mirfak	308°37.0	49°55.2
Aldebaran	290°46.6	16°32.4
Rigel	281°09.7	-8°11.3
Capella	280°30.8	46°00.8
Bellatrix	278°29.3	6°21.6
Elnath	278°09.5	28°37.1
Alnilam	275°43.8	-1°11.8
Betelgeuse	270°58.6	7°24.3
Canopus	263°54.9	-52°42.8
Sirius	258°31.4	-16°44.8
Adhara	255°10.4	-29°00.2
Procyon	244°57.0	5°10.6
Pollux	243°24.5	27°58.9
Avior	234°16.5	-59°34.3
Suhail	222°50.2	-43°30.4
Miaplacidus	221°38.3	-69°47.6
Alphard	217°53.3	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.5
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.3
Acrux	173°05.7	-63°11.6
Gacrux	171°57.4	-57°12.5
Alioth	166°18.0	55°51.9
Spica	158°28.3	-11°15.1
Alkaid	152°56.6	49°13.6
Hadar	148°43.7	-60°27.1
Menkent	148°04.2	-36°27.1
Arcturus	145°53.2	19°05.5
Rigil Kent.	139°47.7	-60°54.1
Kochab	137°19.4	74°05.0
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.4
Antares	112°23.0	-26°28.0
Atria	107°22.4	-69°03.0
Sabik	102°09.6	-15°44.6
Shaula	96°18.5	-37°06.7
Rasalhague	96°04.1	12°32.9
Eltanin	90°45.0	51°29.0
Kaus Aust.	83°40.5	-34°22.3
Vega	80°37.3	38°47.9
Nunki	75°55.3	-26°16.3
Altair	62°05.9	8°54.8
Peacock	53°15.7	-56°40.5
Deneb	49°30.0	45°20.4
Enif	33°44.9	9°57.1
Al Na'ir	27°41.0	-46°52.6
Fomalhaut	15°21.6	-29°31.9
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Mar 17 Fri	SHA	Mer.pass
Venus	354°16.7	12:41
Mars	327°20.2	14:31
Jupiter	160°05.7	01:40
Saturn	92°44.6	06:09

Mar 18 Sat	SHA	Mer.pass
Venus	354°46.1	12:35
Mars	326°38.7	14:30
Jupiter	160°11.7	01:36
Saturn	92°42.5	06:05

Mar 19 Sun	SHA	Mer.pass
Venus	355°16.7	12:29
Mars	325°57.2	14:29
Jupiter	160°17.8	01:32
Saturn	92°40.5	06:01

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.4930 sec ΔT = TT-UT1 = +68.6910 sec

2017 March 17 to Mar. 19 UT

h — Sun — Moon

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	177°53.7	S01°21.5	309°12.0	13.9′	S11°58.4	-7.6′	54.4′
1	192°53.9	20.5	323°44.9	13.9′	12°06.0	-7.6′	54.4′
2	207°54.1	19.5	338°17.8	13.9′	12°13.5	-7.5′	54.4′
3	222°54.3	·· 18.5	352°50.6	13.8′	12°21.0	-7.4′	54.4′
4	237°54.4	17.5	7°23.5	13.8′	12°28.4	-7.4′	54.4′
5	252°54.6	16.6	21°56.3	13.8′	12°35.8	-7.3′	54.4′
6	267°54.8	S01°15.6	36°29.1	13.8′	S12°43.1	-7.3′	54.4′
7	282°55.0	14.6	51°01.9	13.8′	12°50.3	-7.2′	54.3′
8	297°55.2	13.6	65°34.7	13.8′	12°57.5	-7.2′	54.3′
9	312°55.3	·· 12.6	80°07.5	13.8′	13°04.6	-7.1′	54.3′
10	327°55.5	11.6	94°40.2	13.7′	13°11.7	-7.0′	54.3′
11	342°55.7	10.6	109°12.9	13.7′	13°18.7	-7.0′	54.3′
12	357°55.9	S01°09.6	123°45.7	13.7′	S13°25.6	-6.9′	54.3′
13	12°56.1	08.7	138°18.4	13.7′	13°32.5	-6.9′	54.3′
14	27°56.3	07.7	152°51.0	13.7′	13°39.3	-6.8′	54.3′
15	42°56.4	·· 06.7	167°23.7	13.7′	13°46.1	-6.7′	54.3′
16	57°56.6	05.7	181°56.3	13.6′	13°52.8	-6.7′	54.3′
17	72°56.8	04.7	196°29.0	13.6′	13°59.4	-6.6′	54.3′
18	87°57.0	S01°03.7	211°01.6	13.6′	S14°06.0	-6.5′	54.3′
19	102°57.2	02.7	225°34.2	13.6′	14°12.5	-6.5′	54.3′
20	117°57.3	01.7	240°06.7	13.6′	14°19.0	-6.4′	54.2′
21	132°57.5	01°00.7	254°39.3	13.5′	14°25.4	-6.4′	54.2′
22	147°57.7	00°59.8	269°11.8	13.5′	14°31.7	-6.3′	54.2′
23	162°57.9	58.8	283°44.3	13.5′	14°37.9	-6.2′	54.2′
	SD.=16.1	d=1.0	S.D.=14.8				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	177°58.1	S00°57.8	298°16.8	13.5′	S14°44.1	-6.2′	54.2′
1	192°58.2	56.8	312°49.3	13.5′	14°50.2	-6.1′	54.2′
2	207°58.4	55.8	327°21.7	13.4′	14°56.3	-6.0′	54.2′
3	222°58.6	·· 54.8	341°54.1	13.4′	15°02.3	-6.0′	54.2′
4	237°58.8	53.8	356°26.5	13.4′	15°08.2	-5.9′	54.2′
5	252°59.0	52.8	10°58.9	13.4′	15°14.1	-5.8′	54.2′
6	267°59.2	S00°51.9	25°31.3	13.4′	S15°19.9	-5.8′	54.2′
7	282°59.3	50.9	40°03.6	13.3′	15°25.6	-5.7′	54.2′
8	297°59.5	49.9	54°35.9	13.3′	15°31.2	-5.6′	54.2′
9	312°59.7	·· 48.9	69°08.2	13.3′	15°36.8	-5.5′	54.2′
10	327°59.9	47.9	83°40.5	13.3′	15°42.3	-5.5′	54.2′
11	343°00.1	46.9	98°12.8	13.2′	15°47.8	-5.4′	54.2′
12	358°00.3	S00°45.9	112°45.0	13.2′	S15°53.1	-5.3′	54.2′
13	13°00.4	44.9	127°17.2	13.2′	15°58.4	-5.3′	54.2′
14	28°00.6	43.9	141°49.4	13.2′	16°03.7	-5.2′	54.2′
15	43°00.8	·· 43.0	156°21.5	13.1′	16°08.8	-5.1′	54.2′
16	58°01.0	42.0	170°53.7	13.1′	16°13.9	-5.1′	54.2′
17	73°01.2	41.0	185°25.8	13.1′	16°18.9	-5.0′	54.2′
18	88°01.4	S00°40.0	199°57.9	13.1′	S16°23.9	-4.9′	54.2′
19	103°01.5	39.0	214°29.9	13.1′	16°28.8	-4.8′	54.2′
20	118°01.7	38.0	229°02.0	13.0′	16°33.5	-4.8′	54.2′
21	133°01.9	·· 37.0	243°34.0	13.0′	16°38.3	-4.7′	54.2′
22	148°02.1	36.0	258°06.0	13.0′	16°42.9	-4.6′	54.2′
23	163°02.3	35.1	272°37.9	13.0′	16°47.5	-4.5′	54.2′
	SD.=16.1	d=1.0	S.D.=14.8				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°02.4	S00°34.1	287°09.9	12.9′	S16°52.0	-4.5′	54.2′
1	193°02.6	33.1	301°41.8	12.9′	16°56.4	-4.4′	54.2′
2	208°02.8	32.1	316°13.7	12.9′	17°00.8	-4.3′	54.2′
3	223°03.0	·· 31.1	330°45.6	12.9′	17°05.0	-4.2′	54.2′
4	238°03.2	30.1	345°17.4	12.8′	17°09.2	-4.2′	54.2′
5	253°03.4	29.1	359°49.2	12.8′	17°13.4	-4.1′	54.2′
6	268°03.5	S00°28.1	14°21.0	12.8′	S17°17.4	-4.0′	54.2′
7	283°03.7	27.1	28°52.8	12.8′	17°21.4	-3.9′	54.2′
8	298°03.9	26.2	43°24.5	12.7′	17°25.3	-3.8′	54.2′
9	313°04.1	·· 25.2	57°56.2	12.7′	17°29.1	-3.8′	54.2′
10	328°04.3	24.2	72°27.9	12.7′	17°32.8	-3.7′	54.2′
11	343°04.5	23.2	86°59.6	12.7′	17°36.4	-3.6′	54.2′
12	358°04.7	S00°22.2	101°31.2	12.6′	S17°40.0	-3.5′	54.2′
13	13°04.8	21.2	116°02.9	12.6′	17°43.5	-3.5′	54.2′
14	28°05.0	20.2	130°34.5	12.6′	17°46.9	-3.4′	54.2′
15	43°05.2	·· 19.2	145°06.0	12.6′	17°50.3	-3.3′	54.3′
16	58°05.4	18.3	159°37.6	12.5′	17°53.5	-3.2′	54.3′
17	73°05.6	17.3	174°09.1	12.5′	17°56.7	-3.1′	54.3′
18	88°05.8	S00°16.3	188°40.6	12.5′	S17°59.8	-3.1′	54.3′
19	103°05.9	15.3	203°12.0	12.5′	18°02.8	-3.0′	54.3′
20	118°06.1	14.3	217°43.5	12.4′	18°05.7	-2.9′	54.3′
21	133°06.3	·· 13.3	232°14.9	12.4′	18°08.6	-2.8′	54.3′
22	148°06.5	12.3	246°46.3	12.4′	18°11.3	-2.7′	54.3′
23	163°06.7	11.3	261°17.7	12.4′	18°14.0	-2.6′	54.3′
	SD.=16.1	d=1.0	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	03:34	05:00	06:08	18:11	19:19	20:47
N 70°	03:51	05:07	06:08	18:10	19:12	20:29
68°	04:04	05:12	06:08	18:10	19:06	20:15
66°	04:14	05:17	06:08	18:10	19:01	20:04
64°	04:23	05:20	06:08	18:10	18:58	19:55
62°	04:30	05:23	06:07	18:10	18:54	19:48
60°	04:37	05:26	06:07	18:10	18:52	19:41
N 58°	04:42	05:28	06:07	18:10	18:49	19:36
56°	04:46	05:30	06:07	18:10	18:47	19:31
54°	04:50	05:32	06:07	18:10	18:45	19:27
52°	04:54	05:33	06:07	18:10	18:44	19:23
50°	04:57	05:35	06:07	18:10	18:42	19:20
45°	05:03	05:38	06:07	18:10	18:39	19:14
N 40°	05:08	05:40	06:07	18:10	18:37	19:09
35°	05:12	05:41	06:06	18:10	18:35	19:05
30°	05:15	05:42	06:06	18:10	18:34	19:02
20°	05:18	05:44	06:06	18:10	18:32	18:58
N 10°	05:20	05:44	06:05	18:11	18:32	18:56
0°	05:20	05:44	06:05	18:11	18:32	18:56
S 10°	05:19	05:43	06:04	18:12	18:33	18:57
20°	05:16	05:41	06:03	18:12	18:34	19:00
30°	05:10	05:38	06:02	18:13	18:37	19:05
35°	05:07	05:36	06:02	18:14	18:39	19:09
40°	05:02	05:34	06:01	18:14	18:41	19:13
45°	04:56	05:31	06:00	18:15	18:45	19:19
S 50°	04:48	05:26	05:59	18:16	18:48	19:27
52°	04:44	05:24	05:58	18:17	18:50	19:30
54°	04:40	05:22	05:58	18:17	18:53	19:35
56°	04:35	05:20	05:57	18:18	18:55	19:39
58°	04:29	05:17	05:56	18:18	18:58	19:45
S 60°	04:23	05:14	05:55	18:19	19:01	19:51

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	00:08	01:53	03:49	06:36	06:25	06:05
N 70°	–:–	01:18	02:49	06:59	07:01	07:06
68°	–:–	00:54	02:14	07:17	07:26	07:41
66°	–:–	00:35	01:49	07:32	07:46	08:06
64°	–:–	00:19	01:30	07:44	08:02	08:26
62°	–:–	00:07	01:15	07:54	08:15	08:42
60°	23:56	–:–	01:02	08:03	08:26	08:55
N 58°	23:47	–:–	00:50	08:11	08:36	09:07
56°	23:38	–:–	00:41	08:17	08:45	09:17
54°	23:31	–:–	00:32	08:24	08:52	09:25
52°	23:25	–:–	00:24	08:29	08:59	09:33
50°	23:19	–:–	00:17	08:34	09:05	09:40
45°	23:06	–:–	00:03	08:45	09:18	09:56
N 40°	22:56	23:50	–:–	08:54	09:29	10:08
35°	22:47	23:40	–:–	09:02	09:39	10:19
30°	22:39	23:31	–:–	09:08	09:47	10:28
20°	22:26	23:16	–:–	09:20	10:01	10:45
N 10°	22:15	23:02	23:50	09:31	10:14	10:59
0°	22:04	22:50	23:36	09:40	10:26	11:12
S 10°	21:53	22:37	23:23	09:50	10:37	11:25
20°	21:41	22:24	23:08	10:01	10:50	11:39
30°	21:28	22:08	22:51	10:12	11:04	11:56
35°	21:21	21:59	22:41	10:19	11:13	12:05
40°	21:12	21:49	22:30	10:27	11:22	12:16
45°	21:02	21:38	22:17	10:36	11:34	12:29
S 50°	20:50	21:23	22:01	10:48	11:47	12:44
52°	20:45	21:17	21:54	10:53	11:54	12:51
54°	20:39	21:09	21:46	10:58	12:01	12:59
56°	20:32	21:01	21:36	11:05	12:08	13:09
58°	20:24	20:52	21:26	11:12	12:17	13:19
S 60°	20:16	20:42	21:14	11:20	12:27	13:31

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 19-21 78-61%
17	08:25	08:16	12:08	03:30	15:52	
18	08:08	07:59	12:08	04:15	16:38	
19	07:50	07:41	12:08	05:01	17:24	

March 20, 21, 22 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	177°43.0	173°31.2	N11°04.4	142°58.6	N14°08.7	338°06.9	S06°35.1	270°21.6	S22°05.2
1	192°45.4	188°35.0	03.9	157°59.3	09.3	353°09.7	35.0	285°24.0	05.2
2	207°47.9	203°38.8	03.3	173°00.0	09.9	8°12.4	34.9	300°26.4	05.2
3	222°50.4	218°42.6	·· 02.7	188°00.8	·· 10.5	23°15.1	·· 34.8	315°28.8	·· 05.2
4	237°52.8	233°46.4	02.2	203°01.5	11.1	38°17.8	34.7	330°31.2	05.2
5	252°55.3	248°50.2	01.6	218°02.2	11.7	53°20.6	34.5	345°33.6	05.2
6	267°57.8	263°54.0	N11°01.0	233°03.0	N14°12.3	68°23.3	S06°34.4	0°36.0	S22°05.2
7	283°00.2	278°57.8	11°00.5	248°03.7	12.9	83°26.0	34.3	15°38.4	05.2
8	298°02.7	294°01.6	10°59.9	263°04.4	13.5	98°28.7	34.2	30°40.7	05.2
9	313°05.2	309°05.4	·· 59.3	278°05.1	·· 14.1	113°31.5	·· 34.1	45°43.1	·· 05.2
10	328°07.6	324°09.2	58.8	293°05.9	14.8	128°34.2	34.0	60°45.5	05.2
11	343°10.1	339°13.0	58.2	308°06.6	15.4	143°36.9	33.9	75°47.9	05.2
12	358°12.6	354°16.8	N10°57.6	323°07.3	N14°16.0	158°39.6	S06°33.8	90°50.3	S22°05.2
13	13°15.0	9°20.6	57.0	338°08.1	16.6	173°42.4	33.7	105°52.7	05.2
14	28°17.5	24°24.4	56.4	353°08.8	17.2	188°45.1	33.6	120°55.1	05.2
15	43°19.9	39°28.2	·· 55.8	8°09.5	·· 17.8	203°47.8	·· 33.4	135°57.5	·· 05.2
16	58°22.4	54°32.0	55.2	23°10.3	18.4	218°50.5	33.3	150°59.9	05.2
17	73°24.9	69°35.8	54.7	38°11.0	19.0	233°53.3	33.2	166°02.2	05.2
18	88°27.3	84°39.7	N10°54.1	53°11.7	N14°19.6	248°56.0	S06°33.1	181°04.6	S22°05.2
19	103°29.8	99°43.5	53.5	68°12.4	20.2	263°58.7	33.0	196°07.0	05.2
20	118°32.3	114°47.3	52.9	83°13.2	20.8	279°01.4	32.9	211°09.4	05.2
21	133°34.7	129°51.1	·· 52.3	98°13.9	·· 21.4	294°04.2	·· 32.8	226°11.8	·· 05.2
22	148°37.2	144°54.9	51.7	113°14.6	22.0	309°06.9	32.7	241°14.2	05.2
23	163°39.7	159°58.7	51.0	128°15.4	22.6	324°09.6	32.6	256°16.6	05.2
Mer.pass.:12:07		v3.8 d-0.6 m-3.9		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	178°42.1	175°02.6	N10°50.4	143°16.1	N14°23.3	339°12.4	S06°32.4	271°19.0	S22°05.2
1	193°44.6	190°06.4	49.8	158°16.8	23.9	354°15.1	32.3	286°21.4	05.2
2	208°47.0	205°10.2	49.2	173°17.5	24.5	9°17.8	32.2	301°23.8	05.2
3	223°49.5	220°14.0	·· 48.6	188°18.3	·· 25.1	24°20.5	·· 32.1	316°26.2	·· 05.2
4	238°52.0	235°17.8	48.0	203°19.0	25.7	39°23.3	32.0	331°28.6	05.2
5	253°54.4	250°21.7	47.4	218°19.7	26.3	54°26.0	31.9	346°30.9	05.2
6	268°56.9	265°25.5	N10°46.7	233°20.5	N14°26.9	69°28.7	S06°31.8	1°33.3	S22°05.1
7	283°59.4	280°29.3	46.1	248°21.2	27.5	84°31.5	31.7	16°35.7	05.1
8	299°01.8	295°33.2	45.5	263°21.9	28.1	99°34.2	31.6	31°38.1	05.1
9	314°04.3	310°37.0	·· 44.9	278°22.6	·· 28.7	114°36.9	·· 31.4	46°40.5	·· 05.1
10	329°06.8	325°40.8	44.2	293°23.4	29.3	129°39.6	31.3	61°42.9	05.1
11	344°09.2	340°44.6	43.6	308°24.1	29.9	144°42.4	31.2	76°45.3	05.1
12	359°11.7	355°48.5	N10°43.0	323°24.8	N14°30.5	159°45.1	S06°31.1	91°47.7	S22°05.1
13	14°14.2	10°52.3	42.3	338°25.6	31.1	174°47.8	31.0	106°50.1	05.1
14	29°16.6	25°56.1	41.7	353°26.3	31.7	189°50.6	30.9	121°52.5	05.1
15	44°19.1	41°00.0	·· 41.1	8°27.0	·· 32.3	204°53.3	·· 30.8	136°54.9	·· 05.1
16	59°21.5	56°03.8	40.4	23°27.7	32.9	219°56.0	30.7	151°57.3	05.1
17	74°24.0	71°07.6	39.8	38°28.5	33.5	234°58.8	30.6	166°59.7	05.1
18	89°26.5	86°11.5	N10°39.1	53°29.2	N14°34.1	250°01.5	S06°30.4	182°02.1	S22°05.1
19	104°28.9	101°15.3	38.5	68°29.9	34.7	265°04.2	30.3	197°04.5	05.1
20	119°31.4	116°19.1	37.8	83°30.6	35.3	280°06.9	30.2	212°06.9	05.1
21	134°33.9	131°23.0	·· 37.2	98°31.4	·· 35.9	295°09.7	·· 30.1	227°09.2	·· 05.1
22	149°36.3	146°26.8	36.5	113°32.1	36.5	310°12.4	30.0	242°11.6	05.1
23	164°38.8	161°30.6	35.8	128°32.8	37.1	325°15.1	29.9	257°14.0	05.1
Mer.pass.:12:03		v3.8 d-0.6 m-3.9		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	179°41.3	176°34.5	N10°35.2	143°33.6	N14°37.7	340°17.9	S06°29.8	272°16.4	S22°05.1
1	194°43.7	191°38.3	34.5	158°34.3	38.3	355°20.6	29.7	287°18.8	05.1
2	209°46.2	206°42.2	33.9	173°35.0	38.9	10°23.3	29.5	302°21.2	05.1
3	224°48.7	221°46.0	·· 33.2	188°35.7	·· 39.5	25°26.1	·· 29.4	317°23.6	·· 05.1
4	239°51.1	236°49.8	32.5	203°36.5	40.1	40°28.8	29.3	332°26.0	05.1
5	254°53.6	251°53.7	31.9	218°37.2	40.7	55°31.5	29.2	347°28.4	05.1
6	269°56.0	266°57.5	N10°31.2	233°37.9	N14°41.3	70°34.3	S06°29.1	2°30.8	S22°05.1
7	284°58.5	282°01.4	30.5	248°38.6	41.9	85°37.0	29.0	17°33.2	05.1
8	300°01.0	297°05.2	29.8	263°39.4	42.5	100°39.7	28.9	32°35.6	05.1
9	315°03.4	312°09.1	·· 29.2	278°40.1	·· 43.1	115°42.5	·· 28.8	47°38.0	·· 05.1
10	330°05.9	327°12.9	28.5	293°40.8	43.7	130°45.2	28.6	62°40.4	05.1
11	345°08.4	342°16.7	27.8	308°41.5	44.3	145°47.9	28.5	77°42.8	05.1
12	0°10.8	357°20.6	N10°27.1	323°42.3	N14°44.9	160°50.7	S06°28.4	92°45.2	S22°05.1
13	15°13.3	12°24.4	26.4	338°43.0	45.5	175°53.4	28.3	107°47.6	05.1
14	30°15.8	27°28.3	25.7	353°43.7	46.1	190°56.1	28.2	122°50.0	05.1
15	45°18.2	42°32.1	·· 25.0	8°44.4	·· 46.7	205°58.9	·· 28.1	137°52.4	·· 05.1
16	60°20.7	57°36.0	24.4	23°45.2	47.3	221°01.6	28.0	152°54.8	05.1
17	75°23.1	72°39.8	23.7	38°45.9	47.9	236°04.3	27.9	167°57.2	05.1
18	90°25.6	87°43.7	N10°23.0	53°46.6	N14°48.5	251°07.1	S06°27.7	182°59.6	S22°05.1
19	105°28.1	102°47.5	22.3	68°47.3	49.1	266°09.8	27.6	198°02.0	05.1
20	120°30.5	117°51.3	21.6	83°48.1	49.7	281°12.5	27.5	213°04.4	05.1
21	135°33.0	132°55.2	·· 20.9	98°48.8	·· 50.3	296°15.3	·· 27.4	228°06.8	·· 05.1
22	150°35.5	147°59.0	20.2	113°49.5	50.8	311°18.0	27.3	243°09.2	05.1
23	165°37.9	163°02.9	19.5	128°50.2	51.4	326°20.7	27.2	258°11.6	05.1
Mer.pass.:11:59		v3.8 d-0.7 m-3.9		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°11.0
Ankaa	353°13.7	-42°12.9
Schedar	349°38.1	56°37.8
Diphda	348°53.7	-17°53.8
Achernar	335°25.5	-57°09.3
Hamal	327°58.2	23°32.4
Polaris	316°56.8	89°20.3
Acamar	315°16.8	-40°14.6
Menkar	314°12.6	4°09.1
Mirfak	308°37.0	49°55.2
Aldebaran	290°46.6	16°32.4
Rigel	281°09.7	-8°11.3
Capella	280°30.8	46°00.8
Bellatrix	278°29.3	6°21.6
Elnath	278°09.5	28°37.1
Alnilam	275°43.8	-1°11.8
Betelgeuse	270°58.6	7°24.3
Canopus	263°55.0	-52°42.8
Sirius	258°31.4	-16°44.8
Adhara	255°10.4	-29°00.2
Procyon	244°57.0	5°10.6
Pollux	243°24.5	27°58.9
Avior	234°16.6	-59°34.3
Suhail	222°50.2	-43°30.5
Miaplacidus	221°38.4	-69°47.6
Alphard	217°53.4	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.5
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.7	-63°11.6
Gacrux	171°57.4	-57°12.5
Alioth	166°18.0	55°51.9
Spica	158°28.3	-11°15.1
Alkaid	152°56.5	49°13.6
Hadar	148°43.6	-60°27.1
Menkent	148°04.2	-36°27.1
Arcturus	145°53.2	19°05.5
Rigil Kent.	139°47.7	-60°54.1
Kochab	137°19.4	74°05.0
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.4
Antares	112°23.0	-26°28.0
Atria	107°22.4	-69°03.0
Sabik	102°09.6	-15°44.6
Shaula	96°18.4	-37°06.7
Rasalhague	96°04.1	12°32.9
Eltanin	90°45.0	51°29.0
Kaus Aust.	83°40.5	-34°22.3
Vega	80°37.3	38°47.9
Nunki	75°55.3	-26°16.3
Altair	62°05.9	8°54.8
Peacock	53°15.7	-56°40.5
Deneb	49°30.0	45°20.3
Enif	33°44.9	9°57.1
Al Na'ir	27°41.0	-46°52.6
Fomalhaut	15°21.6	-29°31.9
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Mar 20 Mon	SHA	Mer.pass
Venus	355°48.2	12:23
Mars	325°15.6	14:27
Jupiter	160°23.9	01:27
Saturn	92°38.7	05:58

Mar 21 Tue	SHA	Mer.pass
Venus	356°20.4	12:17
Mars	324°34.0	14:26
Jupiter	160°30.2	01:23
Saturn	92°36.9	05:54

Mar 22 Wed	SHA	Mer.pass
Venus	356°53.2	12:11
Mars	323°52.3	14:25
Jupiter	160°36.6	01:19
Saturn	92°35.2	05:50

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.4885 sec ΔT = TT-UT1 = +68.6955 sec

2017 March 20 to Mar. 22 UT

h

	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°06.9	S00°10.3	275°49.0	12.3′	S18°16.6	-2.6′	54.3′
1	193°07.0	09.4	290°20.3	12.3′	18°19.1	-2.5′	54.3′
2	208°07.2	08.4	304°51.6	12.3′	18°21.6	-2.4′	54.3′
3	223°07.4	·· 07.4	319°22.9	12.3′	18°23.9	-2.3′	54.4′
4	238°07.6	06.4	333°54.1	12.2′	18°26.2	-2.2′	54.4′
5	253°07.8	05.4	348°25.3	12.2′	18°28.4	-2.1′	54.4′
6	268°08.0	S00°04.4	2°56.5	12.2′	S18°30.5	-2.1′	54.4′
7	283°08.2	03.4	17°27.7	12.2′	18°32.5	-2.0′	54.4′
8	298°08.3	02.4	31°58.8	12.1′	18°34.4	-1.9′	54.4′
9	313°08.5	·· 01.5	46°30.0	12.1′	18°36.3	-1.8′	54.4′
10	328°08.7	S00°00.5	61°01.0	12.1′	18°38.0	-1.7′	54.4′
11	343°08.9	N00°00.5	75°32.1	12.1′	18°39.7	-1.6′	54.4′
12	358°09.1	N00°01.5	90°03.2	12.0′	S18°41.3	-1.5′	54.5′
13	13°09.3	02.5	104°34.2	12.0′	18°42.8	-1.5′	54.5′
14	28°09.5	03.5	119°05.2	12.0′	18°44.2	-1.4′	54.5′
15	43°09.6	·· 04.5	133°36.2	12.0′	18°45.5	-1.3′	54.5′
16	58°09.8	05.5	148°07.1	11.9′	18°46.7	-1.2′	54.5′
17	73°10.0	06.4	162°38.0	11.9′	18°47.9	-1.1′	54.5′
18	88°10.2	N00°07.4	177°08.9	11.9′	S18°48.9	-1.0′	54.5′
19	103°10.4	08.4	191°39.8	11.9′	18°49.9	-0.9′	54.5′
20	118°10.6	09.4	206°10.7	11.8′	18°50.8	-0.8′	54.6′
21	133°10.8	·· 10.4	220°41.5	11.8′	18°51.6	-0.8′	54.6′
22	148°10.9	11.4	235°12.3	11.8′	18°52.3	-0.7′	54.6′
23	163°11.1	12.4	249°43.1	11.8′	18°52.9	-0.6′	54.6′
	SD.=16.0	d=1.0	S.D.=14.8				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°11.3	N00°13.4	264°13.9	11.8′	S18°53.5	-0.5′	54.6′
1	193°11.5	14.3	278°44.6	11.7′	18°53.9	-0.4′	54.6′
2	208°11.7	15.3	293°15.3	11.7′	18°54.2	-0.3′	54.7′
3	223°11.9	·· 16.3	307°46.0	11.7′	18°54.5	-0.2′	54.7′
4	238°12.1	17.3	322°16.7	11.7′	18°54.7	-0.1′	54.7′
5	253°12.2	18.3	336°47.4	11.6′	18°54.8	-0.0′	54.7′
6	268°12.4	N00°19.3	351°18.0	11.6′	S18°54.7	0.1′	54.7′
7	283°12.6	20.3	5°48.6	11.6′	18°54.6	0.1′	54.7′
8	298°12.8	21.3	20°19.2	11.6′	18°54.5	0.2′	54.8′
9	313°13.0	·· 22.2	34°49.8	11.6′	18°54.2	0.3′	54.8′
10	328°13.2	23.2	49°20.3	11.5′	18°53.8	0.4′	54.8′
11	343°13.4	24.2	63°50.9	11.5′	18°53.3	0.5′	54.8′
12	358°13.5	N00°25.2	78°21.4	11.5′	S18°52.8	0.6′	54.8′
13	13°13.7	26.2	92°51.9	11.5′	18°52.1	0.7′	54.9′
14	28°13.9	27.2	107°22.4	11.5′	18°51.4	0.8′	54.9′
15	43°14.1	·· 28.2	121°52.8	11.4′	18°50.6	0.9′	54.9′
16	58°14.3	29.2	136°23.2	11.4′	18°49.7	1.0′	54.9′
17	73°14.5	30.1	150°53.7	11.4′	18°48.6	1.1′	54.9′
18	88°14.7	N00°31.1	165°24.0	11.4′	S18°47.5	1.2′	55.0′
19	103°14.8	32.1	179°54.4	11.4′	18°46.3	1.2′	55.0′
20	118°15.0	33.1	194°24.8	11.3′	18°45.0	1.3′	55.0′
21	133°15.2	·· 34.1	208°55.1	11.3′	18°43.7	1.4′	55.0′
22	148°15.4	35.1	223°25.4	11.3′	18°42.2	1.5′	55.1′
23	163°15.6	36.1	237°55.7	11.3′	18°40.6	1.6′	55.1′
	SD.=16.0	d=1.0	S.D.=14.9				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°15.8	N00°37.1	252°26.0	11.3′	S18°39.0	1.7′	55.1′
1	193°16.0	38.0	266°56.3	11.3′	18°37.2	1.8′	55.1′
2	208°16.1	39.0	281°26.5	11.2′	18°35.4	1.9′	55.1′
3	223°16.3	·· 40.0	295°56.8	11.2′	18°33.4	2.0′	55.2′
4	238°16.5	41.0	310°27.0	11.2′	18°31.4	2.1′	55.2′
5	253°16.7	42.0	324°57.2	11.2′	18°29.3	2.2′	55.2′
6	268°16.9	N00°43.0	339°27.4	11.2′	S18°27.0	2.3′	55.2′
7	283°17.1	44.0	353°57.5	11.2′	18°24.7	2.4′	55.3′
8	298°17.3	44.9	8°27.7	11.1′	18°22.3	2.5′	55.3′
9	313°17.5	·· 45.9	22°57.8	11.1′	18°19.8	2.5′	55.3′
10	328°17.6	46.9	37°27.9	11.1′	18°17.2	2.6′	55.3′
11	343°17.8	47.9	51°58.0	11.1′	18°14.5	2.7′	55.4′
12	358°18.0	N00°48.9	66°28.1	11.1′	S18°11.8	2.8′	55.4′
13	13°18.2	49.9	80°58.2	11.1′	18°08.9	2.9′	55.4′
14	28°18.4	50.9	95°28.3	11.1′	18°05.9	3.0′	55.4′
15	43°18.6	·· 51.8	109°58.3	11.0′	18°02.9	3.1′	55.5′
16	58°18.8	52.8	124°28.3	11.0′	17°59.7	3.2′	55.5′
17	73°18.9	53.8	138°58.4	11.0′	17°56.5	3.3′	55.5′
18	88°19.1	N00°54.8	153°28.4	11.0′	S17°53.1	3.4′	55.6′
19	103°19.3	55.8	167°58.4	11.0′	17°49.7	3.5′	55.6′
20	118°19.5	56.8	182°28.3	11.0′	17°46.2	3.6′	55.6′
21	133°19.7	·· 57.8	196°58.3	11.0′	17°42.6	3.7′	55.6′
22	148°19.9	58.7	211°28.3	10.9′	17°38.8	3.8′	55.7′
23	163°20.1	59.7	225°58.2	10.9′	17°35.0	3.9′	55.7′
	SD.=16.0	d=1.0	S.D.=15.1				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:13	04:44	05:52	18:24	19:33	21:06
N 70°	03:34	04:53	05:54	18:23	19:24	20:45
68°	03:49	04:59	05:55	18:21	19:17	20:29
66°	04:01	05:05	05:56	18:20	19:12	20:16
64°	04:11	05:09	05:57	18:19	19:07	20:05
62°	04:20	05:13	05:58	18:18	19:03	19:57
60°	04:27	05:17	05:58	18:17	18:59	19:49
N 58°	04:33	05:20	05:59	18:17	18:56	19:43
56°	04:38	05:22	05:59	18:16	18:53	19:38
54°	04:43	05:24	06:00	18:16	18:51	19:33
52°	04:47	05:26	06:00	18:15	18:49	19:29
50°	04:50	05:28	06:00	18:15	18:47	19:25
45°	04:58	05:32	06:01	18:14	18:43	19:18
N 40°	05:03	05:35	06:02	18:13	18:40	19:12
35°	05:07	05:37	06:02	18:13	18:38	19:07
30°	05:11	05:39	06:03	18:12	18:36	19:04
20°	05:16	05:41	06:03	18:11	18:33	18:59
N 10°	05:18	05:43	06:04	18:11	18:32	18:56
0°	05:19	05:43	06:04	18:10	18:31	18:55
S 10°	05:19	05:43	06:04	18:10	18:31	18:55
20°	05:17	05:42	06:04	18:10	18:32	18:57
30°	05:12	05:40	06:04	18:10	18:34	19:01
35°	05:09	05:39	06:04	18:10	18:35	19:04
40°	05:05	05:37	06:04	18:10	18:37	19:08
45°	05:00	05:34	06:04	18:10	18:39	19:13
S 50°	04:53	05:31	06:04	18:10	18:42	19:20
52°	04:50	05:30	06:03	18:10	18:43	19:23
54°	04:46	05:28	06:03	18:10	18:45	19:27
56°	04:42	05:26	06:03	18:10	18:47	19:31
58°	04:37	05:24	06:03	18:10	18:49	19:36
S 60°	04:31	05:21	06:03	18:10	18:51	19:41

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	▬	▬	▬	▬	▬	▬
N 70°	04:13	05:18	05:51	07:19	07:54	09:03
68°	03:27	04:26	05:06	08:05	08:46	09:48
66°	02:57	03:53	04:36	08:35	09:19	10:18
64°	02:35	03:30	04:13	08:58	09:42	10:40
62°	02:17	03:11	03:55	09:16	10:01	10:58
60°	02:02	02:55	03:41	09:31	10:17	11:12
N 58°	01:49	02:42	03:28	09:44	10:30	11:25
56°	01:38	02:31	03:17	09:55	10:41	11:36
54°	01:29	02:21	03:07	10:05	10:51	11:45
52°	01:20	02:12	02:59	10:13	11:00	11:54
50°	01:13	02:04	02:51	10:21	11:08	12:01
45°	00:56	01:47	02:35	10:38	11:25	12:17
N 40°	00:43	01:33	02:21	10:51	11:39	12:31
35°	00:32	01:22	02:10	11:03	11:50	12:42
30°	00:22	01:11	02:00	11:13	12:01	12:52
20°	00:05	00:54	01:42	11:30	12:18	13:09
N 10°	–:–	00:39	01:27	11:45	12:33	13:23
0°	–:–	00:24	01:13	11:59	12:48	13:37
S 10°	–:–	00:10	00:59	12:14	13:02	13:51
20°	23:55	–:–	00:44	12:29	13:17	14:05
30°	23:37	–:–	00:27	12:46	13:35	14:22
35°	23:27	–:–	00:17	12:56	13:45	14:31
40°	23:15	–:–	00:05	13:07	13:56	14:42
45°	23:02	23:52	–:–	13:21	14:10	14:55
S 50°	22:45	23:35	–:–	13:38	14:27	15:11
52°	22:37	23:27	–:–	13:45	14:35	15:18
54°	22:29	23:19	–:–	13:54	14:43	15:27
56°	22:19	23:09	–:–	14:04	14:53	15:36
58°	22:08	22:58	23:58	14:15	15:04	15:46
S 60°	21:55	22:45	23:46	14:28	15:17	15:58

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 22-24 52-33%
20	07:33	07:24	12:07	05:48	18:12	
21	07:15	07:06	12:07	06:36	19:00	
22	06:57	06:48	12:07	07:25	19:50	

March 23, 24, 25 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	180°40.4	178°06.7	N10°18.7	143°51.0	N14°52.0	341°23.5	S06°27.1	273°14.0	S22°05.1
1	195°42.9	193°10.6	18.0	158°51.7	52.6	356°26.2	27.0	288°16.4	05.1
2	210°45.3	208°14.4	17.3	173°52.4	53.2	11°28.9	26.8	303°18.8	05.1
3	225°47.8	223°18.3	·· 16.6	188°53.1	·· 53.8	26°31.7	·· 26.7	318°21.2	·· 05.1
4	240°50.3	238°22.1	15.9	203°53.9	54.4	41°34.4	26.6	333°23.6	05.1
5	255°52.7	253°26.0	15.2	218°54.6	55.0	56°37.2	26.5	348°26.0	05.1
6	270°55.2	268°29.8	N10°14.5	233°55.3	N14°55.6	71°39.9	S06°26.4	3°28.4	S22°05.1
7	285°57.6	283°33.7	13.7	248°56.0	56.2	86°42.6	26.3	18°30.8	05.1
8	301°00.1	298°37.5	13.0	263°56.8	56.8	101°45.4	26.2	33°33.2	05.1
9	316°02.6	313°41.4	·· 12.3	278°57.5	·· 57.4	116°48.1	·· 26.0	48°35.6	·· 05.1
10	331°05.0	328°45.2	11.6	293°58.2	58.0	131°50.8	25.9	63°38.0	05.1
11	346°07.5	343°49.1	10.8	308°58.9	58.6	146°53.6	25.8	78°40.4	05.1
12	1°10.0	358°52.9	N10°10.1	323°59.7	N14°59.1	161°56.3	S06°25.7	93°42.8	S22°05.1
13	16°12.4	13°56.8	09.4	339°00.4	14°59.7	176°59.0	25.6	108°45.2	05.1
14	31°14.9	29°00.6	08.6	354°01.1	15°00.3	192°01.8	25.5	123°47.6	05.1
15	46°17.4	44°04.4	·· 07.9	9°01.8	·· 00.9	207°04.5	·· 25.4	138°50.0	·· 05.1
16	61°19.8	59°08.3	07.2	24°02.5	01.5	222°07.3	25.2	153°52.4	05.1
17	76°22.3	74°12.1	06.4	39°03.3	02.1	237°10.0	25.1	168°54.8	05.1
18	91°24.8	89°16.0	N10°05.7	54°04.0	N15°02.7	252°12.7	S06°25.0	183°57.2	S22°05.0
19	106°27.2	104°19.8	05.0	69°04.7	03.3	267°15.5	24.9	198°59.6	05.0
20	121°29.7	119°23.7	04.2	84°05.4	03.9	282°18.2	24.8	214°02.0	05.0
21	136°32.1	134°27.5	·· 03.5	99°06.2	·· 04.5	297°20.9	·· 24.7	229°04.4	·· 05.0
22	151°34.6	149°31.4	02.7	114°06.9	05.0	312°23.7	24.6	244°06.9	05.0
23	166°37.1	164°35.2	02.0	129°07.6	05.6	327°26.4	24.4	259°09.3	05.0
Mer.pass.:11:55		v3.8 d-0.7 m-3.8		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	181°39.5	179°39.1	N10°01.2	144°08.3	N15°06.2	342°29.2	S06°24.3	274°11.7	S22°05.0
1	196°42.0	194°42.9	10°00.5	159°09.1	06.8	357°31.9	24.2	289°14.1	05.0
2	211°44.5	209°46.8	09°59.7	174°09.8	07.4	12°34.6	24.1	304°16.5	05.0
3	226°46.9	224°50.6	·· 59.0	189°10.5	·· 08.0	27°37.4	·· 24.0	319°18.9	·· 05.0
4	241°49.4	239°54.5	58.2	204°11.2	08.6	42°40.1	23.9	334°21.3	05.0
5	256°51.9	254°58.3	57.4	219°11.9	09.2	57°42.9	23.8	349°23.7	05.0
6	271°54.3	270°02.1	N09°56.7	234°12.7	N15°09.7	72°45.6	S06°23.6	4°26.1	S22°05.0
7	286°56.8	285°06.0	55.9	249°13.4	10.3	87°48.3	23.5	19°28.5	05.0
8	301°59.2	300°09.8	55.1	264°14.1	10.9	102°51.1	23.4	34°30.9	05.0
9	317°01.7	315°13.7	·· 54.4	279°14.8	·· 11.5	117°53.8	·· 23.3	49°33.3	·· 05.0
10	332°04.2	330°17.5	53.6	294°15.5	12.1	132°56.6	23.2	64°35.7	05.0
11	347°06.6	345°21.4	52.8	309°16.3	12.7	147°59.3	23.1	79°38.1	05.0
12	2°09.1	0°25.2	N09°52.1	324°17.0	N15°13.3	163°02.0	S06°23.0	94°40.5	S22°05.0
13	17°11.6	15°29.0	51.3	339°17.7	13.8	178°04.8	22.8	109°42.9	05.0
14	32°14.0	30°32.9	50.5	354°18.4	14.4	193°07.5	22.7	124°45.3	05.0
15	47°16.5	45°36.7	·· 49.8	9°19.2	·· 15.0	208°10.3	·· 22.6	139°47.8	·· 05.0
16	62°19.0	60°40.6	49.0	24°19.9	15.6	223°13.0	22.5	154°50.2	05.0
17	77°21.4	75°44.4	48.2	39°20.6	16.2	238°15.7	22.4	169°52.6	05.0
18	92°23.9	90°48.2	N09°47.4	54°21.3	N15°16.8	253°18.5	S06°22.3	184°55.0	S22°05.0
19	107°26.4	105°52.1	46.6	69°22.0	17.3	268°21.2	22.1	199°57.4	05.0
20	122°28.8	120°55.9	45.8	84°22.8	17.9	283°24.0	22.0	214°59.8	05.0
21	137°31.3	135°59.8	·· 45.1	99°23.5	·· 18.5	298°26.7	·· 21.9	230°02.2	·· 05.0
22	152°33.7	151°03.6	44.3	114°24.2	19.1	313°29.4	21.8	245°04.6	05.0
23	167°36.2	166°07.4	43.5	129°24.9	19.7	328°32.2	21.7	260°07.0	05.0
Mer.pass.:11:51		v3.8 d-0.8 m-3.8		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	182°38.7	181°11.3	N09°42.7	144°25.6	N15°20.3	343°34.9	S06°21.6	275°09.4	S22°05.0
1	197°41.1	196°15.1	41.9	159°26.4	20.8	358°37.7	21.5	290°11.8	05.0
2	212°43.6	211°18.9	41.1	174°27.1	21.4	13°40.4	21.3	305°14.3	05.0
3	227°46.1	226°22.8	·· 40.3	189°27.8	·· 22.0	28°43.1	·· 21.2	320°16.7	·· 05.0
4	242°48.5	241°26.6	39.5	204°28.5	22.6	43°45.9	21.1	335°19.1	05.0
5	257°51.0	256°30.4	38.7	219°29.2	23.2	58°48.6	21.0	350°21.5	05.0
6	272°53.5	271°34.3	N09°37.9	234°30.0	N15°23.7	73°51.4	S06°20.9	5°23.9	S22°05.0
7	287°55.9	286°38.1	37.1	249°30.7	24.3	88°54.1	20.8	20°26.3	05.0
8	302°58.4	301°41.9	36.3	264°31.4	24.9	103°56.9	20.6	35°28.7	05.0
9	318°00.9	316°45.8	·· 35.5	279°32.1	·· 25.5	118°59.6	·· 20.5	50°31.1	·· 05.0
10	333°03.3	331°49.6	34.7	294°32.8	26.1	134°02.3	20.4	65°33.5	05.0
11	348°05.8	346°53.4	33.9	309°33.6	26.6	149°05.1	20.3	80°35.9	05.0
12	3°08.2	1°57.3	N09°33.1	324°34.3	N15°27.2	164°07.8	S06°20.2	95°38.4	S22°05.0
13	18°10.7	17°01.1	32.3	339°35.0	27.8	179°10.6	20.1	110°40.8	05.0
14	33°13.2	32°04.9	31.5	354°35.7	28.4	194°13.3	20.0	125°43.2	05.0
15	48°15.6	47°08.7	·· 30.7	9°36.4	·· 29.0	209°16.1	·· 19.8	140°45.6	·· 05.0
16	63°18.1	62°12.6	29.9	24°37.1	29.5	224°18.8	19.7	155°48.0	05.0
17	78°20.6	77°16.4	29.0	39°37.9	30.1	239°21.5	19.6	170°50.4	05.0
18	93°23.0	92°20.2	N09°28.2	54°38.6	N15°30.7	254°24.3	S06°19.5	185°52.8	S22°05.0
19	108°25.5	107°24.0	27.4	69°39.3	31.3	269°27.0	19.4	200°55.2	05.0
20	123°28.0	122°27.8	26.6	84°40.0	31.8	284°29.8	19.3	215°57.7	05.0
21	138°30.4	137°31.7	·· 25.8	99°40.7	·· 32.4	299°32.5	·· 19.1	231°00.1	·· 05.0
22	153°32.9	152°35.5	24.9	114°41.5	33.0	314°35.3	19.0	246°02.5	05.0
23	168°35.3	167°39.3	24.1	129°42.2	33.6	329°38.0	18.9	261°04.9	05.0
Mer.pass.:11:47		v3.8 d-0.8 m-3.8		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°10.9
Ankaa	353°13.7	-42°12.9
Schedar	349°38.1	56°37.8
Diphda	348°53.7	-17°53.8
Achernar	335°25.5	-57°09.3
Hamal	327°58.2	23°32.4
Polaris	316°57.7	89°20.3
Acamar	315°16.8	-40°14.5
Menkar	314°12.6	4°09.1
Mirfak	308°37.0	49°55.2
Aldebaran	290°46.6	16°32.4
Rigel	281°09.7	-8°11.3
Capella	280°30.8	46°00.8
Bellatrix	278°29.4	6°21.6
Elnath	278°09.5	28°37.1
Alnilam	275°43.8	-1°11.8
Betelgeuse	270°58.6	7°24.3
Canopus	263°55.0	-52°42.8
Sirius	258°31.4	-16°44.8
Adhara	255°10.5	-29°00.2
Procyon	244°57.0	5°10.6
Pollux	243°24.5	27°58.9
Avior	234°16.6	-59°34.3
Suhail	222°50.2	-43°30.5
Miaplacidus	221°38.4	-69°47.6
Alphard	217°53.4	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.5
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.7	-63°11.6
Gacrux	171°57.4	-57°12.5
Alioth	166°18.0	55°52.0
Spica	158°28.3	-11°15.1
Alkaid	152°56.5	49°13.6
Hadar	148°43.6	-60°27.1
Menkent	148°04.2	-36°27.1
Arcturus	145°53.2	19°05.5
Rigil Kent.	139°47.6	-60°54.1
Kochab	137°19.4	74°05.0
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.7	26°39.4
Antares	112°23.0	-26°28.0
Atria	107°22.3	-69°03.0
Sabik	102°09.5	-15°44.6
Shaula	96°18.4	-37°06.7
Rasalhague	96°04.0	12°32.9
Eltanin	90°44.9	51°29.0
Kaus Aust.	83°40.5	-34°22.3
Vega	80°37.3	38°47.8
Nunki	75°55.2	-26°16.3
Altair	62°05.9	8°54.8
Peacock	53°15.6	-56°40.5
Deneb	49°30.0	45°20.3
Enif	33°44.9	9°57.1
Al Na'ir	27°41.0	-46°52.6
Fomalhaut	15°21.6	-29°31.9
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Mar 23 Thu	SHA	Mer.pass
Venus	357°26.3	12:04
Mars	323°10.6	14:24
Jupiter	160°43.1	01:14
Saturn	92°33.6	05:46

Mar 24 Fri	SHA	Mer.pass
Venus	357°59.5	11:58
Mars	322°28.8	14:23
Jupiter	160°49.6	01:10
Saturn	92°32.1	05:42

Mar 25 Sat	SHA	Mer.pass
Venus	358°32.6	11:52
Mars	321°47.0	14:22
Jupiter	160°56.2	01:05
Saturn	92°30.8	05:38

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.4840 sec ΔT = TT-UT1 = +68.7000 sec

2017 March 23 to Mar. 25 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°20.3	N01°00.7	240°28.1	10.9′	S17°31.1	3.9′	55.7′
1	193°20.4	01.7	254°58.0	10.9′	17°27.2	4.0′	55.8′
2	208°20.6	02.7	269°27.9	10.9′	17°23.1	4.1′	55.8′
3	223°20.8	·· 03.7	283°57.8	10.9′	17°18.9	4.2′	55.8′
4	238°21.0	04.7	298°27.7	10.9′	17°14.6	4.3′	55.8′
5	253°21.2	05.6	312°57.6	10.9′	17°10.3	4.4′	55.9′
6	268°21.4	N01°06.6	327°27.4	10.9′	S17°05.8	4.5′	55.9′
7	283°21.6	07.6	341°57.3	10.8′	17°01.3	4.6′	55.9′
8	298°21.8	08.6	356°27.1	10.8′	16°56.6	4.7′	56.0′
9	313°21.9	·· 09.6	10°56.9	10.8′	16°51.9	4.8′	56.0′
10	328°22.1	10.6	25°26.7	10.8′	16°47.1	4.9′	56.0′
11	343°22.3	11.6	39°56.5	10.8′	16°42.2	5.0′	56.1′
12	358°22.5	N01°12.5	54°26.3	10.8′	S16°37.2	5.1′	56.1′
13	13°22.7	13.5	68°56.1	10.8′	16°32.1	5.1′	56.1′
14	28°22.9	14.5	83°25.9	10.8′	16°26.9	5.2′	56.1′
15	43°23.1	·· 15.5	97°55.7	10.8′	16°21.6	5.3′	56.2′
16	58°23.3	16.5	112°25.4	10.7′	16°16.2	5.4′	56.2′
17	73°23.4	17.5	126°55.1	10.7′	16°10.8	5.5′	56.2′
18	88°23.6	N01°18.5	141°24.9	10.7′	S16°05.2	5.6′	56.3′
19	103°23.8	19.4	155°54.6	10.7′	15°59.6	5.7′	56.3′
20	118°24.0	20.4	170°24.3	10.7′	15°53.8	5.8′	56.3′
21	133°24.2	·· 21.4	184°54.0	10.7′	15°48.0	5.9′	56.4′
22	148°24.4	22.4	199°23.7	10.7′	15°42.1	6.0′	56.4′
23	163°24.6	23.4	213°53.4	10.7′	15°36.1	6.0′	56.4′
	SD.=16.0	d=1.0	S.D.=15.3				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°24.8	N01°24.4	228°23.1	10.7′	S15°30.0	6.1′	56.5′
1	193°24.9	25.3	242°52.8	10.7′	15°23.9	6.2′	56.5′
2	208°25.1	26.3	257°22.4	10.7′	15°17.6	6.3′	56.5′
3	223°25.3	·· 27.3	271°52.1	10.7′	15°11.3	6.4′	56.6′
4	238°25.5	28.3	286°21.7	10.6′	15°04.8	6.5′	56.6′
5	253°25.7	29.3	300°51.4	10.6′	14°58.3	6.6′	56.6′
6	268°25.9	N01°30.3	315°21.0	10.6′	S14°51.7	6.7′	56.7′
7	283°26.1	31.3	329°50.6	10.6′	14°45.0	6.7′	56.7′
8	298°26.3	32.2	344°20.3	10.6′	14°38.2	6.8′	56.7′
9	313°26.4	·· 33.2	358°49.9	10.6′	14°31.3	6.9′	56.8′
10	328°26.6	34.2	13°19.5	10.6′	14°24.4	7.0′	56.8′
11	343°26.8	35.2	27°49.1	10.6′	14°17.4	7.1′	56.8′
12	358°27.0	N01°36.2	42°18.7	10.6′	S14°10.2	7.2′	56.9′
13	13°27.2	37.2	56°48.2	10.6′	14°03.0	7.2′	56.9′
14	28°27.4	38.1	71°17.8	10.6′	13°55.7	7.3′	56.9′
15	43°27.6	·· 39.1	85°47.4	10.6′	13°48.4	7.4′	57.0′
16	58°27.8	40.1	100°16.9	10.6′	13°40.9	7.5′	57.0′
17	73°28.0	41.1	114°46.5	10.5′	13°33.4	7.6′	57.0′
18	88°28.1	N01°42.1	129°16.0	10.5′	S13°25.7	7.7′	57.1′
19	103°28.3	43.1	143°45.5	10.5′	13°18.0	7.7′	57.1′
20	118°28.5	44.0	158°15.1	10.5′	13°10.3	7.8′	57.1′
21	133°28.7	·· 45.0	172°44.6	10.5′	13°02.4	7.9′	57.2′
22	148°28.9	46.0	187°14.1	10.5′	12°54.5	8.0′	57.2′
23	163°29.1	47.0	201°43.6	10.5′	12°46.4	8.1′	57.2′
	SD.=16.0	d=1.0	S.D.=15.5				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°29.3	N01°48.0	216°13.1	10.5′	S12°38.3	8.1′	57.3′
1	193°29.5	49.0	230°42.6	10.5′	12°30.2	8.2′	57.3′
2	208°29.6	49.9	245°12.1	10.5′	12°21.9	8.3′	57.4′
3	223°29.8	·· 50.9	259°41.5	10.5′	12°13.6	8.4′	57.4′
4	238°30.0	51.9	274°11.0	10.5′	12°05.2	8.4′	57.4′
5	253°30.2	52.9	288°40.5	10.5′	11°56.7	8.5′	57.5′
6	268°30.4	N01°53.9	303°09.9	10.4′	S11°48.1	8.6′	57.5′
7	283°30.6	54.9	317°39.4	10.4′	11°39.5	8.7′	57.5′
8	298°30.8	55.8	332°08.8	10.4′	11°30.8	8.7′	57.6′
9	313°31.0	·· 56.8	346°38.2	10.4′	11°22.0	8.8′	57.6′
10	328°31.1	57.8	1°07.6	10.4′	11°13.1	8.9′	57.6′
11	343°31.3	58.8	15°37.0	10.4′	11°04.2	9.0′	57.7′
12	358°31.5	N01°59.8	30°06.4	10.4′	S10°55.2	9.0′	57.7′
13	13°31.7	02°00.7	44°35.8	10.4′	10°46.1	9.1′	57.7′
14	28°31.9	01.7	59°05.2	10.4′	10°37.0	9.2′	57.8′
15	43°32.1	·· 02.7	73°34.6	10.4′	10°27.8	9.2′	57.8′
16	58°32.3	03.7	88°04.0	10.4′	10°18.5	9.3′	57.8′
17	73°32.5	04.7	102°33.3	10.4′	10°09.1	9.4′	57.9′
18	88°32.7	N02°05.7	117°02.7	10.3′	S09°59.7	9.4′	57.9′
19	103°32.8	06.6	131°32.0	10.3′	09°50.3	9.5′	57.9′
20	118°33.0	07.6	146°01.3	10.3′	09°40.7	9.6′	58.0′
21	133°33.2	·· 08.6	160°30.6	10.3′	09°31.1	9.6′	58.0′
22	148°33.4	09.6	174°59.9	10.3′	09°21.4	9.7′	58.0′
23	163°33.6	10.6	189°29.2	10.3′	09°11.7	9.8′	58.1′
	SD.=16.0	d=1.0	S.D.=15.7				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	02:52	04:28	05:37	18:38	19:48	21:27
N 70°	03:16	04:38	05:40	18:35	19:38	21:01
68°	03:34	04:46	05:43	18:32	19:29	20:42
66°	03:48	04:53	05:45	18:30	19:22	20:28
64°	03:59	04:58	05:46	18:28	19:16	20:16
62°	04:09	05:03	05:48	18:26	19:11	20:06
60°	04:17	05:07	05:49	18:25	19:07	19:58
N 58°	04:23	05:11	05:50	18:23	19:03	19:51
56°	04:29	05:14	05:51	18:22	19:00	19:45
54°	04:35	05:17	05:52	18:21	18:57	19:39
52°	04:39	05:19	05:53	18:20	18:54	19:35
50°	04:43	05:22	05:54	18:19	18:52	19:30
45°	04:52	05:26	05:56	18:18	18:47	19:22
N 40°	04:58	05:30	05:57	18:16	18:43	19:15
35°	05:03	05:33	05:58	18:15	18:40	19:10
30°	05:07	05:35	05:59	18:14	18:38	19:06
20°	05:13	05:39	06:01	18:12	18:34	19:00
N 10°	05:16	05:41	06:02	18:11	18:32	18:56
0°	05:18	05:42	06:03	18:09	18:30	18:54
S 10°	05:19	05:43	06:04	18:08	18:29	18:54
20°	05:17	05:43	06:05	18:07	18:29	18:55
30°	05:14	05:42	06:06	18:06	18:30	18:58
35°	05:12	05:41	06:06	18:05	18:31	19:00
40°	05:08	05:40	06:07	18:05	18:32	19:03
45°	05:04	05:38	06:08	18:04	18:33	19:07
S 50°	04:58	05:36	06:08	18:03	18:35	19:13
52°	04:55	05:35	06:09	18:03	18:36	19:16
54°	04:52	05:34	06:09	18:02	18:38	19:19
56°	04:48	05:32	06:09	18:02	18:39	19:23
58°	04:44	05:31	06:10	18:02	18:40	19:27
S 60°	04:39	05:29	06:10	18:01	18:42	19:31

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	06:58	06:40	06:29	09:40	11:43	13:39
N 70°	06:03	06:08	06:09	10:34	12:14	13:58
68°	05:30	05:44	05:54	11:07	12:37	14:12
66°	05:06	05:26	05:41	11:31	12:54	14:24
64°	04:46	05:11	05:30	11:49	13:08	14:34
62°	04:31	04:59	05:21	12:05	13:20	14:42
60°	04:18	04:48	05:13	12:17	13:30	14:49
N 58°	04:06	04:39	05:06	12:28	13:39	14:56
56°	03:57	04:30	04:59	12:38	13:47	15:01
54°	03:48	04:23	04:54	12:46	13:54	15:06
52°	03:40	04:16	04:49	12:54	14:00	15:11
50°	03:33	04:11	04:44	13:01	14:05	15:15
45°	03:18	03:58	04:34	13:15	14:17	15:23
N 40°	03:06	03:47	04:26	13:27	14:27	15:31
35°	02:55	03:38	04:19	13:37	14:36	15:37
30°	02:46	03:30	04:13	13:46	14:43	15:42
20°	02:30	03:16	04:02	14:01	14:56	15:52
N 10°	02:16	03:04	03:52	14:14	15:07	16:00
0°	02:03	02:53	03:43	14:27	15:17	16:07
S 10°	01:50	02:41	03:34	14:39	15:27	16:15
20°	01:36	02:29	03:25	14:52	15:38	16:23
30°	01:20	02:15	03:14	15:07	15:50	16:32
35°	01:10	02:07	03:07	15:16	15:57	16:37
40°	01:00	01:58	03:00	15:25	16:05	16:43
45°	00:47	01:47	02:52	15:37	16:15	16:50
S 50°	00:32	01:34	02:41	15:51	16:26	16:58
52°	00:25	01:28	02:37	15:57	16:31	17:02
54°	00:17	01:21	02:31	16:04	16:37	17:06
56°	00:08	01:14	02:26	16:12	16:43	17:11
58°	–:–	01:05	02:19	16:21	16:50	17:16
S 60°	–:–	00:55	02:12	16:31	16:59	17:21

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 25-27 24-9%
23	06:39	06:30	12:06	08:15	20:40	
24	06:21	06:12	12:06	09:05	21:30	
25	06:03	05:54	12:06	09:55	22:21	

March 26, 27, 28 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	183°37.8	182°43.1	N09°23.3	144°42.9	N15°34.2	344°40.8	S06°18.8	276°07.3	S22°04.9
1	198°40.3	197°46.9	22.5	159°43.6	34.7	359°43.5	18.7	291°09.7	04.9
2	213°42.7	212°50.8	21.7	174°44.3	35.3	14°46.2	18.6	306°12.1	04.9
3	228°45.2	227°54.6	·· 20.8	189°45.0	·· 35.9	29°49.0	·· 18.4	321°14.6	·· 04.9
4	243°47.7	242°58.4	20.0	204°45.8	36.5	44°51.7	18.3	336°17.0	04.9
5	258°50.1	258°02.2	19.2	219°46.5	37.0	59°54.5	18.2	351°19.4	04.9
6	273°52.6	273°06.0	N09°18.3	234°47.2	N15°37.6	74°57.2	S06°18.1	6°21.8	S22°04.9
7	288°55.1	288°09.8	17.5	249°47.9	38.2	90°00.0	18.0	21°24.2	04.9
8	303°57.5	303°13.6	16.7	264°48.6	38.8	105°02.7	17.9	36°26.6	04.9
9	319°00.0	318°17.4	·· 15.8	279°49.3	·· 39.3	120°05.5	·· 17.7	51°29.0	·· 04.9
10	334°02.5	333°21.2	15.0	294°50.1	39.9	135°08.2	17.6	66°31.5	04.9
11	349°04.9	348°25.0	14.2	309°50.8	40.5	150°11.0	17.5	81°33.9	04.9
12	4°07.4	3°28.8	N09°13.3	324°51.5	N15°41.0	165°13.7	S06°17.4	96°36.3	S22°04.9
13	19°09.8	18°32.6	12.5	339°52.2	41.6	180°16.4	17.3	111°38.7	04.9
14	34°12.3	33°36.5	11.6	354°52.9	42.2	195°19.2	17.2	126°41.1	04.9
15	49°14.8	48°40.3	·· 10.8	9°53.6	·· 42.8	210°21.9	·· 17.0	141°43.5	·· 04.9
16	64°17.2	63°44.1	09.9	24°54.4	43.3	225°24.7	16.9	156°46.0	04.9
17	79°19.7	78°47.8	09.1	39°55.1	43.9	240°27.4	16.8	171°48.4	04.9
18	94°22.2	93°51.6	N09°08.3	54°55.8	N15°44.5	255°30.2	S06°16.7	186°50.8	S22°04.9
19	109°24.6	108°55.4	07.4	69°56.5	45.0	270°32.9	16.6	201°53.2	04.9
20	124°27.1	123°59.2	06.6	84°57.2	45.6	285°35.7	16.4	216°55.6	04.9
21	139°29.6	139°03.0	·· 05.7	99°57.9	·· 46.2	300°38.4	·· 16.3	231°58.0	·· 04.9
22	154°32.0	154°06.8	04.9	114°58.7	46.8	315°41.2	16.2	247°00.5	04.9
23	169°34.5	169°10.6	04.0	129°59.4	47.3	330°43.9	16.1	262°02.9	04.9
Mer.pass.:11:44		v3.8 d-0.8 m-3.8		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.4	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	184°36.9	184°14.4	N09°03.2	145°00.1	N15°47.9	345°46.7	S06°16.0	277°05.3	S22°04.9
1	199°39.4	199°18.2	02.3	160°00.8	48.5	0°49.4	15.9	292°07.7	04.9
2	214°41.9	214°22.0	01.4	175°01.5	49.0	15°52.1	15.7	307°10.1	04.9
3	229°44.3	229°25.8	09°00.6	190°02.2	·· 49.6	30°54.9	·· 15.6	322°12.6	·· 04.9
4	244°46.8	244°29.5	08°59.7	205°03.0	50.2	45°57.6	15.5	337°15.0	04.9
5	259°49.3	259°33.3	58.9	220°03.7	50.7	61°00.4	15.4	352°17.4	04.9
6	274°51.7	274°37.1	N08°58.0	235°04.4	N15°51.3	76°03.1	S06°15.3	7°19.8	S22°04.9
7	289°54.2	289°40.9	57.2	250°05.1	51.9	91°05.9	15.2	22°22.2	04.9
8	304°56.7	304°44.7	56.3	265°05.8	52.5	106°08.6	15.0	37°24.6	04.9
9	319°59.1	319°48.4	·· 55.4	280°06.5	·· 53.0	121°11.4	·· 14.9	52°27.1	·· 04.9
10	335°01.6	334°52.2	54.6	295°07.2	53.6	136°14.1	14.8	67°29.5	04.9
11	350°04.1	349°56.0	53.7	310°08.0	54.2	151°16.9	14.7	82°31.9	04.9
12	5°06.5	4°59.8	N08°52.8	325°08.7	N15°54.7	166°19.6	S06°14.6	97°34.3	S22°04.9
13	20°09.0	20°03.5	52.0	340°09.4	55.3	181°22.4	14.4	112°36.8	04.9
14	35°11.4	35°07.3	51.1	355°10.1	55.9	196°25.1	14.3	127°39.2	04.9
15	50°13.9	50°11.1	·· 50.2	10°10.8	·· 56.4	211°27.9	·· 14.2	142°41.6	·· 04.9
16	65°16.4	65°14.8	49.4	25°11.5	57.0	226°30.6	14.1	157°44.0	04.9
17	80°18.8	80°18.6	48.5	40°12.2	57.5	241°33.4	14.0	172°46.4	04.9
18	95°21.3	95°22.4	N08°47.6	55°13.0	N15°58.1	256°36.1	S06°13.9	187°48.9	S22°04.9
19	110°23.8	110°26.1	46.7	70°13.7	58.7	271°38.9	13.7	202°51.3	04.9
20	125°26.2	125°29.9	45.9	85°14.4	59.2	286°41.6	13.6	217°53.7	04.9
21	140°28.7	140°33.6	·· 45.0	100°15.1	15°59.8	301°44.4	·· 13.5	232°56.1	·· 04.9
22	155°31.2	155°37.4	44.1	115°15.8	16°00.4	316°47.1	13.4	247°58.5	04.9
23	170°33.6	170°41.1	43.2	130°16.5	00.9	331°49.9	13.3	263°01.0	04.9
Mer.pass.:11:40		v3.8 d-0.9 m-3.8		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.4	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	185°36.1	185°44.9	N08°42.4	145°17.2	N16°01.5	346°52.6	S06°13.2	278°03.4	S22°04.9
1	200°38.5	200°48.6	41.5	160°18.0	02.1	1°55.4	13.0	293°05.8	04.9
2	215°41.0	215°52.4	40.6	175°18.7	02.6	16°58.1	12.9	308°08.2	04.8
3	230°43.5	230°56.1	·· 39.7	190°19.4	·· 03.2	32°00.9	·· 12.8	323°10.7	·· 04.8
4	245°45.9	245°59.9	38.9	205°20.1	03.8	47°03.6	12.7	338°13.1	04.8
5	260°48.4	261°03.6	38.0	220°20.8	04.3	62°06.4	12.6	353°15.5	04.8
6	275°50.9	276°07.4	N08°37.1	235°21.5	N16°04.9	77°09.1	S06°12.4	8°17.9	S22°04.8
7	290°53.3	291°11.1	36.2	250°22.2	05.4	92°11.9	12.3	23°20.4	04.8
8	305°55.8	306°14.8	35.3	265°22.9	06.0	107°14.6	12.2	38°22.8	04.8
9	320°58.3	321°18.6	·· 34.4	280°23.7	·· 06.6	122°17.4	·· 12.1	53°25.2	·· 04.8
10	336°00.7	336°22.3	33.6	295°24.4	07.1	137°20.1	12.0	68°27.6	04.8
11	351°03.2	351°26.0	32.7	310°25.1	07.7	152°22.9	11.8	83°30.1	04.8
12	6°05.7	6°29.8	N08°31.8	325°25.8	N16°08.2	167°25.6	S06°11.7	98°32.5	S22°04.8
13	21°08.1	21°33.5	30.9	340°26.5	08.8	182°28.4	11.6	113°34.9	04.8
14	36°10.6	36°37.2	30.0	355°27.2	09.4	197°31.1	11.5	128°37.3	04.8
15	51°13.0	51°41.0	·· 29.1	10°27.9	·· 09.9	212°33.9	·· 11.4	143°39.8	·· 04.8
16	66°15.5	66°44.7	28.2	25°28.6	10.5	227°36.6	11.3	158°42.2	04.8
17	81°18.0	81°48.4	27.3	40°29.4	11.0	242°39.4	11.1	173°44.6	04.8
18	96°20.4	96°52.1	N08°26.5	55°30.1	N16°11.6	257°42.1	S06°11.0	188°47.0	S22°04.8
19	111°22.9	111°55.8	25.6	70°30.8	12.2	272°44.9	10.9	203°49.5	04.8
20	126°25.4	126°59.6	24.7	85°31.5	12.7	287°47.6	10.8	218°51.9	04.8
21	141°27.8	142°03.3	·· 23.8	100°32.2	·· 13.3	302°50.4	·· 10.7	233°54.3	·· 04.8
22	156°30.3	157°07.0	22.9	115°32.9	13.8	317°53.1	10.5	248°56.7	04.8
23	171°32.8	172°10.7	22.0	130°33.6	14.4	332°55.9	10.4	263°59.2	04.8
Mer.pass.:11:36		v3.8 d-0.9 m-3.9		v0.7 d0.6 m1.4		v2.7 d0.1 m-2.3		v2.4 d0.0 m0.4	

Stars

	SHA	**Dec**
Alpheratz	357°41.2	29°10.9
Ankaa	353°13.7	-42°12.9
Schedar	349°38.1	56°37.8
Diphda	348°53.7	-17°53.8
Achernar	335°25.5	-57°09.2
Hamal	327°58.2	23°32.4
Polaris	316°58.7	89°20.3
Acamar	315°16.8	-40°14.5
Menkar	314°12.6	4°09.1
Mirfak	308°37.0	49°55.2
Aldebaran	290°46.6	16°32.4
Rigel	281°09.7	-8°11.3
Capella	280°30.8	46°00.8
Bellatrix	278°29.4	6°21.6
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.8
Betelgeuse	270°58.6	7°24.3
Canopus	263°55.0	-52°42.8
Sirius	258°31.5	-16°44.8
Adhara	255°10.5	-29°00.2
Procyon	244°57.0	5°10.6
Pollux	243°24.5	27°58.9
Avior	234°16.6	-59°34.3
Suhail	222°50.3	-43°30.5
Miaplacidus	221°38.4	-69°47.6
Alphard	217°53.4	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.5
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.7	-63°11.7
Gacrux	171°57.4	-57°12.6
Alioth	166°18.0	55°52.0
Spica	158°28.3	-11°15.1
Alkaid	152°56.5	49°13.6
Hadar	148°43.6	-60°27.2
Menkent	148°04.2	-36°27.2
Arcturus	145°53.1	19°05.5
Rigil Kent.	139°47.6	-60°54.1
Kochab	137°19.3	74°05.0
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.4
Antares	112°23.0	-26°28.0
Atria	107°22.3	-69°03.1
Sabik	102°09.5	-15°44.6
Shaula	96°18.4	-37°06.7
Rasalhague	96°04.0	12°32.9
Eltanin	90°44.9	51°29.0
Kaus Aust.	83°40.4	-34°22.3
Vega	80°37.2	38°47.8
Nunki	75°55.2	-26°16.3
Altair	62°05.9	8°54.8
Peacock	53°15.6	-56°40.5
Deneb	49°30.0	45°20.3
Enif	33°44.9	9°57.1
Al Na'ir	27°41.0	-46°52.6
Fomalhaut	15°21.6	-29°31.9
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Mar 26 Sun	**SHA**	**Mer.pass**
Venus	359°05.3	11:46
Mars	321°05.1	14:20
Jupiter	161°02.9	01:01
Saturn	92°29.5	05:35

Mar 27 Mon	**SHA**	**Mer.pass**
Venus	359°37.4	11:40
Mars	320°23.1	14:19
Jupiter	161°09.7	00:57
Saturn	92°28.3	05:31

Mar 28 Tue	**SHA**	**Mer.pass**
Venus	0°08.8	11:34
Mars	319°41.2	14:18
Jupiter	161°16.5	00:52
Saturn	92°27.3	05:27

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.4795 sec ΔT = TT-UT1 = +68.7045 sec

2017 March 26 to Mar. 28 UT

h Sun Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°33.8	N02°11.5	203°58.5	10.3'	S09°01.9	9.8'	58.1'
1	193°34.0	12.5	218°27.8	10.3'	08°52.0	9.9'	58.1'
2	208°34.2	13.5	232°57.1	10.3'	08°42.1	10.0'	58.2'
3	223°34.3	·· 14.5	247°26.3	10.2'	08°32.1	10.0'	58.2'
4	238°34.5	15.5	261°55.6	10.2'	08°22.0	10.1'	58.2'
5	253°34.7	16.4	276°24.8	10.2'	08°11.9	10.1'	58.3'
6	268°34.9	N02°17.4	290°54.0	10.2'	S08°01.8	10.2'	58.3'
7	283°35.1	18.4	305°23.2	10.2'	07°51.6	10.2'	58.3'
8	298°35.3	19.4	319°52.4	10.2'	07°41.3	10.3'	58.4'
9	313°35.5	·· 20.4	334°21.6	10.2'	07°30.9	10.4'	58.4'
10	328°35.7	21.3	348°50.8	10.2'	07°20.6	10.4'	58.4'
11	343°35.8	22.3	3°19.9	10.2'	07°10.1	10.5'	58.5'
12	358°36.0	N02°23.3	17°49.1	10.1'	S06°59.6	10.5'	58.5'
13	13°36.2	24.3	32°18.2	10.1'	06°49.1	10.6'	58.5'
14	28°36.4	25.3	46°47.3	10.1'	06°38.5	10.6'	58.6'
15	43°36.6	·· 26.3	61°16.4	10.1'	06°27.9	10.7'	58.6'
16	58°36.8	27.2	75°45.5	10.1'	06°17.2	10.7'	58.6'
17	73°37.0	28.2	90°14.6	10.1'	06°06.4	10.8'	58.7'
18	88°37.2	N02°29.2	104°43.6	10.1'	S05°55.6	10.8'	58.7'
19	103°37.4	30.2	119°12.7	10.0'	05°44.8	10.9'	58.7'
20	118°37.5	31.1	133°41.7	10.0'	05°33.9	10.9'	58.8'
21	133°37.7	·· 32.1	148°10.7	10.0'	05°23.0	10.9'	58.8'
22	148°37.9	33.1	162°39.7	10.0'	05°12.0	11.0'	58.8'
23	163°38.1	34.1	177°08.7	10.0'	05°01.0	11.0'	58.9'
	SD.=16.0	d=1.0			S.D.=15.9		

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°38.3	N02°35.1	191°37.7	10.0'	S04°50.0	11.1'	58.9'
1	193°38.5	36.0	206°06.6	9.9'	04°38.9	11.1'	58.9'
2	208°38.7	37.0	220°35.5	9.9'	04°27.8	11.1'	58.9'
3	223°38.9	·· 38.0	235°04.5	9.9'	04°16.6	11.2'	59.0'
4	238°39.0	39.0	249°33.3	9.9'	04°05.4	11.2'	59.0'
5	253°39.2	40.0	264°02.2	9.9'	03°54.2	11.2'	59.0'
6	268°39.4	N02°40.9	278°31.1	9.8'	S03°42.9	11.3'	59.1'
7	283°39.6	41.9	292°59.9	9.8'	03°31.7	11.3'	59.1'
8	298°39.8	42.9	307°28.7	9.8'	03°20.3	11.3'	59.1'
9	313°40.0	·· 43.9	321°57.5	9.8'	03°09.0	11.4'	59.1'
10	328°40.2	44.9	336°26.3	9.8'	02°57.6	11.4'	59.2'
11	343°40.4	45.8	350°55.1	9.7'	02°46.2	11.4'	59.2'
12	358°40.5	N02°46.8	5°23.8	9.7'	S02°34.7	11.5'	59.2'
13	13°40.7	47.8	19°52.5	9.7'	02°23.2	11.5'	59.3'
14	28°40.9	48.8	34°21.2	9.7'	02°11.8	11.5'	59.3'
15	43°41.1	·· 49.7	48°49.9	9.7'	02°00.2	11.5'	59.3'
16	58°41.3	50.7	63°18.5	9.6'	01°48.7	11.5'	59.3'
17	73°41.5	51.7	77°47.1	9.6'	01°37.1	11.6'	59.4'
18	88°41.7	N02°52.7	92°15.7	9.6'	S01°25.6	11.6'	59.4'
19	103°41.9	53.7	106°44.3	9.6'	01°14.0	11.6'	59.4'
20	118°42.1	54.6	121°12.9	9.5'	01°02.3	11.6'	59.4'
21	133°42.2	·· 55.6	135°41.4	9.5'	00°50.7	11.6'	59.5'
22	148°42.4	56.6	150°09.9	9.5'	00°39.1	11.7'	59.5'
23	163°42.6	57.6	164°38.4	9.5'	00°27.4	11.7'	59.5'
	SD.=16.0	d=1.0			S.D.=16.1		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°42.8	N02°58.5	179°06.8	9.4'	S00°15.7	11.7'	59.5'
1	193°43.0	02°59.5	193°35.3	9.4'	S00°04.0	11.7'	59.6'
2	208°43.2	03°00.5	208°03.7	9.4'	N00°07.6	11.7'	59.6'
3	223°43.4	·· 01.5	222°32.1	9.4'	00°19.3	11.7'	59.6'
4	238°43.6	02.4	237°00.4	9.3'	00°31.1	11.7'	59.6'
5	253°43.7	03.4	251°28.7	9.3'	00°42.8	11.7'	59.6'
6	268°43.9	N03°04.4	265°57.0	9.3'	N00°54.5	11.7'	59.7'
7	283°44.1	05.4	280°25.3	9.3'	01°06.2	11.7'	59.7'
8	298°44.3	06.3	294°53.5	9.2'	01°17.9	11.7'	59.7'
9	313°44.5	·· 07.3	309°21.7	9.2'	01°29.7	11.7'	59.7'
10	328°44.7	08.3	323°49.9	9.2'	01°41.4	11.7'	59.7'
11	343°44.9	09.3	338°18.1	9.1'	01°53.1	11.7'	59.8'
12	358°45.1	N03°10.3	352°46.2	9.1'	N02°04.8	11.7'	59.8'
13	13°45.2	11.2	7°14.3	9.1'	02°16.5	11.7'	59.8'
14	28°45.4	12.2	21°42.4	9.0'	02°28.2	11.7'	59.8'
15	43°45.6	·· 13.2	36°10.4	9.0'	02°39.9	11.7'	59.8'
16	58°45.8	14.2	50°38.4	9.0'	02°51.6	11.7'	59.9'
17	73°46.0	15.1	65°06.4	9.0'	03°03.3	11.7'	59.9'
18	88°46.2	N03°16.1	79°34.3	8.9'	N03°15.0	11.7'	59.9'
19	103°46.4	17.1	94°02.2	8.9'	03°26.6	11.6'	59.9'
20	118°46.6	18.1	108°30.1	8.9'	03°38.3	11.6'	59.9'
21	133°46.7	·· 19.0	122°57.9	8.8'	03°49.9	11.6'	59.9'
22	148°46.9	20.0	137°25.7	8.8'	04°01.5	11.6'	60.0'
23	163°47.1	21.0	151°53.5	8.8'	04°13.1	11.6'	60.0'
	SD.=16.0	d=1.0			S.D.=16.3		

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:27	04:10	05:21	18:52	20:04	21:50
N 70°	02:56	04:23	05:26	18:47	19:51	21:19
68°	03:17	04:33	05:30	18:43	19:41	20:57
66°	03:34	04:41	05:33	18:40	19:32	20:40
64°	03:47	04:47	05:36	18:37	19:25	20:27
62°	03:57	04:53	05:38	18:34	19:19	20:16
60°	04:06	04:58	05:40	18:32	19:14	20:06
N 58°	04:14	05:02	05:42	18:30	19:10	19:58
56°	04:21	05:06	05:43	18:28	19:06	19:52
54°	04:27	05:09	05:45	18:27	19:03	19:46
52°	04:32	05:12	05:46	18:25	18:59	19:40
50°	04:36	05:15	05:47	18:24	18:57	19:36
45°	04:46	05:20	05:50	18:21	18:51	19:26
N 40°	04:53	05:25	05:52	18:19	18:46	19:18
35°	04:59	05:28	05:54	18:17	18:43	19:13
30°	05:03	05:31	05:55	18:16	18:40	19:08
20°	05:10	05:36	05:58	18:13	18:35	19:01
N 10°	05:15	05:39	06:00	18:11	18:32	18:56
0°	05:17	05:41	06:02	18:09	18:29	18:53
S 10°	05:19	05:43	06:04	18:07	18:28	18:52
20°	05:18	05:44	06:06	18:05	18:27	18:52
30°	05:16	05:44	06:08	18:02	18:26	18:54
35°	05:14	05:44	06:09	18:01	18:26	18:56
40°	05:12	05:43	06:10	18:00	18:27	18:58
45°	05:08	05:42	06:11	17:58	18:28	19:02
S 50°	05:03	05:41	06:13	17:57	18:29	19:06
52°	05:01	05:40	06:14	17:56	18:29	19:09
54°	04:58	05:39	06:15	17:55	18:30	19:11
56°	04:55	05:38	06:15	17:54	18:31	19:14
58°	04:51	05:37	06:16	17:53	18:32	19:18
S 60°	04:47	05:36	06:17	17:52	18:33	19:22

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	06:21	06:14	06:07	15:34	17:29	19:27
N 70°	06:09	06:09	06:08	15:44	17:31	19:22
68°	06:00	06:05	06:09	15:52	17:33	19:18
66°	05:52	06:01	06:10	15:58	17:35	19:14
64°	05:45	05:58	06:10	16:04	17:36	19:11
62°	05:39	05:55	06:11	16:08	17:38	19:09
60°	05:34	05:53	06:11	16:13	17:39	19:07
N 58°	05:29	05:51	06:12	16:16	17:40	19:05
56°	05:25	05:49	06:12	16:19	17:40	19:03
54°	05:21	05:47	06:12	16:22	17:41	19:02
52°	05:18	05:46	06:13	16:25	17:42	19:01
50°	05:15	05:44	06:13	16:27	17:42	18:59
45°	05:08	05:41	06:14	16:32	17:44	18:57
N 40°	05:03	05:39	06:14	16:37	17:45	18:54
35°	04:58	05:36	06:15	16:40	17:46	18:52
30°	04:54	05:35	06:15	16:44	17:46	18:51
20°	04:47	05:31	06:16	16:49	17:48	18:48
N 10°	04:40	05:28	06:17	16:54	17:49	18:45
0°	04:34	05:25	06:17	16:58	17:50	18:43
S 10°	04:28	05:23	06:18	17:03	17:51	18:40
20°	04:21	05:20	06:19	17:08	17:52	18:37
30°	04:14	05:16	06:20	17:13	17:53	18:34
35°	04:10	05:14	06:20	17:16	17:54	18:33
40°	04:05	05:12	06:21	17:19	17:55	18:31
45°	03:59	05:09	06:22	17:23	17:56	18:28
S 50°	03:52	05:06	06:23	17:28	17:57	18:26
52°	03:49	05:05	06:23	17:30	17:57	18:24
54°	03:46	05:03	06:24	17:32	17:58	18:23
56°	03:42	05:02	06:24	17:35	17:58	18:22
58°	03:38	05:00	06:25	17:38	17:59	18:20
S 60°	03:33	04:58	06:25	17:41	18:00	18:18

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 28-0 3-0%
26	05:45	05:36	12:06	10:46	23:12	
27	05:27	05:18	12:05	11:38	–:–	
28	05:09	05:00	12:05	12:30	00:04	

March 29, 30, 31 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	186°35.2	187°14.4	N08°21.1	145°34.3	N16°14.9	347°58.6	S06°10.3	279°01.6	S22°04.8
1	201°37.7	202°18.1	20.2	160°35.0	15.5	3°01.4	10.2	294°04.0	04.8
2	216°40.2	217°21.8	19.3	175°35.8	16.1	18°04.1	10.1	309°06.4	04.8
3	231°42.6	232°25.5	·· 18.4	190°36.5	·· 16.6	33°06.9	·· 09.9	324°08.9	·· 04.8
4	246°45.1	247°29.2	17.5	205°37.2	17.2	48°09.6	09.8	339°11.3	04.8
5	261°47.5	262°32.9	16.6	220°37.9	17.7	63°12.4	09.7	354°13.7	04.8
6	276°50.0	277°36.6	N08°15.7	235°38.6	N16°18.3	78°15.2	S06°09.6	9°16.2	S22°04.8
7	291°52.5	292°40.3	14.8	250°39.3	18.8	93°17.9	09.5	24°18.6	04.8
8	306°54.9	307°44.0	13.9	265°40.0	19.4	108°20.7	09.3	39°21.0	04.8
9	321°57.4	322°47.7	·· 13.0	280°40.7	·· 20.0	123°23.4	·· 09.2	54°23.4	·· 04.8
10	336°59.9	337°51.4	12.1	295°41.4	20.5	138°26.2	09.1	69°25.9	04.8
11	352°02.3	352°55.0	11.2	310°42.1	21.1	153°28.9	09.0	84°28.3	04.8
12	7°04.8	7°58.7	N08°10.3	325°42.9	N16°21.6	168°31.7	S06°08.9	99°30.7	S22°04.8
13	22°07.3	23°02.4	09.4	340°43.6	22.2	183°34.4	08.8	114°33.2	04.8
14	37°09.7	38°06.1	08.5	355°44.3	22.7	198°37.2	08.6	129°35.6	04.8
15	52°12.2	53°09.7	·· 07.6	10°45.0	·· 23.3	213°39.9	·· 08.5	144°38.0	·· 04.8
16	67°14.6	68°13.4	06.7	25°45.7	23.8	228°42.7	08.4	159°40.5	04.8
17	82°17.1	83°17.1	05.8	40°46.4	24.4	243°45.4	08.3	174°42.9	04.8
18	97°19.6	98°20.8	N08°04.9	55°47.1	N16°24.9	258°48.2	S06°08.2	189°45.3	S22°04.8
19	112°22.0	113°24.4	04.0	70°47.8	25.5	273°50.9	08.0	204°47.7	04.8
20	127°24.5	128°28.1	03.1	85°48.5	26.0	288°53.7	07.9	219°50.2	04.8
21	142°27.0	143°31.8	·· 02.2	100°49.2	·· 26.6	303°56.4	·· 07.8	234°52.6	·· 04.8
22	157°29.4	158°35.4	01.3	115°50.0	27.1	318°59.2	07.7	249°55.0	04.8
23	172°31.9	173°39.1	00.4	130°50.7	27.7	334°02.0	07.6	264°57.5	04.7
Mer.pass.:11:32		v3.7 d-0.9 m-3.9		v0.7 d0.6 m1.5		v2.8 d0.1 m-2.3		v2.4 d0.0 m0.4	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	187°34.4	188°42.7	N07°59.4	145°51.4	N16°28.2	349°04.7	S06°07.4	279°59.9	S22°04.7
1	202°36.8	203°46.4	58.5	160°52.1	28.8	4°07.5	07.3	295°02.3	04.7
2	217°39.3	218°50.0	57.6	175°52.8	29.3	19°10.2	07.2	310°04.8	04.7
3	232°41.8	233°53.7	·· 56.7	190°53.5	·· 29.9	34°13.0	·· 07.1	325°07.2	·· 04.7
4	247°44.2	248°57.3	55.8	205°54.2	30.4	49°15.7	07.0	340°09.6	04.7
5	262°46.7	264°01.0	54.9	220°54.9	31.0	64°18.5	06.8	355°12.1	04.7
6	277°49.1	279°04.6	N07°54.0	235°55.6	N16°31.5	79°21.2	S06°06.7	10°14.5	S22°04.7
7	292°51.6	294°08.2	53.1	250°56.3	32.1	94°24.0	06.6	25°16.9	04.7
8	307°54.1	309°11.9	52.2	265°57.0	32.6	109°26.7	06.5	40°19.4	04.7
9	322°56.5	324°15.5	·· 51.3	280°57.7	·· 33.2	124°29.5	·· 06.4	55°21.8	·· 04.7
10	337°59.0	339°19.1	50.3	295°58.5	33.7	139°32.3	06.2	70°24.2	04.7
11	353°01.5	354°22.8	49.4	310°59.2	34.3	154°35.0	06.1	85°26.7	04.7
12	8°03.9	9°26.4	N07°48.5	325°59.9	N16°34.8	169°37.8	S06°06.0	100°29.1	S22°04.7
13	23°06.4	24°30.0	47.6	341°00.6	35.4	184°40.5	05.9	115°31.5	04.7
14	38°08.9	39°33.6	46.7	356°01.3	35.9	199°43.3	05.8	130°34.0	04.7
15	53°11.3	54°37.3	·· 45.8	11°02.0	·· 36.5	214°46.0	·· 05.6	145°36.4	·· 04.7
16	68°13.8	69°40.9	44.9	26°02.7	37.0	229°48.8	05.5	160°38.8	04.7
17	83°16.2	84°44.5	44.0	41°03.4	37.6	244°51.5	05.4	175°41.3	04.7
18	98°18.7	99°48.1	N07°43.0	56°04.1	N16°38.1	259°54.3	S06°05.3	190°43.7	S22°04.7
19	113°21.2	114°51.7	42.1	71°04.8	38.7	274°57.0	05.2	205°46.1	04.7
20	128°23.6	129°55.3	41.2	86°05.5	39.2	289°59.8	05.0	220°48.6	04.7
21	143°26.1	144°58.9	·· 40.3	101°06.2	·· 39.7	305°02.6	·· 04.9	235°51.0	·· 04.7
22	158°28.6	160°02.5	39.4	116°06.9	40.3	320°05.3	04.8	250°53.4	04.7
23	173°31.0	175°06.1	38.5	131°07.6	40.8	335°08.1	04.7	265°55.9	04.7
Mer.pass.:11:28		v3.7 d-0.9 m-4.0		v0.7 d0.6 m1.5		v2.8 d0.1 m-2.3		v2.4 d0.0 m0.4	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	188°33.5	190°09.7	N07°37.6	146°08.4	N16°41.4	350°10.8	S06°04.6	280°58.3	S22°04.7
1	203°36.0	205°13.3	36.6	161°09.1	41.9	5°13.6	04.4	296°00.8	04.7
2	218°38.4	220°16.9	35.7	176°09.8	42.5	20°16.3	04.3	311°03.2	04.7
3	233°40.9	235°20.5	·· 34.8	191°10.5	·· 43.0	35°19.1	·· 04.2	326°05.6	·· 04.7
4	248°43.4	250°24.1	33.9	206°11.2	43.6	50°21.8	04.1	341°08.1	04.7
5	263°45.8	265°27.6	33.0	221°11.9	44.1	65°24.6	04.0	356°10.5	04.7
6	278°48.3	280°31.2	N07°32.1	236°12.6	N16°44.6	80°27.4	S06°03.8	11°12.9	S22°04.7
7	293°50.7	295°34.8	31.1	251°13.3	45.2	95°30.1	03.7	26°15.4	04.7
8	308°53.2	310°38.4	30.2	266°14.0	45.7	110°32.9	03.6	41°17.8	04.7
9	323°55.7	325°41.9	·· 29.3	281°14.7	·· 46.3	125°35.6	·· 03.5	56°20.3	·· 04.7
10	338°58.1	340°45.5	28.4	296°15.4	46.8	140°38.4	03.4	71°22.7	04.7
11	354°00.6	355°49.1	27.5	311°16.1	47.4	155°41.1	03.2	86°25.1	04.7
12	9°03.1	10°52.6	N07°26.6	326°16.8	N16°47.9	170°43.9	S06°03.1	101°27.6	S22°04.7
13	24°05.5	25°56.2	25.6	341°17.5	48.4	185°46.7	03.0	116°30.0	04.7
14	39°08.0	40°59.8	24.7	356°18.2	49.0	200°49.4	02.9	131°32.4	04.7
15	54°10.5	56°03.3	·· 23.8	11°18.9	·· 49.5	215°52.2	·· 02.8	146°34.9	·· 04.7
16	69°12.9	71°06.9	22.9	26°19.6	50.1	230°54.9	02.6	161°37.3	04.7
17	84°15.4	86°10.4	22.0	41°20.3	50.6	245°57.7	02.5	176°39.8	04.7
18	99°17.9	101°14.0	N07°21.1	56°21.1	N16°51.1	261°00.4	S06°02.4	191°42.2	S22°04.6
19	114°20.3	116°17.5	20.1	71°21.8	51.7	276°03.2	02.3	206°44.6	04.6
20	129°22.8	131°21.0	19.2	86°22.5	52.2	291°06.0	02.2	221°47.1	04.6
21	144°25.2	146°24.6	·· 18.3	101°23.2	·· 52.8	306°08.7	·· 02.0	236°49.5	·· 04.6
22	159°27.7	161°28.1	17.4	116°23.9	53.3	321°11.5	01.9	251°52.0	04.6
23	174°30.2	176°31.6	16.5	131°24.6	53.8	336°14.2	01.8	266°54.4	04.6
Mer.pass.:11:24		v3.6 d-0.9 m-4.0		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.4 d0.0 m0.4	

Stars

	SHA	**Dec**
Alpheratz	357°41.2	29°10.9
Ankaa	353°13.7	-42°12.9
Schedar	349°38.1	56°37.7
Diphda	348°53.7	-17°53.7
Achernar	335°25.5	-57°09.2
Hamal	327°58.2	23°32.4
Polaris	316°59.5	89°20.3
Acamar	315°16.8	-40°14.5
Menkar	314°12.6	4°09.1
Mirfak	308°37.0	49°55.2
Aldebaran	290°46.6	16°32.4
Rigel	281°09.7	-8°11.3
Capella	280°30.8	46°00.8
Bellatrix	278°29.4	6°21.6
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.8
Betelgeuse	270°58.6	7°24.3
Canopus	263°55.1	-52°42.8
Sirius	258°31.5	-16°44.8
Adhara	255°10.5	-29°00.2
Procyon	244°57.0	5°10.6
Pollux	243°24.6	27°58.9
Avior	234°16.7	-59°34.3
Suhail	222°50.3	-43°30.5
Miaplacidus	221°38.5	-69°47.6
Alphard	217°53.4	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.5
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.7	-63°11.7
Gacrux	171°57.4	-57°12.6
Alioth	166°18.0	55°52.0
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.6
Hadar	148°43.6	-60°27.2
Menkent	148°04.2	-36°27.2
Arcturus	145°53.1	19°05.5
Rigil Kent.	139°47.6	-60°54.1
Kochab	137°19.3	74°05.0
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.2	-69°03.1
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.7
Rasalhague	96°04.0	12°32.9
Eltanin	90°44.9	51°29.0
Kaus Aust.	83°40.4	-34°22.3
Vega	80°37.2	38°47.8
Nunki	75°55.2	-26°16.3
Altair	62°05.9	8°54.8
Peacock	53°15.6	-56°40.5
Deneb	49°29.9	45°20.3
Enif	33°44.9	9°57.1
Al Na'ir	27°41.0	-46°52.6
Fomalhaut	15°21.5	-29°31.9
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Mar 29 Wed	**SHA**	**Mer.pass**
Venus	0°39.2	11:28
Mars	318°59.1	14:17
Jupiter	161°23.4	00:48
Saturn	92°26.4	05:23

Mar 30 Thu	**SHA**	**Mer.pass**
Venus	1°08.4	11:22
Mars	318°17.0	14:16
Jupiter	161°30.3	00:44
Saturn	92°25.5	05:19

Mar 31 Fri	**SHA**	**Mer.pass**
Venus	1°36.2	11:17
Mars	317°34.9	14:15
Jupiter	161°37.3	00:39
Saturn	92°24.8	05:15

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.4750 sec ΔT = TT-UT1 = +68.7090 sec

2017 March 29 to Mar. 31 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°47.3	N03°22.0	166°21.3	8.7′	N04°24.7	11.6′	60.0′
1	193°47.5	22.9	180°49.0	8.7′	04°36.2	11.5′	60.0′
2	208°47.7	23.9	195°16.6	8.7′	04°47.8	11.5′	60.0′
3	223°47.9	·· 24.9	209°44.3	8.6′	04°59.3	11.5′	60.0′
4	238°48.1	25.8	224°11.9	8.6′	05°10.7	11.5′	60.0′
5	253°48.2	26.8	238°39.4	8.6′	05°22.2	11.4′	60.1′
6	268°48.4	N03°27.8	253°07.0	8.5′	N05°33.6	11.4′	60.1′
7	283°48.6	28.8	267°34.5	8.5′	05°45.0	11.4′	60.1′
8	298°48.8	29.7	282°01.9	8.4′	05°56.4	11.3′	60.1′
9	313°49.0	·· 30.7	296°29.4	8.4′	06°07.7	11.3′	60.1′
10	328°49.2	31.7	310°56.8	8.4′	06°19.0	11.3′	60.1′
11	343°49.4	32.7	325°24.1	8.3′	06°30.2	11.2′	60.1′
12	358°49.6	N03°33.6	339°51.4	8.3′	N06°41.5	11.2′	60.1′
13	13°49.7	34.6	354°18.7	8.3′	06°52.6	11.2′	60.1′
14	28°49.9	35.6	8°46.0	8.2′	07°03.8	11.1′	60.2′
15	43°50.1	·· 36.6	23°13.2	8.2′	07°14.9	11.1′	60.2′
16	58°50.3	37.5	37°40.3	8.2′	07°25.9	11.0′	60.2′
17	73°50.5	38.5	52°07.5	8.1′	07°37.0	11.0′	60.2′
18	88°50.7	N03°39.5	66°34.6	8.1′	N07°47.9	10.9′	60.2′
19	103°50.9	40.4	81°01.6	8.0′	07°58.9	10.9′	60.2′
20	118°51.0	41.4	95°28.7	8.0′	08°09.7	10.9′	60.2′
21	133°51.2	·· 42.4	109°55.6	8.0′	08°20.6	10.8′	60.2′
22	148°51.4	43.4	124°22.6	7.9′	08°31.3	10.8′	60.2′
23	163°51.6	44.3	138°49.5	7.9′	08°42.1	10.7′	60.2′
	SD.=16.0	d=1.0	S.D.=16.4				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°51.8	N03°45.3	153°16.4	7.8′	N08°52.7	10.6′	60.2′
1	193°52.0	46.3	167°43.2	7.8′	09°03.3	10.6′	60.2′
2	208°52.2	47.2	182°10.0	7.8′	09°13.9	10.5′	60.2′
3	223°52.4	·· 48.2	196°36.7	7.7′	09°24.4	10.5′	60.2′
4	238°52.5	49.2	211°03.4	7.7′	09°34.8	10.4′	60.2′
5	253°52.7	50.2	225°30.1	7.7′	09°45.2	10.4′	60.2′
6	268°52.9	N03°51.1	239°56.8	7.6′	N09°55.5	10.3′	60.2′
7	283°53.1	52.1	254°23.4	7.6′	10°05.8	10.2′	60.2′
8	298°53.3	53.1	268°49.9	7.5′	10°16.0	10.2′	60.2′
9	313°53.5	·· 54.0	283°16.4	7.5′	10°26.1	10.1′	60.2′
10	328°53.7	55.0	297°42.9	7.5′	10°36.2	10.0′	60.2′
11	343°53.9	56.0	312°09.4	7.4′	10°46.2	10.0′	60.3′
12	358°54.0	N03°56.9	326°35.8	7.4′	N10°56.1	9.9′	60.3′
13	13°54.2	57.9	341°02.2	7.4′	11°06.0	9.8′	60.3′
14	28°54.4	58.9	355°28.5	7.3′	11°15.7	9.7′	60.3′
15	43°54.6	03°59.9	9°54.8	7.3′	11°25.4	9.7′	60.2′
16	58°54.8	04°00.8	24°21.0	7.2′	11°35.1	9.6′	60.2′
17	73°55.0	01.8	38°47.3	7.2′	11°44.6	9.5′	60.2′
18	88°55.2	N04°02.8	53°13.5	7.2′	N11°54.1	9.4′	60.2′
19	103°55.3	03.7	67°39.6	7.1′	12°03.5	9.4′	60.2′
20	118°55.5	04.7	82°05.7	7.1′	12°12.8	9.3′	60.2′
21	133°55.7	·· 05.7	96°31.8	7.1′	12°22.1	9.2′	60.2′
22	148°55.9	06.6	110°57.8	7.0′	12°31.2	9.1′	60.2′
23	163°56.1	07.6	125°23.8	7.0′	12°40.3	9.0′	60.2′
	SD.=16.0	d=1.0	S.D.=16.4				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°56.3	N04°08.6	139°49.8	6.9′	N12°49.3	8.9′	60.2′
1	193°56.5	09.5	154°15.7	6.9′	12°58.2	8.9′	60.2′
2	208°56.6	10.5	168°41.6	6.9′	13°07.0	8.8′	60.2′
3	223°56.8	·· 11.5	183°07.5	6.8′	13°15.7	8.7′	60.2′
4	238°57.0	12.5	197°33.3	6.8′	13°24.4	8.6′	60.2′
5	253°57.2	13.4	211°59.1	6.8′	13°32.9	8.5′	60.2′
6	268°57.4	N04°14.4	226°24.9	6.7′	N13°41.4	8.4′	60.2′
7	283°57.6	15.4	240°50.6	6.7′	13°49.8	8.3′	60.2′
8	298°57.8	16.3	255°16.3	6.7′	13°58.0	8.2′	60.2′
9	313°57.9	·· 17.3	269°41.9	6.6′	14°06.2	8.1′	60.2′
10	328°58.1	18.3	284°07.6	6.6′	14°14.3	8.0′	60.2′
11	343°58.3	19.2	298°33.2	6.6′	14°22.3	7.9′	60.2′
12	358°58.5	N04°20.2	312°58.7	6.6′	N14°30.2	7.8′	60.1′
13	13°58.7	21.2	327°24.3	6.5′	14°38.0	7.7′	60.1′
14	28°58.9	22.1	341°49.8	6.5′	14°45.7	7.6′	60.1′
15	43°59.1	·· 23.1	356°15.2	6.5′	14°53.3	7.5′	60.1′
16	58°59.2	24.1	10°40.7	6.4′	15°00.7	7.4′	60.1′
17	73°59.4	25.0	25°06.1	6.4′	15°08.1	7.3′	60.1′
18	88°59.6	N04°26.0	39°31.5	6.4′	N15°15.4	7.2′	60.1′
19	103°59.8	27.0	53°56.9	6.4′	15°22.6	7.1′	60.1′
20	119°00.0	27.9	68°22.2	6.3′	15°29.7	7.0′	60.1′
21	134°00.2	·· 28.9	82°47.5	6.3′	15°36.6	6.9′	60.1′
22	149°00.4	29.9	97°12.8	6.3′	15°43.5	6.8′	60.0′
23	164°00.5	30.8	111°38.1	6.3′	15°50.2	6.7′	60.0′
	SD.=16.0	d=1.0	S.D.=16.4				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	01:59	03:53	05:06	19:06	20:20	22:19
N 70°	02:35	04:07	05:12	18:59	20:05	21:39
68°	03:00	04:19	05:17	18:54	19:53	21:13
66°	03:19	04:28	05:21	18:49	19:43	20:54
64°	03:34	04:36	05:25	18:45	19:35	20:38
62°	03:46	04:43	05:28	18:42	19:28	20:26
60°	03:56	04:49	05:31	18:39	19:22	20:15
N 58°	04:04	04:53	05:33	18:37	19:17	20:06
56°	04:12	04:58	05:36	18:34	19:12	19:59
54°	04:18	05:02	05:38	18:32	19:08	19:52
52°	04:24	05:05	05:39	18:31	19:05	19:46
50°	04:29	05:08	05:41	18:29	19:02	19:41
45°	04:40	05:15	05:44	18:25	18:55	19:30
N 40°	04:48	05:20	05:47	18:22	18:50	19:22
35°	04:54	05:24	05:50	18:20	18:45	19:15
30°	05:00	05:28	05:52	18:18	18:42	19:10
20°	05:07	05:33	05:55	18:14	18:36	19:02
N 10°	05:13	05:37	05:58	18:11	18:32	18:56
0°	05:16	05:40	06:01	18:08	18:28	18:52
S 10°	05:18	05:43	06:04	18:05	18:26	18:50
20°	05:19	05:45	06:07	18:02	18:24	18:50
30°	05:18	05:46	06:10	17:59	18:23	18:50
35°	05:17	05:46	06:11	17:57	18:22	18:52
40°	05:15	05:46	06:13	17:55	18:22	18:53
45°	05:12	05:46	06:15	17:53	18:22	18:56
S 50°	05:08	05:45	06:18	17:50	18:22	19:00
52°	05:06	05:45	06:19	17:49	18:23	19:02
54°	05:04	05:45	06:20	17:48	18:23	19:04
56°	05:01	05:44	06:21	17:46	18:23	19:06
58°	04:58	05:44	06:23	17:45	18:24	19:09
S 60°	04:55	05:43	06:25	17:43	18:24	19:13

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	06:00	05:52	05:43	21:27	23:33	–:–
N 70°	06:07	06:07	06:09	21:14	23:09	–:–
68°	06:14	06:20	06:28	21:04	22:51	–:–
66°	06:19	06:30	06:44	20:55	22:36	–:–
64°	06:23	06:38	06:57	20:48	22:24	23:57
62°	06:27	06:45	07:08	20:42	22:14	23:43
60°	06:30	06:52	07:17	20:36	22:06	23:31
N 58°	06:33	06:57	07:26	20:32	21:58	23:21
56°	06:36	07:02	07:33	20:28	21:51	23:12
54°	06:39	07:07	07:40	20:24	21:45	23:04
52°	06:41	07:11	07:45	20:20	21:40	22:57
50°	06:43	07:15	07:51	20:17	21:35	22:51
45°	06:47	07:23	08:02	20:11	21:25	22:37
N 40°	06:51	07:30	08:12	20:05	21:16	22:26
35°	06:54	07:36	08:20	20:00	21:09	22:17
30°	06:57	07:41	08:28	19:56	21:02	22:08
20°	07:02	07:50	08:40	19:49	20:51	21:54
N 10°	07:07	07:58	08:51	19:43	20:41	21:41
0°	07:11	08:06	09:02	19:37	20:32	21:29
S 10°	07:15	08:13	09:13	19:31	20:23	21:18
20°	07:20	08:21	09:24	19:24	20:13	21:05
30°	07:25	08:31	09:37	19:17	20:02	20:51
35°	07:28	08:36	09:45	19:13	19:56	20:42
40°	07:31	08:43	09:53	19:08	19:49	20:33
45°	07:35	08:50	10:03	19:03	19:40	20:22
S 50°	07:40	08:59	10:16	18:56	19:30	20:08
52°	07:43	09:03	10:22	18:53	19:25	20:02
54°	07:45	09:07	10:28	18:50	19:20	19:55
56°	07:48	09:12	10:35	18:46	19:15	19:48
58°	07:51	09:18	10:43	18:42	19:08	19:39
S 60°	07:54	09:24	10:52	18:38	19:01	19:30

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 1-3 3-16%
29	04:51	04:42	12:05	13:24	00:57	
30	04:33	04:24	12:04	14:19	01:51	
31	04:15	04:06	12:04	15:16	02:47	

April 01, 02, 03 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	189°32.6	191°35.2	N07°15.6	146°25.3	N16°54.4	351°17.0	S06°01.7	281°56.8	S22°04.6
1	204°35.1	206°38.7	14.6	161°26.0	54.9	6°19.7	01.5	296°59.3	04.6
2	219°37.6	221°42.2	13.7	176°26.7	55.4	21°22.5	01.4	312°01.7	04.6
3	234°40.0	236°45.7	·· 12.8	191°27.4	·· 56.0	36°25.3	·· 01.3	327°04.2	·· 04.6
4	249°42.5	251°49.3	11.9	206°28.1	56.5	51°28.0	01.2	342°06.6	04.6
5	264°45.0	266°52.8	11.0	221°28.8	57.1	66°30.8	01.1	357°09.0	04.6
6	279°47.4	281°56.3	N07°10.1	236°29.5	N16°57.6	81°33.5	S06°00.9	12°11.5	S22°04.6
7	294°49.9	296°59.8	09.1	251°30.2	58.1	96°36.3	00.8	27°13.9	04.6
8	309°52.3	312°03.3	08.2	266°30.9	58.7	111°39.0	00.7	42°16.4	04.6
9	324°54.8	327°06.8	·· 07.3	281°31.6	·· 59.2	126°41.8	·· 00.6	57°18.8	·· 04.6
10	339°57.3	342°10.3	06.4	296°32.3	16°59.7	141°44.6	00.5	72°21.3	04.6
11	354°59.7	357°13.8	05.5	311°33.0	17°00.3	156°47.3	00.3	87°23.7	04.6
12	10°02.2	12°17.3	N07°04.6	326°33.7	N17°00.8	171°50.1	S06°00.2	102°26.1	S22°04.6
13	25°04.7	27°20.8	03.6	341°34.4	01.3	186°52.8	00.1	117°28.6	04.6
14	40°07.1	42°24.3	02.7	356°35.1	01.9	201°55.6	06°00.0	132°31.0	04.6
15	55°09.6	57°27.7	·· 01.8	11°35.8	·· 02.4	216°58.4	05°59.9	147°33.5	·· 04.6
16	70°12.1	72°31.2	00.9	26°36.5	02.9	232°01.1	59.7	162°35.9	04.6
17	85°14.5	87°34.7	07°00.0	41°37.2	03.5	247°03.9	59.6	177°38.4	04.6
18	100°17.0	102°38.2	N06°59.1	56°37.9	N17°04.0	262°06.6	S05°59.5	192°40.8	S22°04.6
19	115°19.5	117°41.7	58.2	71°38.6	04.5	277°09.4	59.4	207°43.2	04.6
20	130°21.9	132°45.1	57.2	86°39.4	05.1	292°12.1	59.3	222°45.7	04.6
21	145°24.4	147°48.6	·· 56.3	101°40.1	·· 05.6	307°14.9	·· 59.1	237°48.1	·· 04.6
22	160°26.8	162°52.1	55.4	116°40.8	06.1	322°17.7	59.0	252°50.6	04.6
23	175°29.3	177°55.5	54.5	131°41.5	06.7	337°20.4	58.9	267°53.0	04.6
Mer.pass.:11:20		v3.5 d-0.9 m-4.0		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.4 d0.0 m0.4	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	190°31.8	192°59.0	N06°53.6	146°42.2	N17°07.2	352°23.2	S05°58.8	282°55.5	S22°04.6
1	205°34.2	208°02.4	52.7	161°42.9	07.7	7°25.9	58.6	297°57.9	04.6
2	220°36.7	223°05.9	51.8	176°43.6	08.3	22°28.7	58.5	313°00.4	04.6
3	235°39.2	238°09.3	·· 50.8	191°44.3	·· 08.8	37°31.5	·· 58.4	328°02.8	·· 04.6
4	250°41.6	253°12.8	49.9	206°45.0	09.3	52°34.2	58.3	343°05.3	04.6
5	265°44.1	268°16.2	49.0	221°45.7	09.8	67°37.0	58.2	358°07.7	04.6
6	280°46.6	283°19.6	N06°48.1	236°46.4	N17°10.4	82°39.7	S05°58.0	13°10.1	S22°04.6
7	295°49.0	298°23.1	47.2	251°47.1	10.9	97°42.5	57.9	28°12.6	04.6
8	310°51.5	313°26.5	46.3	266°47.8	11.4	112°45.3	57.8	43°15.0	04.6
9	325°54.0	328°29.9	·· 45.4	281°48.5	·· 12.0	127°48.0	·· 57.7	58°17.5	·· 04.6
10	340°56.4	343°33.4	44.5	296°49.2	12.5	142°50.8	57.6	73°19.9	04.6
11	355°58.9	358°36.8	43.5	311°49.9	13.0	157°53.5	57.4	88°22.4	04.6
12	11°01.3	13°40.2	N06°42.6	326°50.6	N17°13.5	172°56.3	S05°57.3	103°24.8	S22°04.5
13	26°03.8	28°43.6	41.7	341°51.3	14.1	187°59.0	57.2	118°27.3	04.5
14	41°06.3	43°47.0	40.8	356°52.0	14.6	203°01.8	57.1	133°29.7	04.5
15	56°08.7	58°50.4	·· 39.9	11°52.7	·· 15.1	218°04.6	·· 57.0	148°32.2	·· 04.5
16	71°11.2	73°53.8	39.0	26°53.4	15.7	233°07.3	56.8	163°34.6	04.5
17	86°13.7	88°57.2	38.1	41°54.1	16.2	248°10.1	56.7	178°37.1	04.5
18	101°16.1	104°00.6	N06°37.2	56°54.8	N17°16.7	263°12.8	S05°56.6	193°39.5	S22°04.5
19	116°18.6	119°04.0	36.3	71°55.5	17.2	278°15.6	56.5	208°42.0	04.5
20	131°21.1	134°07.4	35.4	86°56.2	17.8	293°18.4	56.3	223°44.4	04.5
21	146°23.5	149°10.8	·· 34.5	101°56.9	·· 18.3	308°21.1	·· 56.2	238°46.9	·· 04.5
22	161°26.0	164°14.2	33.6	116°57.6	18.8	323°23.9	56.1	253°49.3	04.5
23	176°28.5	179°17.6	32.6	131°58.3	19.3	338°26.6	56.0	268°51.8	04.5
Mer.pass.:11:16		v3.5 d-0.9 m-4.1		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.4 d0.0 m0.4	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	191°30.9	194°21.0	N06°31.7	146°59.0	N17°19.9	353°29.4	S05°55.9	283°54.2	S22°04.5
1	206°33.4	209°24.4	30.8	161°59.7	20.4	8°32.2	55.7	298°56.7	04.5
2	221°35.8	224°27.7	29.9	177°00.4	20.9	23°34.9	55.6	313°59.1	04.5
3	236°38.3	239°31.1	·· 29.0	192°01.1	·· 21.4	38°37.7	·· 55.5	329°01.6	·· 04.5
4	251°40.8	254°34.5	28.1	207°01.8	22.0	53°40.4	55.4	344°04.0	04.5
5	266°43.2	269°37.8	27.2	222°02.5	22.5	68°43.2	55.3	359°06.5	04.5
6	281°45.7	284°41.2	N06°26.3	237°03.2	N17°23.0	83°46.0	S05°55.1	14°08.9	S22°04.5
7	296°48.2	299°44.5	25.4	252°03.9	23.5	98°48.7	55.0	29°11.4	04.5
8	311°50.6	314°47.9	24.5	267°04.6	24.0	113°51.5	54.9	44°13.8	04.5
9	326°53.1	329°51.2	·· 23.6	282°05.3	·· 24.6	128°54.2	·· 54.8	59°16.3	·· 04.5
10	341°55.6	344°54.6	22.7	297°06.0	25.1	143°57.0	54.6	74°18.7	04.5
11	356°58.0	359°57.9	21.8	312°06.7	25.6	158°59.8	54.5	89°21.2	04.5
12	12°00.5	15°01.3	N06°20.9	327°07.4	N17°26.1	174°02.5	S05°54.4	104°23.6	S22°04.5
13	27°02.9	30°04.6	20.0	342°08.1	26.7	189°05.3	54.3	119°26.1	04.5
14	42°05.4	45°07.9	19.1	357°08.8	27.2	204°08.1	54.2	134°28.5	04.5
15	57°07.9	60°11.3	·· 18.2	12°09.5	·· 27.7	219°10.8	·· 54.0	149°31.0	·· 04.5
16	72°10.3	75°14.6	17.3	27°10.2	28.2	234°13.6	53.9	164°33.4	04.5
17	87°12.8	90°17.9	16.4	42°10.9	28.7	249°16.3	53.8	179°35.9	04.5
18	102°15.3	105°21.2	N06°15.5	57°11.6	N17°29.3	264°19.1	S05°53.7	194°38.3	S22°04.5
19	117°17.7	120°24.5	14.6	72°12.3	29.8	279°21.9	53.6	209°40.8	04.5
20	132°20.2	135°27.9	13.7	87°13.0	30.3	294°24.6	53.4	224°43.2	04.5
21	147°22.7	150°31.2	·· 12.8	102°13.7	·· 30.8	309°27.4	·· 53.3	239°45.7	·· 04.5
22	162°25.1	165°34.5	11.9	117°14.4	31.3	324°30.1	53.2	254°48.2	04.5
23	177°27.6	180°37.8	11.0	132°15.1	31.8	339°32.9	53.1	269°50.6	04.5
Mer.pass.:11:12		v3.4 d-0.9 m-4.1		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.4 d0.0 m0.4	

Stars

	SHA	**Dec**
Alpheratz	357°41.2	29°10.9
Ankaa	353°13.7	-42°12.9
Schedar	349°38.1	56°37.7
Diphda	348°53.7	-17°53.7
Achernar	335°25.5	-57°09.2
Hamal	327°58.2	23°32.4
Polaris	317°00.0	89°20.2
Acamar	315°16.8	-40°14.5
Menkar	314°12.6	4°09.1
Mirfak	308°37.0	49°55.2
Aldebaran	290°46.6	16°32.4
Rigel	281°09.7	-8°11.3
Capella	280°30.9	46°00.8
Bellatrix	278°29.4	6°21.6
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.8
Betelgeuse	270°58.6	7°24.3
Canopus	263°55.1	-52°42.8
Sirius	258°31.5	-16°44.8
Adhara	255°10.5	-29°00.2
Procyon	244°57.0	5°10.6
Pollux	243°24.6	27°58.9
Avior	234°16.7	-59°34.3
Suhail	222°50.3	-43°30.5
Miaplacidus	221°38.5	-69°47.6
Alphard	217°53.4	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.5
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.6	-63°11.7
Gacrux	171°57.4	-57°12.6
Alioth	166°18.0	55°52.0
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.6
Hadar	148°43.6	-60°27.2
Menkent	148°04.2	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.6	-60°54.1
Kochab	137°19.2	74°05.0
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.1	-69°03.1
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.7
Rasalhague	96°04.0	12°32.9
Eltanin	90°44.8	51°29.1
Kaus Aust.	83°40.4	-34°22.3
Vega	80°37.2	38°47.9
Nunki	75°55.2	-26°16.3
Altair	62°05.8	8°54.8
Peacock	53°15.5	-56°40.5
Deneb	49°29.9	45°20.3
Enif	33°44.8	9°57.1
Al Na'ir	27°40.9	-46°52.5
Fomalhaut	15°21.5	-29°31.9
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Apr 01 Sat	**SHA**	**Mer.pass**
Venus	2°02.5	11:11
Mars	316°52.6	14:14
Jupiter	161°44.3	00:35
Saturn	92°24.2	05:11

Apr 02 Sun	**SHA**	**Mer.pass**
Venus	2°27.2	11:06
Mars	316°10.4	14:13
Jupiter	161°51.4	00:30
Saturn	92°23.7	05:07

Apr 03 Mon	**SHA**	**Mer.pass**
Venus	2°50.1	11:00
Mars	315°28.1	14:11
Jupiter	161°58.5	00:26
Saturn	92°23.3	05:04

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.4705 sec ΔT = TT-UT1 = +68.7135 sec

2017 April 01 to Apr. 03 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°00.7	N04°31.8	126°03.3	6.2′	N15°56.9	6.6′	60.0′
1	194°00.9	32.7	140°28.5	6.2′	16°03.4	6.5′	60.0′
2	209°01.1	33.7	154°53.7	6.2′	16°09.8	6.4′	60.0′
3	224°01.3	·· 34.7	169°18.9	6.2′	16°16.1	6.3′	60.0′
4	239°01.5	35.6	183°44.0	6.1′	16°22.3	6.1′	60.0′
5	254°01.7	36.6	198°09.2	6.1′	16°28.4	6.0′	60.0′
6	269°01.8	N04°37.6	212°34.3	6.1′	N16°34.4	5.9′	59.9′
7	284°02.0	38.5	226°59.4	6.1′	16°40.3	5.8′	59.9′
8	299°02.2	39.5	241°24.4	6.1′	16°46.0	5.7′	59.9′
9	314°02.4	·· 40.5	255°49.5	6.0′	16°51.6	5.6′	59.9′
10	329°02.6	41.4	270°14.5	6.0′	16°57.2	5.5′	59.9′
11	344°02.8	42.4	284°39.6	6.0′	17°02.6	5.3′	59.9′
12	359°02.9	N04°43.4	299°04.6	6.0′	N17°07.8	5.2′	59.9′
13	14°03.1	44.3	313°29.6	6.0′	17°13.0	5.1′	59.8′
14	29°03.3	45.3	327°54.6	6.0′	17°18.1	5.0′	59.8′
15	44°03.5	·· 46.2	342°19.5	6.0′	17°23.0	4.9′	59.8′
16	59°03.7	47.2	356°44.5	6.0′	17°27.8	4.7′	59.8′
17	74°03.9	48.2	11°09.4	5.9′	17°32.5	4.6′	59.8′
18	89°04.1	N04°49.1	25°34.4	5.9′	N17°37.0	4.5′	59.8′
19	104°04.2	50.1	39°59.3	5.9′	17°41.5	4.4′	59.7′
20	119°04.4	51.1	54°24.3	5.9′	17°45.8	4.3′	59.7′
21	134°04.6	·· 52.0	68°49.2	5.9′	17°50.0	4.1′	59.7′
22	149°04.8	53.0	83°14.1	5.9′	17°54.1	4.0′	59.7′
23	164°05.0	53.9	97°39.0	5.9′	17°58.0	3.9′	59.7′
	SD.=16.0	d=1.0		S.D.=16.3			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°05.2	N04°54.9	112°03.9	5.9′	N18°01.9	3.8′	59.7′
1	194°05.3	55.9	126°28.8	5.9′	18°05.6	3.7′	59.6′
2	209°05.5	56.8	140°53.7	5.9′	18°09.2	3.5′	59.6′
3	224°05.7	·· 57.8	155°18.6	5.9′	18°12.7	3.4′	59.6′
4	239°05.9	58.7	169°43.5	5.9′	18°16.0	3.3′	59.6′
5	254°06.1	04°59.7	184°08.5	5.9′	18°19.2	3.2′	59.6′
6	269°06.3	N05°00.7	198°33.4	5.9′	N18°22.3	3.0′	59.5′
7	284°06.5	01.6	212°58.3	5.9′	18°25.3	2.9′	59.5′
8	299°06.6	02.6	227°23.2	5.9′	18°28.1	2.8′	59.5′
9	314°06.8	·· 03.6	241°48.1	5.9′	18°30.8	2.7′	59.5′
10	329°07.0	04.5	256°13.1	5.9′	18°33.4	2.5′	59.5′
11	344°07.2	05.5	270°38.0	5.9′	18°35.9	2.4′	59.5′
12	359°07.4	N05°06.4	285°02.9	6.0′	N18°38.2	2.3′	59.4′
13	14°07.6	07.4	299°27.9	6.0′	18°40.5	2.2′	59.4′
14	29°07.7	08.3	313°52.9	6.0′	18°42.5	2.0′	59.4′
15	44°07.9	·· 09.3	328°17.9	6.0′	18°44.5	1.9′	59.4′
16	59°08.1	10.3	342°42.9	6.0′	18°46.4	1.8′	59.3′
17	74°08.3	11.2	357°07.9	6.0′	18°48.1	1.7′	59.3′
18	89°08.5	N05°12.2	11°32.9	6.0′	N18°49.7	1.5′	59.3′
19	104°08.7	13.1	25°57.9	6.0′	18°51.1	1.4′	59.3′
20	119°08.8	14.1	40°23.0	6.1′	18°52.5	1.3′	59.3′
21	134°09.0	·· 15.1	54°48.1	6.1′	18°53.7	1.1′	59.2′
22	149°09.2	16.0	69°13.2	6.1′	18°54.8	1.0′	59.2′
23	164°09.4	17.0	83°38.3	6.1′	18°55.7	0.9′	59.2′
	SD.=16.0	d=1.0		S.D.=16.2			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°09.6	N05°17.9	98°03.4	6.1′	N18°56.6	0.8′	59.2′
1	194°09.8	18.9	112°28.6	6.2′	18°57.3	0.6′	59.2′
2	209°09.9	19.8	126°53.8	6.2′	18°57.9	0.5′	59.1′
3	224°10.1	·· 20.8	141°19.0	6.2′	18°58.3	0.4′	59.1′
4	239°10.3	21.8	155°44.2	6.2′	18°58.7	0.3′	59.1′
5	254°10.5	22.7	170°09.5	6.3′	18°58.9	0.2′	59.1′
6	269°10.7	N05°23.7	184°34.7	6.3′	N18°59.0	0.0′	59.1′
7	284°10.9	24.6	199°00.1	6.3′	18°58.9	-0.1′	59.0′
8	299°11.0	25.6	213°25.4	6.4′	18°58.8	-0.2′	59.0′
9	314°11.2	·· 26.5	227°50.8	6.4′	18°58.5	-0.3′	59.0′
10	329°11.4	27.5	242°16.2	6.4′	18°58.1	-0.5′	59.0′
11	344°11.6	28.5	256°41.6	6.5′	18°57.6	-0.6′	58.9′
12	359°11.8	N05°29.4	271°07.1	6.5′	N18°56.9	-0.7′	58.9′
13	14°11.9	30.4	285°32.6	6.5′	18°56.2	-0.8′	58.9′
14	29°12.1	31.3	299°58.1	6.6′	18°55.3	-0.9′	58.9′
15	44°12.3	·· 32.3	314°23.7	6.6′	18°54.3	-1.1′	58.8′
16	59°12.5	33.2	328°49.3	6.6′	18°53.1	-1.2′	58.8′
17	74°12.7	34.2	343°15.0	6.7′	18°51.9	-1.3′	58.8′
18	89°12.9	N05°35.1	357°40.6	6.7′	N18°50.5	-1.4′	58.8′
19	104°13.0	36.1	12°06.4	6.7′	18°49.0	-1.5′	58.8′
20	119°13.2	37.1	26°32.1	6.8′	18°47.4	-1.7′	58.7′
21	134°13.4	·· 38.0	40°57.9	6.8′	18°45.7	-1.8′	58.7′
22	149°13.6	39.0	55°23.8	6.9′	18°43.8	-1.9′	58.7′
23	164°13.8	39.9	69°49.7	6.9′	18°41.9	-2.0′	58.7′
	SD.=16.0	d=1.0		S.D.=16.1			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	01:23	03:34	04:50	19:20	20:37	22:58
N 70°	02:12	03:51	04:58	19:12	20:19	22:02
68°	02:42	04:05	05:04	19:05	20:05	21:30
66°	03:03	04:16	05:10	18:59	19:54	21:08
64°	03:20	04:25	05:15	18:54	19:45	20:50
62°	03:34	04:32	05:18	18:50	19:37	20:36
60°	03:45	04:39	05:22	18:47	19:30	20:24
N 58°	03:55	04:45	05:25	18:43	19:24	20:14
56°	04:03	04:50	05:28	18:41	19:19	20:06
54°	04:10	04:54	05:30	18:38	19:14	19:58
52°	04:16	04:58	05:32	18:36	19:10	19:52
50°	04:22	05:02	05:34	18:34	19:07	19:46
45°	04:34	05:09	05:39	18:29	18:59	19:34
N 40°	04:43	05:15	05:42	18:25	18:53	19:25
35°	04:50	05:20	05:45	18:22	18:48	19:18
30°	04:56	05:24	05:48	18:19	18:43	19:12
20°	05:05	05:31	05:53	18:15	18:37	19:03
N 10°	05:11	05:36	05:57	18:11	18:32	18:56
0°	05:15	05:40	06:00	18:07	18:28	18:52
S 10°	05:18	05:43	06:04	18:03	18:24	18:49
20°	05:20	05:45	06:07	17:59	18:21	18:47
30°	05:20	05:47	06:11	17:55	18:19	18:47
35°	05:19	05:48	06:14	17:53	18:18	18:47
40°	05:18	05:49	06:16	17:50	18:17	18:49
45°	05:16	05:50	06:19	17:47	18:17	18:50
S 50°	05:13	05:50	06:22	17:44	18:16	18:53
52°	05:11	05:50	06:24	17:42	18:16	18:55
54°	05:09	05:50	06:26	17:40	18:16	18:56
56°	05:07	05:50	06:27	17:38	18:15	18:58
58°	05:05	05:50	06:30	17:36	18:15	19:01
S 60°	05:02	05:50	06:32	17:34	18:15	19:04

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	05:30			01:47		
N 70°	06:14	06:27	07:06	01:04	02:53	04:16
68°	06:43	07:09	07:56	00:36	02:11	03:26
66°	07:05	07:38	08:27	00:14	01:43	02:54
64°	07:23	08:00	08:51	–:–	01:21	02:31
62°	07:37	08:17	09:10	–:–	01:04	02:12
60°	07:50	08:32	09:25	–:–	00:50	01:57
N 58°	08:00	08:44	09:38	–:–	00:38	01:44
56°	08:10	08:55	09:49	–:–	00:27	01:33
54°	08:18	09:04	09:59	–:–	00:18	01:23
52°	08:26	09:13	10:08	–:–	00:10	01:14
50°	08:32	09:21	10:16	–:–	00:02	01:06
45°	08:47	09:37	10:33	23:46	–:–	00:49
N 40°	08:59	09:50	10:47	23:33	–:–	00:35
35°	09:09	10:02	10:58	23:22	–:–	00:24
30°	09:18	10:12	11:09	23:12	–:–	00:13
20°	09:33	10:29	11:26	22:56	23:56	–:–
N 10°	09:47	10:44	11:42	22:41	23:40	–:–
0°	10:00	10:58	11:56	22:27	23:26	–:–
S 10°	10:13	11:12	12:10	22:14	23:11	–:–
20°	10:26	11:27	12:26	21:59	22:56	23:54
30°	10:42	11:45	12:44	21:43	22:38	23:36
35°	10:51	11:55	12:54	21:33	22:28	23:26
40°	11:02	12:07	13:06	21:22	22:16	23:14
45°	11:14	12:20	13:20	21:09	22:02	23:01
S 50°	11:30	12:37	13:37	20:53	21:45	22:44
52°	11:37	12:45	13:45	20:46	21:37	22:36
54°	11:45	12:54	13:54	20:38	21:28	22:27
56°	11:53	13:04	14:04	20:28	21:18	22:17
58°	12:04	13:15	14:15	20:18	21:07	22:06
S 60°	12:15	13:28	14:28	20:06	20:54	21:53

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 4-6 25-47%
01	03:57	03:48	12:04	16:14	03:44	
02	03:39	03:31	12:04	17:12	04:43	
03	03:22	03:13	12:03	18:10	05:41	

April 04, 05, 06 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	192°30.1	195°41.1	N06°10.2	147°15.8	N17°32.4	354°35.7	S05°52.9	284°53.1	S22°04.5
1	207°32.5	210°44.4	09.3	162°16.5	32.9	9°38.4	52.8	299°55.5	04.5
2	222°35.0	225°47.7	08.4	177°17.2	33.4	24°41.2	52.7	314°58.0	04.5
3	237°37.4	240°50.9	·· 07.5	192°17.9	·· 33.9	39°43.9	·· 52.6	330°00.4	·· 04.5
4	252°39.9	255°54.2	06.6	207°18.5	34.4	54°46.7	52.5	345°02.9	04.4
5	267°42.4	270°57.5	05.7	222°19.2	34.9	69°49.5	52.3	0°05.3	04.4
6	282°44.8	286°00.8	N06°04.8	237°19.9	N17°35.5	84°52.2	S05°52.2	15°07.8	S22°04.4
7	297°47.3	301°04.1	03.9	252°20.6	36.0	99°55.0	52.1	30°10.2	04.4
8	312°49.8	316°07.3	03.0	267°21.3	36.5	114°57.7	52.0	45°12.7	04.4
9	327°52.2	331°10.6	·· 02.1	282°22.0	·· 37.0	130°00.5	·· 51.9	60°15.2	·· 04.4
10	342°54.7	346°13.9	01.3	297°22.7	37.5	145°03.3	51.7	75°17.6	04.4
11	357°57.2	1°17.1	06°00.4	312°23.4	38.0	160°06.0	51.6	90°20.1	04.4
12	12°59.6	16°20.4	N05°59.5	327°24.1	N17°38.6	175°08.8	S05°51.5	105°22.5	S22°04.4
13	28°02.1	31°23.6	58.6	342°24.8	39.1	190°11.6	51.4	120°25.0	04.4
14	43°04.6	46°26.9	57.7	357°25.5	39.6	205°14.3	51.2	135°27.4	04.4
15	58°07.0	61°30.1	·· 56.8	12°26.2	·· 40.1	220°17.1	·· 51.1	150°29.9	·· 04.4
16	73°09.5	76°33.4	56.0	27°26.9	40.6	235°19.8	51.0	165°32.4	04.4
17	88°11.9	91°36.6	55.1	42°27.6	41.1	250°22.6	50.9	180°34.8	04.4
18	103°14.4	106°39.8	N05°54.2	57°28.3	N17°41.6	265°25.4	S05°50.8	195°37.3	S22°04.4
19	118°16.9	121°43.1	53.3	72°29.0	42.1	280°28.1	50.6	210°39.7	04.4
20	133°19.3	136°46.3	52.4	87°29.7	42.7	295°30.9	50.5	225°42.2	04.4
21	148°21.8	151°49.5	·· 51.6	102°30.4	·· 43.2	310°33.6	·· 50.4	240°44.6	·· 04.4
22	163°24.3	166°52.7	50.7	117°31.1	43.7	325°36.4	50.3	255°47.1	04.4
23	178°26.7	181°55.9	49.8	132°31.8	44.2	340°39.2	50.2	270°49.6	04.4
Mer.pass.:11:08		v3.3 d-0.9 m-4.1		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	193°29.2	196°59.1	N05°48.9	147°32.5	N17°44.7	355°41.9	S05°50.0	285°52.0	S22°04.4
1	208°31.7	212°02.4	48.1	162°33.2	45.2	10°44.7	49.9	300°54.5	04.4
2	223°34.1	227°05.6	47.2	177°33.9	45.7	25°47.5	49.8	315°56.9	04.4
3	238°36.6	242°08.8	·· 46.3	192°34.6	·· 46.2	40°50.2	·· 49.7	330°59.4	·· 04.4
4	253°39.0	257°12.0	45.4	207°35.3	46.7	55°53.0	49.5	346°01.8	04.4
5	268°41.5	272°15.2	44.6	222°36.0	47.3	70°55.7	49.4	1°04.3	04.4
6	283°44.0	287°18.3	N05°43.7	237°36.7	N17°47.8	85°58.5	S05°49.3	16°06.8	S22°04.4
7	298°46.4	302°21.5	42.8	252°37.3	48.3	101°01.3	49.2	31°09.2	04.4
8	313°48.9	317°24.7	42.0	267°38.0	48.8	116°04.0	49.1	46°11.7	04.4
9	328°51.4	332°27.9	·· 41.1	282°38.7	·· 49.3	131°06.8	·· 48.9	61°14.1	·· 04.4
10	343°53.8	347°31.1	40.2	297°39.4	49.8	146°09.5	48.8	76°16.6	04.4
11	358°56.3	2°34.2	39.4	312°40.1	50.3	161°12.3	48.7	91°19.1	04.4
12	13°58.8	17°37.4	N05°38.5	327°40.8	N17°50.8	176°15.1	S05°48.6	106°21.5	S22°04.4
13	29°01.2	32°40.6	37.6	342°41.5	51.3	191°17.8	48.5	121°24.0	04.4
14	44°03.7	47°43.7	36.8	357°42.2	51.8	206°20.6	48.3	136°26.5	04.4
15	59°06.2	62°46.9	·· 35.9	12°42.9	·· 52.3	221°23.4	·· 48.2	151°28.9	·· 04.4
16	74°08.6	77°50.0	35.0	27°43.6	52.8	236°26.1	48.1	166°31.4	04.4
17	89°11.1	92°53.2	34.2	42°44.3	53.3	251°28.9	48.0	181°33.8	04.4
18	104°13.5	107°56.3	N05°33.3	57°45.0	N17°53.9	266°31.6	S05°47.8	196°36.3	S22°04.4
19	119°16.0	122°59.5	32.5	72°45.7	54.4	281°34.4	47.7	211°38.8	04.4
20	134°18.5	138°02.6	31.6	87°46.4	54.9	296°37.2	47.6	226°41.2	04.3
21	149°20.9	153°05.8	·· 30.8	102°47.1	·· 55.4	311°39.9	·· 47.5	241°43.7	·· 04.3
22	164°23.4	168°08.9	29.9	117°47.8	55.9	326°42.7	47.4	256°46.1	04.3
23	179°25.9	183°12.0	29.0	132°48.5	56.4	341°45.5	47.2	271°48.6	04.3
Mer.pass.:11:04		v3.2 d-0.9 m-4.2		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	194°28.3	198°15.1	N05°28.2	147°49.2	N17°56.9	356°48.2	S05°47.1	286°51.1	S22°04.3
1	209°30.8	213°18.3	27.3	162°49.8	57.4	11°51.0	47.0	301°53.5	04.3
2	224°33.3	228°21.4	26.5	177°50.5	57.9	26°53.7	46.9	316°56.0	04.3
3	239°35.7	243°24.5	·· 25.6	192°51.2	·· 58.4	41°56.5	·· 46.7	331°58.5	·· 04.3
4	254°38.2	258°27.6	24.8	207°51.9	58.9	56°59.3	46.6	347°00.9	04.3
5	269°40.7	273°30.7	23.9	222°52.6	59.4	72°02.0	46.5	2°03.4	04.3
6	284°43.1	288°33.8	N05°23.1	237°53.3	N17°59.9	87°04.8	S05°46.4	17°05.9	S22°04.3
7	299°45.6	303°36.9	22.2	252°54.0	18°00.4	102°07.6	46.3	32°08.3	04.3
8	314°48.0	318°40.0	21.4	267°54.7	00.9	117°10.3	46.1	47°10.8	04.3
9	329°50.5	333°43.1	·· 20.5	282°55.4	·· 01.4	132°13.1	·· 46.0	62°13.2	·· 04.3
10	344°53.0	348°46.2	19.7	297°56.1	01.9	147°15.8	45.9	77°15.7	04.3
11	359°55.4	3°49.2	18.9	312°56.8	02.4	162°18.6	45.8	92°18.2	04.3
12	14°57.9	18°52.3	N05°18.0	327°57.5	N18°02.9	177°21.4	S05°45.7	107°20.6	S22°04.3
13	30°00.4	33°55.4	17.2	342°58.2	03.4	192°24.1	45.5	122°23.1	04.3
14	45°02.8	48°58.5	16.3	357°58.9	03.9	207°26.9	45.4	137°25.6	04.3
15	60°05.3	64°01.5	·· 15.5	12°59.5	·· 04.4	222°29.7	·· 45.3	152°28.0	·· 04.3
16	75°07.8	79°04.6	14.7	28°00.2	04.9	237°32.4	45.2	167°30.5	04.3
17	90°10.2	94°07.6	13.8	43°00.9	05.4	252°35.2	45.0	182°33.0	04.3
18	105°12.7	109°10.7	N05°13.0	58°01.6	N18°05.9	267°37.9	S05°44.9	197°35.4	S22°04.3
19	120°15.1	124°13.8	12.2	73°02.3	06.4	282°40.7	44.8	212°37.9	04.3
20	135°17.6	139°16.8	11.3	88°03.0	06.9	297°43.5	44.7	227°40.4	04.3
21	150°20.1	154°19.8	·· 10.5	103°03.7	·· 07.4	312°46.2	·· 44.6	242°42.8	·· 04.3
22	165°22.5	169°22.9	09.7	118°04.4	07.9	327°49.0	44.4	257°45.3	04.3
23	180°25.0	184°25.9	08.8	133°05.1	08.4	342°51.8	44.3	272°47.8	04.3
Mer.pass.:11:00		v3.1 d-0.9 m-4.2		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Stars

	SHA	**Dec**
Alpheratz	357°41.2	29°10.9
Ankaa	353°13.7	-42°12.9
Schedar	349°38.1	56°37.7
Diphda	348°53.7	-17°53.7
Achernar	335°25.5	-57°09.2
Hamal	327°58.2	23°32.4
Polaris	317°00.6	89°20.2
Acamar	315°16.8	-40°14.5
Menkar	314°12.7	4°09.1
Mirfak	308°37.0	49°55.2
Aldebaran	290°46.6	16°32.4
Rigel	281°09.8	-8°11.3
Capella	280°30.9	46°00.8
Bellatrix	278°29.4	6°21.6
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.8
Betelgeuse	270°58.6	7°24.3
Canopus	263°55.1	-52°42.8
Sirius	258°31.5	-16°44.8
Adhara	255°10.5	-29°00.2
Procyon	244°57.0	5°10.6
Pollux	243°24.6	27°58.9
Avior	234°16.7	-59°34.3
Suhail	222°50.3	-43°30.5
Miaplacidus	221°38.5	-69°47.6
Alphard	217°53.4	-8°44.3
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.6
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.6	-63°11.7
Gacrux	171°57.4	-57°12.6
Alioth	166°18.0	55°52.0
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.6
Hadar	148°43.5	-60°27.2
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.5	-60°54.1
Kochab	137°19.2	74°05.1
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.1	-69°03.1
Sabik	102°09.4	-15°44.6
Shaula	96°18.3	-37°06.7
Rasalhague	96°04.0	12°32.9
Eltanin	90°44.8	51°29.1
Kaus Aust.	83°40.4	-34°22.3
Vega	80°37.2	38°47.9
Nunki	75°55.1	-26°16.3
Altair	62°05.8	8°54.8
Peacock	53°15.5	-56°40.5
Deneb	49°29.9	45°20.3
Enif	33°44.8	9°57.1
Al Na'ir	27°40.9	-46°52.5
Fomalhaut	15°21.5	-29°31.9
Scheat	13°51.2	28°10.4
Markab	13°36.1	15°17.7

Apr 04 Tue	**SHA**	**Mer.pass**
Venus	3°11.0	10:55
Mars	314°45.7	14:10
Jupiter	162°05.6	00:22
Saturn	92°23.0	05:00

Apr 05 Wed	**SHA**	**Mer.pass**
Venus	3°30.0	10:50
Mars	314°03.3	14:09
Jupiter	162°12.7	00:17
Saturn	92°22.8	04:56

Apr 06 Thu	**SHA**	**Mer.pass**
Venus	3°46.8	10:45
Mars	313°20.8	14:08
Jupiter	162°19.9	00:13
Saturn	92°22.7	04:52

Horizontal parallax	
Venus:	0.5
Mars:	0.1

DUT1 = UT1-UTC = +0.4656 sec ΔT = TT-UT1 = +68.7184 sec

2017 April 04 to Apr. 06 UT

h

Tue	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°13.9	N05°40.9	84°15.6	7.0'	N18°39.8	-2.1'	58.6'
1	194°14.1	41.8	98°41.6	7.0'	18°37.6	-2.2'	58.6'
2	209°14.3	42.8	113°07.6	7.0'	18°35.3	-2.4'	58.6'
3	224°14.5	·· 43.7	127°33.7	7.1'	18°32.9	-2.5'	58.6'
4	239°14.7	44.7	141°59.8	7.1'	18°30.4	-2.6'	58.5'
5	254°14.9	45.6	156°26.0	7.2'	18°27.7	-2.7'	58.5'
6	269°15.0	N05°46.6	170°52.2	7.2'	N18°24.9	-2.8'	58.5'
7	284°15.2	47.5	185°18.4	7.3'	18°22.1	-2.9'	58.5'
8	299°15.4	48.5	199°44.7	7.3'	18°19.1	-3.0'	58.5'
9	314°15.6	·· 49.4	214°11.1	7.4'	18°16.0	-3.2'	58.4'
10	329°15.8	50.4	228°37.5	7.4'	18°12.8	-3.3'	58.4'
11	344°15.9	51.3	243°03.9	7.5'	18°09.5	-3.4'	58.4'
12	359°16.1	N05°52.3	257°30.5	7.5'	N18°06.0	-3.5'	58.4'
13	14°16.3	53.3	271°57.0	7.6'	18°02.5	-3.6'	58.3'
14	29°16.5	54.2	286°23.6	7.6'	17°58.9	-3.7'	58.3'
15	44°16.7	·· 55.2	300°50.3	7.7'	17°55.1	-3.8'	58.3'
16	59°16.8	56.1	315°17.0	7.7'	17°51.3	-3.9'	58.3'
17	74°17.0	57.1	329°43.8	7.8'	17°47.3	-4.0'	58.2'
18	89°17.2	N05°58.0	344°10.6	7.9'	N17°43.2	-4.1'	58.2'
19	104°17.4	59.0	358°37.5	7.9'	17°39.1	-4.2'	58.2'
20	119°17.6	05°59.9	13°04.4	8.0'	17°34.8	-4.3'	58.2'
21	134°17.7	06°00.9	27°31.4	8.0'	17°30.4	-4.4'	58.1'
22	149°17.9	01.8	41°58.5	8.1'	17°25.9	-4.5'	58.1'
23	164°18.1	02.8	56°25.6	8.1'	17°21.4	-4.6'	58.1'
	SD.=16.0	d=1.0		S.D.=15.9			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°18.3	N06°03.7	70°52.7	8.2'	N17°16.7	-4.7'	58.1'
1	194°18.5	04.7	85°20.0	8.3'	17°11.9	-4.8'	58.1'
2	209°18.6	05.6	99°47.2	8.3'	17°07.0	-4.9'	58.0'
3	224°18.8	·· 06.6	114°14.6	8.4'	17°02.1	-5.0'	58.0'
4	239°19.0	07.5	128°42.0	8.4'	16°57.0	-5.1'	58.0'
5	254°19.2	08.4	143°09.4	8.5'	16°51.8	-5.2'	58.0'
6	269°19.4	N06°09.4	157°36.9	8.5'	N16°46.6	-5.3'	57.9'
7	284°19.5	10.3	172°04.5	8.6'	16°41.2	-5.4'	57.9'
8	299°19.7	11.3	186°32.2	8.7'	16°35.8	-5.5'	57.9'
9	314°19.9	·· 12.2	200°59.8	8.7'	16°30.2	-5.6'	57.9'
10	329°20.1	13.2	215°27.6	8.8'	16°24.6	-5.7'	57.8'
11	344°20.3	14.1	229°55.4	8.8'	16°18.9	-5.8'	57.8'
12	359°20.4	N06°15.1	244°23.3	8.9'	N16°13.1	-5.9'	57.8'
13	14°20.6	16.0	258°51.2	9.0'	16°07.2	-5.9'	57.8'
14	29°20.8	17.0	273°19.2	9.0'	16°01.2	-6.0'	57.7'
15	44°21.0	·· 17.9	287°47.3	9.1'	15°55.1	-6.1'	57.7'
16	59°21.2	18.9	302°15.4	9.1'	15°49.0	-6.2'	57.7'
17	74°21.3	19.8	316°43.6	9.2'	15°42.7	-6.3'	57.7'
18	89°21.5	N06°20.8	331°11.8	9.3'	N15°36.4	-6.4'	57.7'
19	104°21.7	21.7	345°40.1	9.3'	15°30.0	-6.5'	57.6'
20	119°21.9	22.7	0°08.4	9.4'	15°23.5	-6.5'	57.6'
21	134°22.1	·· 23.6	14°36.9	9.5'	15°16.9	-6.6'	57.6'
22	149°22.2	24.5	29°05.4	9.5'	15°10.3	-6.7'	57.6'
23	164°22.4	25.5	43°33.9	9.6'	15°03.5	-6.8'	57.5'
	SD.=16.0	d=0.9		S.D.=15.8			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°22.6	N06°26.4	58°02.5	9.6'	N14°56.7	-6.9'	57.5'
1	194°22.8	27.4	72°31.2	9.7'	14°49.8	-6.9'	57.5'
2	209°22.9	28.3	86°59.9	9.8'	14°42.8	-7.0'	57.5'
3	224°23.1	·· 29.3	101°28.7	9.8'	14°35.8	-7.1'	57.4'
4	239°23.3	30.2	115°57.5	9.9'	14°28.7	-7.2'	57.4'
5	254°23.5	31.2	130°26.4	9.9'	14°21.5	-7.2'	57.4'
6	269°23.7	N06°32.1	144°55.4	10.0'	N14°14.2	-7.3'	57.4'
7	284°23.8	33.0	159°24.4	10.1'	14°06.9	-7.4'	57.4'
8	299°24.0	34.0	173°53.5	10.1'	13°59.4	-7.5'	57.3'
9	314°24.2	·· 34.9	188°22.7	10.2'	13°52.0	-7.5'	57.3'
10	329°24.4	35.9	202°51.9	10.2'	13°44.4	-7.6'	57.3'
11	344°24.5	36.8	217°21.1	10.3'	13°36.8	-7.7'	57.3'
12	359°24.7	N06°37.8	231°50.5	10.4'	N13°29.1	-7.7'	57.2'
13	14°24.9	38.7	246°19.9	10.4'	13°21.3	-7.8'	57.2'
14	29°25.1	39.6	260°49.3	10.5'	13°13.5	-7.9'	57.2'
15	44°25.2	·· 40.6	275°18.8	10.5'	13°05.6	-7.9'	57.2'
16	59°25.4	41.5	289°48.4	10.6'	12°57.7	-8.0'	57.1'
17	74°25.6	42.5	304°18.0	10.7'	12°49.6	-8.0'	57.1'
18	89°25.8	N06°43.4	318°47.7	10.7'	N12°41.6	-8.1'	57.1'
19	104°26.0	44.3	333°17.4	10.8'	12°33.4	-8.2'	57.1'
20	119°26.1	45.3	347°47.2	10.8'	12°25.2	-8.2'	57.1'
21	134°26.3	·· 46.2	2°17.1	10.9'	12°17.0	-8.3'	57.0'
22	149°26.5	47.2	16°47.0	10.9'	12°08.6	-8.3'	57.0'
23	164°26.7	48.1	31°17.0	11.0'	12°00.3	-8.4'	57.0'
	SD.=16.0	d=0.9		S.D.=15.6			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	03:15	04:34	19:35	20:55	▭
N 70°	01:44	03:35	04:44	19:24	20:34	22:31
68°	02:21	03:50	04:52	19:16	20:18	21:50
66°	02:47	04:03	04:58	19:09	20:05	21:23
64°	03:06	04:13	05:04	19:03	19:54	21:02
62°	03:22	04:22	05:09	18:58	19:45	20:47
60°	03:34	04:29	05:13	18:54	19:38	20:34
N 58°	03:45	04:36	05:17	18:50	19:31	20:23
56°	03:54	04:41	05:20	18:47	19:25	20:13
54°	04:02	04:46	05:23	18:44	19:20	20:05
52°	04:09	04:51	05:26	18:41	19:16	19:58
50°	04:15	04:55	05:28	18:38	19:12	19:52
45°	04:28	05:03	05:33	18:33	19:03	19:39
N 40°	04:38	05:10	05:38	18:28	18:56	19:29
35°	04:46	05:16	05:41	18:25	18:50	19:20
30°	04:52	05:20	05:45	18:21	18:45	19:14
20°	05:02	05:28	05:50	18:15	18:38	19:04
N 10°	05:09	05:34	05:55	18:10	18:32	18:56
0°	05:14	05:39	05:59	18:06	18:27	18:51
S 10°	05:18	05:43	06:04	18:01	18:23	18:47
20°	05:20	05:46	06:08	17:57	18:19	18:45
30°	05:21	05:49	06:13	17:52	18:16	18:43
35°	05:21	05:51	06:16	17:49	18:14	18:43
40°	05:21	05:52	06:19	17:46	18:13	18:44
45°	05:19	05:53	06:23	17:42	18:11	18:45
S 50°	05:17	05:55	06:27	17:37	18:10	18:47
52°	05:16	05:55	06:29	17:35	18:09	18:48
54°	05:15	05:56	06:31	17:33	18:08	18:49
56°	05:13	05:56	06:34	17:31	18:08	18:51
58°	05:11	05:57	06:36	17:28	18:07	18:53
S 60°	05:09	05:57	06:39	17:25	18:07	18:55

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	▭	09:19	11:22	▭	05:57	05:43
N 70°	08:25	10:05	11:49	04:56	05:10	05:15
68°	09:07	10:35	12:09	04:13	04:39	04:54
66°	09:36	10:58	12:25	03:44	04:16	04:37
64°	09:57	11:15	12:38	03:22	03:58	04:23
62°	10:15	11:30	12:49	03:05	03:43	04:11
60°	10:29	11:42	12:59	02:50	03:31	04:01
N 58°	10:42	11:52	13:07	02:38	03:20	03:53
56°	10:52	12:01	13:14	02:27	03:10	03:45
54°	11:02	12:10	13:20	02:17	03:02	03:38
52°	11:10	12:17	13:26	02:09	02:54	03:32
50°	11:17	12:23	13:31	02:01	02:47	03:26
45°	11:33	12:37	13:42	01:45	02:33	03:14
N 40°	11:47	12:49	13:52	01:31	02:21	03:04
35°	11:58	12:59	13:59	01:20	02:10	02:55
30°	12:07	13:07	14:06	01:10	02:01	02:48
20°	12:24	13:22	14:18	00:52	01:45	02:34
N 10°	12:39	13:35	14:29	00:37	01:32	02:23
0°	12:53	13:47	14:39	00:23	01:19	02:12
S 10°	13:06	13:59	14:48	00:09	01:06	02:01
20°	13:21	14:12	14:59	–:–	00:52	01:49
30°	13:38	14:26	15:11	–:–	00:36	01:36
35°	13:47	14:35	15:17	–:–	00:27	01:28
40°	13:58	14:45	15:25	–:–	00:16	01:19
45°	14:11	14:56	15:34	–:–	00:03	01:08
S 50°	14:27	15:09	15:45	23:48	–:–	00:55
52°	14:35	15:16	15:50	23:41	–:–	00:49
54°	14:43	15:23	15:55	23:33	–:–	00:43
56°	14:52	15:31	16:02	23:24	–:–	00:35
58°	15:03	15:40	16:08	23:14	–:–	00:27
S 60°	15:15	15:50	16:16	23:02	–:–	00:17

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 7-9 58-78%
04	03:04	02:56	12:03	19:06	06:38	
05	02:47	02:38	12:03	19:59	07:33	
06	02:30	02:21	12:02	20:51	08:25	

April 07, 08, 09 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	195°27.5	199°29.0	N05°08.0	148°05.8	N18°08.9	357°54.5	S05°44.2	287°50.2	S22°04.3
1	210°29.9	214°32.0	07.2	163°06.5	09.4	12°57.3	44.1	302°52.7	04.3
2	225°32.4	229°35.0	06.3	178°07.2	09.9	28°00.0	44.0	317°55.2	04.3
3	240°34.9	244°38.0	·· 05.5	193°07.8	·· 10.4	43°02.8	·· 43.8	332°57.6	·· 04.3
4	255°37.3	259°41.0	04.7	208°08.5	10.9	58°05.6	43.7	348°00.1	04.3
5	270°39.8	274°44.1	03.9	223°09.2	11.4	73°08.3	43.6	3°02.6	04.3
6	285°42.3	289°47.1	N05°03.0	238°09.9	N18°11.9	88°11.1	S05°43.5	18°05.1	S22°04.3
7	300°44.7	304°50.1	02.2	253°10.6	12.4	103°13.9	43.3	33°07.5	04.3
8	315°47.2	319°53.1	01.4	268°11.3	12.9	118°16.6	43.2	48°10.0	04.3
9	330°49.6	334°56.1	05°00.6	283°12.0	·· 13.3	133°19.4	·· 43.1	63°12.5	·· 04.3
10	345°52.1	349°59.1	04°59.8	298°12.7	13.8	148°22.1	43.0	78°14.9	04.2
11	0°54.6	5°02.0	59.0	313°13.4	14.3	163°24.9	42.9	93°17.4	04.2
12	15°57.0	20°05.0	N04°58.1	328°14.1	N18°14.8	178°27.7	S05°42.7	108°19.9	S22°04.2
13	30°59.5	35°08.0	57.3	343°14.8	15.3	193°30.4	42.6	123°22.3	04.2
14	46°02.0	50°11.0	56.5	358°15.4	15.8	208°33.2	42.5	138°24.8	04.2
15	61°04.4	65°14.0	·· 55.7	13°16.1	·· 16.3	223°36.0	·· 42.4	153°27.3	·· 04.2
16	76°06.9	80°16.9	54.9	28°16.8	16.8	238°38.7	42.2	168°29.7	04.2
17	91°09.4	95°19.9	54.1	43°17.5	17.3	253°41.5	42.1	183°32.2	04.2
18	106°11.8	110°22.9	N04°53.3	58°18.2	N18°17.8	268°44.2	S05°42.0	198°34.7	S22°04.2
19	121°14.3	125°25.8	52.5	73°18.9	18.3	283°47.0	41.9	213°37.2	04.2
20	136°16.8	140°28.8	51.7	88°19.6	18.8	298°49.8	41.8	228°39.6	04.2
21	151°19.2	155°31.7	·· 50.9	103°20.3	·· 19.3	313°52.5	·· 41.6	243°42.1	·· 04.2
22	166°21.7	170°34.7	50.1	118°21.0	19.7	328°55.3	41.5	258°44.6	04.2
23	181°24.1	185°37.6	49.3	133°21.6	20.2	343°58.1	41.4	273°47.0	04.2
Mer.pass.:10:56		v3.0 d-0.8 m-4.2		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	196°26.6	200°40.6	N04°48.5	148°22.3	N18°20.7	359°00.8	S05°41.3	288°49.5	S22°04.2
1	211°29.1	215°43.5	47.7	163°23.0	21.2	14°03.6	41.2	303°52.0	04.2
2	226°31.5	230°46.4	46.9	178°23.7	21.7	29°06.3	41.0	318°54.5	04.2
3	241°34.0	245°49.3	·· 46.1	193°24.4	·· 22.2	44°09.1	·· 40.9	333°56.9	·· 04.2
4	256°36.5	260°52.3	45.3	208°25.1	22.7	59°11.9	40.8	348°59.4	04.2
5	271°38.9	275°55.2	44.5	223°25.8	23.2	74°14.6	40.7	4°01.9	04.2
6	286°41.4	290°58.1	N04°43.7	238°26.5	N18°23.7	89°17.4	S05°40.5	19°04.4	S22°04.2
7	301°43.9	306°01.0	42.9	253°27.2	24.1	104°20.2	40.4	34°06.8	04.2
8	316°46.3	321°03.9	42.1	268°27.8	24.6	119°22.9	40.3	49°09.3	04.2
9	331°48.8	336°06.8	·· 41.3	283°28.5	·· 25.1	134°25.7	·· 40.2	64°11.8	·· 04.2
10	346°51.2	351°09.7	40.5	298°29.2	25.6	149°28.5	40.1	79°14.2	04.2
11	1°53.7	6°12.6	39.7	313°29.9	26.1	164°31.2	39.9	94°16.7	04.2
12	16°56.2	21°15.5	N04°39.0	328°30.6	N18°26.6	179°34.0	S05°39.8	109°19.2	S22°04.2
13	31°58.6	36°18.4	38.2	343°31.3	27.1	194°36.7	39.7	124°21.7	04.2
14	47°01.1	51°21.3	37.4	358°32.0	27.6	209°39.5	39.6	139°24.1	04.2
15	62°03.6	66°24.2	·· 36.6	13°32.7	·· 28.0	224°42.3	·· 39.5	154°26.6	·· 04.2
16	77°06.0	81°27.0	35.8	28°33.4	28.5	239°45.0	39.3	169°29.1	04.2
17	92°08.5	96°29.9	35.1	43°34.0	29.0	254°47.8	39.2	184°31.6	04.2
18	107°11.0	111°32.8	N04°34.3	58°34.7	N18°29.5	269°50.6	S05°39.1	199°34.0	S22°04.2
19	122°13.4	126°35.6	33.5	73°35.4	30.0	284°53.3	39.0	214°36.5	04.2
20	137°15.9	141°38.5	32.7	88°36.1	30.5	299°56.1	38.8	229°39.0	04.2
21	152°18.4	156°41.4	·· 32.0	103°36.8	·· 30.9	314°58.8	·· 38.7	244°41.5	·· 04.2
22	167°20.8	171°44.2	31.2	118°37.5	31.4	330°01.6	38.6	259°43.9	04.2
23	182°23.3	186°47.1	30.4	133°38.2	31.9	345°04.4	38.5	274°46.4	04.1
Mer.pass.:10:52		v2.9 d-0.8 m-4.2		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	197°25.7	201°49.9	N04°29.6	148°38.9	N18°32.4	0°07.1	S05°38.4	289°48.9	S22°04.1
1	212°28.2	216°52.7	28.9	163°39.5	32.9	15°09.9	38.2	304°51.4	04.1
2	227°30.7	231°55.6	28.1	178°40.2	33.4	30°12.7	38.1	319°53.8	04.1
3	242°33.1	246°58.4	·· 27.3	193°40.9	·· 33.8	45°15.4	·· 38.0	334°56.3	·· 04.1
4	257°35.6	262°01.2	26.6	208°41.6	34.3	60°18.2	37.9	349°58.8	04.1
5	272°38.1	277°04.1	25.8	223°42.3	34.8	75°20.9	37.8	5°01.3	04.1
6	287°40.5	292°06.9	N04°25.1	238°43.0	N18°35.3	90°23.7	S05°37.6	20°03.8	S22°04.1
7	302°43.0	307°09.7	24.3	253°43.7	35.8	105°26.5	37.5	35°06.2	04.1
8	317°45.5	322°12.5	23.5	268°44.3	36.2	120°29.2	37.4	50°08.7	04.1
9	332°47.9	337°15.3	·· 22.8	283°45.0	·· 36.7	135°32.0	·· 37.3	65°11.2	·· 04.1
10	347°50.4	352°18.1	22.0	298°45.7	37.2	150°34.8	37.2	80°13.7	04.1
11	2°52.8	7°20.9	21.3	313°46.4	37.7	165°37.5	37.0	95°16.1	04.1
12	17°55.3	22°23.7	N04°20.5	328°47.1	N18°38.2	180°40.3	S05°36.9	110°18.6	S22°04.1
13	32°57.8	37°26.5	19.8	343°47.8	38.6	195°43.0	36.8	125°21.1	04.1
14	48°00.2	52°29.3	19.0	358°48.5	39.1	210°45.8	36.7	140°23.6	04.1
15	63°02.7	67°32.1	·· 18.3	13°49.2	·· 39.6	225°48.6	·· 36.5	155°26.1	·· 04.1
16	78°05.2	82°34.9	17.5	28°49.8	40.1	240°51.3	36.4	170°28.5	04.1
17	93°07.6	97°37.6	16.8	43°50.5	40.6	255°54.1	36.3	185°31.0	04.1
18	108°10.1	112°40.4	N04°16.0	58°51.2	N18°41.0	270°56.9	S05°36.2	200°33.5	S22°04.1
19	123°12.6	127°43.2	15.3	73°51.9	41.5	285°59.6	36.1	215°36.0	04.1
20	138°15.0	142°45.9	14.6	88°52.6	42.0	301°02.4	35.9	230°38.5	04.1
21	153°17.5	157°48.7	·· 13.8	103°53.3	·· 42.5	316°05.1	·· 35.8	245°40.9	·· 04.1
22	168°20.0	172°51.5	13.1	118°54.0	42.9	331°07.9	35.7	260°43.4	04.1
23	183°22.4	187°54.2	12.4	133°54.6	43.4	346°10.7	35.6	275°45.9	04.1
Mer.pass.:10:49		v2.8 d-0.8 m-4.3		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°10.9
Ankaa	353°13.6	-42°12.9
Schedar	349°38.1	56°37.7
Diphda	348°53.7	-17°53.7
Achernar	335°25.5	-57°09.2
Hamal	327°58.2	23°32.4
Polaris	317°01.3	89°20.2
Acamar	315°16.8	-40°14.5
Menkar	314°12.7	4°09.1
Mirfak	308°37.0	49°55.2
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.3
Capella	280°30.9	46°00.8
Bellatrix	278°29.4	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°43.9	-1°11.8
Betelgeuse	270°58.6	7°24.3
Canopus	263°55.1	-52°42.8
Sirius	258°31.5	-16°44.8
Adhara	255°10.5	-29°00.2
Procyon	244°57.0	5°10.6
Pollux	243°24.6	27°58.9
Avior	234°16.8	-59°34.3
Suhail	222°50.3	-43°30.5
Miaplacidus	221°38.6	-69°47.7
Alphard	217°53.4	-8°44.2
Regulus	207°40.6	11°52.8
Dubhe	193°48.1	61°39.6
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.7	-63°11.7
Gacrux	171°57.4	-57°12.6
Alioth	166°18.0	55°52.0
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.6
Hadar	148°43.5	-60°27.2
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.5	-60°54.2
Kochab	137°19.2	74°05.1
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.0	-69°03.1
Sabik	102°09.4	-15°44.6
Shaula	96°18.3	-37°06.7
Rasalhague	96°03.9	12°32.9
Eltanin	90°44.8	51°29.1
Kaus Aust.	83°40.3	-34°22.3
Vega	80°37.1	38°47.9
Nunki	75°55.1	-26°16.3
Altair	62°05.8	8°54.8
Peacock	53°15.5	-56°40.4
Deneb	49°29.9	45°20.3
Enif	33°44.8	9°57.1
Al Na'ir	27°40.9	-46°52.5
Fomalhaut	15°21.5	-29°31.9
Scheat	13°51.2	28°10.4
Markab	13°36.0	15°17.7

Apr 07 Fri	SHA	Mer.pass
Venus	4°01.5	10:40
Mars	312°38.3	14:07
Jupiter	162°27.0	00:08
Saturn	92°22.8	04:48

Apr 08 Sat	SHA	Mer.pass
Venus	4°13.9	10:35
Mars	311°55.7	14:06
Jupiter	162°34.2	00:04
Saturn	92°22.9	04:44

Apr 09 Sun	SHA	Mer.pass
Venus	4°24.2	10:31
Mars	311°13.1	14:05
Jupiter	162°41.4	23:55
Saturn	92°23.2	04:40

Horizontal parallax	
Venus:	0.5
Mars:	0.1

h — Sun — Moon

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°26.8	N06°49.0	45°47.0	11.1′	N11°51.8	-8.5′	57.0′
1	194°27.0	50.0	60°17.1	11.1′	11°43.3	-8.5′	56.9′
2	209°27.2	50.9	74°47.2	11.2′	11°34.8	-8.6′	56.9′
3	224°27.4	·· 51.9	89°17.4	11.2′	11°26.2	-8.6′	56.9′
4	239°27.5	52.8	103°47.7	11.3′	11°17.6	-8.7′	56.9′
5	254°27.7	53.7	118°18.0	11.3′	11°08.8	-8.7′	56.9′
6	269°27.9	N06°54.7	132°48.4	11.4′	N11°00.1	-8.8′	56.8′
7	284°28.1	55.6	147°18.8	11.4′	10°51.3	-8.8′	56.8′
8	299°28.2	56.6	161°49.2	11.5′	10°42.4	-8.9′	56.8′
9	314°28.4	·· 57.5	176°19.8	11.5′	10°33.5	-8.9′	56.8′
10	329°28.6	58.4	190°50.3	11.6′	10°24.6	-9.0′	56.7′
11	344°28.8	06°59.4	205°21.0	11.7′	10°15.6	-9.0′	56.7′
12	359°28.9	N07°00.3	219°51.6	11.7′	N10°06.5	-9.1′	56.7′
13	14°29.1	01.3	234°22.4	11.8′	09°57.5	-9.1′	56.7′
14	29°29.3	02.2	248°53.2	11.8′	09°48.3	-9.2′	56.7′
15	44°29.5	·· 03.1	263°24.0	11.9′	09°39.2	-9.2′	56.6′
16	59°29.6	04.1	277°54.9	11.9′	09°29.9	-9.2′	56.6′
17	74°29.8	05.0	292°25.8	12.0′	09°20.7	-9.3′	56.6′
18	89°30.0	N07°05.9	306°56.8	12.0′	N09°11.4	-9.3′	56.6′
19	104°30.2	06.9	321°27.8	12.1′	09°02.1	-9.4′	56.6′
20	119°30.3	07.8	335°58.9	12.1′	08°52.7	-9.4′	56.5′
21	134°30.5	·· 08.7	350°30.0	12.2′	08°43.3	-9.4′	56.5′
22	149°30.7	09.7	5°01.2	12.2′	08°33.8	-9.5′	56.5′
23	164°30.9	10.6	19°32.4	12.2′	08°24.3	-9.5′	56.5′
	SD.=16.0	d=0.9	S.D.=15.5				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°31.0	N07°11.5	34°03.7	12.3′	N08°14.8	-9.5′	56.5′
1	194°31.2	12.5	48°35.0	12.3′	08°05.3	-9.6′	56.4′
2	209°31.4	13.4	63°06.4	12.4′	07°55.7	-9.6′	56.4′
3	224°31.6	·· 14.4	77°37.8	12.4′	07°46.1	-9.6′	56.4′
4	239°31.7	15.3	92°09.2	12.5′	07°36.4	-9.7′	56.4′
5	254°31.9	16.2	106°40.7	12.5′	07°26.7	-9.7′	56.3′
6	269°32.1	N07°17.2	121°12.3	12.6′	N07°17.0	-9.7′	56.3′
7	284°32.3	18.1	135°43.8	12.6′	07°07.3	-9.8′	56.3′
8	299°32.4	19.0	150°15.5	12.6′	06°57.5	-9.8′	56.3′
9	314°32.6	·· 20.0	164°47.1	12.7′	06°47.7	-9.8′	56.3′
10	329°32.8	20.9	179°18.8	12.7′	06°37.9	-9.8′	56.2′
11	344°32.9	21.8	193°50.6	12.8′	06°28.1	-9.9′	56.2′
12	359°33.1	N07°22.8	208°22.4	12.8′	N06°18.2	-9.9′	56.2′
13	14°33.3	23.7	222°54.2	12.8′	06°08.3	-9.9′	56.2′
14	29°33.5	24.6	237°26.1	12.9′	05°58.4	-9.9′	56.2′
15	44°33.6	·· 25.5	251°58.0	12.9′	05°48.4	-9.9′	56.1′
16	59°33.8	26.5	266°29.9	13.0′	05°38.5	-10.0′	56.1′
17	74°34.0	27.4	281°01.9	13.0′	05°28.5	-10.0′	56.1′
18	89°34.2	N07°28.3	295°33.9	13.0′	N05°18.5	-10.0′	56.1′
19	104°34.3	29.3	310°05.9	13.1′	05°08.5	-10.0′	56.1′
20	119°34.5	30.2	324°38.0	13.1′	04°58.5	-10.0′	56.0′
21	134°34.7	·· 31.1	339°10.2	13.1′	04°48.4	-10.1′	56.0′
22	149°34.8	32.1	353°42.3	13.2′	04°38.3	-10.1′	56.0′
23	164°35.0	33.0	8°14.5	13.2′	04°28.3	-10.1′	56.0′
	SD.=16.0	d=0.9	S.D.=15.3				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°35.2	N07°33.9	22°46.7	13.2′	N04°18.2	-10.1′	56.0′
1	194°35.4	34.9	37°19.0	13.3′	04°08.0	-10.1′	55.9′
2	209°35.5	35.8	51°51.3	13.3′	03°57.9	-10.1′	55.9′
3	224°35.7	·· 36.7	66°23.6	13.3′	03°47.8	-10.1′	55.9′
4	239°35.9	37.6	80°56.0	13.4′	03°37.6	-10.2′	55.9′
5	254°36.0	38.6	95°28.3	13.4′	03°27.5	-10.2′	55.9′
6	269°36.2	N07°39.5	110°00.8	13.4′	N03°17.3	-10.2′	55.8′
7	284°36.4	40.4	124°33.2	13.5′	03°07.1	-10.2′	55.8′
8	299°36.6	41.4	139°05.7	13.5′	02°57.0	-10.2′	55.8′
9	314°36.7	·· 42.3	153°38.2	13.5′	02°46.8	-10.2′	55.8′
10	329°36.9	43.2	168°10.7	13.5′	02°36.6	-10.2′	55.8′
11	344°37.1	44.1	182°43.3	13.6′	02°26.4	-10.2′	55.7′
12	359°37.2	N07°45.1	197°15.8	13.6′	N02°16.1	-10.2′	55.7′
13	14°37.4	46.0	211°48.4	13.6′	02°05.9	-10.2′	55.7′
14	29°37.6	46.9	226°21.1	13.6′	01°55.7	-10.2′	55.7′
15	44°37.7	·· 47.8	240°53.7	13.7′	01°45.5	-10.2′	55.7′
16	59°37.9	48.8	255°26.4	13.7′	01°35.3	-10.2′	55.7′
17	74°38.1	49.7	269°59.1	13.7′	01°25.1	-10.2′	55.6′
18	89°38.3	N07°50.6	284°31.9	13.7′	N01°14.8	-10.2′	55.6′
19	104°38.4	51.5	299°04.6	13.8′	01°04.6	-10.2′	55.6′
20	119°38.6	52.5	313°37.4	13.8′	00°54.4	-10.2′	55.6′
21	134°38.8	·· 53.4	328°10.2	13.8′	00°44.2	-10.2′	55.6′
22	149°38.9	54.3	342°43.0	13.8′	00°34.0	-10.2′	55.5′
23	164°39.1	55.2	357°15.8	13.8′	00°23.7	-10.2′	55.5′
	SD.=16.0	d=0.9	S.D.=15.2				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	02:54	04:18	19:49	21:15	▭
N 70°	01:07	03:18	04:29	19:37	20:50	23:13
68°	01:59	03:36	04:39	19:27	20:31	22:12
66°	02:29	03:50	04:47	19:19	20:17	21:39
64°	02:52	04:02	04:53	19:12	20:04	21:16
62°	03:09	04:11	04:59	19:06	19:54	20:58
60°	03:23	04:20	05:04	19:01	19:46	20:43
N 58°	03:35	04:27	05:08	18:57	19:38	20:31
56°	03:45	04:33	05:12	18:53	19:32	20:21
54°	03:53	04:39	05:16	18:49	19:26	20:12
52°	04:01	04:44	05:19	18:46	19:21	20:04
50°	04:08	04:48	05:22	18:43	19:17	19:57
45°	04:22	04:58	05:28	18:37	19:07	19:43
N 40°	04:32	05:05	05:33	18:31	18:59	19:32
35°	04:41	05:12	05:37	18:27	18:53	19:23
30°	04:48	05:17	05:41	18:23	18:47	19:16
20°	04:59	05:25	05:48	18:16	18:39	19:05
N 10°	05:07	05:32	05:53	18:10	18:32	18:56
0°	05:13	05:38	05:59	18:05	18:26	18:50
S 10°	05:18	05:42	06:04	18:00	18:21	18:45
20°	05:21	05:47	06:09	17:54	18:16	18:42
30°	05:23	05:51	06:15	17:48	18:12	18:40
35°	05:24	05:53	06:18	17:45	18:10	18:39
40°	05:24	05:55	06:22	17:41	18:08	18:39
45°	05:23	05:57	06:26	17:36	18:06	18:40
S 50°	05:22	05:59	06:32	17:31	18:03	18:41
52°	05:21	06:00	06:34	17:29	18:02	18:41
54°	05:20	06:01	06:37	17:26	18:01	18:42
56°	05:19	06:02	06:40	17:23	18:00	18:43
58°	05:18	06:03	06:43	17:20	17:59	18:44
S 60°	05:16	06:04	06:46	17:16	17:58	18:46

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	13:15	15:01	16:43	05:34	05:26	05:19
N 70°	13:31	15:09	16:45	05:16	05:16	05:15
68°	13:44	15:16	16:46	05:02	05:08	05:11
66°	13:54	15:22	16:48	04:50	05:00	05:08
64°	14:03	15:26	16:49	04:41	04:54	05:06
62°	14:10	15:31	16:50	04:32	04:49	05:03
60°	14:17	15:34	16:51	04:25	04:44	05:01
N 58°	14:22	15:37	16:51	04:19	04:40	04:59
56°	14:27	15:40	16:52	04:13	04:37	04:58
54°	14:32	15:43	16:53	04:08	04:34	04:56
52°	14:36	15:45	16:53	04:03	04:31	04:55
50°	14:39	15:47	16:54	03:59	04:28	04:54
45°	14:47	15:52	16:55	03:50	04:22	04:51
N 40°	14:54	15:55	16:56	03:42	04:17	04:49
35°	15:00	15:59	16:56	03:36	04:13	04:47
30°	15:05	16:02	16:57	03:30	04:09	04:45
20°	15:13	16:06	16:58	03:20	04:02	04:42
N 10°	15:21	16:11	16:59	03:11	03:56	04:40
0°	15:28	16:15	17:01	03:02	03:51	04:37
S 10°	15:35	16:19	17:02	02:54	03:45	04:34
20°	15:42	16:23	17:03	02:45	03:39	04:32
30°	15:51	16:28	17:04	02:34	03:32	04:28
35°	15:56	16:31	17:05	02:28	03:28	04:27
40°	16:01	16:34	17:05	02:21	03:24	04:24
45°	16:08	16:38	17:06	02:13	03:18	04:22
S 50°	16:15	16:43	17:08	02:04	03:12	04:19
52°	16:19	16:45	17:08	01:59	03:09	04:18
54°	16:23	16:47	17:09	01:54	03:06	04:16
56°	16:27	16:49	17:09	01:49	03:02	04:15
58°	16:32	16:52	17:10	01:42	02:58	04:13
S 60°	16:37	16:55	17:11	01:35	02:54	04:11

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 10-12 86-97%
07	02:13	02:04	12:02	21:39	09:15	
08	01:56	01:48	12:02	22:26	10:03	
09	01:39	01:31	12:02	23:11	10:49	

April 10, 11, 12 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	198°24.9	202°57.0	N04°11.6	148°55.3	N18°43.9	1°13.4	S05°35.5	290°48.4	S22°04.1
1	213°27.3	217°59.7	10.9	163°56.0	44.4	16°16.2	35.3	305°50.9	04.1
2	228°29.8	233°02.5	10.2	178°56.7	44.8	31°19.0	35.2	320°53.3	04.1
3	243°32.3	248°05.2	·· 09.4	193°57.4	·· 45.3	46°21.7	·· 35.1	335°55.8	·· 04.1
4	258°34.7	263°07.9	08.7	208°58.1	45.8	61°24.5	35.0	350°58.3	04.1
5	273°37.2	278°10.7	08.0	223°58.7	46.3	76°27.2	34.9	6°00.8	04.1
6	288°39.7	293°13.4	N04°07.2	238°59.4	N18°46.7	91°30.0	S05°34.7	21°03.3	S22°04.1
7	303°42.1	308°16.1	06.5	254°00.1	47.2	106°32.8	34.6	36°05.8	04.1
8	318°44.6	323°18.8	05.8	269°00.8	47.7	121°35.5	34.5	51°08.2	04.1
9	333°47.1	338°21.5	·· 05.1	284°01.5	·· 48.2	136°38.3	·· 34.4	66°10.7	·· 04.1
10	348°49.5	353°24.2	04.4	299°02.2	48.6	151°41.1	34.2	81°13.2	04.1
11	3°52.0	8°26.9	03.6	314°02.8	49.1	166°43.8	34.1	96°15.7	04.0
12	18°54.4	23°29.6	N04°02.9	329°03.5	N18°49.6	181°46.6	S05°34.0	111°18.2	S22°04.0
13	33°56.9	38°32.3	02.2	344°04.2	50.0	196°49.3	33.9	126°20.6	04.0
14	48°59.4	53°35.0	01.5	359°04.9	50.5	211°52.1	33.8	141°23.1	04.0
15	64°01.8	68°37.7	·· 00.8	14°05.6	·· 51.0	226°54.9	·· 33.6	156°25.6	·· 04.0
16	79°04.3	83°40.4	04°00.1	29°06.3	51.5	241°57.6	33.5	171°28.1	04.0
17	94°06.8	98°43.1	03°59.4	44°07.0	51.9	257°00.4	33.4	186°30.6	04.0
18	109°09.2	113°45.8	N03°58.7	59°07.6	N18°52.4	272°03.2	S05°33.3	201°33.1	S22°04.0
19	124°11.7	128°48.4	58.0	74°08.3	52.9	287°05.9	33.2	216°35.6	04.0
20	139°14.2	143°51.1	57.2	89°09.0	53.3	302°08.7	33.0	231°38.0	04.0
21	154°16.6	158°53.8	·· 56.5	104°09.7	·· 53.8	317°11.4	·· 32.9	246°40.5	·· 04.0
22	169°19.1	173°56.4	55.8	119°10.4	54.3	332°14.2	32.8	261°43.0	04.0
23	184°21.6	188°59.1	55.1	134°11.1	54.7	347°17.0	32.7	276°45.5	04.0
Mer.pass.:10:45		v2.7 d-0.7 m-4.3		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	199°24.0	204°01.8	N03°54.4	149°11.7	N18°55.2	2°19.7	S05°32.6	291°48.0	S22°04.0
1	214°26.5	219°04.4	53.7	164°12.4	55.7	17°22.5	32.4	306°50.5	04.0
2	229°28.9	234°07.0	53.1	179°13.1	56.2	32°25.2	32.3	321°52.9	04.0
3	244°31.4	249°09.7	·· 52.4	194°13.8	·· 56.6	47°28.0	·· 32.2	336°55.4	·· 04.0
4	259°33.9	264°12.3	51.7	209°14.5	57.1	62°30.8	32.1	351°57.9	04.0
5	274°36.3	279°15.0	51.0	224°15.1	57.6	77°33.5	32.0	7°00.4	04.0
6	289°38.8	294°17.6	N03°50.3	239°15.8	N18°58.0	92°36.3	S05°31.8	22°02.9	S22°04.0
7	304°41.3	309°20.2	49.6	254°16.5	58.5	107°39.1	31.7	37°05.4	04.0
8	319°43.7	324°22.8	48.9	269°17.2	59.0	122°41.8	31.6	52°07.9	04.0
9	334°46.2	339°25.5	·· 48.2	284°17.9	·· 59.4	137°44.6	·· 31.5	67°10.3	·· 04.0
10	349°48.7	354°28.1	47.6	299°18.6	18°59.9	152°47.3	31.4	82°12.8	04.0
11	4°51.1	9°30.7	46.9	314°19.2	19°00.3	167°50.1	31.2	97°15.3	04.0
12	19°53.6	24°33.3	N03°46.2	329°19.9	N19°00.8	182°52.9	S05°31.1	112°17.8	S22°04.0
13	34°56.1	39°35.9	45.5	344°20.6	01.3	197°55.6	31.0	127°20.3	04.0
14	49°58.5	54°38.5	44.8	359°21.3	01.7	212°58.4	30.9	142°22.8	04.0
15	65°01.0	69°41.1	·· 44.2	14°22.0	·· 02.2	228°01.2	·· 30.8	157°25.3	·· 04.0
16	80°03.4	84°43.7	43.5	29°22.6	02.7	243°03.9	30.6	172°27.8	04.0
17	95°05.9	99°46.3	42.8	44°23.3	03.1	258°06.7	30.5	187°30.2	04.0
18	110°08.4	114°48.8	N03°42.2	59°24.0	N19°03.6	273°09.4	S05°30.4	202°32.7	S22°04.0
19	125°10.8	129°51.4	41.5	74°24.7	04.1	288°12.2	30.3	217°35.2	04.0
20	140°13.3	144°54.0	40.8	89°25.4	04.5	303°15.0	30.2	232°37.7	04.0
21	155°15.8	159°56.6	·· 40.2	104°26.1	·· 05.0	318°17.7	·· 30.0	247°40.2	·· 04.0
22	170°18.2	174°59.1	39.5	119°26.7	05.4	333°20.5	29.9	262°42.7	03.9
23	185°20.7	190°01.7	38.8	134°27.4	05.9	348°23.2	29.8	277°45.2	03.9
Mer.pass.:10:41		v2.6 d-0.7 m-4.3		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	200°23.2	205°04.3	N03°38.2	149°28.1	N19°06.4	3°26.0	S05°29.7	292°47.7	S22°03.9
1	215°25.6	220°06.8	37.5	164°28.8	06.8	18°28.8	29.5	307°50.2	03.9
2	230°28.1	235°09.4	36.9	179°29.5	07.3	33°31.5	29.4	322°52.7	03.9
3	245°30.5	250°11.9	·· 36.2	194°30.1	·· 07.7	48°34.3	·· 29.3	337°55.1	·· 03.9
4	260°33.0	265°14.4	35.5	209°30.8	08.2	63°37.0	29.2	352°57.6	03.9
5	275°35.5	280°17.0	34.9	224°31.5	08.7	78°39.8	29.1	8°00.1	03.9
6	290°37.9	295°19.5	N03°34.2	239°32.2	N19°09.1	93°42.6	S05°28.9	23°02.6	S22°03.9
7	305°40.4	310°22.1	33.6	254°32.9	09.6	108°45.3	28.8	38°05.1	03.9
8	320°42.9	325°24.6	33.0	269°33.5	10.0	123°48.1	28.7	53°07.6	03.9
9	335°45.3	340°27.1	·· 32.3	284°34.2	·· 10.5	138°50.9	·· 28.6	68°10.1	·· 03.9
10	350°47.8	355°29.6	31.7	299°34.9	11.0	153°53.6	28.5	83°12.6	03.9
11	5°50.3	10°32.1	31.0	314°35.6	11.4	168°56.4	28.3	98°15.1	03.9
12	20°52.7	25°34.7	N03°30.4	329°36.3	N19°11.9	183°59.1	S05°28.2	113°17.6	S22°03.9
13	35°55.2	40°37.2	29.7	344°36.9	12.3	199°01.9	28.1	128°20.1	03.9
14	50°57.7	55°39.7	29.1	359°37.6	12.8	214°04.7	28.0	143°22.5	03.9
15	66°00.1	70°42.2	·· 28.5	14°38.3	·· 13.2	229°07.4	·· 27.9	158°25.0	·· 03.9
16	81°02.6	85°44.7	27.8	29°39.0	13.7	244°10.2	27.8	173°27.5	03.9
17	96°05.0	100°47.2	27.2	44°39.7	14.2	259°12.9	27.6	188°30.0	03.9
18	111°07.5	115°49.6	N03°26.6	59°40.3	N19°14.6	274°15.7	S05°27.5	203°32.5	S22°03.9
19	126°10.0	130°52.1	26.0	74°41.0	15.1	289°18.5	27.4	218°35.0	03.9
20	141°12.4	145°54.6	25.3	89°41.7	15.5	304°21.2	27.3	233°37.5	03.9
21	156°14.9	160°57.1	·· 24.7	104°42.4	·· 16.0	319°24.0	·· 27.2	248°40.0	·· 03.9
22	171°17.4	175°59.6	24.1	119°43.1	16.4	334°26.7	27.0	263°42.5	03.9
23	186°19.8	191°02.0	23.5	134°43.7	16.9	349°29.5	26.9	278°45.0	03.9
Mer.pass.:10:37		v2.6 d-0.7 m-4.3		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Stars

	SHA	Dec
Alpheratz	357°41.2	29°10.9
Ankaa	353°13.6	-42°12.8
Schedar	349°38.1	56°37.7
Diphda	348°53.7	-17°53.7
Achernar	335°25.5	-57°09.2
Hamal	327°58.2	23°32.4
Polaris	317°01.8	89°20.2
Acamar	315°16.8	-40°14.5
Menkar	314°12.7	4°09.1
Mirfak	308°37.1	49°55.2
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.3
Capella	280°30.9	46°00.8
Bellatrix	278°29.4	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°43.9	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.2	-52°42.8
Sirius	258°31.5	-16°44.8
Adhara	255°10.6	-29°00.2
Procyon	244°57.1	5°10.6
Pollux	243°24.6	27°58.9
Avior	234°16.8	-59°34.3
Suhail	222°50.3	-43°30.5
Miaplacidus	221°38.6	-69°47.7
Alphard	217°53.4	-8°44.2
Regulus	207°40.6	11°52.9
Dubhe	193°48.2	61°39.6
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.7	-63°11.7
Gacrux	171°57.4	-57°12.6
Alioth	166°18.0	55°52.0
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.7
Hadar	148°43.5	-60°27.2
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.5	-60°54.2
Kochab	137°19.2	74°05.1
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.0	-69°03.1
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.7
Rasalhague	96°03.9	12°32.9
Eltanin	90°44.7	51°29.1
Kaus Aust.	83°40.3	-34°22.3
Vega	80°37.1	38°47.9
Nunki	75°55.1	-26°16.3
Altair	62°05.8	8°54.8
Peacock	53°15.4	-56°40.4
Deneb	49°29.8	45°20.3
Enif	33°44.8	9°57.1
Al Na'ir	27°40.9	-46°52.5
Fomalhaut	15°21.5	-29°31.9
Scheat	13°51.1	28°10.4
Markab	13°36.0	15°17.7

Apr 10 Mon	**SHA**	**Mer.pass**
Venus	4°32.1	10:26
Mars	310°30.4	14:04
Jupiter	162°48.6	23:51
Saturn	92°23.5	04:36

Apr 11 Tue	**SHA**	**Mer.pass**
Venus	4°37.7	10:22
Mars	309°47.7	14:03
Jupiter	162°55.7	23:46
Saturn	92°24.0	04:32

Apr 12 Wed	**SHA**	**Mer.pass**
Venus	4°41.1	10:18
Mars	309°04.9	14:01
Jupiter	163°02.9	23:42
Saturn	92°24.5	04:28

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.4559 sec ΔT = TT-UT1 = +68.7281 sec

2017 April 10 to Apr. 12 UT

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°39.3	N07°56.2	11°48.7	13.9'	N00°13.5	-10.2'	55.5'
1	194°39.4	57.1	26°21.6	13.9'	N00°03.3	-10.2'	55.5'
2	209°39.6	58.0	40°54.5	13.9'	S00°06.9	-10.2'	55.5'
3	224°39.8	·· 58.9	55°27.4	13.9'	00°17.0	-10.2'	55.4'
4	239°39.9	07°59.9	70°00.3	13.9'	00°27.2	-10.2'	55.4'
5	254°40.1	08°00.8	84°33.3	14.0'	00°37.4	-10.2'	55.4'
6	269°40.3	N08°01.7	99°06.2	14.0'	S00°47.6	-10.2'	55.4'
7	284°40.4	02.6	113°39.2	14.0'	00°57.7	-10.2'	55.4'
8	299°40.6	03.6	128°12.2	14.0'	01°07.9	-10.1'	55.4'
9	314°40.8	·· 04.5	142°45.2	14.0'	01°18.0	-10.1'	55.3'
10	329°41.0	05.4	157°18.2	14.0'	01°28.1	-10.1'	55.3'
11	344°41.1	06.3	171°51.3	14.0'	01°38.3	-10.1'	55.3'
12	359°41.3	N08°07.2	186°24.3	14.1'	S01°48.3	-10.1'	55.3'
13	14°41.5	08.2	200°57.4	14.1'	01°58.4	-10.1'	55.3'
14	29°41.6	09.1	215°30.4	14.1'	02°08.5	-10.1'	55.3'
15	44°41.8	·· 10.0	230°03.5	14.1'	02°18.6	-10.0'	55.2'
16	59°42.0	10.9	244°36.6	14.1'	02°28.6	-10.0'	55.2'
17	74°42.1	11.8	259°09.7	14.1'	02°38.6	-10.0'	55.2'
18	89°42.3	N08°12.8	273°42.9	14.1'	S02°48.6	-10.0'	55.2'
19	104°42.5	13.7	288°16.0	14.1'	02°58.6	-10.0'	55.2'
20	119°42.6	14.6	302°49.1	14.1'	03°08.6	-10.0'	55.2'
21	134°42.8	·· 15.5	317°22.3	14.1'	03°18.5	-9.9'	55.1'
22	149°43.0	16.4	331°55.4	14.2'	03°28.5	-9.9'	55.1'
23	164°43.1	17.4	346°28.6	14.2'	03°38.4	-9.9'	55.1'
	SD.=16.0	d=0.9		S.D.=15.1			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°43.3	N08°18.3	1°01.7	14.2'	S03°48.3	-9.9'	55.1'
1	194°43.5	19.2	15°34.9	14.2'	03°58.1	-9.9'	55.1'
2	209°43.6	20.1	30°08.1	14.2'	04°08.0	-9.8'	55.1'
3	224°43.8	·· 21.0	44°41.3	14.2'	04°17.8	-9.8'	55.0'
4	239°43.9	22.0	59°14.5	14.2'	04°27.6	-9.8'	55.0'
5	254°44.1	22.9	73°47.6	14.2'	04°37.4	-9.8'	55.0'
6	269°44.3	N08°23.8	88°20.8	14.2'	S04°47.1	-9.7'	55.0'
7	284°44.4	24.7	102°54.0	14.2'	04°56.8	-9.7'	55.0'
8	299°44.6	25.6	117°27.2	14.2'	05°06.5	-9.7'	55.0'
9	314°44.8	·· 26.5	132°00.4	14.2'	05°16.2	-9.7'	54.9'
10	329°44.9	27.5	146°33.7	14.2'	05°25.8	-9.6'	54.9'
11	344°45.1	28.4	161°06.9	14.2'	05°35.4	-9.6'	54.9'
12	359°45.3	N08°29.3	175°40.1	14.2'	S05°45.0	-9.6'	54.9'
13	14°45.4	30.2	190°13.3	14.2'	05°54.6	-9.5'	54.9'
14	29°45.6	31.1	204°46.5	14.2'	06°04.1	-9.5'	54.9'
15	44°45.8	·· 32.0	219°19.7	14.2'	06°13.6	-9.5'	54.8'
16	59°45.9	32.9	233°52.9	14.2'	06°23.0	-9.4'	54.8'
17	74°46.1	33.9	248°26.1	14.2'	06°32.5	-9.4'	54.8'
18	89°46.2	N08°34.8	262°59.3	14.2'	S06°41.8	-9.4'	54.8'
19	104°46.4	35.7	277°32.5	14.2'	06°51.2	-9.3'	54.8'
20	119°46.6	36.6	292°05.7	14.2'	07°00.5	-9.3'	54.8'
21	134°46.7	·· 37.5	306°38.9	14.2'	07°09.8	-9.3'	54.8'
22	149°46.9	38.4	321°12.1	14.2'	07°19.1	-9.2'	54.7'
23	164°47.1	39.3	335°45.3	14.2'	07°28.3	-9.2'	54.7'
	SD.=15.9	d=0.9		S.D.=15.0			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°47.2	N08°40.3	350°18.5	14.2'	S07°37.5	-9.2'	54.7'
1	194°47.4	41.2	4°51.6	14.2'	07°46.6	-9.1'	54.7'
2	209°47.6	42.1	19°24.8	14.2'	07°55.7	-9.1'	54.7'
3	224°47.7	·· 43.0	33°58.0	14.2'	08°04.8	-9.0'	54.7'
4	239°47.9	43.9	48°31.1	14.2'	08°13.8	-9.0'	54.7'
5	254°48.0	44.8	63°04.3	14.2'	08°22.8	-9.0'	54.6'
6	269°48.2	N08°45.7	77°37.4	14.1'	S08°31.7	-8.9'	54.6'
7	284°48.4	46.6	92°10.6	14.1'	08°40.6	-8.9'	54.6'
8	299°48.5	47.5	106°43.7	14.1'	08°49.5	-8.8'	54.6'
9	314°48.7	·· 48.5	121°16.8	14.1'	08°58.3	-8.8'	54.6'
10	329°48.9	49.4	135°49.9	14.1'	09°07.1	-8.8'	54.6'
11	344°49.0	50.3	150°23.1	14.1'	09°15.8	-8.7'	54.6'
12	359°49.2	N08°51.2	164°56.1	14.1'	S09°24.5	-8.7'	54.6'
13	14°49.3	52.1	179°29.2	14.1'	09°33.2	-8.6'	54.5'
14	29°49.5	53.0	194°02.3	14.1'	09°41.8	-8.6'	54.5'
15	44°49.7	·· 53.9	208°35.4	14.1'	09°50.3	-8.5'	54.5'
16	59°49.8	54.8	223°08.4	14.1'	09°58.8	-8.5'	54.5'
17	74°50.0	55.7	237°41.5	14.0'	10°07.3	-8.4'	54.5'
18	89°50.1	N08°56.6	252°14.5	14.0'	S10°15.7	-8.4'	54.5'
19	104°50.3	57.5	266°47.5	14.0'	10°24.1	-8.3'	54.5'
20	119°50.5	58.5	281°20.5	14.0'	10°32.4	-8.3'	54.5'
21	134°50.6	08°59.4	295°53.5	14.0'	10°40.7	-8.2'	54.5'
22	149°50.8	09°00.3	310°26.5	14.0'	10°48.9	-8.2'	54.4'
23	164°50.9	01.2	324°59.5	14.0'	10°57.1	-8.1'	54.4'
	SD.=15.9	d=0.9		S.D.=14.9			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	02:31	04:01	20:04	21:37	▭
N 70°	▭	02:59	04:15	19:50	21:07	▭
68°	01:32	03:20	04:26	19:39	20:45	22:40
66°	02:10	03:37	04:35	19:29	20:28	21:57
64°	02:36	03:50	04:43	19:21	20:15	21:30
62°	02:56	04:01	04:49	19:14	20:04	21:10
60°	03:11	04:10	04:55	19:09	19:54	20:53
N 58°	03:24	04:18	05:00	19:03	19:46	20:40
56°	03:35	04:25	05:04	18:59	19:39	20:29
54°	03:45	04:31	05:08	18:55	19:32	20:19
52°	03:53	04:37	05:12	18:51	19:27	20:10
50°	04:01	04:42	05:15	18:48	19:22	20:03
45°	04:16	04:52	05:22	18:40	19:11	19:48
N 40°	04:27	05:00	05:28	18:34	19:02	19:36
35°	04:37	05:07	05:33	18:29	18:55	19:26
30°	04:45	05:13	05:38	18:25	18:49	19:18
20°	04:57	05:23	05:45	18:17	18:39	19:06
N 10°	05:06	05:30	05:52	18:10	18:32	18:56
0°	05:13	05:37	05:58	18:04	18:25	18:49
S 10°	05:18	05:42	06:04	17:58	18:19	18:44
20°	05:22	05:48	06:10	17:52	18:14	18:40
30°	05:25	05:53	06:17	17:45	18:09	18:37
35°	05:26	05:55	06:21	17:41	18:06	18:36
40°	05:26	05:58	06:25	17:36	18:04	18:35
45°	05:27	06:01	06:30	17:31	18:01	18:35
S 50°	05:26	06:04	06:36	17:25	17:57	18:35
52°	05:26	06:05	06:39	17:22	17:56	18:35
54°	05:25	06:06	06:42	17:19	17:55	18:35
56°	05:25	06:08	06:46	17:15	17:53	18:36
58°	05:24	06:10	06:49	17:12	17:51	18:37
S 60°	05:23	06:11	06:53	17:07	17:49	18:37

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	18:23	20:02	21:43	05:13	05:06	04:59
N 70°	18:18	19:51	21:24	05:14	05:12	05:11
68°	18:15	19:43	21:09	05:15	05:18	05:21
66°	18:12	19:35	20:58	05:15	05:22	05:30
64°	18:10	19:29	20:48	05:16	05:26	05:37
62°	18:08	19:24	20:39	05:16	05:29	05:43
60°	18:06	19:20	20:32	05:17	05:32	05:48
N 58°	18:04	19:16	20:26	05:17	05:35	05:53
56°	18:03	19:12	20:20	05:18	05:37	05:57
54°	18:01	19:09	20:15	05:18	05:39	06:01
52°	18:00	19:06	20:11	05:18	05:41	06:05
50°	17:59	19:04	20:07	05:18	05:43	06:08
45°	17:57	18:58	19:58	05:19	05:47	06:15
N 40°	17:55	18:53	19:51	05:20	05:50	06:21
35°	17:53	18:49	19:44	05:20	05:53	06:26
30°	17:52	18:46	19:39	05:20	05:55	06:30
20°	17:49	18:40	19:30	05:21	05:59	06:38
N 10°	17:47	18:34	19:21	05:22	06:03	06:44
0°	17:45	18:29	19:14	05:22	06:06	06:51
S 10°	17:43	18:24	19:06	05:23	06:10	06:57
20°	17:41	18:19	18:58	05:23	06:14	07:04
30°	17:39	18:13	18:49	05:24	06:18	07:11
35°	17:37	18:10	18:43	05:24	06:20	07:16
40°	17:36	18:06	18:37	05:24	06:23	07:21
45°	17:34	18:02	18:30	05:25	06:26	07:27
S 50°	17:32	17:56	18:22	05:25	06:30	07:34
52°	17:31	17:54	18:18	05:25	06:32	07:37
54°	17:30	17:51	18:14	05:26	06:34	07:41
56°	17:29	17:48	18:10	05:26	06:36	07:45
58°	17:27	17:45	18:04	05:26	06:38	07:49
S 60°	17:26	17:42	17:59	05:27	06:41	07:54

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 13-15 99-98%
10	01:23	01:15	12:01	23:56	11:34	
11	01:07	00:59	12:01	–:–	12:18	
12	00:51	00:43	12:01	00:40	13:02	

April 13, 14, 15 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	201°22.3	206°04.5	N03°22.8	149°44.4	N19°17.3	4°32.3	S05°26.8	293°47.5	S22°03.9
1	216°24.8	221°06.9	22.2	164°45.1	17.8	19°35.0	26.7	308°50.0	03.9
2	231°27.2	236°09.4	21.6	179°45.8	18.2	34°37.8	26.6	323°52.5	03.9
3	246°29.7	251°11.9	·· 21.0	194°46.4	·· 18.7	49°40.5	·· 26.4	338°55.0	·· 03.9
4	261°32.1	266°14.3	20.4	209°47.1	19.1	64°43.3	26.3	353°57.5	03.9
5	276°34.6	281°16.8	19.8	224°47.8	19.6	79°46.1	26.2	8°59.9	03.9
6	291°37.1	296°19.2	N03°19.2	239°48.5	N19°20.0	94°48.8	S05°26.1	24°02.4	S22°03.9
7	306°39.5	311°21.6	18.5	254°49.2	20.5	109°51.6	26.0	39°04.9	03.9
8	321°42.0	326°24.1	17.9	269°49.8	21.0	124°54.3	25.8	54°07.4	03.9
9	336°44.5	341°26.5	·· 17.3	284°50.5	·· 21.4	139°57.1	·· 25.7	69°09.9	·· 03.8
10	351°46.9	356°28.9	16.7	299°51.2	21.9	154°59.9	25.6	84°12.4	03.8
11	6°49.4	11°31.3	16.1	314°51.9	22.3	170°02.6	25.5	99°14.9	03.8
12	21°51.9	26°33.8	N03°15.5	329°52.5	N19°22.8	185°05.4	S05°25.4	114°17.4	S22°03.8
13	36°54.3	41°36.2	14.9	344°53.2	23.2	200°08.1	25.2	129°19.9	03.8
14	51°56.8	56°38.6	14.3	359°53.9	23.7	215°10.9	25.1	144°22.4	03.8
15	66°59.3	71°41.0	·· 13.7	14°54.6	·· 24.1	230°13.7	·· 25.0	159°24.9	·· 03.8
16	82°01.7	86°43.4	13.2	29°55.3	24.5	245°16.4	24.9	174°27.4	03.8
17	97°04.2	101°45.8	12.6	44°55.9	25.0	260°19.2	24.8	189°29.9	03.8
18	112°06.6	116°48.2	N03°12.0	59°56.6	N19°25.4	275°21.9	S05°24.6	204°32.4	S22°03.8
19	127°09.1	131°50.6	11.4	74°57.3	25.9	290°24.7	24.5	219°34.9	03.8
20	142°11.6	146°53.0	10.8	89°58.0	26.3	305°27.5	24.4	234°37.4	03.8
21	157°14.0	161°55.3	·· 10.2	104°58.6	·· 26.8	320°30.2	·· 24.3	249°39.9	·· 03.8
22	172°16.5	176°57.7	09.6	119°59.3	27.2	335°33.0	24.2	264°42.4	03.8
23	187°19.0	192°00.1	09.1	135°00.0	27.7	350°35.7	24.1	279°44.9	03.8
Mer.pass.:10:33		v2.5 d-0.6 m-4.4		v0.7 d0.5 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.4	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	202°21.4	207°02.5	N03°08.5	150°00.7	N19°28.1	5°38.5	S05°23.9	294°47.4	S22°03.8
1	217°23.9	222°04.8	07.9	165°01.3	28.6	20°41.3	23.8	309°49.9	03.8
2	232°26.4	237°07.2	07.3	180°02.0	29.0	35°44.0	23.7	324°52.4	03.8
3	247°28.8	252°09.6	·· 06.8	195°02.7	·· 29.5	50°46.8	·· 23.6	339°54.9	·· 03.8
4	262°31.3	267°11.9	06.2	210°03.4	29.9	65°49.5	23.5	354°57.4	03.8
5	277°33.8	282°14.3	05.6	225°04.0	30.4	80°52.3	23.3	9°59.9	03.8
6	292°36.2	297°16.6	N03°05.0	240°04.7	N19°30.8	95°55.1	S05°23.2	25°02.4	S22°03.8
7	307°38.7	312°19.0	04.5	255°05.4	31.2	110°57.8	23.1	40°04.9	03.8
8	322°41.1	327°21.3	03.9	270°06.1	31.7	126°00.6	23.0	55°07.4	03.8
9	337°43.6	342°23.6	·· 03.3	285°06.8	·· 32.1	141°03.3	·· 22.9	70°09.9	·· 03.8
10	352°46.1	357°26.0	02.8	300°07.4	32.6	156°06.1	22.7	85°12.4	03.8
11	7°48.5	12°28.3	02.2	315°08.1	33.0	171°08.9	22.6	100°14.9	03.8
12	22°51.0	27°30.6	N03°01.7	330°08.8	N19°33.5	186°11.6	S05°22.5	115°17.4	S22°03.8
13	37°53.5	42°33.0	01.1	345°09.5	33.9	201°14.4	22.4	130°19.9	03.8
14	52°55.9	57°35.3	00.6	0°10.1	34.3	216°17.1	22.3	145°22.4	03.8
15	67°58.4	72°37.6	03°00.0	15°10.8	·· 34.8	231°19.9	·· 22.2	160°24.9	·· 03.8
16	83°00.9	87°39.9	02°59.5	30°11.5	35.2	246°22.7	22.0	175°27.4	03.8
17	98°03.3	102°42.2	58.9	45°12.2	35.7	261°25.4	21.9	190°29.9	03.8
18	113°05.8	117°44.5	N02°58.4	60°12.8	N19°36.1	276°28.2	S05°21.8	205°32.4	S22°03.8
19	128°08.2	132°46.8	57.8	75°13.5	36.5	291°30.9	21.7	220°34.9	03.7
20	143°10.7	147°49.1	57.3	90°14.2	37.0	306°33.7	21.6	235°37.4	03.7
21	158°13.2	162°51.4	·· 56.7	105°14.9	·· 37.4	321°36.4	·· 21.4	250°39.9	·· 03.7
22	173°15.6	177°53.7	56.2	120°15.5	37.9	336°39.2	21.3	265°42.4	03.7
23	188°18.1	192°56.0	55.7	135°16.2	38.3	351°42.0	21.2	280°44.9	03.7
Mer.pass.:10:29		v2.4 d-0.6 m-4.4		v0.7 d0.4 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.3	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	203°20.6	207°58.2	N02°55.1	150°16.9	N19°38.7	6°44.7	S05°21.1	295°47.4	S22°03.7
1	218°23.0	223°00.5	54.6	165°17.6	39.2	21°47.5	21.0	310°49.9	03.7
2	233°25.5	238°02.8	54.0	180°18.2	39.6	36°50.2	20.9	325°52.4	03.7
3	248°28.0	253°05.1	·· 53.5	195°18.9	·· 40.1	51°53.0	·· 20.7	340°54.9	·· 03.7
4	263°30.4	268°07.3	53.0	210°19.6	40.5	66°55.8	20.6	355°57.4	03.7
5	278°32.9	283°09.6	52.5	225°20.2	40.9	81°58.5	20.5	10°59.9	03.7
6	293°35.4	298°11.8	N02°51.9	240°20.9	N19°41.4	97°01.3	S05°20.4	26°02.4	S22°03.7
7	308°37.8	313°14.1	51.4	255°21.6	41.8	112°04.0	20.3	41°04.9	03.7
8	323°40.3	328°16.4	50.9	270°22.3	42.2	127°06.8	20.1	56°07.4	03.7
9	338°42.7	343°18.6	·· 50.4	285°22.9	·· 42.7	142°09.5	·· 20.0	71°09.9	·· 03.7
10	353°45.2	358°20.8	49.8	300°23.6	43.1	157°12.3	19.9	86°12.4	03.7
11	8°47.7	13°23.1	49.3	315°24.3	43.5	172°15.1	19.8	101°14.9	03.7
12	23°50.1	28°25.3	N02°48.8	330°25.0	N19°44.0	187°17.8	S05°19.7	116°17.4	S22°03.7
13	38°52.6	43°27.5	48.3	345°25.6	44.4	202°20.6	19.6	131°19.9	03.7
14	53°55.1	58°29.8	47.8	0°26.3	44.9	217°23.3	19.4	146°22.4	03.7
15	68°57.5	73°32.0	·· 47.3	15°27.0	·· 45.3	232°26.1	·· 19.3	161°24.9	·· 03.7
16	84°00.0	88°34.2	46.8	30°27.7	45.7	247°28.8	19.2	176°27.5	03.7
17	99°02.5	103°36.4	46.3	45°28.3	46.2	262°31.6	19.1	191°30.0	03.7
18	114°04.9	118°38.6	N02°45.8	60°29.0	N19°46.6	277°34.4	S05°19.0	206°32.5	S22°03.7
19	129°07.4	133°40.9	45.3	75°29.7	47.0	292°37.1	18.8	221°35.0	03.7
20	144°09.9	148°43.1	44.8	90°30.3	47.5	307°39.9	18.7	236°37.5	03.7
21	159°12.3	163°45.3	·· 44.3	105°31.0	·· 47.9	322°42.6	·· 18.6	251°40.0	·· 03.7
22	174°14.8	178°47.5	43.8	120°31.7	48.3	337°45.4	18.5	266°42.5	03.7
23	189°17.2	193°49.7	43.3	135°32.4	48.7	352°48.1	18.4	281°45.0	03.7
Mer.pass.:10:25		v2.3 d-0.5 m-4.4		v0.7 d0.4 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°10.9
Ankaa	353°13.6	-42°12.8
Schedar	349°38.0	56°37.7
Diphda	348°53.7	-17°53.7
Achernar	335°25.5	-57°09.1
Hamal	327°58.2	23°32.4
Polaris	317°02.2	89°20.2
Acamar	315°16.8	-40°14.5
Menkar	314°12.7	4°09.1
Mirfak	308°37.1	49°55.2
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.3
Capella	280°30.9	46°00.8
Bellatrix	278°29.4	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°43.9	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.2	-52°42.8
Sirius	258°31.6	-16°44.8
Adhara	255°10.6	-29°00.2
Procyon	244°57.1	5°10.6
Pollux	243°24.6	27°58.9
Avior	234°16.8	-59°34.3
Suhail	222°50.4	-43°30.5
Miaplacidus	221°38.7	-69°47.7
Alphard	217°53.4	-8°44.3
Regulus	207°40.6	11°52.9
Dubhe	193°48.2	61°39.6
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.3
Acrux	173°05.7	-63°11.8
Gacrux	171°57.4	-57°12.7
Alioth	166°18.0	55°52.1
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.7
Hadar	148°43.5	-60°27.2
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.5	-60°54.2
Kochab	137°19.1	74°05.1
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.5	26°39.4
Antares	112°22.8	-26°28.0
Atria	107°22.0	-69°03.1
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.7
Rasalhague	96°03.9	12°32.9
Eltanin	90°44.7	51°29.1
Kaus Aust.	83°40.3	-34°22.3
Vega	80°37.1	38°47.9
Nunki	75°55.1	-26°16.3
Altair	62°05.7	8°54.8
Peacock	53°15.4	-56°40.4
Deneb	49°29.8	45°20.3
Enif	33°44.8	9°57.1
Al Na'ir	27°40.9	-46°52.5
Fomalhaut	15°21.5	-29°31.8
Scheat	13°51.1	28°10.4
Markab	13°36.0	15°17.7

Apr 13 Thu	SHA	Mer.pass
Venus	4°42.2	10:14
Mars	308°22.1	14:00
Jupiter	163°10.0	23:37
Saturn	92°25.2	04:24

Apr 14 Fri	SHA	Mer.pass
Venus	4°41.0	10:10
Mars	307°39.2	13:59
Jupiter	163°17.1	23:33
Saturn	92°25.9	04:20

Apr 15 Sat	SHA	Mer.pass
Venus	4°37.7	10:07
Mars	306°56.3	13:58
Jupiter	163°24.1	23:29
Saturn	92°26.8	04:16

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.4510 sec ΔT = TT-UT1 = +68.7330 sec

2017 April 13 to Apr. 15 UT

h

Thu	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°51.1	N09°02.1	339°32.5	14.0'	S11°05.2	-8.1'	54.4'
1	194°51.3	03.0	354°05.4	13.9'	11°13.2	-8.0'	54.4'
2	209°51.4	03.9	8°38.3	13.9'	11°21.3	-8.0'	54.4'
3	224°51.6	·· 04.8	23°11.3	13.9'	11°29.2	-7.9'	54.4'
4	239°51.7	05.7	37°44.2	13.9'	11°37.1	-7.9'	54.4'
5	254°51.9	06.6	52°17.1	13.9'	11°45.0	-7.8'	54.4'
6	269°52.1	N09°07.5	66°49.9	13.9'	S11°52.8	-7.8'	54.4'
7	284°52.2	08.4	81°22.8	13.9'	12°00.5	-7.7'	54.3'
8	299°52.4	09.3	95°55.6	13.8'	12°08.2	-7.7'	54.3'
9	314°52.5	·· 10.2	110°28.5	13.8'	12°15.9	-7.6'	54.3'
10	329°52.7	11.1	125°01.3	13.8'	12°23.5	-7.6'	54.3'
11	344°52.8	12.0	139°34.1	13.8'	12°31.0	-7.5'	54.3'
12	359°53.0	N09°12.9	154°06.8	13.8'	S12°38.5	-7.4'	54.3'
13	14°53.2	13.8	168°39.6	13.8'	12°45.9	-7.4'	54.3'
14	29°53.3	14.7	183°12.3	13.7'	12°53.2	-7.3'	54.3'
15	44°53.5	·· 15.6	197°45.1	13.7'	13°00.5	-7.3'	54.3'
16	59°53.6	16.6	212°17.8	13.7'	13°07.8	-7.2'	54.3'
17	74°53.8	17.5	226°50.5	13.7'	13°14.9	-7.1'	54.3'
18	89°53.9	N09°18.4	241°23.1	13.7'	S13°22.1	-7.1'	54.2'
19	104°54.1	19.3	255°55.8	13.6'	13°29.1	-7.0'	54.2'
20	119°54.3	20.2	270°28.4	13.6'	13°36.1	-7.0'	54.2'
21	134°54.4	·· 21.1	285°01.1	13.6'	13°43.0	-6.9'	54.2'
22	149°54.6	22.0	299°33.7	13.6'	13°49.9	-6.8'	54.2'
23	164°54.7	22.9	314°06.2	13.6'	13°56.7	-6.8'	54.2'
	SD.=15.9	d=0.9	S.D.=14.8				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°54.9	N09°23.8	328°38.8	13.6'	S14°03.5	-6.7'	54.2'
1	194°55.0	24.7	343°11.3	13.5'	14°10.2	-6.7'	54.2'
2	209°55.2	25.6	357°43.9	13.5'	14°16.8	-6.6'	54.2'
3	224°55.3	·· 26.5	12°16.4	13.5'	14°23.3	-6.5'	54.2'
4	239°55.5	27.4	26°48.9	13.5'	14°29.8	-6.5'	54.2'
5	254°55.7	28.3	41°21.3	13.5'	14°36.3	-6.4'	54.2'
6	269°55.8	N09°29.2	55°53.8	13.4'	S14°42.6	-6.3'	54.2'
7	284°56.0	30.1	70°26.2	13.4'	14°48.9	-6.3'	54.2'
8	299°56.1	31.0	84°58.6	13.4'	14°55.1	-6.2'	54.1'
9	314°56.3	·· 31.9	99°31.0	13.4'	15°01.3	-6.1'	54.1'
10	329°56.4	32.7	114°03.4	13.4'	15°07.4	-6.1'	54.1'
11	344°56.6	33.6	128°35.7	13.3'	15°13.4	-6.0'	54.1'
12	359°56.7	N09°34.5	143°08.0	13.3'	S15°19.4	-5.9'	54.1'
13	14°56.9	35.4	157°40.3	13.3'	15°25.3	-5.9'	54.1'
14	29°57.1	36.3	172°12.6	13.3'	15°31.1	-5.8'	54.1'
15	44°57.2	·· 37.2	186°44.9	13.3'	15°36.8	-5.7'	54.1'
16	59°57.4	38.1	201°17.1	13.2'	15°42.5	-5.6'	54.1'
17	74°57.5	39.0	215°49.4	13.2'	15°48.1	-5.6'	54.1'
18	89°57.7	N09°39.9	230°21.6	13.2'	S15°53.7	-5.5'	54.1'
19	104°57.8	40.8	244°53.7	13.2'	15°59.2	-5.4'	54.1'
20	119°58.0	41.7	259°25.9	13.1'	16°04.6	-5.4'	54.1'
21	134°58.1	·· 42.6	273°58.0	13.1'	16°09.9	-5.3'	54.1'
22	149°58.3	43.5	288°30.1	13.1'	16°15.1	-5.2'	54.1'
23	164°58.4	44.4	303°02.2	13.1'	16°20.3	-5.1'	54.1'
	SD.=15.9	d=0.9	S.D.=14.8				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°58.6	N09°45.3	317°34.3	13.1'	S16°25.4	-5.1'	54.1'
1	194°58.7	46.2	332°06.4	13.0'	16°30.5	-5.0'	54.1'
2	209°58.9	47.1	346°38.4	13.0'	16°35.4	-4.9'	54.1'
3	224°59.0	·· 48.0	1°10.4	13.0'	16°40.3	-4.8'	54.1'
4	239°59.2	48.9	15°42.4	13.0'	16°45.1	-4.8'	54.1'
5	254°59.3	49.7	30°14.4	13.0'	16°49.8	-4.7'	54.1'
6	269°59.5	N09°50.6	44°46.3	12.9'	S16°54.5	-4.6'	54.1'
7	284°59.6	51.5	59°18.2	12.9'	16°59.1	-4.5'	54.1'
8	299°59.8	52.4	73°50.2	12.9'	17°03.6	-4.5'	54.1'
9	314°59.9	·· 53.3	88°22.0	12.9'	17°08.0	-4.4'	54.1'
10	330°00.1	54.2	102°53.9	12.9'	17°12.4	-4.3'	54.1'
11	345°00.2	55.1	117°25.7	12.8'	17°16.7	-4.2'	54.1'
12	0°00.4	N09°56.0	131°57.6	12.8'	S17°20.9	-4.2'	54.1'
13	15°00.5	56.9	146°29.4	12.8'	17°25.0	-4.1'	54.1'
14	30°00.7	57.8	161°01.1	12.8'	17°29.0	-4.0'	54.1'
15	45°00.8	·· 58.7	175°32.9	12.7'	17°33.0	-3.9'	54.1'
16	60°01.0	09°59.5	190°04.6	12.7'	17°36.9	-3.8'	54.1'
17	75°01.1	10°00.4	204°36.3	12.7'	17°40.7	-3.8'	54.1'
18	90°01.3	N10°01.3	219°08.0	12.7'	S17°44.4	-3.7'	54.1'
19	105°01.4	02.2	233°39.7	12.7'	17°48.1	-3.6'	54.1'
20	120°01.6	03.1	248°11.4	12.6'	17°51.7	-3.5'	54.1'
21	135°01.7	·· 04.0	262°43.0	12.6'	17°55.1	-3.4'	54.1'
22	150°01.9	04.9	277°14.6	12.6'	17°58.6	-3.4'	54.1'
23	165°02.0	05.8	291°46.2	12.6'	18°01.9	-3.3'	54.1'
	SD.=15.9	d=0.9	S.D.=14.7				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	02:06	03:44	20:20	22:02	▭
N 70°	▭	02:40	04:00	20:03	21:25	▭
68°	00:54	03:04	04:13	19:50	21:00	23:25
66°	01:48	03:23	04:23	19:39	20:41	22:19
64°	02:19	03:38	04:32	19:30	20:25	21:45
62°	02:42	03:50	04:40	19:23	20:13	21:22
60°	03:00	04:00	04:46	19:16	20:02	21:04
N 58°	03:14	04:09	04:52	19:10	19:53	20:49
56°	03:26	04:17	04:57	19:05	19:45	20:37
54°	03:36	04:24	05:01	19:00	19:38	20:26
52°	03:45	04:30	05:05	18:56	19:32	20:17
50°	03:53	04:35	05:09	18:52	19:27	20:09
45°	04:10	04:46	05:17	18:44	19:15	19:52
N 40°	04:22	04:56	05:24	18:37	19:06	19:39
35°	04:32	05:03	05:29	18:32	18:58	19:29
30°	04:41	05:10	05:34	18:27	18:51	19:20
20°	04:54	05:20	05:43	18:18	18:40	19:07
N 10°	05:04	05:29	05:50	18:10	18:32	18:57
0°	05:12	05:36	05:57	18:04	18:24	18:49
S 10°	05:18	05:42	06:04	17:57	18:18	18:43
20°	05:23	05:48	06:11	17:50	18:12	18:38
30°	05:26	05:54	06:19	17:42	18:06	18:34
35°	05:28	05:57	06:23	17:37	18:02	18:32
40°	05:29	06:01	06:28	17:32	17:59	18:31
45°	05:30	06:04	06:34	17:26	17:55	18:30
S 50°	05:31	06:08	06:41	17:19	17:51	18:29
52°	05:31	06:10	06:44	17:15	17:50	18:29
54°	05:31	06:12	06:48	17:12	17:48	18:29
56°	05:31	06:14	06:52	17:08	17:46	18:29
58°	05:30	06:16	06:56	17:04	17:44	18:29
S 60°	05:30	06:18	07:01	16:59	17:41	18:29

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	23:27	–:–	01:19	04:50	04:40	04:22
N 70°	22:57	–:–	00:30	05:10	05:10	05:12
68°	22:35	23:58	–:–	05:26	05:33	05:44
66°	22:18	23:36	–:–	05:39	05:51	06:08
64°	22:04	23:17	–:–	05:49	06:05	06:26
62°	21:53	23:03	–:–	05:59	06:17	06:41
60°	21:43	22:50	23:53	06:06	06:28	06:54
N 58°	21:34	22:40	23:41	06:13	06:37	07:05
56°	21:27	22:30	23:30	06:20	06:45	07:15
54°	21:20	22:22	23:21	06:25	06:52	07:23
52°	21:14	22:15	23:13	06:30	06:58	07:31
50°	21:09	22:08	23:05	06:35	07:04	07:38
45°	20:57	21:54	22:49	06:44	07:17	07:52
N 40°	20:47	21:42	22:36	06:53	07:27	08:05
35°	20:39	21:33	22:25	07:00	07:36	08:15
30°	20:32	21:24	22:15	07:06	07:44	08:24
20°	20:19	21:09	21:59	07:17	07:57	08:40
N 10°	20:09	20:56	21:44	07:26	08:09	08:53
0°	19:58	20:44	21:30	07:35	08:20	09:06
S 10°	19:48	20:32	21:17	07:44	08:31	09:19
20°	19:38	20:19	21:03	07:54	08:43	09:33
30°	19:26	20:05	20:46	08:05	08:57	09:49
35°	19:19	19:56	20:37	08:11	09:05	09:58
40°	19:11	19:46	20:26	08:18	09:14	10:08
45°	19:01	19:35	20:13	08:26	09:25	10:21
S 50°	18:50	19:22	19:57	08:37	09:37	10:36
52°	18:45	19:15	19:50	08:41	09:43	10:43
54°	18:39	19:08	19:42	08:47	09:50	10:51
56°	18:33	19:01	19:33	08:52	09:57	10:59
58°	18:26	18:52	19:23	08:59	10:06	11:09
S 60°	18:18	18:42	19:11	09:06	10:15	11:21

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 16-18 95-84%
13	00:36	00:28	12:00	01:24	13:47	
14	00:20	00:13	12:00	02:09	14:32	
15	00:06	00:02	12:00	02:55	15:18	

April 16, 17, 18 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	204°19.7	208°51.8	N02°42.8	150°33.0	N19°49.2	7°50.9	S05°18.3	296°47.5	S22°03.7
1	219°22.2	223°54.0	42.3	165°33.7	49.6	22°53.7	18.1	311°50.0	03.7
2	234°24.6	238°56.2	41.8	180°34.4	50.0	37°56.4	18.0	326°52.5	03.7
3	249°27.1	253°58.4	·· 41.3	195°35.1	·· 50.5	52°59.2	·· 17.9	341°55.0	·· 03.7
4	264°29.6	269°00.6	40.8	210°35.7	50.9	68°01.9	17.8	356°57.5	03.7
5	279°32.0	284°02.7	40.3	225°36.4	51.3	83°04.7	17.7	12°00.0	03.6
6	294°34.5	299°04.9	N02°39.8	240°37.1	N19°51.8	98°07.4	S05°17.6	27°02.5	S22°03.6
7	309°37.0	314°07.1	39.4	255°37.7	52.2	113°10.2	17.4	42°05.1	03.6
8	324°39.4	329°09.2	38.9	270°38.4	52.6	128°12.9	17.3	57°07.6	03.6
9	339°41.9	344°11.4	·· 38.4	285°39.1	·· 53.0	143°15.7	·· 17.2	72°10.1	·· 03.6
10	354°44.3	359°13.5	37.9	300°39.8	53.5	158°18.5	17.1	87°12.6	03.6
11	9°46.8	14°15.7	37.5	315°40.4	53.9	173°21.2	17.0	102°15.1	03.6
12	24°49.3	29°17.8	N02°37.0	330°41.1	N19°54.3	188°24.0	S05°16.9	117°17.6	S22°03.6
13	39°51.7	44°20.0	36.5	345°41.8	54.8	203°26.7	16.7	132°20.1	03.6
14	54°54.2	59°22.1	36.0	0°42.4	55.2	218°29.5	16.6	147°22.6	03.6
15	69°56.7	74°24.3	·· 35.6	15°43.1	·· 55.6	233°32.2	·· 16.5	162°25.1	·· 03.6
16	84°59.1	89°26.4	35.1	30°43.8	56.0	248°35.0	16.4	177°27.6	03.6
17	100°01.6	104°28.5	34.6	45°44.4	56.5	263°37.8	16.3	192°30.1	03.6
18	115°04.1	119°30.6	N02°34.2	60°45.1	N19°56.9	278°40.5	S05°16.2	207°32.7	S22°03.6
19	130°06.5	134°32.8	33.7	75°45.8	57.3	293°43.3	16.0	222°35.2	03.6
20	145°09.0	149°34.9	33.3	90°46.5	57.7	308°46.0	15.9	237°37.7	03.6
21	160°11.5	164°37.0	·· 32.8	105°47.1	·· 58.2	323°48.8	·· 15.8	252°40.2	·· 03.6
22	175°13.9	179°39.1	32.4	120°47.8	58.6	338°51.5	15.7	267°42.7	03.6
23	190°16.4	194°41.2	31.9	135°48.5	59.0	353°54.3	15.6	282°45.2	03.6
Mer.pass.:10:21		v2.2 d-0.5 m-4.4		v0.7 d0.4 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.3	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	205°18.8	209°43.3	N02°31.5	150°49.1	N19°59.4	8°57.0	S05°15.5	297°47.7	S22°03.6
1	220°21.3	224°45.4	31.0	165°49.8	19°59.9	23°59.8	15.3	312°50.2	03.6
2	235°23.8	239°47.5	30.6	180°50.5	20°00.3	39°02.5	15.2	327°52.7	03.6
3	250°26.2	254°49.6	·· 30.1	195°51.2	·· 00.7	54°05.3	·· 15.1	342°55.3	·· 03.6
4	265°28.7	269°51.7	29.7	210°51.8	01.1	69°08.1	15.0	357°57.8	03.6
5	280°31.2	284°53.8	29.2	225°52.5	01.5	84°10.8	14.9	13°00.3	03.6
6	295°33.6	299°55.9	N02°28.8	240°53.2	N20°02.0	99°13.6	S05°14.8	28°02.8	S22°03.6
7	310°36.1	314°57.9	28.3	255°53.8	02.4	114°16.3	14.6	43°05.3	03.6
8	325°38.6	330°00.0	27.9	270°54.5	02.8	129°19.1	14.5	58°07.8	03.6
9	340°41.0	345°02.1	·· 27.5	285°55.2	·· 03.2	144°21.8	·· 14.4	73°10.3	·· 03.6
10	355°43.5	0°04.1	27.0	300°55.8	03.6	159°24.6	14.3	88°12.8	03.6
11	10°46.0	15°06.2	26.6	315°56.5	04.1	174°27.3	14.2	103°15.4	03.6
12	25°48.4	30°08.3	N02°26.2	330°57.2	N20°04.5	189°30.1	S05°14.1	118°17.9	S22°03.6
13	40°50.9	45°10.3	25.8	345°57.8	04.9	204°32.8	13.9	133°20.4	03.6
14	55°53.3	60°12.4	25.3	0°58.5	05.3	219°35.6	13.8	148°22.9	03.5
15	70°55.8	75°14.4	·· 24.9	15°59.2	·· 05.7	234°38.4	·· 13.7	163°25.4	·· 03.5
16	85°58.3	90°16.5	24.5	30°59.9	06.2	249°41.1	13.6	178°27.9	03.5
17	101°00.7	105°18.5	24.1	46°00.5	06.6	264°43.9	13.5	193°30.4	03.5
18	116°03.2	120°20.6	N02°23.6	61°01.2	N20°07.0	279°46.6	S05°13.4	208°33.0	S22°03.5
19	131°05.7	135°22.6	23.2	76°01.9	07.4	294°49.4	13.2	223°35.5	03.5
20	146°08.1	150°24.6	22.8	91°02.5	07.8	309°52.1	13.1	238°38.0	03.5
21	161°10.6	165°26.7	·· 22.4	106°03.2	·· 08.3	324°54.9	·· 13.0	253°40.5	·· 03.5
22	176°13.1	180°28.7	22.0	121°03.9	08.7	339°57.6	12.9	268°43.0	03.5
23	191°15.5	195°30.7	21.6	136°04.5	09.1	355°00.4	12.8	283°45.5	03.5
Mer.pass.:10:17		v2.1 d-0.4 m-4.4		v0.7 d0.4 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.3	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	206°18.0	210°32.7	N02°21.2	151°05.2	N20°09.5	10°03.1	S05°12.7	298°48.0	S22°03.5
1	221°20.5	225°34.7	20.8	166°05.9	09.9	25°05.9	12.6	313°50.6	03.5
2	236°22.9	240°36.7	20.4	181°06.5	10.3	40°08.6	12.4	328°53.1	03.5
3	251°25.4	255°38.7	·· 20.0	196°07.2	·· 10.7	55°11.4	·· 12.3	343°55.6	·· 03.5
4	266°27.8	270°40.7	19.6	211°07.9	11.2	70°14.2	12.2	358°58.1	03.5
5	281°30.3	285°42.7	19.2	226°08.5	11.6	85°16.9	12.1	14°00.6	03.5
6	296°32.8	300°44.7	N02°18.8	241°09.2	N20°12.0	100°19.7	S05°12.0	29°03.1	S22°03.5
7	311°35.2	315°46.7	18.4	256°09.9	12.4	115°22.4	11.9	44°05.7	03.5
8	326°37.7	330°48.7	18.0	271°10.5	12.8	130°25.2	11.7	59°08.2	03.5
9	341°40.2	345°50.7	·· 17.6	286°11.2	·· 13.2	145°27.9	·· 11.6	74°10.7	·· 03.5
10	356°42.6	0°52.7	17.2	301°11.9	13.6	160°30.7	11.5	89°13.2	03.5
11	11°45.1	15°54.7	16.8	316°12.5	14.1	175°33.4	11.4	104°15.7	03.5
12	26°47.6	30°56.7	N02°16.4	331°13.2	N20°14.5	190°36.2	S05°11.3	119°18.2	S22°03.5
13	41°50.0	45°58.6	16.0	346°13.9	14.9	205°38.9	11.2	134°20.8	03.5
14	56°52.5	61°00.6	15.7	1°14.5	15.3	220°41.7	11.1	149°23.3	03.5
15	71°54.9	76°02.6	·· 15.3	16°15.2	·· 15.7	235°44.4	·· 10.9	164°25.8	·· 03.5
16	86°57.4	91°04.5	14.9	31°15.9	16.1	250°47.2	10.8	179°28.3	03.5
17	101°59.9	106°06.5	14.5	46°16.5	16.5	265°49.9	10.7	194°30.8	03.5
18	117°02.3	121°08.4	N02°14.1	61°17.2	N20°16.9	280°52.7	S05°10.6	209°33.4	S22°03.5
19	132°04.8	136°10.4	13.8	76°17.9	17.3	295°55.4	10.5	224°35.9	03.5
20	147°07.3	151°12.3	13.4	91°18.5	17.8	310°58.2	10.4	239°38.4	03.5
21	162°09.7	166°14.3	·· 13.0	106°19.2	·· 18.2	326°00.9	·· 10.3	254°40.9	·· 03.5
22	177°12.2	181°16.2	12.7	121°19.9	18.6	341°03.7	10.1	269°43.4	03.5
23	192°14.7	196°18.2	12.3	136°20.5	19.0	356°06.4	10.0	284°45.9	03.4
Mer.pass.:10:13		v2.0 d-0.4 m-4.4		v0.7 d0.4 m1.5		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°10.9
Ankaa	353°13.6	-42°12.8
Schedar	349°38.0	56°37.7
Diphda	348°53.7	-17°53.7
Achernar	335°25.5	-57°09.1
Hamal	327°58.2	23°32.4
Polaris	317°02.4	89°20.2
Acamar	315°16.8	-40°14.4
Menkar	314°12.7	4°09.1
Mirfak	308°37.1	49°55.2
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.3
Capella	280°30.9	46°00.8
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°43.9	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.2	-52°42.8
Sirius	258°31.6	-16°44.8
Adhara	255°10.6	-29°00.2
Procyon	244°57.1	5°10.6
Pollux	243°24.6	27°58.9
Avior	234°16.8	-59°34.3
Suhail	222°50.4	-43°30.5
Miaplacidus	221°38.7	-69°47.7
Alphard	217°53.4	-8°44.3
Regulus	207°40.6	11°52.9
Dubhe	193°48.2	61°39.6
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.4
Acrux	173°05.7	-63°11.8
Gacrux	171°57.4	-57°12.7
Alioth	166°18.0	55°52.1
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.7
Hadar	148°43.5	-60°27.3
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.5	-60°54.2
Kochab	137°19.1	74°05.1
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.4
Antares	112°22.8	-26°28.0
Atria	107°21.9	-69°03.1
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.7
Rasalhague	96°03.9	12°32.9
Eltanin	90°44.7	51°29.1
Kaus Aust.	83°40.3	-34°22.3
Vega	80°37.1	38°47.9
Nunki	75°55.1	-26°16.3
Altair	62°05.7	8°54.8
Peacock	53°15.3	-56°40.4
Deneb	49°29.8	45°20.3
Enif	33°44.7	9°57.1
Al Na'ir	27°40.8	-46°52.5
Fomalhaut	15°21.5	-29°31.8
Scheat	13°51.1	28°10.4
Markab	13°36.0	15°17.7

Apr 16 Sun	**SHA**	**Mer.pass**
Venus	4°32.1	10:03
Mars	306°13.3	13:57
Jupiter	163°31.2	23:24
Saturn	92°27.8	04:12

Apr 17 Mon	**SHA**	**Mer.pass**
Venus	4°24.5	10:00
Mars	305°30.3	13:56
Jupiter	163°38.2	23:20
Saturn	92°28.9	04:08

Apr 18 Tue	**SHA**	**Mer.pass**
Venus	4°14.7	09:56
Mars	304°47.2	13:55
Jupiter	163°45.2	23:16
Saturn	92°30.1	04:04

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.4461 sec ΔT = TT-UT1 = +68.7379 sec

2017 April 16 to Apr. 18 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°02.2	N10°06.6	306°17.8	12.6′	S18°05.1	-3.2′	54.1′
1	195°02.3	07.5	320°49.3	12.5′	18°08.3	-3.1′	54.1′
2	210°02.5	08.4	335°20.9	12.5′	18°11.4	-3.0′	54.1′
3	225°02.6	·· 09.3	349°52.4	12.5′	18°14.4	-3.0′	54.1′
4	240°02.8	10.2	4°23.9	12.5′	18°17.3	-2.9′	54.1′
5	255°02.9	11.1	18°55.4	12.5′	18°20.1	-2.8′	54.1′
6	270°03.1	N10°12.0	33°26.8	12.4′	S18°22.9	-2.7′	54.1′
7	285°03.2	12.8	47°58.3	12.4′	18°25.5	-2.6′	54.1′
8	300°03.4	13.7	62°29.7	12.4′	18°28.1	-2.5′	54.1′
9	315°03.5	·· 14.6	77°01.1	12.4′	18°30.6	-2.5′	54.1′
10	330°03.7	15.5	91°32.4	12.4′	18°33.1	-2.4′	54.1′
11	345°03.8	16.4	106°03.8	12.4′	18°35.4	-2.3′	54.2′
12	0°04.0	N10°17.3	120°35.2	12.3′	S18°37.6	-2.2′	54.2′
13	15°04.1	18.1	135°06.5	12.3′	18°39.8	-2.1′	54.2′
14	30°04.3	19.0	149°37.8	12.3′	18°41.9	-2.0′	54.2′
15	45°04.4	·· 19.9	164°09.1	12.3′	18°43.9	-2.0′	54.2′
16	60°04.5	20.8	178°40.3	12.3′	18°45.8	-1.9′	54.2′
17	75°04.7	21.7	193°11.6	12.2′	18°47.6	-1.8′	54.2′
18	90°04.8	N10°22.6	207°42.8	12.2′	S18°49.3	-1.7′	54.2′
19	105°05.0	23.4	222°14.0	12.2′	18°51.0	-1.6′	54.2′
20	120°05.1	24.3	236°45.2	12.2′	18°52.5	-1.5′	54.2′
21	135°05.3	·· 25.2	251°16.4	12.2′	18°54.0	-1.4′	54.2′
22	150°05.4	26.1	265°47.6	12.2′	18°55.4	-1.3′	54.2′
23	165°05.6	27.0	280°18.7	12.1′	18°56.7	-1.3′	54.2′
	SD.=15.9	d=0.9		S.D.=14.8			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°05.7	N10°27.8	294°49.9	12.1′	S18°57.9	-1.2′	54.3′
1	195°05.8	28.7	309°21.0	12.1′	18°59.1	-1.1′	54.3′
2	210°06.0	29.6	323°52.1	12.1′	19°00.1	-1.0′	54.3′
3	225°06.1	·· 30.5	338°23.2	12.1′	19°01.1	-0.9′	54.3′
4	240°06.3	31.4	352°54.2	12.1′	19°01.9	-0.8′	54.3′
5	255°06.4	32.2	7°25.3	12.0′	19°02.7	-0.7′	54.3′
6	270°06.6	N10°33.1	21°56.3	12.0′	S19°03.4	-0.6′	54.3′
7	285°06.7	34.0	36°27.4	12.0′	19°04.0	-0.6′	54.3′
8	300°06.9	34.9	50°58.4	12.0′	19°04.5	-0.5′	54.3′
9	315°07.0	·· 35.7	65°29.4	12.0′	19°04.9	-0.4′	54.4′
10	330°07.1	36.6	80°00.3	12.0′	19°05.3	-0.3′	54.4′
11	345°07.3	37.5	94°31.3	12.0′	19°05.5	-0.2′	54.4′
12	0°07.4	N10°38.4	109°02.2	11.9′	S19°05.7	-0.1′	54.4′
13	15°07.6	39.3	123°33.2	11.9′	19°05.8	-0.0′	54.4′
14	30°07.7	40.1	138°04.1	11.9′	19°05.7	0.1′	54.4′
15	45°07.9	·· 41.0	152°35.0	11.9′	19°05.6	0.2′	54.4′
16	60°08.0	41.9	167°05.9	11.9′	19°05.4	0.2′	54.4′
17	75°08.1	42.8	181°36.8	11.9′	19°05.1	0.3′	54.5′
18	90°08.3	N10°43.6	196°07.7	11.9′	S19°04.8	0.4′	54.5′
19	105°08.4	44.5	210°38.5	11.9′	19°04.3	0.5′	54.5′
20	120°08.6	45.4	225°09.4	11.8′	19°03.7	0.6′	54.5′
21	135°08.7	·· 46.2	239°40.2	11.8′	19°03.1	0.7′	54.5′
22	150°08.8	47.1	254°11.0	11.8′	19°02.3	0.8′	54.5′
23	165°09.0	48.0	268°41.8	11.8′	19°01.5	0.9′	54.5′
	SD.=15.9	d=0.9		S.D.=14.8			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°09.1	N10°48.9	283°12.6	11.8′	S19°00.6	1.0′	54.6′
1	195°09.3	49.7	297°43.4	11.8′	18°59.6	1.1′	54.6′
2	210°09.4	50.6	312°14.2	11.8′	18°58.5	1.1′	54.6′
3	225°09.5	·· 51.5	326°44.9	11.8′	18°57.3	1.2′	54.6′
4	240°09.7	52.4	341°15.7	11.7′	18°56.0	1.3′	54.6′
5	255°09.8	53.2	355°46.4	11.7′	18°54.6	1.4′	54.7′
6	270°10.0	N10°54.1	10°17.2	11.7′	S18°53.2	1.5′	54.7′
7	285°10.1	55.0	24°47.9	11.7′	18°51.6	1.6′	54.7′
8	300°10.2	55.8	39°18.6	11.7′	18°50.0	1.7′	54.7′
9	315°10.4	·· 56.7	53°49.3	11.7′	18°48.3	1.8′	54.7′
10	330°10.5	57.6	68°20.0	11.7′	18°46.4	1.9′	54.7′
11	345°10.6	58.4	82°50.7	11.7′	18°44.5	2.0′	54.8′
12	0°10.8	N10°59.3	97°21.3	11.7′	S18°42.5	2.1′	54.8′
13	15°10.9	11°00.2	111°52.0	11.7′	18°40.4	2.1′	54.8′
14	30°11.1	01.0	126°22.7	11.6′	18°38.2	2.2′	54.8′
15	45°11.2	·· 01.9	140°53.3	11.6′	18°36.0	2.3′	54.8′
16	60°11.3	02.8	155°23.9	11.6′	18°33.6	2.4′	54.9′
17	75°11.5	03.7	169°54.6	11.6′	18°31.1	2.5′	54.9′
18	90°11.6	N11°04.5	184°25.2	11.6′	S18°28.6	2.6′	54.9′
19	105°11.7	05.4	198°55.8	11.6′	18°25.9	2.7′	54.9′
20	120°11.9	06.3	213°26.4	11.6′	18°23.2	2.8′	55.0′
21	135°12.0	·· 07.1	227°57.0	11.6′	18°20.4	2.9′	55.0′
22	150°12.2	08.0	242°27.6	11.6′	18°17.5	3.0′	55.0′
23	165°12.3	08.8	256°58.2	11.6′	18°14.5	3.0′	55.0′
	SD.=15.9	d=0.9		S.D.=14.9			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	01:36	03:27	20:36	22:34	▭
N 70°	▭	02:19	03:45	20:17	21:46	▭
68°	▭	02:48	04:00	20:02	21:15	▭
66°	01:22	03:09	04:12	19:50	20:54	22:46
64°	02:01	03:25	04:22	19:40	20:36	22:03
62°	02:27	03:39	04:30	19:31	20:22	21:35
60°	02:47	03:50	04:37	19:23	20:11	21:15
N 58°	03:03	04:00	04:44	19:17	20:01	20:58
56°	03:16	04:09	04:49	19:11	19:52	20:45
54°	03:28	04:16	04:54	19:06	19:44	20:33
52°	03:37	04:23	04:59	19:01	19:38	20:23
50°	03:46	04:29	05:03	18:57	19:32	20:14
45°	04:04	04:41	05:12	18:48	19:19	19:57
N 40°	04:17	04:51	05:19	18:41	19:09	19:43
35°	04:28	04:59	05:25	18:34	19:00	19:32
30°	04:37	05:06	05:31	18:29	18:53	19:22
20°	04:51	05:18	05:40	18:19	18:41	19:08
N 10°	05:02	05:27	05:49	18:11	18:32	18:57
0°	05:11	05:35	05:56	18:03	18:24	18:48
S 10°	05:18	05:42	06:04	17:55	18:17	18:41
20°	05:23	05:49	06:12	17:47	18:10	18:35
30°	05:28	05:56	06:20	17:38	18:03	18:30
35°	05:30	06:00	06:25	17:33	17:59	18:28
40°	05:32	06:04	06:31	17:27	17:55	18:26
45°	05:34	06:08	06:38	17:21	17:51	18:25
S 50°	05:35	06:13	06:46	17:13	17:46	18:23
52°	05:35	06:15	06:49	17:09	17:43	18:23
54°	05:36	06:17	06:53	17:05	17:41	18:22
56°	05:36	06:19	06:58	17:01	17:39	18:22
58°	05:36	06:22	07:02	16:56	17:36	18:21
S 60°	05:37	06:25	07:08	16:50	17:33	18:21

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	▬	▬	▬	▬	▬	▬
N 70°	01:59	03:16	04:00	05:20	05:42	06:37
68°	01:16	02:21	03:08	06:03	06:36	07:29
66°	00:47	01:48	02:36	06:32	07:09	08:01
64°	00:25	01:24	02:12	06:55	07:33	08:25
62°	00:08	01:05	01:53	07:12	07:53	08:44
60°	–:–	00:49	01:38	07:27	08:08	08:59
N 58°	–:–	00:36	01:24	07:39	08:22	09:12
56°	–:–	00:25	01:13	07:50	08:33	09:23
54°	–:–	00:15	01:03	08:00	08:43	09:33
52°	–:–	00:06	00:54	08:08	08:52	09:42
50°	23:58	–:–	00:46	08:16	09:00	09:50
45°	23:41	–:–	00:29	08:32	09:17	10:07
N 40°	23:27	–:–	00:15	08:46	09:31	10:21
35°	23:15	–:–	00:04	08:57	09:43	10:32
30°	23:05	23:53	–:–	09:07	09:53	10:42
20°	22:47	23:36	–:–	09:24	10:11	11:00
N 10°	22:32	23:20	–:–	09:39	10:26	11:15
0°	22:18	23:06	23:54	09:53	10:41	11:29
S 10°	22:03	22:51	23:41	10:07	10:55	11:43
20°	21:48	22:36	23:26	10:22	11:11	11:58
30°	21:31	22:18	23:09	10:39	11:28	12:16
35°	21:21	22:08	22:59	10:49	11:39	12:26
40°	21:09	21:56	22:48	11:01	11:51	12:37
45°	20:55	21:43	22:35	11:14	12:04	12:51
S 50°	20:39	21:26	22:19	11:31	12:21	13:07
52°	20:31	21:18	22:11	11:38	12:29	13:15
54°	20:22	21:09	22:03	11:47	12:38	13:23
56°	20:12	20:59	21:53	11:57	12:48	13:33
58°	20:01	20:48	21:43	12:08	12:59	13:44
S 60°	19:48	20:34	21:30	12:20	13:13	13:56

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 19-21 77-59%
16	00:09	00:16	12:00	03:42	16:05	
17	00:23	00:30	12:00	04:29	16:53	
18	00:36	00:43	11:59	05:17	17:42	

April 19, 20, 21 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	207°17.1	211°20.1	N02°11.9	151°21.2	N20°19.4	11°09.2	S05°09.9	299°48.5	S22°03.4
1	222°19.6	226°22.0	11.6	166°21.9	19.8	26°11.9	09.8	314°51.0	03.4
2	237°22.1	241°23.9	11.2	181°22.5	20.2	41°14.7	09.7	329°53.5	03.4
3	252°24.5	256°25.9	·· 10.8	196°23.2	·· 20.6	56°17.4	·· 09.6	344°56.0	·· 03.4
4	267°27.0	271°27.8	10.5	211°23.9	21.0	71°20.2	09.5	359°58.5	03.4
5	282°29.4	286°29.7	10.1	226°24.5	21.4	86°22.9	09.3	15°01.1	03.4
6	297°31.9	301°31.6	N02°09.8	241°25.2	N20°21.8	101°25.7	S05°09.2	30°03.6	S22°03.4
7	312°34.4	316°33.5	09.4	256°25.9	22.2	116°28.5	09.1	45°06.1	03.4
8	327°36.8	331°35.4	09.1	271°26.5	22.6	131°31.2	09.0	60°08.6	03.4
9	342°39.3	346°37.3	·· 08.7	286°27.2	·· 23.0	146°34.0	·· 08.9	75°11.2	·· 03.4
10	357°41.8	1°39.2	08.4	301°27.9	23.5	161°36.7	08.8	90°13.7	03.4
11	12°44.2	16°41.1	08.0	316°28.5	23.9	176°39.5	08.7	105°16.2	03.4
12	27°46.7	31°43.0	N02°07.7	331°29.2	N20°24.3	191°42.2	S05°08.5	120°18.7	S22°03.4
13	42°49.2	46°44.9	07.4	346°29.9	24.7	206°45.0	08.4	135°21.2	03.4
14	57°51.6	61°46.8	07.0	1°30.5	25.1	221°47.7	08.3	150°23.8	03.4
15	72°54.1	76°48.7	·· 06.7	16°31.2	·· 25.5	236°50.5	·· 08.2	165°26.3	·· 03.4
16	87°56.6	91°50.6	06.3	31°31.8	25.9	251°53.2	08.1	180°28.8	03.4
17	102°59.0	106°52.5	06.0	46°32.5	26.3	266°56.0	08.0	195°31.3	03.4
18	118°01.5	121°54.3	N02°05.7	61°33.2	N20°26.7	281°58.7	S05°07.9	210°33.9	S22°03.4
19	133°03.9	136°56.2	05.3	76°33.8	27.1	297°01.5	07.7	225°36.4	03.4
20	148°06.4	151°58.1	05.0	91°34.5	27.5	312°04.2	07.6	240°38.9	03.4
21	163°08.9	166°59.9	·· 04.7	106°35.2	·· 27.9	327°06.9	·· 07.5	255°41.4	·· 03.4
22	178°11.3	182°01.8	04.4	121°35.8	28.3	342°09.7	07.4	270°43.9	03.4
23	193°13.8	197°03.6	04.0	136°36.5	28.7	357°12.4	07.3	285°46.5	03.4
Mer.pass.:10:09		v1.9 d-0.4 m-4.4		v0.7 d0.4 m1.6		v2.8 d0.1 m-2.3		v2.5 d0.0 m0.3	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	208°16.3	212°05.5	N02°03.7	151°37.2	N20°29.1	12°15.2	S05°07.2	300°49.0	S22°03.4
1	223°18.7	227°07.4	03.4	166°37.8	29.5	27°17.9	07.1	315°51.5	03.4
2	238°21.2	242°09.2	03.1	181°38.5	29.9	42°20.7	06.9	330°54.0	03.4
3	253°23.7	257°11.0	·· 02.8	196°39.2	·· 30.3	57°23.4	·· 06.8	345°56.6	·· 03.4
4	268°26.1	272°12.9	02.5	211°39.8	30.7	72°26.2	06.7	0°59.1	03.4
5	283°28.6	287°14.7	02.1	226°40.5	31.1	87°28.9	06.6	16°01.6	03.4
6	298°31.0	302°16.6	N02°01.8	241°41.1	N20°31.5	102°31.7	S05°06.5	31°04.1	S22°03.4
7	313°33.5	317°18.4	01.5	256°41.8	31.9	117°34.4	06.4	46°06.7	03.4
8	328°36.0	332°20.2	01.2	271°42.5	32.3	132°37.2	06.3	61°09.2	03.3
9	343°38.4	347°22.0	·· 00.9	286°43.1	·· 32.7	147°39.9	·· 06.2	76°11.7	·· 03.3
10	358°40.9	2°23.9	00.6	301°43.8	33.1	162°42.7	06.0	91°14.2	03.3
11	13°43.4	17°25.7	00.3	316°44.5	33.5	177°45.4	05.9	106°16.8	03.3
12	28°45.8	32°27.5	N02°00.0	331°45.1	N20°33.9	192°48.2	S05°05.8	121°19.3	S22°03.3
13	43°48.3	47°29.3	01°59.7	346°45.8	34.3	207°50.9	05.7	136°21.8	03.3
14	58°50.8	62°31.1	59.4	1°46.4	34.7	222°53.7	05.6	151°24.3	03.3
15	73°53.2	77°32.9	·· 59.1	16°47.1	·· 35.1	237°56.4	·· 05.5	166°26.9	·· 03.3
16	88°55.7	92°34.7	58.8	31°47.8	35.5	252°59.2	05.4	181°29.4	03.3
17	103°58.2	107°36.5	58.5	46°48.4	35.8	268°01.9	05.3	196°31.9	03.3
18	119°00.6	122°38.3	N01°58.2	61°49.1	N20°36.2	283°04.7	S05°05.1	211°34.5	S22°03.3
19	134°03.1	137°40.1	58.0	76°49.8	36.6	298°07.4	05.0	226°37.0	03.3
20	149°05.5	152°41.9	57.7	91°50.4	37.0	313°10.2	04.9	241°39.5	03.3
21	164°08.0	167°43.7	·· 57.4	106°51.1	·· 37.4	328°12.9	·· 04.8	256°42.0	·· 03.3
22	179°10.5	182°45.5	57.1	121°51.7	37.8	343°15.7	04.7	271°44.6	03.3
23	194°12.9	197°47.2	56.8	136°52.4	38.2	358°18.4	04.6	286°47.1	03.3
Mer.pass.:10:05		v1.9 d-0.3 m-4.4		v0.7 d0.4 m1.6		v2.7 d0.1 m-2.3		v2.5 d0.0 m0.3	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	209°15.4	212°49.0	N01°56.5	151°53.1	N20°38.6	13°21.1	S05°04.5	301°49.6	S22°03.3
1	224°17.9	227°50.8	56.3	166°53.7	39.0	28°23.9	04.4	316°52.1	03.3
2	239°20.3	242°52.6	56.0	181°54.4	39.4	43°26.6	04.2	331°54.7	03.3
3	254°22.8	257°54.3	·· 55.7	196°55.1	·· 39.8	58°29.4	·· 04.1	346°57.2	·· 03.3
4	269°25.3	272°56.1	55.4	211°55.7	40.2	73°32.1	04.0	1°59.7	03.3
5	284°27.7	287°57.8	55.2	226°56.4	40.6	88°34.9	03.9	17°02.3	03.3
6	299°30.2	302°59.6	N01°54.9	241°57.0	N20°41.0	103°37.6	S05°03.8	32°04.8	S22°03.3
7	314°32.7	318°01.4	54.6	256°57.7	41.3	118°40.4	03.7	47°07.3	03.3
8	329°35.1	333°03.1	54.4	271°58.4	41.7	133°43.1	03.6	62°09.9	03.3
9	344°37.6	348°04.8	·· 54.1	286°59.0	·· 42.1	148°45.9	·· 03.5	77°12.4	·· 03.3
10	359°40.0	3°06.6	53.8	301°59.7	42.5	163°48.6	03.4	92°14.9	03.3
11	14°42.5	18°08.3	53.6	317°00.3	42.9	178°51.3	03.2	107°17.4	03.3
12	29°45.0	33°10.1	N01°53.3	332°01.0	N20°43.3	193°54.1	S05°03.1	122°20.0	S22°03.3
13	44°47.4	48°11.8	53.1	347°01.7	43.7	208°56.8	03.0	137°22.5	03.3
14	59°49.9	63°13.5	52.8	2°02.3	44.1	223°59.6	02.9	152°25.0	03.3
15	74°52.4	78°15.3	·· 52.6	17°03.0	·· 44.5	239°02.3	·· 02.8	167°27.6	·· 03.3
16	89°54.8	93°17.0	52.3	32°03.7	44.8	254°05.1	02.7	182°30.1	03.3
17	104°57.3	108°18.7	52.1	47°04.3	45.2	269°07.8	02.6	197°32.6	03.2
18	119°59.8	123°20.4	N01°51.8	62°05.0	N20°45.6	284°10.6	S05°02.5	212°35.2	S22°03.2
19	135°02.2	138°22.1	51.6	77°05.6	46.0	299°13.3	02.3	227°37.7	03.2
20	150°04.7	153°23.9	51.3	92°06.3	46.4	314°16.1	02.2	242°40.2	03.2
21	165°07.1	168°25.6	·· 51.1	107°07.0	·· 46.8	329°18.8	·· 02.1	257°42.8	·· 03.2
22	180°09.6	183°27.3	50.9	122°07.6	47.2	344°21.5	02.0	272°45.3	03.2
23	195°12.1	198°29.0	50.6	137°08.3	47.5	359°24.3	01.9	287°47.8	03.2
Mer.pass.:10:01		v1.8 d-0.3 m-4.5		v0.7 d0.4 m1.6		v2.7 d0.1 m-2.3		v2.5 d0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°10.9
Ankaa	353°13.6	-42°12.8
Schedar	349°38.0	56°37.7
Diphda	348°53.6	-17°53.7
Achernar	335°25.5	-57°09.1
Hamal	327°58.2	23°32.4
Polaris	317°02.7	89°20.2
Acamar	315°16.8	-40°14.4
Menkar	314°12.7	4°09.1
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.3
Capella	280°30.9	46°00.8
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.2	-52°42.8
Sirius	258°31.6	-16°44.8
Adhara	255°10.6	-29°00.2
Procyon	244°57.1	5°10.6
Pollux	243°24.7	27°58.9
Avior	234°16.9	-59°34.3
Suhail	222°50.4	-43°30.5
Miaplacidus	221°38.8	-69°47.7
Alphard	217°53.5	-8°44.3
Regulus	207°40.6	11°52.9
Dubhe	193°48.2	61°39.6
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.4
Acrux	173°05.7	-63°11.8
Gacrux	171°57.4	-57°12.7
Alioth	166°18.0	55°52.1
Spica	158°28.2	-11°15.1
Alkaid	152°56.4	49°13.7
Hadar	148°43.5	-60°27.3
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.5	-60°54.2
Kochab	137°19.1	74°05.1
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.4
Antares	112°22.8	-26°28.0
Atria	107°21.9	-69°03.1
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.7
Rasalhague	96°03.9	12°32.9
Eltanin	90°44.7	51°29.1
Kaus Aust.	83°40.2	-34°22.3
Vega	80°37.0	38°47.9
Nunki	75°55.0	-26°16.3
Altair	62°05.7	8°54.8
Peacock	53°15.3	-56°40.4
Deneb	49°29.7	45°20.3
Enif	33°44.7	9°57.2
Al Na'ir	27°40.8	-46°52.5
Fomalhaut	15°21.4	-29°31.8
Scheat	13°51.1	28°10.4
Markab	13°36.0	15°17.7

Apr 19 Wed	SHA	Mer.pass
Venus	4°03.0	09:53
Mars	304°04.1	13:54
Jupiter	163°52.1	23:11
Saturn	92°31.3	04:00

Apr 20 Thu	SHA	Mer.pass
Venus	3°49.2	09:50
Mars	303°20.9	13:53
Jupiter	163°58.9	23:07
Saturn	92°32.7	03:56

Apr 21 Fri	SHA	Mer.pass
Venus	3°33.6	09:48
Mars	302°37.7	13:52
Jupiter	164°05.7	23:02
Saturn	92°34.2	03:52

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.4412 sec ΔT = TT-UT1 = +68.7428 sec

2017 April 19 to Apr. 21 UT

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°12.4	N11°09.7	271°28.7	11.6'	S18°11.4	3.1'	55.0'
1	195°12.6	10.6	285°59.3	11.6'	18°08.2	3.2'	55.1'
2	210°12.7	11.4	300°29.9	11.6'	18°04.9	3.3'	55.1'
3	225°12.8	·· 12.3	315°00.4	11.5'	18°01.6	3.4'	55.1'
4	240°13.0	13.2	329°31.0	11.5'	17°58.1	3.5'	55.1'
5	255°13.1	14.0	344°01.5	11.5'	17°54.6	3.6'	55.2'
6	270°13.2	N11°14.9	358°32.0	11.5'	S17°50.9	3.7'	55.2'
7	285°13.4	15.8	13°02.5	11.5'	17°47.2	3.8'	55.2'
8	300°13.5	16.6	27°33.1	11.5'	17°43.4	3.9'	55.2'
9	315°13.6	·· 17.5	42°03.6	11.5'	17°39.5	3.9'	55.3'
10	330°13.8	18.3	56°34.1	11.5'	17°35.5	4.0'	55.3'
11	345°13.9	19.2	71°04.6	11.5'	17°31.4	4.1'	55.3'
12	0°14.0	N11°20.1	85°35.1	11.5'	S17°27.3	4.2'	55.3'
13	15°14.2	20.9	100°05.6	11.5'	17°23.0	4.3'	55.4'
14	30°14.3	21.8	114°36.0	11.5'	17°18.6	4.4'	55.4'
15	45°14.4	·· 22.7	129°06.5	11.5'	17°14.2	4.5'	55.4'
16	60°14.6	23.5	143°37.0	11.5'	17°09.7	4.6'	55.4'
17	75°14.7	24.4	158°07.5	11.5'	17°05.1	4.7'	55.5'
18	90°14.8	N11°25.2	172°37.9	11.5'	S17°00.4	4.7'	55.5'
19	105°15.0	26.1	187°08.4	11.5'	16°55.6	4.8'	55.5'
20	120°15.1	26.9	201°38.8	11.4'	16°50.7	4.9'	55.6'
21	135°15.2	·· 27.8	216°09.3	11.4'	16°45.7	5.0'	55.6'
22	150°15.4	28.7	230°39.7	11.4'	16°40.7	5.1'	55.6'
23	165°15.5	29.5	245°10.1	11.4'	16°35.5	5.2'	55.6'
	SD.=15.9	d=0.9	S.D.=15.1				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°15.6	N11°30.4	259°40.5	11.4'	S16°30.3	5.3'	55.7'
1	195°15.8	31.2	274°11.0	11.4'	16°25.0	5.4'	55.7'
2	210°15.9	32.1	288°41.4	11.4'	16°19.6	5.4'	55.7'
3	225°16.0	·· 32.9	303°11.8	11.4'	16°14.1	5.5'	55.8'
4	240°16.2	33.8	317°42.2	11.4'	16°08.5	5.6'	55.8'
5	255°16.3	34.7	332°12.6	11.4'	16°02.8	5.7'	55.8'
6	270°16.4	N11°35.5	346°43.0	11.4'	S15°57.1	5.8'	55.9'
7	285°16.5	36.4	1°13.4	11.4'	15°51.3	5.9'	55.9'
8	300°16.7	37.2	15°43.8	11.4'	15°45.3	6.0'	55.9'
9	315°16.8	·· 38.1	30°14.1	11.4'	15°39.3	6.0'	55.9'
10	330°16.9	38.9	44°44.5	11.4'	15°33.2	6.1'	56.0'
11	345°17.1	39.8	59°14.9	11.4'	15°27.1	6.2'	56.0'
12	0°17.2	N11°40.6	73°45.2	11.4'	S15°20.8	6.3'	56.0'
13	15°17.3	41.5	88°15.6	11.3'	15°14.5	6.4'	56.1'
14	30°17.5	42.3	102°45.9	11.3'	15°08.0	6.5'	56.1'
15	45°17.6	·· 43.2	117°16.3	11.3'	15°01.5	6.6'	56.1'
16	60°17.7	44.1	131°46.6	11.3'	14°54.9	6.6'	56.2'
17	75°17.8	44.9	146°16.9	11.3'	14°48.3	6.7'	56.2'
18	90°18.0	N11°45.8	160°47.2	11.3'	S14°41.5	6.8'	56.2'
19	105°18.1	46.6	175°17.6	11.3'	14°34.7	6.9'	56.3'
20	120°18.2	47.5	189°47.9	11.3'	14°27.7	7.0'	56.3'
21	135°18.3	·· 48.3	204°18.2	11.3'	14°20.7	7.0'	56.3'
22	150°18.5	49.2	218°48.5	11.3'	14°13.6	7.1'	56.4'
23	165°18.6	50.0	233°18.8	11.3'	14°06.5	7.2'	56.4'
	SD.=15.9	d=0.9	S.D.=15.3				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°18.7	N11°50.9	247°49.0	11.3'	S13°59.2	7.3'	56.4'
1	195°18.9	51.7	262°19.3	11.3'	13°51.9	7.4'	56.5'
2	210°19.0	52.6	276°49.6	11.3'	13°44.5	7.4'	56.5'
3	225°19.1	·· 53.4	291°19.8	11.3'	13°37.0	7.5'	56.6'
4	240°19.2	54.2	305°50.1	11.2'	13°29.4	7.6'	56.6'
5	255°19.4	55.1	320°20.3	11.2'	13°21.8	7.7'	56.6'
6	270°19.5	N11°55.9	334°50.6	11.2'	S13°14.1	7.8'	56.7'
7	285°19.6	56.8	349°20.8	11.2'	13°06.3	7.8'	56.7'
8	300°19.7	57.6	3°51.0	11.2'	12°58.4	7.9'	56.7'
9	315°19.9	·· 58.5	18°21.2	11.2'	12°50.4	8.0'	56.8'
10	330°20.0	11°59.3	32°51.4	11.2'	12°42.4	8.1'	56.8'
11	345°20.1	12°00.2	47°21.6	11.2'	12°34.3	8.1'	56.8'
12	0°20.2	N12°01.0	61°51.8	11.2'	S12°26.1	8.2'	56.9'
13	15°20.4	01.9	76°22.0	11.2'	12°17.9	8.3'	56.9'
14	30°20.5	02.7	90°52.1	11.2'	12°09.5	8.4'	57.0'
15	45°20.6	·· 03.6	105°22.3	11.1'	12°01.1	8.4'	57.0'
16	60°20.7	04.4	119°52.4	11.1'	11°52.6	8.5'	57.0'
17	75°20.9	05.2	134°22.6	11.1'	11°44.1	8.6'	57.1'
18	90°21.0	N12°06.1	148°52.7	11.1'	S11°35.5	8.7'	57.1'
19	105°21.1	06.9	163°22.8	11.1'	11°26.8	8.7'	57.1'
20	120°21.2	07.8	177°52.9	11.1'	11°18.0	8.8'	57.2'
21	135°21.3	·· 08.6	192°23.0	11.1'	11°09.2	8.9'	57.2'
22	150°21.5	09.5	206°53.1	11.1'	11°00.2	8.9'	57.3'
23	165°21.6	10.3	221°23.1	11.1'	10°51.3	9.0'	57.3'
	SD.=15.9	d=0.8	S.D.=15.5				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	00:53	03:09	20:54	23:27	▭
N 70°	▭	01:56	03:30	20:31	22:09	▭
68°	▭	02:30	03:47	20:14	21:32	▭
66°	00:46	02:54	04:00	20:00	21:07	23:32
64°	01:41	03:13	04:11	19:49	20:48	22:23
62°	02:12	03:28	04:20	19:39	20:32	21:50
60°	02:35	03:41	04:29	19:31	20:19	21:26
N 58°	02:52	03:51	04:36	19:24	20:08	21:08
56°	03:07	04:00	04:42	19:17	19:59	20:53
54°	03:19	04:09	04:47	19:12	19:51	20:41
52°	03:30	04:16	04:52	19:06	19:43	20:30
50°	03:39	04:22	04:57	19:02	19:37	20:20
45°	03:58	04:36	05:07	18:52	19:23	20:01
N 40°	04:12	04:46	05:15	18:44	19:12	19:46
35°	04:24	04:55	05:22	18:37	19:03	19:34
30°	04:34	05:03	05:28	18:30	18:55	19:25
20°	04:49	05:16	05:38	18:20	18:42	19:09
N 10°	05:01	05:26	05:47	18:11	18:32	18:57
0°	05:10	05:34	05:56	18:02	18:23	18:48
S 10°	05:18	05:42	06:04	17:54	18:15	18:40
20°	05:24	05:50	06:12	17:45	18:07	18:33
30°	05:30	05:58	06:22	17:35	17:59	18:27
35°	05:32	06:02	06:28	17:29	17:55	18:25
40°	05:35	06:06	06:34	17:23	17:51	18:22
45°	05:37	06:11	06:41	17:16	17:46	18:20
S 50°	05:39	06:17	06:50	17:07	17:40	18:18
52°	05:40	06:19	06:54	17:03	17:37	18:17
54°	05:41	06:22	06:59	16:58	17:35	18:16
56°	05:42	06:25	07:03	16:53	17:32	18:15
58°	05:42	06:28	07:09	16:48	17:29	18:14
S 60°	05:43	06:32	07:15	16:42	17:25	18:13

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	05:50	05:03	04:49	06:29	08:58	10:55
N 70°	04:17	04:22	04:23	08:02	09:38	11:19
68°	03:37	03:54	04:04	08:41	10:06	11:37
66°	03:10	03:32	03:48	09:08	10:26	11:52
64°	02:48	03:15	03:35	09:29	10:43	12:04
62°	02:31	03:01	03:25	09:46	10:56	12:14
60°	02:17	02:49	03:15	09:59	11:08	12:23
N 58°	02:05	02:39	03:07	10:11	11:18	12:30
56°	01:55	02:30	03:00	10:22	11:27	12:37
54°	01:45	02:22	02:53	10:31	11:34	12:43
52°	01:37	02:14	02:47	10:39	11:41	12:48
50°	01:29	02:08	02:42	10:46	11:47	12:53
45°	01:14	01:54	02:31	11:01	12:01	13:04
N 40°	01:00	01:42	02:21	11:14	12:12	13:12
35°	00:49	01:32	02:13	11:25	12:21	13:20
30°	00:40	01:24	02:06	11:34	12:29	13:26
20°	00:23	01:09	01:53	11:51	12:43	13:37
N 10°	00:08	00:55	01:43	12:05	12:55	13:47
0°	–:–	00:43	01:32	12:18	13:07	13:56
S 10°	–:–	00:31	01:22	12:31	13:18	14:05
20°	–:–	00:18	01:11	12:45	13:30	14:14
30°	–:–	00:03	00:58	13:01	13:44	14:25
35°	23:54	–:–	00:51	13:10	13:52	14:31
40°	23:44	–:–	00:43	13:21	14:01	14:38
45°	23:32	–:–	00:33	13:33	14:11	14:47
S 50°	23:18	–:–	00:21	13:48	14:24	14:56
52°	23:11	–:–	00:16	13:55	14:30	15:01
54°	23:03	–:–	00:10	14:02	14:36	15:06
56°	22:55	–:–	00:03	14:11	14:43	15:11
58°	22:46	23:56	–:–	14:21	14:52	15:17
S 60°	22:35	23:47	–:–	14:32	15:01	15:24

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 22-24 49-30%
19	00:50	00:56	11:59	06:06	18:30	
20	01:03	01:09	11:59	06:55	19:19	
21	01:15	01:21	11:59	07:44	20:09	

April 22, 23, 24 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	210°14.5	213°30.7	N01°50.4	152°08.9	N20°47.9	14°27.0	S05°01.8	302°50.3	S22°03.2
1	225°17.0	228°32.4	50.1	167°09.6	48.3	29°29.8	01.7	317°52.9	03.2
2	240°19.5	243°34.1	49.9	182°10.3	48.7	44°32.5	01.6	332°55.4	03.2
3	255°21.9	258°35.8	·· 49.7	197°10.9	·· 49.1	59°35.3	·· 01.5	347°57.9	·· 03.2
4	270°24.4	273°37.5	49.4	212°11.6	49.5	74°38.0	01.3	3°00.5	03.2
5	285°26.9	288°39.1	49.2	227°12.2	49.8	89°40.7	01.2	18°03.0	03.2
6	300°29.3	303°40.8	N01°49.0	242°12.9	N20°50.2	104°43.5	S05°01.1	33°05.5	S22°03.2
7	315°31.8	318°42.5	48.8	257°13.5	50.6	119°46.2	01.0	48°08.1	03.2
8	330°34.3	333°44.2	48.5	272°14.2	51.0	134°49.0	00.9	63°10.6	03.2
9	345°36.7	348°45.8	·· 48.3	287°14.9	·· 51.4	149°51.7	·· 00.8	78°13.1	·· 03.2
10	0°39.2	3°47.5	48.1	302°15.5	51.8	164°54.5	00.7	93°15.7	03.2
11	15°41.6	18°49.2	47.9	317°16.2	52.1	179°57.2	00.6	108°18.2	03.2
12	30°44.1	33°50.8	N01°47.7	332°16.8	N20°52.5	194°59.9	S05°00.5	123°20.7	S22°03.2
13	45°46.6	48°52.5	47.5	347°17.5	52.9	210°02.7	00.4	138°23.3	03.2
14	60°49.0	63°54.2	47.2	2°18.2	53.3	225°05.4	00.2	153°25.8	03.2
15	75°51.5	78°55.8	·· 47.0	17°18.8	·· 53.7	240°08.2	·· 00.1	168°28.4	·· 03.2
16	90°54.0	93°57.5	46.8	32°19.5	54.0	255°10.9	05°00.0	183°30.9	03.2
17	105°56.4	108°59.1	46.6	47°20.1	54.4	270°13.7	04°59.9	198°33.4	03.2
18	120°58.9	124°00.8	N01°46.4	62°20.8	N20°54.8	285°16.4	S04°59.8	213°36.0	S22°03.2
19	136°01.4	139°02.4	46.2	77°21.5	55.2	300°19.1	59.7	228°38.5	03.2
20	151°03.8	154°04.0	46.0	92°22.1	55.6	315°21.9	59.6	243°41.0	03.2
21	166°06.3	169°05.7	·· 45.8	107°22.8	·· 55.9	330°24.6	·· 59.5	258°43.6	·· 03.2
22	181°08.7	184°07.3	45.6	122°23.4	56.3	345°27.4	59.4	273°46.1	03.2
23	196°11.2	199°09.0	45.4	137°24.1	56.7	0°30.1	59.3	288°48.6	03.2
Mer.pass.:09:57		v1.7 d-0.2 m-4.5		v0.7 d0.4 m1.6		v2.7 d0.1 m-2.3		v2.5 d0.0 m0.3	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	211°13.7	214°10.6	N01°45.2	152°24.7	N20°57.1	15°32.9	S04°59.1	303°51.2	S22°03.2
1	226°16.1	229°12.2	45.0	167°25.4	57.4	30°35.6	59.0	318°53.7	03.1
2	241°18.6	244°13.8	44.8	182°26.1	57.8	45°38.3	58.9	333°56.2	03.1
3	256°21.1	259°15.4	·· 44.6	197°26.7	·· 58.2	60°41.1	·· 58.8	348°58.8	·· 03.1
4	271°23.5	274°17.1	44.4	212°27.4	58.6	75°43.8	58.7	4°01.3	03.1
5	286°26.0	289°18.7	44.3	227°28.0	58.9	90°46.6	58.6	19°03.9	03.1
6	301°28.5	304°20.3	N01°44.1	242°28.7	N20°59.3	105°49.3	S04°58.5	34°06.4	S22°03.1
7	316°30.9	319°21.9	43.9	257°29.3	20°59.7	120°52.0	58.4	49°08.9	03.1
8	331°33.4	334°23.5	43.7	272°30.0	21°00.1	135°54.8	58.3	64°11.5	03.1
9	346°35.9	349°25.1	·· 43.5	287°30.7	·· 00.4	150°57.5	·· 58.2	79°14.0	·· 03.1
10	1°38.3	4°26.7	43.4	302°31.3	00.8	166°00.3	58.1	94°16.5	03.1
11	16°40.8	19°28.3	43.2	317°32.0	01.2	181°03.0	57.9	109°19.1	03.1
12	31°43.2	34°29.9	N01°43.0	332°32.6	N21°01.6	196°05.7	S04°57.8	124°21.6	S22°03.1
13	46°45.7	49°31.5	42.8	347°33.3	01.9	211°08.5	57.7	139°24.2	03.1
14	61°48.2	64°33.1	42.7	2°33.9	02.3	226°11.2	57.6	154°26.7	03.1
15	76°50.6	79°34.6	·· 42.5	17°34.6	·· 02.7	241°14.0	·· 57.5	169°29.2	·· 03.1
16	91°53.1	94°36.2	42.3	32°35.3	03.1	256°16.7	57.4	184°31.8	03.1
17	106°55.6	109°37.8	42.2	47°35.9	03.4	271°19.4	57.3	199°34.3	03.1
18	121°58.0	124°39.4	N01°42.0	62°36.6	N21°03.8	286°22.2	S04°57.2	214°36.9	S22°03.1
19	137°00.5	139°40.9	41.8	77°37.2	04.2	301°24.9	57.1	229°39.4	03.1
20	152°03.0	154°42.5	41.7	92°37.9	04.5	316°27.7	57.0	244°41.9	03.1
21	167°05.4	169°44.1	·· 41.5	107°38.5	·· 04.9	331°30.4	·· 56.9	259°44.5	·· 03.1
22	182°07.9	184°45.6	41.3	122°39.2	05.3	346°33.1	56.8	274°47.0	03.1
23	197°10.4	199°47.2	41.2	137°39.9	05.6	1°35.9	56.6	289°49.6	03.1
Mer.pass.:09:53		v1.6 d-0.2 m-4.5		v0.7 d0.4 m1.6		v2.7 d0.1 m-2.3		v2.5 d0.0 m0.3	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	212°12.8	214°48.8	N01°41.0	152°40.5	N21°06.0	16°38.6	S04°56.5	304°52.1	S22°03.1
1	227°15.3	229°50.3	40.9	167°41.2	06.4	31°41.3	56.4	319°54.6	03.1
2	242°17.7	244°51.9	40.7	182°41.8	06.8	46°44.1	56.3	334°57.2	03.1
3	257°20.2	259°53.4	·· 40.6	197°42.5	·· 07.1	61°46.8	·· 56.2	349°59.7	·· 03.1
4	272°22.7	274°55.0	40.4	212°43.1	07.5	76°49.6	56.1	5°02.3	03.1
5	287°25.1	289°56.5	40.3	227°43.8	07.9	91°52.3	56.0	20°04.8	03.1
6	302°27.6	304°58.0	N01°40.1	242°44.4	N21°08.2	106°55.0	S04°55.9	35°07.3	S22°03.1
7	317°30.1	319°59.6	40.0	257°45.1	08.6	121°57.8	55.8	50°09.9	03.1
8	332°32.5	335°01.1	39.9	272°45.8	09.0	137°00.5	55.7	65°12.4	03.0
9	347°35.0	350°02.7	·· 39.7	287°46.4	·· 09.3	152°03.2	·· 55.6	80°15.0	·· 03.0
10	2°37.5	5°04.2	39.6	302°47.1	09.7	167°06.0	55.5	95°17.5	03.0
11	17°39.9	20°05.7	39.5	317°47.7	10.1	182°08.7	55.3	110°20.1	03.0
12	32°42.4	35°07.2	N01°39.3	332°48.4	N21°10.4	197°11.5	S04°55.2	125°22.6	S22°03.0
13	47°44.8	50°08.8	39.2	347°49.0	10.8	212°14.2	55.1	140°25.1	03.0
14	62°47.3	65°10.3	39.1	2°49.7	11.1	227°16.9	55.0	155°27.7	03.0
15	77°49.8	80°11.8	·· 38.9	17°50.3	·· 11.5	242°19.7	·· 54.9	170°30.2	·· 03.0
16	92°52.2	95°13.3	38.8	32°51.0	11.9	257°22.4	54.8	185°32.8	03.0
17	107°54.7	110°14.8	38.7	47°51.7	12.2	272°25.1	54.7	200°35.3	03.0
18	122°57.2	125°16.3	N01°38.5	62°52.3	N21°12.6	287°27.9	S04°54.6	215°37.9	S22°03.0
19	137°59.6	140°17.8	38.4	77°53.0	13.0	302°30.6	54.5	230°40.4	03.0
20	153°02.1	155°19.3	38.3	92°53.6	13.3	317°33.3	54.4	245°42.9	03.0
21	168°04.6	170°20.8	·· 38.2	107°54.3	·· 13.7	332°36.1	·· 54.3	260°45.5	·· 03.0
22	183°07.0	185°22.3	38.1	122°54.9	14.0	347°38.8	54.2	275°48.0	03.0
23	198°09.5	200°23.8	37.9	137°55.6	14.4	2°41.5	54.1	290°50.6	03.0
Mer.pass.:09:50		v1.6 d-0.2 m-4.5		v0.7 d0.4 m1.6		v2.7 d0.1 m-2.3		v2.5 d0.0 m0.3	

Stars

	SHA	**Dec**
Alpheratz	357°41.1	29°10.9
Ankaa	353°13.6	-42°12.8
Schedar	349°38.0	56°37.7
Diphda	348°53.6	-17°53.7
Achernar	335°25.5	-57°09.1
Hamal	327°58.2	23°32.4
Polaris	317°03.0	89°20.1
Acamar	315°16.8	-40°14.4
Menkar	314°12.7	4°09.2
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.3
Capella	280°31.0	46°00.8
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.3	-52°42.8
Sirius	258°31.6	-16°44.8
Adhara	255°10.6	-29°00.1
Procyon	244°57.1	5°10.6
Pollux	243°24.7	27°58.9
Avior	234°16.9	-59°34.3
Suhail	222°50.4	-43°30.5
Miaplacidus	221°38.8	-69°47.7
Alphard	217°53.5	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.2	61°39.6
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.4
Acrux	173°05.7	-63°11.8
Gacrux	171°57.4	-57°12.7
Alioth	166°18.0	55°52.1
Spica	158°28.2	-11°15.1
Alkaid	152°56.4	49°13.7
Hadar	148°43.5	-60°27.3
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.5	-60°54.2
Kochab	137°19.1	74°05.1
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.4
Antares	112°22.8	-26°28.0
Atria	107°21.8	-69°03.1
Sabik	102°09.3	-15°44.6
Shaula	96°18.1	-37°06.7
Rasalhague	96°03.8	12°32.9
Eltanin	90°44.6	51°29.1
Kaus Aust.	83°40.2	-34°22.3
Vega	80°37.0	38°47.9
Nunki	75°55.0	-26°16.3
Altair	62°05.7	8°54.8
Peacock	53°15.3	-56°40.4
Deneb	49°29.7	45°20.3
Enif	33°44.7	9°57.2
Al Na'ir	27°40.8	-46°52.5
Fomalhaut	15°21.4	-29°31.8
Scheat	13°51.1	28°10.4
Markab	13°36.0	15°17.7

Apr 22 Sat	**SHA**	**Mer.pass**
Venus	3°16.1	09:45
Mars	301°54.4	13:51
Jupiter	164°12.5	22:58
Saturn	92°35.8	03:48

Apr 23 Sun	**SHA**	**Mer.pass**
Venus	2°56.9	09:42
Mars	301°11.1	13:50
Jupiter	164°19.2	22:54
Saturn	92°37.5	03:44

Apr 24 Mon	**SHA**	**Mer.pass**
Venus	2°35.9	09:40
Mars	300°27.7	13:49
Jupiter	164°25.8	22:49
Saturn	92°39.3	03:40

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.4363 sec ΔT = TT-UT1 = +68.7477 sec

2017 April 22 to Apr. 24 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	180°21.7	N12°11.1	235°53.2	11.0′	S10°42.2	9.1′	57.3′
1	195°21.8	12.0	250°23.2	11.0′	10°33.1	9.2′	57.4′
2	210°22.0	12.8	264°53.2	11.0′	10°23.9	9.2′	57.4′
3	225°22.1	·· 13.7	279°23.2	11.0′	10°14.6	9.3′	57.4′
4	240°22.2	14.5	293°53.2	11.0′	10°05.3	9.4′	57.5′
5	255°22.3	15.3	308°23.2	11.0′	09°55.9	9.4′	57.5′
6	270°22.4	N12°16.2	322°53.2	11.0′	S09°46.5	9.5′	57.6′
7	285°22.6	17.0	337°23.1	10.9′	09°37.0	9.6′	57.6′
8	300°22.7	17.9	351°53.1	10.9′	09°27.4	9.6′	57.6′
9	315°22.8	·· 18.7	6°23.0	10.9′	09°17.7	9.7′	57.7′
10	330°22.9	19.5	20°52.9	10.9′	09°08.0	9.7′	57.7′
11	345°23.0	20.4	35°22.8	10.9′	08°58.3	9.8′	57.8′
12	0°23.2	N12°21.2	49°52.6	10.9′	S08°48.4	9.9′	57.8′
13	15°23.3	22.0	64°22.5	10.8′	08°38.5	9.9′	57.8′
14	30°23.4	22.9	78°52.3	10.8′	08°28.6	10.0′	57.9′
15	45°23.5	·· 23.7	93°22.2	10.8′	08°18.6	10.0′	57.9′
16	60°23.6	24.5	107°51.9	10.8′	08°08.5	10.1′	57.9′
17	75°23.8	25.4	122°21.7	10.8′	07°58.4	10.2′	58.0′
18	90°23.9	N12°26.2	136°51.5	10.7′	S07°48.2	10.2′	58.0′
19	105°24.0	27.1	151°21.2	10.7′	07°37.9	10.3′	58.1′
20	120°24.1	27.9	165°50.9	10.7′	07°27.6	10.3′	58.1′
21	135°24.2	·· 28.7	180°20.6	10.7′	07°17.3	10.4′	58.1′
22	150°24.3	29.6	194°50.3	10.7′	07°06.8	10.4′	58.2′
23	165°24.5	30.4	209°20.0	10.6′	06°56.4	10.5′	58.2′
	SD.=15.9	d=0.8	S.D.=15.8				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°24.6	N12°31.2	223°49.6	10.6′	S06°45.9	10.5′	58.3′
1	195°24.7	32.1	238°19.2	10.6′	06°35.3	10.6′	58.3′
2	210°24.8	32.9	252°48.8	10.6′	06°24.7	10.6′	58.3′
3	225°24.9	·· 33.7	267°18.4	10.6′	06°14.0	10.7′	58.4′
4	240°25.0	34.5	281°47.9	10.5′	06°03.3	10.7′	58.4′
5	255°25.2	35.4	296°17.4	10.5′	05°52.5	10.8′	58.5′
6	270°25.3	N12°36.2	310°46.9	10.5′	S05°41.7	10.8′	58.5′
7	285°25.4	37.0	325°16.4	10.5′	05°30.8	10.9′	58.5′
8	300°25.5	37.9	339°45.8	10.4′	05°19.9	10.9′	58.6′
9	315°25.6	·· 38.7	354°15.2	10.4′	05°09.0	11.0′	58.6′
10	330°25.7	39.5	8°44.6	10.4′	04°58.0	11.0′	58.6′
11	345°25.8	40.4	23°14.0	10.3′	04°46.9	11.1′	58.7′
12	0°26.0	N12°41.2	37°43.3	10.3′	S04°35.8	11.1′	58.7′
13	15°26.1	42.0	52°12.6	10.3′	04°24.7	11.1′	58.8′
14	30°26.2	42.8	66°41.9	10.3′	04°13.6	11.2′	58.8′
15	45°26.3	·· 43.7	81°11.2	10.2′	04°02.4	11.2′	58.8′
16	60°26.4	44.5	95°40.4	10.2′	03°51.1	11.3′	58.9′
17	75°26.5	45.3	110°09.6	10.2′	03°39.8	11.3′	58.9′
18	90°26.6	N12°46.1	124°38.7	10.1′	S03°28.5	11.3′	59.0′
19	105°26.8	47.0	139°07.8	10.1′	03°17.2	11.4′	59.0′
20	120°26.9	47.8	153°36.9	10.1′	03°05.8	11.4′	59.0′
21	135°27.0	·· 48.6	168°06.0	10.0′	02°54.4	11.4′	59.1′
22	150°27.1	49.5	182°35.0	10.0′	02°42.9	11.5′	59.1′
23	165°27.2	50.3	197°04.0	10.0′	02°31.4	11.5′	59.1′
	SD.=15.9	d=0.8	S.D.=16.0				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°27.3	N12°51.1	211°33.0	9.9′	S02°19.9	11.5′	59.2′
1	195°27.4	51.9	226°01.9	9.9′	02°08.4	11.6′	59.2′
2	210°27.5	52.7	240°30.8	9.9′	01°56.8	11.6′	59.2′
3	225°27.7	·· 53.6	254°59.6	9.8′	01°45.2	11.6′	59.3′
4	240°27.8	54.4	269°28.5	9.8′	01°33.6	11.6′	59.3′
5	255°27.9	55.2	283°57.2	9.8′	01°22.0	11.7′	59.4′
6	270°28.0	N12°56.0	298°26.0	9.7′	S01°10.3	11.7′	59.4′
7	285°28.1	56.9	312°54.7	9.7′	00°58.6	11.7′	59.4′
8	300°28.2	57.7	327°23.4	9.7′	00°46.9	11.7′	59.5′
9	315°28.3	·· 58.5	341°52.0	9.6′	00°35.2	11.7′	59.5′
10	330°28.4	12°59.3	356°20.6	9.6′	00°23.5	11.8′	59.5′
11	345°28.5	13°00.1	10°49.2	9.5′	S00°11.7	11.8′	59.6′
12	0°28.6	N13°01.0	25°17.7	9.5′	N00°00.1	11.8′	59.6′
13	15°28.8	01.8	39°46.1	9.5′	00°11.9	11.8′	59.6′
14	30°28.9	02.6	54°14.6	9.4′	00°23.7	11.8′	59.7′
15	45°29.0	·· 03.4	68°43.0	9.4′	00°35.5	11.8′	59.7′
16	60°29.1	04.2	83°11.3	9.3′	00°47.3	11.8′	59.7′
17	75°29.2	05.1	97°39.6	9.3′	00°59.1	11.8′	59.8′
18	90°29.3	N13°05.9	112°07.9	9.2′	N01°11.0	11.8′	59.8′
19	105°29.4	06.7	126°36.1	9.2′	01°22.8	11.9′	59.8′
20	120°29.5	07.5	141°04.3	9.2′	01°34.7	11.9′	59.9′
21	135°29.6	·· 08.3	155°32.4	9.1′	01°46.5	11.9′	59.9′
22	150°29.7	09.1	170°00.5	9.1′	01°58.4	11.9′	59.9′
23	165°29.8	10.0	184°28.6	9.0′	02°10.3	11.9′	59.9′
	SD.=15.9	d=0.8	S.D.=16.2				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	02:50	21:12	▭	▭
N 70°	▭	01:28	03:14	20:46	22:38	▭
68°	▭	02:11	03:33	20:26	21:51	▭
66°	▭	02:39	03:48	20:11	21:21	▭
64°	01:17	03:00	04:01	19:58	20:59	22:48
62°	01:55	03:17	04:11	19:47	20:42	22:06
60°	02:21	03:31	04:20	19:38	20:28	21:39
N 58°	02:41	03:42	04:28	19:30	20:16	21:18
56°	02:57	03:52	04:35	19:23	20:06	21:02
54°	03:10	04:01	04:41	19:17	19:57	20:48
52°	03:22	04:09	04:46	19:12	19:49	20:37
50°	03:32	04:16	04:51	19:06	19:42	20:26
45°	03:52	04:30	05:02	18:56	19:27	20:06
N 40°	04:07	04:42	05:11	18:47	19:15	19:50
35°	04:20	04:52	05:18	18:39	19:06	19:37
30°	04:30	05:00	05:25	18:32	18:57	19:27
20°	04:47	05:13	05:36	18:21	18:44	19:10
N 10°	04:59	05:24	05:46	18:11	18:32	18:58
0°	05:09	05:34	05:55	18:02	18:23	18:47
S 10°	05:18	05:42	06:04	17:53	18:14	18:39
20°	05:25	05:51	06:13	17:43	18:05	18:31
30°	05:31	06:00	06:24	17:32	17:57	18:25
35°	05:35	06:04	06:30	17:26	17:52	18:22
40°	05:38	06:09	06:37	17:19	17:47	18:18
45°	05:40	06:15	06:45	17:11	17:41	18:15
S 50°	05:43	06:21	06:55	17:01	17:35	18:12
52°	05:45	06:24	06:59	16:57	17:32	18:11
54°	05:46	06:27	07:04	16:52	17:28	18:10
56°	05:47	06:31	07:09	16:46	17:25	18:09
58°	05:48	06:34	07:15	16:40	17:21	18:07
S 60°	05:49	06:38	07:22	16:33	17:17	18:06

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	04:39	04:31	04:23	12:48	14:42	16:38
N 70°	04:23	04:22	04:21	13:02	14:48	16:37
68°	04:11	04:15	04:19	13:13	14:53	16:36
66°	04:00	04:09	04:18	13:23	14:57	16:35
64°	03:51	04:04	04:16	13:30	15:01	16:34
62°	03:44	04:00	04:15	13:37	15:04	16:34
60°	03:37	03:56	04:14	13:43	15:06	16:33
N 58°	03:31	03:53	04:13	13:48	15:09	16:33
56°	03:26	03:50	04:13	13:52	15:11	16:33
54°	03:21	03:47	04:12	13:56	15:13	16:32
52°	03:17	03:45	04:11	14:00	15:14	16:32
50°	03:13	03:42	04:11	14:03	15:16	16:32
45°	03:05	03:37	04:09	14:10	15:19	16:31
N 40°	02:58	03:33	04:08	14:16	15:22	16:30
35°	02:52	03:30	04:07	14:21	15:24	16:30
30°	02:47	03:27	04:07	14:25	15:26	16:30
20°	02:37	03:21	04:05	14:33	15:30	16:29
N 10°	02:29	03:16	04:04	14:39	15:33	16:28
0°	02:22	03:12	04:03	14:45	15:36	16:28
S 10°	02:14	03:07	04:02	14:52	15:39	16:27
20°	02:06	03:02	04:00	14:58	15:42	16:26
30°	01:57	02:57	03:59	15:05	15:45	16:25
35°	01:51	02:54	03:58	15:10	15:47	16:25
40°	01:45	02:50	03:58	15:14	15:49	16:24
45°	01:38	02:46	03:57	15:20	15:52	16:24
S 50°	01:29	02:41	03:55	15:26	15:55	16:23
52°	01:25	02:38	03:55	15:29	15:56	16:23
54°	01:21	02:36	03:54	15:33	15:58	16:22
56°	01:16	02:33	03:54	15:36	15:59	16:22
58°	01:11	02:30	03:53	15:40	16:01	16:21
S 60°	01:04	02:26	03:52	15:45	16:03	16:21

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 25-27 20-6%
22	01:27	01:33	11:58	08:34	20:59	
23	01:38	01:44	11:58	09:24	21:49	
24	01:49	01:55	11:58	10:15	22:41	

April 25, 26, 27 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	213°12.0	215°25.3	N01°37.8	152°56.2	N21°14.8	17°44.3	S04°54.0	305°53.1	S22°03.0
1	228°14.4	230°26.8	37.7	167°56.9	15.1	32°47.0	53.9	320°55.7	03.0
2	243°16.9	245°28.3	37.6	182°57.5	15.5	47°49.8	53.7	335°58.2	03.0
3	258°19.3	260°29.8	·· 37.5	197°58.2	·· 15.9	62°52.5	·· 53.6	351°00.8	·· 03.0
4	273°21.8	275°31.2	37.4	212°58.9	16.2	77°55.2	53.5	6°03.3	03.0
5	288°24.3	290°32.7	37.3	227°59.5	16.6	92°58.0	53.4	21°05.9	03.0
6	303°26.7	305°34.2	N01°37.2	243°00.2	N21°16.9	108°00.7	S04°53.3	36°08.4	S22°03.0
7	318°29.2	320°35.7	37.1	258°00.8	17.3	123°03.4	53.2	51°10.9	03.0
8	333°31.7	335°37.1	37.0	273°01.5	17.6	138°06.2	53.1	66°13.5	03.0
9	348°34.1	350°38.6	·· 36.9	288°02.1	·· 18.0	153°08.9	·· 53.0	81°16.0	·· 03.0
10	3°36.6	5°40.1	36.8	303°02.8	18.4	168°11.6	52.9	96°18.6	03.0
11	18°39.1	20°41.5	36.7	318°03.4	18.7	183°14.4	52.8	111°21.1	03.0
12	33°41.5	35°43.0	N01°36.6	333°04.1	N21°19.1	198°17.1	S04°52.7	126°23.7	S22°03.0
13	48°44.0	50°44.4	36.5	348°04.7	19.4	213°19.8	52.6	141°26.2	03.0
14	63°46.4	65°45.9	36.4	3°05.4	19.8	228°22.6	52.5	156°28.8	03.0
15	78°48.9	80°47.3	·· 36.3	18°06.0	·· 20.1	243°25.3	·· 52.4	171°31.3	·· 02.9
16	93°51.4	95°48.8	36.2	33°06.7	20.5	258°28.0	52.3	186°33.9	02.9
17	108°53.8	110°50.2	36.1	48°07.3	20.9	273°30.8	52.2	201°36.4	02.9
18	123°56.3	125°51.7	N01°36.1	63°08.0	N21°21.2	288°33.5	S04°52.0	216°39.0	S22°02.9
19	138°58.8	140°53.1	36.0	78°08.7	21.6	303°36.2	51.9	231°41.5	02.9
20	154°01.2	155°54.5	35.9	93°09.3	21.9	318°39.0	51.8	246°44.1	02.9
21	169°03.7	170°56.0	·· 35.8	108°10.0	·· 22.3	333°41.7	·· 51.7	261°46.6	·· 02.9
22	184°06.2	185°57.4	35.7	123°10.6	22.6	348°44.4	51.6	276°49.2	02.9
23	199°08.6	200°58.8	35.7	138°11.3	23.0	3°47.1	51.5	291°51.7	02.9
Mer.pass.:09:46		v1.5 d-0.1 m-4.5		v0.7 d0.4 m1.6		v2.7 d0.1 m-2.3		v2.5 d0.0 m0.3	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	214°11.1	216°00.3	N01°35.6	153°11.9	N21°23.3	18°49.9	S04°51.4	306°54.3	S22°02.9
1	229°13.6	231°01.7	35.5	168°12.6	23.7	33°52.6	51.3	321°56.8	02.9
2	244°16.0	246°03.1	35.4	183°13.2	24.0	48°55.3	51.2	336°59.3	02.9
3	259°18.5	261°04.5	·· 35.4	198°13.9	·· 24.4	63°58.1	·· 51.1	352°01.9	·· 02.9
4	274°20.9	276°05.9	35.3	213°14.5	24.7	79°00.8	51.0	7°04.4	02.9
5	289°23.4	291°07.4	35.2	228°15.2	25.1	94°03.5	50.9	22°07.0	02.9
6	304°25.9	306°08.8	N01°35.2	243°15.8	N21°25.4	109°06.3	S04°50.8	37°09.5	S22°02.9
7	319°28.3	321°10.2	35.1	258°16.5	25.8	124°09.0	50.7	52°12.1	02.9
8	334°30.8	336°11.6	35.0	273°17.1	26.1	139°11.7	50.6	67°14.6	02.9
9	349°33.3	351°13.0	·· 35.0	288°17.8	·· 26.5	154°14.5	·· 50.5	82°17.2	·· 02.9
10	4°35.7	6°14.4	34.9	303°18.4	26.8	169°17.2	50.4	97°19.7	02.9
11	19°38.2	21°15.8	34.9	318°19.1	27.2	184°19.9	50.3	112°22.3	02.9
12	34°40.7	36°17.2	N01°34.8	333°19.7	N21°27.5	199°22.6	S04°50.2	127°24.8	S22°02.9
13	49°43.1	51°18.6	34.8	348°20.4	27.9	214°25.4	50.1	142°27.4	02.9
14	64°45.6	66°19.9	34.7	3°21.0	28.2	229°28.1	50.0	157°30.0	02.9
15	79°48.1	81°21.3	·· 34.6	18°21.7	·· 28.6	244°30.8	·· 49.8	172°32.5	·· 02.9
16	94°50.5	96°22.7	34.6	33°22.3	28.9	259°33.6	49.7	187°35.1	02.9
17	109°53.0	111°24.1	34.5	48°23.0	29.3	274°36.3	49.6	202°37.6	02.9
18	124°55.4	126°25.5	N01°34.5	63°23.6	N21°29.6	289°39.0	S04°49.5	217°40.2	S22°02.9
19	139°57.9	141°26.9	34.5	78°24.3	30.0	304°41.8	49.4	232°42.7	02.9
20	155°00.4	156°28.2	34.4	93°24.9	30.3	319°44.5	49.3	247°45.3	02.9
21	170°02.8	171°29.6	·· 34.4	108°25.6	·· 30.7	334°47.2	·· 49.2	262°47.8	·· 02.9
22	185°05.3	186°31.0	34.3	123°26.2	31.0	349°49.9	49.1	277°50.4	02.8
23	200°07.8	201°32.3	34.3	138°26.9	31.4	4°52.7	49.0	292°52.9	02.8
Mer.pass.:09:42		v1.4 d-0.1 m-4.5		v0.7 d0.4 m1.6		v2.7 d0.1 m-2.3		v2.5 d0.0 m0.3	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	215°10.2	216°33.7	N01°34.3	153°27.5	N21°31.7	19°55.4	S04°48.9	307°55.5	S22°02.8
1	230°12.7	231°35.1	34.2	168°28.2	32.1	34°58.1	48.8	322°58.0	02.8
2	245°15.2	246°36.4	34.2	183°28.8	32.4	50°00.8	48.7	338°00.6	02.8
3	260°17.6	261°37.8	·· 34.2	198°29.5	·· 32.7	65°03.6	·· 48.6	353°03.1	·· 02.8
4	275°20.1	276°39.1	34.1	213°30.2	33.1	80°06.3	48.5	8°05.7	02.8
5	290°22.5	291°40.5	34.1	228°30.8	33.4	95°09.0	48.4	23°08.2	02.8
6	305°25.0	306°41.8	N01°34.1	243°31.5	N21°33.8	110°11.8	S04°48.3	38°10.8	S22°02.8
7	320°27.5	321°43.2	34.0	258°32.1	34.1	125°14.5	48.2	53°13.3	02.8
8	335°29.9	336°44.5	34.0	273°32.8	34.5	140°17.2	48.1	68°15.9	02.8
9	350°32.4	351°45.9	·· 34.0	288°33.4	·· 34.8	155°19.9	·· 48.0	83°18.5	·· 02.8
10	5°34.9	6°47.2	34.0	303°34.1	35.1	170°22.7	47.9	98°21.0	02.8
11	20°37.3	21°48.5	34.0	318°34.7	35.5	185°25.4	47.8	113°23.6	02.8
12	35°39.8	36°49.9	N01°33.9	333°35.4	N21°35.8	200°28.1	S04°47.7	128°26.1	S22°02.8
13	50°42.3	51°51.2	33.9	348°36.0	36.2	215°30.8	47.6	143°28.7	02.8
14	65°44.7	66°52.5	33.9	3°36.7	36.5	230°33.6	47.5	158°31.2	02.8
15	80°47.2	81°53.9	·· 33.9	18°37.3	·· 36.8	245°36.3	·· 47.4	173°33.8	·· 02.8
16	95°49.7	96°55.2	33.9	33°37.9	37.2	260°39.0	47.3	188°36.3	02.8
17	110°52.1	111°56.5	33.9	48°38.6	37.5	275°41.7	47.2	203°38.9	02.8
18	125°54.6	126°57.8	N01°33.9	63°39.2	N21°37.9	290°44.5	S04°47.1	218°41.4	S22°02.8
19	140°57.0	141°59.1	33.9	78°39.9	38.2	305°47.2	47.0	233°44.0	02.8
20	155°59.5	157°00.5	33.8	93°40.5	38.5	320°49.9	46.9	248°46.6	02.8
21	171°02.0	172°01.8	·· 33.8	108°41.2	·· 38.9	335°52.6	·· 46.8	263°49.1	·· 02.8
22	186°04.4	187°03.1	33.8	123°41.8	39.2	350°55.4	46.7	278°51.7	02.8
23	201°06.9	202°04.4	33.8	138°42.5	39.5	5°58.1	46.6	293°54.2	02.8
Mer.pass.:09:38		v1.4 d-0.0 m-4.5		v0.7 d0.3 m1.6		v2.7 d0.1 m-2.3		v2.6 d0.0 m0.3	

Stars

	SHA	**Dec**
Alpheratz	357°41.1	29°10.9
Ankaa	353°13.6	-42°12.8
Schedar	349°38.0	56°37.6
Diphda	348°53.6	-17°53.7
Achernar	335°25.5	-57°09.1
Hamal	327°58.2	23°32.4
Polaris	317°03.1	89°20.1
Acamar	315°16.8	-40°14.4
Menkar	314°12.7	4°09.2
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.2
Capella	280°31.0	46°00.8
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.3	-52°42.7
Sirius	258°31.6	-16°44.8
Adhara	255°10.6	-29°00.1
Procyon	244°57.1	5°10.6
Pollux	243°24.7	27°58.9
Avior	234°16.9	-59°34.3
Suhail	222°50.4	-43°30.5
Miaplacidus	221°38.9	-69°47.7
Alphard	217°53.5	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.3	61°39.6
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.4
Acrux	173°05.7	-63°11.8
Gacrux	171°57.4	-57°12.7
Alioth	166°18.0	55°52.1
Spica	158°28.2	-11°15.1
Alkaid	152°56.4	49°13.7
Hadar	148°43.5	-60°27.3
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.5	-60°54.2
Kochab	137°19.1	74°05.2
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.4
Antares	112°22.8	-26°28.0
Atria	107°21.8	-69°03.1
Sabik	102°09.3	-15°44.6
Shaula	96°18.1	-37°06.7
Rasalhague	96°03.8	12°32.9
Eltanin	90°44.6	51°29.1
Kaus Aust.	83°40.2	-34°22.3
Vega	80°37.0	38°47.9
Nunki	75°55.0	-26°16.3
Altair	62°05.7	8°54.8
Peacock	53°15.2	-56°40.4
Deneb	49°29.7	45°20.3
Enif	33°44.7	9°57.2
Al Na'ir	27°40.8	-46°52.4
Fomalhaut	15°21.4	-29°31.8
Scheat	13°51.1	28°10.4
Markab	13°36.0	15°17.7

Apr 25 Tue	**SHA**	**Mer.pass**
Venus	2°13.4	09:37
Mars	299°44.3	13:48
Jupiter	164°32.3	22:45
Saturn	92°41.2	03:36

Apr 26 Wed	**SHA**	**Mer.pass**
Venus	1°49.2	09:35
Mars	299°00.8	13:47
Jupiter	164°38.8	22:41
Saturn	92°43.2	03:32

Apr 27 Thu	**SHA**	**Mer.pass**
Venus	1°23.5	09:33
Mars	298°17.3	13:46
Jupiter	164°45.2	22:36
Saturn	92°45.2	03:28

Horizontal parallax	
Venus:	0.4
Mars:	0.1

DUT1 = UT1-UTC = +0.4315 sec ΔT = TT-UT1 = +68.7525 sec

2017 April 25 to Apr. 27 UT

h

Tue	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	180°29.9	N13°10.8	198°56.6	9.0′	N02°22.1	11.9′	60.0′
1	195°30.1	11.6	213°24.5	8.9′	02°34.0	11.9′	60.0′
2	210°30.2	12.4	227°52.4	8.9′	02°45.9	11.9′	60.0′
3	225°30.3	·· 13.2	242°20.3	8.8′	02°57.7	11.9′	60.1′
4	240°30.4	14.0	256°48.1	8.8′	03°09.6	11.8′	60.1′
5	255°30.5	14.8	271°15.9	8.7′	03°21.4	11.8′	60.1′
6	270°30.6	N13°15.7	285°43.6	8.7′	N03°33.2	11.8′	60.2′
7	285°30.7	16.5	300°11.2	8.6′	03°45.1	11.8′	60.2′
8	300°30.8	17.3	314°38.9	8.6′	03°56.9	11.8′	60.2′
9	315°30.9	·· 18.1	329°06.4	8.5′	04°08.7	11.8′	60.2′
10	330°31.0	18.9	343°33.9	8.5′	04°20.5	11.8′	60.3′
11	345°31.1	19.7	358°01.4	8.4′	04°32.2	11.8′	60.3′
12	0°31.2	N13°20.5	12°28.8	8.4′	N04°44.0	11.7′	60.3′
13	15°31.3	21.3	26°56.2	8.3′	04°55.7	11.7′	60.3′
14	30°31.4	22.1	41°23.5	8.3′	05°07.4	11.7′	60.4′
15	45°31.5	·· 23.0	55°50.8	8.2′	05°19.1	11.7′	60.4′
16	60°31.6	23.8	70°18.0	8.2′	05°30.8	11.7′	60.4′
17	75°31.7	24.6	84°45.2	8.1′	05°42.4	11.6′	60.4′
18	90°31.8	N13°25.4	99°12.3	8.1′	N05°54.0	11.6′	60.5′
19	105°31.9	26.2	113°39.3	8.0′	06°05.6	11.6′	60.5′
20	120°32.0	27.0	128°06.3	8.0′	06°17.2	11.5′	60.5′
21	135°32.1	·· 27.8	142°33.3	7.9′	06°28.7	11.5′	60.5′
22	150°32.2	28.6	157°00.2	7.9′	06°40.2	11.5′	60.6′
23	165°32.3	29.4	171°27.0	7.8′	06°51.7	11.4′	60.6′
	SD.=15.9	d=0.8			S.D.=16.4		

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°32.4	N13°30.2	185°53.8	7.8′	N07°03.1	11.4′	60.6′
1	195°32.6	31.0	200°20.5	7.7′	07°14.5	11.4′	60.6′
2	210°32.7	31.8	214°47.2	7.7′	07°25.9	11.3′	60.6′
3	225°32.8	·· 32.6	229°13.8	7.6′	07°37.2	11.3′	60.7′
4	240°32.9	33.4	243°40.4	7.5′	07°48.4	11.3′	60.7′
5	255°33.0	34.2	258°06.9	7.5′	07°59.7	11.2′	60.7′
6	270°33.1	N13°35.0	272°33.4	7.4′	N08°10.9	11.2′	60.7′
7	285°33.2	35.9	286°59.8	7.4′	08°22.0	11.1′	60.7′
8	300°33.3	36.7	301°26.2	7.3′	08°33.1	11.1′	60.7′
9	315°33.4	·· 37.5	315°52.5	7.3′	08°44.1	11.0′	60.8′
10	330°33.5	38.3	330°18.7	7.2′	08°55.1	11.0′	60.8′
11	345°33.6	39.1	344°44.9	7.2′	09°06.1	10.9′	60.8′
12	0°33.7	N13°39.9	359°11.0	7.1′	N09°16.9	10.9′	60.8′
13	15°33.8	40.7	13°37.1	7.1′	09°27.8	10.8′	60.8′
14	30°33.9	41.5	28°03.1	7.0′	09°38.5	10.7′	60.8′
15	45°33.9	·· 42.3	42°29.1	6.9′	09°49.3	10.7′	60.8′
16	60°34.0	43.1	56°55.0	6.9′	09°59.9	10.6′	60.9′
17	75°34.1	43.9	71°20.9	6.8′	10°10.5	10.6′	60.9′
18	90°34.2	N13°44.7	85°46.7	6.8′	N10°21.0	10.5′	60.9′
19	105°34.3	45.5	100°12.4	6.7′	10°31.5	10.4′	60.9′
20	120°34.4	46.3	114°38.1	6.7′	10°41.9	10.4′	60.9′
21	135°34.5	·· 47.1	129°03.8	6.6′	10°52.2	10.3′	60.9′
22	150°34.6	47.9	143°29.4	6.6′	11°02.5	10.2′	60.9′
23	165°34.7	48.7	157°54.9	6.5′	11°12.7	10.2′	60.9′
	SD.=15.9	d=0.8			S.D.=16.6		

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°34.8	N13°49.4	172°20.4	6.5′	N11°22.8	10.1′	60.9′
1	195°34.9	50.2	186°45.8	6.4′	11°32.8	10.0′	61.0′
2	210°35.0	51.0	201°11.2	6.3′	11°42.8	9.9′	61.0′
3	225°35.1	·· 51.8	215°36.5	6.3′	11°52.7	9.8′	61.0′
4	240°35.2	52.6	230°01.8	6.2′	12°02.5	9.8′	61.0′
5	255°35.3	53.4	244°27.0	6.2′	12°12.2	9.7′	61.0′
6	270°35.4	N13°54.2	258°52.1	6.1′	N12°21.9	9.6′	61.0′
7	285°35.5	55.0	273°17.3	6.1′	12°31.4	9.5′	61.0′
8	300°35.6	55.8	287°42.3	6.0′	12°40.9	9.4′	61.0′
9	315°35.7	·· 56.6	302°07.3	6.0′	12°50.3	9.4′	61.0′
10	330°35.8	57.4	316°32.3	5.9′	12°59.6	9.3′	61.0′
11	345°35.9	58.2	330°57.2	5.9′	13°08.8	9.2′	61.0′
12	0°36.0	N13°59.0	345°22.1	5.8′	N13°18.0	9.1′	61.0′
13	15°36.1	13°59.8	359°46.9	5.8′	13°27.0	9.0′	61.0′
14	30°36.2	14°00.6	14°11.7	5.7′	13°35.9	8.9′	61.0′
15	45°36.2	·· 01.4	28°36.4	5.7′	13°44.8	8.8′	61.0′
16	60°36.3	02.1	43°01.0	5.7′	13°53.5	8.7′	61.0′
17	75°36.4	02.9	57°25.7	5.6′	14°02.2	8.6′	61.0′
18	90°36.5	N14°03.7	71°50.3	5.6′	N14°10.8	8.5′	61.0′
19	105°36.6	04.5	86°14.8	5.5′	14°19.2	8.4′	61.0′
20	120°36.7	05.3	100°39.3	5.5′	14°27.6	8.3′	61.0′
21	135°36.8	·· 06.1	115°03.7	5.4′	14°35.8	8.2′	61.0′
22	150°36.9	06.9	129°28.1	5.4′	14°44.0	8.1′	61.0′
23	165°37.0	07.7	143°52.5	5.3′	14°52.1	8.0′	61.0′
	SD.=15.9	d=0.8			S.D.=16.6		

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	02:29	21:32	▭	▭
N 70°	▭	00:50	02:58	21:01	23:26	▭
68°	▭	01:50	03:20	20:39	22:12	▭
66°	▭	02:23	03:37	20:22	21:36	▭
64°	00:43	02:47	03:50	20:07	21:12	23:30
62°	01:37	03:06	04:02	19:56	20:52	22:24
60°	02:07	03:21	04:11	19:46	20:37	21:52
N 58°	02:30	03:34	04:20	19:37	20:24	21:29
56°	02:47	03:44	04:27	19:29	20:13	21:11
54°	03:02	03:54	04:34	19:23	20:03	20:56
52°	03:14	04:02	04:40	19:17	19:55	20:43
50°	03:25	04:10	04:45	19:11	19:47	20:32
45°	03:46	04:25	04:57	18:59	19:31	20:11
N 40°	04:03	04:38	05:06	18:50	19:19	19:54
35°	04:16	04:48	05:15	18:41	19:08	19:40
30°	04:27	04:57	05:22	18:34	18:59	19:29
20°	04:44	05:11	05:34	18:22	18:45	19:12
N 10°	04:58	05:23	05:45	18:11	18:33	18:58
0°	05:08	05:33	05:54	18:01	18:22	18:47
S 10°	05:18	05:43	06:04	17:51	18:13	18:38
20°	05:26	05:52	06:14	17:41	18:04	18:30
30°	05:33	06:01	06:26	17:29	17:54	18:22
35°	05:37	06:07	06:33	17:23	17:49	18:18
40°	05:40	06:12	06:40	17:15	17:43	18:15
45°	05:44	06:18	06:49	17:06	17:37	18:11
S 50°	05:48	06:26	06:59	16:56	17:29	18:07
52°	05:49	06:29	07:04	16:51	17:26	18:06
54°	05:51	06:32	07:09	16:45	17:22	18:04
56°	05:52	06:36	07:15	16:39	17:19	18:02
58°	05:54	06:40	07:22	16:33	17:14	18:01
S 60°	05:56	06:45	07:29	16:25	17:10	17:59

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	04:16	04:08	03:59	18:38	20:45	23:00
N 70°	04:20	04:19	04:19	18:29	20:26	22:26
68°	04:23	04:28	04:35	18:22	20:12	22:02
66°	04:26	04:36	04:48	18:16	20:00	21:44
64°	04:29	04:42	04:59	18:11	19:50	21:29
62°	04:31	04:48	05:08	18:07	19:42	21:16
60°	04:33	04:52	05:16	18:03	19:35	21:06
N 58°	04:34	04:57	05:23	18:00	19:29	20:57
56°	04:36	05:01	05:29	17:57	19:23	20:49
54°	04:37	05:04	05:35	17:54	19:18	20:41
52°	04:38	05:07	05:40	17:52	19:14	20:35
50°	04:39	05:10	05:45	17:50	19:10	20:29
45°	04:42	05:17	05:55	17:45	19:01	20:17
N 40°	04:44	05:22	06:03	17:41	18:54	20:07
35°	04:46	05:27	06:10	17:38	18:48	19:58
30°	04:48	05:31	06:17	17:35	18:42	19:50
20°	04:50	05:38	06:28	17:30	18:33	19:37
N 10°	04:53	05:44	06:38	17:25	18:25	19:26
0°	04:55	05:50	06:47	17:21	18:17	19:15
S 10°	04:58	05:56	06:56	17:17	18:09	19:04
20°	05:01	06:03	07:06	17:12	18:01	18:53
30°	05:04	06:10	07:18	17:07	17:52	18:40
35°	05:05	06:14	07:25	17:04	17:46	18:32
40°	05:07	06:19	07:32	17:01	17:40	18:23
45°	05:10	06:25	07:41	16:57	17:33	18:13
S 50°	05:13	06:32	07:52	16:52	17:25	18:01
52°	05:14	06:35	07:57	16:50	17:21	17:56
54°	05:15	06:39	08:03	16:48	17:17	17:50
56°	05:17	06:43	08:09	16:45	17:12	17:43
58°	05:19	06:47	08:16	16:43	17:07	17:35
S 60°	05:21	06:52	08:24	16:40	17:01	17:27

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 28-1 2-2%
25	02:00	02:05	11:58	11:08	23:36	
26	02:10	02:15	11:58	12:03	–:–	
27	02:19	02:24	11:58	13:01	00:32	

April 28, 29, 30 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	216°09.4	217°05.7	N01°33.8	153°43.1	N21°39.9	21°00.8	S04°46.5	308°56.8	S22°02.8
1	231°11.8	232°07.0	33.8	168°43.8	40.2	36°03.5	46.4	323°59.3	02.8
2	246°14.3	247°08.3	33.8	183°44.4	40.6	51°06.3	46.3	339°01.9	02.8
3	261°16.8	262°09.6	·· 33.9	198°45.1	·· 40.9	66°09.0	·· 46.2	354°04.5	·· 02.8
4	276°19.2	277°10.9	33.9	213°45.7	41.2	81°11.7	46.1	9°07.0	02.7
5	291°21.7	292°12.2	33.9	228°46.4	41.6	96°14.4	45.9	24°09.6	02.7
6	306°24.2	307°13.5	N01°33.9	243°47.0	N21°41.9	111°17.2	S04°45.8	39°12.1	S22°02.7
7	321°26.6	322°14.7	33.9	258°47.7	42.2	126°19.9	45.7	54°14.7	02.7
8	336°29.1	337°16.0	33.9	273°48.3	42.6	141°22.6	45.6	69°17.2	02.7
9	351°31.5	352°17.3	·· 33.9	288°49.0	·· 42.9	156°25.3	·· 45.5	84°19.8	·· 02.7
10	6°34.0	7°18.6	33.9	303°49.6	43.2	171°28.1	45.4	99°22.4	02.7
11	21°36.5	22°19.9	33.9	318°50.3	43.6	186°30.8	45.3	114°24.9	02.7
12	36°38.9	37°21.1	N01°34.0	333°50.9	N21°43.9	201°33.5	S04°45.2	129°27.5	S22°02.7
13	51°41.4	52°22.4	34.0	348°51.6	44.2	216°36.2	45.1	144°30.0	02.7
14	66°43.9	67°23.7	34.0	3°52.2	44.6	231°38.9	45.0	159°32.6	02.7
15	81°46.3	82°25.0	·· 34.0	18°52.9	·· 44.9	246°41.7	·· 44.9	174°35.2	·· 02.7
16	96°48.8	97°26.2	34.1	33°53.5	45.2	261°44.4	44.8	189°37.7	02.7
17	111°51.3	112°27.5	34.1	48°54.2	45.6	276°47.1	44.7	204°40.3	02.7
18	126°53.7	127°28.7	N01°34.1	63°54.8	N21°45.9	291°49.8	S04°44.6	219°42.8	S22°02.7
19	141°56.2	142°30.0	34.1	78°55.5	46.2	306°52.6	44.5	234°45.4	02.7
20	156°58.6	157°31.3	34.2	93°56.1	46.5	321°55.3	44.4	249°48.0	02.7
21	172°01.1	172°32.5	·· 34.2	108°56.8	·· 46.9	336°58.0	·· 44.3	264°50.5	·· 02.7
22	187°03.6	187°33.8	34.2	123°57.4	47.2	352°00.7	44.2	279°53.1	02.7
23	202°06.0	202°35.0	34.3	138°58.1	47.5	7°03.4	44.1	294°55.6	02.7
Mer.pass.:09:34		v1.3 d0.0 m-4.5		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.3		v2.6 d0.0 m0.3	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	217°08.5	217°36.3	N01°34.3	153°58.7	N21°47.9	22°06.2	S04°44.0	309°58.2	S22°02.7
1	232°11.0	232°37.5	34.3	168°59.3	48.2	37°08.9	43.9	325°00.8	02.7
2	247°13.4	247°38.8	34.4	184°00.0	48.5	52°11.6	43.8	340°03.3	02.7
3	262°15.9	262°40.0	·· 34.4	199°00.6	·· 48.8	67°14.3	·· 43.7	355°05.9	·· 02.7
4	277°18.4	277°41.2	34.5	214°01.3	49.2	82°17.0	43.6	10°08.4	02.7
5	292°20.8	292°42.5	34.5	229°01.9	49.5	97°19.8	43.5	25°11.0	02.7
6	307°23.3	307°43.7	N01°34.6	244°02.6	N21°49.8	112°22.5	S04°43.4	40°13.6	S22°02.7
7	322°25.8	322°44.9	34.6	259°03.2	50.2	127°25.2	43.3	55°16.1	02.7
8	337°28.2	337°46.2	34.7	274°03.9	50.5	142°27.9	43.2	70°18.7	02.7
9	352°30.7	352°47.4	·· 34.7	289°04.5	·· 50.8	157°30.6	·· 43.1	85°21.2	·· 02.7
10	7°33.1	7°48.6	34.8	304°05.2	51.1	172°33.3	43.0	100°23.8	02.6
11	22°35.6	22°49.8	34.8	319°05.8	51.5	187°36.1	42.9	115°26.4	02.6
12	37°38.1	37°51.1	N01°34.9	334°06.5	N21°51.8	202°38.8	S04°42.8	130°28.9	S22°02.6
13	52°40.5	52°52.3	34.9	349°07.1	52.1	217°41.5	42.7	145°31.5	02.6
14	67°43.0	67°53.5	35.0	4°07.8	52.4	232°44.2	42.6	160°34.1	02.6
15	82°45.5	82°54.7	·· 35.0	19°08.4	·· 52.8	247°46.9	·· 42.6	175°36.6	·· 02.6
16	97°47.9	97°55.9	35.1	34°09.1	53.1	262°49.7	42.5	190°39.2	02.6
17	112°50.4	112°57.1	35.2	49°09.7	53.4	277°52.4	42.4	205°41.7	02.6
18	127°52.9	127°58.3	N01°35.2	64°10.3	N21°53.7	292°55.1	S04°42.3	220°44.3	S22°02.6
19	142°55.3	142°59.5	35.3	79°11.0	54.0	307°57.8	42.2	235°46.9	02.6
20	157°57.8	158°00.7	35.4	94°11.6	54.4	323°00.5	42.1	250°49.4	02.6
21	173°00.3	173°01.9	·· 35.4	109°12.3	·· 54.7	338°03.2	·· 42.0	265°52.0	·· 02.6
22	188°02.7	188°03.1	35.5	124°12.9	55.0	353°06.0	41.9	280°54.6	02.6
23	203°05.2	203°04.3	35.6	139°13.6	55.3	8°08.7	41.8	295°57.1	02.6
Mer.pass.:09:30		v1.2 d0.0 m-4.5		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.3		v2.6 d0.0 m0.3	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	218°07.6	218°05.5	N01°35.6	154°14.2	N21°55.6	23°11.4	S04°41.7	310°59.7	S22°02.6
1	233°10.1	233°06.7	35.7	169°14.9	56.0	38°14.1	41.6	326°02.3	02.6
2	248°12.6	248°07.9	35.8	184°15.5	56.3	53°16.8	41.5	341°04.8	02.6
3	263°15.0	263°09.1	·· 35.9	199°16.2	·· 56.6	68°19.5	·· 41.4	356°07.4	·· 02.6
4	278°17.5	278°10.3	35.9	214°16.8	56.9	83°22.3	41.3	11°10.0	02.6
5	293°20.0	293°11.4	36.0	229°17.4	57.2	98°25.0	41.2	26°12.5	02.6
6	308°22.4	308°12.6	N01°36.1	244°18.1	N21°57.6	113°27.7	S04°41.1	41°15.1	S22°02.6
7	323°24.9	323°13.8	36.2	259°18.7	57.9	128°30.4	41.0	56°17.7	02.6
8	338°27.4	338°15.0	36.3	274°19.4	58.2	143°33.1	40.9	71°20.2	02.6
9	353°29.8	353°16.1	·· 36.4	289°20.0	·· 58.5	158°35.8	·· 40.8	86°22.8	·· 02.6
10	8°32.3	8°17.3	36.4	304°20.7	58.8	173°38.5	40.7	101°25.3	02.6
11	23°34.8	23°18.5	36.5	319°21.3	59.1	188°41.3	40.6	116°27.9	02.6
12	38°37.2	38°19.6	N01°36.6	334°22.0	N21°59.5	203°44.0	S04°40.5	131°30.5	S22°02.6
13	53°39.7	53°20.8	36.7	349°22.6	21°59.8	218°46.7	40.4	146°33.0	02.6
14	68°42.1	68°22.0	36.8	4°23.3	22°00.1	233°49.4	40.3	161°35.6	02.6
15	83°44.6	83°23.1	·· 36.9	19°23.9	·· 00.4	248°52.1	·· 40.2	176°38.2	·· 02.5
16	98°47.1	98°24.3	37.0	34°24.5	00.7	263°54.8	40.1	191°40.7	02.5
17	113°49.5	113°25.4	37.1	49°25.2	01.0	278°57.5	40.0	206°43.3	02.5
18	128°52.0	128°26.6	N01°37.2	64°25.8	N22°01.4	294°00.3	S04°39.9	221°45.9	S22°02.5
19	143°54.5	143°27.7	37.3	79°26.5	01.7	309°03.0	39.8	236°48.5	02.5
20	158°56.9	158°28.9	37.4	94°27.1	02.0	324°05.7	39.7	251°51.0	02.5
21	173°59.4	173°30.0	·· 37.5	109°27.8	·· 02.3	339°08.4	·· 39.6	266°53.6	·· 02.5
22	189°01.9	188°31.2	37.6	124°28.4	02.6	354°11.1	39.5	281°56.2	02.5
23	204°04.3	203°32.3	37.7	139°29.1	02.9	9°13.8	39.4	296°58.7	02.5
Mer.pass.:09:26		v1.2 d0.1 m-4.5		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.3		v2.6 d0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°41.1	29°10.9
Ankaa	353°13.6	-42°12.8
Schedar	349°38.0	56°37.6
Diphda	348°53.6	-17°53.6
Achernar	335°25.5	-57°09.0
Hamal	327°58.2	23°32.4
Polaris	317°02.9	89°20.1
Acamar	315°16.8	-40°14.4
Menkar	314°12.7	4°09.2
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.2
Capella	280°31.0	46°00.8
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.3	-52°42.7
Sirius	258°31.6	-16°44.8
Adhara	255°10.7	-29°00.1
Procyon	244°57.1	5°10.6
Pollux	243°24.7	27°58.9
Avior	234°17.0	-59°34.3
Suhail	222°50.5	-43°30.5
Miaplacidus	221°38.9	-69°47.7
Alphard	217°53.5	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.3	61°39.7
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.4
Acrux	173°05.7	-63°11.8
Gacrux	171°57.4	-57°12.7
Alioth	166°18.0	55°52.1
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.7
Hadar	148°43.5	-60°27.3
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.4	-60°54.3
Kochab	137°19.1	74°05.2
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.5
Antares	112°22.7	-26°28.0
Atria	107°21.7	-69°03.2
Sabik	102°09.3	-15°44.6
Shaula	96°18.1	-37°06.7
Rasalhague	96°03.8	12°32.9
Eltanin	90°44.6	51°29.1
Kaus Aust.	83°40.2	-34°22.3
Vega	80°37.0	38°47.9
Nunki	75°55.0	-26°16.3
Altair	62°05.6	8°54.8
Peacock	53°15.2	-56°40.4
Deneb	49°29.7	45°20.3
Enif	33°44.7	9°57.2
Al Na'ir	27°40.7	-46°52.4
Fomalhaut	15°21.4	-29°31.8
Scheat	13°51.0	28°10.4
Markab	13°35.9	15°17.7

Apr 28 Fri	SHA	Mer.pass
Venus	0°56.3	09:31
Mars	297°33.8	13:45
Jupiter	164°51.5	22:32
Saturn	92°47.4	03:24

Apr 29 Sat	SHA	Mer.pass
Venus	0°27.8	09:29
Mars	296°50.2	13:43
Jupiter	164°57.6	22:28
Saturn	92°49.7	03:20

Apr 30 Sun	SHA	Mer.pass
Venus	359°57.9	09:27
Mars	296°06.6	13:42
Jupiter	165°03.7	22:23
Saturn	92°52.0	03:15

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.4266 sec ΔT = TT-UT1 = +68.7574 sec

2017 April 28 to Apr. 30 UT

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°37.1	N14°08.5	158°16.8	5.3′	N15°00.0	7.9′	61.0′
1	195°37.2	09.2	172°41.1	5.3′	15°07.8	7.8′	61.0′
2	210°37.3	10.0	187°05.4	5.2′	15°15.6	7.7′	61.0′
3	225°37.4	·· 10.8	201°29.6	5.2′	15°23.2	7.6′	61.0′
4	240°37.4	11.6	215°53.7	5.2′	15°30.7	7.5′	61.0′
5	255°37.5	12.4	230°17.9	5.1′	15°38.1	7.3′	61.0′
6	270°37.6	N14°13.2	244°42.0	5.1′	N15°45.4	7.2′	61.0′
7	285°37.7	14.0	259°06.0	5.0′	15°52.6	7.1′	61.0′
8	300°37.8	14.7	273°30.1	5.0′	15°59.6	7.0′	60.9′
9	315°37.9	·· 15.5	287°54.1	5.0′	16°06.6	6.9′	60.9′
10	330°38.0	16.3	302°18.0	5.0′	16°13.4	6.8′	60.9′
11	345°38.1	17.1	316°42.0	4.9′	16°20.1	6.6′	60.9′
12	0°38.2	N14°17.9	331°05.9	4.9′	N16°26.7	6.5′	60.9′
13	15°38.2	18.6	345°29.8	4.9′	16°33.2	6.4′	60.9′
14	30°38.3	19.4	359°53.6	4.8′	16°39.5	6.3′	60.9′
15	45°38.4	·· 20.2	14°17.4	4.8′	16°45.7	6.2′	60.9′
16	60°38.5	21.0	28°41.2	4.8′	16°51.8	6.0′	60.9′
17	75°38.6	21.8	43°05.0	4.8′	16°57.8	5.9′	60.9′
18	90°38.7	N14°22.6	57°28.8	4.7′	N17°03.7	5.8′	60.8′
19	105°38.8	23.3	71°52.5	4.7′	17°09.4	5.7′	60.8′
20	120°38.9	24.1	86°16.2	4.7′	17°15.0	5.5′	60.8′
21	135°38.9	·· 24.9	100°39.9	4.7′	17°20.5	5.4′	60.8′
22	150°39.0	25.7	115°03.6	4.7′	17°25.8	5.3′	60.8′
23	165°39.1	26.4	129°27.2	4.7′	17°31.1	5.2′	60.8′
	SD.=15.9	d=0.8	S.D.=16.6				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°39.2	N14°27.2	143°50.9	4.6′	N17°36.2	5.0′	60.8′
1	195°39.3	28.0	158°14.5	4.6′	17°41.1	4.9′	60.7′
2	210°39.4	28.8	172°38.1	4.6′	17°46.0	4.8′	60.7′
3	225°39.5	·· 29.6	187°01.7	4.6′	17°50.7	4.6′	60.7′
4	240°39.5	30.3	201°25.3	4.6′	17°55.3	4.5′	60.7′
5	255°39.6	31.1	215°48.9	4.6′	17°59.7	4.4′	60.7′
6	270°39.7	N14°31.9	230°12.5	4.6′	N18°04.0	4.3′	60.7′
7	285°39.8	32.7	244°36.1	4.6′	18°08.2	4.1′	60.6′
8	300°39.9	33.4	258°59.6	4.6′	18°12.3	4.0′	60.6′
9	315°40.0	·· 34.2	273°23.2	4.6′	18°16.2	3.9′	60.6′
10	330°40.1	35.0	287°46.8	4.6′	18°20.0	3.7′	60.6′
11	345°40.1	35.7	302°10.3	4.6′	18°23.6	3.6′	60.6′
12	0°40.2	N14°36.5	316°33.9	4.6′	N18°27.1	3.4′	60.5′
13	15°40.3	37.3	330°57.5	4.6′	18°30.5	3.3′	60.5′
14	30°40.4	38.1	345°21.0	4.6′	18°33.8	3.2′	60.5′
15	45°40.5	·· 38.8	359°44.6	4.6′	18°36.9	3.0′	60.5′
16	60°40.6	39.6	14°08.2	4.6′	18°39.9	2.9′	60.5′
17	75°40.6	40.4	28°31.8	4.6′	18°42.7	2.8′	60.4′
18	90°40.7	N14°41.1	42°55.4	4.6′	N18°45.4	2.6′	60.4′
19	105°40.8	41.9	57°19.0	4.6′	18°48.0	2.5′	60.4′
20	120°40.9	42.7	71°42.7	4.6′	18°50.4	2.4′	60.4′
21	135°41.0	·· 43.4	86°06.3	4.7′	18°52.7	2.2′	60.3′
22	150°41.0	44.2	100°30.0	4.7′	18°54.9	2.1′	60.3′
23	165°41.1	45.0	114°53.6	4.7′	18°56.9	2.0′	60.3′
	SD.=15.9	d=0.8	S.D.=16.5				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°41.2	N14°45.8	129°17.3	4.7′	N18°58.8	1.8′	60.3′
1	195°41.3	46.5	143°41.1	4.7′	19°00.6	1.7′	60.2′
2	210°41.4	47.3	158°04.8	4.7′	19°02.2	1.6′	60.2′
3	225°41.4	·· 48.1	172°28.6	4.8′	19°03.7	1.4′	60.2′
4	240°41.5	48.8	186°52.3	4.8′	19°05.0	1.3′	60.2′
5	255°41.6	49.6	201°16.1	4.8′	19°06.2	1.1′	60.1′
6	270°41.7	N14°50.3	215°40.0	4.8′	N19°07.3	1.0′	60.1′
7	285°41.8	51.1	230°03.8	4.9′	19°08.3	0.9′	60.1′
8	300°41.8	51.9	244°27.7	4.9′	19°09.1	0.7′	60.1′
9	315°41.9	·· 52.6	258°51.7	4.9′	19°09.8	0.6′	60.0′
10	330°42.0	53.4	273°15.6	5.0′	19°10.3	0.5′	60.0′
11	345°42.1	54.2	287°39.6	5.0′	19°10.7	0.3′	60.0′
12	0°42.2	N14°54.9	302°03.6	5.0′	N19°11.0	0.2′	60.0′
13	15°42.2	55.7	316°27.7	5.1′	19°11.1	0.1′	59.9′
14	30°42.3	56.5	330°51.8	5.1′	19°11.1	-0.1′	59.9′
15	45°42.4	·· 57.2	345°15.9	5.2′	19°11.0	-0.2′	59.9′
16	60°42.5	58.0	359°40.1	5.2′	19°10.8	-0.3′	59.8′
17	75°42.5	58.7	14°04.3	5.2′	19°10.4	-0.5′	59.8′
18	90°42.6	N14°59.5	28°28.6	5.3′	N19°09.8	-0.6′	59.8′
19	105°42.7	15°00.3	42°52.9	5.3′	19°09.2	-0.7′	59.8′
20	120°42.8	01.0	57°17.3	5.4′	19°08.4	-0.8′	59.7′
21	135°42.9	·· 01.8	71°41.7	5.4′	19°07.5	-1.0′	59.7′
22	150°42.9	02.5	86°06.1	5.5′	19°06.5	-1.1′	59.7′
23	165°43.0	03.3	100°30.6	5.5′	19°05.3	-1.2′	59.6′
	SD.=15.9	d=0.8	S.D.=16.3				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	02:07	21:54	▭	▭
N 70°	▭	▭	02:42	21:17	▭	▭
68°	▭	01:26	03:06	20:52	22:37	▭
66°	▭	02:07	03:25	20:33	21:53	▭
64°	▭	02:34	03:40	20:17	21:24	▭
62°	01:15	02:54	03:52	20:04	21:03	22:47
60°	01:52	03:11	04:03	19:53	20:46	22:07
N 58°	02:18	03:25	04:12	19:44	20:32	21:40
56°	02:37	03:37	04:20	19:36	20:20	21:20
54°	02:53	03:47	04:28	19:28	20:09	21:04
52°	03:06	03:56	04:34	19:22	20:00	20:50
50°	03:18	04:04	04:40	19:16	19:52	20:39
45°	03:41	04:20	04:52	19:03	19:35	20:15
N 40°	03:58	04:33	05:03	18:53	19:22	19:58
35°	04:12	04:44	05:11	18:44	19:11	19:43
30°	04:24	04:54	05:19	18:36	19:01	19:32
20°	04:42	05:09	05:32	18:23	18:46	19:13
N 10°	04:56	05:22	05:43	18:11	18:33	18:59
0°	05:08	05:33	05:54	18:01	18:22	18:47
S 10°	05:18	05:43	06:04	17:50	18:12	18:37
20°	05:27	05:53	06:15	17:39	18:02	18:28
30°	05:35	06:03	06:28	17:26	17:51	18:19
35°	05:39	06:09	06:35	17:19	17:45	18:15
40°	05:43	06:15	06:43	17:11	17:39	18:11
45°	05:47	06:22	06:52	17:02	17:32	18:07
S 50°	05:52	06:30	07:04	16:50	17:24	18:02
52°	05:53	06:33	07:09	16:45	17:21	18:00
54°	05:55	06:37	07:15	16:39	17:17	17:58
56°	05:57	06:42	07:21	16:33	17:12	17:56
58°	06:00	06:46	07:28	16:25	17:08	17:54
S 60°	06:02	06:51	07:37	16:17	17:02	17:52

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	03:46	03:16	▭	–:–	01:37	▭
N 70°	04:21	04:28	04:52	–:–	00:25	02:08
68°	04:46	05:06	05:44	23:48	–:–	01:17
66°	05:05	05:33	06:16	23:22	–:–	00:45
64°	05:21	05:53	06:40	23:01	–:–	00:21
62°	05:34	06:10	06:59	22:45	–:–	00:02
60°	05:45	06:24	07:14	22:32	23:47	–:–
N 58°	05:55	06:36	07:27	22:20	23:34	–:–
56°	06:04	06:46	07:39	22:10	23:22	–:–
54°	06:11	06:56	07:49	22:01	23:12	–:–
52°	06:18	07:04	07:58	21:53	23:04	–:–
50°	06:24	07:11	08:06	21:46	22:56	23:56
45°	06:38	07:27	08:23	21:31	22:39	23:39
N 40°	06:49	07:40	08:37	21:18	22:25	23:26
35°	06:58	07:51	08:49	21:07	22:13	23:14
30°	07:07	08:01	08:59	20:58	22:03	23:03
20°	07:21	08:18	09:17	20:42	21:45	22:46
N 10°	07:34	08:33	09:32	20:28	21:30	22:30
0°	07:46	08:47	09:47	20:15	21:16	22:16
S 10°	07:58	09:01	10:02	20:02	21:01	22:01
20°	08:11	09:15	10:17	19:48	20:46	21:45
30°	08:26	09:33	10:36	19:32	20:28	21:27
35°	08:35	09:43	10:46	19:22	20:18	21:17
40°	08:45	09:54	10:58	19:12	20:06	21:05
45°	08:56	10:08	11:12	19:00	19:52	20:51
S 50°	09:11	10:24	11:30	18:44	19:35	20:33
52°	09:17	10:32	11:38	18:37	19:27	20:25
54°	09:25	10:41	11:47	18:30	19:18	20:16
56°	09:33	10:50	11:57	18:21	19:08	20:06
58°	09:42	11:02	12:09	18:11	18:57	19:54
S 60°	09:53	11:14	12:23	18:00	18:44	19:41

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 2-4 6-22%
28	02:28	02:33	11:57	14:00	01:30	
29	02:37	02:41	11:57	15:01	02:31	
30	02:45	02:49	11:57	16:01	03:31	

May 01, 02, 03 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	219°06.8	218°33.5	N01°37.8	154°29.7	N22°03.2	24°16.5	S04°39.3	312°01.3	S22°02.5
1	234°09.3	233°34.6	37.9	169°30.4	03.5	39°19.2	39.2	327°03.9	02.5
2	249°11.7	248°35.7	38.0	184°31.0	03.9	54°22.0	39.1	342°06.4	02.5
3	264°14.2	263°36.9	·· 38.1	199°31.6	·· 04.2	69°24.7	·· 39.1	357°09.0	·· 02.5
4	279°16.6	278°38.0	38.3	214°32.3	04.5	84°27.4	39.0	12°11.6	02.5
5	294°19.1	293°39.1	38.4	229°32.9	04.8	99°30.1	38.9	27°14.1	02.5
6	309°21.6	308°40.3	N01°38.5	244°33.6	N22°05.1	114°32.8	S04°38.8	42°16.7	S22°02.5
7	324°24.0	323°41.4	38.6	259°34.2	05.4	129°35.5	38.7	57°19.3	02.5
8	339°26.5	338°42.5	38.7	274°34.9	05.7	144°38.2	38.6	72°21.8	02.5
9	354°29.0	353°43.6	·· 38.8	289°35.5	·· 06.0	159°40.9	·· 38.5	87°24.4	·· 02.5
10	9°31.4	8°44.7	39.0	304°36.1	06.3	174°43.6	38.4	102°27.0	02.5
11	24°33.9	23°45.9	39.1	319°36.8	06.6	189°46.4	38.3	117°29.6	02.5
12	39°36.4	38°47.0	N01°39.2	334°37.4	N22°07.0	204°49.1	S04°38.2	132°32.1	S22°02.5
13	54°38.8	53°48.1	39.3	349°38.1	07.3	219°51.8	38.1	147°34.7	02.5
14	69°41.3	68°49.2	39.5	4°38.7	07.6	234°54.5	38.0	162°37.3	02.5
15	84°43.7	83°50.3	·· 39.6	19°39.4	·· 07.9	249°57.2	·· 37.9	177°39.8	·· 02.5
16	99°46.2	98°51.4	39.7	34°40.0	08.2	264°59.9	37.8	192°42.4	02.5
17	114°48.7	113°52.5	39.8	49°40.7	08.5	280°02.6	37.7	207°45.0	02.5
18	129°51.1	128°53.6	N01°40.0	64°41.3	N22°08.8	295°05.3	S04°37.6	222°47.5	S22°02.5
19	144°53.6	143°54.7	40.1	79°41.9	09.1	310°08.0	37.5	237°50.1	02.5
20	159°56.1	158°55.8	40.2	94°42.6	09.4	325°10.7	37.4	252°52.7	02.5
21	174°58.5	173°56.9	·· 40.4	109°43.2	·· 09.7	340°13.4	·· 37.3	267°55.3	·· 02.4
22	190°01.0	188°58.0	40.5	124°43.9	10.0	355°16.1	37.2	282°57.8	02.4
23	205°03.5	203°59.1	40.7	139°44.5	10.3	10°18.9	37.2	298°00.4	02.4
Mer.pass.:09:22		v1.1 d0.1 m-4.5		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.3		v2.6 d0.0 m0.2	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	220°05.9	219°00.2	N01°40.8	154°45.2	N22°10.6	25°21.6	S04°37.1	313°03.0	S22°02.4
1	235°08.4	234°01.3	40.9	169°45.8	10.9	40°24.3	37.0	328°05.5	02.4
2	250°10.9	249°02.4	41.1	184°46.4	11.2	55°27.0	36.9	343°08.1	02.4
3	265°13.3	264°03.4	·· 41.2	199°47.1	·· 11.5	70°29.7	·· 36.8	358°10.7	·· 02.4
4	280°15.8	279°04.5	41.4	214°47.7	11.8	85°32.4	36.7	13°13.3	02.4
5	295°18.2	294°05.6	41.5	229°48.4	12.1	100°35.1	36.6	28°15.8	02.4
6	310°20.7	309°06.7	N01°41.7	244°49.0	N22°12.4	115°37.8	S04°36.5	43°18.4	S22°02.4
7	325°23.2	324°07.7	41.8	259°49.7	12.7	130°40.5	36.4	58°21.0	02.4
8	340°25.6	339°08.8	42.0	274°50.3	13.0	145°43.2	36.3	73°23.6	02.4
9	355°28.1	354°09.9	·· 42.1	289°50.9	·· 13.3	160°45.9	·· 36.2	88°26.1	·· 02.4
10	10°30.6	9°11.0	42.3	304°51.6	13.6	175°48.6	36.1	103°28.7	02.4
11	25°33.0	24°12.0	42.4	319°52.2	13.9	190°51.3	36.0	118°31.3	02.4
12	40°35.5	39°13.1	N01°42.6	334°52.9	N22°14.2	205°54.0	S04°35.9	133°33.8	S22°02.4
13	55°38.0	54°14.2	42.7	349°53.5	14.5	220°56.7	35.8	148°36.4	02.4
14	70°40.4	69°15.2	42.9	4°54.2	14.8	235°59.5	35.8	163°39.0	02.4
15	85°42.9	84°16.3	·· 43.1	19°54.8	·· 15.1	251°02.2	·· 35.7	178°41.6	·· 02.4
16	100°45.4	99°17.3	43.2	34°55.4	15.4	266°04.9	35.6	193°44.1	02.4
17	115°47.8	114°18.4	43.4	49°56.1	15.7	281°07.6	35.5	208°46.7	02.4
18	130°50.3	129°19.4	N01°43.6	64°56.7	N22°16.0	296°10.3	S04°35.4	223°49.3	S22°02.4
19	145°52.7	144°20.5	43.7	79°57.4	16.3	311°13.0	35.3	238°51.9	02.4
20	160°55.2	159°21.5	43.9	94°58.0	16.6	326°15.7	35.2	253°54.4	02.4
21	175°57.7	174°22.6	·· 44.1	109°58.7	·· 16.9	341°18.4	·· 35.1	268°57.0	·· 02.4
22	191°00.1	189°23.6	44.2	124°59.3	17.2	356°21.1	35.0	283°59.6	02.4
23	206°02.6	204°24.7	44.4	139°59.9	17.5	11°23.8	34.9	299°02.2	02.4
Mer.pass.:09:18		v1.1 d0.1 m-4.5		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.3		v2.6 d0.0 m0.2	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	221°05.1	219°25.7	N01°44.6	155°00.6	N22°17.8	26°26.5	S04°34.8	314°04.7	S22°02.4
1	236°07.5	234°26.8	44.7	170°01.2	18.1	41°29.2	34.7	329°07.3	02.4
2	251°10.0	249°27.8	44.9	185°01.9	18.4	56°31.9	34.6	344°09.9	02.3
3	266°12.5	264°28.8	·· 45.1	200°02.5	·· 18.7	71°34.6	·· 34.6	359°12.5	·· 02.3
4	281°14.9	279°29.9	45.3	215°03.1	19.0	86°37.3	34.5	14°15.0	02.3
5	296°17.4	294°30.9	45.5	230°03.8	19.3	101°40.0	34.4	29°17.6	02.3
6	311°19.9	309°31.9	N01°45.6	245°04.4	N22°19.6	116°42.7	S04°34.3	44°20.2	S22°02.3
7	326°22.3	324°32.9	45.8	260°05.1	19.9	131°45.4	34.2	59°22.8	02.3
8	341°24.8	339°34.0	46.0	275°05.7	20.2	146°48.1	34.1	74°25.4	02.3
9	356°27.2	354°35.0	·· 46.2	290°06.4	·· 20.5	161°50.8	·· 34.0	89°27.9	·· 02.3
10	11°29.7	9°36.0	46.4	305°07.0	20.7	176°53.5	33.9	104°30.5	02.3
11	26°32.2	24°37.0	46.6	320°07.6	21.0	191°56.2	33.8	119°33.1	02.3
12	41°34.6	39°38.1	N01°46.7	335°08.3	N22°21.3	206°58.9	S04°33.7	134°35.7	S22°02.3
13	56°37.1	54°39.1	46.9	350°08.9	21.6	222°01.6	33.6	149°38.2	02.3
14	71°39.6	69°40.1	47.1	5°09.6	21.9	237°04.3	33.6	164°40.8	02.3
15	86°42.0	84°41.1	·· 47.3	20°10.2	·· 22.2	252°07.0	·· 33.5	179°43.4	·· 02.3
16	101°44.5	99°42.1	47.5	35°10.8	22.5	267°09.7	33.4	194°46.0	02.3
17	116°47.0	114°43.1	47.7	50°11.5	22.8	282°12.4	33.3	209°48.6	02.3
18	131°49.4	129°44.1	N01°47.9	65°12.1	N22°23.1	297°15.1	S04°33.2	224°51.1	S22°02.3
19	146°51.9	144°45.1	48.1	80°12.8	23.4	312°17.8	33.1	239°53.7	02.3
20	161°54.3	159°46.1	48.3	95°13.4	23.6	327°20.5	33.0	254°56.3	02.3
21	176°56.8	174°47.1	·· 48.5	110°14.1	·· 23.9	342°23.2	·· 32.9	269°58.9	·· 02.3
22	191°59.3	189°48.1	48.7	125°14.7	24.2	357°25.9	32.8	285°01.4	02.3
23	207°01.7	204°49.1	48.9	140°15.3	24.5	12°28.6	32.7	300°04.0	02.3
Mer.pass.:09:14		v1.0 d0.2 m-4.5		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.3		v2.6 d0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°41.0	29°10.9
Ankaa	353°13.5	-42°12.7
Schedar	349°37.9	56°37.6
Diphda	348°53.6	-17°53.6
Achernar	335°25.5	-57°09.0
Hamal	327°58.1	23°32.4
Polaris	317°02.8	89°20.1
Acamar	315°16.8	-40°14.4
Menkar	314°12.7	4°09.2
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.3	-52°42.7
Sirius	258°31.6	-16°44.8
Adhara	255°10.7	-29°00.1
Procyon	244°57.1	5°10.6
Pollux	243°24.7	27°58.9
Avior	234°17.0	-59°34.3
Suhail	222°50.5	-43°30.5
Miaplacidus	221°38.9	-69°47.7
Alphard	217°53.5	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.3	61°39.7
Denebola	182°30.8	14°28.5
Gienah	175°49.3	-17°38.4
Acrux	173°05.7	-63°11.8
Gacrux	171°57.4	-57°12.7
Alioth	166°18.0	55°52.1
Spica	158°28.2	-11°15.1
Alkaid	152°56.4	49°13.8
Hadar	148°43.4	-60°27.3
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.4	-60°54.3
Kochab	137°19.1	74°05.2
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.5
Antares	112°22.7	-26°28.0
Atria	107°21.7	-69°03.2
Sabik	102°09.3	-15°44.6
Shaula	96°18.1	-37°06.7
Rasalhague	96°03.8	12°32.9
Eltanin	90°44.6	51°29.1
Kaus Aust.	83°40.1	-34°22.3
Vega	80°37.0	38°47.9
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°54.9
Peacock	53°15.2	-56°40.4
Deneb	49°29.6	45°20.3
Enif	33°44.6	9°57.2
Al Na'ir	27°40.7	-46°52.4
Fomalhaut	15°21.3	-29°31.8
Scheat	13°51.0	28°10.4
Markab	13°35.9	15°17.7

May 01 Mon	SHA	Mer.pass
Venus	359°26.7	09:25
Mars	295°22.9	13:41
Jupiter	165°09.7	22:19
Saturn	92°54.5	03:11

May 02 Tue	SHA	Mer.pass
Venus	358°54.3	09:23
Mars	294°39.2	13:40
Jupiter	165°15.6	22:15
Saturn	92°57.0	03:07

May 03 Wed	SHA	Mer.pass
Venus	358°20.6	09:22
Mars	293°55.5	13:39
Jupiter	165°21.4	22:10
Saturn	92°59.7	03:03

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.4217 sec ΔT = TT-UT1 = +68.7623 sec

2017 May 01 to May. 03 UT

h

Mon	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	180°43.1	N15°04.0	114°55.1	5.6'	N19°04.0	-1.4'	59.6'
1	195°43.2	04.8	129°19.7	5.6'	19°02.6	-1.5'	59.6'
2	210°43.2	05.6	143°44.4	5.7'	19°01.0	-1.6'	59.6'
3	225°43.3	·· 06.3	158°09.1	5.7'	18°59.4	-1.7'	59.5'
4	240°43.4	07.1	172°33.8	5.8'	18°57.6	-1.9'	59.5'
5	255°43.5	07.8	186°58.6	5.8'	18°55.6	-2.0'	59.5'
6	270°43.5	N15°08.6	201°23.5	5.9'	N18°53.6	-2.1'	59.4'
7	285°43.6	09.3	215°48.4	6.0'	18°51.4	-2.2'	59.4'
8	300°43.7	10.1	230°13.4	6.0'	18°49.1	-2.4'	59.4'
9	315°43.7	·· 10.8	244°38.4	6.1'	18°46.7	-2.5'	59.3'
10	330°43.8	11.6	259°03.5	6.1'	18°44.2	-2.6'	59.3'
11	345°43.9	12.3	273°28.7	6.2'	18°41.5	-2.7'	59.3'
12	0°44.0	N15°13.1	287°53.9	6.3'	N18°38.7	-2.8'	59.2'
13	15°44.0	13.8	302°19.2	6.3'	18°35.8	-3.0'	59.2'
14	30°44.1	14.6	316°44.6	6.4'	18°32.8	-3.1'	59.2'
15	45°44.2	·· 15.3	331°10.0	6.4'	18°29.7	-3.2'	59.1'
16	60°44.3	16.1	345°35.4	6.5'	18°26.4	-3.3'	59.1'
17	75°44.3	16.8	0°01.0	6.6'	18°23.1	-3.4'	59.1'
18	90°44.4	N15°17.6	14°26.6	6.6'	N18°19.6	-3.5'	59.0'
19	105°44.5	18.3	28°52.3	6.7'	18°16.0	-3.6'	59.0'
20	120°44.5	19.1	43°18.0	6.8'	18°12.3	-3.8'	59.0'
21	135°44.6	·· 19.8	57°43.8	6.8'	18°08.5	-3.9'	58.9'
22	150°44.7	20.6	72°09.7	6.9'	18°04.6	-4.0'	58.9'
23	165°44.8	21.3	86°35.6	7.0'	18°00.5	-4.1'	58.9'
	SD.=15.9	d=0.8	S.D.=16.1				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°44.8	N15°22.1	101°01.6	7.1'	N17°56.4	-4.2'	58.9'
1	195°44.9	22.8	115°27.7	7.1'	17°52.1	-4.3'	58.8'
2	210°45.0	23.6	129°53.9	7.2'	17°47.8	-4.4'	58.8'
3	225°45.0	·· 24.3	144°20.1	7.3'	17°43.3	-4.5'	58.8'
4	240°45.1	25.1	158°46.4	7.3'	17°38.7	-4.6'	58.7'
5	255°45.2	25.8	173°12.8	7.4'	17°34.1	-4.7'	58.7'
6	270°45.2	N15°26.5	187°39.2	7.5'	N17°29.3	-4.8'	58.7'
7	285°45.3	27.3	202°05.8	7.6'	17°24.4	-4.9'	58.6'
8	300°45.4	28.0	216°32.4	7.6'	17°19.4	-5.0'	58.6'
9	315°45.4	·· 28.8	230°59.0	7.7'	17°14.3	-5.1'	58.6'
10	330°45.5	29.5	245°25.8	7.8'	17°09.2	-5.2'	58.5'
11	345°45.6	30.3	259°52.6	7.9'	17°03.9	-5.3'	58.5'
12	0°45.6	N15°31.0	274°19.5	7.9'	N16°58.5	-5.4'	58.5'
13	15°45.7	31.7	288°46.4	8.0'	16°53.0	-5.5'	58.4'
14	30°45.8	32.5	303°13.5	8.1'	16°47.5	-5.6'	58.4'
15	45°45.8	·· 33.2	317°40.6	8.2'	16°41.8	-5.7'	58.4'
16	60°45.9	34.0	332°07.8	8.2'	16°36.0	-5.8'	58.3'
17	75°46.0	34.7	346°35.1	8.3'	16°30.2	-5.9'	58.3'
18	90°46.0	N15°35.4	1°02.4	8.4'	N16°24.2	-6.0'	58.3'
19	105°46.1	36.2	15°29.8	8.5'	16°18.2	-6.1'	58.2'
20	120°46.2	36.9	29°57.3	8.5'	16°12.1	-6.2'	58.2'
21	135°46.2	·· 37.6	44°24.9	8.6'	16°05.9	-6.3'	58.2'
22	150°46.3	38.4	58°52.5	8.7'	15°59.6	-6.3'	58.1'
23	165°46.4	39.1	73°20.2	8.8'	15°53.2	-6.4'	58.1'
	SD.=15.9	d=0.7	S.D.=15.9				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°46.4	N15°39.9	87°48.0	8.8'	N15°46.7	-6.5'	58.1'
1	195°46.5	40.6	102°15.9	8.9'	15°40.2	-6.6'	58.0'
2	210°46.6	41.3	116°43.9	9.0'	15°33.6	-6.7'	58.0'
3	225°46.6	·· 42.1	131°11.9	9.1'	15°26.8	-6.8'	58.0'
4	240°46.7	42.8	145°40.0	9.1'	15°20.0	-6.8'	57.9'
5	255°46.8	43.5	160°08.2	9.2'	15°13.2	-6.9'	57.9'
6	270°46.8	N15°44.3	174°36.4	9.3'	N15°06.2	-7.0'	57.9'
7	285°46.9	45.0	189°04.8	9.4'	14°59.2	-7.1'	57.8'
8	300°46.9	45.7	203°33.2	9.4'	14°52.1	-7.1'	57.8'
9	315°47.0	·· 46.5	218°01.7	9.5'	14°44.9	-7.2'	57.8'
10	330°47.1	47.2	232°30.2	9.6'	14°37.6	-7.3'	57.7'
11	345°47.1	47.9	246°58.8	9.7'	14°30.3	-7.4'	57.7'
12	0°47.2	N15°48.6	261°27.6	9.7'	N14°22.9	-7.4'	57.7'
13	15°47.3	49.4	275°56.3	9.8'	14°15.4	-7.5'	57.6'
14	30°47.3	50.1	290°25.2	9.9'	14°07.9	-7.6'	57.6'
15	45°47.4	·· 50.8	304°54.1	10.0'	14°00.3	-7.7'	57.6'
16	60°47.4	51.6	319°23.1	10.0'	13°52.6	-7.7'	57.6'
17	75°47.5	52.3	333°52.2	10.1'	13°44.8	-7.8'	57.5'
18	90°47.6	N15°53.0	348°21.3	10.2'	N13°37.0	-7.9'	57.5'
19	105°47.6	53.7	2°50.6	10.3'	13°29.1	-7.9'	57.5'
20	120°47.7	54.5	17°19.8	10.3'	13°21.2	-8.0'	57.4'
21	135°47.7	·· 55.2	31°49.2	10.4'	13°13.2	-8.0'	57.4'
22	150°47.8	55.9	46°18.6	10.5'	13°05.1	-8.1'	57.4'
23	165°47.9	56.7	60°48.1	10.5'	12°57.0	-8.2'	57.3'
	SD.=15.9	d=0.7	S.D.=15.7				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	01:43	22:19	▭	▭
N 70°	▭	▭	02:24	21:34	▭	▭
68°	▭	00:53	02:52	21:05	23:15	▭
66°	▭	01:48	03:13	20:44	22:11	▭
64°	▭	02:20	03:30	20:27	21:38	▭
62°	00:47	02:43	03:43	20:13	21:14	23:20
60°	01:36	03:01	03:55	20:01	20:55	22:23
N 58°	02:05	03:16	04:05	19:51	20:40	21:52
56°	02:27	03:29	04:14	19:42	20:27	21:30
54°	02:44	03:40	04:21	19:34	20:16	21:12
52°	02:58	03:49	04:28	19:27	20:06	20:57
50°	03:11	03:58	04:35	19:20	19:57	20:45
45°	03:35	04:15	04:48	19:07	19:40	20:20
N 40°	03:54	04:29	04:59	18:56	19:25	20:01
35°	04:08	04:41	05:08	18:46	19:14	19:46
30°	04:21	04:51	05:16	18:38	19:04	19:34
20°	04:40	05:07	05:30	18:24	18:47	19:14
N 10°	04:55	05:20	05:42	18:12	18:34	18:59
0°	05:07	05:32	05:54	18:00	18:22	18:47
S 10°	05:18	05:43	06:05	17:49	18:11	18:36
20°	05:27	05:54	06:16	17:37	18:00	18:26
30°	05:36	06:05	06:30	17:24	17:49	18:17
35°	05:41	06:11	06:37	17:16	17:43	18:13
40°	05:46	06:18	06:46	17:07	17:36	18:08
45°	05:50	06:25	06:56	16:57	17:28	18:03
S 50°	05:56	06:34	07:08	16:45	17:19	17:58
52°	05:58	06:38	07:14	16:39	17:15	17:55
54°	06:00	06:42	07:20	16:33	17:11	17:53
56°	06:02	06:47	07:27	16:26	17:06	17:51
58°	06:05	06:52	07:35	16:18	17:01	17:48
S 60°	06:08	06:58	07:44	16:09	16:55	17:45

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	▭	06:37	08:54	▭	04:28	04:04
N 70°	05:59	07:40	09:27	03:06	03:25	03:30
68°	06:48	08:15	09:50	02:16	02:49	03:06
66°	07:20	08:40	10:09	01:45	02:23	02:47
64°	07:43	09:00	10:23	01:22	02:03	02:31
62°	08:01	09:16	10:36	01:03	01:47	02:18
60°	08:17	09:29	10:46	00:47	01:33	02:07
N 58°	08:30	09:40	10:55	00:34	01:22	01:58
56°	08:41	09:50	11:03	00:23	01:11	01:49
54°	08:51	09:59	11:10	00:13	01:02	01:42
52°	08:59	10:07	11:16	00:04	00:54	01:35
50°	09:07	10:14	11:22	–:–	00:47	01:29
45°	09:24	10:28	11:34	–:–	00:32	01:16
N 40°	09:38	10:41	11:45	–:–	00:19	01:05
35°	09:49	10:51	11:53	–:–	00:08	00:55
30°	09:59	11:00	12:01	23:58	–:–	00:47
20°	10:17	11:16	12:14	23:42	–:–	00:33
N 10°	10:32	11:30	12:25	23:27	–:–	00:20
0°	10:46	11:43	12:36	23:14	–:–	00:09
S 10°	11:00	11:55	12:47	23:00	23:57	–:–
20°	11:16	12:09	12:58	22:45	23:44	–:–
30°	11:33	12:25	13:11	22:28	23:29	–:–
35°	11:43	12:34	13:18	22:19	23:21	–:–
40°	11:55	12:44	13:27	22:07	23:11	–:–
45°	12:09	12:56	13:37	21:54	23:00	–:–
S 50°	12:25	13:11	13:49	21:38	22:46	23:55
52°	12:33	13:18	13:54	21:30	22:39	23:50
54°	12:42	13:25	14:00	21:22	22:32	23:44
56°	12:51	13:34	14:07	21:12	22:24	23:38
58°	13:03	13:43	14:15	21:01	22:15	23:31
S 60°	13:15	13:54	14:23	20:49	22:04	23:23

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 5-7 32-54%
01	02:52	02:56	11:57	17:00	04:31	
02	02:59	03:03	11:57	17:56	05:28	
03	03:06	03:09	11:57	18:48	06:22	

May 04, 05, 06 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	222°04.2	219°50.1	N01°49.1	155°16.0	N22°24.8	27°31.3	S04°32.7	315°06.6	S22°02.3
1	237°06.7	234°51.1	49.3	170°16.6	25.1	42°34.0	32.6	330°09.2	02.3
2	252°09.1	249°52.1	49.5	185°17.3	25.4	57°36.7	32.5	345°11.8	02.3
3	267°11.6	264°53.1	·· 49.7	200°17.9	·· 25.7	72°39.4	·· 32.4	0°14.3	·· 02.3
4	282°14.1	279°54.1	49.9	215°18.5	25.9	87°42.1	32.3	15°16.9	02.3
5	297°16.5	294°55.0	50.2	230°19.2	26.2	102°44.8	32.2	30°19.5	02.3
6	312°19.0	309°56.0	N01°50.4	245°19.8	N22°26.5	117°47.5	S04°32.1	45°22.1	S22°02.3
7	327°21.5	324°57.0	50.6	260°20.5	26.8	132°50.2	32.0	60°24.7	02.2
8	342°23.9	339°58.0	50.8	275°21.1	27.1	147°52.9	31.9	75°27.2	02.2
9	357°26.4	354°59.0	·· 51.0	290°21.7	·· 27.4	162°55.6	·· 31.8	90°29.8	·· 02.2
10	12°28.8	9°59.9	51.2	305°22.4	27.7	177°58.3	31.8	105°32.4	02.2
11	27°31.3	25°00.9	51.4	320°23.0	27.9	193°01.0	31.7	120°35.0	02.2
12	42°33.8	40°01.9	N01°51.7	335°23.7	N22°28.2	208°03.7	S04°31.6	135°37.6	S22°02.2
13	57°36.2	55°02.9	51.9	350°24.3	28.5	223°06.4	31.5	150°40.2	02.2
14	72°38.7	70°03.8	52.1	5°24.9	28.8	238°09.1	31.4	165°42.7	02.2
15	87°41.2	85°04.8	·· 52.3	20°25.6	·· 29.1	253°11.8	·· 31.3	180°45.3	·· 02.2
16	102°43.6	100°05.8	52.6	35°26.2	29.3	268°14.5	31.2	195°47.9	02.2
17	117°46.1	115°06.7	52.8	50°26.9	29.6	283°17.1	31.1	210°50.5	02.2
18	132°48.6	130°07.7	N01°53.0	65°27.5	N22°29.9	298°19.8	S04°31.0	225°53.1	S22°02.2
19	147°51.0	145°08.6	53.2	80°28.1	30.2	313°22.5	31.0	240°55.6	02.2
20	162°53.5	160°09.6	53.5	95°28.8	30.5	328°25.2	30.9	255°58.2	02.2
21	177°56.0	175°10.6	·· 53.7	110°29.4	·· 30.7	343°27.9	·· 30.8	271°00.8	·· 02.2
22	192°58.4	190°11.5	53.9	125°30.1	31.0	358°30.6	30.7	286°03.4	02.2
23	208°00.9	205°12.5	54.2	140°30.7	31.3	13°33.3	30.6	301°06.0	02.2
Mer.pass.:09:10		v1.0 d0.2 m-4.5		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	223°03.3	220°13.4	N01°54.4	155°31.3	N22°31.6	28°36.0	S04°30.5	316°08.6	S22°02.2
1	238°05.8	235°14.4	54.6	170°32.0	31.9	43°38.7	30.4	331°11.1	02.2
2	253°08.3	250°15.3	54.9	185°32.6	32.1	58°41.4	30.3	346°13.7	02.2
3	268°10.7	265°16.2	·· 55.1	200°33.3	·· 32.4	73°44.1	·· 30.3	1°16.3	·· 02.2
4	283°13.2	280°17.2	55.4	215°33.9	32.7	88°46.8	30.2	16°18.9	02.2
5	298°15.7	295°18.1	55.6	230°34.5	33.0	103°49.5	30.1	31°21.5	02.2
6	313°18.1	310°19.1	N01°55.8	245°35.2	N22°33.2	118°52.2	S04°30.0	46°24.1	S22°02.2
7	328°20.6	325°20.0	56.1	260°35.8	33.5	133°54.9	29.9	61°26.6	02.2
8	343°23.1	340°20.9	56.3	275°36.5	33.8	148°57.5	29.8	76°29.2	02.2
9	358°25.5	355°21.9	·· 56.6	290°37.1	·· 34.1	164°00.2	·· 29.7	91°31.8	·· 02.2
10	13°28.0	10°22.8	56.8	305°37.7	34.4	179°02.9	29.6	106°34.4	02.2
11	28°30.4	25°23.7	57.1	320°38.4	34.6	194°05.6	29.6	121°37.0	02.2
12	43°32.9	40°24.7	N01°57.3	335°39.0	N22°34.9	209°08.3	S04°29.5	136°39.6	S22°02.1
13	58°35.4	55°25.6	57.6	350°39.6	35.2	224°11.0	29.4	151°42.1	02.1
14	73°37.8	70°26.5	57.8	5°40.3	35.4	239°13.7	29.3	166°44.7	02.1
15	88°40.3	85°27.4	·· 58.1	20°40.9	·· 35.7	254°16.4	·· 29.2	181°47.3	·· 02.1
16	103°42.8	100°28.3	58.3	35°41.6	36.0	269°19.1	29.1	196°49.9	02.1
17	118°45.2	115°29.3	58.6	50°42.2	36.3	284°21.8	29.0	211°52.5	02.1
18	133°47.7	130°30.2	N01°58.8	65°42.8	N22°36.5	299°24.5	S04°29.0	226°55.1	S22°02.1
19	148°50.2	145°31.1	59.1	80°43.5	36.8	314°27.1	28.9	241°57.7	02.1
20	163°52.6	160°32.0	59.4	95°44.1	37.1	329°29.8	28.8	257°00.2	02.1
21	178°55.1	175°32.9	·· 59.6	110°44.8	·· 37.4	344°32.5	·· 28.7	272°02.8	·· 02.1
22	193°57.6	190°33.8	01°59.9	125°45.4	37.6	359°35.2	28.6	287°05.4	02.1
23	209°00.0	205°34.7	02°00.1	140°46.0	37.9	14°37.9	28.5	302°08.0	02.1
Mer.pass.:09:06		v0.9 d0.2 m-4.5		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	224°02.5	220°35.7	N02°00.4	155°46.7	N22°38.2	29°40.6	S04°28.4	317°10.6	S22°02.1
1	239°04.9	235°36.6	00.7	170°47.3	38.4	44°43.3	28.4	332°13.2	02.1
2	254°07.4	250°37.5	00.9	185°48.0	38.7	59°46.0	28.3	347°15.8	02.1
3	269°09.9	265°38.4	·· 01.2	200°48.6	·· 39.0	74°48.7	·· 28.2	2°18.3	·· 02.1
4	284°12.3	280°39.3	01.5	215°49.2	39.2	89°51.3	28.1	17°20.9	02.1
5	299°14.8	295°40.2	01.8	230°49.9	39.5	104°54.0	28.0	32°23.5	02.1
6	314°17.3	310°41.1	N02°02.0	245°50.5	N22°39.8	119°56.7	S04°27.9	47°26.1	S22°02.1
7	329°19.7	325°41.9	02.3	260°51.1	40.0	134°59.4	27.8	62°28.7	02.1
8	344°22.2	340°42.8	02.6	275°51.8	40.3	150°02.1	27.8	77°31.3	02.1
9	359°24.7	355°43.7	·· 02.9	290°52.4	·· 40.6	165°04.8	·· 27.7	92°33.9	·· 02.1
10	14°27.1	10°44.6	03.1	305°53.1	40.9	180°07.5	27.6	107°36.5	02.1
11	29°29.6	25°45.5	03.4	320°53.7	41.1	195°10.2	27.5	122°39.0	02.1
12	44°32.0	40°46.4	N02°03.7	335°54.3	N22°41.4	210°12.8	S04°27.4	137°41.6	S22°02.1
13	59°34.5	55°47.3	04.0	350°55.0	41.6	225°15.5	27.3	152°44.2	02.1
14	74°37.0	70°48.2	04.2	5°55.6	41.9	240°18.2	27.3	167°46.8	02.1
15	89°39.4	85°49.0	·· 04.5	20°56.3	·· 42.2	255°20.9	·· 27.2	182°49.4	·· 02.1
16	104°41.9	100°49.9	04.8	35°56.9	42.4	270°23.6	27.1	197°52.0	02.0
17	119°44.4	115°50.8	05.1	50°57.5	42.7	285°26.3	27.0	212°54.6	02.0
18	134°46.8	130°51.7	N02°05.4	65°58.2	N22°43.0	300°28.9	S04°26.9	227°57.2	S22°02.0
19	149°49.3	145°52.5	05.7	80°58.8	43.2	315°31.6	26.8	242°59.8	02.0
20	164°51.8	160°53.4	06.0	95°59.4	43.5	330°34.3	26.8	258°02.3	02.0
21	179°54.2	175°54.3	·· 06.3	111°00.1	·· 43.8	345°37.0	·· 26.7	273°04.9	·· 02.0
22	194°56.7	190°55.2	06.5	126°00.7	44.0	0°39.7	26.6	288°07.5	02.0
23	209°59.2	205°56.0	06.8	141°01.4	44.3	15°42.4	26.5	303°10.1	02.0
Mer.pass.:09:02		v0.9 d0.3 m-4.4		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°41.0	29°10.9
Ankaa	353°13.5	-42°12.7
Schedar	349°37.9	56°37.6
Diphda	348°53.6	-17°53.6
Achernar	335°25.5	-57°09.0
Hamal	327°58.1	23°32.4
Polaris	317°02.7	89°20.1
Acamar	315°16.8	-40°14.4
Menkar	314°12.7	4°09.2
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.3	-52°42.7
Sirius	258°31.6	-16°44.7
Adhara	255°10.7	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.7	27°58.9
Avior	234°17.0	-59°34.3
Suhail	222°50.5	-43°30.5
Miaplacidus	221°39.0	-69°47.7
Alphard	217°53.5	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.3	61°39.7
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.4
Acrux	173°05.7	-63°11.8
Gacrux	171°57.4	-57°12.7
Alioth	166°18.0	55°52.1
Spica	158°28.2	-11°15.1
Alkaid	152°56.4	49°13.8
Hadar	148°43.4	-60°27.3
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.4	-60°54.3
Kochab	137°19.1	74°05.2
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.5
Antares	112°22.7	-26°28.0
Atria	107°21.7	-69°03.2
Sabik	102°09.3	-15°44.6
Shaula	96°18.1	-37°06.7
Rasalhague	96°03.8	12°32.9
Eltanin	90°44.5	51°29.1
Kaus Aust.	83°40.1	-34°22.3
Vega	80°36.9	38°47.9
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°54.9
Peacock	53°15.1	-56°40.4
Deneb	49°29.6	45°20.3
Enif	33°44.6	9°57.2
Al Na'ir	27°40.7	-46°52.4
Fomalhaut	15°21.3	-29°31.8
Scheat	13°51.0	28°10.4
Markab	13°35.9	15°17.7

May 04 Thu	SHA	Mer.pass
Venus	357°45.9	09:20
Mars	293°11.8	13:38
Jupiter	165°27.1	22:06
Saturn	93°02.4	02:59

May 05 Fri	SHA	Mer.pass
Venus	357°10.1	09:19
Mars	292°28.0	13:37
Jupiter	165°32.7	22:02
Saturn	93°05.2	02:55

May 06 Sat	SHA	Mer.pass
Venus	356°33.2	09:17
Mars	291°44.2	13:36
Jupiter	165°38.1	21:57
Saturn	93°08.1	02:51

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.4177 sec ΔT = TT-UT1 = +68.7663 sec

2017 May 04 to May. 06 UT

h

	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°47.9	**N**15°57.4	75°17.7	10.6′	**N**12°48.8	-8.2′	57.3′
1	195°48.0	58.1	89°47.4	10.7′	12°40.5	-8.3′	57.3′
2	210°48.0	58.8	104°17.1	10.7′	12°32.2	-8.3′	57.2′
3	225°48.1	15°59.5	118°46.9	10.8′	12°23.8	-8.4′	57.2′
4	240°48.1	16°00.3	133°16.7	10.9′	12°15.4	-8.5′	57.2′
5	255°48.2	01.0	147°46.6	11.0′	12°06.9	-8.5′	57.1′
6	270°48.3	**N**16°01.7	162°16.6	11.0′	**N**11°58.4	-8.6′	57.1′
7	285°48.3	02.4	176°46.7	11.1′	11°49.8	-8.6′	57.1′
8	300°48.4	03.2	191°16.8	11.2′	11°41.1	-8.7′	57.1′
9	315°48.4	·· 03.9	205°47.0	11.2′	11°32.4	-8.7′	57.0′
10	330°48.5	04.6	220°17.3	11.3′	11°23.7	-8.8′	57.0′
11	345°48.5	05.3	234°47.6	11.4′	11°14.9	-8.8′	57.0′
12	0°48.6	**N**16°06.0	249°18.0	11.4′	**N**11°06.1	-8.9′	56.9′
13	15°48.7	06.8	263°48.4	11.5′	10°57.2	-8.9′	56.9′
14	30°48.7	07.5	278°18.9	11.5′	10°48.2	-9.0′	56.9′
15	45°48.8	·· 08.2	292°49.5	11.6′	10°39.3	-9.0′	56.9′
16	60°48.8	08.9	307°20.1	11.7′	10°30.2	-9.1′	56.8′
17	75°48.9	09.6	321°50.8	11.7′	10°21.1	-9.1′	56.8′
18	90°48.9	**N**16°10.3	336°21.6	11.8′	**N**10°12.0	-9.1′	56.8′
19	105°49.0	11.1	350°52.4	11.9′	10°02.9	-9.2′	56.7′
20	120°49.0	11.8	5°23.3	11.9′	09°53.7	-9.2′	56.7′
21	135°49.1	·· 12.5	19°54.2	12.0′	09°44.4	-9.3′	56.7′
22	150°49.2	13.2	34°25.2	12.0′	09°35.2	-9.3′	56.7′
23	165°49.2	13.9	48°56.3	12.1′	09°25.8	-9.3′	56.6′
	SD.=15.8	d=0.7	S.D.=15.5				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°49.3	**N**16°14.6	63°27.4	12.1′	**N**09°16.5	-9.4′	56.6′
1	195°49.3	15.3	77°58.6	12.2′	09°07.1	-9.4′	56.6′
2	210°49.4	16.1	92°29.8	12.3′	08°57.7	-9.4′	56.5′
3	225°49.4	·· 16.8	107°01.1	12.3′	08°48.2	-9.5′	56.5′
4	240°49.5	17.5	121°32.4	12.4′	08°38.7	-9.5′	56.5′
5	255°49.5	18.2	136°03.8	12.4′	08°29.2	-9.5′	56.5′
6	270°49.6	**N**16°18.9	150°35.3	12.5′	**N**08°19.6	-9.6′	56.4′
7	285°49.6	19.6	165°06.8	12.5′	08°10.0	-9.6′	56.4′
8	300°49.7	20.3	179°38.3	12.6′	08°00.4	-9.6′	56.4′
9	315°49.7	·· 21.0	194°09.9	12.6′	07°50.7	-9.7′	56.4′
10	330°49.8	21.7	208°41.6	12.7′	07°41.0	-9.7′	56.3′
11	345°49.8	22.4	223°13.3	12.7′	07°31.3	-9.7′	56.3′
12	0°49.9	**N**16°23.2	237°45.1	12.8′	**N**07°21.6	-9.8′	56.3′
13	15°49.9	23.9	252°16.9	12.8′	07°11.8	-9.8′	56.2′
14	30°50.0	24.6	266°48.7	12.9′	07°02.0	-9.8′	56.2′
15	45°50.0	·· 25.3	281°20.6	12.9′	06°52.2	-9.8′	56.2′
16	60°50.1	26.0	295°52.6	13.0′	06°42.3	-9.9′	56.2′
17	75°50.1	26.7	310°24.5	13.0′	06°32.5	-9.9′	56.1′
18	90°50.2	**N**16°27.4	324°56.6	13.1′	**N**06°22.6	-9.9′	56.1′
19	105°50.2	28.1	339°28.7	13.1′	06°12.7	-9.9′	56.1′
20	120°50.3	28.8	354°00.8	13.1′	06°02.7	-9.9′	56.1′
21	135°50.3	·· 29.5	8°33.0	13.2′	05°52.8	-10.0′	56.0′
22	150°50.4	30.2	23°05.2	13.2′	05°42.8	-10.0′	56.0′
23	165°50.4	30.9	37°37.4	13.3′	05°32.8	-10.0′	56.0′
	SD.=15.8	d=0.7	S.D.=15.3				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°50.5	**N**16°31.6	52°09.7	13.3′	**N**05°22.8	-10.0′	56.0′
1	195°50.5	32.3	66°42.1	13.4′	05°12.8	-10.0′	55.9′
2	210°50.6	33.0	81°14.4	13.4′	05°02.7	-10.0′	55.9′
3	225°50.6	·· 33.7	95°46.8	13.4′	04°52.7	-10.1′	55.9′
4	240°50.7	34.4	110°19.3	13.5′	04°42.6	-10.1′	55.9′
5	255°50.7	35.1	124°51.8	13.5′	04°32.5	-10.1′	55.9′
6	270°50.8	**N**16°35.8	139°24.3	13.5′	**N**04°22.4	-10.1′	55.8′
7	285°50.8	36.5	153°56.9	13.6′	04°12.3	-10.1′	55.8′
8	300°50.8	37.2	168°29.5	13.6′	04°02.2	-10.1′	55.8′
9	315°50.9	·· 37.9	183°02.1	13.7′	03°52.1	-10.1′	55.8′
10	330°50.9	38.6	197°34.8	13.7′	03°41.9	-10.1′	55.7′
11	345°51.0	39.3	212°07.5	13.7′	03°31.8	-10.2′	55.7′
12	0°51.0	**N**16°40.0	226°40.2	13.7′	**N**03°21.6	-10.2′	55.7′
13	15°51.1	40.7	241°13.0	13.8′	03°11.4	-10.2′	55.7′
14	30°51.1	41.4	255°45.8	13.8′	03°01.3	-10.2′	55.6′
15	45°51.2	·· 42.1	270°18.6	13.8′	02°51.1	-10.2′	55.6′
16	60°51.2	42.8	284°51.5	13.9′	02°40.9	-10.2′	55.6′
17	75°51.2	43.5	299°24.3	13.9′	02°30.7	-10.2′	55.6′
18	90°51.3	**N**16°44.2	313°57.3	13.9′	**N**02°20.5	-10.2′	55.6′
19	105°51.3	44.9	328°30.2	14.0′	02°10.3	-10.2′	55.5′
20	120°51.4	45.6	343°03.2	14.0′	02°00.1	-10.2′	55.5′
21	135°51.4	·· 46.2	357°36.2	14.0′	01°49.9	-10.2′	55.5′
22	150°51.5	46.9	12°09.2	14.0′	01°39.7	-10.2′	55.5′
23	165°51.5	47.6	26°42.2	14.1′	01°29.5	-10.2′	55.5′
	SD.=15.8	d=0.7	S.D.=15.2				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	01:12	22:53	▭	▭
N 70°	▭	▭	02:06	21:53	▭	▭
68°	▭	▭	02:38	21:19	▭	▭
66°	▭	01:27	03:01	20:55	22:33	▭
64°	▭	02:05	03:20	20:36	21:52	▭
62°	▭	02:31	03:34	20:21	21:25	▭
60°	01:18	02:51	03:47	20:08	21:04	22:42
N 58°	01:52	03:08	03:58	19:57	20:48	22:05
56°	02:16	03:21	04:07	19:48	20:34	21:40
54°	02:35	03:33	04:15	19:39	20:22	21:20
52°	02:51	03:43	04:23	19:32	20:12	21:05
50°	03:04	03:52	04:29	19:25	20:03	20:51
45°	03:30	04:11	04:44	19:11	19:44	20:25
N 40°	03:49	04:26	04:55	18:59	19:29	20:05
35°	04:05	04:38	05:05	18:49	19:16	19:49
30°	04:18	04:48	05:14	18:40	19:06	19:36
20°	04:38	05:05	05:29	18:25	18:48	19:16
N 10°	04:54	05:19	05:41	18:12	18:34	19:00
0°	05:07	05:32	05:53	18:00	18:22	18:47
S 10°	05:18	05:43	06:05	17:48	18:10	18:35
20°	05:28	05:55	06:17	17:36	17:59	18:25
30°	05:38	06:07	06:32	17:21	17:46	18:15
35°	05:43	06:13	06:40	17:13	17:40	18:10
40°	05:48	06:20	06:49	17:04	17:32	18:05
45°	05:54	06:29	07:00	16:53	17:24	17:59
S 50°	05:59	06:38	07:13	16:40	17:15	17:53
52°	06:02	06:42	07:19	16:34	17:10	17:51
54°	06:05	06:47	07:25	16:27	17:06	17:48
56°	06:07	06:52	07:33	16:20	17:00	17:45
58°	06:10	06:58	07:41	16:11	16:55	17:42
S 60°	06:14	07:04	07:51	16:02	16:48	17:39

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	10:51	12:40	14:22	03:53	03:44	03:36
N 70°	11:11	12:50	14:26	03:32	03:31	03:30
68°	11:26	12:59	14:30	03:15	03:21	03:25
66°	11:38	13:07	14:33	03:02	03:12	03:20
64°	11:49	13:13	14:35	02:51	03:05	03:16
62°	11:57	13:18	14:37	02:41	02:59	03:13
60°	12:05	13:22	14:39	02:33	02:53	03:10
N 58°	12:11	13:26	14:40	02:26	02:48	03:08
56°	12:17	13:30	14:42	02:19	02:44	03:05
54°	12:22	13:33	14:43	02:13	02:40	03:03
52°	12:27	13:36	14:44	02:08	02:36	03:01
50°	12:31	13:39	14:45	02:04	02:33	03:00
45°	12:40	13:44	14:47	01:53	02:26	02:56
N 40°	12:48	13:49	14:49	01:45	02:20	02:53
35°	12:54	13:53	14:51	01:37	02:15	02:50
30°	13:00	13:57	14:52	01:31	02:11	02:47
20°	13:09	14:03	14:55	01:20	02:03	02:43
N 10°	13:18	14:09	14:57	01:10	01:56	02:39
0°	13:26	14:14	14:59	01:00	01:49	02:36
S 10°	13:34	14:19	15:01	00:51	01:43	02:32
20°	13:43	14:24	15:03	00:41	01:35	02:28
30°	13:52	14:30	15:06	00:29	01:27	02:24
35°	13:58	14:34	15:07	00:22	01:23	02:21
40°	14:04	14:38	15:09	00:15	01:17	02:18
45°	14:12	14:43	15:11	00:06	01:11	02:15
S 50°	14:21	14:48	15:13	–:–	01:03	02:11
52°	14:25	14:51	15:14	–:–	01:00	02:09
54°	14:29	14:53	15:15	–:–	00:56	02:07
56°	14:34	14:57	15:17	–:–	00:52	02:04
58°	14:39	15:00	15:18	–:–	00:47	02:02
S 60°	14:46	15:04	15:20	–:–	00:42	01:59

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 65-83%
04	03:12	03:14	11:57	19:38	07:13	
05	03:17	03:20	11:57	20:25	08:01	
06	03:22	03:24	11:57	21:10	08:47	

May 07, 08, 09 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	225°01.6	220°56.9	N02°07.1	156°02.0	N22°44.5	30°45.1	S04°26.4	318°12.7	S22°02.0
1	240°04.1	235°57.7	07.4	171°02.6	44.8	45°47.7	26.3	333°15.3	02.0
2	255°06.5	250°58.6	07.7	186°03.3	45.1	60°50.4	26.3	348°17.9	02.0
3	270°09.0	265°59.5	·· 08.0	201°03.9	·· 45.3	75°53.1	·· 26.2	3°20.5	·· 02.0
4	285°11.5	281°00.3	08.3	216°04.5	45.6	90°55.8	26.1	18°23.1	02.0
5	300°13.9	296°01.2	08.6	231°05.2	45.9	105°58.5	26.0	33°25.6	02.0
6	315°16.4	311°02.0	N02°08.9	246°05.8	N22°46.1	121°01.2	S04°25.9	48°28.2	S22°02.0
7	330°18.9	326°02.9	09.2	261°06.5	46.4	136°03.8	25.8	63°30.8	02.0
8	345°21.3	341°03.7	09.5	276°07.1	46.6	151°06.5	25.8	78°33.4	02.0
9	0°23.8	356°04.6	·· 09.8	291°07.7	·· 46.9	166°09.2	·· 25.7	93°36.0	·· 02.0
10	15°26.3	11°05.4	10.1	306°08.4	47.1	181°11.9	25.6	108°38.6	02.0
11	30°28.7	26°06.3	10.4	321°09.0	47.4	196°14.6	25.5	123°41.2	02.0
12	45°31.2	41°07.1	N02°10.7	336°09.6	N22°47.7	211°17.2	S04°25.4	138°43.8	S22°02.0
13	60°33.6	56°08.0	11.0	351°10.3	47.9	226°19.9	25.3	153°46.4	02.0
14	75°36.1	71°08.8	11.4	6°10.9	48.2	241°22.6	25.3	168°49.0	02.0
15	90°38.6	86°09.7	·· 11.7	21°11.5	·· 48.4	256°25.3	·· 25.2	183°51.6	·· 02.0
16	105°41.0	101°10.5	12.0	36°12.2	48.7	271°28.0	25.1	198°54.2	02.0
17	120°43.5	116°11.3	12.3	51°12.8	48.9	286°30.6	25.0	213°56.7	02.0
18	135°46.0	131°12.2	N02°12.6	66°13.5	N22°49.2	301°33.3	S04°24.9	228°59.3	S22°02.0
19	150°48.4	146°13.0	12.9	81°14.1	49.5	316°36.0	24.9	244°01.9	02.0
20	165°50.9	161°13.8	13.2	96°14.7	49.7	331°38.7	24.8	259°04.5	01.9
21	180°53.4	176°14.7	·· 13.6	111°15.4	·· 50.0	346°41.4	·· 24.7	274°07.1	·· 01.9
22	195°55.8	191°15.5	13.9	126°16.0	50.2	1°44.0	24.6	289°09.7	01.9
23	210°58.3	206°16.3	14.2	141°16.6	50.5	16°46.7	24.5	304°12.3	01.9
Mer.pass.:08:58		v0.9 d0.3 m-4.4		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	226°00.8	221°17.1	N02°14.5	156°17.3	N22°50.7	31°49.4	S04°24.5	319°14.9	S22°01.9
1	241°03.2	236°18.0	14.8	171°17.9	51.0	46°52.1	24.4	334°17.5	01.9
2	256°05.7	251°18.8	15.2	186°18.6	51.2	61°54.8	24.3	349°20.1	01.9
3	271°08.1	266°19.6	·· 15.5	201°19.2	·· 51.5	76°57.4	·· 24.2	4°22.7	·· 01.9
4	286°10.6	281°20.4	15.8	216°19.8	51.7	92°00.1	24.1	19°25.3	01.9
5	301°13.1	296°21.3	16.1	231°20.5	52.0	107°02.8	24.1	34°27.9	01.9
6	316°15.5	311°22.1	N02°16.5	246°21.1	N22°52.2	122°05.5	S04°24.0	49°30.5	S22°01.9
7	331°18.0	326°22.9	16.8	261°21.7	52.5	137°08.1	23.9	64°33.1	01.9
8	346°20.5	341°23.7	17.1	276°22.4	52.7	152°10.8	23.8	79°35.6	01.9
9	1°22.9	356°24.5	·· 17.5	291°23.0	·· 53.0	167°13.5	·· 23.7	94°38.2	·· 01.9
10	16°25.4	11°25.3	17.8	306°23.6	53.2	182°16.2	23.6	109°40.8	01.9
11	31°27.9	26°26.1	18.1	321°24.3	53.5	197°18.8	23.6	124°43.4	01.9
12	46°30.3	41°26.9	N02°18.5	336°24.9	N22°53.7	212°21.5	S04°23.5	139°46.0	S22°01.9
13	61°32.8	56°27.7	18.8	351°25.6	54.0	227°24.2	23.4	154°48.6	01.9
14	76°35.3	71°28.5	19.1	6°26.2	54.2	242°26.9	23.3	169°51.2	01.9
15	91°37.7	86°29.3	·· 19.5	21°26.8	·· 54.5	257°29.5	·· 23.3	184°53.8	·· 01.9
16	106°40.2	101°30.1	19.8	36°27.5	54.7	272°32.2	23.2	199°56.4	01.9
17	121°42.6	116°30.9	20.1	51°28.1	55.0	287°34.9	23.1	214°59.0	01.9
18	136°45.1	131°31.7	N02°20.5	66°28.7	N22°55.2	302°37.6	S04°23.0	230°01.6	S22°01.9
19	151°47.6	146°32.5	20.8	81°29.4	55.5	317°40.2	22.9	245°04.2	01.9
20	166°50.0	161°33.3	21.2	96°30.0	55.7	332°42.9	22.9	260°06.8	01.9
21	181°52.5	176°34.1	·· 21.5	111°30.6	·· 56.0	347°45.6	·· 22.8	275°09.4	·· 01.9
22	196°55.0	191°34.9	21.9	126°31.3	56.2	2°48.3	22.7	290°12.0	01.9
23	211°57.4	206°35.7	22.2	141°31.9	56.5	17°50.9	22.6	305°14.6	01.9
Mer.pass.:08:54		v0.8 d0.3 m-4.4		v0.6 d0.3 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	226°59.9	221°36.5	N02°22.6	156°32.5	N22°56.7	32°53.6	S04°22.5	320°17.2	S22°01.8
1	242°02.4	236°37.3	22.9	171°33.2	56.9	47°56.3	22.5	335°19.8	01.8
2	257°04.8	251°38.0	23.3	186°33.8	57.2	62°59.0	22.4	350°22.4	01.8
3	272°07.3	266°38.8	·· 23.6	201°34.5	·· 57.4	78°01.6	·· 22.3	5°25.0	·· 01.8
4	287°09.7	281°39.6	24.0	216°35.1	57.7	93°04.3	22.2	20°27.6	01.8
5	302°12.2	296°40.4	24.3	231°35.7	57.9	108°07.0	22.2	35°30.2	01.8
6	317°14.7	311°41.2	N02°24.7	246°36.4	N22°58.2	123°09.6	S04°22.1	50°32.8	S22°01.8
7	332°17.1	326°41.9	25.0	261°37.0	58.4	138°12.3	22.0	65°35.4	01.8
8	347°19.6	341°42.7	25.4	276°37.6	58.6	153°15.0	21.9	80°37.9	01.8
9	2°22.1	356°43.5	·· 25.7	291°38.3	·· 58.9	168°17.7	·· 21.8	95°40.5	·· 01.8
10	17°24.5	11°44.3	26.1	306°38.9	59.1	183°20.3	21.8	110°43.1	01.8
11	32°27.0	26°45.0	26.5	321°39.5	59.4	198°23.0	21.7	125°45.7	01.8
12	47°29.5	41°45.8	N02°26.8	336°40.2	N22°59.6	213°25.7	S04°21.6	140°48.3	S22°01.8
13	62°31.9	56°46.6	27.2	351°40.8	22°59.8	228°28.3	21.5	155°50.9	01.8
14	77°34.4	71°47.3	27.5	6°41.4	23°00.1	243°31.0	21.5	170°53.5	01.8
15	92°36.9	86°48.1	·· 27.9	21°42.1	·· 00.3	258°33.7	·· 21.4	185°56.1	·· 01.8
16	107°39.3	101°48.9	28.3	36°42.7	00.6	273°36.3	21.3	200°58.7	01.8
17	122°41.8	116°49.6	28.6	51°43.4	00.8	288°39.0	21.2	216°01.3	01.8
18	137°44.2	131°50.4	N02°29.0	66°44.0	N23°01.0	303°41.7	S04°21.1	231°03.9	S22°01.8
19	152°46.7	146°51.1	29.4	81°44.6	01.3	318°44.4	21.1	246°06.5	01.8
20	167°49.2	161°51.9	29.7	96°45.3	01.5	333°47.0	21.0	261°09.1	01.8
21	182°51.6	176°52.7	·· 30.1	111°45.9	·· 01.8	348°49.7	·· 20.9	276°11.7	·· 01.8
22	197°54.1	191°53.4	30.5	126°46.5	02.0	3°52.4	20.8	291°14.3	01.8
23	212°56.6	206°54.2	30.9	141°47.2	02.2	18°55.0	20.8	306°16.9	01.8
Mer.pass.:08:51		v0.8 d0.3 m-4.4		v0.6 d0.2 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Stars

	SHA	**Dec**
Alpheratz	357°41.0	29°10.9
Ankaa	353°13.5	-42°12.7
Schedar	349°37.9	56°37.6
Diphda	348°53.6	-17°53.6
Achernar	335°25.5	-57°09.0
Hamal	327°58.1	23°32.4
Polaris	317°02.6	89°20.1
Acamar	315°16.8	-40°14.3
Menkar	314°12.7	4°09.2
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.4	-52°42.7
Sirius	258°31.6	-16°44.7
Adhara	255°10.7	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.7	27°58.9
Avior	234°17.1	-59°34.3
Suhail	222°50.5	-43°30.5
Miaplacidus	221°39.0	-69°47.7
Alphard	217°53.5	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.4	61°39.7
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.4
Acrux	173°05.7	-63°11.9
Gacrux	171°57.4	-57°12.8
Alioth	166°18.0	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.8
Hadar	148°43.4	-60°27.4
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.4	-60°54.3
Kochab	137°19.1	74°05.2
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.5
Antares	112°22.7	-26°28.0
Atria	107°21.6	-69°03.2
Sabik	102°09.3	-15°44.6
Shaula	96°18.0	-37°06.7
Rasalhague	96°03.8	12°32.9
Eltanin	90°44.5	51°29.2
Kaus Aust.	83°40.1	-34°22.3
Vega	80°36.9	38°47.9
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°54.9
Peacock	53°15.1	-56°40.4
Deneb	49°29.6	45°20.3
Enif	33°44.6	9°57.2
Al Na'ir	27°40.6	-46°52.4
Fomalhaut	15°21.3	-29°31.8
Scheat	13°51.0	28°10.4
Markab	13°35.9	15°17.7

May 07 Sun	**SHA**	**Mer.pass**
Venus	355°55.3	09:16
Mars	291°00.4	13:35
Jupiter	165°43.4	21:53
Saturn	93°11.1	02:47

May 08 Mon	**SHA**	**Mer.pass**
Venus	355°16.4	09:14
Mars	290°16.5	13:34
Jupiter	165°48.6	21:49
Saturn	93°14.1	02:43

May 09 Tue	**SHA**	**Mer.pass**
Venus	354°36.6	09:13
Mars	289°32.7	13:33
Jupiter	165°53.7	21:45
Saturn	93°17.3	02:38

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.4138 sec ΔT = TT-UT1 = +68.7702 sec

2017 May 07 to May. 09 UT

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Sun	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	180°51.5	N16°48.3	41°15.3	14.1'	N01°19.2	-10.2'	55.4'
1	195°51.6	49.0	55°48.4	14.1'	01°09.0	-10.2'	55.4'
2	210°51.6	49.7	70°21.5	14.1'	00°58.8	-10.2'	55.4'
3	225°51.7	·· 50.4	84°54.7	14.1'	00°48.6	-10.2'	55.4'
4	240°51.7	51.1	99°27.8	14.2'	00°38.4	-10.2'	55.4'
5	255°51.8	51.8	114°01.0	14.2'	00°28.2	-10.2'	55.3'
6	270°51.8	N16°52.4	128°34.2	14.2'	N00°18.0	-10.2'	55.3'
7	285°51.8	53.1	143°07.4	14.2'	N00°07.8	-10.2'	55.3'
8	300°51.9	53.8	157°40.7	14.2'	S00°02.3	-10.2'	55.3'
9	315°51.9	·· 54.5	172°13.9	14.3'	00°12.5	-10.2'	55.3'
10	330°52.0	55.2	186°47.2	14.3'	00°22.7	-10.2'	55.2'
11	345°52.0	55.9	201°20.5	14.3'	00°32.9	-10.2'	55.2'
12	0°52.0	N16°56.6	215°53.8	14.3'	S00°43.0	-10.2'	55.2'
13	15°52.1	57.2	230°27.1	14.3'	00°53.2	-10.1'	55.2'
14	30°52.1	57.9	245°00.5	14.3'	01°03.3	-10.1'	55.2'
15	45°52.1	·· 58.6	259°33.8	14.4'	01°13.4	-10.1'	55.1'
16	60°52.2	16°59.3	274°07.2	14.4'	01°23.5	-10.1'	55.1'
17	75°52.2	17°00.0	288°40.6	14.4'	01°33.7	-10.1'	55.1'
18	90°52.3	N17°00.7	303°13.9	14.4'	S01°43.7	-10.1'	55.1'
19	105°52.3	01.3	317°47.3	14.4'	01°53.8	-10.1'	55.1'
20	120°52.3	02.0	332°20.8	14.4'	02°03.9	-10.1'	55.1'
21	135°52.4	·· 02.7	346°54.2	14.4'	02°13.9	-10.0'	55.0'
22	150°52.4	03.4	1°27.6	14.4'	02°24.0	-10.0'	55.0'
23	165°52.4	04.1	16°01.1	14.4'	02°34.0	-10.0'	55.0'
	SD.=15.8	d=0.7	S.D.=15.0				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°52.5	N17°04.7	30°34.5	14.5'	S02°44.0	-10.0'	55.0'
1	195°52.5	05.4	45°08.0	14.5'	02°54.0	-10.0'	55.0'
2	210°52.6	06.1	59°41.4	14.5'	03°04.0	-10.0'	55.0'
3	225°52.6	·· 06.8	74°14.9	14.5'	03°13.9	-9.9'	54.9'
4	240°52.6	07.4	88°48.4	14.5'	03°23.9	-9.9'	54.9'
5	255°52.7	08.1	103°21.9	14.5'	03°33.8	-9.9'	54.9'
6	270°52.7	N17°08.8	117°55.4	14.5'	S03°43.7	-9.9'	54.9'
7	285°52.7	09.5	132°28.9	14.5'	03°53.5	-9.9'	54.9'
8	300°52.8	10.2	147°02.4	14.5'	04°03.4	-9.8'	54.9'
9	315°52.8	·· 10.8	161°35.9	14.5'	04°13.2	-9.8'	54.8'
10	330°52.8	11.5	176°09.4	14.5'	04°23.0	-9.8'	54.8'
11	345°52.9	12.2	190°42.9	14.5'	04°32.8	-9.8'	54.8'
12	0°52.9	N17°12.8	205°16.4	14.5'	S04°42.6	-9.8'	54.8'
13	15°52.9	13.5	219°49.9	14.5'	04°52.3	-9.7'	54.8'
14	30°53.0	14.2	234°23.4	14.5'	05°02.0	-9.7'	54.8'
15	45°53.0	·· 14.9	248°56.9	14.5'	05°11.7	-9.7'	54.7'
16	60°53.0	15.5	263°30.4	14.5'	05°21.4	-9.6'	54.7'
17	75°53.1	16.2	278°03.9	14.5'	05°31.0	-9.6'	54.7'
18	90°53.1	N17°16.9	292°37.4	14.5'	S05°40.6	-9.6'	54.7'
19	105°53.1	17.5	307°10.9	14.5'	05°50.2	-9.6'	54.7'
20	120°53.2	18.2	321°44.4	14.5'	05°59.8	-9.5'	54.7'
21	135°53.2	·· 18.9	336°17.9	14.5'	06°09.3	-9.5'	54.7'
22	150°53.2	19.5	350°51.4	14.5'	06°18.8	-9.5'	54.6'
23	165°53.2	20.2	5°24.9	14.5'	06°28.2	-9.4'	54.6'
	SD.=15.8	d=0.7	S.D.=14.9				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°53.3	N17°20.9	19°58.4	14.5'	S06°37.7	-9.4'	54.6'
1	195°53.3	21.5	34°31.8	14.5'	06°47.1	-9.4'	54.6'
2	210°53.3	22.2	49°05.3	14.5'	06°56.4	-9.3'	54.6'
3	225°53.4	·· 22.9	63°38.8	14.5'	07°05.8	-9.3'	54.6'
4	240°53.4	23.5	78°12.2	14.5'	07°15.1	-9.3'	54.6'
5	255°53.4	24.2	92°45.7	14.4'	07°24.3	-9.2'	54.6'
6	270°53.5	N17°24.9	107°19.1	14.4'	S07°33.6	-9.2'	54.5'
7	285°53.5	25.5	121°52.5	14.4'	07°42.7	-9.2'	54.5'
8	300°53.5	26.2	136°26.0	14.4'	07°51.9	-9.1'	54.5'
9	315°53.5	·· 26.9	150°59.4	14.4'	08°01.0	-9.1'	54.5'
10	330°53.6	27.5	165°32.8	14.4'	08°10.1	-9.1'	54.5'
11	345°53.6	28.2	180°06.2	14.4'	08°19.2	-9.0'	54.5'
12	0°53.6	N17°28.8	194°39.6	14.4'	S08°28.2	-9.0'	54.5'
13	15°53.7	29.5	209°12.9	14.4'	08°37.1	-8.9'	54.5'
14	30°53.7	30.2	223°46.3	14.4'	08°46.1	-8.9'	54.4'
15	45°53.7	·· 30.8	238°19.6	14.3'	08°55.0	-8.9'	54.4'
16	60°53.7	31.5	252°53.0	14.3'	09°03.8	-8.8'	54.4'
17	75°53.8	32.1	267°26.3	14.3'	09°12.6	-8.8'	54.4'
18	90°53.8	N17°32.8	281°59.6	14.3'	S09°21.4	-8.7'	54.4'
19	105°53.8	33.4	296°32.9	14.3'	09°30.1	-8.7'	54.4'
20	120°53.8	34.1	311°06.2	14.3'	09°38.8	-8.7'	54.4'
21	135°53.9	·· 34.8	325°39.5	14.3'	09°47.4	-8.6'	54.4'
22	150°53.9	35.4	340°12.7	14.2'	09°56.0	-8.6'	54.4'
23	165°53.9	36.1	354°46.0	14.2'	10°04.5	-8.5'	54.3'
	SD.=15.8	d=0.7	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	00:20	–:–	▭	▭
N 70°	▭	▭	01:45	22:14	▭	▭
68°	▭	▭	02:23	21:34	▭	▭
66°	▭	01:02	02:49	21:07	23:00	▭
64°	▭	01:50	03:10	20:46	22:08	▭
62°	▭	02:19	03:26	20:29	21:37	▭
60°	00:55	02:42	03:39	20:15	21:14	23:06
N 58°	01:38	02:59	03:51	20:04	20:56	22:19
56°	02:06	03:14	04:01	19:54	20:41	21:50
54°	02:26	03:26	04:10	19:45	20:28	21:29
52°	02:43	03:37	04:17	19:37	20:17	21:12
50°	02:57	03:47	04:24	19:29	20:08	20:57
45°	03:25	04:06	04:40	19:14	19:48	20:30
N 40°	03:45	04:22	04:52	19:02	19:32	20:09
35°	04:01	04:35	05:02	18:51	19:19	19:52
30°	04:15	04:46	05:11	18:42	19:08	19:39
20°	04:36	05:04	05:27	18:26	18:50	19:17
N 10°	04:53	05:18	05:40	18:13	18:35	19:01
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:18	05:43	06:05	17:47	18:09	18:35
20°	05:29	05:56	06:19	17:34	17:57	18:24
30°	05:40	06:08	06:33	17:19	17:44	18:13
35°	05:45	06:15	06:42	17:10	17:37	18:07
40°	05:51	06:23	06:52	17:01	17:29	18:02
45°	05:57	06:32	07:03	16:49	17:21	17:56
S 50°	06:03	06:42	07:17	16:35	17:10	17:49
52°	06:06	06:47	07:24	16:29	17:06	17:46
54°	06:09	06:52	07:31	16:22	17:01	17:43
56°	06:12	06:57	07:39	16:14	16:55	17:40
58°	06:16	07:03	07:48	16:05	16:49	17:37
S 60°	06:19	07:10	07:58	15:54	16:42	17:33

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	16:02	17:41	19:21	03:29	03:22	03:14
N 70°	16:00	17:32	19:05	03:28	03:26	03:24
68°	15:58	17:26	18:52	03:27	03:30	03:33
66°	15:57	17:20	18:42	03:27	03:33	03:40
64°	15:56	17:15	18:34	03:26	03:36	03:46
62°	15:55	17:11	18:26	03:26	03:38	03:51
60°	15:54	17:07	18:20	03:25	03:40	03:55
N 58°	15:53	17:04	18:15	03:25	03:42	03:59
56°	15:52	17:01	18:10	03:25	03:44	04:03
54°	15:51	16:59	18:05	03:24	03:45	04:06
52°	15:51	16:57	18:01	03:24	03:47	04:09
50°	15:50	16:55	17:58	03:24	03:48	04:12
45°	15:49	16:50	17:50	03:23	03:50	04:18
N 40°	15:48	16:46	17:44	03:23	03:53	04:23
35°	15:47	16:43	17:38	03:23	03:55	04:27
30°	15:47	16:40	17:33	03:22	03:56	04:31
20°	15:45	16:35	17:25	03:22	03:59	04:37
N 10°	15:44	16:31	17:18	03:21	04:02	04:43
0°	15:43	16:27	17:11	03:21	04:05	04:48
S 10°	15:42	16:23	17:04	03:20	04:07	04:54
20°	15:41	16:19	16:57	03:19	04:10	04:59
30°	15:40	16:14	16:49	03:19	04:13	05:06
35°	15:40	16:12	16:44	03:18	04:14	05:10
40°	15:39	16:09	16:39	03:18	04:16	05:14
45°	15:38	16:05	16:33	03:17	04:19	05:19
S 50°	15:37	16:01	16:26	03:17	04:21	05:25
52°	15:37	15:59	16:22	03:16	04:23	05:28
54°	15:36	15:57	16:19	03:16	04:24	05:31
56°	15:36	15:55	16:15	03:16	04:25	05:34
58°	15:35	15:52	16:10	03:15	04:27	05:38
S 60°	15:34	15:49	16:05	03:15	04:29	05:42

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 11-13 89-98%
07	03:26	03:28	11:57	21:54	09:32	
08	03:30	03:32	11:56	22:38	10:16	
09	03:33	03:34	11:56	23:22	11:00	

May 10, 11, 12 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	227°59.0	221°54.9	N02°31.2	156°47.8	N23°02.5	33°57.7	S04°20.7	321°19.5	S22°01.8
1	243°01.5	236°55.7	31.6	171°48.4	02.7	49°00.4	20.6	336°22.1	01.8
2	258°04.0	251°56.4	32.0	186°49.1	02.9	64°03.0	20.5	351°24.7	01.8
3	273°06.4	266°57.2	·· 32.4	201°49.7	·· 03.2	79°05.7	·· 20.5	6°27.3	·· 01.7
4	288°08.9	281°57.9	32.7	216°50.3	03.4	94°08.4	20.4	21°29.9	01.7
5	303°11.4	296°58.6	33.1	231°51.0	03.6	109°11.0	20.3	36°32.5	01.7
6	318°13.8	311°59.4	N02°33.5	246°51.6	N23°03.9	124°13.7	S04°20.2	51°35.1	S22°01.7
7	333°16.3	327°00.1	33.9	261°52.2	04.1	139°16.4	20.2	66°37.7	01.7
8	348°18.7	342°00.9	34.3	276°52.9	04.3	154°19.0	20.1	81°40.3	01.7
9	3°21.2	357°01.6	·· 34.7	291°53.5	·· 04.6	169°21.7	·· 20.0	96°42.9	·· 01.7
10	18°23.7	12°02.3	35.0	306°54.1	04.8	184°24.4	19.9	111°45.5	01.7
11	33°26.1	27°03.1	35.4	321°54.8	05.0	199°27.0	19.9	126°48.1	01.7
12	48°28.6	42°03.8	N02°35.8	336°55.4	N23°05.3	214°29.7	S04°19.8	141°50.7	S22°01.7
13	63°31.1	57°04.5	36.2	351°56.0	05.5	229°32.4	19.7	156°53.3	01.7
14	78°33.5	72°05.3	36.6	6°56.7	05.7	244°35.0	19.6	171°55.9	01.7
15	93°36.0	87°06.0	·· 37.0	21°57.3	·· 06.0	259°37.7	·· 19.6	186°58.5	·· 01.7
16	108°38.5	102°06.7	37.4	36°58.0	06.2	274°40.3	19.5	202°01.1	01.7
17	123°40.9	117°07.4	37.8	51°58.6	06.4	289°43.0	19.4	217°03.7	01.7
18	138°43.4	132°08.2	N02°38.1	66°59.2	N23°06.7	304°45.7	S04°19.3	232°06.3	S22°01.7
19	153°45.8	147°08.9	38.5	81°59.9	06.9	319°48.3	19.3	247°08.9	01.7
20	168°48.3	162°09.6	38.9	97°00.5	07.1	334°51.0	19.2	262°11.5	01.7
21	183°50.8	177°10.3	·· 39.3	112°01.1	·· 07.3	349°53.7	·· 19.1	277°14.2	·· 01.7
22	198°53.2	192°11.0	39.7	127°01.8	07.6	4°56.3	19.0	292°16.8	01.7
23	213°55.7	207°11.8	40.1	142°02.4	07.8	19°59.0	19.0	307°19.4	01.7
Mer.pass.:08:47		v0.7 d0.4 m-4.4		v0.6 d0.2 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	228°58.2	222°12.5	N02°40.5	157°03.0	N23°08.0	35°01.7	S04°18.9	322°22.0	S22°01.7
1	244°00.6	237°13.2	40.9	172°03.7	08.3	50°04.3	18.8	337°24.6	01.7
2	259°03.1	252°13.9	41.3	187°04.3	08.5	65°07.0	18.7	352°27.2	01.7
3	274°05.6	267°14.6	·· 41.7	202°04.9	·· 08.7	80°09.6	·· 18.7	7°29.8	·· 01.7
4	289°08.0	282°15.3	42.1	217°05.6	08.9	95°12.3	18.6	22°32.4	01.7
5	304°10.5	297°16.0	42.5	232°06.2	09.2	110°15.0	18.5	37°35.0	01.7
6	319°13.0	312°16.7	N02°42.9	247°06.8	N23°09.4	125°17.6	S04°18.5	52°37.6	S22°01.6
7	334°15.4	327°17.4	43.3	262°07.5	09.6	140°20.3	18.4	67°40.2	01.6
8	349°17.9	342°18.1	43.8	277°08.1	09.8	155°22.9	18.3	82°42.8	01.6
9	4°20.3	357°18.8	·· 44.2	292°08.7	·· 10.1	170°25.6	·· 18.2	97°45.4	·· 01.6
10	19°22.8	12°19.5	44.6	307°09.4	10.3	185°28.3	18.2	112°48.0	01.6
11	34°25.3	27°20.2	45.0	322°10.0	10.5	200°30.9	18.1	127°50.6	01.6
12	49°27.7	42°20.9	N02°45.4	337°10.6	N23°10.7	215°33.6	S04°18.0	142°53.2	S22°01.6
13	64°30.2	57°21.6	45.8	352°11.3	11.0	230°36.2	17.9	157°55.8	01.6
14	79°32.7	72°22.3	46.2	7°11.9	11.2	245°38.9	17.9	172°58.4	01.6
15	94°35.1	87°23.0	·· 46.6	22°12.5	·· 11.4	260°41.6	·· 17.8	188°01.0	·· 01.6
16	109°37.6	102°23.7	47.0	37°13.2	11.6	275°44.2	17.7	203°03.6	01.6
17	124°40.1	117°24.4	47.5	52°13.8	11.8	290°46.9	17.7	218°06.2	01.6
18	139°42.5	132°25.1	N02°47.9	67°14.4	N23°12.1	305°49.5	S04°17.6	233°08.8	S22°01.6
19	154°45.0	147°25.8	48.3	82°15.1	12.3	320°52.2	17.5	248°11.4	01.6
20	169°47.5	162°26.5	48.7	97°15.7	12.5	335°54.8	17.4	263°14.0	01.6
21	184°49.9	177°27.2	·· 49.1	112°16.3	·· 12.7	350°57.5	·· 17.4	278°16.7	·· 01.6
22	199°52.4	192°27.8	49.6	127°17.0	12.9	6°00.2	17.3	293°19.3	01.6
23	214°54.8	207°28.5	50.0	142°17.6	13.2	21°02.8	17.2	308°21.9	01.6
Mer.pass.:08:43		v0.7 d0.4 m-4.4		v0.6 d0.2 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	229°57.3	222°29.2	N02°50.4	157°18.2	N23°13.4	36°05.5	S04°17.2	323°24.5	S22°01.6
1	244°59.8	237°29.9	50.8	172°18.9	13.6	51°08.1	17.1	338°27.1	01.6
2	260°02.2	252°30.6	51.2	187°19.5	13.8	66°10.8	17.0	353°29.7	01.6
3	275°04.7	267°31.2	·· 51.7	202°20.1	·· 14.0	81°13.4	·· 16.9	8°32.3	·· 01.6
4	290°07.2	282°31.9	52.1	217°20.8	14.3	96°16.1	16.9	23°34.9	01.6
5	305°09.6	297°32.6	52.5	232°21.4	14.5	111°18.8	16.8	38°37.5	01.6
6	320°12.1	312°33.3	N02°53.0	247°22.0	N23°14.7	126°21.4	S04°16.7	53°40.1	S22°01.6
7	335°14.6	327°33.9	53.4	262°22.7	14.9	141°24.1	16.7	68°42.7	01.6
8	350°17.0	342°34.6	53.8	277°23.3	15.1	156°26.7	16.6	83°45.3	01.6
9	5°19.5	357°35.3	·· 54.3	292°23.9	·· 15.3	171°29.4	·· 16.5	98°47.9	·· 01.5
10	20°21.9	12°36.0	54.7	307°24.6	15.6	186°32.0	16.4	113°50.5	01.5
11	35°24.4	27°36.6	55.1	322°25.2	15.8	201°34.7	16.4	128°53.1	01.5
12	50°26.9	42°37.3	N02°55.6	337°25.8	N23°16.0	216°37.3	S04°16.3	143°55.8	S22°01.5
13	65°29.3	57°37.9	56.0	352°26.5	16.2	231°40.0	16.2	158°58.4	01.5
14	80°31.8	72°38.6	56.4	7°27.1	16.4	246°42.6	16.2	174°01.0	01.5
15	95°34.3	87°39.3	·· 56.9	22°27.7	·· 16.6	261°45.3	·· 16.1	189°03.6	·· 01.5
16	110°36.7	102°39.9	57.3	37°28.4	16.8	276°47.9	16.0	204°06.2	01.5
17	125°39.2	117°40.6	57.7	52°29.0	17.1	291°50.6	16.0	219°08.8	01.5
18	140°41.7	132°41.2	N02°58.2	67°29.6	N23°17.3	306°53.2	S04°15.9	234°11.4	S22°01.5
19	155°44.1	147°41.9	58.6	82°30.3	17.5	321°55.9	15.8	249°14.0	01.5
20	170°46.6	162°42.5	59.1	97°30.9	17.7	336°58.6	15.8	264°16.6	01.5
21	185°49.1	177°43.2	02°59.5	112°31.5	·· 17.9	352°01.2	·· 15.7	279°19.2	·· 01.5
22	200°51.5	192°43.9	03°00.0	127°32.2	18.1	7°03.9	15.6	294°21.8	01.5
23	215°54.0	207°44.5	00.4	142°32.8	18.3	22°06.5	15.5	309°24.4	01.5
Mer.pass.:08:39		v0.7 d0.4 m-4.4		v0.6 d0.2 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°41.0	29°10.9
Ankaa	353°13.5	-42°12.7
Schedar	349°37.9	56°37.6
Diphda	348°53.6	-17°53.6
Achernar	335°25.5	-57°09.0
Hamal	327°58.1	23°32.4
Polaris	317°02.2	89°20.0
Acamar	315°16.8	-40°14.3
Menkar	314°12.6	4°09.2
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.9	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.7	7°24.3
Canopus	263°55.4	-52°42.7
Sirius	258°31.7	-16°44.7
Adhara	255°10.7	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.7	27°58.9
Avior	234°17.1	-59°34.3
Suhail	222°50.5	-43°30.5
Miaplacidus	221°39.1	-69°47.7
Alphard	217°53.5	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.4	61°39.7
Denebola	182°30.8	14°28.5
Gienah	175°49.4	-17°38.4
Acrux	173°05.8	-63°11.9
Gacrux	171°57.5	-57°12.8
Alioth	166°18.1	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.8
Hadar	148°43.4	-60°27.4
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.6
Rigil Kent.	139°47.4	-60°54.3
Kochab	137°19.1	74°05.2
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.5
Antares	112°22.7	-26°28.0
Atria	107°21.6	-69°03.2
Sabik	102°09.2	-15°44.6
Shaula	96°18.0	-37°06.7
Rasalhague	96°03.7	12°32.9
Eltanin	90°44.5	51°29.2
Kaus Aust.	83°40.1	-34°22.3
Vega	80°36.9	38°47.9
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°54.9
Peacock	53°15.0	-56°40.4
Deneb	49°29.6	45°20.4
Enif	33°44.6	9°57.2
Al Na'ir	27°40.6	-46°52.4
Fomalhaut	15°21.3	-29°31.7
Scheat	13°51.0	28°10.4
Markab	13°35.9	15°17.7

May 10 Wed	**SHA**	**Mer.pass**
Venus	353°55.9	09:12
Mars	288°48.8	13:32
Jupiter	165°58.7	21:40
Saturn	93°20.5	02:34

May 11 Thu	**SHA**	**Mer.pass**
Venus	353°14.3	09:11
Mars	288°04.9	13:31
Jupiter	166°03.5	21:36
Saturn	93°23.8	02:30

May 12 Fri	**SHA**	**Mer.pass**
Venus	352°31.9	09:10
Mars	287°20.9	13:30
Jupiter	166°08.2	21:32
Saturn	93°27.2	02:26

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.4098 sec ΔT = TT-UT1 = +68.7742 sec

2017 May 10 to May. 12 UT

h

	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°53.9	N17°36.7	9°19.2	14.2′	S10°13.0	-8.5′	54.3′
1	195°54.0	37.4	23°52.4	14.2′	10°21.5	-8.4′	54.3′
2	210°54.0	38.0	38°25.6	14.2′	10°29.9	-8.4′	54.3′
3	225°54.0	·· 38.7	52°58.8	14.2′	10°38.3	-8.3′	54.3′
4	240°54.0	39.3	67°31.9	14.2′	10°46.6	-8.3′	54.3′
5	255°54.1	40.0	82°05.1	14.1′	10°54.9	-8.2′	54.3′
6	270°54.1	N17°40.6	96°38.2	14.1′	S11°03.1	-8.2′	54.3′
7	285°54.1	41.3	111°11.3	14.1′	11°11.2	-8.1′	54.3′
8	300°54.1	41.9	125°44.4	14.1′	11°19.4	-8.1′	54.3′
9	315°54.1	·· 42.6	140°17.5	14.1′	11°27.4	-8.0′	54.2′
10	330°54.2	43.2	154°50.5	14.0′	11°35.4	-8.0′	54.2′
11	345°54.2	43.9	169°23.6	14.0′	11°43.4	-7.9′	54.2′
12	0°54.2	N17°44.5	183°56.6	14.0′	S11°51.3	-7.9′	54.2′
13	15°54.2	45.2	198°29.6	14.0′	11°59.2	-7.8′	54.2′
14	30°54.2	45.8	213°02.6	14.0′	12°07.0	-7.8′	54.2′
15	45°54.3	·· 46.5	227°35.5	13.9′	12°14.7	-7.7′	54.2′
16	60°54.3	47.1	242°08.5	13.9′	12°22.4	-7.7′	54.2′
17	75°54.3	47.8	256°41.4	13.9′	12°30.1	-7.6′	54.2′
18	90°54.3	N17°48.4	271°14.3	13.9′	S12°37.7	-7.6′	54.2′
19	105°54.4	49.1	285°47.2	13.9′	12°45.2	-7.5′	54.2′
20	120°54.4	49.7	300°20.0	13.8′	12°52.7	-7.4′	54.2′
21	135°54.4	·· 50.3	314°52.8	13.8′	13°00.1	-7.4′	54.1′
22	150°54.4	51.0	329°25.7	13.8′	13°07.4	-7.3′	54.1′
23	165°54.4	51.6	343°58.4	13.8′	13°14.7	-7.3′	54.1′
	SD.=15.8	d=0.7	S.D.=14.8				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°54.4	N17°52.3	358°31.2	13.8′	S13°22.0	-7.2′	54.1′
1	195°54.5	52.9	13°04.0	13.7′	13°29.2	-7.2′	54.1′
2	210°54.5	53.6	27°36.7	13.7′	13°36.3	-7.1′	54.1′
3	225°54.5	·· 54.2	42°09.4	13.7′	13°43.4	-7.0′	54.1′
4	240°54.5	54.8	56°42.1	13.7′	13°50.4	-7.0′	54.1′
5	255°54.5	55.5	71°14.7	13.6′	13°57.3	-6.9′	54.1′
6	270°54.6	N17°56.1	85°47.4	13.6′	S14°04.2	-6.8′	54.1′
7	285°54.6	56.8	100°20.0	13.6′	14°11.0	-6.8′	54.1′
8	300°54.6	57.4	114°52.6	13.6′	14°17.8	-6.7′	54.1′
9	315°54.6	·· 58.0	129°25.1	13.6′	14°24.5	-6.7′	54.1′
10	330°54.6	58.7	143°57.7	13.5′	14°31.1	-6.6′	54.1′
11	345°54.6	59.3	158°30.2	13.5′	14°37.6	-6.5′	54.1′
12	0°54.6	N17°59.9	173°02.7	13.5′	S14°44.1	-6.5′	54.1′
13	15°54.7	18°00.6	187°35.2	13.5′	14°50.6	-6.4′	54.1′
14	30°54.7	01.2	202°07.6	13.4′	14°56.9	-6.3′	54.0′
15	45°54.7	·· 01.8	216°40.1	13.4′	15°03.2	-6.3′	54.0′
16	60°54.7	02.5	231°12.5	13.4′	15°09.5	-6.2′	54.0′
17	75°54.7	03.1	245°44.9	13.4′	15°15.7	-6.1′	54.0′
18	90°54.7	N18°03.7	260°17.2	13.3′	S15°21.8	-6.1′	54.0′
19	105°54.7	04.4	274°49.6	13.3′	15°27.8	-6.0′	54.0′
20	120°54.8	05.0	289°21.9	13.3′	15°33.8	-5.9′	54.0′
21	135°54.8	·· 05.6	303°54.2	13.3′	15°39.6	-5.9′	54.0′
22	150°54.8	06.3	318°26.4	13.3′	15°45.5	-5.8′	54.0′
23	165°54.8	06.9	332°58.7	13.2′	15°51.2	-5.7′	54.0′
	SD.=15.8	d=0.6	S.D.=14.7				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°54.8	N18°07.5	347°30.9	13.2′	S15°56.9	-5.7′	54.0′
1	195°54.8	08.2	2°03.1	13.2′	16°02.5	-5.6′	54.0′
2	210°54.8	08.8	16°35.2	13.2′	16°08.1	-5.5′	54.0′
3	225°54.8	·· 09.4	31°07.4	13.1′	16°13.5	-5.4′	54.0′
4	240°54.9	10.0	45°39.5	13.1′	16°18.9	-5.4′	54.0′
5	255°54.9	10.7	60°11.6	13.1′	16°24.3	-5.3′	54.0′
6	270°54.9	N18°11.3	74°43.7	13.1′	S16°29.5	-5.2′	54.0′
7	285°54.9	11.9	89°15.7	13.0′	16°34.7	-5.1′	54.0′
8	300°54.9	12.5	103°47.8	13.0′	16°39.8	-5.1′	54.0′
9	315°54.9	·· 13.2	118°19.8	13.0′	16°44.8	-5.0′	54.0′
10	330°54.9	13.8	132°51.7	13.0′	16°49.8	-4.9′	54.0′
11	345°54.9	14.4	147°23.7	12.9′	16°54.7	-4.8′	54.0′
12	0°54.9	N18°15.0	161°55.6	12.9′	S16°59.5	-4.8′	54.0′
13	15°55.0	15.7	176°27.6	12.9′	17°04.2	-4.7′	54.0′
14	30°55.0	16.3	190°59.5	12.9′	17°08.9	-4.6′	54.0′
15	45°55.0	·· 16.9	205°31.3	12.9′	17°13.5	-4.5′	54.0′
16	60°55.0	17.5	220°03.2	12.8′	17°18.0	-4.5′	54.0′
17	75°55.0	18.1	234°35.0	12.8′	17°22.4	-4.4′	54.0′
18	90°55.0	N18°18.8	249°06.8	12.8′	S17°26.7	-4.3′	54.0′
19	105°55.0	19.4	263°38.6	12.8′	17°31.0	-4.2′	54.0′
20	120°55.0	20.0	278°10.3	12.7′	17°35.2	-4.2′	54.0′
21	135°55.0	·· 20.6	292°42.1	12.7′	17°39.3	-4.1′	54.0′
22	150°55.0	21.2	307°13.8	12.7′	17°43.3	-4.0′	54.0′
23	165°55.0	21.9	321°45.5	12.7′	17°47.3	-3.9′	54.0′
	SD.=15.8	d=0.6	S.D.=14.7				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	01:22	22:39	▭	▭
68°	▭	▭	02:08	21:49	▭	▭
66°	▭	00:21	02:38	21:18	–:–	▭
64°	▭	01:33	03:00	20:56	22:25	▭
62°	▭	02:07	03:17	20:38	21:49	▭
60°	00:18	02:32	03:32	20:23	21:24	–:–
N 58°	01:23	02:51	03:44	20:10	21:04	22:34
56°	01:55	03:06	03:55	19:59	20:48	22:01
54°	02:18	03:20	04:04	19:50	20:35	21:37
52°	02:36	03:31	04:12	19:41	20:23	21:19
50°	02:51	03:41	04:20	19:34	20:13	21:04
45°	03:20	04:02	04:36	19:18	19:52	20:34
N 40°	03:41	04:18	04:49	19:05	19:35	20:12
35°	03:58	04:32	05:00	18:54	19:21	19:55
30°	04:12	04:43	05:09	18:44	19:10	19:41
20°	04:34	05:02	05:26	18:27	18:51	19:19
N 10°	04:52	05:18	05:40	18:13	18:35	19:01
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:18	05:44	06:06	17:47	18:09	18:34
20°	05:30	05:57	06:20	17:33	17:56	18:23
30°	05:41	06:10	06:35	17:17	17:42	18:11
35°	05:47	06:18	06:44	17:08	17:35	18:05
40°	05:53	06:26	06:55	16:58	17:26	17:59
45°	06:00	06:35	07:07	16:45	17:17	17:52
S 50°	06:07	06:46	07:21	16:31	17:06	17:45
52°	06:10	06:51	07:28	16:24	17:01	17:42
54°	06:13	06:56	07:36	16:16	16:56	17:39
56°	06:17	07:02	07:44	16:08	16:50	17:35
58°	06:21	07:09	07:54	15:58	16:43	17:31
S 60°	06:25	07:16	08:05	15:47	16:36	17:27

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	21:04	22:54	–:–	03:05	02:55	02:39
N 70°	20:38	22:12	23:45	03:23	03:21	03:21
68°	20:19	21:44	23:05	03:36	03:42	03:50
66°	20:03	21:23	22:38	03:48	03:58	04:12
64°	19:51	21:06	22:17	03:57	04:11	04:29
62°	19:40	20:52	22:00	04:05	04:22	04:44
60°	19:31	20:41	21:46	04:12	04:32	04:56
N 58°	19:24	20:30	21:34	04:18	04:40	05:06
56°	19:17	20:22	21:23	04:24	04:48	05:15
54°	19:11	20:14	21:14	04:29	04:54	05:23
52°	19:05	20:07	21:06	04:33	05:00	05:31
50°	19:00	20:01	20:59	04:38	05:06	05:37
45°	18:49	19:47	20:43	04:46	05:17	05:51
N 40°	18:40	19:36	20:31	04:54	05:27	06:03
35°	18:33	19:27	20:20	05:00	05:35	06:13
30°	18:26	19:19	20:10	05:06	05:43	06:22
20°	18:15	19:04	19:54	05:16	05:55	06:37
N 10°	18:05	18:52	19:40	05:24	06:07	06:50
0°	17:55	18:40	19:27	05:32	06:17	07:03
S 10°	17:46	18:29	19:13	05:40	06:27	07:15
20°	17:36	18:17	18:59	05:49	06:39	07:28
30°	17:25	18:03	18:43	05:59	06:52	07:44
35°	17:18	17:55	18:34	06:05	06:59	07:52
40°	17:11	17:46	18:24	06:11	07:07	08:03
45°	17:03	17:35	18:11	06:19	07:17	08:14
S 50°	16:52	17:22	17:56	06:28	07:29	08:29
52°	16:48	17:16	17:49	06:32	07:35	08:36
54°	16:43	17:10	17:41	06:37	07:41	08:43
56°	16:37	17:02	17:33	06:42	07:48	08:52
58°	16:30	16:54	17:23	06:48	07:56	09:01
S 60°	16:23	16:45	17:11	06:54	08:05	09:12

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 14-16 100-98%
10	03:36	03:37	11:56	–:–	11:44	
11	03:38	03:39	11:56	00:06	12:29	
12	03:39	03:40	11:56	00:52	13:15	

May 13, 14, 15 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	230°56.4	222°45.2	N03°00.8	157°33.4	N23°18.5	37°09.2	S04°15.5	324°27.1	S22°01.5
1	245°58.9	237°45.8	01.3	172°34.1	18.7	52°11.8	15.4	339°29.7	01.5
2	261°01.4	252°46.4	01.7	187°34.7	19.0	67°14.5	15.3	354°32.3	01.5
3	276°03.8	267°47.1	·· 02.2	202°35.3	·· 19.2	82°17.1	·· 15.3	9°34.9	·· 01.5
4	291°06.3	282°47.7	02.6	217°36.0	19.4	97°19.8	15.2	24°37.5	01.5
5	306°08.8	297°48.4	03.1	232°36.6	19.6	112°22.4	15.1	39°40.1	01.5
6	321°11.2	312°49.0	N03°03.5	247°37.2	N23°19.8	127°25.1	S04°15.1	54°42.7	S22°01.5
7	336°13.7	327°49.7	04.0	262°37.9	20.0	142°27.7	15.0	69°45.3	01.5
8	351°16.2	342°50.3	04.4	277°38.5	20.2	157°30.4	14.9	84°47.9	01.5
9	6°18.6	357°50.9	·· 04.9	292°39.1	·· 20.4	172°33.0	·· 14.9	99°50.5	·· 01.5
10	21°21.1	12°51.6	05.4	307°39.8	20.6	187°35.7	14.8	114°53.1	01.5
11	36°23.6	27°52.2	05.8	322°40.4	20.8	202°38.3	14.7	129°55.8	01.5
12	51°26.0	42°52.8	N03°06.3	337°41.0	N23°21.0	217°40.9	S04°14.7	144°58.4	S22°01.4
13	66°28.5	57°53.5	06.7	352°41.7	21.2	232°43.6	14.6	160°01.0	01.4
14	81°30.9	72°54.1	07.2	7°42.3	21.4	247°46.2	14.5	175°03.6	01.4
15	96°33.4	87°54.7	·· 07.6	22°42.9	·· 21.6	262°48.9	·· 14.5	190°06.2	·· 01.4
16	111°35.9	102°55.3	08.1	37°43.6	21.9	277°51.5	14.4	205°08.8	01.4
17	126°38.3	117°56.0	08.6	52°44.2	22.1	292°54.2	14.3	220°11.4	01.4
18	141°40.8	132°56.6	N03°09.0	67°44.8	N23°22.3	307°56.8	S04°14.3	235°14.0	S22°01.4
19	156°43.3	147°57.2	09.5	82°45.4	22.5	322°59.5	14.2	250°16.6	01.4
20	171°45.7	162°57.8	10.0	97°46.1	22.7	338°02.1	14.1	265°19.3	01.4
21	186°48.2	177°58.5	·· 10.4	112°46.7	·· 22.9	353°04.8	·· 14.1	280°21.9	·· 01.4
22	201°50.7	192°59.1	10.9	127°47.3	23.1	8°07.4	14.0	295°24.5	01.4
23	216°53.1	207°59.7	11.4	142°48.0	23.3	23°10.1	13.9	310°27.1	01.4
Mer.pass.:08:35		v0.6 d0.4 m-4.4		v0.6 d0.2 m1.6		v2.7 d0.1 m-2.2		v2.6 d0.0 m0.2	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	231°55.6	223°00.3	N03°11.8	157°48.6	N23°23.5	38°12.7	S04°13.9	325°29.7	S22°01.4
1	246°58.1	238°00.9	12.3	172°49.2	23.7	53°15.4	13.8	340°32.3	01.4
2	262°00.5	253°01.6	12.8	187°49.9	23.9	68°18.0	13.7	355°34.9	01.4
3	277°03.0	268°02.2	·· 13.2	202°50.5	·· 24.1	83°20.6	·· 13.7	10°37.5	·· 01.4
4	292°05.4	283°02.8	13.7	217°51.1	24.3	98°23.3	13.6	25°40.2	01.4
5	307°07.9	298°03.4	14.2	232°51.8	24.5	113°25.9	13.5	40°42.8	01.4
6	322°10.4	313°04.0	N03°14.7	247°52.4	N23°24.7	128°28.6	S04°13.5	55°45.4	S22°01.4
7	337°12.8	328°04.6	15.1	262°53.0	24.9	143°31.2	13.4	70°48.0	01.4
8	352°15.3	343°05.2	15.6	277°53.7	25.1	158°33.9	13.3	85°50.6	01.4
9	7°17.8	358°05.8	·· 16.1	292°54.3	·· 25.3	173°36.5	·· 13.3	100°53.2	·· 01.4
10	22°20.2	13°06.4	16.6	307°54.9	25.5	188°39.1	13.2	115°55.8	01.4
11	37°22.7	28°07.0	17.0	322°55.6	25.7	203°41.8	13.1	130°58.4	01.4
12	52°25.2	43°07.6	N03°17.5	337°56.2	N23°25.9	218°44.4	S04°13.1	146°01.1	S22°01.4
13	67°27.6	58°08.2	18.0	352°56.8	26.1	233°47.1	13.0	161°03.7	01.4
14	82°30.1	73°08.8	18.5	7°57.5	26.3	248°49.7	13.0	176°06.3	01.4
15	97°32.5	88°09.4	·· 19.0	22°58.1	·· 26.5	263°52.4	·· 12.9	191°08.9	·· 01.3
16	112°35.0	103°10.0	19.4	37°58.7	26.7	278°55.0	12.8	206°11.5	01.3
17	127°37.5	118°10.6	19.9	52°59.4	26.9	293°57.6	12.8	221°14.1	01.3
18	142°39.9	133°11.2	N03°20.4	68°00.0	N23°27.0	309°00.3	S04°12.7	236°16.7	S22°01.3
19	157°42.4	148°11.8	20.9	83°00.6	27.2	324°02.9	12.6	251°19.4	01.3
20	172°44.9	163°12.4	21.4	98°01.3	27.4	339°05.6	12.6	266°22.0	01.3
21	187°47.3	178°13.0	·· 21.9	113°01.9	·· 27.6	354°08.2	·· 12.5	281°24.6	·· 01.3
22	202°49.8	193°13.6	22.4	128°02.5	27.8	9°10.8	12.4	296°27.2	01.3
23	217°52.3	208°14.2	22.8	143°03.1	28.0	24°13.5	12.4	311°29.8	01.3
Mer.pass.:08:31		v0.6 d0.5 m-4.4		v0.6 d0.2 m1.6		v2.6 d0.1 m-2.2		v2.6 d0.0 m0.2	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	232°54.7	223°14.8	N03°23.3	158°03.8	N23°28.2	39°16.1	S04°12.3	326°32.4	S22°01.3
1	247°57.2	238°15.3	23.8	173°04.4	28.4	54°18.8	12.2	341°35.0	01.3
2	262°59.7	253°15.9	24.3	188°05.0	28.6	69°21.4	12.2	356°37.7	01.3
3	278°02.1	268°16.5	·· 24.8	203°05.7	·· 28.8	84°24.0	·· 12.1	11°40.3	·· 01.3
4	293°04.6	283°17.1	25.3	218°06.3	29.0	99°26.7	12.1	26°42.9	01.3
5	308°07.0	298°17.7	25.8	233°06.9	29.2	114°29.3	12.0	41°45.5	01.3
6	323°09.5	313°18.2	N03°26.3	248°07.6	N23°29.4	129°31.9	S04°11.9	56°48.1	S22°01.3
7	338°12.0	328°18.8	26.8	263°08.2	29.6	144°34.6	11.9	71°50.7	01.3
8	353°14.4	343°19.4	27.3	278°08.8	29.7	159°37.2	11.8	86°53.4	01.3
9	8°16.9	358°20.0	·· 27.8	293°09.5	·· 29.9	174°39.9	·· 11.7	101°56.0	·· 01.3
10	23°19.4	13°20.6	28.3	308°10.1	30.1	189°42.5	11.7	116°58.6	01.3
11	38°21.8	28°21.1	28.8	323°10.7	30.3	204°45.1	11.6	132°01.2	01.3
12	53°24.3	43°21.7	N03°29.3	338°11.4	N23°30.5	219°47.8	S04°11.6	147°03.8	S22°01.3
13	68°26.8	58°22.3	29.8	353°12.0	30.7	234°50.4	11.5	162°06.4	01.3
14	83°29.2	73°22.8	30.3	8°12.6	30.9	249°53.0	11.4	177°09.1	01.3
15	98°31.7	88°23.4	·· 30.8	23°13.2	·· 31.1	264°55.7	·· 11.4	192°11.7	·· 01.3
16	113°34.2	103°24.0	31.3	38°13.9	31.3	279°58.3	11.3	207°14.3	01.3
17	128°36.6	118°24.5	31.8	53°14.5	31.4	295°00.9	11.3	222°16.9	01.2
18	143°39.1	133°25.1	N03°32.3	68°15.1	N23°31.6	310°03.6	S04°11.2	237°19.5	S22°01.2
19	158°41.5	148°25.7	32.8	83°15.8	31.8	325°06.2	11.1	252°22.1	01.2
20	173°44.0	163°26.2	33.3	98°16.4	32.0	340°08.8	11.1	267°24.8	01.2
21	188°46.5	178°26.8	·· 33.8	113°17.0	·· 32.2	355°11.5	·· 11.0	282°27.4	·· 01.2
22	203°48.9	193°27.4	34.3	128°17.7	32.4	10°14.1	10.9	297°30.0	01.2
23	218°51.4	208°27.9	34.8	143°18.3	32.6	25°16.7	10.9	312°32.6	01.2
Mer.pass.:08:27		v0.6 d0.5 m-4.4		v0.6 d0.2 m1.6		v2.6 d0.1 m-2.2		v2.6 d0.0 m0.2	

Stars

	SHA	**Dec**
Alpheratz	357°41.0	29°10.9
Ankaa	353°13.5	-42°12.7
Schedar	349°37.8	56°37.6
Diphda	348°53.5	-17°53.6
Achernar	335°25.4	-57°09.0
Hamal	327°58.1	23°32.4
Polaris	317°01.7	89°20.0
Acamar	315°16.8	-40°14.3
Menkar	314°12.6	4°09.2
Mirfak	308°37.1	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.9	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.8
Betelgeuse	270°58.8	7°24.3
Canopus	263°55.4	-52°42.7
Sirius	258°31.7	-16°44.7
Adhara	255°10.7	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.1	-59°34.3
Suhail	222°50.5	-43°30.5
Miaplacidus	221°39.1	-69°47.7
Alphard	217°53.5	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.4	61°39.7
Denebola	182°30.8	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.8	-63°11.9
Gacrux	171°57.5	-57°12.8
Alioth	166°18.1	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.8
Hadar	148°43.4	-60°27.4
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.4	-60°54.3
Kochab	137°19.1	74°05.3
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.5
Antares	112°22.7	-26°28.0
Atria	107°21.6	-69°03.2
Sabik	102°09.2	-15°44.6
Shaula	96°18.0	-37°06.7
Rasalhague	96°03.7	12°32.9
Eltanin	90°44.5	51°29.2
Kaus Aust.	83°40.0	-34°22.3
Vega	80°36.9	38°48.0
Nunki	75°54.8	-26°16.3
Altair	62°05.5	8°54.9
Peacock	53°15.0	-56°40.4
Deneb	49°29.5	45°20.4
Enif	33°44.5	9°57.2
Al Na'ir	27°40.6	-46°52.4
Fomalhaut	15°21.3	-29°31.7
Scheat	13°50.9	28°10.4
Markab	13°35.8	15°17.7

May 13 Sat	**SHA**	**Mer.pass**
Venus	351°48.7	09:09
Mars	286°37.0	13:29
Jupiter	166°12.7	21:28
Saturn	93°30.6	02:22

May 14 Sun	**SHA**	**Mer.pass**
Venus	351°04.7	09:08
Mars	285°53.0	13:28
Jupiter	166°17.1	21:23
Saturn	93°34.1	02:18

May 15 Mon	**SHA**	**Mer.pass**
Venus	350°20.0	09:07
Mars	285°09.1	13:27
Jupiter	166°21.4	21:19
Saturn	93°37.7	02:13

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.4058 sec ΔT = TT-UT1 = +68.7782 sec

2017 May 13 to May. 15 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°55.0	N18°22.5	336°17.1	12.7'	S17°51.2	-3.8'	54.0'
1	195°55.0	23.1	350°48.8	12.6'	17°54.9	-3.8'	54.0'
2	210°55.1	23.7	5°20.4	12.6'	17°58.7	-3.7'	54.0'
3	225°55.1	·· 24.3	19°52.0	12.6'	18°02.3	-3.6'	54.0'
4	240°55.1	24.9	34°23.6	12.6'	18°05.8	-3.5'	54.0'
5	255°55.1	25.6	48°55.2	12.6'	18°09.3	-3.4'	54.0'
6	270°55.1	N18°26.2	63°26.7	12.5'	S18°12.7	-3.3'	54.0'
7	285°55.1	26.8	77°58.3	12.5'	18°16.0	-3.3'	54.0'
8	300°55.1	27.4	92°29.8	12.5'	18°19.2	-3.2'	54.0'
9	315°55.1	·· 28.0	107°01.3	12.5'	18°22.3	-3.1'	54.0'
10	330°55.1	28.6	121°32.7	12.5'	18°25.4	-3.0'	54.0'
11	345°55.1	29.2	136°04.2	12.4'	18°28.4	-2.9'	54.0'
12	0°55.1	N18°29.8	150°35.6	12.4'	S18°31.3	-2.8'	54.0'
13	15°55.1	30.4	165°07.1	12.4'	18°34.1	-2.8'	54.0'
14	30°55.1	31.1	179°38.4	12.4'	18°36.8	-2.7'	54.0'
15	45°55.1	·· 31.7	194°09.8	12.4'	18°39.4	-2.6'	54.0'
16	60°55.1	32.3	208°41.2	12.4'	18°42.0	-2.5'	54.0'
17	75°55.1	32.9	223°12.5	12.3'	18°44.4	-2.4'	54.0'
18	90°55.1	N18°33.5	237°43.9	12.3'	S18°46.8	-2.3'	54.0'
19	105°55.1	34.1	252°15.2	12.3'	18°49.1	-2.3'	54.0'
20	120°55.1	34.7	266°46.5	12.3'	18°51.3	-2.2'	54.0'
21	135°55.1	·· 35.3	281°17.8	12.3'	18°53.4	-2.1'	54.0'
22	150°55.1	35.9	295°49.0	12.3'	18°55.5	-2.0'	54.0'
23	165°55.1	36.5	310°20.3	12.2'	18°57.4	-1.9'	54.0'
	SD.=15.8	d=0.6		S.D.=14.7			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°55.1	N18°37.1	324°51.5	12.2'	S18°59.3	-1.8'	54.0'
1	195°55.1	37.7	339°22.7	12.2'	19°01.1	-1.7'	54.1'
2	210°55.1	38.3	353°53.9	12.2'	19°02.8	-1.6'	54.1'
3	225°55.1	·· 38.9	8°25.1	12.2'	19°04.4	-1.6'	54.1'
4	240°55.1	39.5	22°56.3	12.2'	19°05.9	-1.5'	54.1'
5	255°55.1	40.1	37°27.4	12.2'	19°07.3	-1.4'	54.1'
6	270°55.1	N18°40.7	51°58.6	12.1'	S19°08.7	-1.3'	54.1'
7	285°55.1	41.3	66°29.7	12.1'	19°09.9	-1.2'	54.1'
8	300°55.1	41.9	81°00.8	12.1'	19°11.1	-1.1'	54.1'
9	315°55.1	·· 42.5	95°31.9	12.1'	19°12.2	-1.0'	54.1'
10	330°55.1	43.1	110°03.0	12.1'	19°13.1	-0.9'	54.1'
11	345°55.1	43.7	124°34.1	12.1'	19°14.0	-0.9'	54.1'
12	0°55.1	N18°44.3	139°05.2	12.1'	S19°14.9	-0.8'	54.1'
13	15°55.1	44.9	153°36.3	12.1'	19°15.6	-0.7'	54.1'
14	30°55.1	45.5	168°07.3	12.0'	19°16.2	-0.6'	54.1'
15	45°55.1	·· 46.1	182°38.4	12.0'	19°16.8	-0.5'	54.2'
16	60°55.1	46.7	197°09.4	12.0'	19°17.2	-0.4'	54.2'
17	75°55.1	47.3	211°40.4	12.0'	19°17.6	-0.3'	54.2'
18	90°55.1	N18°47.9	226°11.4	12.0'	S19°17.9	-0.2'	54.2'
19	105°55.1	48.5	240°42.4	12.0'	19°18.0	-0.1'	54.2'
20	120°55.1	49.1	255°13.4	12.0'	19°18.1	-0.1'	54.2'
21	135°55.1	·· 49.7	269°44.4	12.0'	19°18.1	0.0'	54.2'
22	150°55.1	50.3	284°15.4	12.0'	19°18.1	0.1'	54.2'
23	165°55.1	50.8	298°46.3	12.0'	19°17.9	0.2'	54.2'
	SD.=15.8	d=0.6		S.D.=14.8			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°55.1	N18°51.4	313°17.3	12.0'	S19°17.6	0.3'	54.2'
1	195°55.0	52.0	327°48.2	11.9'	19°17.3	0.4'	54.2'
2	210°55.0	52.6	342°19.2	11.9'	19°16.8	0.5'	54.3'
3	225°55.0	·· 53.2	356°50.1	11.9'	19°16.3	0.6'	54.3'
4	240°55.0	53.8	11°21.1	11.9'	19°15.7	0.7'	54.3'
5	255°55.0	54.4	25°52.0	11.9'	19°15.0	0.8'	54.3'
6	270°55.0	N18°55.0	40°22.9	11.9'	S19°14.2	0.8'	54.3'
7	285°55.0	55.6	54°53.8	11.9'	19°13.3	0.9'	54.3'
8	300°55.0	56.1	69°24.7	11.9'	19°12.3	1.0'	54.3'
9	315°55.0	·· 56.7	83°55.6	11.9'	19°11.2	1.1'	54.3'
10	330°55.0	57.3	98°26.5	11.9'	19°10.1	1.2'	54.3'
11	345°55.0	57.9	112°57.4	11.9'	19°08.8	1.3'	54.4'
12	0°55.0	N18°58.5	127°28.3	11.9'	S19°07.5	1.4'	54.4'
13	15°55.0	59.1	141°59.2	11.9'	19°06.1	1.5'	54.4'
14	30°54.9	18°59.6	156°30.1	11.9'	19°04.5	1.6'	54.4'
15	45°54.9	19°00.2	171°01.0	11.9'	19°02.9	1.7'	54.4'
16	60°54.9	00.8	185°31.8	11.9'	19°01.2	1.7'	54.4'
17	75°54.9	01.4	200°02.7	11.9'	18°59.4	1.8'	54.4'
18	90°54.9	N19°02.0	214°33.6	11.9'	S18°57.6	1.9'	54.5'
19	105°54.9	02.6	229°04.5	11.9'	18°55.6	2.0'	54.5'
20	120°54.9	03.1	243°35.3	11.9'	18°53.5	2.1'	54.5'
21	135°54.9	·· 03.7	258°06.2	11.9'	18°51.4	2.2'	54.5'
22	150°54.9	04.3	272°37.1	11.9'	18°49.1	2.3'	54.5'
23	165°54.9	04.9	287°07.9	11.9'	18°46.8	2.4'	54.5'
	SD.=15.8	d=0.6		S.D.=14.8			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	00:52	23:14	▭	▭
68°	▭	▭	01:52	22:05	▭	▭
66°	▭	▭	02:26	21:30	▭	▭
64°	▭	01:14	02:50	21:05	22:45	▭
62°	▭	01:55	03:09	20:46	22:01	▭
60°	▭	02:22	03:24	20:30	21:33	▭
N 58°	01:07	02:43	03:38	20:17	21:12	22:52
56°	01:44	02:59	03:49	20:05	20:55	22:12
54°	02:09	03:13	03:59	19:55	20:41	21:46
52°	02:28	03:26	04:08	19:46	20:28	21:26
50°	02:44	03:36	04:15	19:38	20:18	21:10
45°	03:15	03:58	04:32	19:21	19:56	20:39
N 40°	03:37	04:15	04:46	19:08	19:38	20:16
35°	03:55	04:29	04:57	18:56	19:24	19:58
30°	04:10	04:41	05:07	18:46	19:12	19:43
20°	04:33	05:01	05:24	18:29	18:52	19:20
N 10°	04:51	05:17	05:39	18:14	18:36	19:02
0°	05:06	05:31	05:53	18:00	18:22	18:47
S 10°	05:19	05:44	06:06	17:46	18:08	18:34
20°	05:31	05:58	06:21	17:32	17:55	18:22
30°	05:43	06:12	06:37	17:15	17:40	18:09
35°	05:49	06:20	06:47	17:06	17:33	18:03
40°	05:56	06:28	06:58	16:55	17:24	17:57
45°	06:03	06:38	07:10	16:42	17:14	17:49
S 50°	06:10	06:50	07:26	16:27	17:02	17:42
52°	06:14	06:55	07:33	16:19	16:57	17:38
54°	06:17	07:01	07:41	16:11	16:51	17:35
56°	06:21	07:07	07:50	16:02	16:45	17:31
58°	06:26	07:14	08:00	15:52	16:38	17:26
S 60°	06:30	07:22	08:11	15:41	16:30	17:22

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	▬	▬	▬	▬	▬	▬
N 70°	–:–	01:12	02:11	03:24	03:36	04:16
68°	–:–	00:17	01:11	04:05	04:31	05:16
66°	23:44	–:–	00:37	04:33	05:04	05:50
64°	23:20	–:–	00:12	04:54	05:29	06:15
62°	23:01	23:52	–:–	05:11	05:48	06:35
60°	22:45	23:36	–:–	05:26	06:03	06:51
N 58°	22:32	23:23	–:–	05:38	06:17	07:04
56°	22:20	23:11	23:55	05:48	06:28	07:16
54°	22:10	23:01	23:45	05:58	06:38	07:26
52°	22:02	22:52	23:36	06:06	06:47	07:35
50°	21:54	22:44	23:29	06:14	06:55	07:43
45°	21:37	22:26	23:12	06:30	07:12	08:00
N 40°	21:23	22:12	22:58	06:43	07:27	08:14
35°	21:11	22:00	22:47	06:54	07:38	08:26
30°	21:01	21:50	22:37	07:04	07:49	08:37
20°	20:43	21:32	22:19	07:21	08:07	08:55
N 10°	20:28	21:16	22:04	07:35	08:22	09:10
0°	20:14	21:01	21:50	07:49	08:37	09:25
S 10°	19:59	20:47	21:35	08:03	08:51	09:39
20°	19:44	20:31	21:20	08:18	09:07	09:55
30°	19:27	20:13	21:03	08:35	09:25	10:12
35°	19:17	20:03	20:52	08:45	09:35	10:23
40°	19:05	19:51	20:41	08:56	09:47	10:35
45°	18:52	19:37	20:27	09:09	10:01	10:49
S 50°	18:35	19:20	20:10	09:26	10:18	11:05
52°	18:27	19:12	20:03	09:33	10:26	11:13
54°	18:19	19:03	19:54	09:42	10:35	11:22
56°	18:09	18:53	19:44	09:51	10:45	11:32
58°	17:58	18:41	19:33	10:02	10:57	11:44
S 60°	17:45	18:28	19:20	10:14	11:10	11:57

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 17-19 94-82%
13	03:40	03:40	11:56	01:38	14:01	
14	03:40	03:40	11:56	02:25	14:49	
15	03:40	03:40	11:56	03:13	15:37	

May 16, 17, 18 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	233°53.9	223°28.5	N03°35.3	158°18.9	N23°32.7	40°19.4	S04°10.8	327°35.2	S22°01.2
1	248°56.3	238°29.0	35.9	173°19.6	32.9	55°22.0	10.8	342°37.8	01.2
2	263°58.8	253°29.6	36.4	188°20.2	33.1	70°24.6	10.7	357°40.5	01.2
3	279°01.3	268°30.1	·· 36.9	203°20.8	·· 33.3	85°27.3	·· 10.6	12°43.1	·· 01.2
4	294°03.7	283°30.7	37.4	218°21.5	33.5	100°29.9	10.6	27°45.7	01.2
5	309°06.2	298°31.2	37.9	233°22.1	33.7	115°32.5	10.5	42°48.3	01.2
6	324°08.7	313°31.8	N03°38.4	248°22.7	N23°33.8	130°35.2	S04°10.5	57°50.9	S22°01.2
7	339°11.1	328°32.3	38.9	263°23.3	34.0	145°37.8	10.4	72°53.6	01.2
8	354°13.6	343°32.9	39.5	278°24.0	34.2	160°40.4	10.3	87°56.2	01.2
9	9°16.0	358°33.4	·· 40.0	293°24.6	·· 34.4	175°43.1	·· 10.3	102°58.8	·· 01.2
10	24°18.5	13°34.0	40.5	308°25.2	34.6	190°45.7	10.2	118°01.4	01.2
11	39°21.0	28°34.5	41.0	323°25.9	34.8	205°48.3	10.2	133°04.0	01.2
12	54°23.4	43°35.1	N03°41.5	338°26.5	N23°34.9	220°51.0	S04°10.1	148°06.7	S22°01.2
13	69°25.9	58°35.6	42.1	353°27.1	35.1	235°53.6	10.0	163°09.3	01.2
14	84°28.4	73°36.1	42.6	8°27.8	35.3	250°56.2	10.0	178°11.9	01.2
15	99°30.8	88°36.7	·· 43.1	23°28.4	·· 35.5	265°58.8	·· 09.9	193°14.5	·· 01.2
16	114°33.3	103°37.2	43.6	38°29.0	35.6	281°01.5	09.9	208°17.1	01.2
17	129°35.8	118°37.8	44.1	53°29.7	35.8	296°04.1	09.8	223°19.8	01.2
18	144°38.2	133°38.3	N03°44.7	68°30.3	N23°36.0	311°06.7	S04°09.7	238°22.4	S22°01.2
19	159°40.7	148°38.8	45.2	83°30.9	36.2	326°09.4	09.7	253°25.0	01.1
20	174°43.1	163°39.4	45.7	98°31.6	36.4	341°12.0	09.6	268°27.6	01.1
21	189°45.6	178°39.9	·· 46.2	113°32.2	·· 36.5	356°14.6	·· 09.6	283°30.2	·· 01.1
22	204°48.1	193°40.4	46.8	128°32.8	36.7	11°17.2	09.5	298°32.9	01.1
23	219°50.5	208°41.0	47.3	143°33.4	36.9	26°19.9	09.5	313°35.5	01.1
Mer.pass.:08:23		v0.6 d0.5 m-4.4		v0.6 d0.2 m1.6		v2.6 d0.1 m-2.2		v2.6 d0.0 m0.2	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	234°53.0	223°41.5	N03°47.8	158°34.1	N23°37.1	41°22.5	S04°09.4	328°38.1	S22°01.1
1	249°55.5	238°42.0	48.4	173°34.7	37.2	56°25.1	09.3	343°40.7	01.1
2	264°57.9	253°42.6	48.9	188°35.3	37.4	71°27.8	09.3	358°43.3	01.1
3	280°00.4	268°43.1	·· 49.4	203°36.0	·· 37.6	86°30.4	·· 09.2	13°46.0	·· 01.1
4	295°02.9	283°43.6	50.0	218°36.6	37.8	101°33.0	09.2	28°48.6	01.1
5	310°05.3	298°44.1	50.5	233°37.2	37.9	116°35.6	09.1	43°51.2	01.1
6	325°07.8	313°44.6	N03°51.0	248°37.9	N23°38.1	131°38.3	S04°09.1	58°53.8	S22°01.1
7	340°10.3	328°45.2	51.6	263°38.5	38.3	146°40.9	09.0	73°56.4	01.1
8	355°12.7	343°45.7	52.1	278°39.1	38.5	161°43.5	08.9	88°59.1	01.1
9	10°15.2	358°46.2	·· 52.6	293°39.8	·· 38.6	176°46.1	·· 08.9	104°01.7	·· 01.1
10	25°17.6	13°46.7	53.2	308°40.4	38.8	191°48.8	08.8	119°04.3	01.1
11	40°20.1	28°47.2	53.7	323°41.0	39.0	206°51.4	08.8	134°06.9	01.1
12	55°22.6	43°47.8	N03°54.3	338°41.6	N23°39.1	221°54.0	S04°08.7	149°09.6	S22°01.1
13	70°25.0	58°48.3	54.8	353°42.3	39.3	236°56.6	08.7	164°12.2	01.1
14	85°27.5	73°48.8	55.3	8°42.9	39.5	251°59.3	08.6	179°14.8	01.1
15	100°30.0	88°49.3	·· 55.9	23°43.5	·· 39.7	267°01.9	·· 08.5	194°17.4	·· 01.1
16	115°32.4	103°49.8	56.4	38°44.2	39.8	282°04.5	08.5	209°20.0	01.1
17	130°34.9	118°50.3	57.0	53°44.8	40.0	297°07.1	08.4	224°22.7	01.1
18	145°37.4	133°50.8	N03°57.5	68°45.4	N23°40.2	312°09.7	S04°08.4	239°25.3	S22°01.1
19	160°39.8	148°51.3	58.0	83°46.1	40.3	327°12.4	08.3	254°27.9	01.1
20	175°42.3	163°51.8	58.6	98°46.7	40.5	342°15.0	08.3	269°30.5	01.1
21	190°44.8	178°52.4	·· 59.1	113°47.3	·· 40.7	357°17.6	·· 08.2	284°33.2	·· 01.0
22	205°47.2	193°52.9	03°59.7	128°48.0	40.8	12°20.2	08.1	299°35.8	01.0
23	220°49.7	208°53.4	04°00.2	143°48.6	41.0	27°22.9	08.1	314°38.4	01.0
Mer.pass.:08:19		v0.5 d0.5 m-4.4		v0.6 d0.2 m1.6		v2.6 d0.1 m-2.2		v2.6 d0.0 m0.2	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	235°52.1	223°53.9	N04°00.8	158°49.2	N23°41.2	42°25.5	S04°08.0	329°41.0	S22°01.0
1	250°54.6	238°54.4	01.3	173°49.8	41.3	57°28.1	08.0	344°43.6	01.0
2	265°57.1	253°54.9	01.9	188°50.5	41.5	72°30.7	07.9	359°46.3	01.0
3	280°59.5	268°55.4	·· 02.4	203°51.1	·· 41.7	87°33.3	·· 07.9	14°48.9	·· 01.0
4	296°02.0	283°55.9	03.0	218°51.7	41.8	102°36.0	07.8	29°51.5	01.0
5	311°04.5	298°56.4	03.5	233°52.4	42.0	117°38.6	07.8	44°54.1	01.0
6	326°06.9	313°56.9	N04°04.1	248°53.0	N23°42.2	132°41.2	S04°07.7	59°56.8	S22°01.0
7	341°09.4	328°57.3	04.6	263°53.6	42.3	147°43.8	07.7	74°59.4	01.0
8	356°11.9	343°57.8	05.2	278°54.3	42.5	162°46.4	07.6	90°02.0	01.0
9	11°14.3	358°58.3	·· 05.8	293°54.9	·· 42.7	177°49.0	·· 07.5	105°04.6	·· 01.0
10	26°16.8	13°58.8	06.3	308°55.5	42.8	192°51.7	07.5	120°07.3	01.0
11	41°19.2	28°59.3	06.9	323°56.1	43.0	207°54.3	07.4	135°09.9	01.0
12	56°21.7	43°59.8	N04°07.4	338°56.8	N23°43.2	222°56.9	S04°07.4	150°12.5	S22°01.0
13	71°24.2	59°00.3	08.0	353°57.4	43.3	237°59.5	07.3	165°15.1	01.0
14	86°26.6	74°00.8	08.5	8°58.0	43.5	253°02.1	07.3	180°17.8	01.0
15	101°29.1	89°01.3	·· 09.1	23°58.7	·· 43.6	268°04.8	·· 07.2	195°20.4	·· 01.0
16	116°31.6	104°01.8	09.7	38°59.3	43.8	283°07.4	07.2	210°23.0	01.0
17	131°34.0	119°02.2	10.2	53°59.9	44.0	298°10.0	07.1	225°25.6	01.0
18	146°36.5	134°02.7	N04°10.8	69°00.6	N23°44.1	313°12.6	S04°07.1	240°28.3	S22°01.0
19	161°39.0	149°03.2	11.3	84°01.2	44.3	328°15.2	07.0	255°30.9	01.0
20	176°41.4	164°03.7	11.9	99°01.8	44.5	343°17.8	07.0	270°33.5	01.0
21	191°43.9	179°04.2	·· 12.5	114°02.4	·· 44.6	358°20.5	·· 06.9	285°36.1	·· 01.0
22	206°46.4	194°04.6	13.0	129°03.1	44.8	13°23.1	06.8	300°38.8	01.0
23	221°48.8	209°05.1	13.6	144°03.7	44.9	28°25.7	06.8	315°41.4	00.9
Mer.pass.:08:15		v0.5 d0.5 m-4.4		v0.6 d0.2 m1.6		v2.6 d0.1 m-2.2		v2.6 d0.0 m0.1	

Stars

	SHA	Dec
Alpheratz	357°40.9	29°10.9
Ankaa	353°13.4	-42°12.7
Schedar	349°37.8	56°37.6
Diphda	348°53.5	-17°53.6
Achernar	335°25.4	-57°08.9
Hamal	327°58.1	23°32.4
Polaris	317°01.3	89°20.0
Acamar	315°16.8	-40°14.3
Menkar	314°12.6	4°09.2
Mirfak	308°37.0	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.9	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.8	7°24.3
Canopus	263°55.4	-52°42.7
Sirius	258°31.7	-16°44.7
Adhara	255°10.7	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.1	-59°34.3
Suhail	222°50.6	-43°30.5
Miaplacidus	221°39.2	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.4	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.8	-63°11.9
Gacrux	171°57.5	-57°12.8
Alioth	166°18.1	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.8
Hadar	148°43.4	-60°27.4
Menkent	148°04.1	-36°27.3
Arcturus	145°53.0	19°05.7
Rigil Kent.	139°47.4	-60°54.3
Kochab	137°19.1	74°05.3
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.5
Antares	112°22.7	-26°28.0
Atria	107°21.5	-69°03.2
Sabik	102°09.2	-15°44.6
Shaula	96°18.0	-37°06.7
Rasalhague	96°03.7	12°33.0
Eltanin	90°44.5	51°29.2
Kaus Aust.	83°40.0	-34°22.3
Vega	80°36.9	38°48.0
Nunki	75°54.8	-26°16.3
Altair	62°05.5	8°54.9
Peacock	53°15.0	-56°40.4
Deneb	49°29.5	45°20.4
Enif	33°44.5	9°57.2
Al Na'ir	27°40.5	-46°52.4
Fomalhaut	15°21.2	-29°31.7
Scheat	13°50.9	28°10.4
Markab	13°35.8	15°17.8

May 16 Tue	**SHA**	**Mer.pass**
Venus	349°34.6	09:06
Mars	284°25.1	13:26
Jupiter	166°25.5	21:15
Saturn	93°41.4	02:09

May 17 Wed	**SHA**	**Mer.pass**
Venus	348°48.5	09:05
Mars	283°41.1	13:25
Jupiter	166°29.5	21:11
Saturn	93°45.1	02:05

May 18 Thu	**SHA**	**Mer.pass**
Venus	348°01.7	09:04
Mars	282°57.1	13:24
Jupiter	166°33.3	21:07
Saturn	93°48.9	02:01

Horizontal parallax	
Venus:	0.3
Mars:	0.1

DUT1 = UT1-UTC = +0.4019 sec ΔT = TT-UT1 = +68.7821 sec

2017 May 16 to May. 18 UT

h

	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°54.8	N19°05.4	301°38.8	11.9′	S18°44.4	2.5′	54.6′
1	195°54.8	06.0	316°09.7	11.9′	18°41.9	2.6′	54.6′
2	210°54.8	06.6	330°40.5	11.9′	18°39.3	2.6′	54.6′
3	225°54.8	·· 07.2	345°11.4	11.9′	18°36.6	2.7′	54.6′
4	240°54.8	07.7	359°42.2	11.9′	18°33.8	2.8′	54.6′
5	255°54.8	08.3	14°13.1	11.9′	18°31.0	2.9′	54.6′
6	270°54.8	N19°08.9	28°44.0	11.9′	S18°28.0	3.0′	54.7′
7	285°54.8	09.5	43°14.8	11.9′	18°25.0	3.1′	54.7′
8	300°54.7	10.0	57°45.7	11.9′	18°21.8	3.2′	54.7′
9	315°54.7	·· 10.6	72°16.6	11.9′	18°18.6	3.3′	54.7′
10	330°54.7	11.2	86°47.4	11.9′	18°15.3	3.4′	54.7′
11	345°54.7	11.8	101°18.3	11.9′	18°11.9	3.4′	54.7′
12	0°54.7	N19°12.3	115°49.2	11.9′	S18°08.4	3.5′	54.8′
13	15°54.7	12.9	130°20.0	11.9′	18°04.9	3.6′	54.8′
14	30°54.7	13.5	144°50.9	11.9′	18°01.2	3.7′	54.8′
15	45°54.6	·· 14.0	159°21.8	11.9′	17°57.5	3.8′	54.8′
16	60°54.6	14.6	173°52.7	11.9′	17°53.6	3.9′	54.8′
17	75°54.6	15.2	188°23.5	11.9′	17°49.7	4.0′	54.9′
18	90°54.6	N19°15.7	202°54.4	11.9′	S17°45.7	4.1′	54.9′
19	105°54.6	16.3	217°25.3	11.9′	17°41.6	4.1′	54.9′
20	120°54.6	16.9	231°56.2	11.9′	17°37.4	4.2′	54.9′
21	135°54.5	·· 17.4	246°27.1	11.9′	17°33.2	4.3′	54.9′
22	150°54.5	18.0	260°58.0	11.9′	17°28.8	4.4′	55.0′
23	165°54.5	18.6	275°28.9	11.9′	17°24.4	4.5′	55.0′
	SD.=15.8	d=0.6	S.D.=14.9				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°54.5	N19°19.1	289°59.8	11.9′	S17°19.8	4.6′	55.0′
1	195°54.5	19.7	304°30.7	11.9′	17°15.2	4.7′	55.0′
2	210°54.5	20.3	319°01.6	11.9′	17°10.5	4.7′	55.0′
3	225°54.4	·· 20.8	333°32.5	11.9′	17°05.7	4.8′	55.1′
4	240°54.4	21.4	348°03.4	11.9′	17°00.9	4.9′	55.1′
5	255°54.4	21.9	2°34.3	11.9′	16°55.9	5.0′	55.1′
6	270°54.4	N19°22.5	17°05.2	11.9′	S16°50.9	5.1′	55.1′
7	285°54.4	23.1	31°36.1	11.9′	16°45.8	5.2′	55.2′
8	300°54.3	23.6	46°07.0	11.9′	16°40.6	5.2′	55.2′
9	315°54.3	·· 24.2	60°38.0	11.9′	16°35.3	5.3′	55.2′
10	330°54.3	24.7	75°08.9	11.9′	16°29.9	5.4′	55.2′
11	345°54.3	25.3	89°39.8	11.9′	16°24.5	5.5′	55.3′
12	0°54.3	N19°25.9	104°10.8	11.9′	S16°18.9	5.6′	55.3′
13	15°54.2	26.4	118°41.7	11.9′	16°13.3	5.7′	55.3′
14	30°54.2	27.0	133°12.6	11.9′	16°07.6	5.7′	55.3′
15	45°54.2	·· 27.5	147°43.6	11.9′	16°01.8	5.8′	55.4′
16	60°54.2	28.1	162°14.5	11.9′	15°55.9	5.9′	55.4′
17	75°54.2	28.6	176°45.5	12.0′	15°50.0	6.0′	55.4′
18	90°54.1	N19°29.2	191°16.4	12.0′	S15°44.0	6.1′	55.4′
19	105°54.1	29.7	205°47.4	12.0′	15°37.9	6.1′	55.5′
20	120°54.1	30.3	220°18.3	12.0′	15°31.7	6.2′	55.5′
21	135°54.1	·· 30.8	234°49.3	12.0′	15°25.4	6.3′	55.5′
22	150°54.0	31.4	249°20.3	12.0′	15°19.1	6.4′	55.5′
23	165°54.0	31.9	263°51.2	12.0′	15°12.6	6.5′	55.6′
	SD.=15.8	d=0.6	S.D.=15.1				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°54.0	N19°32.5	278°22.2	12.0′	S15°06.1	6.5′	55.6′
1	195°54.0	33.0	292°53.2	12.0′	14°59.5	6.6′	55.6′
2	210°53.9	33.6	307°24.1	12.0′	14°52.9	6.7′	55.7′
3	225°53.9	·· 34.1	321°55.1	12.0′	14°46.1	6.8′	55.7′
4	240°53.9	34.7	336°26.1	12.0′	14°39.3	6.9′	55.7′
5	255°53.9	35.2	350°57.0	12.0′	14°32.4	6.9′	55.7′
6	270°53.8	N19°35.8	5°28.0	12.0′	S14°25.4	7.0′	55.8′
7	285°53.8	36.3	19°59.0	12.0′	14°18.4	7.1′	55.8′
8	300°53.8	36.9	34°30.0	12.0′	14°11.2	7.2′	55.8′
9	315°53.8	·· 37.4	49°01.0	12.0′	14°04.0	7.2′	55.9′
10	330°53.7	38.0	63°31.9	12.0′	13°56.8	7.3′	55.9′
11	345°53.7	38.5	78°02.9	12.0′	13°49.4	7.4′	55.9′
12	0°53.7	N19°39.0	92°33.9	12.0′	S13°42.0	7.5′	56.0′
13	15°53.7	39.6	107°04.9	12.0′	13°34.5	7.5′	56.0′
14	30°53.6	40.1	121°35.8	12.0′	13°26.9	7.6′	56.0′
15	45°53.6	·· 40.7	136°06.8	12.0′	13°19.2	7.7′	56.0′
16	60°53.6	41.2	150°37.8	12.0′	13°11.5	7.8′	56.1′
17	75°53.6	41.7	165°08.7	12.0′	13°03.7	7.8′	56.1′
18	90°53.5	N19°42.3	179°39.7	12.0′	S12°55.8	7.9′	56.1′
19	105°53.5	42.8	194°10.7	12.0′	12°47.9	8.0′	56.2′
20	120°53.5	43.4	208°41.6	12.0′	12°39.9	8.0′	56.2′
21	135°53.4	·· 43.9	223°12.6	12.0′	12°31.8	8.1′	56.2′
22	150°53.4	44.4	237°43.6	12.0′	12°23.6	8.2′	56.3′
23	165°53.4	45.0	252°14.5	12.0′	12°15.4	8.3′	56.3′
	SD.=15.8	d=0.5	S.D.=15.2				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°						
N 70°						
68°			01:35	22:23		
66°			02:14	21:42		
64°		00:51	02:40	21:15	23:11	
62°		01:42	03:01	20:54	22:15	
60°		02:12	03:18	20:37	21:43	
N 58°	00:46	02:35	03:31	20:23	21:20	23:15
56°	01:32	02:53	03:43	20:11	21:02	22:24
54°	02:00	03:08	03:54	20:00	20:47	21:55
52°	02:21	03:20	04:03	19:51	20:34	21:34
50°	02:38	03:32	04:11	19:42	20:22	21:16
45°	03:10	03:54	04:29	19:25	19:59	20:44
N 40°	03:34	04:12	04:43	19:10	19:41	20:20
35°	03:52	04:27	04:55	18:58	19:27	20:01
30°	04:08	04:39	05:05	18:48	19:14	19:46
20°	04:31	04:59	05:23	18:30	18:54	19:22
N 10°	04:50	05:16	05:39	18:14	18:37	19:03
0°	05:05	05:31	05:53	18:00	18:22	18:47
S 10°	05:19	05:45	06:07	17:46	18:08	18:34
20°	05:32	05:59	06:22	17:31	17:54	18:21
30°	05:45	06:14	06:39	17:13	17:39	18:08
35°	05:51	06:22	06:49	17:03	17:31	18:01
40°	05:58	06:31	07:00	16:52	17:21	17:54
45°	06:06	06:41	07:14	16:39	17:11	17:47
S 50°	06:14	06:54	07:30	16:23	16:59	17:38
52°	06:18	06:59	07:37	16:15	16:53	17:35
54°	06:21	07:05	07:46	16:07	16:47	17:31
56°	06:26	07:12	07:55	15:57	16:40	17:26
58°	06:30	07:19	08:06	15:47	16:33	17:22
S 60°	06:35	07:28	08:18	15:34	16:24	17:17

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°		03:34	03:12		06:14	08:17
N 70°	02:33	02:39	02:40	05:34	07:09	08:47
68°	01:46	02:05	02:17	06:21	07:41	09:10
66°	01:15	01:41	01:58	06:52	08:05	09:27
64°	00:52	01:22	01:43	07:14	08:24	09:41
62°	00:34	01:06	01:31	07:32	08:39	09:53
60°	00:19	00:53	01:20	07:47	08:52	10:03
N 58°	00:06	00:42	01:11	08:00	09:03	10:12
56°	–:–	00:32	01:03	08:11	09:12	10:19
54°	–:–	00:23	00:56	08:20	09:21	10:26
52°	–:–	00:15	00:49	08:29	09:28	10:32
50°	–:–	00:08	00:43	08:36	09:35	10:38
45°	23:53	–:–	00:31	08:53	09:49	10:50
N 40°	23:41	–:–	00:20	09:06	10:01	11:00
35°	23:30	–:–	00:11	09:17	10:11	11:08
30°	23:21	–:–	00:03	09:27	10:20	11:15
20°	23:05	23:49	–:–	09:44	10:35	11:28
N 10°	22:51	23:37	–:–	09:59	10:49	11:39
0°	22:38	23:26	–:–	10:13	11:01	11:49
S 10°	22:25	23:15	–:–	10:27	11:13	11:59
20°	22:11	23:02	23:55	10:41	11:26	12:10
30°	21:55	22:49	23:44	10:58	11:41	12:22
35°	21:45	22:40	23:38	11:08	11:50	12:29
40°	21:34	22:31	23:31	11:19	12:00	12:37
45°	21:22	22:21	23:22	11:32	12:11	12:47
S 50°	21:07	22:07	23:12	11:48	12:25	12:58
52°	20:59	22:01	23:08	11:55	12:31	13:03
54°	20:51	21:55	23:02	12:03	12:38	13:09
56°	20:42	21:47	22:57	12:12	12:46	13:15
58°	20:32	21:39	22:50	12:23	12:55	13:22
S 60°	20:21	21:29	22:43	12:35	13:05	13:30

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 20-22 74-55%
16	03:39	03:39	11:56	04:01	16:25	
17	03:38	03:37	11:56	04:49	17:13	
18	03:36	03:35	11:56	05:37	18:01	

May 19, 20, 21 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	236°51.3	224°05.6	N04°14.2	159°04.3	N23°45.1	43°28.3	S04°06.7	330°44.0	S22°00.9
1	251°53.7	239°06.1	14.7	174°05.0	45.2	58°30.9	06.7	345°46.6	00.9
2	266°56.2	254°06.5	15.3	189°05.6	45.4	73°33.5	06.6	0°49.3	00.9
3	281°58.7	269°07.0	·· 15.9	204°06.2	·· 45.6	88°36.1	·· 06.6	15°51.9	·· 00.9
4	297°01.1	284°07.5	16.4	219°06.9	45.7	103°38.8	06.5	30°54.5	00.9
5	312°03.6	299°08.0	17.0	234°07.5	45.9	118°41.4	06.5	45°57.2	00.9
6	327°06.1	314°08.4	N04°17.6	249°08.1	N23°46.0	133°44.0	S04°06.4	60°59.8	S22°00.9
7	342°08.5	329°08.9	18.2	264°08.8	46.2	148°46.6	06.4	76°02.4	00.9
8	357°11.0	344°09.4	18.7	279°09.4	46.3	163°49.2	06.3	91°05.0	00.9
9	12°13.5	359°09.8	·· 19.3	294°10.0	·· 46.5	178°51.8	·· 06.3	106°07.7	·· 00.9
10	27°15.9	14°10.3	19.9	309°10.6	46.7	193°54.4	06.2	121°10.3	00.9
11	42°18.4	29°10.8	20.4	324°11.3	46.8	208°57.0	06.2	136°12.9	00.9
12	57°20.9	44°11.2	N04°21.0	339°11.9	N23°47.0	223°59.7	S04°06.1	151°15.5	S22°00.9
13	72°23.3	59°11.7	21.6	354°12.5	47.1	239°02.3	06.1	166°18.2	00.9
14	87°25.8	74°12.1	22.2	9°13.2	47.3	254°04.9	06.0	181°20.8	00.9
15	102°28.2	89°12.6	·· 22.8	24°13.8	·· 47.4	269°07.5	·· 06.0	196°23.4	·· 00.9
16	117°30.7	104°13.1	23.3	39°14.4	47.6	284°10.1	05.9	211°26.1	00.9
17	132°33.2	119°13.5	23.9	54°15.1	47.7	299°12.7	05.9	226°28.7	00.9
18	147°35.6	134°14.0	N04°24.5	69°15.7	N23°47.9	314°15.3	S04°05.8	241°31.3	S22°00.9
19	162°38.1	149°14.4	25.1	84°16.3	48.0	329°17.9	05.8	256°33.9	00.9
20	177°40.6	164°14.9	25.6	99°16.9	48.2	344°20.5	05.7	271°36.6	00.9
21	192°43.0	179°15.3	·· 26.2	114°17.6	·· 48.3	359°23.1	·· 05.7	286°39.2	·· 00.9
22	207°45.5	194°15.8	26.8	129°18.2	48.5	14°25.8	05.6	301°41.8	00.9
23	222°48.0	209°16.2	27.4	144°18.8	48.6	29°28.4	05.6	316°44.4	00.9
Mer.pass.:08:11		v0.5 d0.6 m-4.4		v0.6 d0.2 m1.6		v2.6 d0.1 m-2.2		v2.6 d0.0 m0.1	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	237°50.4	224°16.7	N04°28.0	159°19.5	N23°48.8	44°31.0	S04°05.5	331°47.1	S22°00.9
1	252°52.9	239°17.2	28.6	174°20.1	48.9	59°33.6	05.5	346°49.7	00.8
2	267°55.3	254°17.6	29.1	189°20.7	49.1	74°36.2	05.4	1°52.3	00.8
3	282°57.8	269°18.0	·· 29.7	204°21.4	·· 49.2	89°38.8	·· 05.4	16°55.0	·· 00.8
4	298°00.3	284°18.5	30.3	219°22.0	49.4	104°41.4	05.3	31°57.6	00.8
5	313°02.7	299°18.9	30.9	234°22.6	49.5	119°44.0	05.3	47°00.2	00.8
6	328°05.2	314°19.4	N04°31.5	249°23.2	N23°49.7	134°46.6	S04°05.2	62°02.9	S22°00.8
7	343°07.7	329°19.8	32.1	264°23.9	49.8	149°49.2	05.2	77°05.5	00.8
8	358°10.1	344°20.3	32.7	279°24.5	50.0	164°51.8	05.1	92°08.1	00.8
9	13°12.6	359°20.7	·· 33.3	294°25.1	·· 50.1	179°54.4	·· 05.1	107°10.7	·· 00.8
10	28°15.1	14°21.2	33.8	309°25.8	50.3	194°57.0	05.0	122°13.4	00.8
11	43°17.5	29°21.6	34.4	324°26.4	50.4	209°59.6	05.0	137°16.0	00.8
12	58°20.0	44°22.0	N04°35.0	339°27.0	N23°50.6	225°02.3	S04°04.9	152°18.6	S22°00.8
13	73°22.5	59°22.5	35.6	354°27.7	50.7	240°04.9	04.9	167°21.3	00.8
14	88°24.9	74°22.9	36.2	9°28.3	50.8	255°07.5	04.8	182°23.9	00.8
15	103°27.4	89°23.3	·· 36.8	24°28.9	·· 51.0	270°10.1	·· 04.8	197°26.5	·· 00.8
16	118°29.8	104°23.8	37.4	39°29.5	51.1	285°12.7	04.7	212°29.2	00.8
17	133°32.3	119°24.2	38.0	54°30.2	51.3	300°15.3	04.7	227°31.8	00.8
18	148°34.8	134°24.6	N04°38.6	69°30.8	N23°51.4	315°17.9	S04°04.6	242°34.4	S22°00.8
19	163°37.2	149°25.1	39.2	84°31.4	51.6	330°20.5	04.6	257°37.0	00.8
20	178°39.7	164°25.5	39.8	99°32.1	51.7	345°23.1	04.5	272°39.7	00.8
21	193°42.2	179°25.9	·· 40.4	114°32.7	·· 51.9	0°25.7	·· 04.5	287°42.3	·· 00.8
22	208°44.6	194°26.4	41.0	129°33.3	52.0	15°28.3	04.4	302°44.9	00.8
23	223°47.1	209°26.8	41.6	144°34.0	52.1	30°30.9	04.4	317°47.6	00.8
Mer.pass.:08:07		v0.4 d0.6 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.2		v2.6 d0.0 m0.1	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	238°49.6	224°27.2	N04°42.2	159°34.6	N23°52.3	45°33.5	S04°04.3	332°50.2	S22°00.8
1	253°52.0	239°27.6	42.8	174°35.2	52.4	60°36.1	04.3	347°52.8	00.8
2	268°54.5	254°28.1	43.4	189°35.8	52.6	75°38.7	04.2	2°55.5	00.7
3	283°57.0	269°28.5	·· 44.0	204°36.5	·· 52.7	90°41.3	·· 04.2	17°58.1	·· 00.7
4	298°59.4	284°28.9	44.6	219°37.1	52.8	105°43.9	04.2	33°00.7	00.7
5	314°01.9	299°29.3	45.2	234°37.7	53.0	120°46.5	04.1	48°03.4	00.7
6	329°04.3	314°29.8	N04°45.8	249°38.4	N23°53.1	135°49.1	S04°04.1	63°06.0	S22°00.7
7	344°06.8	329°30.2	46.4	264°39.0	53.3	150°51.7	04.0	78°08.6	00.7
8	359°09.3	344°30.6	47.0	279°39.6	53.4	165°54.3	04.0	93°11.2	00.7
9	14°11.7	359°31.0	·· 47.6	294°40.3	·· 53.5	180°56.9	·· 03.9	108°13.9	·· 00.7
10	29°14.2	14°31.4	48.2	309°40.9	53.7	195°59.5	03.9	123°16.5	00.7
11	44°16.7	29°31.8	48.8	324°41.5	53.8	211°02.1	03.8	138°19.1	00.7
12	59°19.1	44°32.3	N04°49.4	339°42.1	N23°53.9	226°04.7	S04°03.8	153°21.8	S22°00.7
13	74°21.6	59°32.7	50.0	354°42.8	54.1	241°07.3	03.7	168°24.4	00.7
14	89°24.1	74°33.1	50.6	9°43.4	54.2	256°09.9	03.7	183°27.0	00.7
15	104°26.5	89°33.5	·· 51.3	24°44.0	·· 54.4	271°12.5	·· 03.6	198°29.7	·· 00.7
16	119°29.0	104°33.9	51.9	39°44.7	54.5	286°15.1	03.6	213°32.3	00.7
17	134°31.4	119°34.3	52.5	54°45.3	54.6	301°17.7	03.6	228°34.9	00.7
18	149°33.9	134°34.7	N04°53.1	69°45.9	N23°54.8	316°20.3	S04°03.5	243°37.6	S22°00.7
19	164°36.4	149°35.1	53.7	84°46.6	54.9	331°22.9	03.5	258°40.2	00.7
20	179°38.8	164°35.5	54.3	99°47.2	55.0	346°25.5	03.4	273°42.8	00.7
21	194°41.3	179°35.9	·· 54.9	114°47.8	·· 55.2	1°28.1	·· 03.4	288°45.5	·· 00.7
22	209°43.8	194°36.4	55.5	129°48.4	55.3	16°30.7	03.3	303°48.1	00.7
23	224°46.2	209°36.8	56.1	144°49.1	55.4	31°33.3	03.3	318°50.7	00.7
Mer.pass.:08:03		v0.4 d0.6 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.2		v2.6 d0.0 m0.1	

Stars

	SHA	Dec
Alpheratz	357°40.9	29°10.9
Ankaa	353°13.4	-42°12.6
Schedar	349°37.8	56°37.6
Diphda	348°53.5	-17°53.6
Achernar	335°25.4	-57°08.9
Hamal	327°58.1	23°32.4
Polaris	317°00.9	89°20.0
Acamar	315°16.8	-40°14.3
Menkar	314°12.6	4°09.2
Mirfak	308°37.0	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.9	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.6
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.8	7°24.4
Canopus	263°55.4	-52°42.7
Sirius	258°31.7	-16°44.7
Adhara	255°10.7	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.2	-59°34.3
Suhail	222°50.6	-43°30.5
Miaplacidus	221°39.2	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.7	11°52.9
Dubhe	193°48.5	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.8	-63°11.9
Gacrux	171°57.5	-57°12.8
Alioth	166°18.1	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.8
Hadar	148°43.5	-60°27.4
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.4	-60°54.3
Kochab	137°19.1	74°05.3
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.5
Antares	112°22.7	-26°28.0
Atria	107°21.5	-69°03.2
Sabik	102°09.2	-15°44.6
Shaula	96°18.0	-37°06.7
Rasalhague	96°03.7	12°33.0
Eltanin	90°44.4	51°29.2
Kaus Aust.	83°40.0	-34°22.3
Vega	80°36.8	38°48.0
Nunki	75°54.8	-26°16.3
Altair	62°05.5	8°54.9
Peacock	53°14.9	-56°40.4
Deneb	49°29.5	45°20.4
Enif	33°44.5	9°57.2
Al Na'ir	27°40.5	-46°52.4
Fomalhaut	15°21.2	-29°31.7
Scheat	13°50.9	28°10.4
Markab	13°35.8	15°17.8

May 19 Fri	SHA	Mer.pass
Venus	347°14.3	09:03
Mars	282°13.1	13:23
Jupiter	166°37.0	21:02
Saturn	93°52.7	01:57

May 20 Sat	SHA	Mer.pass
Venus	346°26.3	09:03
Mars	281°29.0	13:22
Jupiter	166°40.6	20:58
Saturn	93°56.7	01:53

May 21 Sun	SHA	Mer.pass
Venus	345°37.7	09:02
Mars	280°45.0	13:21
Jupiter	166°43.9	20:54
Saturn	94°00.6	01:48

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3979 sec ΔT = TT-UT1 = +68.7861 sec

2017 May 19 to May. 21 UT

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°53.4	**N**19°45.5	266°45.5	11.9'	**S**12°07.1	8.3'	56.3'
1	195°53.3	46.0	281°16.4	11.9'	11°58.8	8.4'	56.4'
2	210°53.3	46.6	295°47.3	11.9'	11°50.3	8.5'	56.4'
3	225°53.3	·· 47.1	310°18.3	11.9'	11°41.8	8.5'	56.4'
4	240°53.2	47.7	324°49.2	11.9'	11°33.3	8.6'	56.5'
5	255°53.2	48.2	339°20.1	11.9'	11°24.6	8.7'	56.5'
6	270°53.2	**N**19°48.7	353°51.0	11.9'	**S**11°15.9	8.7'	56.5'
7	285°53.1	49.2	8°22.0	11.9'	11°07.1	8.8'	56.6'
8	300°53.1	49.8	22°52.9	11.9'	10°58.3	8.9'	56.6'
9	315°53.1	·· 50.3	37°23.8	11.9'	10°49.4	8.9'	56.6'
10	330°53.0	50.8	51°54.6	11.9'	10°40.4	9.0'	56.7'
11	345°53.0	51.4	66°25.5	11.9'	10°31.4	9.1'	56.7'
12	0°53.0	**N**19°51.9	80°56.4	11.9'	**S**10°22.3	9.1'	56.7'
13	15°52.9	52.4	95°27.2	11.9'	10°13.2	9.2'	56.8'
14	30°52.9	53.0	109°58.1	11.8'	10°04.0	9.2'	56.8'
15	45°52.9	·· 53.5	124°28.9	11.8'	09°54.7	9.3'	56.9'
16	60°52.8	54.0	138°59.8	11.8'	09°45.3	9.4'	56.9'
17	75°52.8	54.5	153°30.6	11.8'	09°35.9	9.4'	56.9'
18	90°52.8	**N**19°55.1	168°01.4	11.8'	**S**09°26.5	9.5'	57.0'
19	105°52.7	55.6	182°32.2	11.8'	09°16.9	9.6'	57.0'
20	120°52.7	56.1	197°03.0	11.8'	09°07.4	9.6'	57.0'
21	135°52.7	·· 56.6	211°33.7	11.8'	08°57.7	9.7'	57.1'
22	150°52.6	57.2	226°04.5	11.7'	08°48.0	9.7'	57.1'
23	165°52.6	57.7	240°35.2	11.7'	08°38.3	9.8'	57.2'
	SD.=15.8	d=0.5		S.D.=15.5			

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°52.6	**N**19°58.2	255°06.0	11.7'	**S**08°28.5	9.8'	57.2'
1	195°52.5	58.7	269°36.7	11.7'	08°18.6	9.9'	57.2'
2	210°52.5	59.2	284°07.4	11.7'	08°08.7	10.0'	57.3'
3	225°52.5	19°59.8	298°38.0	11.7'	07°58.7	10.0'	57.3'
4	240°52.4	20°00.3	313°08.7	11.7'	07°48.7	10.1'	57.3'
5	255°52.4	00.8	327°39.3	11.6'	07°38.6	10.1'	57.4'
6	270°52.4	**N**20°01.3	342°10.0	11.6'	**S**07°28.4	10.2'	57.4'
7	285°52.3	01.8	356°40.6	11.6'	07°18.3	10.2'	57.5'
8	300°52.3	02.4	11°11.1	11.6'	07°08.0	10.3'	57.5'
9	315°52.2	·· 02.9	25°41.7	11.6'	06°57.7	10.3'	57.5'
10	330°52.2	03.4	40°12.2	11.5'	06°47.4	10.4'	57.6'
11	345°52.2	03.9	54°42.8	11.5'	06°37.0	10.4'	57.6'
12	0°52.1	**N**20°04.4	69°13.3	11.5'	**S**06°26.5	10.5'	57.6'
13	15°52.1	04.9	83°43.7	11.5'	06°16.1	10.5'	57.7'
14	30°52.1	05.4	98°14.2	11.4'	06°05.5	10.6'	57.7'
15	45°52.0	·· 06.0	112°44.6	11.4'	05°54.9	10.6'	57.8'
16	60°52.0	06.5	127°15.0	11.4'	05°44.3	10.6'	57.8'
17	75°51.9	07.0	141°45.4	11.4'	05°33.6	10.7'	57.8'
18	90°51.9	**N**20°07.5	156°15.8	11.3'	**S**05°22.9	10.7'	57.9'
19	105°51.9	08.0	170°46.1	11.3'	05°12.2	10.8'	57.9'
20	120°51.8	08.5	185°16.4	11.3'	05°01.4	10.8'	58.0'
21	135°51.8	·· 09.0	199°46.7	11.3'	04°50.5	10.9'	58.0'
22	150°51.7	09.5	214°16.9	11.2'	04°39.6	10.9'	58.0'
23	165°51.7	10.0	228°47.1	11.2'	04°28.7	10.9'	58.1'
	SD.=15.8	d=0.5		S.D.=15.7			

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°51.7	**N**20°10.6	243°17.3	11.2'	**S**04°17.8	11.0'	58.1'
1	195°51.6	11.1	257°47.5	11.1'	04°06.7	11.0'	58.2'
2	210°51.6	11.6	272°17.6	11.1'	03°55.7	11.1'	58.2'
3	225°51.5	·· 12.1	286°47.7	11.1'	03°44.6	11.1'	58.2'
4	240°51.5	12.6	301°17.8	11.0'	03°33.5	11.1'	58.3'
5	255°51.4	13.1	315°47.8	11.0'	03°22.4	11.2'	58.3'
6	270°51.4	**N**20°13.6	330°17.8	11.0'	**S**03°11.2	11.2'	58.4'
7	285°51.4	14.1	344°47.7	10.9'	03°00.0	11.2'	58.4'
8	300°51.3	14.6	359°17.7	10.9'	02°48.7	11.3'	58.4'
9	315°51.3	·· 15.1	13°47.6	10.9'	02°37.4	11.3'	58.5'
10	330°51.2	15.6	28°17.4	10.8'	02°26.1	11.3'	58.5'
11	345°51.2	16.1	42°47.2	10.8'	02°14.8	11.4'	58.6'
12	0°51.1	**N**20°16.6	57°17.0	10.8'	**S**02°03.4	11.4'	58.6'
13	15°51.1	17.1	71°46.7	10.7'	01°52.0	11.4'	58.6'
14	30°51.0	17.6	86°16.4	10.7'	01°40.6	11.4'	58.7'
15	45°51.0	·· 18.1	100°46.1	10.6'	01°29.2	11.5'	58.7'
16	60°51.0	18.6	115°15.7	10.6'	01°17.7	11.5'	58.8'
17	75°50.9	19.1	129°45.3	10.6'	01°06.2	11.5'	58.8'
18	90°50.9	**N**20°19.6	144°14.8	10.5'	**S**00°54.7	11.5'	58.8'
19	105°50.8	20.1	158°44.3	10.5'	00°43.1	11.5'	58.9'
20	120°50.8	20.6	173°13.8	10.4'	00°31.6	11.6'	58.9'
21	135°50.7	·· 21.1	187°43.2	10.4'	00°20.0	11.6'	59.0'
22	150°50.7	21.6	202°12.5	10.3'	**S**00°08.4	11.6'	59.0'
23	165°50.6	22.1	216°41.9	10.3'	00°03.2	11.6'	59.0'
	SD.=15.8	d=0.5		S.D.=16.0			

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	01:16	22:44	▭	▭
66°	▭	▭	02:02	21:55	▭	▭
64°	▭	00:08	02:31	21:24	–:–	▭
62°	▭	01:28	02:53	21:02	22:29	▭
60°	▭	02:03	03:11	20:44	21:53	▭
N 58°	00:07	02:27	03:26	20:29	21:28	–:–
56°	01:20	02:46	03:38	20:16	21:09	22:37
54°	01:51	03:02	03:49	20:05	20:52	22:04
52°	02:14	03:15	03:59	19:55	20:39	21:41
50°	02:32	03:27	04:08	19:46	20:27	21:22
45°	03:06	03:51	04:26	19:28	20:03	20:48
N 40°	03:31	04:09	04:40	19:13	19:44	20:23
35°	03:50	04:25	04:53	19:01	19:29	20:04
30°	04:05	04:37	05:04	18:50	19:16	19:48
20°	04:30	04:58	05:22	18:31	18:55	19:23
N 10°	04:49	05:16	05:38	18:15	18:37	19:04
0°	05:05	05:31	05:53	18:00	18:22	18:48
S 10°	05:20	05:45	06:08	17:45	18:08	18:33
20°	05:33	06:00	06:23	17:30	17:53	18:20
30°	05:46	06:15	06:41	17:12	17:37	18:07
35°	05:53	06:24	06:51	17:02	17:29	18:00
40°	06:00	06:33	07:03	16:50	17:19	17:52
45°	06:08	06:44	07:17	16:36	17:08	17:44
S 50°	06:17	06:57	07:34	16:19	16:55	17:35
52°	06:21	07:03	07:41	16:11	16:50	17:31
54°	06:25	07:09	07:50	16:02	16:43	17:27
56°	06:30	07:16	08:00	15:52	16:36	17:23
58°	06:35	07:24	08:11	15:41	16:28	17:18
S 60°	06:40	07:33	08:24	15:28	16:19	17:12

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	02:59	02:50	02:41	10:09	12:00	13:52
N 70°	02:39	02:38	02:36	10:28	12:10	13:54
68°	02:23	02:28	02:32	10:42	12:18	13:57
66°	02:11	02:20	02:28	10:54	12:24	13:58
64°	02:00	02:13	02:25	11:04	12:30	14:00
62°	01:51	02:07	02:22	11:12	12:35	14:01
60°	01:43	02:02	02:19	11:19	12:39	14:02
N 58°	01:36	01:57	02:17	11:25	12:43	14:03
56°	01:30	01:53	02:15	11:31	12:46	14:04
54°	01:24	01:50	02:14	11:36	12:49	14:05
52°	01:19	01:46	02:12	11:40	12:51	14:06
50°	01:15	01:43	02:11	11:44	12:54	14:06
45°	01:05	01:37	02:08	11:53	12:59	14:08
N 40°	00:56	01:31	02:05	12:00	13:03	14:09
35°	00:49	01:26	02:03	12:06	13:07	14:10
30°	00:43	01:22	02:01	12:12	13:10	14:11
20°	00:32	01:15	01:57	12:21	13:16	14:12
N 10°	00:23	01:08	01:54	12:29	13:21	14:14
0°	00:14	01:02	01:51	12:37	13:25	14:15
S 10°	00:05	00:56	01:48	12:44	13:30	14:16
20°	–:–	00:50	01:45	12:52	13:35	14:17
30°	–:–	00:42	01:42	13:02	13:40	14:19
35°	–:–	00:38	01:40	13:07	13:43	14:19
40°	–:–	00:33	01:37	13:13	13:47	14:20
45°	–:–	00:27	01:35	13:19	13:51	14:21
S 50°	–:–	00:20	01:32	13:28	13:55	14:22
52°	–:–	00:17	01:30	13:31	13:58	14:23
54°	–:–	00:14	01:28	13:35	14:00	14:24
56°	–:–	00:10	01:27	13:40	14:03	14:24
58°	–:–	00:06	01:25	13:45	14:05	14:25
S 60°	–:–	00:01	01:23	13:51	14:09	14:26

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 23-25 45-25%
19	03:33	03:32	11:56	06:25	18:50	
20	03:30	03:29	11:57	07:14	19:38	
21	03:27	03:25	11:57	08:03	20:28	

May 22, 23, 24 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	239°48.7	224°37.2	N04°56.8	159°49.7	N23°55.6	46°35.9	S04°03.2	333°53.4	S22°00.7
1	254°51.2	239°37.6	57.4	174°50.3	55.7	61°38.5	03.2	348°56.0	00.7
2	269°53.6	254°38.0	58.0	189°51.0	55.8	76°41.1	03.2	3°58.6	00.7
3	284°56.1	269°38.4	·· 58.6	204°51.6	·· 56.0	91°43.6	·· 03.1	19°01.3	·· 00.6
4	299°58.6	284°38.8	59.2	219°52.2	56.1	106°46.2	03.1	34°03.9	00.6
5	315°01.0	299°39.2	04°59.8	234°52.9	56.2	121°48.8	03.0	49°06.5	00.6
6	330°03.5	314°39.6	N05°00.5	249°53.5	N23°56.3	136°51.4	S04°03.0	64°09.2	S22°00.6
7	345°05.9	329°40.0	01.1	264°54.1	56.5	151°54.0	02.9	79°11.8	00.6
8	0°08.4	344°40.3	01.7	279°54.7	56.6	166°56.6	02.9	94°14.4	00.6
9	15°10.9	359°40.7	·· 02.3	294°55.4	·· 56.7	181°59.2	·· 02.9	109°17.1	·· 00.6
10	30°13.3	14°41.1	02.9	309°56.0	56.9	197°01.8	02.8	124°19.7	00.6
11	45°15.8	29°41.5	03.6	324°56.6	57.0	212°04.4	02.8	139°22.3	00.6
12	60°18.3	44°41.9	N05°04.2	339°57.3	N23°57.1	227°07.0	S04°02.7	154°25.0	S22°00.6
13	75°20.7	59°42.3	04.8	354°57.9	57.2	242°09.6	02.7	169°27.6	00.6
14	90°23.2	74°42.7	05.4	9°58.5	57.4	257°12.2	02.6	184°30.3	00.6
15	105°25.7	89°43.1	·· 06.1	24°59.2	·· 57.5	272°14.8	·· 02.6	199°32.9	·· 00.6
16	120°28.1	104°43.5	06.7	39°59.8	57.6	287°17.4	02.5	214°35.5	00.6
17	135°30.6	119°43.9	07.3	55°00.4	57.8	302°19.9	02.5	229°38.2	00.6
18	150°33.1	134°44.2	N05°07.9	70°01.0	N23°57.9	317°22.5	S04°02.5	244°40.8	S22°00.6
19	165°35.5	149°44.6	08.6	85°01.7	58.0	332°25.1	02.4	259°43.4	00.6
20	180°38.0	164°45.0	09.2	100°02.3	58.1	347°27.7	02.4	274°46.1	00.6
21	195°40.4	179°45.4	·· 09.8	115°02.9	·· 58.3	2°30.3	·· 02.3	289°48.7	·· 00.6
22	210°42.9	194°45.8	10.4	130°03.6	58.4	17°32.9	02.3	304°51.3	00.6
23	225°45.4	209°46.2	11.1	145°04.2	58.5	32°35.5	02.3	319°54.0	00.6
Mer.pass.:07:59		v0.4 d0.6 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.2		v2.6 d0.0 m0.1	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	240°47.8	224°46.5	N05°11.7	160°04.8	N23°58.6	47°38.1	S04°02.2	334°56.6	S22°00.6
1	255°50.3	239°46.9	12.3	175°05.4	58.8	62°40.7	02.2	349°59.2	00.6
2	270°52.8	254°47.3	13.0	190°06.1	58.9	77°43.3	02.1	5°01.9	00.6
3	285°55.2	269°47.7	·· 13.6	205°06.7	·· 59.0	92°45.8	·· 02.1	20°04.5	·· 00.5
4	300°57.7	284°48.1	14.2	220°07.3	59.1	107°48.4	02.0	35°07.2	00.5
5	316°00.2	299°48.4	14.9	235°08.0	59.2	122°51.0	02.0	50°09.8	00.5
6	331°02.6	314°48.8	N05°15.5	250°08.6	N23°59.4	137°53.6	S04°02.0	65°12.4	S22°00.5
7	346°05.1	329°49.2	16.1	265°09.2	59.5	152°56.2	01.9	80°15.1	00.5
8	1°07.5	344°49.6	16.8	280°09.9	59.6	167°58.8	01.9	95°17.7	00.5
9	16°10.0	359°49.9	·· 17.4	295°10.5	·· 59.7	183°01.4	·· 01.8	110°20.3	·· 00.5
10	31°12.5	14°50.3	18.0	310°11.1	23°59.8	198°04.0	01.8	125°23.0	00.5
11	46°14.9	29°50.7	18.7	325°11.7	24°00.0	213°06.5	01.8	140°25.6	00.5
12	61°17.4	44°51.0	N05°19.3	340°12.4	N24°00.1	228°09.1	S04°01.7	155°28.2	S22°00.5
13	76°19.9	59°51.4	19.9	355°13.0	00.2	243°11.7	01.7	170°30.9	00.5
14	91°22.3	74°51.8	20.6	10°13.6	00.3	258°14.3	01.6	185°33.5	00.5
15	106°24.8	89°52.1	·· 21.2	25°14.3	·· 00.4	273°16.9	·· 01.6	200°36.2	·· 00.5
16	121°27.3	104°52.5	21.9	40°14.9	00.6	288°19.5	01.6	215°38.8	00.5
17	136°29.7	119°52.9	22.5	55°15.5	00.7	303°22.0	01.5	230°41.4	00.5
18	151°32.2	134°53.2	N05°23.1	70°16.2	N24°00.8	318°24.6	S04°01.5	245°44.1	S22°00.5
19	166°34.7	149°53.6	23.8	85°16.8	00.9	333°27.2	01.4	260°46.7	00.5
20	181°37.1	164°54.0	24.4	100°17.4	01.0	348°29.8	01.4	275°49.3	00.5
21	196°39.6	179°54.3	·· 25.1	115°18.1	·· 01.1	3°32.4	·· 01.4	290°52.0	·· 00.5
22	211°42.0	194°54.7	25.7	130°18.7	01.3	18°35.0	01.3	305°54.6	00.5
23	226°44.5	209°55.0	26.3	145°19.3	01.4	33°37.5	01.3	320°57.3	00.5
Mer.pass.:07:56		v0.4 d0.6 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.1		v2.6 d0.0 m0.1	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	241°47.0	224°55.4	N05°27.0	160°19.9	N24°01.5	48°40.1	S04°01.3	335°59.9	S22°00.5
1	256°49.4	239°55.7	27.6	175°20.6	01.6	63°42.7	01.2	351°02.5	00.5
2	271°51.9	254°56.1	28.3	190°21.2	01.7	78°45.3	01.2	6°05.2	00.5
3	286°54.4	269°56.5	·· 28.9	205°21.8	·· 01.8	93°47.9	·· 01.1	21°07.8	·· 00.5
4	301°56.8	284°56.8	29.6	220°22.5	01.9	108°50.5	01.1	36°10.5	00.4
5	316°59.3	299°57.2	30.2	235°23.1	02.1	123°53.0	01.1	51°13.1	00.4
6	332°01.8	314°57.5	N05°30.9	250°23.7	N24°02.2	138°55.6	S04°01.0	66°15.7	S22°00.4
7	347°04.2	329°57.9	31.5	265°24.4	02.3	153°58.2	01.0	81°18.4	00.4
8	2°06.7	344°58.2	32.1	280°25.0	02.4	169°00.8	00.9	96°21.0	00.4
9	17°09.1	359°58.6	·· 32.8	295°25.6	·· 02.5	184°03.4	·· 00.9	111°23.6	·· 00.4
10	32°11.6	14°58.9	33.4	310°26.2	02.6	199°05.9	00.9	126°26.3	00.4
11	47°14.1	29°59.3	34.1	325°26.9	02.7	214°08.5	00.8	141°28.9	00.4
12	62°16.5	44°59.6	N05°34.7	340°27.5	N24°02.8	229°11.1	S04°00.8	156°31.6	S22°00.4
13	77°19.0	60°00.0	35.4	355°28.1	03.0	244°13.7	00.8	171°34.2	00.4
14	92°21.5	75°00.3	36.0	10°28.8	03.1	259°16.3	00.7	186°36.8	00.4
15	107°23.9	90°00.7	·· 36.7	25°29.4	·· 03.2	274°18.8	·· 00.7	201°39.5	·· 00.4
16	122°26.4	105°01.0	37.3	40°30.0	03.3	289°21.4	00.6	216°42.1	00.4
17	137°28.9	120°01.3	38.0	55°30.7	03.4	304°24.0	00.6	231°44.8	00.4
18	152°31.3	135°01.7	N05°38.7	70°31.3	N24°03.5	319°26.6	S04°00.6	246°47.4	S22°00.4
19	167°33.8	150°02.0	39.3	85°31.9	03.6	334°29.1	00.5	261°50.0	00.4
20	182°36.3	165°02.4	40.0	100°32.5	03.7	349°31.7	00.5	276°52.7	00.4
21	197°38.7	180°02.7	·· 40.6	115°33.2	·· 03.8	4°34.3	·· 00.5	291°55.3	·· 00.4
22	212°41.2	195°03.0	41.3	130°33.8	03.9	19°36.9	00.4	306°58.0	00.4
23	227°43.6	210°03.4	41.9	145°34.4	04.0	34°39.5	00.4	322°00.6	00.4
Mer.pass.:07:52		v0.4 d0.6 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.1		v2.6 d0.0 m0.1	

Stars

	SHA	Dec
Alpheratz	357°40.9	29°10.9
Ankaa	353°13.4	-42°12.6
Schedar	349°37.8	56°37.6
Diphda	348°53.5	-17°53.6
Achernar	335°25.4	-57°08.9
Hamal	327°58.1	23°32.4
Polaris	317°00.4	89°20.0
Acamar	315°16.8	-40°14.3
Menkar	314°12.6	4°09.2
Mirfak	308°37.0	49°55.1
Aldebaran	290°46.7	16°32.4
Rigel	281°09.9	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.6
Elnath	278°09.7	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.8	7°24.4
Canopus	263°55.4	-52°42.7
Sirius	258°31.7	-16°44.7
Adhara	255°10.7	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.2	-59°34.3
Suhail	222°50.6	-43°30.5
Miaplacidus	221°39.3	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.5	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.8	-63°11.9
Gacrux	171°57.5	-57°12.8
Alioth	166°18.1	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.8
Hadar	148°43.5	-60°27.4
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.4	-60°54.4
Kochab	137°19.1	74°05.3
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.5
Antares	112°22.6	-26°28.0
Atria	107°21.5	-69°03.3
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.7
Rasalhague	96°03.7	12°33.0
Eltanin	90°44.4	51°29.2
Kaus Aust.	83°40.0	-34°22.3
Vega	80°36.8	38°48.0
Nunki	75°54.8	-26°16.3
Altair	62°05.5	8°54.9
Peacock	53°14.9	-56°40.4
Deneb	49°29.4	45°20.4
Enif	33°44.5	9°57.2
Al Na'ir	27°40.5	-46°52.4
Fomalhaut	15°21.2	-29°31.7
Scheat	13°50.9	28°10.4
Markab	13°35.8	15°17.8

May 22 Mon	SHA	Mer.pass
Venus	344°48.5	09:01
Mars	280°01.0	13:20
Jupiter	166°47.2	20:50
Saturn	94°04.7	01:44

May 23 Tue	SHA	Mer.pass
Venus	343°58.7	09:01
Mars	279°17.0	13:19
Jupiter	166°50.2	20:46
Saturn	94°08.8	01:40

May 24 Wed	SHA	Mer.pass
Venus	343°08.4	09:00
Mars	278°33.0	13:18
Jupiter	166°53.2	20:42
Saturn	94°12.9	01:36

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3939 sec ΔT = TT-UT1 = +68.7901 sec

2017 May 22 to May. 24 UT

h

Mon	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°50.6	N20°22.6	231°11.1	10.2'	N00°14.8	11.6'	59.1'
1	195°50.5	23.1	245°40.3	10.2'	00°26.5	11.7'	59.1'
2	210°50.5	23.5	260°09.5	10.1'	00°38.1	11.7'	59.1'
3	225°50.4	· · 24.0	274°38.6	10.1'	00°49.8	11.7'	59.2'
4	240°50.4	24.5	289°07.7	10.1'	01°01.5	11.7'	59.2'
5	255°50.4	25.0	303°36.7	10.0'	01°13.2	11.7'	59.3'
6	270°50.3	N20°25.5	318°05.7	9.9'	N01°24.9	11.7'	59.3'
7	285°50.3	26.0	332°34.6	9.9'	01°36.6	11.7'	59.3'
8	300°50.2	26.5	347°03.5	9.8'	01°48.3	11.7'	59.4'
9	315°50.2	· · 27.0	1°32.3	9.8'	02°00.0	11.7'	59.4'
10	330°50.1	27.5	16°01.1	9.7'	02°11.8	11.7'	59.5'
11	345°50.1	27.9	30°29.8	9.7'	02°23.5	11.7'	59.5'
12	0°50.0	N20°28.4	44°58.5	9.6'	N02°35.2	11.7'	59.5'
13	15°50.0	28.9	59°27.1	9.6'	02°47.0	11.7'	59.6'
14	30°49.9	29.4	73°55.6	9.5'	02°58.7	11.7'	59.6'
15	45°49.9	· · 29.9	88°24.1	9.5'	03°10.4	11.7'	59.6'
16	60°49.8	30.4	102°52.5	9.4'	03°22.2	11.7'	59.7'
17	75°49.8	30.9	117°20.9	9.3'	03°33.9	11.7'	59.7'
18	90°49.7	N20°31.3	131°49.2	9.3'	N03°45.6	11.7'	59.7'
19	105°49.7	31.8	146°17.5	9.2'	03°57.3	11.7'	59.8'
20	120°49.6	32.3	160°45.7	9.2'	04°09.0	11.7'	59.8'
21	135°49.6	· · 32.8	175°13.8	9.1'	04°20.7	11.7'	59.9'
22	150°49.5	33.3	189°41.9	9.0'	04°32.4	11.7'	59.9'
23	165°49.4	33.7	204°09.9	9.0'	04°44.1	11.7'	59.9'
	SD.=15.8	d=0.5		S.D.=16.2			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°49.4	N20°34.2	218°37.9	8.9'	N04°55.7	11.7'	60.0'
1	195°49.3	34.7	233°05.8	8.9'	05°07.4	11.6'	60.0'
2	210°49.3	35.2	247°33.6	8.8'	05°19.0	11.6'	60.0'
3	225°49.2	· · 35.6	262°01.4	8.7'	05°30.6	11.6'	60.1'
4	240°49.2	36.1	276°29.1	8.7'	05°42.2	11.6'	60.1'
5	255°49.1	36.6	290°56.7	8.6'	05°53.8	11.6'	60.1'
6	270°49.1	N20°37.1	305°24.3	8.5'	N06°05.3	11.5'	60.2'
7	285°49.0	37.5	319°51.8	8.5'	06°16.9	11.5'	60.2'
8	300°49.0	38.0	334°19.2	8.4'	06°28.3	11.5'	60.2'
9	315°48.9	· · 38.5	348°46.6	8.3'	06°39.8	11.5'	60.3'
10	330°48.9	39.0	3°13.9	8.3'	06°51.3	11.4'	60.3'
11	345°48.8	39.4	17°41.2	8.2'	07°02.7	11.4'	60.3'
12	0°48.7	N20°39.9	32°08.3	8.1'	N07°14.1	11.4'	60.4'
13	15°48.7	40.4	46°35.4	8.1'	07°25.4	11.3'	60.4'
14	30°48.6	40.9	61°02.5	8.0'	07°36.7	11.3'	60.4'
15	45°48.6	· · 41.3	75°29.5	7.9'	07°48.0	11.3'	60.4'
16	60°48.5	41.8	89°56.4	7.9'	07°59.2	11.2'	60.5'
17	75°48.5	42.3	104°23.2	7.8'	08°10.4	11.2'	60.5'
18	90°48.4	N20°42.7	118°49.9	7.7'	N08°21.6	11.1'	60.5'
19	105°48.4	43.2	133°16.6	7.7'	08°32.7	11.1'	60.6'
20	120°48.3	43.7	147°43.3	7.6'	08°43.8	11.1'	60.6'
21	135°48.2	· · 44.1	162°09.8	7.5'	08°54.8	11.0'	60.6'
22	150°48.2	44.6	176°36.3	7.4'	09°05.8	11.0'	60.6'
23	165°48.1	45.1	191°02.7	7.4'	09°16.8	10.9'	60.7'
	SD.=15.8	d=0.5		S.D.=16.4			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°48.1	N20°45.5	205°29.0	7.3'	N09°27.7	10.9'	60.7'
1	195°48.0	46.0	219°55.3	7.2'	09°38.5	10.8'	60.7'
2	210°48.0	46.4	234°21.5	7.2'	09°49.3	10.8'	60.7'
3	225°47.9	· · 46.9	248°47.6	7.1'	10°00.0	10.7'	60.8'
4	240°47.8	47.4	263°13.7	7.0'	10°10.7	10.6'	60.8'
5	255°47.8	47.8	277°39.7	6.9'	10°21.3	10.6'	60.8'
6	270°47.7	N20°48.3	292°05.6	6.9'	N10°31.8	10.5'	60.8'
7	285°47.7	48.8	306°31.4	6.8'	10°42.3	10.5'	60.9'
8	300°47.6	49.2	320°57.2	6.7'	10°52.8	10.4'	60.9'
9	315°47.5	· · 49.7	335°22.9	6.7'	11°03.1	10.3'	60.9'
10	330°47.5	50.1	349°48.5	6.6'	11°13.4	10.3'	60.9'
11	345°47.4	50.6	4°14.1	6.5'	11°23.7	10.2'	61.0'
12	0°47.4	N20°51.0	18°39.5	6.4'	N11°33.8	10.1'	61.0'
13	15°47.3	51.5	33°05.0	6.4'	11°43.9	10.1'	61.0'
14	30°47.2	52.0	47°30.3	6.3'	11°54.0	10.0'	61.0'
15	45°47.2	· · 52.4	61°55.6	6.2'	12°03.9	9.9'	61.0'
16	60°47.1	52.9	76°20.8	6.2'	12°13.8	9.8'	61.1'
17	75°47.0	53.3	90°45.9	6.1'	12°23.6	9.8'	61.1'
18	90°47.0	N20°53.8	105°10.9	6.0'	N12°33.3	9.7'	61.1'
19	105°46.9	54.2	119°35.9	6.0'	12°42.9	9.6'	61.1'
20	120°46.9	54.7	134°00.8	5.9'	12°52.5	9.5'	61.1'
21	135°46.8	· · 55.1	148°25.7	5.8'	13°02.0	9.4'	61.1'
22	150°46.7	55.6	162°50.5	5.7'	13°11.4	9.3'	61.2'
23	165°46.7	56.0	177°15.2	5.7'	13°20.7	9.3'	61.2'
	SD.=15.8	d=0.5		S.D.=16.6			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	00:53	23:10	▭	▭
66°	▭	▭	01:49	22:08	▭	▭
64°	▭	▭	02:22	21:34	▭	▭
62°	▭	01:14	02:46	21:09	22:44	▭
60°	▭	01:53	03:05	20:50	22:03	▭
N 58°	▭	02:20	03:20	20:34	21:36	▭
56°	01:07	02:40	03:34	20:21	21:15	22:51
54°	01:43	02:57	03:45	20:09	20:58	22:13
52°	02:08	03:11	03:55	19:59	20:44	21:48
50°	02:27	03:23	04:04	19:50	20:31	21:28
45°	03:02	03:48	04:23	19:31	20:07	20:52
N 40°	03:28	04:07	04:38	19:16	19:47	20:26
35°	03:48	04:23	04:51	19:03	19:31	20:07
30°	04:04	04:36	05:02	18:51	19:18	19:50
20°	04:29	04:57	05:21	18:32	18:56	19:25
N 10°	04:49	05:15	05:38	18:16	18:38	19:05
0°	05:05	05:31	05:53	18:00	18:22	18:48
S 10°	05:20	05:46	06:08	17:45	18:07	18:33
20°	05:34	06:01	06:24	17:29	17:52	18:19
30°	05:48	06:17	06:43	17:11	17:36	18:06
35°	05:55	06:26	06:53	17:00	17:27	17:58
40°	06:03	06:36	07:06	16:48	17:17	17:51
45°	06:11	06:47	07:20	16:33	17:06	17:42
S 50°	06:20	07:01	07:37	16:16	16:53	17:33
52°	06:25	07:07	07:45	16:08	16:46	17:29
54°	06:29	07:13	07:55	15:58	16:40	17:24
56°	06:34	07:21	08:05	15:48	16:32	17:19
58°	06:39	07:29	08:17	15:36	16:24	17:14
S 60°	06:45	07:38	08:30	15:23	16:15	17:08

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	02:33	02:25	02:16	15:47	17:49	20:00
N 70°	02:34	02:32	02:31	15:43	17:36	19:35
68°	02:35	02:38	02:43	15:39	17:26	19:16
66°	02:35	02:43	02:53	15:36	17:17	19:02
64°	02:36	02:48	03:02	15:33	17:10	18:49
62°	02:36	02:51	03:09	15:31	17:04	18:39
60°	02:37	02:55	03:15	15:29	16:59	18:30
N 58°	02:37	02:58	03:21	15:27	16:54	18:23
56°	02:37	03:00	03:26	15:26	16:50	18:16
54°	02:37	03:03	03:30	15:24	16:46	18:10
52°	02:38	03:05	03:35	15:23	16:43	18:05
50°	02:38	03:07	03:38	15:22	16:40	18:00
45°	02:38	03:11	03:46	15:19	16:33	17:49
N 40°	02:39	03:15	03:53	15:17	16:28	17:40
35°	02:39	03:18	03:59	15:15	16:23	17:33
30°	02:40	03:20	04:04	15:14	16:19	17:26
20°	02:40	03:25	04:13	15:11	16:12	17:15
N 10°	02:41	03:30	04:21	15:08	16:05	17:05
0°	02:41	03:34	04:29	15:06	16:00	16:56
S 10°	02:42	03:38	04:37	15:04	15:54	16:47
20°	02:43	03:42	04:45	15:01	15:47	16:37
30°	02:43	03:47	04:54	14:58	15:40	16:26
35°	02:44	03:50	05:00	14:57	15:36	16:19
40°	02:44	03:54	05:06	14:55	15:32	16:12
45°	02:45	03:58	05:13	14:53	15:26	16:04
S 50°	02:46	04:03	05:22	14:50	15:20	15:53
52°	02:46	04:05	05:26	14:49	15:17	15:49
54°	02:46	04:07	05:31	14:48	15:14	15:44
56°	02:47	04:10	05:36	14:46	15:10	15:38
58°	02:47	04:13	05:41	14:45	15:06	15:31
S 60°	02:48	04:16	05:47	14:43	15:02	15:24

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 26-28 16-3%
22	03:22	03:20	11:57	08:54	21:20	
23	03:18	03:15	11:57	09:47	22:14	
24	03:12	03:09	11:57	10:42	23:11	

May 25, 26, 27 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	242°46.1	225°03.7	N05°42.6	160°35.1	N24°04.1	49°42.0	S04°00.4	337°03.2	S22°00.4
1	257°48.6	240°04.1	43.2	175°35.7	04.3	64°44.6	00.3	352°05.9	00.4
2	272°51.0	255°04.4	43.9	190°36.3	04.4	79°47.2	00.3	7°08.5	00.4
3	287°53.5	270°04.7	·· 44.6	205°37.0	·· 04.5	94°49.8	·· 00.3	22°11.2	·· 00.4
4	302°56.0	285°05.1	45.2	220°37.6	04.6	109°52.3	00.2	37°13.8	00.3
5	317°58.4	300°05.4	45.9	235°38.2	04.7	124°54.9	00.2	52°16.4	00.3
6	333°00.9	315°05.7	N05°46.5	250°38.9	N24°04.8	139°57.5	S04°00.1	67°19.1	S22°00.3
7	348°03.4	330°06.1	47.2	265°39.5	04.9	155°00.0	00.1	82°21.7	00.3
8	3°05.8	345°06.4	47.8	280°40.1	05.0	170°02.6	00.1	97°24.4	00.3
9	18°08.3	0°06.7	·· 48.5	295°40.7	·· 05.1	185°05.2	·· 00.0	112°27.0	·· 00.3
10	33°10.8	15°07.0	49.2	310°41.4	05.2	200°07.8	00.0	127°29.6	00.3
11	48°13.2	30°07.4	49.8	325°42.0	05.3	215°10.3	04°00.0	142°32.3	00.3
12	63°15.7	45°07.7	N05°50.5	340°42.6	N24°05.4	230°12.9	S03°59.9	157°34.9	S22°00.3
13	78°18.1	60°08.0	51.2	355°43.3	05.5	245°15.5	59.9	172°37.6	00.3
14	93°20.6	75°08.3	51.8	10°43.9	05.6	260°18.1	59.9	187°40.2	00.3
15	108°23.1	90°08.7	·· 52.5	25°44.5	·· 05.7	275°20.6	·· 59.8	202°42.9	·· 00.3
16	123°25.5	105°09.0	53.1	40°45.2	05.8	290°23.2	59.8	217°45.5	00.3
17	138°28.0	120°09.3	53.8	55°45.8	05.9	305°25.8	59.8	232°48.1	00.3
18	153°30.5	135°09.6	N05°54.5	70°46.4	N24°06.0	320°28.3	S03°59.7	247°50.8	S22°00.3
19	168°32.9	150°10.0	55.1	85°47.0	06.1	335°30.9	59.7	262°53.4	00.3
20	183°35.4	165°10.3	55.8	100°47.7	06.2	350°33.5	59.7	277°56.1	00.3
21	198°37.9	180°10.6	·· 56.5	115°48.3	·· 06.3	5°36.1	·· 59.6	292°58.7	·· 00.3
22	213°40.3	195°10.9	57.1	130°48.9	06.4	20°38.6	59.6	308°01.3	00.3
23	228°42.8	210°11.2	57.8	145°49.6	06.5	35°41.2	59.6	323°04.0	00.3
Mer.pass.:07:48		v0.3 d0.7 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.1		v2.6 d0.0 m0.1	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	243°45.3	225°11.5	N05°58.5	160°50.2	N24°06.6	50°43.8	S03°59.5	338°06.6	S22°00.3
1	258°47.7	240°11.9	59.1	175°50.8	06.7	65°46.3	59.5	353°09.3	00.3
2	273°50.2	255°12.2	05°59.8	190°51.5	06.8	80°48.9	59.5	8°11.9	00.3
3	288°52.6	270°12.5	06°00.5	205°52.1	·· 06.9	95°51.5	·· 59.4	23°14.6	·· 00.3
4	303°55.1	285°12.8	01.2	220°52.7	07.0	110°54.0	59.4	38°17.2	00.2
5	318°57.6	300°13.1	01.8	235°53.4	07.1	125°56.6	59.4	53°19.8	00.2
6	334°00.0	315°13.4	N06°02.5	250°54.0	N24°07.2	140°59.2	S03°59.3	68°22.5	S22°00.2
7	349°02.5	330°13.7	03.2	265°54.6	07.3	156°01.7	59.3	83°25.1	00.2
8	4°05.0	345°14.0	03.8	280°55.2	07.4	171°04.3	59.3	98°27.8	00.2
9	19°07.4	0°14.3	·· 04.5	295°55.9	·· 07.5	186°06.9	·· 59.2	113°30.4	·· 00.2
10	34°09.9	15°14.7	05.2	310°56.5	07.6	201°09.4	59.2	128°33.1	00.2
11	49°12.4	30°15.0	05.9	325°57.1	07.6	216°12.0	59.2	143°35.7	00.2
12	64°14.8	45°15.3	N06°06.5	340°57.8	N24°07.7	231°14.6	S03°59.2	158°38.3	S22°00.2
13	79°17.3	60°15.6	07.2	355°58.4	07.8	246°17.1	59.1	173°41.0	00.2
14	94°19.8	75°15.9	07.9	10°59.0	07.9	261°19.7	59.1	188°43.6	00.2
15	109°22.2	90°16.2	·· 08.6	25°59.7	·· 08.0	276°22.3	·· 59.1	203°46.3	·· 00.2
16	124°24.7	105°16.5	09.2	41°00.3	08.1	291°24.8	59.0	218°48.9	00.2
17	139°27.1	120°16.8	09.9	56°00.9	08.2	306°27.4	59.0	233°51.6	00.2
18	154°29.6	135°17.1	N06°10.6	71°01.6	N24°08.3	321°30.0	S03°59.0	248°54.2	S22°00.2
19	169°32.1	150°17.4	11.3	86°02.2	08.4	336°32.5	58.9	263°56.8	00.2
20	184°34.5	165°17.7	11.9	101°02.8	08.5	351°35.1	58.9	278°59.5	00.2
21	199°37.0	180°18.0	·· 12.6	116°03.5	·· 08.6	6°37.6	·· 58.9	294°02.1	·· 00.2
22	214°39.5	195°18.3	13.3	131°04.1	08.7	21°40.2	58.8	309°04.8	00.2
23	229°41.9	210°18.6	14.0	146°04.7	08.7	36°42.8	58.8	324°07.4	00.2
Mer.pass.:07:44		v0.3 d0.7 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.1		v2.6 d0.0 m0.1	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	244°44.4	225°18.9	N06°14.7	161°05.3	N24°08.8	51°45.3	S03°58.8	339°10.1	S22°00.2
1	259°46.9	240°19.2	15.3	176°06.0	08.9	66°47.9	58.8	354°12.7	00.2
2	274°49.3	255°19.5	16.0	191°06.6	09.0	81°50.5	58.7	9°15.4	00.2
3	289°51.8	270°19.8	·· 16.7	206°07.2	·· 09.1	96°53.0	·· 58.7	24°18.0	·· 00.2
4	304°54.2	285°20.0	17.4	221°07.9	09.2	111°55.6	58.7	39°20.6	00.1
5	319°56.7	300°20.3	18.1	236°08.5	09.3	126°58.1	58.6	54°23.3	00.1
6	334°59.2	315°20.6	N06°18.7	251°09.1	N24°09.4	142°00.7	S03°58.6	69°25.9	S22°00.1
7	350°01.6	330°20.9	19.4	266°09.8	09.4	157°03.3	58.6	84°28.6	00.1
8	5°04.1	345°21.2	20.1	281°10.4	09.5	172°05.8	58.5	99°31.2	00.1
9	20°06.6	0°21.5	·· 20.8	296°11.0	·· 09.6	187°08.4	·· 58.5	114°33.9	·· 00.1
10	35°09.0	15°21.8	21.5	311°11.7	09.7	202°10.9	58.5	129°36.5	00.1
11	50°11.5	30°22.1	22.2	326°12.3	09.8	217°13.5	58.5	144°39.2	00.1
12	65°14.0	45°22.4	N06°22.9	341°12.9	N24°09.9	232°16.1	S03°58.4	159°41.8	S22°00.1
13	80°16.4	60°22.6	23.5	356°13.6	10.0	247°18.6	58.4	174°44.5	00.1
14	95°18.9	75°22.9	24.2	11°14.2	10.0	262°21.2	58.4	189°47.1	00.1
15	110°21.4	90°23.2	·· 24.9	26°14.8	·· 10.1	277°23.7	·· 58.3	204°49.7	·· 00.1
16	125°23.8	105°23.5	25.6	41°15.4	10.2	292°26.3	58.3	219°52.4	00.1
17	140°26.3	120°23.8	26.3	56°16.1	10.3	307°28.9	58.3	234°55.0	00.1
18	155°28.7	135°24.1	N06°27.0	71°16.7	N24°10.4	322°31.4	S03°58.3	249°57.7	S22°00.1
19	170°31.2	150°24.3	27.7	86°17.3	10.5	337°34.0	58.2	265°00.3	00.1
20	185°33.7	165°24.6	28.3	101°18.0	10.5	352°36.5	58.2	280°03.0	00.1
21	200°36.1	180°24.9	·· 29.0	116°18.6	·· 10.6	7°39.1	·· 58.2	295°05.6	·· 00.1
22	215°38.6	195°25.2	29.7	131°19.2	10.7	22°41.6	58.2	310°08.3	00.1
23	230°41.1	210°25.5	30.4	146°19.9	10.8	37°44.2	58.1	325°10.9	00.1
Mer.pass.:07:40		v0.3 d0.7 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.1		v2.6 d0.0 m0.1	

Stars

	SHA	Dec
Alpheratz	357°40.9	29°10.9
Ankaa	353°13.4	-42°12.6
Schedar	349°37.7	56°37.6
Diphda	348°53.5	-17°53.5
Achernar	335°25.4	-57°08.9
Hamal	327°58.0	23°32.4
Polaris	316°59.6	89°20.0
Acamar	315°16.8	-40°14.2
Menkar	314°12.6	4°09.2
Mirfak	308°37.0	49°55.0
Aldebaran	290°46.7	16°32.4
Rigel	281°09.9	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.8	7°24.4
Canopus	263°55.5	-52°42.6
Sirius	258°31.7	-16°44.7
Adhara	255°10.7	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.2	-59°34.3
Suhail	222°50.6	-43°30.5
Miaplacidus	221°39.3	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.5	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.8	-63°11.9
Gacrux	171°57.5	-57°12.8
Alioth	166°18.1	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.9
Hadar	148°43.5	-60°27.4
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.4	-60°54.4
Kochab	137°19.2	74°05.3
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.0
Atria	107°21.5	-69°03.3
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.7
Rasalhague	96°03.7	12°33.0
Eltanin	90°44.4	51°29.3
Kaus Aust.	83°40.0	-34°22.3
Vega	80°36.8	38°48.0
Nunki	75°54.8	-26°16.3
Altair	62°05.4	8°54.9
Peacock	53°14.9	-56°40.4
Deneb	49°29.4	45°20.4
Enif	33°44.5	9°57.2
Al Na'ir	27°40.5	-46°52.4
Fomalhaut	15°21.2	-29°31.7
Scheat	13°50.8	28°10.4
Markab	13°35.7	15°17.8

May 25 Thu	SHA	Mer.pass
Venus	342°17.6	09:00
Mars	277°49.0	13:17
Jupiter	166°55.9	20:38
Saturn	94°17.1	01:32

May 26 Fri	SHA	Mer.pass
Venus	341°26.3	08:59
Mars	277°04.9	13:16
Jupiter	166°58.5	20:34
Saturn	94°21.4	01:27

May 27 Sat	SHA	Mer.pass
Venus	340°34.5	08:59
Mars	276°21.0	13:15
Jupiter	167°00.9	20:29
Saturn	94°25.7	01:23

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3900 sec ΔT = TT-UT1 = +68.7940 sec

2017 May 25 to May. 27 UT

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Thu	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°46.6	N20°56.5	191°39.8	5.6'	N13°29.9	9.2'	61.2'
1	195°46.5	56.9	206°04.4	5.5'	13°39.0	9.1'	61.2'
2	210°46.5	57.4	220°28.9	5.5'	13°48.0	9.0'	61.2'
3	225°46.4	·· 57.8	234°53.4	5.4'	13°57.0	8.9'	61.2'
4	240°46.4	58.3	249°17.7	5.3'	14°05.8	8.8'	61.2'
5	255°46.3	58.7	263°42.1	5.3'	14°14.6	8.7'	61.3'
6	270°46.2	N20°59.1	278°06.3	5.2'	N14°23.2	8.6'	61.3'
7	285°46.2	20°59.6	292°30.5	5.2'	14°31.8	8.5'	61.3'
8	300°46.1	21°00.0	306°54.6	5.1'	14°40.2	8.4'	61.3'
9	315°46.0	·· 00.5	321°18.7	5.0'	14°48.6	8.3'	61.3'
10	330°46.0	00.9	335°42.7	5.0'	14°56.9	8.2'	61.3'
11	345°45.9	01.4	350°06.6	4.9'	15°05.0	8.1'	61.3'
12	0°45.8	N21°01.8	4°30.5	4.8'	N15°13.0	8.0'	61.3'
13	15°45.8	02.2	18°54.3	4.8'	15°21.0	7.9'	61.3'
14	30°45.7	02.7	33°18.1	4.7'	15°28.8	7.8'	61.3'
15	45°45.6	·· 03.1	47°41.8	4.7'	15°36.5	7.7'	61.3'
16	60°45.6	03.6	62°05.4	4.6'	15°44.1	7.5'	61.3'
17	75°45.5	04.0	76°29.0	4.6'	15°51.6	7.4'	61.4'
18	90°45.4	N21°04.4	90°52.5	4.5'	N15°59.0	7.3'	61.4'
19	105°45.4	04.9	105°16.0	4.5'	16°06.2	7.2'	61.4'
20	120°45.3	05.3	119°39.5	4.4'	16°13.4	7.1'	61.4'
21	135°45.2	·· 05.8	134°02.8	4.4'	16°20.4	7.0'	61.4'
22	150°45.2	06.2	148°26.2	4.3'	16°27.3	6.8'	61.4'
23	165°45.1	06.6	162°49.5	4.3'	16°34.1	6.7'	61.4'
	SD.=15.8	d=0.4		S.D.=16.7			

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°45.0	N21°07.1	177°12.7	4.2'	N16°40.8	6.6'	61.4'
1	195°45.0	07.5	191°35.9	4.2'	16°47.3	6.5'	61.4'
2	210°44.9	07.9	205°59.0	4.1'	16°53.7	6.4'	61.4'
3	225°44.8	·· 08.4	220°22.1	4.1'	17°00.0	6.2'	61.4'
4	240°44.8	08.8	234°45.2	4.0'	17°06.2	6.1'	61.4'
5	255°44.7	09.2	249°08.2	4.0'	17°12.2	6.0'	61.4'
6	270°44.6	N21°09.6	263°31.2	4.0'	N17°18.1	5.8'	61.4'
7	285°44.5	10.1	277°54.1	3.9'	17°23.9	5.7'	61.4'
8	300°44.5	10.5	292°17.1	3.9'	17°29.6	5.6'	61.4'
9	315°44.4	·· 10.9	306°39.9	3.9'	17°35.1	5.5'	61.4'
10	330°44.3	11.4	321°02.8	3.8'	17°40.5	5.3'	61.4'
11	345°44.3	11.8	335°25.6	3.8'	17°45.8	5.2'	61.3'
12	0°44.2	N21°12.2	349°48.3	3.8'	N17°50.9	5.1'	61.3'
13	15°44.1	12.6	4°11.1	3.7'	17°55.9	4.9'	61.3'
14	30°44.1	13.1	18°33.8	3.7'	18°00.7	4.8'	61.3'
15	45°44.0	·· 13.5	32°56.5	3.7'	18°05.4	4.7'	61.3'
16	60°43.9	13.9	47°19.2	3.7'	18°10.0	4.5'	61.3'
17	75°43.8	14.3	61°41.8	3.6'	18°14.5	4.4'	61.3'
18	90°43.8	N21°14.8	76°04.5	3.6'	N18°18.8	4.2'	61.3'
19	105°43.7	15.2	90°27.1	3.6'	18°22.9	4.1'	61.3'
20	120°43.6	15.6	104°49.7	3.6'	18°27.0	4.0'	61.3'
21	135°43.5	·· 16.0	119°12.3	3.6'	18°30.9	3.8'	61.3'
22	150°43.5	16.4	133°34.8	3.6'	18°34.6	3.7'	61.2'
23	165°43.4	16.9	147°57.4	3.5'	18°38.2	3.5'	61.2'
	SD.=15.8	d=0.4		S.D.=16.7			

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°43.3	N21°17.3	162°19.9	3.5'	N18°41.7	3.4'	61.2'
1	195°43.3	17.7	176°42.5	3.5'	18°45.0	3.3'	61.2'
2	210°43.2	18.1	191°05.0	3.5'	18°48.2	3.1'	61.2'
3	225°43.1	·· 18.5	205°27.5	3.5'	18°51.2	3.0'	61.2'
4	240°43.0	18.9	219°50.0	3.5'	18°54.1	2.8'	61.2'
5	255°43.0	19.4	234°12.5	3.5'	18°56.9	2.7'	61.2'
6	270°42.9	N21°19.8	248°35.1	3.5'	N18°59.5	2.5'	61.1'
7	285°42.8	20.2	262°57.6	3.5'	19°01.9	2.4'	61.1'
8	300°42.7	20.6	277°20.1	3.5'	19°04.3	2.2'	61.1'
9	315°42.7	·· 21.0	291°42.7	3.5'	19°06.4	2.1'	61.1'
10	330°42.6	21.4	306°05.2	3.5'	19°08.5	2.0'	61.1'
11	345°42.5	21.8	320°27.7	3.6'	19°10.4	1.8'	61.1'
12	0°42.4	N21°22.3	334°50.3	3.6'	N19°12.1	1.7'	61.0'
13	15°42.4	22.7	349°12.9	3.6'	19°13.7	1.5'	61.0'
14	30°42.3	23.1	3°35.5	3.6'	19°15.1	1.4'	61.0'
15	45°42.2	·· 23.5	17°58.1	3.6'	19°16.5	1.2'	61.0'
16	60°42.1	23.9	32°20.7	3.6'	19°17.6	1.1'	61.0'
17	75°42.1	24.3	46°43.4	3.7'	19°18.6	0.9'	60.9'
18	90°42.0	N21°24.7	61°06.0	3.7'	N19°19.5	0.8'	60.9'
19	105°41.9	25.1	75°28.7	3.7'	19°20.3	0.7'	60.9'
20	120°41.8	25.5	89°51.5	3.7'	19°20.8	0.5'	60.9'
21	135°41.7	·· 25.9	104°14.2	3.8'	19°21.3	0.4'	60.8'
22	150°41.7	26.3	118°37.0	3.8'	19°21.6	0.2'	60.8'
23	165°41.6	26.7	132°59.8	3.8'	19°21.7	0.1'	60.8'
	SD.=15.8	d=0.4		S.D.=16.6			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	00:14	–:–	▭	▭
66°	▭	▭	01:37	22:21	▭	▭
64°	▭	▭	02:13	21:43	▭	▭
62°	▭	00:58	02:39	21:17	23:02	▭
60°	▭	01:44	02:59	20:56	22:13	▭
N 58°	▭	02:13	03:15	20:40	21:43	▭
56°	00:52	02:34	03:29	20:26	21:21	23:07
54°	01:34	02:52	03:41	20:14	21:03	22:22
52°	02:01	03:07	03:52	20:03	20:49	21:55
50°	02:22	03:19	04:01	19:54	20:36	21:34
45°	02:59	03:45	04:21	19:34	20:10	20:56
N 40°	03:25	04:05	04:36	19:18	19:50	20:30
35°	03:45	04:21	04:50	19:05	19:34	20:09
30°	04:02	04:34	05:01	18:53	19:20	19:52
20°	04:28	04:57	05:21	18:33	18:58	19:26
N 10°	04:48	05:15	05:38	18:16	18:39	19:06
0°	05:06	05:31	05:53	18:01	18:23	18:49
S 10°	05:21	05:47	06:09	17:45	18:07	18:33
20°	05:35	06:02	06:26	17:28	17:52	18:19
30°	05:49	06:19	06:45	17:09	17:35	18:05
35°	05:57	06:28	06:55	16:58	17:26	17:57
40°	06:05	06:38	07:08	16:46	17:16	17:49
45°	06:14	06:50	07:23	16:31	17:04	17:40
S 50°	06:23	07:04	07:41	16:13	16:50	17:30
52°	06:28	07:10	07:49	16:04	16:44	17:26
54°	06:32	07:17	07:59	15:55	16:37	17:21
56°	06:37	07:25	08:10	15:44	16:29	17:16
58°	06:43	07:33	08:22	15:32	16:20	17:11
S 60°	06:49	07:43	08:36	15:17	16:10	17:05

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	02:05	01:46	▭	22:25	–:–	▭
N 70°	02:31	02:34	02:45	21:38	23:37	–:–
68°	02:51	03:05	03:32	21:08	22:50	–:–
66°	03:07	03:28	04:02	20:45	22:20	23:35
64°	03:20	03:46	04:25	20:28	21:57	23:11
62°	03:31	04:01	04:44	20:13	21:39	22:51
60°	03:41	04:14	04:59	20:01	21:24	22:35
N 58°	03:49	04:25	05:12	19:50	21:12	22:22
56°	03:57	04:35	05:23	19:41	21:01	22:10
54°	04:03	04:43	05:33	19:33	20:51	22:00
52°	04:09	04:51	05:42	19:26	20:43	21:51
50°	04:15	04:58	05:50	19:19	20:35	21:43
45°	04:26	05:13	06:06	19:05	20:18	21:25
N 40°	04:36	05:25	06:20	18:54	20:05	21:11
35°	04:45	05:36	06:32	18:44	19:54	20:59
30°	04:52	05:45	06:42	18:35	19:44	20:49
20°	05:05	06:01	07:00	18:21	19:26	20:30
N 10°	05:16	06:15	07:16	18:08	19:11	20:15
0°	05:27	06:28	07:30	17:56	18:57	20:00
S 10°	05:38	06:41	07:45	17:44	18:43	19:45
20°	05:49	06:55	08:00	17:31	18:28	19:29
30°	06:03	07:11	08:18	17:16	18:11	19:11
35°	06:10	07:21	08:29	17:08	18:01	19:00
40°	06:19	07:32	08:41	16:58	17:50	18:48
45°	06:30	07:45	08:55	16:47	17:36	18:34
S 50°	06:42	08:00	09:12	16:33	17:20	18:16
52°	06:48	08:08	09:21	16:27	17:13	18:08
54°	06:55	08:16	09:30	16:20	17:04	17:59
56°	07:02	08:25	09:40	16:12	16:55	17:48
58°	07:10	08:36	09:52	16:03	16:44	17:36
S 60°	07:19	08:48	10:06	15:53	16:31	17:23

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 0-2 0-4%
25	03:06	03:03	11:57	11:41	–:–	
26	03:00	02:57	11:57	12:43	00:12	
27	02:53	02:50	11:57	13:45	01:14	

May 28, 29, 30 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	245°43.5	225°25.7	N06°31.1	161°20.5	N24°10.9	52°46.7	S03°58.1	340°13.6	S22°00.1
1	260°46.0	240°26.0	31.8	176°21.1	10.9	67°49.3	58.1	355°16.2	00.1
2	275°48.5	255°26.3	32.5	191°21.8	11.0	82°51.9	58.0	10°18.8	00.1
3	290°50.9	270°26.6	·· 33.2	206°22.4	·· 11.1	97°54.4	·· 58.0	25°21.5	·· 00.0
4	305°53.4	285°26.8	33.9	221°23.0	11.2	112°57.0	58.0	40°24.1	00.0
5	320°55.9	300°27.1	34.6	236°23.7	11.3	127°59.5	58.0	55°26.8	00.0
6	335°58.3	315°27.4	N06°35.3	251°24.3	N24°11.3	143°02.1	S03°57.9	70°29.4	S22°00.0
7	351°00.8	330°27.6	36.0	266°24.9	11.4	158°04.6	57.9	85°32.1	00.0
8	6°03.2	345°27.9	36.6	281°25.6	11.5	173°07.2	57.9	100°34.7	00.0
9	21°05.7	0°28.2	·· 37.3	296°26.2	·· 11.6	188°09.7	·· 57.9	115°37.4	·· 00.0
10	36°08.2	15°28.5	38.0	311°26.8	11.6	203°12.3	57.8	130°40.0	00.0
11	51°10.6	30°28.7	38.7	326°27.5	11.7	218°14.8	57.8	145°42.7	00.0
12	66°13.1	45°29.0	N06°39.4	341°28.1	N24°11.8	233°17.4	S03°57.8	160°45.3	S22°00.0
13	81°15.6	60°29.3	40.1	356°28.7	11.9	248°19.9	57.8	175°48.0	00.0
14	96°18.0	75°29.5	40.8	11°29.4	11.9	263°22.5	57.7	190°50.6	00.0
15	111°20.5	90°29.8	·· 41.5	26°30.0	·· 12.0	278°25.0	·· 57.7	205°53.3	·· 00.0
16	126°23.0	105°30.0	42.2	41°30.6	12.1	293°27.6	57.7	220°55.9	00.0
17	141°25.4	120°30.3	42.9	56°31.2	12.2	308°30.1	57.7	235°58.5	00.0
18	156°27.9	135°30.6	N06°43.6	71°31.9	N24°12.2	323°32.7	S03°57.6	251°01.2	S22°00.0
19	171°30.4	150°30.8	44.3	86°32.5	12.3	338°35.2	57.6	266°03.8	00.0
20	186°32.8	165°31.1	45.0	101°33.1	12.4	353°37.8	57.6	281°06.5	00.0
21	201°35.3	180°31.4	·· 45.7	116°33.8	·· 12.5	8°40.3	·· 57.6	296°09.1	·· 00.0
22	216°37.7	195°31.6	46.4	131°34.4	12.5	23°42.9	57.5	311°11.8	00.0
23	231°40.2	210°31.9	47.1	146°35.0	12.6	38°45.4	57.5	326°14.4	00.0
Mer.pass.:07:36		v0.3 d0.7 m-4.3		v0.6 d0.1 m1.6		v2.6 d0.0 m-2.1		v2.6 d0.0 m0.1	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	246°42.7	225°32.1	N06°47.8	161°35.7	N24°12.7	53°48.0	S03°57.5	341°17.1	S22°00.0
1	261°45.1	240°32.4	48.5	176°36.3	12.8	68°50.5	57.5	356°19.7	00.0
2	276°47.6	255°32.6	49.2	191°36.9	12.8	83°53.1	57.4	11°22.4	22°00.0
3	291°50.1	270°32.9	·· 49.9	206°37.6	·· 12.9	98°55.6	·· 57.4	26°25.0	21°59.9
4	306°52.5	285°33.1	50.6	221°38.2	13.0	113°58.2	57.4	41°27.7	59.9
5	321°55.0	300°33.4	51.3	236°38.8	13.0	129°00.7	57.4	56°30.3	59.9
6	336°57.5	315°33.7	N06°52.0	251°39.5	N24°13.1	144°03.3	S03°57.3	71°33.0	S21°59.9
7	351°59.9	330°33.9	52.7	266°40.1	13.2	159°05.8	57.3	86°35.6	59.9
8	7°02.4	345°34.2	53.4	281°40.7	13.2	174°08.4	57.3	101°38.3	59.9
9	22°04.9	0°34.4	·· 54.1	296°41.4	·· 13.3	189°10.9	·· 57.3	116°40.9	·· 59.9
10	37°07.3	15°34.7	54.8	311°42.0	13.4	204°13.5	57.3	131°43.6	59.9
11	52°09.8	30°34.9	55.5	326°42.6	13.4	219°16.0	57.2	146°46.2	59.9
12	67°12.2	45°35.1	N06°56.2	341°43.3	N24°13.5	234°18.6	S03°57.2	161°48.9	S21°59.9
13	82°14.7	60°35.4	56.9	356°43.9	13.6	249°21.1	57.2	176°51.5	59.9
14	97°17.2	75°35.6	57.6	11°44.5	13.6	264°23.6	57.2	191°54.2	59.9
15	112°19.6	90°35.9	·· 58.4	26°45.2	·· 13.7	279°26.2	·· 57.1	206°56.8	·· 59.9
16	127°22.1	105°36.1	59.1	41°45.8	13.8	294°28.7	57.1	221°59.5	59.9
17	142°24.6	120°36.4	06°59.8	56°46.4	13.8	309°31.3	57.1	237°02.1	59.9
18	157°27.0	135°36.6	N07°00.5	71°47.1	N24°13.9	324°33.8	S03°57.1	252°04.8	S21°59.9
19	172°29.5	150°36.9	01.2	86°47.7	14.0	339°36.4	57.1	267°07.4	59.9
20	187°32.0	165°37.1	01.9	101°48.3	14.0	354°38.9	57.0	282°10.1	59.9
21	202°34.4	180°37.3	·· 02.6	116°49.0	·· 14.1	9°41.4	·· 57.0	297°12.7	·· 59.9
22	217°36.9	195°37.6	03.3	131°49.6	14.2	24°44.0	57.0	312°15.4	59.9
23	232°39.4	210°37.8	04.0	146°50.2	14.2	39°46.5	57.0	327°18.0	59.9
Mer.pass.:07:32		v0.3 d0.7 m-4.3		v0.6 d0.1 m1.6		v2.5 d0.0 m-2.1		v2.6 d0.0 m0.1	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	247°41.8	225°38.1	N07°04.7	161°50.9	N24°14.3	54°49.1	S03°56.9	342°20.7	S21°59.9
1	262°44.3	240°38.3	05.4	176°51.5	14.4	69°51.6	56.9	357°23.3	59.9
2	277°46.7	255°38.5	06.1	191°52.1	14.4	84°54.2	56.9	12°26.0	59.9
3	292°49.2	270°38.8	·· 06.9	206°52.8	·· 14.5	99°56.7	·· 56.9	27°28.6	·· 59.8
4	307°51.7	285°39.0	07.6	221°53.4	14.5	114°59.2	56.9	42°31.3	59.8
5	322°54.1	300°39.2	08.3	236°54.0	14.6	130°01.8	56.8	57°33.9	59.8
6	337°56.6	315°39.5	N07°09.0	251°54.7	N24°14.7	145°04.3	S03°56.8	72°36.6	S21°59.8
7	352°59.1	330°39.7	09.7	266°55.3	14.7	160°06.9	56.8	87°39.2	59.8
8	8°01.5	345°39.9	10.4	281°55.9	14.8	175°09.4	56.8	102°41.9	59.8
9	23°04.0	0°40.2	·· 11.1	296°56.6	·· 14.8	190°11.9	·· 56.8	117°44.5	·· 59.8
10	38°06.5	15°40.4	11.8	311°57.2	14.9	205°14.5	56.7	132°47.2	59.8
11	53°08.9	30°40.6	12.6	326°57.8	15.0	220°17.0	56.7	147°49.8	59.8
12	68°11.4	45°40.9	N07°13.3	341°58.5	N24°15.0	235°19.6	S03°56.7	162°52.5	S21°59.8
13	83°13.8	60°41.1	14.0	356°59.1	15.1	250°22.1	56.7	177°55.1	59.8
14	98°16.3	75°41.3	14.7	11°59.7	15.1	265°24.6	56.7	192°57.8	59.8
15	113°18.8	90°41.5	·· 15.4	27°00.4	·· 15.2	280°27.2	·· 56.6	208°00.4	·· 59.8
16	128°21.2	105°41.8	16.1	42°01.0	15.3	295°29.7	56.6	223°03.1	59.8
17	143°23.7	120°42.0	16.8	57°01.6	15.3	310°32.2	56.6	238°05.7	59.8
18	158°26.2	135°42.2	N07°17.6	72°02.3	N24°15.4	325°34.8	S03°56.6	253°08.4	S21°59.8
19	173°28.6	150°42.4	18.3	87°02.9	15.4	340°37.3	56.6	268°11.0	59.8
20	188°31.1	165°42.7	19.0	102°03.5	15.5	355°39.8	56.6	283°13.7	59.8
21	203°33.6	180°42.9	·· 19.7	117°04.2	·· 15.5	10°42.4	·· 56.5	298°16.3	·· 59.8
22	218°36.0	195°43.1	20.4	132°04.8	15.6	25°44.9	56.5	313°19.0	59.8
23	233°38.5	210°43.3	21.1	147°05.4	15.6	40°47.5	56.5	328°21.6	59.8
Mer.pass.:07:28		v0.2 d0.7 m-4.3		v0.6 d0.1 m1.6		v2.5 d0.0 m-2.1		v2.6 d0.0 m0.1	

Stars

	SHA	**Dec**
Alpheratz	357°40.9	29°10.9
Ankaa	353°13.4	-42°12.6
Schedar	349°37.7	56°37.6
Diphda	348°53.4	-17°53.5
Achernar	335°25.3	-57°08.9
Hamal	327°58.0	23°32.4
Polaris	316°58.7	89°20.0
Acamar	315°16.8	-40°14.2
Menkar	314°12.6	4°09.2
Mirfak	308°37.0	49°55.0
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.8	7°24.4
Canopus	263°55.5	-52°42.6
Sirius	258°31.7	-16°44.7
Adhara	255°10.8	-29°00.1
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.2	-59°34.3
Suhail	222°50.6	-43°30.5
Miaplacidus	221°39.3	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.5	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.9	-63°11.9
Gacrux	171°57.5	-57°12.8
Alioth	166°18.1	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.9
Hadar	148°43.5	-60°27.4
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.4	-60°54.4
Kochab	137°19.2	74°05.3
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.0
Atria	107°21.4	-69°03.3
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.7
Rasalhague	96°03.7	12°33.0
Eltanin	90°44.4	51°29.3
Kaus Aust.	83°39.9	-34°22.3
Vega	80°36.8	38°48.0
Nunki	75°54.7	-26°16.3
Altair	62°05.4	8°54.9
Peacock	53°14.8	-56°40.4
Deneb	49°29.4	45°20.4
Enif	33°44.4	9°57.2
Al Na'ir	27°40.4	-46°52.3
Fomalhaut	15°21.1	-29°31.7
Scheat	13°50.8	28°10.4
Markab	13°35.7	15°17.8

May 28 Sun	**SHA**	**Mer.pass**
Venus	339°42.2	08:58
Mars	275°37.0	13:14
Jupiter	167°03.2	20:25
Saturn	94°30.0	01:19

May 29 Mon	**SHA**	**Mer.pass**
Venus	338°49.5	08:58
Mars	274°53.0	13:13
Jupiter	167°05.3	20:21
Saturn	94°34.4	01:15

May 30 Tue	**SHA**	**Mer.pass**
Venus	337°56.2	08:57
Mars	274°09.1	13:12
Jupiter	167°07.3	20:17
Saturn	94°38.8	01:10

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3860 sec ΔT = TT-UT1 = +68.7980 sec

2017 May 28 to May. 30 UT

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Sun	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°41.5	N21°27.1	147°22.6	3.9′	N19°21.8	-0.1′	60.8′
1	195°41.4	27.5	161°45.5	3.9′	19°21.6	-0.2′	60.7′
2	210°41.4	27.9	176°08.4	3.9′	19°21.4	-0.3′	60.7′
3	225°41.3	·· 28.3	190°31.4	4.0′	19°21.0	-0.5′	60.7′
4	240°41.2	28.7	204°54.4	4.0′	19°20.4	-0.6′	60.7′
5	255°41.1	29.1	219°17.4	4.1′	19°19.7	-0.8′	60.6′
6	270°41.0	N21°29.5	233°40.5	4.1′	N19°18.9	-0.9′	60.6′
7	285°41.0	29.9	248°03.6	4.1′	19°17.9	-1.0′	60.6′
8	300°40.9	30.3	262°26.8	4.2′	19°16.8	-1.2′	60.6′
9	315°40.8	·· 30.7	276°50.0	4.2′	19°15.6	-1.3′	60.5′
10	330°40.7	31.1	291°13.3	4.3′	19°14.2	-1.5′	60.5′
11	345°40.6	31.5	305°36.6	4.3′	19°12.7	-1.6′	60.5′
12	0°40.6	N21°31.9	320°00.0	4.4′	N19°11.0	-1.7′	60.4′
13	15°40.5	32.3	334°23.4	4.5′	19°09.2	-1.9′	60.4′
14	30°40.4	32.7	348°46.9	4.5′	19°07.3	-2.0′	60.4′
15	45°40.3	·· 33.1	3°10.4	4.6′	19°05.2	-2.1′	60.4′
16	60°40.2	33.5	17°34.0	4.6′	19°03.0	-2.3′	60.3′
17	75°40.2	33.9	31°57.7	4.7′	19°00.7	-2.4′	60.3′
18	90°40.1	N21°34.3	46°21.4	4.7′	N18°58.2	-2.5′	60.3′
19	105°40.0	34.7	60°45.2	4.8′	18°55.6	-2.7′	60.2′
20	120°39.9	35.1	75°09.0	4.9′	18°52.9	-2.8′	60.2′
21	135°39.8	·· 35.5	89°32.9	4.9′	18°50.1	-2.9′	60.2′
22	150°39.7	35.8	103°56.9	5.0′	18°47.1	-3.0′	60.1′
23	165°39.7	36.2	118°21.0	5.1′	18°44.0	-3.2′	60.1′
	SD.=15.8	d=0.4	S.D.=16.5				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°39.6	N21°36.6	132°45.1	5.1′	N18°40.7	-3.3′	60.1′
1	195°39.5	37.0	147°09.3	5.2′	18°37.4	-3.4′	60.0′
2	210°39.4	37.4	161°33.5	5.3′	18°33.9	-3.5′	60.0′
3	225°39.3	·· 37.8	175°57.8	5.4′	18°30.3	-3.7′	60.0′
4	240°39.2	38.2	190°22.2	5.4′	18°26.6	-3.8′	59.9′
5	255°39.2	38.6	204°46.7	5.5′	18°22.7	-3.9′	59.9′
6	270°39.1	N21°38.9	219°11.2	5.6′	N18°18.8	-4.0′	59.9′
7	285°39.0	39.3	233°35.9	5.7′	18°14.7	-4.1′	59.8′
8	300°38.9	39.7	248°00.6	5.7′	18°10.5	-4.3′	59.8′
9	315°38.8	·· 40.1	262°25.3	5.8′	18°06.1	-4.4′	59.8′
10	330°38.7	40.5	276°50.2	5.9′	18°01.7	-4.5′	59.7′
11	345°38.7	40.8	291°15.1	6.0′	17°57.1	-4.6′	59.7′
12	0°38.6	N21°41.2	305°40.1	6.1′	N17°52.5	-4.7′	59.7′
13	15°38.5	41.6	320°05.2	6.1′	17°47.7	-4.8′	59.6′
14	30°38.4	42.0	334°30.4	6.2′	17°42.8	-4.9′	59.6′
15	45°38.3	·· 42.4	348°55.7	6.3′	17°37.8	-5.1′	59.5′
16	60°38.2	42.7	3°21.0	6.4′	17°32.7	-5.2′	59.5′
17	75°38.1	43.1	17°46.4	6.5′	17°27.4	-5.3′	59.5′
18	90°38.1	N21°43.5	32°11.9	6.5′	N17°22.1	-5.4′	59.4′
19	105°38.0	43.9	46°37.5	6.6′	17°16.7	-5.5′	59.4′
20	120°37.9	44.2	61°03.2	6.7′	17°11.1	-5.6′	59.4′
21	135°37.8	·· 44.6	75°28.9	6.8′	17°05.5	-5.7′	59.3′
22	150°37.7	45.0	89°54.8	6.9′	16°59.8	-5.8′	59.3′
23	165°37.6	45.4	104°20.7	7.0′	16°53.9	-5.9′	59.2′
	SD.=15.8	d=0.4	S.D.=16.3				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°37.5	N21°45.7	118°46.7	7.1′	N16°48.0	-6.0′	59.2′
1	195°37.5	46.1	133°12.8	7.1′	16°41.9	-6.1′	59.2′
2	210°37.4	46.5	147°39.0	7.2′	16°35.8	-6.2′	59.1′
3	225°37.3	·· 46.8	162°05.3	7.3′	16°29.6	-6.3′	59.1′
4	240°37.2	47.2	176°31.7	7.4′	16°23.2	-6.4′	59.1′
5	255°37.1	47.6	190°58.1	7.5′	16°16.8	-6.5′	59.0′
6	270°37.0	N21°48.0	205°24.7	7.6′	N16°10.3	-6.6′	59.0′
7	285°36.9	48.3	219°51.3	7.7′	16°03.7	-6.7′	58.9′
8	300°36.8	48.7	234°18.0	7.8′	15°57.0	-6.7′	58.9′
9	315°36.8	·· 49.1	248°44.8	7.9′	15°50.2	-6.8′	58.9′
10	330°36.7	49.4	263°11.7	7.9′	15°43.3	-6.9′	58.8′
11	345°36.6	49.8	277°38.7	8.0′	15°36.4	-7.0′	58.8′
12	0°36.5	N21°50.1	292°05.8	8.1′	N15°29.3	-7.1′	58.8′
13	15°36.4	50.5	306°33.0	8.2′	15°22.2	-7.2′	58.7′
14	30°36.3	50.9	321°00.2	8.3′	15°15.0	-7.3′	58.7′
15	45°36.2	·· 51.2	335°27.5	8.4′	15°07.7	-7.3′	58.6′
16	60°36.1	51.6	349°55.0	8.5′	15°00.3	-7.4′	58.6′
17	75°36.0	52.0	4°22.5	8.6′	14°52.9	-7.5′	58.6′
18	90°35.9	N21°52.3	18°50.1	8.6′	N14°45.3	-7.6′	58.5′
19	105°35.9	52.7	33°17.8	8.7′	14°37.7	-7.6′	58.5′
20	120°35.8	53.0	47°45.6	8.8′	14°30.1	-7.7′	58.4′
21	135°35.7	·· 53.4	62°13.4	8.9′	14°22.3	-7.8′	58.4′
22	150°35.6	53.8	76°41.4	9.0′	14°14.5	-7.9′	58.4′
23	165°35.5	54.1	91°09.4	9.1′	14°06.6	-7.9′	58.3′
	SD.=15.8	d=0.4	S.D.=16.0				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			01:25	22:34		
64°			02:05	21:52		
62°		00:38	02:33	21:24	23:26	
60°		01:35	02:54	21:02	22:23	
N 58°		02:06	03:11	20:45	21:51	
56°	00:34	02:29	03:25	20:30	21:27	23:28
54°	01:26	02:47	03:38	20:18	21:09	22:31
52°	01:55	03:03	03:49	20:07	20:53	22:01
50°	02:17	03:16	03:58	19:57	20:40	21:39
45°	02:56	03:42	04:18	19:37	20:13	21:00
N 40°	03:23	04:03	04:35	19:21	19:53	20:33
35°	03:44	04:19	04:48	19:07	19:36	20:12
30°	04:01	04:33	05:00	18:55	19:22	19:54
20°	04:27	04:56	05:20	18:35	18:59	19:28
N 10°	04:48	05:15	05:38	18:17	18:40	19:07
0°	05:06	05:32	05:54	18:01	18:23	18:49
S 10°	05:21	05:47	06:10	17:45	18:08	18:34
20°	05:36	06:03	06:27	17:28	17:52	18:19
30°	05:51	06:20	06:46	17:08	17:34	18:04
35°	05:59	06:30	06:57	16:57	17:25	17:56
40°	06:07	06:40	07:10	16:44	17:14	17:48
45°	06:16	06:52	07:26	16:29	17:02	17:39
S 50°	06:26	07:07	07:44	16:10	16:48	17:28
52°	06:31	07:13	07:53	16:02	16:41	17:24
54°	06:36	07:21	08:03	15:52	16:34	17:19
56°	06:41	07:29	08:14	15:41	16:26	17:14
58°	06:47	07:38	08:27	15:28	16:17	17:08
S 60°	06:53	07:48	08:42	15:13	16:07	17:01

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°			06:11			02:30
N 70°	03:28	05:02	06:54	01:05	01:38	01:46
68°	04:24	05:45	07:23	00:09	00:54	01:17
66°	04:58	06:14	07:44	–:–	00:25	00:54
64°	05:22	06:36	08:01	–:–	00:02	00:37
62°	05:42	06:54	08:15	23:45	–:–	00:22
60°	05:57	07:08	08:27	23:30	–:–	00:10
N 58°	06:11	07:21	08:37	23:17	23:59	–:–
56°	06:23	07:31	08:46	23:06	23:50	–:–
54°	06:33	07:41	08:54	22:56	23:41	–:–
52°	06:42	07:49	09:01	22:48	23:34	–:–
50°	06:50	07:57	09:07	22:40	23:27	–:–
45°	07:07	08:13	09:21	22:24	23:13	23:54
N 40°	07:21	08:26	09:32	22:10	23:01	23:45
35°	07:33	08:37	09:42	21:58	22:51	23:36
30°	07:44	08:47	09:50	21:48	22:42	23:29
20°	08:02	09:04	10:05	21:31	22:26	23:16
N 10°	08:18	09:19	10:17	21:16	22:13	23:05
0°	08:32	09:32	10:29	21:01	22:00	22:55
S 10°	08:47	09:46	10:41	20:47	21:47	22:44
20°	09:03	10:01	10:53	20:31	21:33	22:33
30°	09:21	10:17	11:07	20:14	21:17	22:20
35°	09:31	10:27	11:16	20:03	21:08	22:12
40°	09:44	10:38	11:25	19:51	20:57	22:03
45°	09:58	10:51	11:36	19:37	20:45	21:53
S 50°	10:15	11:07	11:49	19:20	20:30	21:41
52°	10:23	11:15	11:56	19:12	20:22	21:35
54°	10:33	11:23	12:02	19:03	20:15	21:29
56°	10:43	11:32	12:10	18:53	20:06	21:22
58°	10:55	11:43	12:19	18:41	19:56	21:14
S 60°	11:08	11:55	12:28	18:28	19:44	21:05

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 3-5 11-29%
28	02:46	02:42	11:57	14:47	02:16	
29	02:38	02:34	11:57	15:46	03:17	
30	02:30	02:26	11:58	16:42	04:14	

May 31, 01, 02 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	248°41.0	225°43.6	N07°21.9	162°06.1	N24°15.7	55°50.0	S03°56.5	343°24.3	S21°59.8
1	263°43.4	240°43.8	22.6	177°06.7	15.8	70°52.5	56.5	358°26.9	59.8
2	278°45.9	255°44.0	23.3	192°07.3	15.8	85°55.1	56.4	13°29.6	59.7
3	293°48.3	270°44.2	·· 24.0	207°08.0	·· 15.9	100°57.6	·· 56.4	28°32.2	·· 59.7
4	308°50.8	285°44.4	24.7	222°08.6	15.9	116°00.1	56.4	43°34.9	59.7
5	323°53.3	300°44.6	25.5	237°09.3	16.0	131°02.7	56.4	58°37.5	59.7
6	338°55.7	315°44.9	N07°26.2	252°09.9	N24°16.0	146°05.2	S03°56.4	73°40.2	S21°59.7
7	353°58.2	330°45.1	26.9	267°10.5	16.1	161°07.7	56.4	88°42.8	59.7
8	9°00.7	345°45.3	27.6	282°11.2	16.1	176°10.3	56.3	103°45.5	59.7
9	24°03.1	0°45.5	·· 28.3	297°11.8	·· 16.2	191°12.8	·· 56.3	118°48.1	·· 59.7
10	39°05.6	15°45.7	29.1	312°12.4	16.2	206°15.3	56.3	133°50.8	59.7
11	54°08.1	30°45.9	29.8	327°13.1	16.3	221°17.9	56.3	148°53.4	59.7
12	69°10.5	45°46.1	N07°30.5	342°13.7	N24°16.3	236°20.4	S03°56.3	163°56.1	S21°59.7
13	84°13.0	60°46.3	31.2	357°14.3	16.4	251°22.9	56.3	178°58.7	59.7
14	99°15.5	75°46.6	31.9	12°15.0	16.4	266°25.4	56.2	194°01.4	59.7
15	114°17.9	90°46.8	·· 32.7	27°15.6	·· 16.5	281°28.0	·· 56.2	209°04.0	·· 59.7
16	129°20.4	105°47.0	33.4	42°16.2	16.5	296°30.5	56.2	224°06.7	59.7
17	144°22.8	120°47.2	34.1	57°16.9	16.6	311°33.0	56.2	239°09.3	59.7
18	159°25.3	135°47.4	N07°34.8	72°17.5	N24°16.6	326°35.6	S03°56.2	254°12.0	S21°59.7
19	174°27.8	150°47.6	35.6	87°18.1	16.7	341°38.1	56.2	269°14.6	59.7
20	189°30.2	165°47.8	36.3	102°18.8	16.7	356°40.6	56.1	284°17.3	59.7
21	204°32.7	180°48.0	·· 37.0	117°19.4	·· 16.8	11°43.2	·· 56.1	299°19.9	·· 59.7
22	219°35.2	195°48.2	37.7	132°20.0	16.8	26°45.7	56.1	314°22.6	59.7
23	234°37.6	210°48.4	38.5	147°20.7	16.9	41°48.2	56.1	329°25.3	59.7
Mer.pass.:07:24		v0.2 d0.7 m-4.3		v0.6 d0.1 m1.6		v2.5 d0.0 m-2.1		v2.7 d0.0 m0.1	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	249°40.1	225°48.6	N07°39.2	162°21.3	N24°16.9	56°50.7	S03°56.1	344°27.9	S21°59.7
1	264°42.6	240°48.8	39.9	177°22.0	16.9	71°53.3	56.1	359°30.6	59.6
2	279°45.0	255°49.0	40.6	192°22.6	17.0	86°55.8	56.0	14°33.2	59.6
3	294°47.5	270°49.2	·· 41.4	207°23.2	·· 17.0	101°58.3	·· 56.0	29°35.9	·· 59.6
4	309°49.9	285°49.4	42.1	222°23.9	17.1	117°00.9	56.0	44°38.5	59.6
5	324°52.4	300°49.6	42.8	237°24.5	17.1	132°03.4	56.0	59°41.2	59.6
6	339°54.9	315°49.8	N07°43.5	252°25.1	N24°17.2	147°05.9	S03°56.0	74°43.8	S21°59.6
7	354°57.3	330°50.0	44.3	267°25.8	17.2	162°08.4	56.0	89°46.5	59.6
8	9°59.8	345°50.2	45.0	282°26.4	17.3	177°11.0	56.0	104°49.1	59.6
9	25°02.3	0°50.4	·· 45.7	297°27.0	·· 17.3	192°13.5	·· 55.9	119°51.8	·· 59.6
10	40°04.7	15°50.6	46.5	312°27.7	17.3	207°16.0	55.9	134°54.4	59.6
11	55°07.2	30°50.8	47.2	327°28.3	17.4	222°18.5	55.9	149°57.1	59.6
12	70°09.7	45°51.0	N07°47.9	342°28.9	N24°17.4	237°21.1	S03°55.9	164°59.7	S21°59.6
13	85°12.1	60°51.2	48.6	357°29.6	17.5	252°23.6	55.9	180°02.4	59.6
14	100°14.6	75°51.4	49.4	12°30.2	17.5	267°26.1	55.9	195°05.0	59.6
15	115°17.1	90°51.6	·· 50.1	27°30.9	·· 17.5	282°28.6	·· 55.9	210°07.7	·· 59.6
16	130°19.5	105°51.7	50.8	42°31.5	17.6	297°31.2	55.9	225°10.4	59.6
17	145°22.0	120°51.9	51.6	57°32.1	17.6	312°33.7	55.8	240°13.0	59.6
18	160°24.4	135°52.1	N07°52.3	72°32.8	N24°17.7	327°36.2	S03°55.8	255°15.7	S21°59.6
19	175°26.9	150°52.3	53.0	87°33.4	17.7	342°38.7	55.8	270°18.3	59.6
20	190°29.4	165°52.5	53.8	102°34.0	17.7	357°41.2	55.8	285°21.0	59.6
21	205°31.8	180°52.7	·· 54.5	117°34.7	·· 17.8	12°43.8	·· 55.8	300°23.6	·· 59.6
22	220°34.3	195°52.9	55.2	132°35.3	17.8	27°46.3	55.8	315°26.3	59.6
23	235°36.8	210°53.1	56.0	147°35.9	17.9	42°48.8	55.8	330°28.9	59.6
Mer.pass.:07:20		v0.2 d0.7 m-4.3		v0.6 d0.0 m1.6		v2.5 d0.0 m-2.1		v2.7 d0.0 m0.1	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	250°39.2	225°53.2	N07°56.7	162°36.6	N24°17.9	57°51.3	S03°55.8	345°31.6	S21°59.6
1	265°41.7	240°53.4	57.4	177°37.2	17.9	72°53.8	55.7	0°34.2	59.5
2	280°44.2	255°53.6	58.2	192°37.8	18.0	87°56.4	55.7	15°36.9	59.5
3	295°46.6	270°53.8	·· 58.9	207°38.5	·· 18.0	102°58.9	·· 55.7	30°39.5	·· 59.5
4	310°49.1	285°54.0	07°59.6	222°39.1	18.0	118°01.4	55.7	45°42.2	59.5
5	325°51.6	300°54.1	08°00.4	237°39.8	18.1	133°03.9	55.7	60°44.9	59.5
6	340°54.0	315°54.3	N08°01.1	252°40.4	N24°18.1	148°06.4	S03°55.7	75°47.5	S21°59.5
7	355°56.5	330°54.5	01.8	267°41.0	18.1	163°09.0	55.7	90°50.2	59.5
8	10°58.9	345°54.7	02.6	282°41.7	18.2	178°11.5	55.7	105°52.8	59.5
9	26°01.4	0°54.9	·· 03.3	297°42.3	·· 18.2	193°14.0	·· 55.6	120°55.5	·· 59.5
10	41°03.9	15°55.0	04.0	312°42.9	18.2	208°16.5	55.6	135°58.1	59.5
11	56°06.3	30°55.2	04.8	327°43.6	18.3	223°19.0	55.6	151°00.8	59.5
12	71°08.8	45°55.4	N08°05.5	342°44.2	N24°18.3	238°21.6	S03°55.6	166°03.4	S21°59.5
13	86°11.3	60°55.6	06.2	357°44.9	18.3	253°24.1	55.6	181°06.1	59.5
14	101°13.7	75°55.7	07.0	12°45.5	18.4	268°26.6	55.6	196°08.7	59.5
15	116°16.2	90°55.9	·· 07.7	27°46.1	·· 18.4	283°29.1	·· 55.6	211°11.4	·· 59.5
16	131°18.7	105°56.1	08.5	42°46.8	18.4	298°31.6	55.6	226°14.1	59.5
17	146°21.1	120°56.3	09.2	57°47.4	18.5	313°34.1	55.6	241°16.7	59.5
18	161°23.6	135°56.4	N08°09.9	72°48.0	N24°18.5	328°36.7	S03°55.5	256°19.4	S21°59.5
19	176°26.0	150°56.6	10.7	87°48.7	18.5	343°39.2	55.5	271°22.0	59.5
20	191°28.5	165°56.8	11.4	102°49.3	18.6	358°41.7	55.5	286°24.7	59.5
21	206°31.0	180°56.9	·· 12.1	117°50.0	·· 18.6	13°44.2	·· 55.5	301°27.3	·· 59.5
22	221°33.4	195°57.1	12.9	132°50.6	18.6	28°46.7	55.5	316°30.0	59.5
23	236°35.9	210°57.3	13.6	147°51.2	18.6	43°49.2	55.5	331°32.6	59.4
Mer.pass.:07:16		v0.2 d0.7 m-4.2		v0.6 d0.0 m1.7		v2.5 d0.0 m-2.1		v2.7 d0.0 m0.1	

Stars

	SHA	Dec
Alpheratz	357°40.8	29°10.9
Ankaa	353°13.3	-42°12.6
Schedar	349°37.7	56°37.6
Diphda	348°53.4	-17°53.5
Achernar	335°25.3	-57°08.9
Hamal	327°58.0	23°32.4
Polaris	316°58.0	89°20.0
Acamar	315°16.8	-40°14.2
Menkar	314°12.6	4°09.2
Mirfak	308°37.0	49°55.0
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.8	7°24.4
Canopus	263°55.5	-52°42.6
Sirius	258°31.7	-16°44.7
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.3	-59°34.3
Suhail	222°50.6	-43°30.5
Miaplacidus	221°39.4	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.6	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.9	-63°11.9
Gacrux	171°57.5	-57°12.8
Alioth	166°18.2	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.9
Hadar	148°43.5	-60°27.5
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.4	-60°54.4
Kochab	137°19.2	74°05.3
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.3
Sabik	102°09.1	-15°44.6
Shaula	96°17.9	-37°06.7
Rasalhague	96°03.7	12°33.0
Eltanin	90°44.4	51°29.3
Kaus Aust.	83°39.9	-34°22.3
Vega	80°36.8	38°48.0
Nunki	75°54.7	-26°16.3
Altair	62°05.4	8°54.9
Peacock	53°14.8	-56°40.4
Deneb	49°29.4	45°20.4
Enif	33°44.4	9°57.3
Al Na'ir	27°40.4	-46°52.3
Fomalhaut	15°21.1	-29°31.7
Scheat	13°50.8	28°10.4
Markab	13°35.7	15°17.8

May 31 Wed	SHA	Mer.pass
Venus	337°02.6	08:57
Mars	273°25.1	13:11
Jupiter	167°09.0	20:13
Saturn	94°43.3	01:06

Jun 01 Thu	SHA	Mer.pass
Venus	336°08.5	08:57
Mars	272°41.2	13:10
Jupiter	167°10.6	20:09
Saturn	94°47.8	01:02

Jun 02 Fri	SHA	Mer.pass
Venus	335°14.0	08:56
Mars	271°57.3	13:09
Jupiter	167°12.1	20:05
Saturn	94°52.4	00:58

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3820 sec ΔT = TT-UT1 = +68.8020 sec

2017 May 31 to Jun. 02 UT

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°35.4	N21°54.5	105°37.6	9.2'	N13°58.6	-8.0'	58.3'
1	195°35.3	54.8	120°05.8	9.3'	13°50.6	-8.1'	58.3'
2	210°35.2	55.2	134°34.1	9.3'	13°42.5	-8.1'	58.2'
3	225°35.1	·· 55.5	149°02.5	9.4'	13°34.3	-8.2'	58.2'
4	240°35.0	55.9	163°30.9	9.5'	13°26.1	-8.3'	58.1'
5	255°34.9	56.2	177°59.5	9.6'	13°17.8	-8.3'	58.1'
6	270°34.9	N21°56.6	192°28.1	9.7'	N13°09.4	-8.4'	58.1'
7	285°34.8	56.9	206°56.9	9.8'	13°01.0	-8.5'	58.0'
8	300°34.7	57.3	221°25.7	9.9'	12°52.5	-8.5'	58.0'
9	315°34.6	·· 57.6	235°54.6	9.9'	12°43.9	-8.6'	57.9'
10	330°34.5	58.0	250°23.6	10.0'	12°35.3	-8.6'	57.9'
11	345°34.4	58.3	264°52.6	10.1'	12°26.7	-8.7'	57.9'
12	0°34.3	N21°58.7	279°21.8	10.2'	N12°17.9	-8.7'	57.8'
13	15°34.2	59.0	293°51.0	10.3'	12°09.2	-8.8'	57.8'
14	30°34.1	59.4	308°20.3	10.3'	12°00.3	-8.9'	57.8'
15	45°34.0	21°59.7	322°49.7	10.4'	11°51.5	-8.9'	57.7'
16	60°33.9	22°00.1	337°19.2	10.5'	11°42.5	-9.0'	57.7'
17	75°33.8	00.4	351°48.7	10.6'	11°33.5	-9.0'	57.6'
18	90°33.7	N22°00.8	6°18.3	10.7'	N11°24.5	-9.1'	57.6'
19	105°33.6	01.1	20°48.0	10.7'	11°15.4	-9.1'	57.6'
20	120°33.5	01.4	35°17.8	10.8'	11°06.3	-9.2'	57.5'
21	135°33.5	·· 01.8	49°47.7	10.9'	10°57.1	-9.2'	57.5'
22	150°33.4	02.1	64°17.6	11.0'	10°47.9	-9.2'	57.5'
23	165°33.3	02.5	78°47.6	11.0'	10°38.6	-9.3'	57.4'
	SD.=15.8	d=0.4	S.D.=15.8				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°33.2	N22°02.8	93°17.7	11.1'	N10°29.3	-9.3'	57.4'
1	195°33.1	03.2	107°47.9	11.2'	10°20.0	-9.4'	57.3'
2	210°33.0	03.5	122°18.1	11.3'	10°10.6	-9.4'	57.3'
3	225°32.9	·· 03.8	136°48.4	11.3'	10°01.1	-9.5'	57.3'
4	240°32.8	04.2	151°18.8	11.4'	09°51.7	-9.5'	57.2'
5	255°32.7	04.5	165°49.2	11.5'	09°42.1	-9.5'	57.2'
6	270°32.6	N22°04.8	180°19.7	11.6'	N09°32.6	-9.6'	57.2'
7	285°32.5	05.2	194°50.3	11.6'	09°23.0	-9.6'	57.1'
8	300°32.4	05.5	209°21.0	11.7'	09°13.4	-9.6'	57.1'
9	315°32.3	·· 05.8	223°51.7	11.8'	09°03.7	-9.7'	57.1'
10	330°32.2	06.2	238°22.5	11.8'	08°54.1	-9.7'	57.0'
11	345°32.1	06.5	252°53.4	11.9'	08°44.3	-9.7'	57.0'
12	0°32.0	N22°06.8	267°24.3	12.0'	N08°34.6	-9.8'	57.0'
13	15°31.9	07.2	281°55.3	12.0'	08°24.8	-9.8'	56.9'
14	30°31.8	07.5	296°26.4	12.1'	08°15.0	-9.8'	56.9'
15	45°31.7	·· 07.8	310°57.5	12.2'	08°05.1	-9.9'	56.8'
16	60°31.6	08.2	325°28.7	12.2'	07°55.3	-9.9'	56.8'
17	75°31.5	08.5	339°59.9	12.3'	07°45.4	-9.9'	56.8'
18	90°31.4	N22°08.8	354°31.3	12.3'	N07°35.5	-9.9'	56.7'
19	105°31.3	09.1	9°02.6	12.4'	07°25.5	-10.0'	56.7'
20	120°31.2	09.5	23°34.1	12.5'	07°15.5	-10.0'	56.7'
21	135°31.1	·· 09.8	38°05.6	12.5'	07°05.5	-10.0'	56.6'
22	150°31.0	10.1	52°37.1	12.6'	06°55.5	-10.0'	56.6'
23	165°30.9	10.5	67°08.7	12.6'	06°45.5	-10.0'	56.6'
	SD.=15.8	d=0.3	S.D.=15.5				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°30.8	N22°10.8	81°40.4	12.7'	N06°35.4	-10.1'	56.5'
1	195°30.7	11.1	96°12.1	12.8'	06°25.4	-10.1'	56.5'
2	210°30.6	11.4	110°43.9	12.8'	06°15.3	-10.1'	56.5'
3	225°30.5	·· 11.7	125°15.7	12.9'	06°05.1	-10.1'	56.4'
4	240°30.4	12.1	139°47.6	12.9'	05°55.0	-10.1'	56.4'
5	255°30.3	12.4	154°19.6	13.0'	05°44.9	-10.2'	56.4'
6	270°30.2	N22°12.7	168°51.6	13.0'	N05°34.7	-10.2'	56.4'
7	285°30.1	13.0	183°23.6	13.1'	05°24.5	-10.2'	56.3'
8	300°30.0	13.3	197°55.7	13.1'	05°14.3	-10.2'	56.3'
9	315°29.9	·· 13.7	212°27.9	13.2'	05°04.1	-10.2'	56.3'
10	330°29.8	14.0	227°00.0	13.2'	04°53.9	-10.2'	56.2'
11	345°29.7	14.3	241°32.3	13.3'	04°43.7	-10.2'	56.2'
12	0°29.6	N22°14.6	256°04.6	13.3'	N04°33.4	-10.2'	56.2'
13	15°29.5	14.9	270°36.9	13.4'	04°23.2	-10.3'	56.1'
14	30°29.4	15.2	285°09.3	13.4'	04°12.9	-10.3'	56.1'
15	45°29.3	·· 15.6	299°41.7	13.4'	04°02.6	-10.3'	56.1'
16	60°29.2	15.9	314°14.2	13.5'	03°52.3	-10.3'	56.0'
17	75°29.1	16.2	328°46.7	13.5'	03°42.1	-10.3'	56.0'
18	90°29.0	N22°16.5	343°19.2	13.6'	N03°31.8	-10.3'	56.0'
19	105°28.9	16.8	357°51.8	13.6'	03°21.5	-10.3'	56.0'
20	120°28.8	17.1	12°24.5	13.7'	03°11.2	-10.3'	55.9'
21	135°28.7	·· 17.4	26°57.2	13.7'	03°00.9	-10.3'	55.9'
22	150°28.6	17.7	41°29.9	13.7'	02°50.5	-10.3'	55.9'
23	165°28.5	18.0	56°02.6	13.8'	02°40.2	-10.3'	55.8'
	SD.=15.8	d=0.3	S.D.=15.3				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			01:12	22:48		
64°			01:58	22:00		
62°			02:27	21:30		
60°		01:26	02:49	21:08	22:33	
N 58°		02:00	03:07	20:50	21:57	
56°		02:24	03:22	20:35	21:33	
54°	01:18	02:44	03:35	20:22	21:13	22:40
52°	01:50	02:59	03:46	20:10	20:57	22:07
50°	02:13	03:13	03:56	20:00	20:43	21:44
45°	02:53	03:40	04:17	19:40	20:16	21:04
N 40°	03:21	04:01	04:33	19:23	19:55	20:36
35°	03:42	04:18	04:47	19:09	19:38	20:14
30°	04:00	04:32	04:59	18:57	19:24	19:56
20°	04:27	04:56	05:20	18:36	19:00	19:29
N 10°	04:48	05:15	05:38	18:18	18:41	19:08
0°	05:06	05:32	05:54	18:01	18:24	18:50
S 10°	05:22	05:48	06:11	17:45	18:08	18:34
20°	05:37	06:04	06:28	17:28	17:51	18:19
30°	05:52	06:22	06:48	17:08	17:34	18:03
35°	06:00	06:32	06:59	16:56	17:24	17:55
40°	06:09	06:42	07:13	16:43	17:13	17:47
45°	06:18	06:55	07:28	16:27	17:01	17:37
S 50°	06:29	07:10	07:47	16:08	16:46	17:27
52°	06:33	07:16	07:56	15:59	16:39	17:22
54°	06:39	07:24	08:06	15:49	16:32	17:17
56°	06:44	07:32	08:18	15:37	16:23	17:11
58°	06:50	07:41	08:31	15:24	16:14	17:05
S 60°	06:57	07:52	08:47	15:09	16:03	16:59

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	08:19	10:14	12:00	02:13	02:03	01:54
N 70°	08:44	10:28	12:07	01:48	01:47	01:46
68°	09:02	10:39	12:12	01:28	01:35	01:39
66°	09:17	10:48	12:17	01:12	01:24	01:33
64°	09:29	10:56	12:20	01:00	01:16	01:28
62°	09:39	11:02	12:23	00:49	01:08	01:23
60°	09:48	11:08	12:26	00:39	01:01	01:19
N 58°	09:56	11:13	12:29	00:31	00:56	01:16
56°	10:02	11:18	12:31	00:24	00:50	01:13
54°	10:08	11:21	12:33	00:17	00:46	01:10
52°	10:14	11:25	12:35	00:11	00:42	01:08
50°	10:18	11:28	12:36	00:06	00:38	01:05
45°	10:29	11:35	12:40	–:–	00:29	01:00
N 40°	10:38	11:41	12:43	–:–	00:22	00:56
35°	10:45	11:46	12:45	–:–	00:16	00:53
30°	10:52	11:51	12:47	–:–	00:11	00:49
20°	11:03	11:58	12:51	–:–	00:02	00:44
N 10°	11:13	12:05	12:55	23:54	–:–	00:39
0°	11:22	12:11	12:58	23:46	–:–	00:34
S 10°	11:31	12:18	13:01	23:38	–:–	00:29
20°	11:41	12:24	13:05	23:30	–:–	00:24
30°	11:52	12:32	13:08	23:20	–:–	00:18
35°	11:58	12:36	13:11	23:15	–:–	00:15
40°	12:06	12:41	13:13	23:08	–:–	00:11
45°	12:14	12:47	13:16	23:01	–:–	00:06
S 50°	12:24	12:54	13:20	22:52	–:–	00:01
52°	12:29	12:57	13:21	22:48	23:58	–:–
54°	12:34	13:00	13:23	22:43	23:56	–:–
56°	12:40	13:04	13:25	22:38	23:53	–:–
58°	12:46	13:08	13:27	22:32	23:49	–:–
S 60°	12:53	13:13	13:29	22:26	23:45	–:–

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 6-8 39-60%
31	02:22	02:17	11:58	17:34	05:08	
01	02:13	02:08	11:58	18:23	05:59	
02	02:03	01:59	11:58	19:09	06:46	

June 03, 04, 05 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	251°38.4	225°57.4	N08°14.4	162°51.9	N24°18.7	58°51.7	S03°55.5	346°35.3	S21°59.4
1	266°40.8	240°57.6	15.1	177°52.5	18.7	73°54.3	55.5	1°37.9	59.4
2	281°43.3	255°57.8	15.8	192°53.1	18.7	88°56.8	55.5	16°40.6	59.4
3	296°45.8	270°57.9	·· 16.6	207°53.8	·· 18.8	103°59.3	·· 55.5	31°43.3	·· 59.4
4	311°48.2	285°58.1	17.3	222°54.4	18.8	119°01.8	55.5	46°45.9	59.4
5	326°50.7	300°58.3	18.1	237°55.1	18.8	134°04.3	55.4	61°48.6	59.4
6	341°53.2	315°58.4	N08°18.8	252°55.7	N24°18.8	149°06.8	S03°55.4	76°51.2	S21°59.4
7	356°55.6	330°58.6	19.5	267°56.3	18.9	164°09.3	55.4	91°53.9	59.4
8	11°58.1	345°58.7	20.3	282°57.0	18.9	179°11.8	55.4	106°56.5	59.4
9	27°00.5	0°58.9	·· 21.0	297°57.6	·· 18.9	194°14.4	·· 55.4	121°59.2	·· 59.4
10	42°03.0	15°59.1	21.8	312°58.2	18.9	209°16.9	55.4	137°01.8	59.4
11	57°05.5	30°59.2	22.5	327°58.9	19.0	224°19.4	55.4	152°04.5	59.4
12	72°07.9	45°59.4	N08°23.3	342°59.5	N24°19.0	239°21.9	S03°55.4	167°07.2	S21°59.4
13	87°10.4	60°59.5	24.0	358°00.2	19.0	254°24.4	55.4	182°09.8	59.4
14	102°12.9	75°59.7	24.7	13°00.8	19.0	269°26.9	55.4	197°12.5	59.4
15	117°15.3	90°59.8	·· 25.5	28°01.4	·· 19.1	284°29.4	·· 55.4	212°15.1	·· 59.4
16	132°17.8	106°00.0	26.2	43°02.1	19.1	299°31.9	55.4	227°17.8	59.4
17	147°20.3	121°00.2	27.0	58°02.7	19.1	314°34.4	55.4	242°20.4	59.4
18	162°22.7	136°00.3	N08°27.7	73°03.4	N24°19.1	329°37.0	S03°55.3	257°23.1	S21°59.4
19	177°25.2	151°00.5	28.5	88°04.0	19.1	344°39.5	55.3	272°25.7	59.4
20	192°27.7	166°00.6	29.2	103°04.6	19.2	359°42.0	55.3	287°28.4	59.4
21	207°30.1	181°00.8	·· 29.9	118°05.3	·· 19.2	14°44.5	·· 55.3	302°31.1	·· 59.4
22	222°32.6	196°00.9	30.7	133°05.9	19.2	29°47.0	55.3	317°33.7	59.3
23	237°35.0	211°01.1	31.4	148°06.5	19.2	44°49.5	55.3	332°36.4	59.3
Mer.pass.:07:12		v0.2 d0.7 m-4.2		v0.6 d0.0 m1.7		v2.5 d0.0 m-2.1		v2.7 d0.0 m0.0	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	252°37.5	226°01.2	N08°32.2	163°07.2	N24°19.2	59°52.0	S03°55.3	347°39.0	S21°59.3
1	267°40.0	241°01.4	32.9	178°07.8	19.3	74°54.5	55.3	2°41.7	59.3
2	282°42.4	256°01.5	33.7	193°08.5	19.3	89°57.0	55.3	17°44.3	59.3
3	297°44.9	271°01.7	·· 34.4	208°09.1	·· 19.3	104°59.5	·· 55.3	32°47.0	·· 59.3
4	312°47.4	286°01.8	35.2	223°09.7	19.3	120°02.0	55.3	47°49.7	59.3
5	327°49.8	301°02.0	35.9	238°10.4	19.3	135°04.5	55.3	62°52.3	59.3
6	342°52.3	316°02.1	N08°36.7	253°11.0	N24°19.4	150°07.0	S03°55.3	77°55.0	S21°59.3
7	357°54.8	331°02.2	37.4	268°11.7	19.4	165°09.5	55.3	92°57.6	59.3
8	12°57.2	346°02.4	38.2	283°12.3	19.4	180°12.0	55.3	108°00.3	59.3
9	27°59.7	1°02.5	·· 38.9	298°12.9	·· 19.4	195°14.6	·· 55.3	123°02.9	·· 59.3
10	43°02.1	16°02.7	39.6	313°13.6	19.4	210°17.1	55.2	138°05.6	59.3
11	58°04.6	31°02.8	40.4	328°14.2	19.4	225°19.6	55.2	153°08.3	59.3
12	73°07.1	46°03.0	N08°41.1	343°14.9	N24°19.5	240°22.1	S03°55.2	168°10.9	S21°59.3
13	88°09.5	61°03.1	41.9	358°15.5	19.5	255°24.6	55.2	183°13.6	59.3
14	103°12.0	76°03.2	42.6	13°16.1	19.5	270°27.1	55.2	198°16.2	59.3
15	118°14.5	91°03.4	·· 43.4	28°16.8	·· 19.5	285°29.6	·· 55.2	213°18.9	·· 59.3
16	133°16.9	106°03.5	44.1	43°17.4	19.5	300°32.1	55.2	228°21.5	59.3
17	148°19.4	121°03.6	44.9	58°18.1	19.5	315°34.6	55.2	243°24.2	59.3
18	163°21.9	136°03.8	N08°45.6	73°18.7	N24°19.5	330°37.1	S03°55.2	258°26.9	S21°59.3
19	178°24.3	151°03.9	46.4	88°19.3	19.6	345°39.6	55.2	273°29.5	59.3
20	193°26.8	166°04.1	47.1	103°20.0	19.6	0°42.1	55.2	288°32.2	59.3
21	208°29.3	181°04.2	·· 47.9	118°20.6	·· 19.6	15°44.6	·· 55.2	303°34.8	·· 59.2
22	223°31.7	196°04.3	48.6	133°21.3	19.6	30°47.1	55.2	318°37.5	59.2
23	238°34.2	211°04.5	49.4	148°21.9	19.6	45°49.6	55.2	333°40.1	59.2
Mer.pass.:07:08		v0.1 d0.7 m-4.2		v0.6 d0.0 m1.7		v2.5 d0.0 m-2.1		v2.7 d0.0 m0.0	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	253°36.6	226°04.6	N08°50.1	163°22.5	N24°19.6	60°52.1	S03°55.2	348°42.8	S21°59.2
1	268°39.1	241°04.7	50.9	178°23.2	19.6	75°54.6	55.2	3°45.5	59.2
2	283°41.6	256°04.8	51.6	193°23.8	19.6	90°57.1	55.2	18°48.1	59.2
3	298°44.0	271°05.0	·· 52.4	208°24.5	·· 19.7	105°59.6	·· 55.2	33°50.8	·· 59.2
4	313°46.5	286°05.1	53.1	223°25.1	19.7	121°02.1	55.2	48°53.4	59.2
5	328°49.0	301°05.2	53.9	238°25.7	19.7	136°04.6	55.2	63°56.1	59.2
6	343°51.4	316°05.4	N08°54.6	253°26.4	N24°19.7	151°07.1	S03°55.2	78°58.7	S21°59.2
7	358°53.9	331°05.5	55.4	268°27.0	19.7	166°09.6	55.2	94°01.4	59.2
8	13°56.4	346°05.6	56.1	283°27.7	19.7	181°12.1	55.2	109°04.1	59.2
9	28°58.8	1°05.7	·· 56.9	298°28.3	·· 19.7	196°14.6	·· 55.2	124°06.7	·· 59.2
10	44°01.3	16°05.9	57.6	313°28.9	19.7	211°17.1	55.2	139°09.4	59.2
11	59°03.7	31°06.0	58.4	328°29.6	19.7	226°19.6	55.2	154°12.0	59.2
12	74°06.2	46°06.1	N08°59.1	343°30.2	N24°19.7	241°22.1	S03°55.2	169°14.7	S21°59.2
13	89°08.7	61°06.2	08°59.9	358°30.9	19.7	256°24.6	55.2	184°17.3	59.2
14	104°11.1	76°06.4	09°00.7	13°31.5	19.7	271°27.1	55.2	199°20.0	59.2
15	119°13.6	91°06.5	·· 01.4	28°32.1	·· 19.7	286°29.6	·· 55.2	214°22.7	·· 59.2
16	134°16.1	106°06.6	02.2	43°32.8	19.8	301°32.1	55.2	229°25.3	59.2
17	149°18.5	121°06.7	02.9	58°33.4	19.8	316°34.5	55.1	244°28.0	59.2
18	164°21.0	136°06.8	N09°03.7	73°34.1	N24°19.8	331°37.0	S03°55.1	259°30.6	S21°59.2
19	179°23.5	151°07.0	04.4	88°34.7	19.8	346°39.5	55.1	274°33.3	59.2
20	194°25.9	166°07.1	05.2	103°35.4	19.8	1°42.0	55.1	289°36.0	59.1
21	209°28.4	181°07.2	·· 05.9	118°36.0	·· 19.8	16°44.5	·· 55.1	304°38.6	·· 59.1
22	224°30.9	196°07.3	06.7	133°36.6	19.8	31°47.0	55.1	319°41.3	59.1
23	239°33.3	211°07.4	07.4	148°37.3	19.8	46°49.5	55.1	334°43.9	59.1
Mer.pass.:07:04		v0.1 d0.8 m-4.2		v0.6 d0.0 m1.7		v2.5 d0.0 m-2.1		v2.7 d0.0 m0.0	

Stars

	SHA	Dec
Alpheratz	357°40.8	29°10.9
Ankaa	353°13.3	-42°12.6
Schedar	349°37.6	56°37.6
Diphda	348°53.4	-17°53.5
Achernar	335°25.3	-57°08.8
Hamal	327°58.0	23°32.4
Polaris	316°57.3	89°19.9
Acamar	315°16.7	-40°14.2
Menkar	314°12.6	4°09.2
Mirfak	308°37.0	49°55.0
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.2
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.8	7°24.4
Canopus	263°55.5	-52°42.6
Sirius	258°31.7	-16°44.7
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.3	-59°34.3
Suhail	222°50.7	-43°30.5
Miaplacidus	221°39.4	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.6	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.9	-63°11.9
Gacrux	171°57.6	-57°12.8
Alioth	166°18.2	55°52.2
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.9
Hadar	148°43.5	-60°27.5
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.4	-60°54.4
Kochab	137°19.2	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.3
Sabik	102°09.1	-15°44.6
Shaula	96°17.9	-37°06.7
Rasalhague	96°03.6	12°33.0
Eltanin	90°44.4	51°29.3
Kaus Aust.	83°39.9	-34°22.3
Vega	80°36.8	38°48.1
Nunki	75°54.7	-26°16.3
Altair	62°05.4	8°54.9
Peacock	53°14.8	-56°40.4
Deneb	49°29.3	45°20.4
Enif	33°44.4	9°57.3
Al Na'ir	27°40.4	-46°52.3
Fomalhaut	15°21.1	-29°31.7
Scheat	13°50.8	28°10.4
Markab	13°35.7	15°17.8

Jun 03 Sat	SHA	Mer.pass
Venus	334°19.1	08:56
Mars	271°13.5	13:08
Jupiter	167°13.4	20:01
Saturn	94°56.9	00:53

Jun 04 Sun	SHA	Mer.pass
Venus	333°23.7	08:56
Mars	270°29.7	13:07
Jupiter	167°14.5	19:57
Saturn	95°01.5	00:49

Jun 05 Mon	SHA	Mer.pass
Venus	332°27.9	08:56
Mars	269°45.9	13:06
Jupiter	167°15.4	19:53
Saturn	95°06.2	00:45

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3793 sec ΔT = TT-UT1 = +68.8047 sec

2017 June 03 to Jun. 05 UT

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°28.4	N22°18.4	70°35.4	13.8'	N02°29.9	-10.3'	55.8'
1	195°28.3	18.7	85°08.2	13.8'	02°19.6	-10.3'	55.8'
2	210°28.2	19.0	99°41.1	13.9'	02°09.3	-10.3'	55.8'
3	225°28.1	· · 19.3	114°14.0	13.9'	01°59.0	-10.3'	55.7'
4	240°28.0	19.6	128°46.9	13.9'	01°48.6	-10.3'	55.7'
5	255°27.9	19.9	143°19.9	14.0'	01°38.3	-10.3'	55.7'
6	270°27.8	N22°20.2	157°52.9	14.0'	N01°28.0	-10.3'	55.6'
7	285°27.7	20.5	172°25.9	14.0'	01°17.7	-10.3'	55.6'
8	300°27.6	20.8	186°59.0	14.1'	01°07.4	-10.3'	55.6'
9	315°27.5	· · 21.1	201°32.0	14.1'	00°57.1	-10.3'	55.6'
10	330°27.4	21.4	216°05.2	14.1'	00°46.8	-10.3'	55.5'
11	345°27.3	21.7	230°38.3	14.2'	00°36.5	-10.3'	55.5'
12	0°27.2	N22°22.0	245°11.5	14.2'	N00°26.2	-10.3'	55.5'
13	15°27.1	22.3	259°44.7	14.2'	00°15.9	-10.3'	55.5'
14	30°27.0	22.6	274°17.9	14.2'	N00°05.7	-10.3'	55.4'
15	45°26.9	· · 22.9	288°51.1	14.3'	S00°04.6	-10.3'	55.4'
16	60°26.8	23.2	303°24.4	14.3'	00°14.9	-10.3'	55.4'
17	75°26.7	23.5	317°57.7	14.3'	00°25.1	-10.2'	55.4'
18	90°26.5	N22°23.8	332°31.0	14.3'	S00°35.3	-10.2'	55.3'
19	105°26.4	24.1	347°04.4	14.3'	00°45.6	-10.2'	55.3'
20	120°26.3	24.4	1°37.7	14.4'	00°55.8	-10.2'	55.3'
21	135°26.2	· · 24.7	16°11.1	14.4'	01°06.0	-10.2'	55.3'
22	150°26.1	25.0	30°44.5	14.4'	01°16.2	-10.2'	55.2'
23	165°26.0	25.2	45°17.9	14.4'	01°26.4	-10.2'	55.2'
	SD.=15.8	d=0.3	S.D.=15.1				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°25.9	N22°25.5	59°51.3	14.4'	S01°36.5	-10.2'	55.2'
1	195°25.8	25.8	74°24.8	14.5'	01°46.7	-10.1'	55.2'
2	210°25.7	26.1	88°58.3	14.5'	01°56.8	-10.1'	55.2'
3	225°25.6	· · 26.4	103°31.8	14.5'	02°06.9	-10.1'	55.1'
4	240°25.5	26.7	118°05.3	14.5'	02°17.0	-10.1'	55.1'
5	255°25.4	27.0	132°38.8	14.5'	02°27.1	-10.1'	55.1'
6	270°25.3	N22°27.3	147°12.3	14.5'	S02°37.2	-10.1'	55.1'
7	285°25.2	27.6	161°45.8	14.5'	02°47.2	-10.0'	55.0'
8	300°25.1	27.8	176°19.4	14.6'	02°57.3	-10.0'	55.0'
9	315°25.0	· · 28.1	190°53.0	14.6'	03°07.3	-10.0'	55.0'
10	330°24.8	28.4	205°26.5	14.6'	03°17.3	-10.0'	55.0'
11	345°24.7	28.7	220°00.1	14.6'	03°27.2	-10.0'	55.0'
12	0°24.6	N22°29.0	234°33.7	14.6'	S03°37.2	-9.9'	54.9'
13	15°24.5	29.3	249°07.3	14.6'	03°47.1	-9.9'	54.9'
14	30°24.4	29.5	263°40.9	14.6'	03°57.0	-9.9'	54.9'
15	45°24.3	· · 29.8	278°14.5	14.6'	04°06.9	-9.9'	54.9'
16	60°24.2	30.1	292°48.2	14.6'	04°16.8	-9.8'	54.9'
17	75°24.1	30.4	307°21.8	14.6'	04°26.6	-9.8'	54.8'
18	90°24.0	N22°30.7	321°55.4	14.6'	S04°36.4	-9.8'	54.8'
19	105°23.9	30.9	336°29.1	14.6'	04°46.2	-9.8'	54.8'
20	120°23.8	31.2	351°02.7	14.6'	04°56.0	-9.7'	54.8'
21	135°23.7	· · 31.5	5°36.3	14.6'	05°05.7	-9.7'	54.8'
22	150°23.5	31.8	20°10.0	14.6'	05°15.4	-9.7'	54.8'
23	165°23.4	32.1	34°43.6	14.6'	05°25.1	-9.7'	54.7'
	SD.=15.8	d=0.3	S.D.=15.0				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°23.3	N22°32.3	49°17.3	14.6'	S05°34.8	-9.6'	54.7'
1	195°23.2	32.6	63°50.9	14.6'	05°44.4	-9.6'	54.7'
2	210°23.1	32.9	78°24.6	14.6'	05°54.0	-9.6'	54.7'
3	225°23.0	· · 33.1	92°58.2	14.6'	06°03.5	-9.6'	54.7'
4	240°22.9	33.4	107°31.9	14.6'	06°13.1	-9.5'	54.7'
5	255°22.8	33.7	122°05.5	14.6'	06°22.6	-9.5'	54.6'
6	270°22.7	N22°34.0	136°39.2	14.6'	S06°32.1	-9.5'	54.6'
7	285°22.6	34.2	151°12.8	14.6'	06°41.5	-9.4'	54.6'
8	300°22.4	34.5	165°46.4	14.6'	06°50.9	-9.4'	54.6'
9	315°22.3	· · 34.8	180°20.1	14.6'	07°00.3	-9.4'	54.6'
10	330°22.2	35.0	194°53.7	14.6'	07°09.6	-9.3'	54.6'
11	345°22.1	35.3	209°27.3	14.6'	07°19.0	-9.3'	54.5'
12	0°22.0	N22°35.6	224°00.9	14.6'	S07°28.2	-9.3'	54.5'
13	15°21.9	35.8	238°34.5	14.6'	07°37.5	-9.2'	54.5'
14	30°21.8	36.1	253°08.1	14.6'	07°46.7	-9.2'	54.5'
15	45°21.7	· · 36.4	267°41.7	14.6'	07°55.8	-9.2'	54.5'
16	60°21.6	36.6	282°15.3	14.6'	08°05.0	-9.1'	54.5'
17	75°21.4	36.9	296°48.9	14.6'	08°14.1	-9.1'	54.5'
18	90°21.3	N22°37.2	311°22.4	14.6'	S08°23.1	-9.0'	54.4'
19	105°21.2	37.4	325°56.0	14.5'	08°32.1	-9.0'	54.4'
20	120°21.1	37.7	340°29.5	14.5'	08°41.1	-9.0'	54.4'
21	135°21.0	· · 37.9	355°03.1	14.5'	08°50.1	-8.9'	54.4'
22	150°20.9	38.2	9°36.6	14.5'	08°59.0	-8.9'	54.4'
23	165°20.8	38.5	24°10.1	14.5'	09°07.8	-8.8'	54.4'
	SD.=15.8	d=0.3	S.D.=14.9				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			00:59	23:02		
64°			01:51	22:08		
62°			02:22	21:36		
60°		01:17	02:45	21:13	22:42	
N 58°		01:55	03:04	20:54	22:04	
56°		02:20	03:19	20:38	21:38	
54°	01:10	02:40	03:32	20:25	21:17	22:49
52°	01:45	02:57	03:44	20:14	21:01	22:13
50°	02:09	03:11	03:54	20:03	20:47	21:49
45°	02:50	03:38	04:15	19:42	20:19	21:07
N 40°	03:19	04:00	04:32	19:25	19:57	20:38
35°	03:41	04:17	04:46	19:10	19:40	20:16
30°	03:59	04:32	04:59	18:58	19:25	19:58
20°	04:27	04:55	05:20	18:37	19:01	19:30
N 10°	04:48	05:15	05:38	18:19	18:42	19:09
0°	05:06	05:32	05:55	18:02	18:24	18:50
S 10°	05:23	05:49	06:11	17:45	18:08	18:34
20°	05:38	06:05	06:29	17:28	17:51	18:19
30°	05:53	06:23	06:49	17:07	17:33	18:03
35°	06:02	06:33	07:01	16:55	17:23	17:55
40°	06:11	06:44	07:15	16:42	17:12	17:46
45°	06:20	06:57	07:30	16:26	16:59	17:36
S 50°	06:31	07:12	07:50	16:06	16:44	17:25
52°	06:36	07:19	07:59	15:57	16:37	17:20
54°	06:41	07:27	08:10	15:47	16:30	17:15
56°	06:47	07:35	08:22	15:35	16:21	17:09
58°	06:53	07:45	08:35	15:21	16:12	17:03
S 60°	07:00	07:56	08:51	15:05	16:01	16:56

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	13:42	15:21	17:00	01:47	01:39	01:31
N 70°	13:42	15:15	16:47	01:44	01:42	01:39
68°	13:42	15:10	16:36	01:41	01:44	01:46
66°	13:42	15:05	16:28	01:40	01:46	01:52
64°	13:42	15:02	16:21	01:38	01:47	01:57
62°	13:42	14:59	16:14	01:36	01:49	02:01
60°	13:42	14:56	16:09	01:35	01:50	02:04
N 58°	13:42	14:54	16:04	01:34	01:51	02:08
56°	13:42	14:52	16:00	01:33	01:52	02:11
54°	13:42	14:50	15:57	01:32	01:53	02:13
52°	13:42	14:48	15:53	01:31	01:53	02:16
50°	13:42	14:47	15:50	01:30	01:54	02:18
45°	13:42	14:43	15:44	01:29	01:56	02:23
N 40°	13:42	14:41	15:38	01:27	01:57	02:26
35°	13:42	14:38	15:33	01:26	01:58	02:30
30°	13:42	14:36	15:29	01:25	01:59	02:33
20°	13:43	14:33	15:22	01:23	02:01	02:38
N 10°	13:43	14:29	15:16	01:21	02:02	02:43
0°	13:43	14:26	15:10	01:20	02:04	02:47
S 10°	13:43	14:24	15:04	01:18	02:05	02:52
20°	13:43	14:20	14:58	01:16	02:07	02:56
30°	13:43	14:17	14:51	01:14	02:08	03:02
35°	13:43	14:15	14:47	01:13	02:09	03:05
40°	13:43	14:13	14:42	01:12	02:11	03:08
45°	13:43	14:10	14:37	01:10	02:12	03:12
S 50°	13:44	14:07	14:31	01:08	02:13	03:17
52°	13:44	14:06	14:28	01:07	02:14	03:20
54°	13:44	14:04	14:25	01:06	02:15	03:22
56°	13:44	14:02	14:22	01:05	02:16	03:25
58°	13:44	14:01	14:18	01:04	02:17	03:28
S 60°	13:44	13:59	14:14	01:03	02:18	03:31

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 9-11 70-86%
03	01:54	01:49	11:58	19:53	07:31	
04	01:44	01:39	11:58	20:37	08:15	
05	01:33	01:28	11:59	21:20	08:59	

June 06, 07, 08 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	254°35.8	226°07.5	N09°08.2	163°37.9	N24°19.8	61°52.0	S03°55.1	349°46.6	S21°59.1
1	269°38.2	241°07.7	09.0	178°38.6	19.8	76°54.5	55.1	4°49.2	59.1
2	284°40.7	256°07.8	09.7	193°39.2	19.8	91°57.0	55.1	19°51.9	59.1
3	299°43.2	271°07.9	·· 10.5	208°39.8	·· 19.8	106°59.5	·· 55.1	34°54.6	·· 59.1
4	314°45.6	286°08.0	11.2	223°40.5	19.8	122°02.0	55.1	49°57.2	59.1
5	329°48.1	301°08.1	12.0	238°41.1	19.8	137°04.5	55.1	64°59.9	59.1
6	344°50.6	316°08.2	N09°12.7	253°41.8	N24°19.8	152°07.0	S03°55.1	80°02.5	S21°59.1
7	359°53.0	331°08.3	13.5	268°42.4	19.8	167°09.5	55.1	95°05.2	59.1
8	14°55.5	346°08.4	14.2	283°43.1	19.8	182°11.9	55.1	110°07.9	59.1
9	29°58.0	1°08.5	·· 15.0	298°43.7	·· 19.8	197°14.4	·· 55.1	125°10.5	·· 59.1
10	45°00.4	16°08.7	15.8	313°44.3	19.8	212°16.9	55.1	140°13.2	59.1
11	60°02.9	31°08.8	16.5	328°45.0	19.8	227°19.4	55.1	155°15.8	59.1
12	75°05.4	46°08.9	N09°17.3	343°45.6	N24°19.8	242°21.9	S03°55.1	170°18.5	S21°59.1
13	90°07.8	61°09.0	18.0	358°46.3	19.8	257°24.4	55.1	185°21.1	59.1
14	105°10.3	76°09.1	18.8	13°46.9	19.8	272°26.9	55.1	200°23.8	59.1
15	120°12.7	91°09.2	·· 19.5	28°47.6	·· 19.8	287°29.4	·· 55.2	215°26.5	·· 59.1
16	135°15.2	106°09.3	20.3	43°48.2	19.8	302°31.9	55.2	230°29.1	59.1
17	150°17.7	121°09.4	21.1	58°48.8	19.8	317°34.4	55.2	245°31.8	59.1
18	165°20.1	136°09.5	N09°21.8	73°49.5	N24°19.8	332°36.8	S03°55.2	260°34.4	S21°59.0
19	180°22.6	151°09.6	22.6	88°50.1	19.8	347°39.3	55.2	275°37.1	59.0
20	195°25.1	166°09.7	23.3	103°50.8	19.8	2°41.8	55.2	290°39.8	59.0
21	210°27.5	181°09.8	·· 24.1	118°51.4	·· 19.8	17°44.3	·· 55.2	305°42.4	·· 59.0
22	225°30.0	196°09.9	24.8	133°52.1	19.8	32°46.8	55.2	320°45.1	59.0
23	240°32.5	211°10.0	25.6	148°52.7	19.7	47°49.3	55.2	335°47.7	59.0
Mer.pass.:07:00		v0.1 d0.8 m-4.2		v0.6 d0.0 m1.7		v2.5 d0.0 m-2.1		v2.7 d0.0 m0.0	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	255°34.9	226°10.1	N09°26.4	163°53.3	N24°19.7	62°51.8	S03°55.2	350°50.4	S21°59.0
1	270°37.4	241°10.2	27.1	178°54.0	19.7	77°54.2	55.2	5°53.1	59.0
2	285°39.8	256°10.3	27.9	193°54.6	19.7	92°56.7	55.2	20°55.7	59.0
3	300°42.3	271°10.4	·· 28.6	208°55.3	·· 19.7	107°59.2	·· 55.2	35°58.4	·· 59.0
4	315°44.8	286°10.5	29.4	223°55.9	19.7	123°01.7	55.2	51°01.0	59.0
5	330°47.2	301°10.6	30.2	238°56.6	19.7	138°04.2	55.2	66°03.7	59.0
6	345°49.7	316°10.7	N09°30.9	253°57.2	N24°19.7	153°06.7	S03°55.2	81°06.4	S21°59.0
7	0°52.2	331°10.8	31.7	268°57.8	19.7	168°09.2	55.2	96°09.0	59.0
8	15°54.6	346°10.9	32.4	283°58.5	19.7	183°11.6	55.2	111°11.7	59.0
9	30°57.1	1°10.9	·· 33.2	298°59.1	·· 19.7	198°14.1	·· 55.2	126°14.3	·· 59.0
10	45°59.6	16°11.0	34.0	313°59.8	19.7	213°16.6	55.2	141°17.0	59.0
11	61°02.0	31°11.1	34.7	329°00.4	19.7	228°19.1	55.2	156°19.7	59.0
12	76°04.5	46°11.2	N09°35.5	344°01.1	N24°19.6	243°21.6	S03°55.2	171°22.3	S21°59.0
13	91°07.0	61°11.3	36.2	359°01.7	19.6	258°24.1	55.2	186°25.0	59.0
14	106°09.4	76°11.4	37.0	14°02.4	19.6	273°26.5	55.2	201°27.6	59.0
15	121°11.9	91°11.5	·· 37.8	29°03.0	·· 19.6	288°29.0	·· 55.2	216°30.3	·· 59.0
16	136°14.3	106°11.6	38.5	44°03.6	19.6	303°31.5	55.2	231°33.0	59.0
17	151°16.8	121°11.7	39.3	59°04.3	19.6	318°34.0	55.2	246°35.6	58.9
18	166°19.3	136°11.7	N09°40.0	74°04.9	N24°19.6	333°36.5	S03°55.2	261°38.3	S21°58.9
19	181°21.7	151°11.8	40.8	89°05.6	19.6	348°38.9	55.2	276°40.9	58.9
20	196°24.2	166°11.9	41.6	104°06.2	19.5	3°41.4	55.2	291°43.6	58.9
21	211°26.7	181°12.0	·· 42.3	119°06.9	·· 19.5	18°43.9	·· 55.2	306°46.3	·· 58.9
22	226°29.1	196°12.1	43.1	134°07.5	19.5	33°46.4	55.3	321°48.9	58.9
23	241°31.6	211°12.2	43.9	149°08.2	19.5	48°48.9	55.3	336°51.6	58.9
Mer.pass.:06:57		v0.1 d0.8 m-4.2		v0.6 d-0.0 m1.7		v2.5 d-0.0 m-2.1		v2.7 d0.0 m0.0	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	256°34.1	226°12.2	N09°44.6	164°08.8	N24°19.5	63°51.3	S03°55.3	351°54.2	S21°58.9
1	271°36.5	241°12.3	45.4	179°09.4	19.5	78°53.8	55.3	6°56.9	58.9
2	286°39.0	256°12.4	46.1	194°10.1	19.5	93°56.3	55.3	21°59.6	58.9
3	301°41.5	271°12.5	·· 46.9	209°10.7	·· 19.4	108°58.8	·· 55.3	37°02.2	·· 58.9
4	316°43.9	286°12.6	47.7	224°11.4	19.4	124°01.3	55.3	52°04.9	58.9
5	331°46.4	301°12.6	48.4	239°12.0	19.4	139°03.7	55.3	67°07.5	58.9
6	346°48.8	316°12.7	N09°49.2	254°12.7	N24°19.4	154°06.2	S03°55.3	82°10.2	S21°58.9
7	1°51.3	331°12.8	50.0	269°13.3	19.4	169°08.7	55.3	97°12.9	58.9
8	16°53.8	346°12.9	50.7	284°14.0	19.4	184°11.2	55.3	112°15.5	58.9
9	31°56.2	1°12.9	·· 51.5	299°14.6	·· 19.3	199°13.7	·· 55.3	127°18.2	·· 58.9
10	46°58.7	16°13.0	52.2	314°15.3	19.3	214°16.1	55.3	142°20.8	58.9
11	62°01.2	31°13.1	53.0	329°15.9	19.3	229°18.6	55.3	157°23.5	58.9
12	77°03.6	46°13.2	N09°53.8	344°16.5	N24°19.3	244°21.1	S03°55.3	172°26.2	S21°58.9
13	92°06.1	61°13.2	54.5	359°17.2	19.3	259°23.6	55.3	187°28.8	58.9
14	107°08.6	76°13.3	55.3	14°17.8	19.3	274°26.0	55.4	202°31.5	58.9
15	122°11.0	91°13.4	·· 56.1	29°18.5	·· 19.2	289°28.5	·· 55.4	217°34.1	·· 58.8
16	137°13.5	106°13.5	56.8	44°19.1	19.2	304°31.0	55.4	232°36.8	58.8
17	152°16.0	121°13.5	57.6	59°19.8	19.2	319°33.5	55.4	247°39.5	58.8
18	167°18.4	136°13.6	N09°58.4	74°20.4	N24°19.2	334°35.9	S03°55.4	262°42.1	S21°58.8
19	182°20.9	151°13.7	59.1	89°21.1	19.2	349°38.4	55.4	277°44.8	58.8
20	197°23.3	166°13.7	09°59.9	104°21.7	19.1	4°40.9	55.4	292°47.4	58.8
21	212°25.8	181°13.8	10°00.6	119°22.4	·· 19.1	19°43.4	·· 55.4	307°50.1	·· 58.8
22	227°28.3	196°13.9	01.4	134°23.0	19.1	34°45.8	55.4	322°52.8	58.8
23	242°30.7	211°13.9	02.2	149°23.6	19.1	49°48.3	55.4	337°55.4	58.8
Mer.pass.:06:53		v0.1 d0.8 m-4.2		v0.6 d-0.0 m1.7		v2.5 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Stars

	SHA	**Dec**
Alpheratz	357°40.8	29°10.9
Ankaa	353°13.3	-42°12.6
Schedar	349°37.6	56°37.6
Diphda	348°53.4	-17°53.5
Achernar	335°25.3	-57°08.8
Hamal	327°58.0	23°32.4
Polaris	316°56.3	89°19.9
Acamar	315°16.7	-40°14.2
Menkar	314°12.5	4°09.2
Mirfak	308°36.9	49°55.0
Aldebaran	290°46.7	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.8	7°24.4
Canopus	263°55.5	-52°42.6
Sirius	258°31.7	-16°44.7
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.3	-59°34.3
Suhail	222°50.7	-43°30.5
Miaplacidus	221°39.5	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.6	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°05.9	-63°11.9
Gacrux	171°57.6	-57°12.8
Alioth	166°18.2	55°52.3
Spica	158°28.2	-11°15.1
Alkaid	152°56.5	49°13.9
Hadar	148°43.5	-60°27.5
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.5	-60°54.4
Kochab	137°19.3	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.3
Sabik	102°09.1	-15°44.6
Shaula	96°17.9	-37°06.7
Rasalhague	96°03.6	12°33.0
Eltanin	90°44.4	51°29.3
Kaus Aust.	83°39.9	-34°22.3
Vega	80°36.7	38°48.1
Nunki	75°54.7	-26°16.3
Altair	62°05.4	8°55.0
Peacock	53°14.7	-56°40.4
Deneb	49°29.3	45°20.4
Enif	33°44.4	9°57.3
Al Na'ir	27°40.3	-46°52.3
Fomalhaut	15°21.1	-29°31.7
Scheat	13°50.7	28°10.4
Markab	13°35.6	15°17.8

Jun 06 Tue	**SHA**	**Mer.pass**
Venus	331°31.8	08:55
Mars	269°02.1	13:05
Jupiter	167°16.2	19:49
Saturn	95°10.8	00:41

Jun 07 Wed	**SHA**	**Mer.pass**
Venus	330°35.2	08:55
Mars	268°18.4	13:04
Jupiter	167°16.8	19:45
Saturn	95°15.5	00:37

Jun 08 Thu	**SHA**	**Mer.pass**
Venus	329°38.2	08:55
Mars	267°34.7	13:03
Jupiter	167°17.3	19:41
Saturn	95°20.2	00:32

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3772 sec ΔT = TT-UT1 = +68.8068 sec

2017 June 06 to Jun. 08 UT

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Tue	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°20.7	N22°38.7	38°43.6	14.5'	S09°16.6	-8.8'	54.4'
1	195°20.5	39.0	53°17.0	14.5'	09°25.4	-8.8'	54.4'
2	210°20.4	39.2	67°50.5	14.5'	09°34.1	-8.7'	54.3'
3	225°20.3	·· 39.5	82°24.0	14.4'	09°42.8	-8.7'	54.3'
4	240°20.2	39.7	96°57.4	14.4'	09°51.5	-8.6'	54.3'
5	255°20.1	40.0	111°30.8	14.4'	10°00.1	-8.6'	54.3'
6	270°20.0	N22°40.3	126°04.2	14.4'	S10°08.6	-8.5'	54.3'
7	285°19.9	40.5	140°37.6	14.4'	10°17.1	-8.5'	54.3'
8	300°19.8	40.8	155°11.0	14.4'	10°25.6	-8.4'	54.3'
9	315°19.6	·· 41.0	169°44.4	14.3'	10°34.0	-8.4'	54.3'
10	330°19.5	41.3	184°17.7	14.3'	10°42.4	-8.3'	54.2'
11	345°19.4	41.5	198°51.0	14.3'	10°50.7	-8.3'	54.2'
12	0°19.3	N22°41.8	213°24.3	14.3'	S10°59.0	-8.3'	54.2'
13	15°19.2	42.0	227°57.6	14.3'	11°07.2	-8.2'	54.2'
14	30°19.1	42.3	242°30.9	14.3'	11°15.4	-8.2'	54.2'
15	45°19.0	·· 42.5	257°04.1	14.2'	11°23.6	-8.1'	54.2'
16	60°18.8	42.8	271°37.4	14.2'	11°31.6	-8.1'	54.2'
17	75°18.7	43.0	286°10.6	14.2'	11°39.7	-8.0'	54.2'
18	90°18.6	N22°43.3	300°43.7	14.2'	S11°47.6	-8.0'	54.2'
19	105°18.5	43.5	315°16.9	14.2'	11°55.6	-7.9'	54.2'
20	120°18.4	43.7	329°50.1	14.1'	12°03.5	-7.8'	54.2'
21	135°18.3	·· 44.0	344°23.2	14.1'	12°11.3	-7.8'	54.1'
22	150°18.1	44.2	358°56.3	14.1'	12°19.0	-7.7'	54.1'
23	165°18.0	44.5	13°29.4	14.1'	12°26.8	-7.7'	54.1'
	SD.=15.7	d=0.3		S.D.=14.8			

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°17.9	N22°44.7	28°02.4	14.0'	S12°34.4	-7.6'	54.1'
1	195°17.8	45.0	42°35.5	14.0'	12°42.0	-7.6'	54.1'
2	210°17.7	45.2	57°08.5	14.0'	12°49.6	-7.5'	54.1'
3	225°17.6	·· 45.4	71°41.5	14.0'	12°57.1	-7.5'	54.1'
4	240°17.5	45.7	86°14.4	14.0'	13°04.5	-7.4'	54.1'
5	255°17.3	45.9	100°47.4	13.9'	13°11.9	-7.4'	54.1'
6	270°17.2	N22°46.2	115°20.3	13.9'	S13°19.2	-7.3'	54.1'
7	285°17.1	46.4	129°53.2	13.9'	13°26.5	-7.2'	54.1'
8	300°17.0	46.6	144°26.1	13.9'	13°33.7	-7.2'	54.1'
9	315°16.9	·· 46.9	158°58.9	13.8'	13°40.9	-7.1'	54.1'
10	330°16.8	47.1	173°31.7	13.8'	13°47.9	-7.1'	54.1'
11	345°16.6	47.3	188°04.5	13.8'	13°55.0	-7.0'	54.0'
12	0°16.5	N22°47.6	202°37.3	13.8'	S14°01.9	-6.9'	54.0'
13	15°16.4	47.8	217°10.0	13.7'	14°08.9	-6.9'	54.0'
14	30°16.3	48.0	231°42.8	13.7'	14°15.7	-6.8'	54.0'
15	45°16.2	·· 48.3	246°15.4	13.7'	14°22.5	-6.8'	54.0'
16	60°16.1	48.5	260°48.1	13.7'	14°29.2	-6.7'	54.0'
17	75°15.9	48.7	275°20.8	13.6'	14°35.9	-6.6'	54.0'
18	90°15.8	N22°49.0	289°53.4	13.6'	S14°42.5	-6.6'	54.0'
19	105°15.7	49.2	304°26.0	13.6'	14°49.0	-6.5'	54.0'
20	120°15.6	49.4	318°58.5	13.5'	14°55.5	-6.4'	54.0'
21	135°15.5	·· 49.6	333°31.1	13.5'	15°01.9	-6.4'	54.0'
22	150°15.3	49.9	348°03.6	13.5'	15°08.2	-6.3'	54.0'
23	165°15.2	50.1	2°36.1	13.5'	15°14.5	-6.2'	54.0'
	SD.=15.7	d=0.2		S.D.=14.7			

Thu	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°15.1	N22°50.3	17°08.5	13.4'	S15°20.7	-6.2'	54.0'
1	195°15.0	50.5	31°40.9	13.4'	15°26.8	-6.1'	54.0'
2	210°14.9	50.8	46°13.3	13.4'	15°32.9	-6.0'	54.0'
3	225°14.7	·· 51.0	60°45.7	13.4'	15°38.9	-6.0'	54.0'
4	240°14.6	51.2	75°18.1	13.3'	15°44.8	-5.9'	54.0'
5	255°14.5	51.4	89°50.4	13.3'	15°50.7	-5.8'	54.0'
6	270°14.4	N22°51.7	104°22.7	13.3'	S15°56.5	-5.8'	54.0'
7	285°14.3	51.9	118°55.0	13.3'	16°02.2	-5.7'	54.0'
8	300°14.2	52.1	133°27.2	13.2'	16°07.9	-5.6'	54.0'
9	315°14.0	·· 52.3	147°59.4	13.2'	16°13.4	-5.5'	54.0'
10	330°13.9	52.5	162°31.6	13.2'	16°18.9	-5.5'	54.0'
11	345°13.8	52.7	177°03.7	13.1'	16°24.4	-5.4'	54.0'
12	0°13.7	N22°53.0	191°35.9	13.1'	S16°29.8	-5.3'	54.0'
13	15°13.6	53.2	206°08.0	13.1'	16°35.1	-5.3'	54.0'
14	30°13.4	53.4	220°40.1	13.1'	16°40.3	-5.2'	54.0'
15	45°13.3	·· 53.6	235°12.1	13.0'	16°45.4	-5.1'	54.0'
16	60°13.2	53.8	249°44.1	13.0'	16°50.5	-5.0'	53.9'
17	75°13.1	54.0	264°16.1	13.0'	16°55.5	-5.0'	53.9'
18	90°13.0	N22°54.3	278°48.1	13.0'	S17°00.4	-4.9'	53.9'
19	105°12.8	54.5	293°20.1	12.9'	17°05.3	-4.8'	53.9'
20	120°12.7	54.7	307°52.0	12.9'	17°10.0	-4.7'	53.9'
21	135°12.6	·· 54.9	322°23.9	12.9'	17°14.7	-4.7'	53.9'
22	150°12.5	55.1	336°55.7	12.9'	17°19.4	-4.6'	53.9'
23	165°12.4	55.3	351°27.6	12.8'	17°23.9	-4.5'	53.9'
	SD.=15.7	d=0.2		S.D.=14.7			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			00:44	23:18		
64°			01:44	22:15		
62°			02:18	21:41		
60°		01:09	02:42	21:17	22:51	
N 58°		01:50	03:01	20:58	22:09	
56°		02:17	03:17	20:42	21:42	
54°	01:03	02:37	03:30	20:28	21:21	22:57
52°	01:41	02:54	03:42	20:16	21:04	22:18
50°	02:06	03:09	03:52	20:06	20:50	21:53
45°	02:48	03:37	04:14	19:44	20:21	21:10
N 40°	03:18	03:59	04:31	19:27	19:59	20:40
35°	03:40	04:16	04:46	19:12	19:42	20:18
30°	03:58	04:31	04:58	18:59	19:27	20:00
20°	04:26	04:55	05:20	18:38	19:03	19:32
N 10°	04:48	05:15	05:38	18:20	18:43	19:10
0°	05:07	05:33	05:55	18:03	18:25	18:51
S 10°	05:23	05:49	06:12	17:46	18:08	18:35
20°	05:39	06:06	06:30	17:28	17:51	18:19
30°	05:55	06:24	06:51	17:07	17:33	18:03
35°	06:03	06:35	07:03	16:55	17:23	17:55
40°	06:12	06:46	07:16	16:41	17:12	17:46
45°	06:22	06:59	07:33	16:25	16:59	17:36
S 50°	06:33	07:14	07:53	16:05	16:43	17:24
52°	06:38	07:22	08:02	15:56	16:36	17:19
54°	06:44	07:29	08:13	15:45	16:28	17:14
56°	06:50	07:38	08:25	15:33	16:19	17:08
58°	06:56	07:48	08:39	15:19	16:10	17:02
S 60°	07:03	07:59	08:55	15:02	15:58	16:54

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	18:41	20:29	22:35	01:22	01:12	00:58
N 70°	18:20	19:54	21:28	01:37	01:35	01:34
68°	18:03	19:29	20:52	01:49	01:53	02:00
66°	17:49	19:10	20:27	01:59	02:07	02:19
64°	17:38	18:54	20:07	02:07	02:19	02:35
62°	17:29	18:42	19:51	02:14	02:30	02:49
60°	17:21	18:31	19:38	02:20	02:38	03:00
N 58°	17:14	18:21	19:26	02:26	02:46	03:10
56°	17:08	18:13	19:17	02:30	02:53	03:18
54°	17:02	18:06	19:08	02:35	02:59	03:26
52°	16:57	18:00	19:00	02:39	03:04	03:33
50°	16:53	17:54	18:53	02:42	03:09	03:39
45°	16:43	17:41	18:38	02:50	03:20	03:53
N 40°	16:35	17:31	18:26	02:57	03:29	04:04
35°	16:28	17:22	18:15	03:02	03:37	04:13
30°	16:22	17:14	18:06	03:07	03:43	04:21
20°	16:11	17:01	17:50	03:16	03:55	04:36
N 10°	16:02	16:49	17:37	03:24	04:05	04:48
0°	15:54	16:38	17:24	03:31	04:15	05:00
S 10°	15:45	16:28	17:11	03:38	04:25	05:12
20°	15:36	16:16	16:58	03:46	04:35	05:25
30°	15:26	16:03	16:42	03:55	04:47	05:39
35°	15:20	15:55	16:33	04:00	04:54	05:48
40°	15:14	15:47	16:23	04:05	05:02	05:57
45°	15:06	15:37	16:11	04:12	05:11	06:09
S 50°	14:57	15:25	15:57	04:20	05:22	06:22
52°	14:52	15:19	15:50	04:24	05:27	06:29
54°	14:48	15:13	15:43	04:28	05:33	06:36
56°	14:43	15:06	15:35	04:33	05:39	06:44
58°	14:37	14:59	15:25	04:38	05:46	06:53
S 60°	14:30	14:50	15:15	04:44	05:54	07:03

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 12-14 92-99%
06	01:23	01:17	11:59	22:04	09:42	
07	01:12	01:06	11:59	22:49	10:27	
08	01:00	00:55	11:59	23:35	11:12	

June 09, 10, 11 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	257°33.2	226°14.0	N10°02.9	164°24.3	N24°19.0	64°50.8	S03°55.4	352°58.1	S21°58.8
1	272°35.7	241°14.1	03.7	179°24.9	19.0	79°53.2	55.4	8°00.7	58.8
2	287°38.1	256°14.1	04.5	194°25.6	19.0	94°55.7	55.5	23°03.4	58.8
3	302°40.6	271°14.2	·· 05.2	209°26.2	·· 19.0	109°58.2	·· 55.5	38°06.1	·· 58.8
4	317°43.1	286°14.3	06.0	224°26.9	18.9	125°00.7	55.5	53°08.7	58.8
5	332°45.5	301°14.3	06.8	239°27.5	18.9	140°03.1	55.5	68°11.4	58.8
6	347°48.0	316°14.4	N10°07.5	254°28.2	N24°18.9	155°05.6	S03°55.5	83°14.0	S21°58.8
7	2°50.4	331°14.4	08.3	269°28.8	18.9	170°08.1	55.5	98°16.7	58.8
8	17°52.9	346°14.5	09.1	284°29.5	18.8	185°10.5	55.5	113°19.4	58.8
9	32°55.4	1°14.6	·· 09.8	299°30.1	·· 18.8	200°13.0	·· 55.5	128°22.0	·· 58.8
10	47°57.8	16°14.6	10.6	314°30.8	18.8	215°15.5	55.5	143°24.7	58.8
11	63°00.3	31°14.7	11.4	329°31.4	18.8	230°18.0	55.5	158°27.4	58.8
12	78°02.8	46°14.7	N10°12.1	344°32.1	N24°18.7	245°20.4	S03°55.5	173°30.0	S21°58.8
13	93°05.2	61°14.8	12.9	359°32.7	18.7	260°22.9	55.6	188°32.7	58.7
14	108°07.7	76°14.8	13.7	14°33.4	18.7	275°25.4	55.6	203°35.3	58.7
15	123°10.2	91°14.9	·· 14.4	29°34.0	·· 18.7	290°27.8	·· 55.6	218°38.0	·· 58.7
16	138°12.6	106°14.9	15.2	44°34.6	18.6	305°30.3	55.6	233°40.7	58.7
17	153°15.1	121°15.0	16.0	59°35.3	18.6	320°32.8	55.6	248°43.3	58.7
18	168°17.6	136°15.1	N10°16.7	74°35.9	N24°18.6	335°35.2	S03°55.6	263°46.0	S21°58.7
19	183°20.0	151°15.1	17.5	89°36.6	18.5	350°37.7	55.6	278°48.6	58.7
20	198°22.5	166°15.2	18.3	104°37.2	18.5	5°40.2	55.6	293°51.3	58.7
21	213°24.9	181°15.2	·· 19.0	119°37.9	·· 18.5	20°42.6	·· 55.6	308°54.0	·· 58.7
22	228°27.4	196°15.3	19.8	134°38.5	18.4	35°45.1	55.6	323°56.6	58.7
23	243°29.9	211°15.3	20.6	149°39.2	18.4	50°47.6	55.7	338°59.3	58.7
Mer.pass.:06:49		v0.1 d0.8 m-4.2		v0.6 d-0.0 m1.7		v2.5 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	258°32.3	226°15.4	N10°21.3	164°39.8	N24°18.4	65°50.0	S03°55.7	354°01.9	S21°58.7
1	273°34.8	241°15.4	22.1	179°40.5	18.4	80°52.5	55.7	9°04.6	58.7
2	288°37.3	256°15.4	22.9	194°41.1	18.3	95°55.0	55.7	24°07.3	58.7
3	303°39.7	271°15.5	·· 23.6	209°41.8	·· 18.3	110°57.4	·· 55.7	39°09.9	·· 58.7
4	318°42.2	286°15.5	24.4	224°42.4	18.3	125°59.9	55.7	54°12.6	58.7
5	333°44.7	301°15.6	25.2	239°43.1	18.2	141°02.4	55.7	69°15.3	58.7
6	348°47.1	316°15.6	N10°25.9	254°43.7	N24°18.2	156°04.8	S03°55.7	84°17.9	S21°58.7
7	3°49.6	331°15.7	26.7	269°44.4	18.2	171°07.3	55.8	99°20.6	58.7
8	18°52.1	346°15.7	27.5	284°45.0	18.1	186°09.7	55.8	114°23.2	58.7
9	33°54.5	1°15.8	·· 28.2	299°45.7	·· 18.1	201°12.2	·· 55.8	129°25.9	·· 58.7
10	48°57.0	16°15.8	29.0	314°46.3	18.1	216°14.7	55.8	144°28.6	58.7
11	63°59.4	31°15.8	29.8	329°47.0	18.0	231°17.1	55.8	159°31.2	58.7
12	79°01.9	46°15.9	N10°30.5	344°47.6	N24°18.0	246°19.6	S03°55.8	174°33.9	S21°58.6
13	94°04.4	61°15.9	31.3	359°48.3	17.9	261°22.1	55.8	189°36.5	58.6
14	109°06.8	76°16.0	32.1	14°48.9	17.9	276°24.5	55.8	204°39.2	58.6
15	124°09.3	91°16.0	·· 32.8	29°49.6	·· 17.9	291°27.0	·· 55.9	219°41.9	·· 58.6
16	139°11.8	106°16.0	33.6	44°50.2	17.8	306°29.4	55.9	234°44.5	58.6
17	154°14.2	121°16.1	34.4	59°50.9	17.8	321°31.9	55.9	249°47.2	58.6
18	169°16.7	136°16.1	N10°35.1	74°51.5	N24°17.8	336°34.4	S03°55.9	264°49.9	S21°58.6
19	184°19.2	151°16.1	35.9	89°52.2	17.7	351°36.8	55.9	279°52.5	58.6
20	199°21.6	166°16.2	36.7	104°52.8	17.7	6°39.3	55.9	294°55.2	58.6
21	214°24.1	181°16.2	·· 37.4	119°53.5	·· 17.6	21°41.7	·· 55.9	309°57.8	·· 58.6
22	229°26.6	196°16.3	38.2	134°54.1	17.6	36°44.2	56.0	325°00.5	58.6
23	244°29.0	211°16.3	39.0	149°54.8	17.6	51°46.7	56.0	340°03.2	58.6
Mer.pass.:06:45		v0.0 d0.8 m-4.2		v0.6 d-0.0 m1.7		v2.5 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	259°31.5	226°16.3	N10°39.7	164°55.4	N24°17.5	66°49.1	S03°56.0	355°05.8	S21°58.6
1	274°33.9	241°16.4	40.5	179°56.1	17.5	81°51.6	56.0	10°08.5	58.6
2	289°36.4	256°16.4	41.3	194°56.7	17.4	96°54.0	56.0	25°11.2	58.6
3	304°38.9	271°16.4	·· 42.0	209°57.4	·· 17.4	111°56.5	·· 56.0	40°13.8	·· 58.6
4	319°41.3	286°16.4	42.8	224°58.0	17.4	126°59.0	56.0	55°16.5	58.6
5	334°43.8	301°16.5	43.6	239°58.7	17.3	142°01.4	56.1	70°19.1	58.6
6	349°46.3	316°16.5	N10°44.3	254°59.3	N24°17.3	157°03.9	S03°56.1	85°21.8	S21°58.6
7	4°48.7	331°16.5	45.1	270°00.0	17.2	172°06.3	56.1	100°24.5	58.6
8	19°51.2	346°16.6	45.9	285°00.6	17.2	187°08.8	56.1	115°27.1	58.6
9	34°53.7	1°16.6	·· 46.7	300°01.3	·· 17.2	202°11.2	·· 56.1	130°29.8	·· 58.6
10	49°56.1	16°16.6	47.4	315°01.9	17.1	217°13.7	56.1	145°32.4	58.5
11	64°58.6	31°16.6	48.2	330°02.6	17.1	232°16.1	56.1	160°35.1	58.5
12	80°01.1	46°16.7	N10°49.0	345°03.2	N24°17.0	247°18.6	S03°56.2	175°37.8	S21°58.5
13	95°03.5	61°16.7	49.7	0°03.9	17.0	262°21.1	56.2	190°40.4	58.5
14	110°06.0	76°16.7	50.5	15°04.5	16.9	277°23.5	56.2	205°43.1	58.5
15	125°08.4	91°16.7	·· 51.3	30°05.2	·· 16.9	292°26.0	·· 56.2	220°45.8	·· 58.5
16	140°10.9	106°16.7	52.0	45°05.8	16.8	307°28.4	56.2	235°48.4	58.5
17	155°13.4	121°16.8	52.8	60°06.5	16.8	322°30.9	56.2	250°51.1	58.5
18	170°15.8	136°16.8	N10°53.6	75°07.1	N24°16.8	337°33.3	S03°56.3	265°53.7	S21°58.5
19	185°18.3	151°16.8	54.3	90°07.8	16.7	352°35.8	56.3	280°56.4	58.5
20	200°20.8	166°16.8	55.1	105°08.4	16.7	7°38.2	56.3	295°59.1	58.5
21	215°23.2	181°16.8	·· 55.9	120°09.1	·· 16.6	22°40.7	·· 56.3	311°01.7	·· 58.5
22	230°25.7	196°16.9	56.6	135°09.7	16.6	37°43.1	56.3	326°04.4	58.5
23	245°28.2	211°16.9	57.4	150°10.4	16.5	52°45.6	56.3	341°07.1	58.5
Mer.pass.:06:41		v0.0 d0.8 m-4.2		v0.7 d-0.0 m1.7		v2.5 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Stars

	SHA	Dec
Alpheratz	357°40.8	29°10.9
Ankaa	353°13.3	-42°12.6
Schedar	349°37.6	56°37.6
Diphda	348°53.4	-17°53.5
Achernar	335°25.2	-57°08.8
Hamal	327°57.9	23°32.4
Polaris	316°55.3	89°19.9
Acamar	315°16.7	-40°14.2
Menkar	314°12.5	4°09.2
Mirfak	308°36.9	49°55.0
Aldebaran	290°46.6	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.6
Sirius	258°31.7	-16°44.7
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.3	-59°34.3
Suhail	222°50.7	-43°30.5
Miaplacidus	221°39.5	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.6	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°06.0	-63°12.0
Gacrux	171°57.6	-57°12.8
Alioth	166°18.2	55°52.3
Spica	158°28.2	-11°15.1
Alkaid	152°56.6	49°13.9
Hadar	148°43.5	-60°27.5
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.5	-60°54.4
Kochab	137°19.3	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.3
Sabik	102°09.1	-15°44.6
Shaula	96°17.9	-37°06.8
Rasalhague	96°03.6	12°33.0
Eltanin	90°44.4	51°29.3
Kaus Aust.	83°39.9	-34°22.3
Vega	80°36.7	38°48.1
Nunki	75°54.7	-26°16.3
Altair	62°05.4	8°55.0
Peacock	53°14.7	-56°40.4
Deneb	49°29.3	45°20.5
Enif	33°44.3	9°57.3
Al Na'ir	27°40.3	-46°52.3
Fomalhaut	15°21.0	-29°31.6
Scheat	13°50.7	28°10.5
Markab	13°35.6	15°17.8

Jun 09 Fri	SHA	Mer.pass
Venus	328°40.8	08:55
Mars	266°51.1	13:02
Jupiter	167°17.6	19:37
Saturn	95°24.9	00:28

Jun 10 Sat	SHA	Mer.pass
Venus	327°43.0	08:55
Mars	266°07.5	13:01
Jupiter	167°17.7	19:33
Saturn	95°29.6	00:24

Jun 11 Sun	SHA	Mer.pass
Venus	326°44.8	08:55
Mars	265°23.9	13:00
Jupiter	167°17.6	19:30
Saturn	95°34.3	00:20

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3750 sec ΔT = TT-UT1 = +68.8090 sec

2017 June 09 to Jun. 11 UT

h

	Sun		Moon				
Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°12.2	N22°55.5	5°59.4	12.8′	S17°28.4	-4.4′	53.9′
1	195°12.1	55.7	20°31.2	12.8′	17°32.8	-4.4′	53.9′
2	210°12.0	55.9	35°02.9	12.8′	17°37.1	-4.3′	53.9′
3	225°11.9	·· 56.1	49°34.7	12.7′	17°41.3	-4.2′	53.9′
4	240°11.7	56.3	64°06.4	12.7′	17°45.5	-4.1′	53.9′
5	255°11.6	56.5	78°38.1	12.7′	17°49.5	-4.0′	54.0′
6	270°11.5	N22°56.8	93°09.7	12.7′	S17°53.5	-4.0′	54.0′
7	285°11.4	57.0	107°41.4	12.6′	17°57.4	-3.9′	54.0′
8	300°11.3	57.2	122°13.0	12.6′	18°01.3	-3.8′	54.0′
9	315°11.1	·· 57.4	136°44.6	12.6′	18°05.0	-3.7′	54.0′
10	330°11.0	57.6	151°16.1	12.6′	18°08.7	-3.6′	54.0′
11	345°10.9	57.8	165°47.7	12.5′	18°12.3	-3.5′	54.0′
12	0°10.8	N22°58.0	180°19.2	12.5′	S18°15.8	-3.5′	54.0′
13	15°10.6	58.2	194°50.7	12.5′	18°19.2	-3.4′	54.0′
14	30°10.5	58.4	209°22.2	12.5′	18°22.6	-3.3′	54.0′
15	45°10.4	·· 58.6	223°53.6	12.4′	18°25.8	-3.2′	54.0′
16	60°10.3	58.8	238°25.1	12.4′	18°29.0	-3.1′	54.0′
17	75°10.2	59.0	252°56.5	12.4′	18°32.1	-3.1′	54.0′
18	90°10.0	N22°59.1	267°27.9	12.4′	S18°35.1	-3.0′	54.0′
19	105°09.9	59.3	281°59.2	12.4′	18°38.0	-2.9′	54.0′
20	120°09.8	59.5	296°30.6	12.3′	18°40.9	-2.8′	54.0′
21	135°09.7	·· 59.7	311°01.9	12.3′	18°43.6	-2.7′	54.0′
22	150°09.5	22°59.9	325°33.2	12.3′	18°46.3	-2.6′	54.0′
23	165°09.4	23°00.1	340°04.5	12.3′	18°48.9	-2.5′	54.0′
	SD.=15.7	d=0.2	S.D.=14.7				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°09.3	N23°00.3	354°35.7	12.3′	S18°51.4	-2.5′	54.0′
1	195°09.2	00.5	9°07.0	12.2′	18°53.8	-2.4′	54.0′
2	210°09.0	00.7	23°38.2	12.2′	18°56.1	-2.3′	54.0′
3	225°08.9	·· 00.9	38°09.4	12.2′	18°58.4	-2.2′	54.0′
4	240°08.8	01.1	52°40.6	12.2′	19°00.5	-2.1′	54.0′
5	255°08.7	01.3	67°11.8	12.2′	19°02.6	-2.0′	54.0′
6	270°08.5	N23°01.4	81°42.9	12.1′	S19°04.6	-1.9′	54.0′
7	285°08.4	01.6	96°14.0	12.1′	19°06.5	-1.8′	54.0′
8	300°08.3	01.8	110°45.2	12.1′	19°08.3	-1.8′	54.0′
9	315°08.2	·· 02.0	125°16.3	12.1′	19°10.0	-1.7′	54.0′
10	330°08.1	02.2	139°47.3	12.1′	19°11.6	-1.6′	54.0′
11	345°07.9	02.4	154°18.4	12.1′	19°13.2	-1.5′	54.1′
12	0°07.8	N23°02.6	168°49.5	12.0′	S19°14.6	-1.4′	54.1′
13	15°07.7	02.7	183°20.5	12.0′	19°16.0	-1.3′	54.1′
14	30°07.6	02.9	197°51.5	12.0′	19°17.2	-1.2′	54.1′
15	45°07.4	·· 03.1	212°22.5	12.0′	19°18.4	-1.1′	54.1′
16	60°07.3	03.3	226°53.5	12.0′	19°19.5	-1.1′	54.1′
17	75°07.2	03.5	241°24.5	12.0′	19°20.5	-1.0′	54.1′
18	90°07.1	N23°03.6	255°55.5	12.0′	S19°21.5	-0.9′	54.1′
19	105°06.9	03.8	270°26.5	12.0′	19°22.3	-0.8′	54.1′
20	120°06.8	04.0	284°57.4	11.9′	19°23.0	-0.7′	54.1′
21	135°06.7	·· 04.2	299°28.3	11.9′	19°23.7	-0.6′	54.1′
22	150°06.6	04.3	313°59.3	11.9′	19°24.2	-0.5′	54.1′
23	165°06.4	04.5	328°30.2	11.9′	19°24.7	-0.4′	54.1′
	SD.=15.7	d=0.2	S.D.=14.7				

Sun	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	180°06.3	N23°04.7	343°01.1	11.9′	S19°25.1	-0.3′	54.1′
1	195°06.2	04.9	357°32.0	11.9′	19°25.4	-0.2′	54.1′
2	210°06.0	05.0	12°02.9	11.9′	19°25.6	-0.2′	54.2′
3	225°05.9	·· 05.2	26°33.7	11.9′	19°25.7	-0.1′	54.2′
4	240°05.8	05.4	41°04.6	11.9′	19°25.7	0.0′	54.2′
5	255°05.7	05.6	55°35.5	11.9′	19°25.6	0.1′	54.2′
6	270°05.5	N23°05.7	70°06.3	11.8′	S19°25.4	0.2′	54.2′
7	285°05.4	05.9	84°37.2	11.8′	19°25.2	0.3′	54.2′
8	300°05.3	06.1	99°08.0	11.8′	19°24.8	0.4′	54.2′
9	315°05.2	·· 06.2	113°38.8	11.8′	19°24.4	0.5′	54.2′
10	330°05.0	06.4	128°09.7	11.8′	19°23.9	0.6′	54.2′
11	345°04.9	06.6	142°40.5	11.8′	19°23.2	0.7′	54.2′
12	0°04.8	N23°06.7	157°11.3	11.8′	S19°22.5	0.8′	54.2′
13	15°04.7	06.9	171°42.1	11.8′	19°21.7	0.8′	54.3′
14	30°04.5	07.1	186°12.9	11.8′	19°20.8	0.9′	54.3′
15	45°04.4	·· 07.2	200°43.7	11.8′	19°19.9	1.0′	54.3′
16	60°04.3	07.4	215°14.5	11.8′	19°18.8	1.1′	54.3′
17	75°04.1	07.6	229°45.3	11.8′	19°17.6	1.2′	54.3′
18	90°04.0	N23°07.7	244°16.1	11.8′	S19°16.4	1.3′	54.3′
19	105°03.9	07.9	258°46.9	11.8′	19°15.0	1.4′	54.3′
20	120°03.8	08.0	273°17.7	11.8′	19°13.6	1.5′	54.3′
21	135°03.6	·· 08.2	287°48.5	11.8′	19°12.0	1.6′	54.3′
22	150°03.5	08.4	302°19.3	11.8′	19°10.4	1.7′	54.3′
23	165°03.4	08.5	316°50.0	11.8′	19°08.7	1.8′	54.4′
	SD.=15.7	d=0.2	S.D.=14.8				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	00:28	23:38	▭	▭
64°	▭	▭	01:39	22:21	▭	▭
62°	▭	▭	02:14	21:46	▭	▭
60°	▭	01:02	02:39	21:21	22:59	▭
N 58°	▭	01:46	02:59	21:01	22:14	▭
56°	▭	02:14	03:15	20:45	21:46	▭
54°	00:57	02:35	03:29	20:31	21:24	23:04
52°	01:37	02:53	03:41	20:19	21:07	22:23
50°	02:03	03:07	03:51	20:08	20:52	21:56
45°	02:47	03:36	04:13	19:46	20:23	21:12
N 40°	03:17	03:58	04:31	19:28	20:01	20:42
35°	03:40	04:16	04:46	19:14	19:43	20:20
30°	03:58	04:31	04:58	19:01	19:28	20:01
20°	04:26	04:55	05:20	18:39	19:04	19:33
N 10°	04:49	05:16	05:39	18:20	18:43	19:10
0°	05:07	05:33	05:56	18:03	18:26	18:52
S 10°	05:24	05:50	06:13	17:46	18:09	18:35
20°	05:40	06:07	06:31	17:28	17:52	18:19
30°	05:56	06:26	06:52	17:07	17:33	18:03
35°	06:04	06:36	07:04	16:55	17:23	17:54
40°	06:14	06:48	07:18	16:41	17:11	17:45
45°	06:24	07:01	07:34	16:24	16:58	17:35
S 50°	06:35	07:16	07:55	16:04	16:42	17:24
52°	06:40	07:24	08:04	15:54	16:35	17:19
54°	06:46	07:32	08:15	15:44	16:27	17:13
56°	06:52	07:41	08:28	15:31	16:18	17:07
58°	06:58	07:51	08:42	15:17	16:08	17:00
S 60°	07:06	08:02	08:59	15:00	15:57	16:53

Lat.	**Moonrise** Fri	Sat	Sun	**Moonset** Fri	Sat	Sun
N 72°	–:–	▬	▬	00:27	▬	▬
N 70°	23:00	–:–	00:15	01:35	01:40	02:05
68°	22:09	23:11	23:53	02:11	02:32	03:09
66°	21:37	22:36	23:20	02:37	03:04	03:44
64°	21:14	22:11	22:55	02:57	03:28	04:10
62°	20:55	21:51	22:36	03:14	03:46	04:29
60°	20:40	21:35	22:20	03:27	04:02	04:46
N 58°	20:27	21:21	22:07	03:39	04:15	04:59
56°	20:16	21:09	21:56	03:49	04:26	05:11
54°	20:06	20:59	21:45	03:58	04:36	05:21
52°	19:57	20:50	21:36	04:06	04:45	05:31
50°	19:49	20:41	21:28	04:14	04:53	05:39
45°	19:33	20:24	21:11	04:29	05:10	05:56
N 40°	19:19	20:10	20:57	04:42	05:24	06:11
35°	19:07	19:58	20:45	04:53	05:36	06:23
30°	18:57	19:47	20:35	05:02	05:46	06:33
20°	18:40	19:29	20:17	05:19	06:04	06:51
N 10°	18:25	19:13	20:01	05:33	06:19	07:07
0°	18:11	18:59	19:47	05:47	06:34	07:22
S 10°	17:57	18:44	19:32	06:00	06:48	07:37
20°	17:42	18:28	19:17	06:14	07:04	07:52
30°	17:25	18:10	18:59	06:31	07:21	08:10
35°	17:15	18:00	18:48	06:41	07:32	08:21
40°	17:03	17:48	18:36	06:52	07:44	08:33
45°	16:50	17:34	18:22	07:05	07:58	08:47
S 50°	16:34	17:17	18:05	07:20	08:15	09:04
52°	16:26	17:09	17:57	07:28	08:23	09:12
54°	16:18	17:00	17:48	07:36	08:32	09:21
56°	16:08	16:49	17:38	07:45	08:42	09:32
58°	15:58	16:38	17:26	07:56	08:53	09:43
S 60°	15:45	16:24	17:13	08:08	09:06	09:57

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 15-17 100-96%
09	00:49	00:43	11:59	–:–	11:59	◯
10	00:37	00:31	11:59	00:22	12:46	
11	00:25	00:19	12:00	01:10	13:34	

June 12, 13, 14 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	260°30.6	226°16.9	N10°58.2	165°11.0	N24°16.5	67°48.0	S03°56.4	356°09.7	S21°58.5
1	275°33.1	241°16.9	59.0	180°11.7	16.4	82°50.5	56.4	11°12.4	58.5
2	290°35.5	256°16.9	10°59.7	195°12.3	16.4	97°53.0	56.4	26°15.0	58.5
3	305°38.0	271°16.9	11°00.5	210°13.0	·· 16.3	112°55.4	·· 56.4	41°17.7	·· 58.5
4	320°40.5	286°17.0	01.3	225°13.6	16.3	127°57.9	56.4	56°20.4	58.5
5	335°42.9	301°17.0	02.0	240°14.3	16.2	143°00.3	56.4	71°23.0	58.5
6	350°45.4	316°17.0	N11°02.8	255°14.9	N24°16.2	158°02.8	S03°56.5	86°25.7	S21°58.5
7	5°47.9	331°17.0	03.6	270°15.6	16.1	173°05.2	56.5	101°28.4	58.5
8	20°50.3	346°17.0	04.3	285°16.3	16.1	188°07.7	56.5	116°31.0	58.5
9	35°52.8	1°17.0	·· 05.1	300°16.9	·· 16.0	203°10.1	·· 56.5	131°33.7	·· 58.4
10	50°55.3	16°17.0	05.9	315°17.6	16.0	218°12.6	56.5	146°36.3	58.4
11	65°57.7	31°17.0	06.6	330°18.2	15.9	233°15.0	56.6	161°39.0	58.4
12	81°00.2	46°17.0	N11°07.4	345°18.9	N24°15.9	248°17.4	S03°56.6	176°41.7	S21°58.4
13	96°02.7	61°17.0	08.2	0°19.5	15.8	263°19.9	56.6	191°44.3	58.4
14	111°05.1	76°17.0	08.9	15°20.2	15.8	278°22.3	56.6	206°47.0	58.4
15	126°07.6	91°17.1	·· 09.7	30°20.8	·· 15.7	293°24.8	·· 56.6	221°49.7	·· 58.4
16	141°10.0	106°17.1	10.5	45°21.5	15.7	308°27.2	56.6	236°52.3	58.4
17	156°12.5	121°17.1	11.3	60°22.1	15.6	323°29.7	56.7	251°55.0	58.4
18	171°15.0	136°17.1	N11°12.0	75°22.8	N24°15.5	338°32.1	S03°56.7	266°57.6	S21°58.4
19	186°17.4	151°17.1	12.8	90°23.4	15.5	353°34.6	56.7	282°00.3	58.4
20	201°19.9	166°17.1	13.6	105°24.1	15.4	8°37.0	56.7	297°03.0	58.4
21	216°22.4	181°17.1	·· 14.3	120°24.7	·· 15.4	23°39.5	·· 56.7	312°05.6	·· 58.4
22	231°24.8	196°17.1	15.1	135°25.4	15.3	38°41.9	56.8	327°08.3	58.4
23	246°27.3	211°17.1	15.9	150°26.0	15.3	53°44.4	56.8	342°11.0	58.4
Mer.pass.:06:37		v0.0 d0.8 m-4.2		v0.7 d-0.0 m1.7		v2.5 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	261°29.8	226°17.1	N11°16.6	165°26.7	N24°15.2	68°46.8	S03°56.8	357°13.6	S21°58.4
1	276°32.2	241°17.1	17.4	180°27.4	15.2	83°49.3	56.8	12°16.3	58.4
2	291°34.7	256°17.1	18.2	195°28.0	15.1	98°51.7	56.8	27°18.9	58.4
3	306°37.2	271°17.1	·· 18.9	210°28.7	·· 15.0	113°54.1	·· 56.9	42°21.6	·· 58.4
4	321°39.6	286°17.1	19.7	225°29.3	15.0	128°56.6	56.9	57°24.3	58.4
5	336°42.1	301°17.1	20.5	240°30.0	14.9	143°59.0	56.9	72°26.9	58.4
6	351°44.5	316°17.1	N11°21.3	255°30.6	N24°14.9	159°01.5	S03°56.9	87°29.6	S21°58.4
7	6°47.0	331°17.1	22.0	270°31.3	14.8	174°03.9	56.9	102°32.3	58.3
8	21°49.5	346°17.1	22.8	285°31.9	14.7	189°06.4	57.0	117°34.9	58.3
9	36°51.9	1°17.1	·· 23.6	300°32.6	·· 14.7	204°08.8	·· 57.0	132°37.6	·· 58.3
10	51°54.4	16°17.0	24.3	315°33.2	14.6	219°11.2	57.0	147°40.2	58.3
11	66°56.9	31°17.0	25.1	330°33.9	14.6	234°13.7	57.0	162°42.9	58.3
12	81°59.3	46°17.0	N11°25.9	345°34.6	N24°14.5	249°16.1	S03°57.1	177°45.6	S21°58.3
13	97°01.8	61°17.0	26.6	0°35.2	14.4	264°18.6	57.1	192°48.2	58.3
14	112°04.3	76°17.0	27.4	15°35.9	14.4	279°21.0	57.1	207°50.9	58.3
15	127°06.7	91°17.0	·· 28.2	30°36.5	·· 14.3	294°23.5	·· 57.1	222°53.6	·· 58.3
16	142°09.2	106°17.0	28.9	45°37.2	14.3	309°25.9	57.1	237°56.2	58.3
17	157°11.7	121°17.0	29.7	60°37.8	14.2	324°28.3	57.2	252°58.9	58.3
18	172°14.1	136°17.0	N11°30.5	75°38.5	N24°14.1	339°30.8	S03°57.2	268°01.5	S21°58.3
19	187°16.6	151°17.0	31.2	90°39.1	14.1	354°33.2	57.2	283°04.2	58.3
20	202°19.0	166°16.9	32.0	105°39.8	14.0	9°35.7	57.2	298°06.9	58.3
21	217°21.5	181°16.9	·· 32.8	120°40.5	·· 13.9	24°38.1	·· 57.3	313°09.5	·· 58.3
22	232°24.0	196°16.9	33.6	135°41.1	13.9	39°40.5	57.3	328°12.2	58.3
23	247°26.4	211°16.9	34.3	150°41.8	13.8	54°43.0	57.3	343°14.9	58.3
Mer.pass.:06:33		v-0.0 d0.8 m-4.2		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	262°28.9	226°16.9	N11°35.1	165°42.4	N24°13.7	69°45.4	S03°57.3	358°17.5	S21°58.3
1	277°31.4	241°16.9	35.9	180°43.1	13.7	84°47.8	57.3	13°20.2	58.3
2	292°33.8	256°16.8	36.6	195°43.7	13.6	99°50.3	57.4	28°22.8	58.3
3	307°36.3	271°16.8	·· 37.4	210°44.4	·· 13.6	114°52.7	·· 57.4	43°25.5	·· 58.3
4	322°38.8	286°16.8	38.2	225°45.0	13.5	129°55.2	57.4	58°28.2	58.3
5	337°41.2	301°16.8	38.9	240°45.7	13.4	144°57.6	57.4	73°30.8	58.3
6	352°43.7	316°16.8	N11°39.7	255°46.4	N24°13.4	160°00.0	S03°57.5	88°33.5	S21°58.2
7	7°46.1	331°16.8	40.5	270°47.0	13.3	175°02.5	57.5	103°36.2	58.2
8	22°48.6	346°16.7	41.2	285°47.7	13.2	190°04.9	57.5	118°38.8	58.2
9	37°51.1	1°16.7	·· 42.0	300°48.3	·· 13.1	205°07.3	·· 57.5	133°41.5	·· 58.2
10	52°53.5	16°16.7	42.8	315°49.0	13.1	220°09.8	57.6	148°44.1	58.2
11	67°56.0	31°16.7	43.5	330°49.6	13.0	235°12.2	57.6	163°46.8	58.2
12	82°58.5	46°16.6	N11°44.3	345°50.3	N24°12.9	250°14.6	S03°57.6	178°49.5	S21°58.2
13	98°00.9	61°16.6	45.1	0°51.0	12.9	265°17.1	57.6	193°52.1	58.2
14	113°03.4	76°16.6	45.8	15°51.6	12.8	280°19.5	57.7	208°54.8	58.2
15	128°05.9	91°16.6	·· 46.6	30°52.3	·· 12.7	295°21.9	·· 57.7	223°57.5	·· 58.2
16	143°08.3	106°16.5	47.4	45°52.9	12.7	310°24.4	57.7	239°00.1	58.2
17	158°10.8	121°16.5	48.1	60°53.6	12.6	325°26.8	57.7	254°02.8	58.2
18	173°13.3	136°16.5	N11°48.9	75°54.2	N24°12.5	340°29.2	S03°57.8	269°05.5	S21°58.2
19	188°15.7	151°16.5	49.7	90°54.9	12.5	355°31.7	57.8	284°08.1	58.2
20	203°18.2	166°16.4	50.5	105°55.6	12.4	10°34.1	57.8	299°10.8	58.2
21	218°20.6	181°16.4	·· 51.2	120°56.2	·· 12.3	25°36.5	·· 57.8	314°13.4	·· 58.2
22	233°23.1	196°16.4	52.0	135°56.9	12.2	40°39.0	57.9	329°16.1	58.2
23	248°25.6	211°16.3	52.8	150°57.5	12.2	55°41.4	57.9	344°18.8	58.2
Mer.pass.:06:29		v-0.0 d0.8 m-4.2		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Stars

	SHA	Dec
Alpheratz	357°40.7	29°11.0
Ankaa	353°13.2	-42°12.5
Schedar	349°37.5	56°37.6
Diphda	348°53.3	-17°53.5
Achernar	335°25.2	-57°08.8
Hamal	327°57.9	23°32.4
Polaris	316°54.2	89°19.9
Acamar	315°16.7	-40°14.1
Menkar	314°12.5	4°09.3
Mirfak	308°36.9	49°55.0
Aldebaran	290°46.6	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°31.0	46°00.7
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.5
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.3	-59°34.2
Suhail	222°50.7	-43°30.5
Miaplacidus	221°39.5	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.7	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.4	-17°38.4
Acrux	173°06.0	-63°12.0
Gacrux	171°57.6	-57°12.8
Alioth	166°18.2	55°52.3
Spica	158°28.2	-11°15.1
Alkaid	152°56.6	49°13.9
Hadar	148°43.5	-60°27.5
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.5	-60°54.4
Kochab	137°19.3	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.3
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.0
Eltanin	90°44.4	51°29.3
Kaus Aust.	83°39.9	-34°22.3
Vega	80°36.7	38°48.1
Nunki	75°54.7	-26°16.3
Altair	62°05.3	8°55.0
Peacock	53°14.7	-56°40.4
Deneb	49°29.3	45°20.5
Enif	33°44.3	9°57.3
Al Na'ir	27°40.3	-46°52.3
Fomalhaut	15°21.0	-29°31.6
Scheat	13°50.7	28°10.5
Markab	13°35.6	15°17.8

Jun 12 Mon	SHA	Mer.pass
Venus	325°46.3	08:55
Mars	264°40.4	12:59
Jupiter	167°17.4	19:26
Saturn	95°39.1	00:15

Jun 13 Tue	SHA	Mer.pass
Venus	324°47.3	08:55
Mars	263°56.9	12:58
Jupiter	167°17.0	19:22
Saturn	95°43.9	00:11

Jun 14 Wed	SHA	Mer.pass
Venus	323°48.0	08:55
Mars	263°13.5	12:57
Jupiter	167°16.5	19:18
Saturn	95°48.6	00:07

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3729 sec ΔT = TT-UT1 = +68.8111 sec

2017 June 12 to Jun. 14 UT

h

Mon	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°03.3	N23°08.7	331°20.8	11.8'	S19°06.9	1.8'	54.4'
1	195°03.1	08.8	345°51.6	11.8'	19°05.0	1.9'	54.4'
2	210°03.0	09.0	0°22.4	11.8'	19°03.0	2.0'	54.4'
3	225°02.9	·· 09.1	14°53.2	11.8'	19°00.9	2.1'	54.4'
4	240°02.7	09.3	29°24.0	11.8'	18°58.8	2.2'	54.4'
5	255°02.6	09.5	43°54.8	11.8'	18°56.5	2.3'	54.4'
6	270°02.5	N23°09.6	58°25.6	11.8'	S18°54.2	2.4'	54.4'
7	285°02.4	09.8	72°56.4	11.8'	18°51.7	2.5'	54.5'
8	300°02.2	09.9	87°27.2	11.8'	18°49.2	2.6'	54.5'
9	315°02.1	·· 10.1	101°58.0	11.8'	18°46.6	2.7'	54.5'
10	330°02.0	10.2	116°28.8	11.8'	18°43.9	2.7'	54.5'
11	345°01.8	10.4	130°59.6	11.8'	18°41.1	2.8'	54.5'
12	0°01.7	N23°10.5	145°30.4	11.8'	S18°38.2	2.9'	54.5'
13	15°01.6	10.7	160°01.2	11.8'	18°35.2	3.0'	54.5'
14	30°01.5	10.8	174°32.1	11.8'	18°32.2	3.1'	54.6'
15	45°01.3	·· 11.0	189°02.9	11.8'	18°29.0	3.2'	54.6'
16	60°01.2	11.1	203°33.7	11.8'	18°25.8	3.3'	54.6'
17	75°01.1	11.3	218°04.6	11.8'	18°22.5	3.4'	54.6'
18	90°00.9	N23°11.4	232°35.4	11.9'	S18°19.1	3.5'	54.6'
19	105°00.8	11.5	247°06.3	11.9'	18°15.5	3.5'	54.6'
20	120°00.7	11.7	261°37.2	11.9'	18°12.0	3.6'	54.6'
21	135°00.6	·· 11.8	276°08.0	11.9'	18°08.3	3.7'	54.7'
22	150°00.4	12.0	290°38.9	11.9'	18°04.5	3.8'	54.7'
23	165°00.3	12.1	305°09.8	11.9'	18°00.7	3.9'	54.7'
	SD.=15.7	d=0.2	S.D.=14.9				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°00.2	N23°12.3	319°40.7	11.9'	S17°56.7	4.0'	54.7'
1	195°00.0	12.4	334°11.6	11.9'	17°52.7	4.1'	54.7'
2	209°59.9	12.5	348°42.5	11.9'	17°48.6	4.2'	54.7'
3	224°59.8	·· 12.7	3°13.4	11.9'	17°44.4	4.2'	54.7'
4	239°59.6	12.8	17°44.3	11.9'	17°40.1	4.3'	54.8'
5	254°59.5	12.9	32°15.3	11.9'	17°35.7	4.4'	54.8'
6	269°59.4	N23°13.1	46°46.2	11.9'	S17°31.3	4.5'	54.8'
7	284°59.3	13.2	61°17.2	12.0'	17°26.7	4.6'	54.8'
8	299°59.1	13.4	75°48.1	12.0'	17°22.1	4.7'	54.8'
9	314°59.0	·· 13.5	90°19.1	12.0'	17°17.4	4.8'	54.9'
10	329°58.9	13.6	104°50.1	12.0'	17°12.6	4.8'	54.9'
11	344°58.7	13.8	119°21.1	12.0'	17°07.7	4.9'	54.9'
12	359°58.6	N23°13.9	133°52.1	12.0'	S17°02.8	5.0'	54.9'
13	14°58.5	14.0	148°23.1	12.0'	16°57.7	5.1'	54.9'
14	29°58.3	14.2	162°54.1	12.0'	16°52.6	5.2'	54.9'
15	44°58.2	·· 14.3	177°25.1	12.0'	16°47.4	5.3'	55.0'
16	59°58.1	14.4	191°56.2	12.0'	16°42.1	5.3'	55.0'
17	74°57.9	14.5	206°27.2	12.1'	16°36.7	5.4'	55.0'
18	89°57.8	N23°14.7	220°58.3	12.1'	S16°31.2	5.5'	55.0'
19	104°57.7	14.8	235°29.3	12.1'	16°25.7	5.6'	55.0'
20	119°57.6	14.9	250°00.4	12.1'	16°20.1	5.7'	55.1'
21	134°57.4	·· 15.0	264°31.5	12.1'	16°14.4	5.7'	55.1'
22	149°57.3	15.2	279°02.6	12.1'	16°08.6	5.8'	55.1'
23	164°57.2	15.3	293°33.7	12.1'	16°02.8	5.9'	55.1'
	SD.=15.7	d=0.1	S.D.=15.0				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°57.0	N23°15.4	308°04.9	12.1'	S15°56.8	6.0'	55.1'
1	194°56.9	15.5	322°36.0	12.1'	15°50.8	6.1'	55.2'
2	209°56.8	15.7	337°07.1	12.2'	15°44.7	6.1'	55.2'
3	224°56.6	·· 15.8	351°38.3	12.2'	15°38.5	6.2'	55.2'
4	239°56.5	15.9	6°09.5	12.2'	15°32.3	6.3'	55.2'
5	254°56.4	16.0	20°40.6	12.2'	15°25.9	6.4'	55.2'
6	269°56.2	N23°16.1	35°11.8	12.2'	S15°19.5	6.4'	55.3'
7	284°56.1	16.3	49°43.0	12.2'	15°13.0	6.5'	55.3'
8	299°56.0	16.4	64°14.2	12.2'	15°06.5	6.6'	55.3'
9	314°55.8	·· 16.5	78°45.5	12.2'	14°59.9	6.7'	55.3'
10	329°55.7	16.6	93°16.7	12.2'	14°53.1	6.7'	55.3'
11	344°55.6	16.7	107°47.9	12.2'	14°46.4	6.8'	55.4'
12	359°55.4	N23°16.8	122°19.2	12.3'	S14°39.5	6.9'	55.4'
13	14°55.3	17.0	136°50.4	12.3'	14°32.6	7.0'	55.4'
14	29°55.2	17.1	151°21.7	12.3'	14°25.5	7.0'	55.4'
15	44°55.0	·· 17.2	165°53.0	12.3'	14°18.5	7.1'	55.5'
16	59°54.9	17.3	180°24.3	12.3'	14°11.3	7.2'	55.5'
17	74°54.8	17.4	194°55.6	12.3'	14°04.1	7.3'	55.5'
18	89°54.6	N23°17.5	209°26.9	12.3'	S13°56.8	7.3'	55.5'
19	104°54.5	17.6	223°58.2	12.3'	13°49.4	7.4'	55.6'
20	119°54.4	17.7	238°29.5	12.3'	13°42.0	7.5'	55.6'
21	134°54.3	·· 17.9	253°00.8	12.3'	13°34.4	7.5'	55.6'
22	149°54.1	18.0	267°32.2	12.3'	13°26.9	7.6'	55.6'
23	164°54.0	18.1	282°03.5	12.3'	13°19.2	7.7'	55.7'
	SD.=15.7	d=0.1	S.D.=15.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°						
64°			01:35	22:26		
62°			02:11	21:49		
60°		00:56	02:37	21:24	23:06	
N 58°		01:43	02:57	21:03	22:18	
56°		02:12	03:14	20:47	21:49	
54°	00:51	02:34	03:28	20:33	21:27	23:10
52°	01:35	02:51	03:40	20:21	21:09	22:26
50°	02:01	03:06	03:51	20:10	20:54	21:59
45°	02:46	03:35	04:13	19:48	20:25	21:14
N 40°	03:16	03:58	04:31	19:30	20:03	20:44
35°	03:39	04:16	04:46	19:15	19:44	20:21
30°	03:58	04:31	04:58	19:02	19:29	20:03
20°	04:27	04:56	05:20	18:40	19:05	19:34
N 10°	04:49	05:16	05:39	18:21	18:44	19:11
0°	05:08	05:34	05:56	18:04	18:26	18:52
S 10°	05:25	05:51	06:14	17:46	18:09	18:36
20°	05:41	06:08	06:32	17:28	17:52	18:20
30°	05:57	06:27	06:53	17:07	17:33	18:03
35°	06:06	06:37	07:05	16:55	17:23	17:55
40°	06:15	06:49	07:19	16:41	17:11	17:45
45°	06:25	07:02	07:36	16:24	16:58	17:35
S 50°	06:37	07:18	07:57	16:03	16:42	17:23
52°	06:42	07:26	08:06	15:54	16:35	17:18
54°	06:48	07:34	08:17	15:43	16:26	17:13
56°	06:54	07:43	08:30	15:30	16:17	17:06
58°	07:00	07:53	08:44	15:16	16:07	17:00
S 60°	07:08	08:04	09:02	14:58	15:56	16:52

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	■	02:19	01:35	■	03:23	05:46
N 70°	00:48	00:55	00:57	03:13	04:45	06:23
68°	–:–	00:16	00:29	04:07	05:24	06:50
66°	23:49	–:–	00:09	04:40	05:50	07:10
64°	23:28	23:52	–:–	05:04	06:11	07:26
62°	23:11	23:38	23:59	05:23	06:27	07:39
60°	22:57	23:27	23:50	05:39	06:41	07:50
N 58°	22:45	23:17	23:42	05:52	06:53	08:00
56°	22:35	23:08	23:35	06:04	07:03	08:08
54°	22:26	23:00	23:29	06:14	07:12	08:16
52°	22:17	22:53	23:24	06:22	07:20	08:22
50°	22:10	22:46	23:18	06:30	07:27	08:28
45°	21:54	22:33	23:07	06:47	07:43	08:41
N 40°	21:41	22:21	22:58	07:01	07:55	08:52
35°	21:30	22:11	22:50	07:13	08:06	09:01
30°	21:20	22:03	22:43	07:23	08:15	09:09
20°	21:03	21:48	22:31	07:41	08:31	09:23
N 10°	20:49	21:35	22:21	07:56	08:45	09:35
0°	20:35	21:23	22:11	08:10	08:58	09:46
S 10°	20:21	21:11	22:01	08:24	09:11	09:57
20°	20:07	20:58	21:50	08:40	09:25	10:09
30°	19:50	20:43	21:38	08:57	09:41	10:22
35°	19:40	20:34	21:31	09:07	09:50	10:30
40°	19:29	20:25	21:23	09:18	10:00	10:39
45°	19:16	20:13	21:13	09:32	10:13	10:49
S 50°	19:00	19:59	21:02	09:48	10:27	11:01
52°	18:52	19:52	20:57	09:56	10:34	11:07
54°	18:44	19:45	20:51	10:05	10:42	11:13
56°	18:34	19:37	20:44	10:14	10:50	11:20
58°	18:23	19:28	20:37	10:25	11:00	11:28
S 60°	18:11	19:17	20:28	10:38	11:11	11:37

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 18-20 92-79%
12	00:13	00:07	12:00	01:58	14:23	
13	00:01	00:06	12:00	02:47	15:11	
14	00:12	00:18	12:00	03:35	15:58	

June 15, 16, 17 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	263°28.0	226°16.3	N11°53.5	165°58.2	N24°12.1	70°43.8	S03°57.9	359°21.4	S21°58.2
1	278°30.5	241°16.3	54.3	180°58.8	12.0	85°46.3	57.9	14°24.1	58.2
2	293°33.0	256°16.2	55.1	195°59.5	11.9	100°48.7	58.0	29°26.8	58.2
3	308°35.4	271°16.2	·· 55.8	211°00.2	·· 11.9	115°51.1	·· 58.0	44°29.4	·· 58.2
4	323°37.9	286°16.2	56.6	226°00.8	11.8	130°53.6	58.0	59°32.1	58.2
5	338°40.4	301°16.1	57.4	241°01.5	11.7	145°56.0	58.0	74°34.7	58.1
6	353°42.8	316°16.1	N11°58.1	256°02.1	N24°11.6	160°58.4	S03°58.1	89°37.4	S21°58.1
7	8°45.3	331°16.1	58.9	271°02.8	11.6	176°00.9	58.1	104°40.1	58.1
8	23°47.8	346°16.0	11°59.7	286°03.4	11.5	191°03.3	58.1	119°42.7	58.1
9	38°50.2	1°16.0	12°00.4	301°04.1	·· 11.4	206°05.7	·· 58.1	134°45.4	·· 58.1
10	53°52.7	16°15.9	01.2	316°04.8	11.3	221°08.1	58.2	149°48.1	58.1
11	68°55.1	31°15.9	02.0	331°05.4	11.3	236°10.6	58.2	164°50.7	58.1
12	83°57.6	46°15.9	N12°02.7	346°06.1	N24°11.2	251°13.0	S03°58.2	179°53.4	S21°58.1
13	99°00.1	61°15.8	03.5	1°06.7	11.1	266°15.4	58.3	194°56.0	58.1
14	114°02.5	76°15.8	04.3	16°07.4	11.0	281°17.8	58.3	209°58.7	58.1
15	129°05.0	91°15.7	·· 05.0	31°08.1	·· 10.9	296°20.3	·· 58.3	225°01.4	·· 58.1
16	144°07.5	106°15.7	05.8	46°08.7	10.9	311°22.7	58.3	240°04.0	58.1
17	159°09.9	121°15.7	06.6	61°09.4	10.8	326°25.1	58.4	255°06.7	58.1
18	174°12.4	136°15.6	N12°07.3	76°10.0	N24°10.7	341°27.6	S03°58.4	270°09.4	S21°58.1
19	189°14.9	151°15.6	08.1	91°10.7	10.6	356°30.0	58.4	285°12.0	58.1
20	204°17.3	166°15.5	08.9	106°11.4	10.6	11°32.4	58.4	300°14.7	58.1
21	219°19.8	181°15.5	·· 09.6	121°12.0	·· 10.5	26°34.8	·· 58.5	315°17.4	·· 58.1
22	234°22.3	196°15.4	10.4	136°12.7	10.4	41°37.3	58.5	330°20.0	58.1
23	249°24.7	211°15.4	11.2	151°13.3	10.3	56°39.7	58.5	345°22.7	58.1
Mer.pass.:06:25		v-0.0 d0.8 m-4.2		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	264°27.2	226°15.3	N12°11.9	166°14.0	N24°10.2	71°42.1	S03°58.6	0°25.3	S21°58.1
1	279°29.6	241°15.3	12.7	181°14.7	10.1	86°44.5	58.6	15°28.0	58.1
2	294°32.1	256°15.2	13.5	196°15.3	10.1	101°47.0	58.6	30°30.7	58.1
3	309°34.6	271°15.2	·· 14.2	211°16.0	·· 10.0	116°49.4	·· 58.6	45°33.3	·· 58.0
4	324°37.0	286°15.1	15.0	226°16.6	09.9	131°51.8	58.7	60°36.0	58.0
5	339°39.5	301°15.1	15.7	241°17.3	09.8	146°54.2	58.7	75°38.7	58.0
6	354°42.0	316°15.0	N12°16.5	256°18.0	N24°09.7	161°56.7	S03°58.7	90°41.3	S21°58.0
7	9°44.4	331°15.0	17.3	271°18.6	09.6	176°59.1	58.8	105°44.0	58.0
8	24°46.9	346°14.9	18.0	286°19.3	09.6	192°01.5	58.8	120°46.6	58.0
9	39°49.4	1°14.9	·· 18.8	301°19.9	·· 09.5	207°03.9	·· 58.8	135°49.3	·· 58.0
10	54°51.8	16°14.8	19.6	316°20.6	09.4	222°06.3	58.9	150°52.0	58.0
11	69°54.3	31°14.8	20.3	331°21.3	09.3	237°08.8	58.9	165°54.6	58.0
12	84°56.7	46°14.7	N12°21.1	346°21.9	N24°09.2	252°11.2	S03°58.9	180°57.3	S21°58.0
13	99°59.2	61°14.7	21.9	1°22.6	09.1	267°13.6	58.9	196°00.0	58.0
14	115°01.7	76°14.6	22.6	16°23.2	09.1	282°16.0	59.0	211°02.6	58.0
15	130°04.1	91°14.5	·· 23.4	31°23.9	·· 09.0	297°18.4	·· 59.0	226°05.3	·· 58.0
16	145°06.6	106°14.5	24.2	46°24.6	08.9	312°20.9	59.0	241°07.9	58.0
17	160°09.1	121°14.4	24.9	61°25.2	08.8	327°23.3	59.1	256°10.6	58.0
18	175°11.5	136°14.4	N12°25.7	76°25.9	N24°08.7	342°25.7	S03°59.1	271°13.3	S21°58.0
19	190°14.0	151°14.3	26.5	91°26.6	08.6	357°28.1	59.1	286°15.9	58.0
20	205°16.5	166°14.3	27.2	106°27.2	08.5	12°30.5	59.2	301°18.6	58.0
21	220°18.9	181°14.2	·· 28.0	121°27.9	·· 08.4	27°33.0	·· 59.2	316°21.3	·· 58.0
22	235°21.4	196°14.1	28.7	136°28.5	08.3	42°35.4	59.2	331°23.9	58.0
23	250°23.9	211°14.1	29.5	151°29.2	08.3	57°37.8	59.2	346°26.6	58.0
Mer.pass.:06:21		v-0.0 d0.8 m-4.2		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	265°26.3	226°14.0	N12°30.3	166°29.9	N24°08.2	72°40.2	S03°59.3	1°29.3	S21°58.0
1	280°28.8	241°13.9	31.0	181°30.5	08.1	87°42.6	59.3	16°31.9	58.0
2	295°31.2	256°13.9	31.8	196°31.2	08.0	102°45.0	59.3	31°34.6	57.9
3	310°33.7	271°13.8	·· 32.6	211°31.8	·· 07.9	117°47.5	·· 59.4	46°37.2	·· 57.9
4	325°36.2	286°13.7	33.3	226°32.5	07.8	132°49.9	59.4	61°39.9	57.9
5	340°38.6	301°13.7	34.1	241°33.2	07.7	147°52.3	59.4	76°42.6	57.9
6	355°41.1	316°13.6	N12°34.9	256°33.8	N24°07.6	162°54.7	S03°59.5	91°45.2	S21°57.9
7	10°43.6	331°13.5	35.6	271°34.5	07.5	177°57.1	59.5	106°47.9	57.9
8	25°46.0	346°13.5	36.4	286°35.2	07.4	192°59.5	59.5	121°50.6	57.9
9	40°48.5	1°13.4	·· 37.1	301°35.8	·· 07.3	208°02.0	·· 59.6	136°53.2	·· 57.9
10	55°51.0	16°13.3	37.9	316°36.5	07.3	223°04.4	59.6	151°55.9	57.9
11	70°53.4	31°13.3	38.7	331°37.2	07.2	238°06.8	59.6	166°58.5	57.9
12	85°55.9	46°13.2	N12°39.4	346°37.8	N24°07.1	253°09.2	S03°59.7	182°01.2	S21°57.9
13	100°58.3	61°13.1	40.2	1°38.5	07.0	268°11.6	59.7	197°03.9	57.9
14	116°00.8	76°13.0	40.9	16°39.1	06.9	283°14.0	59.7	212°06.5	57.9
15	131°03.3	91°13.0	·· 41.7	31°39.8	·· 06.8	298°16.4	·· 59.8	227°09.2	·· 57.9
16	146°05.7	106°12.9	42.5	46°40.5	06.7	313°18.9	59.8	242°11.9	57.9
17	161°08.2	121°12.8	43.2	61°41.1	06.6	328°21.3	59.8	257°14.5	57.9
18	176°10.7	136°12.7	N12°44.0	76°41.8	N24°06.5	343°23.7	S03°59.9	272°17.2	S21°57.9
19	191°13.1	151°12.7	44.8	91°42.5	06.4	358°26.1	59.9	287°19.8	57.9
20	206°15.6	166°12.6	45.5	106°43.1	06.3	13°28.5	03°59.9	302°22.5	57.9
21	221°18.1	181°12.5	·· 46.3	121°43.8	·· 06.2	28°30.9	04°00.0	317°25.2	·· 57.9
22	236°20.5	196°12.4	47.0	136°44.5	06.1	43°33.3	00.0	332°27.8	57.9
23	251°23.0	211°12.4	47.8	151°45.1	06.0	58°35.7	00.0	347°30.5	57.9
Mer.pass.:06:17		v-0.1 d0.8 m-4.1		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Stars

	SHA	Dec
Alpheratz	357°40.7	29°11.0
Ankaa	353°13.2	-42°12.5
Schedar	349°37.5	56°37.6
Diphda	348°53.3	-17°53.5
Achernar	335°25.2	-57°08.8
Hamal	327°57.9	23°32.4
Polaris	316°53.3	89°19.9
Acamar	315°16.7	-40°14.1
Menkar	314°12.5	4°09.3
Mirfak	308°36.9	49°55.0
Aldebaran	290°46.6	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°30.9	46°00.7
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.5
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.6
Pollux	243°24.8	27°58.9
Avior	234°17.4	-59°34.2
Suhail	222°50.7	-43°30.5
Miaplacidus	221°39.6	-69°47.7
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.7	61°39.7
Denebola	182°30.9	14°28.6
Gienah	175°49.5	-17°38.4
Acrux	173°06.0	-63°12.0
Gacrux	171°57.6	-57°12.8
Alioth	166°18.2	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.6	49°13.9
Hadar	148°43.5	-60°27.5
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.5	-60°54.4
Kochab	137°19.4	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.4
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.0
Eltanin	90°44.3	51°29.4
Kaus Aust.	83°39.8	-34°22.3
Vega	80°36.7	38°48.1
Nunki	75°54.6	-26°16.3
Altair	62°05.3	8°55.0
Peacock	53°14.6	-56°40.4
Deneb	49°29.3	45°20.5
Enif	33°44.3	9°57.3
Al Na'ir	27°40.2	-46°52.3
Fomalhaut	15°21.0	-29°31.6
Scheat	13°50.7	28°10.5
Markab	13°35.6	15°17.8

Jun 15 Thu	SHA	Mer.pass
Venus	322°48.3	08:55
Mars	262°30.1	12:56
Jupiter	167°15.8	19:14
Saturn	95°53.4	00:03

Jun 16 Fri	SHA	Mer.pass
Venus	321°48.2	08:55
Mars	261°46.8	12:54
Jupiter	167°14.9	19:10
Saturn	95°58.2	23:54

Jun 17 Sat	SHA	Mer.pass
Venus	320°47.7	08:55
Mars	261°03.5	12:53
Jupiter	167°13.9	19:06
Saturn	96°02.9	23:50

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3708 sec ΔT = TT-UT1 = +68.8132 sec

2017 June 15 to Jun. 17 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	179°53.9	N23°18.2	296°34.9	12.4′	S13°11.5	7.8′	55.7′
1	194°53.7	18.3	311°06.2	12.4′	13°03.7	7.8′	55.7′
2	209°53.6	18.4	325°37.6	12.4′	12°55.8	7.9′	55.7′
3	224°53.5	·· 18.5	340°09.0	12.4′	12°47.9	8.0′	55.8′
4	239°53.3	18.6	354°40.3	12.4′	12°39.9	8.0′	55.8′
5	254°53.2	18.7	9°11.7	12.4′	12°31.8	8.1′	55.8′
6	269°53.1	N23°18.8	23°43.1	12.4′	S12°23.7	8.2′	55.8′
7	284°52.9	18.9	38°14.5	12.4′	12°15.5	8.2′	55.9′
8	299°52.8	19.0	52°45.9	12.4′	12°07.3	8.3′	55.9′
9	314°52.7	·· 19.1	67°17.3	12.4′	11°58.9	8.4′	55.9′
10	329°52.5	19.2	81°48.7	12.4′	11°50.5	8.4′	55.9′
11	344°52.4	19.3	96°20.2	12.4′	11°42.1	8.5′	56.0′
12	359°52.3	N23°19.4	110°51.6	12.4′	S11°33.6	8.5′	56.0′
13	14°52.1	19.5	125°23.0	12.4′	11°25.0	8.6′	56.0′
14	29°52.0	19.6	139°54.4	12.4′	11°16.4	8.7′	56.0′
15	44°51.9	·· 19.7	154°25.9	12.4′	11°07.7	8.7′	56.1′
16	59°51.7	19.8	168°57.3	12.4′	10°58.9	8.8′	56.1′
17	74°51.6	19.9	183°28.7	12.4′	10°50.1	8.9′	56.1′
18	89°51.5	N23°20.0	198°00.2	12.4′	S10°41.2	8.9′	56.2′
19	104°51.3	20.1	212°31.6	12.4′	10°32.3	9.0′	56.2′
20	119°51.2	20.2	227°03.0	12.4′	10°23.2	9.0′	56.2′
21	134°51.0	·· 20.3	241°34.5	12.4′	10°14.2	9.1′	56.2′
22	149°50.9	20.3	256°05.9	12.4′	10°05.1	9.1′	56.3′
23	164°50.8	20.4	270°37.3	12.4′	09°55.9	9.2′	56.3′
	SD.=15.7	d=0.1	S.D.=15.3				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	179°50.6	N23°20.5	285°08.8	12.4′	S09°46.7	9.3′	56.3′
1	194°50.5	20.6	299°40.2	12.4′	09°37.4	9.3′	56.4′
2	209°50.4	20.7	314°11.6	12.4′	09°28.0	9.4′	56.4′
3	224°50.2	·· 20.8	328°43.0	12.4′	09°18.6	9.4′	56.4′
4	239°50.1	20.9	343°14.4	12.4′	09°09.2	9.5′	56.4′
5	254°50.0	21.0	357°45.9	12.4′	08°59.7	9.5′	56.5′
6	269°49.8	N23°21.0	12°17.3	12.4′	S08°50.1	9.6′	56.5′
7	284°49.7	21.1	26°48.7	12.4′	08°40.5	9.6′	56.5′
8	299°49.6	21.2	41°20.1	12.4′	08°30.9	9.7′	56.6′
9	314°49.4	·· 21.3	55°51.5	12.4′	08°21.1	9.7′	56.6′
10	329°49.3	21.4	70°22.9	12.4′	08°11.4	9.8′	56.6′
11	344°49.2	21.5	84°54.2	12.4′	08°01.6	9.8′	56.7′
12	359°49.0	N23°21.5	99°25.6	12.4′	S07°51.7	9.9′	56.7′
13	14°48.9	21.6	113°57.0	12.4′	07°41.8	9.9′	56.7′
14	29°48.8	21.7	128°28.3	12.3′	07°31.8	10.0′	56.8′
15	44°48.6	·· 21.8	142°59.7	12.3′	07°21.8	10.0′	56.8′
16	59°48.5	21.9	157°31.0	12.3′	07°11.8	10.1′	56.8′
17	74°48.4	21.9	172°02.3	12.3′	07°01.7	10.1′	56.8′
18	89°48.2	N23°22.0	186°33.6	12.3′	S06°51.5	10.2′	56.9′
19	104°48.1	22.1	201°04.9	12.3′	06°41.3	10.2′	56.9′
20	119°48.0	22.2	215°36.2	12.3′	06°31.1	10.3′	56.9′
21	134°47.8	·· 22.2	230°07.5	12.3′	06°20.8	10.3′	57.0′
22	149°47.7	22.3	244°38.7	12.2′	06°10.5	10.3′	57.0′
23	164°47.5	22.4	259°10.0	12.2′	06°00.1	10.4′	57.0′
	SD.=15.7	d=0.1	S.D.=15.5				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	179°47.4	N23°22.5	273°41.2	12.2′	S05°49.7	10.4′	57.1′
1	194°47.3	22.5	288°12.4	12.2′	05°39.3	10.5′	57.1′
2	209°47.1	22.6	302°43.6	12.2′	05°28.8	10.5′	57.1′
3	224°47.0	·· 22.7	317°14.8	12.2′	05°18.3	10.5′	57.2′
4	239°46.9	22.7	331°45.9	12.1′	05°07.7	10.6′	57.2′
5	254°46.7	22.8	346°17.0	12.1′	04°57.1	10.6′	57.2′
6	269°46.6	N23°22.9	0°48.2	12.1′	S04°46.5	10.7′	57.3′
7	284°46.5	22.9	15°19.2	12.1′	04°35.8	10.7′	57.3′
8	299°46.3	23.0	29°50.3	12.1′	04°25.1	10.7′	57.3′
9	314°46.2	·· 23.1	44°21.4	12.0′	04°14.4	10.8′	57.4′
10	329°46.1	23.1	58°52.4	12.0′	04°03.6	10.8′	57.4′
11	344°45.9	23.2	73°23.4	12.0′	03°52.8	10.8′	57.5′
12	359°45.8	N23°23.3	87°54.4	12.0′	S03°41.9	10.9′	57.5′
13	14°45.7	23.3	102°25.3	11.9′	03°31.0	10.9′	57.5′
14	29°45.5	23.4	116°56.3	11.9′	03°20.1	10.9′	57.6′
15	44°45.4	·· 23.5	131°27.2	11.9′	03°09.2	11.0′	57.6′
16	59°45.2	23.5	145°58.0	11.9′	02°58.2	11.0′	57.6′
17	74°45.1	23.6	160°28.9	11.8′	02°47.3	11.0′	57.7′
18	89°45.0	N23°23.6	174°59.7	11.8′	S02°36.2	11.0′	57.7′
19	104°44.8	23.7	189°30.5	11.8′	02°25.2	11.1′	57.7′
20	119°44.7	23.8	204°01.2	11.7′	02°14.1	11.1′	57.8′
21	134°44.6	·· 23.8	218°32.0	11.7′	02°03.0	11.1′	57.8′
22	149°44.4	23.9	233°02.7	11.7′	01°51.9	11.1′	57.8′
23	164°44.3	23.9	247°33.3	11.6′	01°40.7	11.2′	57.9′
	SD.=15.7	d=0.1	S.D.=15.7				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	▭	▭	▭	▭
66°	▭	▭	▭	▭	▭	▭
64°	▭	▭	01:33	22:30	▭	▭
62°	▭	▭	02:10	21:52	▭	▭
60°	▭	00:52	02:36	21:26	23:11	▭
N 58°	▭	01:41	02:56	21:05	22:21	▭
56°	▭	02:11	03:13	20:49	21:51	▭
54°	00:47	02:33	03:27	20:35	21:29	23:15
52°	01:33	02:51	03:39	20:22	21:11	22:29
50°	02:00	03:06	03:50	20:11	20:56	22:01
45°	02:46	03:35	04:13	19:49	20:26	21:16
N 40°	03:16	03:58	04:31	19:31	20:04	20:45
35°	03:39	04:16	04:46	19:16	19:46	20:22
30°	03:58	04:31	04:59	19:03	19:30	20:04
20°	04:27	04:56	05:21	18:41	19:05	19:35
N 10°	04:49	05:16	05:40	18:22	18:45	19:12
0°	05:08	05:35	05:57	18:04	18:27	18:53
S 10°	05:25	05:52	06:14	17:47	18:10	18:36
20°	05:41	06:09	06:33	17:28	17:53	18:20
30°	05:58	06:28	06:54	17:07	17:34	18:04
35°	06:07	06:38	07:06	16:55	17:23	17:55
40°	06:16	06:50	07:21	16:41	17:11	17:45
45°	06:26	07:04	07:37	16:24	16:58	17:35
S 50°	06:38	07:20	07:58	16:03	16:42	17:23
52°	06:43	07:27	08:08	15:53	16:34	17:18
54°	06:49	07:35	08:19	15:42	16:26	17:12
56°	06:55	07:44	08:32	15:30	16:17	17:06
58°	07:02	07:54	08:46	15:15	16:07	17:00
S 60°	07:09	08:06	09:04	14:58	15:55	16:52

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	01:20	01:09	01:00	07:40	09:29	11:18
N 70°	00:56	00:54	00:52	08:03	09:43	11:24
68°	00:37	00:42	00:45	08:20	09:53	11:28
66°	00:22	00:32	00:40	08:34	10:02	11:32
64°	00:10	00:24	00:35	08:46	10:09	11:35
62°	–:–	00:16	00:31	08:55	10:15	11:38
60°	–:–	00:10	00:27	09:04	10:21	11:41
N 58°	–:–	00:04	00:24	09:11	10:26	11:43
56°	23:59	–:–	00:21	09:17	10:30	11:45
54°	23:55	–:–	00:19	09:23	10:34	11:46
52°	23:51	–:–	00:16	09:28	10:37	11:48
50°	23:47	–:–	00:14	09:33	10:40	11:49
45°	23:39	–:–	00:10	09:43	10:47	11:52
N 40°	23:33	–:–	00:06	09:51	10:52	11:55
35°	23:27	–:–	00:02	09:58	10:57	11:57
30°	23:22	23:59	–:–	10:05	11:01	11:59
20°	23:13	23:54	–:–	10:15	11:08	12:03
N 10°	23:05	23:50	–:–	10:25	11:15	12:05
0°	22:58	23:45	–:–	10:33	11:21	12:08
S 10°	22:51	23:41	–:–	10:42	11:26	12:11
20°	22:43	23:36	–:–	10:51	11:33	12:14
30°	22:34	23:31	–:–	11:02	11:40	12:17
35°	22:29	23:28	–:–	11:08	11:44	12:19
40°	22:23	23:25	–:–	11:14	11:48	12:21
45°	22:16	23:21	–:–	11:22	11:53	12:23
S 50°	22:08	23:16	–:–	11:32	11:59	12:26
52°	22:04	23:14	–:–	11:36	12:02	12:27
54°	22:00	23:11	–:–	11:41	12:05	12:28
56°	21:55	23:09	–:–	11:46	12:09	12:30
58°	21:50	23:06	–:–	11:52	12:13	12:32
S 60°	21:44	23:02	–:–	11:59	12:17	12:33

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 21-23 70-50%
15	00:25	00:31	12:01	04:22	16:46	
16	00:37	00:44	12:01	05:09	17:33	
17	00:50	00:57	12:01	05:57	18:21	

June 18, 19, 20 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	266°25.5	226°12.3	N12°48.6	166°45.8	N24°05.9	73°38.2	S04°00.1	2°33.2	S21°57.9
1	281°27.9	241°12.2	49.3	181°46.4	05.8	88°40.6	00.1	17°35.8	57.8
2	296°30.4	256°12.1	50.1	196°47.1	05.7	103°43.0	00.1	32°38.5	57.8
3	311°32.8	271°12.0	·· 50.8	211°47.8	·· 05.6	118°45.4	·· 00.2	47°41.1	·· 57.8
4	326°35.3	286°12.0	51.6	226°48.4	05.5	133°47.8	00.2	62°43.8	57.8
5	341°37.8	301°11.9	52.4	241°49.1	05.4	148°50.2	00.2	77°46.5	57.8
6	356°40.2	316°11.8	N12°53.1	256°49.8	N24°05.3	163°52.6	S04°00.3	92°49.1	S21°57.8
7	11°42.7	331°11.7	53.9	271°50.4	05.2	178°55.0	00.3	107°51.8	57.8
8	26°45.2	346°11.6	54.6	286°51.1	05.1	193°57.4	00.4	122°54.5	57.8
9	41°47.6	1°11.5	·· 55.4	301°51.8	·· 05.0	208°59.8	·· 00.4	137°57.1	·· 57.8
10	56°50.1	16°11.5	56.2	316°52.4	04.9	224°02.3	00.4	152°59.8	57.8
11	71°52.6	31°11.4	56.9	331°53.1	04.8	239°04.7	00.5	168°02.4	57.8
12	86°55.0	46°11.3	N12°57.7	346°53.8	N24°04.7	254°07.1	S04°00.5	183°05.1	S21°57.8
13	101°57.5	61°11.2	58.4	1°54.4	04.6	269°09.5	00.5	198°07.8	57.8
14	117°00.0	76°11.1	12°59.2	16°55.1	04.5	284°11.9	00.6	213°10.4	57.8
15	132°02.4	91°11.0	13°00.0	31°55.8	·· 04.4	299°14.3	·· 00.6	228°13.1	·· 57.8
16	147°04.9	106°10.9	00.7	46°56.4	04.3	314°16.7	00.6	243°15.8	57.8
17	162°07.3	121°10.8	01.5	61°57.1	04.2	329°19.1	00.7	258°18.4	57.8
18	177°09.8	136°10.8	N13°02.2	76°57.8	N24°04.1	344°21.5	S04°00.7	273°21.1	S21°57.8
19	192°12.3	151°10.7	03.0	91°58.4	04.0	359°23.9	00.7	288°23.7	57.8
20	207°14.7	166°10.6	03.7	106°59.1	03.9	14°26.3	00.8	303°26.4	57.8
21	222°17.2	181°10.5	·· 04.5	121°59.8	·· 03.8	29°28.7	·· 00.8	318°29.1	·· 57.8
22	237°19.7	196°10.4	05.3	137°00.4	03.7	44°31.1	00.9	333°31.7	57.8
23	252°22.1	211°10.3	06.0	152°01.1	03.6	59°33.5	00.9	348°34.4	57.7
Mer.pass.:06:13		v-0.1 d0.8 m-4.1		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	267°24.6	226°10.2	N13°06.8	167°01.8	N24°03.5	74°35.9	S04°00.9	3°37.1	S21°57.7
1	282°27.1	241°10.1	07.5	182°02.4	03.4	89°38.3	01.0	18°39.7	57.7
2	297°29.5	256°10.0	08.3	197°03.1	03.2	104°40.7	01.0	33°42.4	57.7
3	312°32.0	271°09.9	·· 09.0	212°03.8	·· 03.1	119°43.1	·· 01.0	48°45.0	·· 57.7
4	327°34.4	286°09.8	09.8	227°04.4	03.0	134°45.6	01.1	63°47.7	57.7
5	342°36.9	301°09.7	10.6	242°05.1	02.9	149°48.0	01.1	78°50.4	57.7
6	357°39.4	316°09.6	N13°11.3	257°05.8	N24°02.8	164°50.4	S04°01.2	93°53.0	S21°57.7
7	12°41.8	331°09.5	12.1	272°06.4	02.7	179°52.8	01.2	108°55.7	57.7
8	27°44.3	346°09.4	12.8	287°07.1	02.6	194°55.2	01.2	123°58.4	57.7
9	42°46.8	1°09.3	·· 13.6	302°07.8	·· 02.5	209°57.6	·· 01.3	139°01.0	·· 57.7
10	57°49.2	16°09.2	14.3	317°08.4	02.4	225°00.0	01.3	154°03.7	57.7
11	72°51.7	31°09.1	15.1	332°09.1	02.3	240°02.4	01.3	169°06.3	57.7
12	87°54.2	46°09.0	N13°15.8	347°09.8	N24°02.2	255°04.8	S04°01.4	184°09.0	S21°57.7
13	102°56.6	61°08.9	16.6	2°10.4	02.1	270°07.2	01.4	199°11.7	57.7
14	117°59.1	76°08.8	17.4	17°11.1	01.9	285°09.6	01.5	214°14.3	57.7
15	133°01.6	91°08.7	·· 18.1	32°11.8	·· 01.8	300°12.0	·· 01.5	229°17.0	·· 57.7
16	148°04.0	106°08.6	18.9	47°12.4	01.7	315°14.4	01.5	244°19.7	57.7
17	163°06.5	121°08.5	19.6	62°13.1	01.6	330°16.8	01.6	259°22.3	57.7
18	178°08.9	136°08.4	N13°20.4	77°13.8	N24°01.5	345°19.2	S04°01.6	274°25.0	S21°57.7
19	193°11.4	151°08.3	21.1	92°14.4	01.4	0°21.6	01.7	289°27.6	57.7
20	208°13.9	166°08.2	21.9	107°15.1	01.3	15°24.0	01.7	304°30.3	57.7
21	223°16.3	181°08.1	·· 22.6	122°15.8	·· 01.2	30°26.4	·· 01.7	319°33.0	·· 57.7
22	238°18.8	196°07.9	23.4	137°16.4	01.0	45°28.8	01.8	334°35.6	57.6
23	253°21.3	211°07.8	24.1	152°17.1	00.9	60°31.2	01.8	349°38.3	57.6
Mer.pass.:06:09		v-0.1 d0.8 m-4.1		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	268°23.7	226°07.7	N13°24.9	167°17.8	N24°00.8	75°33.6	S04°01.9	4°41.0	S21°57.6
1	283°26.2	241°07.6	25.6	182°18.5	00.7	90°36.0	01.9	19°43.6	57.6
2	298°28.7	256°07.5	26.4	197°19.1	00.6	105°38.3	01.9	34°46.3	57.6
3	313°31.1	271°07.4	·· 27.1	212°19.8	·· 00.5	120°40.7	·· 02.0	49°48.9	·· 57.6
4	328°33.6	286°07.3	27.9	227°20.5	00.4	135°43.1	02.0	64°51.6	57.6
5	343°36.1	301°07.2	28.7	242°21.1	00.2	150°45.5	02.1	79°54.3	57.6
6	358°38.5	316°07.1	N13°29.4	257°21.8	N24°00.1	165°47.9	S04°02.1	94°56.9	S21°57.6
7	13°41.0	331°06.9	30.2	272°22.5	24°00.0	180°50.3	02.1	109°59.6	57.6
8	28°43.4	346°06.8	30.9	287°23.1	23°59.9	195°52.7	02.2	125°02.2	57.6
9	43°45.9	1°06.7	·· 31.7	302°23.8	·· 59.8	210°55.1	·· 02.2	140°04.9	·· 57.6
10	58°48.4	16°06.6	32.4	317°24.5	59.7	225°57.5	02.3	155°07.6	57.6
11	73°50.8	31°06.5	33.2	332°25.2	59.5	240°59.9	02.3	170°10.2	57.6
12	88°53.3	46°06.4	N13°33.9	347°25.8	N23°59.4	256°02.3	S04°02.3	185°12.9	S21°57.6
13	103°55.8	61°06.2	34.7	2°26.5	59.3	271°04.7	02.4	200°15.6	57.6
14	118°58.2	76°06.1	35.4	17°27.2	59.2	286°07.1	02.4	215°18.2	57.6
15	134°00.7	91°06.0	·· 36.2	32°27.8	·· 59.1	301°09.5	·· 02.5	230°20.9	·· 57.6
16	149°03.2	106°05.9	36.9	47°28.5	58.9	316°11.9	02.5	245°23.5	57.6
17	164°05.6	121°05.8	37.7	62°29.2	58.8	331°14.3	02.6	260°26.2	57.6
18	179°08.1	136°05.6	N13°38.4	77°29.8	N23°58.7	346°16.7	S04°02.6	275°28.9	S21°57.6
19	194°10.5	151°05.5	39.2	92°30.5	58.6	1°19.1	02.6	290°31.5	57.6
20	209°13.0	166°05.4	39.9	107°31.2	58.5	16°21.4	02.7	305°34.2	57.6
21	224°15.5	181°05.3	·· 40.7	122°31.9	·· 58.3	31°23.8	·· 02.7	320°36.9	·· 57.5
22	239°17.9	196°05.1	41.4	137°32.5	58.2	46°26.2	02.8	335°39.5	57.5
23	254°20.4	211°05.0	42.2	152°33.2	58.1	61°28.6	02.8	350°42.2	57.5
Mer.pass.:06:05		v-0.1 d0.8 m-4.1		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Stars

	SHA	**Dec**
Alpheratz	357°40.7	29°11.0
Ankaa	353°13.2	-42°12.5
Schedar	349°37.5	56°37.6
Diphda	348°53.3	-17°53.5
Achernar	335°25.1	-57°08.8
Hamal	327°57.9	23°32.4
Polaris	316°52.3	89°19.9
Acamar	315°16.7	-40°14.1
Menkar	314°12.5	4°09.3
Mirfak	308°36.8	49°55.0
Aldebaran	290°46.6	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°30.9	46°00.6
Bellatrix	278°29.5	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.5
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.4	-59°34.2
Suhail	222°50.7	-43°30.4
Miaplacidus	221°39.6	-69°47.6
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.7	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.4
Acrux	173°06.0	-63°12.0
Gacrux	171°57.7	-57°12.8
Alioth	166°18.3	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.6	49°13.9
Hadar	148°43.6	-60°27.5
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.7
Rigil Kent.	139°47.5	-60°54.5
Kochab	137°19.4	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.6
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.4
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.3	51°29.4
Kaus Aust.	83°39.8	-34°22.3
Vega	80°36.7	38°48.1
Nunki	75°54.6	-26°16.3
Altair	62°05.3	8°55.0
Peacock	53°14.6	-56°40.4
Deneb	49°29.2	45°20.5
Enif	33°44.3	9°57.3
Al Na'ir	27°40.2	-46°52.3
Fomalhaut	15°21.0	-29°31.6
Scheat	13°50.6	28°10.5
Markab	13°35.6	15°17.8

Jun 18 Sun	**SHA**	**Mer.pass**
Venus	319°46.8	08:55
Mars	260°20.3	12:52
Jupiter	167°12.7	19:02
Saturn	96°07.7	23:46

Jun 19 Mon	**SHA**	**Mer.pass**
Venus	318°45.6	08:55
Mars	259°37.2	12:51
Jupiter	167°11.3	18:59
Saturn	96°12.5	23:41

Jun 20 Tue	**SHA**	**Mer.pass**
Venus	317°44.0	08:56
Mars	258°54.1	12:50
Jupiter	167°09.8	18:55
Saturn	96°17.2	23:37

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3687 sec ΔT = TT-UT1 = +68.8153 sec

2017 June 18 to Jun. 20 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°44.2	N23°24.0	262°04.0	11.6'	S01°29.6	11.2'	57.9'
1	194°44.0	24.0	276°34.5	11.6'	01°18.4	11.2'	57.9'
2	209°43.9	24.1	291°05.1	11.5'	01°07.2	11.2'	58.0'
3	224°43.8	·· 24.1	305°35.6	11.5'	00°55.9	11.2'	58.0'
4	239°43.6	24.2	320°06.1	11.5'	00°44.7	11.3'	58.1'
5	254°43.5	24.2	334°36.6	11.4'	00°33.4	11.3'	58.1'
6	269°43.3	N23°24.3	349°07.0	11.4'	S00°22.1	11.3'	58.1'
7	284°43.2	24.3	3°37.3	11.3'	S00°10.8	11.3'	58.2'
8	299°43.1	24.4	18°07.7	11.3'	N00°00.5	11.3'	58.2'
9	314°42.9	·· 24.4	32°37.9	11.3'	00°11.8	11.3'	58.2'
10	329°42.8	24.5	47°08.2	11.2'	00°23.2	11.4'	58.3'
11	344°42.7	24.5	61°38.4	11.2'	00°34.5	11.4'	58.3'
12	359°42.5	N23°24.6	76°08.6	11.1'	N00°45.9	11.4'	58.3'
13	14°42.4	24.6	90°38.7	11.1'	00°57.3	11.4'	58.4'
14	29°42.3	24.7	105°08.7	11.0'	01°08.7	11.4'	58.4'
15	44°42.1	·· 24.7	119°38.8	11.0'	01°20.1	11.4'	58.4'
16	59°42.0	24.8	134°08.8	11.0'	01°31.5	11.4'	58.5'
17	74°41.8	24.8	148°38.7	10.9'	01°42.9	11.4'	58.5'
18	89°41.7	N23°24.8	163°08.6	10.9'	N01°54.3	11.4'	58.6'
19	104°41.6	24.9	177°38.4	10.8'	02°05.7	11.4'	58.6'
20	119°41.4	24.9	192°08.2	10.8'	02°17.1	11.4'	58.6'
21	134°41.3	·· 25.0	206°37.9	10.7'	02°28.6	11.4'	58.7'
22	149°41.2	25.0	221°07.6	10.7'	02°40.0	11.4'	58.7'
23	164°41.0	25.0	235°37.2	10.6'	02°51.4	11.4'	58.7'
	SD.=15.7	d=0.1		S.D.=15.9			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°40.9	N23°25.1	250°06.8	10.6'	N03°02.9	11.4'	58.8'
1	194°40.8	25.1	264°36.4	10.5'	03°14.3	11.4'	58.8'
2	209°40.6	25.2	279°05.8	10.4'	03°25.7	11.4'	58.8'
3	224°40.5	·· 25.2	293°35.2	10.4'	03°37.1	11.4'	58.9'
4	239°40.3	25.2	308°04.6	10.3'	03°48.5	11.4'	58.9'
5	254°40.2	25.3	322°33.9	10.3'	03°59.9	11.4'	59.0'
6	269°40.1	N23°25.3	337°03.2	10.2'	N04°11.3	11.4'	59.0'
7	284°39.9	25.3	351°32.3	10.2'	04°22.7	11.4'	59.0'
8	299°39.8	25.4	6°01.5	10.1'	04°34.1	11.4'	59.1'
9	314°39.7	·· 25.4	20°30.5	10.0'	04°45.5	11.4'	59.1'
10	329°39.5	25.4	34°59.5	10.0'	04°56.8	11.4'	59.1'
11	344°39.4	25.5	49°28.5	9.9'	05°08.2	11.3'	59.2'
12	359°39.2	N23°25.5	63°57.4	9.9'	N05°19.5	11.3'	59.2'
13	14°39.1	25.5	78°26.2	9.8'	05°30.8	11.3'	59.2'
14	29°39.0	25.5	92°55.0	9.7'	05°42.1	11.3'	59.3'
15	44°38.8	·· 25.6	107°23.7	9.7'	05°53.4	11.3'	59.3'
16	59°38.7	25.6	121°52.3	9.6'	06°04.7	11.2'	59.3'
17	74°38.6	25.6	136°20.9	9.5'	06°15.9	11.2'	59.4'
18	89°38.4	N23°25.6	150°49.4	9.5'	N06°27.1	11.2'	59.4'
19	104°38.3	25.7	165°17.8	9.4'	06°38.3	11.2'	59.5'
20	119°38.2	25.7	179°46.2	9.3'	06°49.5	11.2'	59.5'
21	134°38.0	·· 25.7	194°14.5	9.3'	07°00.6	11.1'	59.5'
22	149°37.9	25.7	208°42.7	9.2'	07°11.7	11.1'	59.6'
23	164°37.7	25.8	223°10.8	9.1'	07°22.8	11.1'	59.6'
	SD.=15.7	d=0.0		S.D.=16.1			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°37.6	N23°25.8	237°38.9	9.1'	N07°33.8	11.0'	59.6'
1	194°37.5	25.8	252°07.0	9.0'	07°44.9	11.0'	59.7'
2	209°37.3	25.8	266°34.9	8.9'	07°55.9	11.0'	59.7'
3	224°37.2	·· 25.8	281°02.8	8.8'	08°06.8	10.9'	59.7'
4	239°37.1	25.9	295°30.6	8.8'	08°17.7	10.9'	59.8'
5	254°36.9	25.9	309°58.3	8.7'	08°28.6	10.9'	59.8'
6	269°36.8	N23°25.9	324°26.0	8.6'	N08°39.4	10.8'	59.8'
7	284°36.6	25.9	338°53.6	8.5'	08°50.2	10.8'	59.9'
8	299°36.5	25.9	353°21.1	8.5'	09°01.0	10.7'	59.9'
9	314°36.4	·· 25.9	7°48.5	8.4'	09°11.7	10.7'	59.9'
10	329°36.2	25.9	22°15.9	8.3'	09°22.4	10.7'	59.9'
11	344°36.1	26.0	36°43.2	8.2'	09°33.0	10.6'	60.0'
12	359°36.0	N23°26.0	51°10.4	8.2'	N09°43.6	10.6'	60.0'
13	14°35.8	26.0	65°37.5	8.1'	09°54.1	10.5'	60.0'
14	29°35.7	26.0	80°04.6	8.0'	10°04.6	10.5'	60.1'
15	44°35.6	·· 26.0	94°31.5	7.9'	10°15.1	10.4'	60.1'
16	59°35.4	26.0	108°58.5	7.9'	10°25.4	10.4'	60.1'
17	74°35.3	26.0	123°25.3	7.8'	10°35.8	10.3'	60.2'
18	89°35.1	N23°26.0	137°52.0	7.7'	N10°46.0	10.2'	60.2'
19	104°35.0	26.0	152°18.7	7.6'	10°56.2	10.2'	60.2'
20	119°34.9	26.0	166°45.3	7.6'	11°06.4	10.1'	60.3'
21	134°34.7	·· 26.0	181°11.8	7.5'	11°16.5	10.1'	60.3'
22	149°34.6	26.1	195°38.2	7.4'	11°26.5	10.0'	60.3'
23	164°34.5	26.1	210°04.6	7.3'	11°36.5	9.9'	60.3'
	SD.=15.7	d=0.0		S.D.=16.4			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°						
64°			01:31	22:32		
62°			02:09	21:54		
60°		00:50	02:36	21:27	23:14	
N 58°		01:40	02:56	21:07	22:23	
56°		02:10	03:13	20:50	21:53	
54°	00:45	02:33	03:27	20:36	21:30	23:18
52°	01:32	02:51	03:40	20:23	21:12	22:31
50°	02:00	03:06	03:50	20:12	20:57	22:03
45°	02:46	03:35	04:13	19:50	20:27	21:17
N 40°	03:16	03:58	04:31	19:32	20:05	20:46
35°	03:40	04:16	04:46	19:17	19:46	20:23
30°	03:58	04:32	04:59	19:04	19:31	20:05
20°	04:27	04:57	05:21	18:42	19:06	19:35
N 10°	04:50	05:17	05:40	18:23	18:46	19:13
0°	05:09	05:35	05:58	18:05	18:28	18:54
S 10°	05:26	05:52	06:15	17:48	18:10	18:37
20°	05:42	06:10	06:34	17:29	17:53	18:21
30°	05:59	06:29	06:55	17:08	17:34	18:04
35°	06:07	06:39	07:07	16:55	17:24	17:55
40°	06:17	06:51	07:22	16:41	17:12	17:46
45°	06:27	07:05	07:38	16:24	16:58	17:35
S 50°	06:39	07:21	07:59	16:04	16:42	17:24
52°	06:44	07:28	08:09	15:54	16:35	17:18
54°	06:50	07:36	08:20	15:43	16:26	17:13
56°	06:56	07:45	08:33	15:30	16:17	17:07
58°	07:03	07:56	08:48	15:15	16:07	17:00
S 60°	07:11	08:07	09:05	14:58	15:55	16:52

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	00:52	00:43	00:35	13:08	15:03	17:05
N 70°	00:50	00:48	00:46	13:07	14:54	16:47
68°	00:48	00:51	00:55	13:06	14:47	16:33
66°	00:47	00:54	01:02	13:05	14:41	16:21
64°	00:46	00:56	01:08	13:04	14:36	16:12
62°	00:45	00:58	01:14	13:04	14:32	16:04
60°	00:44	01:00	01:19	13:03	14:29	15:57
N 58°	00:43	01:02	01:23	13:03	14:25	15:51
56°	00:42	01:03	01:27	13:02	14:23	15:45
54°	00:42	01:05	01:30	13:02	14:20	15:41
52°	00:41	01:06	01:33	13:01	14:18	15:36
50°	00:40	01:07	01:36	13:01	14:16	15:32
45°	00:39	01:10	01:42	13:00	14:11	15:24
N 40°	00:38	01:12	01:47	13:00	14:07	15:17
35°	00:37	01:14	01:52	12:59	14:04	15:11
30°	00:37	01:15	01:56	12:59	14:01	15:05
20°	00:35	01:18	02:03	12:58	13:56	14:56
N 10°	00:34	01:21	02:09	12:57	13:51	14:48
0°	00:33	01:23	02:15	12:57	13:47	14:41
S 10°	00:32	01:25	02:21	12:56	13:43	14:33
20°	00:31	01:28	02:27	12:55	13:39	14:25
30°	00:30	01:31	02:34	12:54	13:34	14:16
35°	00:29	01:33	02:39	12:54	13:31	14:11
40°	00:29	01:35	02:43	12:53	13:28	14:05
45°	00:28	01:37	02:49	12:53	13:24	13:58
S 50°	00:27	01:40	02:56	12:52	13:19	13:50
52°	00:26	01:41	02:59	12:51	13:17	13:46
54°	00:26	01:43	03:02	12:51	13:15	13:42
56°	00:25	01:44	03:06	12:51	13:12	13:37
58°	00:24	01:46	03:10	12:50	13:10	13:32
S 60°	00:24	01:48	03:15	12:50	13:07	13:26

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 24-26 39-19%
18	01:03	01:10	12:01	06:45	19:10	
19	01:16	01:23	12:01	07:35	20:01	
20	01:30	01:36	12:02	08:28	20:55	

June 21, 22, 23 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	269°22.9	226°04.9	N13°42.9	167°33.9	N23°58.0	76°31.0	S04°02.8	5°44.8	S21°57.5
1	284°25.3	241°04.8	43.7	182°34.5	57.8	91°33.4	02.9	20°47.5	57.5
2	299°27.8	256°04.6	44.4	197°35.2	57.7	106°35.8	02.9	35°50.2	57.5
3	314°30.3	271°04.5	·· 45.1	212°35.9	·· 57.6	121°38.2	·· 03.0	50°52.8	·· 57.5
4	329°32.7	286°04.4	45.9	227°36.6	57.5	136°40.6	03.0	65°55.5	57.5
5	344°35.2	301°04.3	46.6	242°37.2	57.4	151°43.0	03.1	80°58.1	57.5
6	359°37.7	316°04.1	N13°47.4	257°37.9	N23°57.2	166°45.3	S04°03.1	96°00.8	S21°57.5
7	14°40.1	331°04.0	48.1	272°38.6	57.1	181°47.7	03.2	111°03.5	57.5
8	29°42.6	346°03.9	48.9	287°39.2	57.0	196°50.1	03.2	126°06.1	57.5
9	44°45.0	1°03.7	·· 49.6	302°39.9	·· 56.9	211°52.5	·· 03.2	141°08.8	·· 57.5
10	59°47.5	16°03.6	50.4	317°40.6	56.7	226°54.9	03.3	156°11.5	57.5
11	74°50.0	31°03.5	51.1	332°41.3	56.6	241°57.3	03.3	171°14.1	57.5
12	89°52.4	46°03.3	N13°51.9	347°41.9	N23°56.5	256°59.7	S04°03.4	186°16.8	S21°57.5
13	104°54.9	61°03.2	52.6	2°42.6	56.3	272°02.1	03.4	201°19.4	57.5
14	119°57.4	76°03.1	53.4	17°43.3	56.2	287°04.4	03.5	216°22.1	57.5
15	134°59.8	91°02.9	·· 54.1	32°44.0	·· 56.1	302°06.8	·· 03.5	231°24.8	·· 57.5
16	150°02.3	106°02.8	54.8	47°44.6	56.0	317°09.2	03.5	246°27.4	57.5
17	165°04.8	121°02.7	55.6	62°45.3	55.8	332°11.6	03.6	261°30.1	57.5
18	180°07.2	136°02.5	N13°56.3	77°46.0	N23°55.7	347°14.0	S04°03.6	276°32.7	S21°57.5
19	195°09.7	151°02.4	57.1	92°46.7	55.6	2°16.4	03.7	291°35.4	57.5
20	210°12.2	166°02.3	57.8	107°47.3	55.5	17°18.8	03.7	306°38.1	57.4
21	225°14.6	181°02.1	·· 58.6	122°48.0	·· 55.3	32°21.1	·· 03.8	321°40.7	·· 57.4
22	240°17.1	196°02.0	13°59.3	137°48.7	55.2	47°23.5	03.8	336°43.4	57.4
23	255°19.5	211°01.8	14°00.1	152°49.3	55.1	62°25.9	03.9	351°46.0	57.4
Mer.pass.:06:01		v-0.1 d0.7 m-4.1		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	270°22.0	226°01.7	N14°00.8	167°50.0	N23°54.9	77°28.3	S04°03.9	6°48.7	S21°57.4
1	285°24.5	241°01.6	01.5	182°50.7	54.8	92°30.7	04.0	21°51.4	57.4
2	300°26.9	256°01.4	02.3	197°51.4	54.7	107°33.1	04.0	36°54.0	57.4
3	315°29.4	271°01.3	·· 03.0	212°52.0	·· 54.5	122°35.5	·· 04.0	51°56.7	·· 57.4
4	330°31.9	286°01.1	03.8	227°52.7	54.4	137°37.8	04.1	66°59.4	57.4
5	345°34.3	301°01.0	04.5	242°53.4	54.3	152°40.2	04.1	82°02.0	57.4
6	0°36.8	316°00.8	N14°05.3	257°54.1	N23°54.1	167°42.6	S04°04.2	97°04.7	S21°57.4
7	15°39.3	331°00.7	06.0	272°54.7	54.0	182°45.0	04.2	112°07.3	57.4
8	30°41.7	346°00.5	06.7	287°55.4	53.9	197°47.4	04.3	127°10.0	57.4
9	45°44.2	1°00.4	·· 07.5	302°56.1	·· 53.7	212°49.7	·· 04.3	142°12.7	·· 57.4
10	60°46.7	16°00.3	08.2	317°56.8	53.6	227°52.1	04.4	157°15.3	57.4
11	75°49.1	31°00.1	09.0	332°57.4	53.5	242°54.5	04.4	172°18.0	57.4
12	90°51.6	46°00.0	N14°09.7	347°58.1	N23°53.3	257°56.9	S04°04.5	187°20.6	S21°57.4
13	105°54.0	60°59.8	10.4	2°58.8	53.2	272°59.3	04.5	202°23.3	57.4
14	120°56.5	75°59.7	11.2	17°59.5	53.1	288°01.7	04.6	217°26.0	57.4
15	135°59.0	90°59.5	·· 11.9	33°00.1	·· 52.9	303°04.0	·· 04.6	232°28.6	·· 57.4
16	151°01.4	105°59.4	12.7	48°00.8	52.8	318°06.4	04.7	247°31.3	57.4
17	166°03.9	120°59.2	13.4	63°01.5	52.7	333°08.8	04.7	262°33.9	57.4
18	181°06.4	135°59.1	N14°14.1	78°02.2	N23°52.5	348°11.2	S04°04.8	277°36.6	S21°57.4
19	196°08.8	150°58.9	14.9	93°02.8	52.4	3°13.5	04.8	292°39.3	57.3
20	211°11.3	165°58.8	15.6	108°03.5	52.3	18°15.9	04.8	307°41.9	57.3
21	226°13.8	180°58.6	·· 16.3	123°04.2	·· 52.1	33°18.3	·· 04.9	322°44.6	·· 57.3
22	241°16.2	195°58.4	17.1	138°04.9	52.0	48°20.7	04.9	337°47.2	57.3
23	256°18.7	210°58.3	17.8	153°05.6	51.8	63°23.1	05.0	352°49.9	57.3
Mer.pass.:05:58		v-0.1 d0.7 m-4.1		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-2.0		v2.7 d0.0 m0.0	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	271°21.1	225°58.1	N14°18.6	168°06.2	N23°51.7	78°25.4	S04°05.0	7°52.6	S21°57.3
1	286°23.6	240°58.0	19.3	183°06.9	51.6	93°27.8	05.1	22°55.2	57.3
2	301°26.1	255°57.8	20.0	198°07.6	51.4	108°30.2	05.1	37°57.9	57.3
3	316°28.5	270°57.7	·· 20.8	213°08.3	·· 51.3	123°32.6	·· 05.2	53°00.5	·· 57.3
4	331°31.0	285°57.5	21.5	228°08.9	51.1	138°34.9	05.2	68°03.2	57.3
5	346°33.5	300°57.3	22.2	243°09.6	51.0	153°37.3	05.3	83°05.9	57.3
6	1°35.9	315°57.2	N14°23.0	258°10.3	N23°50.9	168°39.7	S04°05.3	98°08.5	S21°57.3
7	16°38.4	330°57.0	23.7	273°11.0	50.7	183°42.1	05.4	113°11.2	57.3
8	31°40.9	345°56.9	24.4	288°11.6	50.6	198°44.4	05.4	128°13.8	57.3
9	46°43.3	0°56.7	·· 25.2	303°12.3	·· 50.4	213°46.8	·· 05.5	143°16.5	·· 57.3
10	61°45.8	15°56.5	25.9	318°13.0	50.3	228°49.2	05.5	158°19.2	57.3
11	76°48.3	30°56.4	26.6	333°13.7	50.2	243°51.6	05.6	173°21.8	57.3
12	91°50.7	45°56.2	N14°27.4	348°14.4	N23°50.0	258°53.9	S04°05.6	188°24.5	S21°57.3
13	106°53.2	60°56.1	28.1	3°15.0	49.9	273°56.3	05.7	203°27.1	57.3
14	121°55.6	75°55.9	28.8	18°15.7	49.7	288°58.7	05.7	218°29.8	57.3
15	136°58.1	90°55.7	·· 29.6	33°16.4	·· 49.6	304°01.1	·· 05.8	233°32.5	·· 57.3
16	152°00.6	105°55.6	30.3	48°17.1	49.4	319°03.4	05.8	248°35.1	57.3
17	167°03.0	120°55.4	31.0	63°17.8	49.3	334°05.8	05.9	263°37.8	57.3
18	182°05.5	135°55.2	N14°31.8	78°18.4	N23°49.2	349°08.2	S04°05.9	278°40.4	S21°57.3
19	197°08.0	150°55.1	32.5	93°19.1	49.0	4°10.6	06.0	293°43.1	57.2
20	212°10.4	165°54.9	33.2	108°19.8	48.9	19°12.9	06.0	308°45.8	57.2
21	227°12.9	180°54.7	·· 34.0	123°20.5	·· 48.7	34°15.3	·· 06.1	323°48.4	·· 57.2
22	242°15.4	195°54.5	34.7	138°21.1	48.6	49°17.7	06.1	338°51.1	57.2
23	257°17.8	210°54.4	35.4	153°21.8	48.4	64°20.0	06.2	353°53.7	57.2
Mer.pass.:05:54		v-0.2 d0.7 m-4.1		v0.7 d-0.1 m1.7		v2.4 d-0.0 m-1.9		v2.7 d0.0 m0.0	

Stars

	SHA	Dec
Alpheratz	357°40.7	29°11.0
Ankaa	353°13.1	-42°12.5
Schedar	349°37.4	56°37.6
Diphda	348°53.3	-17°53.4
Achernar	335°25.1	-57°08.8
Hamal	327°57.9	23°32.4
Polaris	316°51.0	89°19.9
Acamar	315°16.6	-40°14.1
Menkar	314°12.5	4°09.3
Mirfak	308°36.8	49°55.0
Aldebaran	290°46.6	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°30.9	46°00.6
Bellatrix	278°29.4	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.5
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.4	-59°34.2
Suhail	222°50.7	-43°30.4
Miaplacidus	221°39.6	-69°47.6
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.7	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.4
Acrux	173°06.1	-63°12.0
Gacrux	171°57.7	-57°12.8
Alioth	166°18.3	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.6	49°13.9
Hadar	148°43.6	-60°27.5
Menkent	148°04.1	-36°27.3
Arcturus	145°53.1	19°05.8
Rigil Kent.	139°47.5	-60°54.5
Kochab	137°19.5	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.4
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.3	51°29.4
Kaus Aust.	83°39.8	-34°22.3
Vega	80°36.7	38°48.2
Nunki	75°54.6	-26°16.3
Altair	62°05.3	8°55.0
Peacock	53°14.6	-56°40.4
Deneb	49°29.2	45°20.5
Enif	33°44.3	9°57.3
Al Na'ir	27°40.2	-46°52.3
Fomalhaut	15°20.9	-29°31.6
Scheat	13°50.6	28°10.5
Markab	13°35.5	15°17.9

Jun 21 Wed	SHA	Mer.pass
Venus	316°42.0	08:56
Mars	258°11.0	12:49
Jupiter	167°08.1	18:51
Saturn	96°22.0	23:33

Jun 22 Thu	SHA	Mer.pass
Venus	315°39.7	08:56
Mars	257°28.0	12:48
Jupiter	167°06.3	18:47
Saturn	96°26.7	23:29

Jun 23 Fri	SHA	Mer.pass
Venus	314°37.0	08:56
Mars	256°45.1	12:47
Jupiter	167°04.3	18:43
Saturn	96°31.4	23:24

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3666 sec ΔT = TT-UT1 = +68.8174 sec

2017 June 21 to Jun. 23 UT

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°34.3	N23°26.1	224°30.9	7.2'	N11°46.4	9.9'	60.4'
1	194°34.2	26.1	238°57.1	7.2'	11°56.2	9.8'	60.4'
2	209°34.0	26.1	253°23.2	7.1'	12°06.0	9.7'	60.4'
3	224°33.9	·· 26.1	267°49.2	7.0'	12°15.7	9.7'	60.4'
4	239°33.8	26.1	282°15.2	6.9'	12°25.3	9.6'	60.5'
5	254°33.6	26.1	296°41.1	6.8'	12°34.9	9.5'	60.5'
6	269°33.5	N23°26.1	311°06.9	6.8'	N12°44.4	9.4'	60.5'
7	284°33.4	26.1	325°32.6	6.7'	12°53.8	9.4'	60.6'
8	299°33.2	26.1	339°58.2	6.6'	13°03.1	9.3'	60.6'
9	314°33.1	·· 26.1	354°23.8	6.5'	13°12.4	9.2'	60.6'
10	329°33.0	26.1	8°49.3	6.4'	13°21.5	9.1'	60.6'
11	344°32.8	26.1	23°14.7	6.4'	13°30.6	9.1'	60.6'
12	359°32.7	N23°26.0	37°40.0	6.3'	N13°39.6	9.0'	60.7'
13	14°32.5	26.0	52°05.3	6.2'	13°48.6	8.9'	60.7'
14	29°32.4	26.0	66°30.5	6.1'	13°57.4	8.8'	60.7'
15	44°32.3	·· 26.0	80°55.6	6.1'	14°06.1	8.7'	60.7'
16	59°32.1	26.0	95°20.6	6.0'	14°14.8	8.6'	60.8'
17	74°32.0	26.0	109°45.5	5.9'	14°23.4	8.5'	60.8'
18	89°31.9	N23°26.0	124°10.4	5.8'	N14°31.9	8.4'	60.8'
19	104°31.7	26.0	138°35.2	5.8'	14°40.2	8.3'	60.8'
20	119°31.6	26.0	152°59.9	5.7'	14°48.5	8.2'	60.8'
21	134°31.4	·· 26.0	167°24.5	5.6'	14°56.7	8.1'	60.9'
22	149°31.3	26.0	181°49.1	5.5'	15°04.8	8.0'	60.9'
23	164°31.2	25.9	196°13.6	5.5'	15°12.8	7.9'	60.9'
	SD.=15.7	d=0.0		S.D.=16.5			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°31.0	N23°25.9	210°38.0	5.4'	N15°20.7	7.8'	60.9'
1	194°30.9	25.9	225°02.3	5.3'	15°28.5	7.7'	60.9'
2	209°30.8	25.9	239°26.6	5.2'	15°36.2	7.6'	61.0'
3	224°30.6	·· 25.9	253°50.8	5.2'	15°43.8	7.5'	61.0'
4	239°30.5	25.9	268°14.9	5.1'	15°51.3	7.4'	61.0'
5	254°30.4	25.8	282°39.0	5.0'	15°58.6	7.3'	61.0'
6	269°30.2	N23°25.8	297°03.0	5.0'	N16°05.9	7.2'	61.0'
7	284°30.1	25.8	311°26.9	4.9'	16°13.1	7.1'	61.0'
8	299°29.9	25.8	325°50.7	4.8'	16°20.1	7.0'	61.1'
9	314°29.8	·· 25.8	340°14.5	4.8'	16°27.0	6.9'	61.1'
10	329°29.7	25.8	354°38.3	4.7'	16°33.8	6.8'	61.1'
11	344°29.5	25.7	9°01.9	4.6'	16°40.5	6.6'	61.1'
12	359°29.4	N23°25.7	23°25.5	4.6'	N16°47.1	6.5'	61.1'
13	14°29.3	25.7	37°49.0	4.5'	16°53.6	6.4'	61.1'
14	29°29.1	25.7	52°12.5	4.4'	16°59.9	6.3'	61.1'
15	44°29.0	·· 25.6	66°35.9	4.4'	17°06.1	6.2'	61.1'
16	59°28.9	25.6	80°59.3	4.3'	17°12.2	6.0'	61.2'
17	74°28.7	25.6	95°22.6	4.3'	17°18.2	5.9'	61.2'
18	89°28.6	N23°25.6	109°45.8	4.2'	N17°24.0	5.8'	61.2'
19	104°28.4	25.5	124°09.0	4.2'	17°29.8	5.7'	61.2'
20	119°28.3	25.5	138°32.1	4.1'	17°35.4	5.5'	61.2'
21	134°28.2	·· 25.5	152°55.2	4.1'	17°40.8	5.4'	61.2'
22	149°28.0	25.4	167°18.3	4.0'	17°46.2	5.3'	61.2'
23	164°27.9	25.4	181°41.2	4.0'	17°51.4	5.1'	61.2'
	SD.=15.7	d=-0.0		S.D.=16.7			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°27.8	N23°25.4	196°04.2	3.9'	N17°56.5	5.0'	61.2'
1	194°27.6	25.4	210°27.0	3.9'	18°01.4	4.9'	61.2'
2	209°27.5	25.3	224°49.9	3.8'	18°06.2	4.7'	61.2'
3	224°27.4	·· 25.3	239°12.7	3.8'	18°10.9	4.6'	61.2'
4	239°27.2	25.3	253°35.4	3.7'	18°15.5	4.5'	61.2'
5	254°27.1	25.2	267°58.1	3.7'	18°19.9	4.3'	61.2'
6	269°26.9	N23°25.2	282°20.8	3.7'	N18°24.2	4.2'	61.2'
7	284°26.8	25.1	296°43.5	3.6'	18°28.3	4.1'	61.2'
8	299°26.7	25.1	311°06.1	3.6'	18°32.3	3.9'	61.2'
9	314°26.5	·· 25.1	325°28.6	3.6'	18°36.2	3.8'	61.3'
10	329°26.4	25.0	339°51.2	3.5'	18°39.9	3.7'	61.3'
11	344°26.3	25.0	354°13.7	3.5'	18°43.5	3.5'	61.3'
12	359°26.1	N23°25.0	8°36.2	3.5'	N18°46.9	3.4'	61.3'
13	14°26.0	24.9	22°58.6	3.4'	18°50.2	3.2'	61.2'
14	29°25.9	24.9	37°21.0	3.4'	18°53.4	3.1'	61.2'
15	44°25.7	·· 24.8	51°43.4	3.4'	18°56.4	2.9'	61.2'
16	59°25.6	24.8	66°05.8	3.4'	18°59.2	2.8'	61.2'
17	74°25.5	24.7	80°28.2	3.4'	19°02.0	2.7'	61.2'
18	89°25.3	N23°24.7	94°50.5	3.3'	N19°04.6	2.5'	61.2'
19	104°25.2	24.7	109°12.9	3.3'	19°07.0	2.4'	61.2'
20	119°25.1	24.6	123°35.2	3.3'	19°09.3	2.2'	61.2'
21	134°24.9	·· 24.6	137°57.5	3.3'	19°11.4	2.1'	61.2'
22	149°24.8	24.5	152°19.8	3.3'	19°13.4	1.9'	61.2'
23	164°24.6	24.5	166°42.1	3.3'	19°15.3	1.8'	61.2'
	SD.=15.7	d=-0.0		S.D.=16.7			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°						
64°			01:32	22:32		
62°			02:10	21:54		
60°		00:50	02:36	21:28	23:14	
N 58°		01:41	02:57	21:07	22:23	
56°		02:11	03:13	20:51	21:53	
54°	00:46	02:33	03:28	20:36	21:31	23:18
52°	01:33	02:51	03:40	20:24	21:13	22:31
50°	02:01	03:06	03:51	20:13	20:58	22:03
45°	02:46	03:36	04:14	19:50	20:28	21:18
N 40°	03:17	03:59	04:32	19:32	20:05	20:47
35°	03:40	04:17	04:47	19:17	19:47	20:24
30°	03:59	04:32	05:00	19:04	19:32	20:05
20°	04:28	04:57	05:22	18:42	19:07	19:36
N 10°	04:51	05:18	05:41	18:23	18:46	19:13
0°	05:10	05:36	05:58	18:06	18:28	18:54
S 10°	05:27	05:53	06:16	17:48	18:11	18:37
20°	05:43	06:10	06:34	17:30	17:54	18:21
30°	05:59	06:29	06:56	17:08	17:35	18:05
35°	06:08	06:40	07:08	16:56	17:24	17:56
40°	06:18	06:52	07:22	16:42	17:12	17:47
45°	06:28	07:05	07:39	16:25	16:59	17:36
S 50°	06:40	07:21	08:00	16:04	16:43	17:24
52°	06:45	07:29	08:10	15:54	16:35	17:19
54°	06:51	07:37	08:21	15:43	16:27	17:13
56°	06:57	07:46	08:34	15:30	16:18	17:07
58°	07:04	07:56	08:48	15:16	16:08	17:00
S 60°	07:11	08:08	09:06	14:58	15:56	16:53

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	00:25	00:11 23:35		19:18	22:01	
N 70°	00:45	00:45	00:49	18:46	20:48	22:39
68°	01:00	01:09	01:27	18:22	20:10	21:45
66°	01:13	01:29	01:54	18:04	19:44	21:12
64°	01:23	01:44	02:15	17:49	19:24	20:47
62°	01:32	01:57	02:32	17:37	19:07	20:28
60°	01:40	02:08	02:46	17:27	18:54	20:12
N 58°	01:47	02:18	02:58	17:17	18:42	19:59
56°	01:53	02:26	03:08	17:10	18:32	19:48
54°	01:59	02:34	03:18	17:03	18:23	19:37
52°	02:04	02:41	03:26	16:56	18:15	19:28
50°	02:09	02:47	03:33	16:51	18:08	19:20
45°	02:18	03:00	03:49	16:38	17:53	19:03
N 40°	02:27	03:11	04:02	16:28	17:40	18:49
35°	02:34	03:21	04:14	16:20	17:29	18:37
30°	02:40	03:29	04:23	16:12	17:20	18:27
20°	02:51	03:43	04:40	15:59	17:04	18:09
N 10°	03:01	03:56	04:55	15:48	16:50	17:54
0°	03:10	04:08	05:09	15:37	16:37	17:39
S 10°	03:19	04:20	05:23	15:26	16:24	17:24
20°	03:29	04:33	05:38	15:15	16:10	17:09
30°	03:40	04:48	05:56	15:02	15:54	16:51
35°	03:47	04:56	06:06	14:55	15:45	16:41
40°	03:54	05:06	06:17	14:46	15:34	16:29
45°	04:03	05:18	06:31	14:36	15:22	16:15
S 50°	04:14	05:32	06:48	14:25	15:07	15:57
52°	04:19	05:39	06:55	14:19	15:00	15:49
54°	04:24	05:46	07:04	14:13	14:52	15:40
56°	04:30	05:54	07:14	14:06	14:43	15:30
58°	04:37	06:04	07:25	13:59	14:33	15:19
S 60°	04:45	06:14	07:38	13:50	14:22	15:06

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 27-29 10-1%
21	01:43	01:49	12:02	09:23	21:52	
22	01:56	02:02	12:02	10:22	22:53	
23	02:09	02:15	12:02	11:24	23:56	

June 24, 25, 26 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	272°20.3	225°54.2	N14°36.2	168°22.5	N23°48.3	79°22.4	S04°06.2	8°56.4	S21°57.2
1	287°22.8	240°54.0	36.9	183°23.2	48.1	94°24.8	06.3	23°59.1	57.2
2	302°25.2	255°53.9	37.6	198°23.9	48.0	109°27.1	06.3	39°01.7	57.2
3	317°27.7	270°53.7	·· 38.4	213°24.5	·· 47.8	124°29.5	·· 06.4	54°04.4	·· 57.2
4	332°30.1	285°53.5	39.1	228°25.2	47.7	139°31.9	06.4	69°07.0	57.2
5	347°32.6	300°53.3	39.8	243°25.9	47.5	154°34.3	06.5	84°09.7	57.2
6	2°35.1	315°53.2	N14°40.5	258°26.6	N23°47.4	169°36.6	S04°06.5	99°12.4	S21°57.2
7	17°37.5	330°53.0	41.3	273°27.3	47.3	184°39.0	06.6	114°15.0	57.2
8	32°40.0	345°52.8	42.0	288°27.9	47.1	199°41.4	06.6	129°17.7	57.2
9	47°42.5	0°52.6	·· 42.7	303°28.6	·· 47.0	214°43.7	·· 06.7	144°20.3	·· 57.2
10	62°44.9	15°52.5	43.5	318°29.3	46.8	229°46.1	06.8	159°23.0	57.2
11	77°47.4	30°52.3	44.2	333°30.0	46.7	244°48.5	06.8	174°25.7	57.2
12	92°49.9	45°52.1	N14°44.9	348°30.7	N23°46.5	259°50.8	S04°06.9	189°28.3	S21°57.2
13	107°52.3	60°51.9	45.6	3°31.3	46.4	274°53.2	06.9	204°31.0	57.2
14	122°54.8	75°51.7	46.4	18°32.0	46.2	289°55.6	07.0	219°33.6	57.2
15	137°57.3	90°51.6	·· 47.1	33°32.7	·· 46.1	304°57.9	·· 07.0	234°36.3	·· 57.2
16	152°59.7	105°51.4	47.8	48°33.4	45.9	320°00.3	07.1	249°38.9	57.2
17	168°02.2	120°51.2	48.5	63°34.1	45.7	335°02.7	07.1	264°41.6	57.2
18	183°04.6	135°51.0	N14°49.3	78°34.8	N23°45.6	350°05.0	S04°07.2	279°44.3	S21°57.2
19	198°07.1	150°50.8	50.0	93°35.4	45.4	5°07.4	07.2	294°46.9	57.1
20	213°09.6	165°50.7	50.7	108°36.1	45.3	20°09.8	07.3	309°49.6	57.1
21	228°12.0	180°50.5	·· 51.4	123°36.8	·· 45.1	35°12.1	·· 07.3	324°52.2	·· 57.1
22	243°14.5	195°50.3	52.2	138°37.5	45.0	50°14.5	07.4	339°54.9	57.1
23	258°17.0	210°50.1	52.9	153°38.2	44.8	65°16.9	07.4	354°57.6	57.1
Mer.pass.:05:50		v-0.2 d0.7 m-4.1		v0.7 d-0.1 m1.7		v2.4 d-0.1 m-1.9		v2.7 d0.0 m0.0	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	273°19.4	225°49.9	N14°53.6	168°38.8	N23°44.7	80°19.2	S04°07.5	10°00.2	S21°57.1
1	288°21.9	240°49.7	54.3	183°39.5	44.5	95°21.6	07.5	25°02.9	57.1
2	303°24.4	255°49.5	55.1	198°40.2	44.4	110°23.9	07.6	40°05.5	57.1
3	318°26.8	270°49.4	·· 55.8	213°40.9	·· 44.2	125°26.3	·· 07.7	55°08.2	·· 57.1
4	333°29.3	285°49.2	56.5	228°41.6	44.1	140°28.7	07.7	70°10.9	57.1
5	348°31.8	300°49.0	57.2	243°42.3	43.9	155°31.0	07.8	85°13.5	57.1
6	3°34.2	315°48.8	N14°58.0	258°42.9	N23°43.7	170°33.4	S04°07.8	100°16.2	S21°57.1
7	18°36.7	330°48.6	58.7	273°43.6	43.6	185°35.8	07.9	115°18.8	57.1
8	33°39.1	345°48.4	14°59.4	288°44.3	43.4	200°38.1	07.9	130°21.5	57.1
9	48°41.6	0°48.2	15°00.1	303°45.0	·· 43.3	215°40.5	·· 08.0	145°24.1	·· 57.1
10	63°44.1	15°48.0	00.8	318°45.7	43.1	230°42.8	08.0	160°26.8	57.1
11	78°46.5	30°47.8	01.6	333°46.4	43.0	245°45.2	08.1	175°29.5	57.1
12	93°49.0	45°47.6	N15°02.3	348°47.0	N23°42.8	260°47.6	S04°08.1	190°32.1	S21°57.1
13	108°51.5	60°47.4	03.0	3°47.7	42.6	275°49.9	08.2	205°34.8	57.1
14	123°53.9	75°47.3	03.7	18°48.4	42.5	290°52.3	08.3	220°37.4	57.1
15	138°56.4	90°47.1	·· 04.4	33°49.1	·· 42.3	305°54.6	·· 08.3	235°40.1	·· 57.1
16	153°58.9	105°46.9	05.2	48°49.8	42.2	320°57.0	08.4	250°42.7	57.1
17	169°01.3	120°46.7	05.9	63°50.5	42.0	335°59.4	08.4	265°45.4	57.1
18	184°03.8	135°46.5	N15°06.6	78°51.1	N23°41.8	351°01.7	S04°08.5	280°48.1	S21°57.1
19	199°06.3	150°46.3	07.3	93°51.8	41.7	6°04.1	08.5	295°50.7	57.0
20	214°08.7	165°46.1	08.0	108°52.5	41.5	21°06.4	08.6	310°53.4	57.0
21	229°11.2	180°45.9	·· 08.7	123°53.2	·· 41.4	36°08.8	·· 08.7	325°56.0	·· 57.0
22	244°13.6	195°45.7	09.5	138°53.9	41.2	51°11.2	08.7	340°58.7	57.0
23	259°16.1	210°45.5	10.2	153°54.6	41.0	66°13.5	08.8	356°01.4	57.0
Mer.pass.:05:46		v-0.2 d0.7 m-4.1		v0.7 d-0.2 m1.6		v2.4 d-0.1 m-1.9		v2.7 d0.0 m0.0	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	274°18.6	225°45.3	N15°10.9	168°55.3	N23°40.9	81°15.9	S04°08.8	11°04.0	S21°57.0
1	289°21.0	240°45.1	11.6	183°55.9	40.7	96°18.2	08.9	26°06.7	57.0
2	304°23.5	255°44.9	12.3	198°56.6	40.6	111°20.6	08.9	41°09.3	57.0
3	319°26.0	270°44.7	·· 13.0	213°57.3	·· 40.4	126°22.9	·· 09.0	56°12.0	·· 57.0
4	334°28.4	285°44.5	13.7	228°58.0	40.2	141°25.3	09.0	71°14.6	57.0
5	349°30.9	300°44.3	14.5	243°58.7	40.1	156°27.7	09.1	86°17.3	57.0
6	4°33.4	315°44.1	N15°15.2	258°59.4	N23°39.9	171°30.0	S04°09.2	101°20.0	S21°57.0
7	19°35.8	330°43.9	15.9	274°00.1	39.7	186°32.4	09.2	116°22.6	57.0
8	34°38.3	345°43.6	16.6	289°00.7	39.6	201°34.7	09.3	131°25.3	57.0
9	49°40.8	0°43.4	·· 17.3	304°01.4	·· 39.4	216°37.1	·· 09.3	146°27.9	·· 57.0
10	64°43.2	15°43.2	18.0	319°02.1	39.2	231°39.4	09.4	161°30.6	57.0
11	79°45.7	30°43.0	18.7	334°02.8	39.1	246°41.8	09.4	176°33.2	57.0
12	94°48.1	45°42.8	N15°19.5	349°03.5	N23°38.9	261°44.1	S04°09.5	191°35.9	S21°57.0
13	109°50.6	60°42.6	20.2	4°04.2	38.7	276°46.5	09.6	206°38.6	57.0
14	124°53.1	75°42.4	20.9	19°04.9	38.6	291°48.9	09.6	221°41.2	57.0
15	139°55.5	90°42.2	·· 21.6	34°05.5	·· 38.4	306°51.2	·· 09.7	236°43.9	·· 57.0
16	154°58.0	105°42.0	22.3	49°06.2	38.2	321°53.6	09.7	251°46.5	57.0
17	170°00.5	120°41.8	23.0	64°06.9	38.1	336°55.9	09.8	266°49.2	57.0
18	185°02.9	135°41.6	N15°23.7	79°07.6	N23°37.9	351°58.3	S04°09.9	281°51.8	S21°57.0
19	200°05.4	150°41.3	24.4	94°08.3	37.7	7°00.6	09.9	296°54.5	56.9
20	215°07.9	165°41.1	25.1	109°09.0	37.6	22°03.0	10.0	311°57.2	56.9
21	230°10.3	180°40.9	·· 25.8	124°09.7	·· 37.4	37°05.3	·· 10.0	326°59.8	·· 56.9
22	245°12.8	195°40.7	26.6	139°10.4	37.2	52°07.7	10.1	342°02.5	56.9
23	260°15.2	210°40.5	27.3	154°11.0	37.1	67°10.0	10.2	357°05.1	56.9
Mer.pass.:05:42		v-0.2 d0.7 m-4.1		v0.7 d-0.2 m1.6		v2.4 d-0.1 m-1.9		v2.7 d0.0 m0.0	

Stars

	SHA	**Dec**
Alpheratz	357°40.6	29°11.0
Ankaa	353°13.1	-42°12.5
Schedar	349°37.4	56°37.6
Diphda	348°53.2	-17°53.4
Achernar	335°25.1	-57°08.7
Hamal	327°57.8	23°32.4
Polaris	316°49.6	89°19.9
Acamar	315°16.6	-40°14.1
Menkar	314°12.4	4°09.3
Mirfak	308°36.8	49°55.0
Aldebaran	290°46.6	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°30.9	46°00.6
Bellatrix	278°29.4	6°21.7
Elnath	278°09.6	28°37.1
Alnilam	275°44.0	-1°11.7
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.5
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-29°00.0
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.4	-59°34.2
Suhail	222°50.7	-43°30.4
Miaplacidus	221°39.7	-69°47.6
Alphard	217°53.6	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.7	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.4
Acrux	173°06.1	-63°12.0
Gacrux	171°57.7	-57°12.8
Alioth	166°18.3	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.6	49°13.9
Hadar	148°43.6	-60°27.5
Menkent	148°04.1	-36°27.4
Arcturus	145°53.1	19°05.8
Rigil Kent.	139°47.5	-60°54.5
Kochab	137°19.5	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.3	-69°03.4
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.3	51°29.4
Kaus Aust.	83°39.8	-34°22.3
Vega	80°36.7	38°48.2
Nunki	75°54.6	-26°16.3
Altair	62°05.3	8°55.0
Peacock	53°14.5	-56°40.4
Deneb	49°29.2	45°20.5
Enif	33°44.2	9°57.3
Al Na'ir	27°40.1	-46°52.3
Fomalhaut	15°20.9	-29°31.6
Scheat	13°50.6	28°10.5
Markab	13°35.5	15°17.9

Jun 24 Sat	**SHA**	**Mer.pass**
Venus	313°33.9	08:56
Mars	256°02.2	12:46
Jupiter	167°02.1	18:40
Saturn	96°36.1	23:20

Jun 25 Sun	**SHA**	**Mer.pass**
Venus	312°30.5	08:57
Mars	255°19.4	12:45
Jupiter	166°59.8	18:36
Saturn	96°40.8	23:16

Jun 26 Mon	**SHA**	**Mer.pass**
Venus	311°26.7	08:57
Mars	254°36.7	12:44
Jupiter	166°57.3	18:32
Saturn	96°45.4	23:12

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3644 sec ΔT = TT-UT1 = +68.8196 sec

2017 June 24 to Jun. 26 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°24.5	N23°24.4	181°04.4	3.3'	N19°17.0	1.6'	61.2'
1	194°24.4	24.4	195°26.6	3.3'	19°18.6	1.5'	61.2'
2	209°24.2	24.3	209°48.9	3.3'	19°20.0	1.3'	61.2'
3	224°24.1	·· 24.3	224°11.2	3.3'	19°21.3	1.2'	61.2'
4	239°24.0	24.2	238°33.5	3.3'	19°22.4	1.1'	61.2'
5	254°23.8	24.2	252°55.8	3.3'	19°23.4	0.9'	61.2'
6	269°23.7	N23°24.1	267°18.0	3.3'	N19°24.2	0.8'	61.1'
7	284°23.6	24.1	281°40.3	3.3'	19°24.9	0.6'	61.1'
8	299°23.4	24.0	296°02.7	3.3'	19°25.4	0.5'	61.1'
9	314°23.3	·· 24.0	310°25.0	3.3'	19°25.8	0.3'	61.1'
10	329°23.2	23.9	324°47.3	3.3'	19°26.0	0.2'	61.1'
11	344°23.0	23.9	339°09.7	3.4'	19°26.1	0.0'	61.1'
12	359°22.9	N23°23.8	353°32.0	3.4'	N19°26.1	-0.1'	61.1'
13	14°22.8	23.7	7°54.4	3.4'	19°25.9	-0.3'	61.1'
14	29°22.6	23.7	22°16.8	3.4'	19°25.6	-0.4'	61.0'
15	44°22.5	·· 23.6	36°39.3	3.4'	19°25.1	-0.6'	61.0'
16	59°22.4	23.6	51°01.7	3.5'	19°24.4	-0.7'	61.0'
17	74°22.2	23.5	65°24.2	3.5'	19°23.6	-0.9'	61.0'
18	89°22.1	N23°23.4	79°46.7	3.5'	N19°22.7	-1.0'	61.0'
19	104°21.9	23.4	94°09.3	3.6'	19°21.7	-1.1'	61.0'
20	119°21.8	23.3	108°31.8	3.6'	19°20.4	-1.3'	60.9'
21	134°21.7	·· 23.3	122°54.5	3.6'	19°19.1	-1.4'	60.9'
22	149°21.5	23.2	137°17.1	3.7'	19°17.6	-1.6'	60.9'
23	164°21.4	23.1	151°39.8	3.7'	19°16.0	-1.7'	60.9'
	SD.=15.7	d=-0.0	S.D.=16.6				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°21.3	N23°23.1	166°02.5	3.8'	N19°14.2	-1.9'	60.9'
1	194°21.1	23.0	180°25.3	3.8'	19°12.2	-2.0'	60.8'
2	209°21.0	22.9	194°48.1	3.8'	19°10.2	-2.1'	60.8'
3	224°20.9	·· 22.9	209°11.0	3.9'	19°08.0	-2.3'	60.8'
4	239°20.7	22.8	223°33.9	3.9'	19°05.6	-2.4'	60.8'
5	254°20.6	22.7	237°56.9	4.0'	19°03.2	-2.5'	60.8'
6	269°20.5	N23°22.7	252°19.9	4.0'	N19°00.5	-2.7'	60.7'
7	284°20.3	22.6	266°42.9	4.1'	18°57.8	-2.8'	60.7'
8	299°20.2	22.5	281°06.1	4.1'	18°54.9	-3.0'	60.7'
9	314°20.1	·· 22.4	295°29.2	4.2'	18°51.9	-3.1'	60.7'
10	329°19.9	22.4	309°52.5	4.3'	18°48.7	-3.2'	60.6'
11	344°19.8	22.3	324°15.7	4.3'	18°45.4	-3.4'	60.6'
12	359°19.7	N23°22.2	338°39.1	4.4'	N18°42.0	-3.5'	60.6'
13	14°19.5	22.1	353°02.5	4.4'	18°38.4	-3.6'	60.6'
14	29°19.4	22.1	7°26.0	4.5'	18°34.7	-3.8'	60.5'
15	44°19.3	·· 22.0	21°49.5	4.6'	18°30.9	-3.9'	60.5'
16	59°19.1	21.9	36°13.1	4.6'	18°27.0	-4.0'	60.5'
17	74°19.0	21.8	50°36.8	4.7'	18°22.9	-4.1'	60.5'
18	89°18.9	N23°21.8	65°00.5	4.8'	N18°18.7	-4.3'	60.4'
19	104°18.7	21.7	79°24.3	4.8'	18°14.4	-4.4'	60.4'
20	119°18.6	21.6	93°48.2	4.9'	18°09.9	-4.5'	60.4'
21	134°18.5	·· 21.5	108°12.2	5.0'	18°05.4	-4.6'	60.3'
22	149°18.3	21.4	122°36.2	5.1'	18°00.7	-4.8'	60.3'
23	164°18.2	21.4	137°00.3	5.1'	17°55.8	-4.9'	60.3'
	SD.=15.7	d=-0.1	S.D.=16.5				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°18.1	N23°21.3	151°24.5	5.2'	N17°50.9	-5.0'	60.3'
1	194°17.9	21.2	165°48.7	5.3'	17°45.9	-5.1'	60.2'
2	209°17.8	21.1	180°13.0	5.4'	17°40.7	-5.2'	60.2'
3	224°17.7	·· 21.0	194°37.5	5.4'	17°35.4	-5.3'	60.2'
4	239°17.5	20.9	209°01.9	5.5'	17°30.0	-5.5'	60.1'
5	254°17.4	20.9	223°26.5	5.6'	17°24.5	-5.6'	60.1'
6	269°17.3	N23°20.8	237°51.2	5.7'	N17°18.8	-5.7'	60.1'
7	284°17.2	20.7	252°15.9	5.8'	17°13.1	-5.8'	60.0'
8	299°17.0	20.6	266°40.7	5.9'	17°07.3	-5.9'	60.0'
9	314°16.9	·· 20.5	281°05.6	5.9'	17°01.3	-6.0'	60.0'
10	329°16.8	20.4	295°30.6	6.0'	16°55.2	-6.1'	59.9'
11	344°16.6	20.3	309°55.6	6.1'	16°49.1	-6.2'	59.9'
12	359°16.5	N23°20.2	324°20.8	6.2'	N16°42.8	-6.3'	59.9'
13	14°16.4	20.1	338°46.0	6.3'	16°36.4	-6.4'	59.8'
14	29°16.2	20.1	353°11.3	6.4'	16°29.9	-6.5'	59.8'
15	44°16.1	·· 20.0	7°36.7	6.5'	16°23.3	-6.6'	59.8'
16	59°16.0	19.9	22°02.2	6.5'	16°16.7	-6.7'	59.7'
17	74°15.8	19.8	36°27.8	6.6'	16°09.9	-6.8'	59.7'
18	89°15.7	N23°19.7	50°53.5	6.7'	N16°03.0	-6.9'	59.7'
19	104°15.6	19.6	65°19.3	6.8'	15°56.0	-7.0'	59.6'
20	119°15.4	19.5	79°45.1	6.9'	15°49.0	-7.1'	59.6'
21	134°15.3	·· 19.4	94°11.1	7.0'	15°41.8	-7.2'	59.5'
22	149°15.2	19.3	108°37.1	7.1'	15°34.5	-7.3'	59.5'
23	164°15.0	19.2	123°03.2	7.2'	15°27.2	-7.4'	59.5'
	SD.=15.7	d=-0.1	S.D.=16.3				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°						
64°			01:34	22:31		
62°			02:11	21:54		
60°		00:52	02:37	21:28	23:12	
N 58°		01:42	02:58	21:07	22:23	
56°		02:12	03:15	20:51	21:53	
54°	00:48	02:34	03:29	20:36	21:31	23:16
52°	01:34	02:52	03:41	20:24	21:13	22:31
50°	02:02	03:07	03:52	20:13	20:58	22:03
45°	02:47	03:37	04:14	19:51	20:28	21:18
N 40°	03:18	04:00	04:32	19:33	20:06	20:47
35°	03:41	04:18	04:48	19:18	19:48	20:24
30°	04:00	04:33	05:01	19:05	19:32	20:06
20°	04:29	04:58	05:23	18:43	19:07	19:37
N 10°	04:51	05:18	05:41	18:24	18:47	19:14
0°	05:10	05:36	05:59	18:06	18:29	18:55
S 10°	05:27	05:54	06:16	17:49	18:12	18:38
20°	05:43	06:11	06:35	17:30	17:54	18:22
30°	06:00	06:30	06:56	17:09	17:36	18:06
35°	06:09	06:40	07:09	16:57	17:25	17:57
40°	06:18	06:52	07:23	16:43	17:13	17:47
45°	06:28	07:06	07:39	16:26	17:00	17:37
S 50°	06:40	07:22	08:00	16:05	16:44	17:25
52°	06:45	07:29	08:10	15:55	16:36	17:20
54°	06:51	07:37	08:21	15:44	16:28	17:14
56°	06:57	07:46	08:34	15:32	16:19	17:08
58°	07:04	07:57	08:48	15:17	16:09	17:01
S 60°	07:11	08:08	09:06	15:00	15:57	16:54

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°			03:01			01:07
N 70°	01:09	02:18	04:08	23:42	23:59	–:–
68°	02:04	03:11	04:44	22:49	23:22	23:39
66°	02:37	03:44	05:10	22:16	22:56	23:20
64°	03:01	04:08	05:30	21:52	22:36	23:04
62°	03:21	04:27	05:46	21:33	22:19	22:51
60°	03:37	04:42	05:59	21:17	22:05	22:40
N 58°	03:50	04:55	06:11	21:03	21:53	22:31
56°	04:02	05:07	06:21	20:52	21:43	22:22
54°	04:12	05:17	06:30	20:42	21:34	22:15
52°	04:21	05:26	06:38	20:33	21:26	22:08
50°	04:29	05:34	06:45	20:25	21:18	22:02
45°	04:46	05:51	07:00	20:07	21:03	21:49
N 40°	05:01	06:05	07:12	19:53	20:50	21:38
35°	05:13	06:16	07:23	19:41	20:38	21:29
30°	05:23	06:27	07:32	19:31	20:29	21:21
20°	05:41	06:45	07:48	19:13	20:12	21:06
N 10°	05:57	07:00	08:02	18:57	19:57	20:54
0°	06:12	07:14	08:15	18:42	19:43	20:42
S 10°	06:27	07:29	08:27	18:27	19:30	20:30
20°	06:43	07:44	08:41	18:11	19:15	20:17
30°	07:01	08:02	08:57	17:53	18:58	20:03
35°	07:12	08:12	09:06	17:42	18:48	19:54
40°	07:24	08:24	09:17	17:30	18:36	19:44
45°	07:39	08:38	09:29	17:16	18:23	19:33
S 50°	07:56	08:55	09:44	16:58	18:06	19:19
52°	08:05	09:03	09:51	16:49	17:58	19:12
54°	08:14	09:12	09:58	16:40	17:50	19:05
56°	08:24	09:22	10:07	16:30	17:40	18:57
58°	08:36	09:33	10:16	16:18	17:29	18:48
S 60°	08:50	09:46	10:27	16:04	17:16	18:37

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 0-2 0-8%
24	02:22	02:28	12:02	12:27	–:–	
25	02:35	02:41	12:03	13:29	00:58	
26	02:48	02:54	12:03	14:28	01:59	

June 27, 28, 29 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	275°17.7	225°40.3	N15°28.0	169°11.7	N23°36.9	82°12.4	S04°10.2	12°07.8	S21°56.9
1	290°20.2	240°40.1	28.7	184°12.4	36.7	97°14.7	10.3	27°10.4	56.9
2	305°22.6	255°39.8	29.4	199°13.1	36.6	112°17.1	10.3	42°13.1	56.9
3	320°25.1	270°39.6	·· 30.1	214°13.8	·· 36.4	127°19.4	·· 10.4	57°15.7	·· 56.9
4	335°27.6	285°39.4	30.8	229°14.5	36.2	142°21.8	10.4	72°18.4	56.9
5	350°30.0	300°39.2	31.5	244°15.2	36.0	157°24.1	10.5	87°21.1	56.9
6	5°32.5	315°39.0	N15°32.2	259°15.9	N23°35.9	172°26.5	S04°10.6	102°23.7	S21°56.9
7	20°35.0	330°38.7	32.9	274°16.6	35.7	187°28.8	10.6	117°26.4	56.9
8	35°37.4	345°38.5	33.6	289°17.2	35.5	202°31.2	10.7	132°29.0	56.9
9	50°39.9	0°38.3	·· 34.3	304°17.9	·· 35.3	217°33.5	·· 10.7	147°31.7	·· 56.9
10	65°42.4	15°38.1	35.0	319°18.6	35.2	232°35.9	10.8	162°34.3	56.9
11	80°44.8	30°37.9	35.7	334°19.3	35.0	247°38.2	10.9	177°37.0	56.9
12	95°47.3	45°37.6	N15°36.4	349°20.0	N23°34.8	262°40.6	S04°10.9	192°39.7	S21°56.9
13	110°49.7	60°37.4	37.1	4°20.7	34.7	277°42.9	11.0	207°42.3	56.9
14	125°52.2	75°37.2	37.8	19°21.4	34.5	292°45.3	11.1	222°45.0	56.9
15	140°54.7	90°37.0	·· 38.5	34°22.1	·· 34.3	307°47.6	·· 11.1	237°47.6	·· 56.9
16	155°57.1	105°36.7	39.2	49°22.8	34.1	322°50.0	11.2	252°50.3	56.9
17	170°59.6	120°36.5	39.9	64°23.5	34.0	337°52.3	11.2	267°52.9	56.9
18	186°02.1	135°36.3	N15°40.6	79°24.1	N23°33.8	352°54.6	S04°11.3	282°55.6	S21°56.9
19	201°04.5	150°36.1	41.3	94°24.8	33.6	7°57.0	11.4	297°58.2	56.9
20	216°07.0	165°35.8	42.1	109°25.5	33.4	22°59.3	11.4	313°00.9	56.8
21	231°09.5	180°35.6	·· 42.8	124°26.2	·· 33.3	38°01.7	·· 11.5	328°03.6	·· 56.8
22	246°11.9	195°35.4	43.5	139°26.9	33.1	53°04.0	11.5	343°06.2	56.8
23	261°14.4	210°35.1	44.1	154°27.6	32.9	68°06.4	11.6	358°08.9	56.8
Mer.pass.:05:38		v-0.2 d0.7 m-4.1		v0.7 d-0.2 m1.6		v2.4 d-0.1 m-1.9		v2.7 d0.0 m0.0	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	276°16.9	225°34.9	N15°44.8	169°28.3	N23°32.7	83°08.7	S04°11.7	13°11.5	S21°56.8
1	291°19.3	240°34.7	45.5	184°29.0	32.5	98°11.1	11.7	28°14.2	56.8
2	306°21.8	255°34.5	46.2	199°29.7	32.4	113°13.4	11.8	43°16.8	56.8
3	321°24.2	270°34.2	·· 46.9	214°30.4	·· 32.2	128°15.7	·· 11.9	58°19.5	·· 56.8
4	336°26.7	285°34.0	47.6	229°31.1	32.0	143°18.1	11.9	73°22.1	56.8
5	351°29.2	300°33.8	48.3	244°31.7	31.8	158°20.4	12.0	88°24.8	56.8
6	6°31.6	315°33.5	N15°49.0	259°32.4	N23°31.6	173°22.8	S04°12.0	103°27.5	S21°56.8
7	21°34.1	330°33.3	49.7	274°33.1	31.5	188°25.1	12.1	118°30.1	56.8
8	36°36.6	345°33.1	50.4	289°33.8	31.3	203°27.5	12.2	133°32.8	56.8
9	51°39.0	0°32.8	·· 51.1	304°34.5	·· 31.1	218°29.8	·· 12.2	148°35.4	·· 56.8
10	66°41.5	15°32.6	51.8	319°35.2	30.9	233°32.1	12.3	163°38.1	56.8
11	81°44.0	30°32.3	52.5	334°35.9	30.7	248°34.5	12.4	178°40.7	56.8
12	96°46.4	45°32.1	N15°53.2	349°36.6	N23°30.6	263°36.8	S04°12.4	193°43.4	S21°56.8
13	111°48.9	60°31.9	53.9	4°37.3	30.4	278°39.2	12.5	208°46.0	56.8
14	126°51.3	75°31.6	54.6	19°38.0	30.2	293°41.5	12.5	223°48.7	56.8
15	141°53.8	90°31.4	·· 55.3	34°38.7	·· 30.0	308°43.8	·· 12.6	238°51.3	·· 56.8
16	156°56.3	105°31.1	56.0	49°39.4	29.8	323°46.2	12.7	253°54.0	56.8
17	171°58.7	120°30.9	56.7	64°40.1	29.7	338°48.5	12.7	268°56.7	56.8
18	187°01.2	135°30.7	N15°57.4	79°40.8	N23°29.5	353°50.9	S04°12.8	283°59.3	S21°56.8
19	202°03.7	150°30.4	58.1	94°41.4	29.3	8°53.2	12.9	299°02.0	56.8
20	217°06.1	165°30.2	58.7	109°42.1	29.1	23°55.5	12.9	314°04.6	56.8
21	232°08.6	180°29.9	15°59.4	124°42.8	·· 28.9	38°57.9	·· 13.0	329°07.3	·· 56.8
22	247°11.1	195°29.7	16°00.1	139°43.5	28.7	54°00.2	13.1	344°09.9	56.7
23	262°13.5	210°29.5	00.8	154°44.2	28.5	69°02.6	13.1	359°12.6	56.7
Mer.pass.:05:34		v-0.2 d0.7 m-4.1		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.7 d0.0 m0.0	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	277°16.0	225°29.2	N16°01.5	169°44.9	N23°28.4	84°04.9	S04°13.2	14°15.2	S21°56.7
1	292°18.5	240°29.0	02.2	184°45.6	28.2	99°07.2	13.2	29°17.9	56.7
2	307°20.9	255°28.7	02.9	199°46.3	28.0	114°09.6	13.3	44°20.5	56.7
3	322°23.4	270°28.5	·· 03.6	214°47.0	·· 27.8	129°11.9	·· 13.4	59°23.2	·· 56.7
4	337°25.8	285°28.2	04.3	229°47.7	27.6	144°14.3	13.4	74°25.8	56.7
5	352°28.3	300°28.0	05.0	244°48.4	27.4	159°16.6	13.5	89°28.5	56.7
6	7°30.8	315°27.7	N16°05.6	259°49.1	N23°27.2	174°18.9	S04°13.6	104°31.2	S21°56.7
7	22°33.2	330°27.5	06.3	274°49.8	27.1	189°21.3	13.6	119°33.8	56.7
8	37°35.7	345°27.2	07.0	289°50.5	26.9	204°23.6	13.7	134°36.5	56.7
9	52°38.2	0°27.0	·· 07.7	304°51.2	·· 26.7	219°25.9	·· 13.8	149°39.1	·· 56.7
10	67°40.6	15°26.7	08.4	319°51.9	26.5	234°28.3	13.8	164°41.8	56.7
11	82°43.1	30°26.5	09.1	334°52.6	26.3	249°30.6	13.9	179°44.4	56.7
12	97°45.6	45°26.2	N16°09.8	349°53.3	N23°26.1	264°32.9	S04°14.0	194°47.1	S21°56.7
13	112°48.0	60°26.0	10.4	4°54.0	25.9	279°35.3	14.0	209°49.7	56.7
14	127°50.5	75°25.7	11.1	19°54.7	25.7	294°37.6	14.1	224°52.4	56.7
15	142°53.0	90°25.5	·· 11.8	34°55.3	·· 25.5	309°39.9	·· 14.2	239°55.0	·· 56.7
16	157°55.4	105°25.2	12.5	49°56.0	25.4	324°42.3	14.2	254°57.7	56.7
17	172°57.9	120°24.9	13.2	64°56.7	25.2	339°44.6	14.3	270°00.3	56.7
18	188°00.3	135°24.7	N16°13.9	79°57.4	N23°25.0	354°46.9	S04°14.4	285°03.0	S21°56.7
19	203°02.8	150°24.4	14.5	94°58.1	24.8	9°49.3	14.4	300°05.6	56.7
20	218°05.3	165°24.2	15.2	109°58.8	24.6	24°51.6	14.5	315°08.3	56.7
21	233°07.7	180°23.9	·· 15.9	124°59.5	·· 24.4	39°53.9	·· 14.6	330°11.0	·· 56.7
22	248°10.2	195°23.7	16.6	140°00.2	24.2	54°56.3	14.6	345°13.6	56.7
23	263°12.7	210°23.4	17.3	155°00.9	24.0	69°58.6	14.7	0°16.3	56.6
Mer.pass.:05:30		v-0.2 d0.7 m-4.1		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.7 d0.0 m0.0	

Stars

	SHA	Dec
Alpheratz	357°40.6	29°11.0
Ankaa	353°13.1	-42°12.5
Schedar	349°37.3	56°37.6
Diphda	348°53.2	-17°53.4
Achernar	335°25.0	-57°08.7
Hamal	327°57.8	23°32.4
Polaris	316°48.5	89°19.9
Acamar	315°16.6	-40°14.1
Menkar	314°12.4	4°09.3
Mirfak	308°36.8	49°55.0
Aldebaran	290°46.6	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°30.9	46°00.6
Bellatrix	278°29.4	6°21.7
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.6
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.5
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-28°59.9
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.4	-59°34.2
Suhail	222°50.7	-43°30.4
Miaplacidus	221°39.7	-69°47.6
Alphard	217°53.7	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.8	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.4
Acrux	173°06.1	-63°12.0
Gacrux	171°57.7	-57°12.9
Alioth	166°18.3	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.6	49°13.9
Hadar	148°43.6	-60°27.5
Menkent	148°04.1	-36°27.4
Arcturus	145°53.1	19°05.8
Rigil Kent.	139°47.5	-60°54.5
Kochab	137°19.6	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.4	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.4
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.3	51°29.4
Kaus Aust.	83°39.8	-34°22.3
Vega	80°36.7	38°48.2
Nunki	75°54.6	-26°16.3
Altair	62°05.3	8°55.0
Peacock	53°14.5	-56°40.4
Deneb	49°29.2	45°20.6
Enif	33°44.2	9°57.4
Al Na'ir	27°40.1	-46°52.3
Fomalhaut	15°20.9	-29°31.6
Scheat	13°50.6	28°10.5
Markab	13°35.5	15°17.9

Jun 27 Tue	**SHA**	**Mer.pass**
Venus	310°22.6	08:57
Mars	253°54.0	12:43
Jupiter	166°54.7	18:28
Saturn	96°50.1	23:07

Jun 28 Wed	**SHA**	**Mer.pass**
Venus	309°18.1	08:58
Mars	253°11.4	12:42
Jupiter	166°51.9	18:25
Saturn	96°54.7	23:03

Jun 29 Thu	**SHA**	**Mer.pass**
Venus	308°13.2	08:58
Mars	252°28.9	12:40
Jupiter	166°48.9	18:21
Saturn	96°59.2	22:59

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3623 sec ΔT = TT-UT1 = +68.8217 sec

2017 June 27 to Jun. 29 UT

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°14.9	N23°19.1	137°29.4	7.3'	N15°19.8	-7.5'	59.4'
1	194°14.8	19.0	151°55.7	7.3'	15°12.3	-7.6'	59.4'
2	209°14.7	18.9	166°22.1	7.4'	15°04.7	-7.6'	59.4'
3	224°14.5	·· 18.8	180°48.6	7.5'	14°57.0	-7.7'	59.3'
4	239°14.4	18.7	195°15.2	7.6'	14°49.2	-7.8'	59.3'
5	254°14.3	18.6	209°41.8	7.7'	14°41.4	-7.9'	59.2'
6	269°14.1	N23°18.5	224°08.6	7.8'	N14°33.4	-8.0'	59.2'
7	284°14.0	18.4	238°35.4	7.9'	14°25.4	-8.0'	59.2'
8	299°13.9	18.3	253°02.4	8.0'	14°17.3	-8.1'	59.1'
9	314°13.7	·· 18.2	267°29.4	8.1'	14°09.2	-8.2'	59.1'
10	329°13.6	18.1	281°56.5	8.2'	14°00.9	-8.3'	59.1'
11	344°13.5	17.9	296°23.7	8.3'	13°52.6	-8.3'	59.0'
12	359°13.4	N23°17.8	310°51.1	8.3'	N13°44.2	-8.4'	59.0'
13	14°13.2	17.7	325°18.4	8.4'	13°35.8	-8.5'	58.9'
14	29°13.1	17.6	339°45.9	8.5'	13°27.2	-8.6'	58.9'
15	44°13.0	·· 17.5	354°13.5	8.6'	13°18.7	-8.6'	58.9'
16	59°12.8	17.4	8°41.2	8.7'	13°10.0	-8.7'	58.8'
17	74°12.7	17.3	23°08.9	8.8'	13°01.3	-8.8'	58.8'
18	89°12.6	N23°17.2	37°36.8	8.9'	N12°52.5	-8.8'	58.7'
19	104°12.4	17.1	52°04.7	9.0'	12°43.6	-8.9'	58.7'
20	119°12.3	17.0	66°32.7	9.1'	12°34.7	-8.9'	58.7'
21	134°12.2	·· 16.8	81°00.8	9.2'	12°25.7	-9.0'	58.6'
22	149°12.1	16.7	95°29.0	9.2'	12°16.7	-9.1'	58.6'
23	164°11.9	16.6	109°57.3	9.3'	12°07.6	-9.1'	58.5'
	SD.=15.7	d=-0.1	S.D.=16.1				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°11.8	N23°16.5	124°25.7	9.4'	N11°58.5	-9.2'	58.5'
1	194°11.7	16.4	138°54.2	9.5'	11°49.3	-9.2'	58.5'
2	209°11.5	16.3	153°22.7	9.6'	11°40.0	-9.3'	58.4'
3	224°11.4	·· 16.1	167°51.4	9.7'	11°30.7	-9.3'	58.4'
4	239°11.3	16.0	182°20.1	9.8'	11°21.3	-9.4'	58.3'
5	254°11.2	15.9	196°48.9	9.8'	11°11.9	-9.4'	58.3'
6	269°11.0	N23°15.8	211°17.8	9.9'	N11°02.5	-9.5'	58.3'
7	284°10.9	15.7	225°46.8	10.0'	10°53.0	-9.5'	58.2'
8	299°10.8	15.5	240°15.8	10.1'	10°43.4	-9.6'	58.2'
9	314°10.6	·· 15.4	254°45.0	10.2'	10°33.8	-9.6'	58.1'
10	329°10.5	15.3	269°14.2	10.3'	10°24.2	-9.7'	58.1'
11	344°10.4	15.2	283°43.5	10.3'	10°14.5	-9.7'	58.1'
12	359°10.3	N23°15.0	298°12.9	10.4'	N10°04.8	-9.7'	58.0'
13	14°10.1	14.9	312°42.3	10.5'	09°55.0	-9.8'	58.0'
14	29°10.0	14.8	327°11.9	10.6'	09°45.2	-9.8'	58.0'
15	44°09.9	·· 14.7	341°41.5	10.7'	09°35.3	-9.9'	57.9'
16	59°09.8	14.5	356°11.2	10.7'	09°25.5	-9.9'	57.9'
17	74°09.6	14.4	10°41.0	10.8'	09°15.5	-9.9'	57.8'
18	89°09.5	N23°14.3	25°10.9	10.9'	N09°05.6	-10.0'	57.8'
19	104°09.4	14.1	39°40.8	11.0'	08°55.6	-10.0'	57.8'
20	119°09.2	14.0	54°10.8	11.1'	08°45.6	-10.0'	57.7'
21	134°09.1	·· 13.9	68°40.9	11.1'	08°35.5	-10.1'	57.7'
22	149°09.0	13.7	83°11.1	11.2'	08°25.4	-10.1'	57.6'
23	164°08.9	13.6	97°41.3	11.3'	08°15.3	-10.1'	57.6'
	SD.=15.7	d=-0.1	S.D.=15.8				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°08.7	N23°13.5	112°11.6	11.3'	N08°05.2	-10.2'	57.6'
1	194°08.6	13.3	126°42.0	11.4'	07°55.0	-10.2'	57.5'
2	209°08.5	13.2	141°12.5	11.5'	07°44.8	-10.2'	57.5'
3	224°08.4	·· 13.1	155°43.0	11.6'	07°34.6	-10.2'	57.4'
4	239°08.2	12.9	170°13.6	11.6'	07°24.4	-10.3'	57.4'
5	254°08.1	12.8	184°44.3	11.7'	07°14.1	-10.3'	57.4'
6	269°08.0	N23°12.7	199°15.0	11.8'	N07°03.8	-10.3'	57.3'
7	284°07.9	12.5	213°45.8	11.8'	06°53.5	-10.3'	57.3'
8	299°07.7	12.4	228°16.7	11.9'	06°43.2	-10.3'	57.2'
9	314°07.6	·· 12.2	242°47.6	12.0'	06°32.8	-10.4'	57.2'
10	329°07.5	12.1	257°18.6	12.0'	06°22.5	-10.4'	57.2'
11	344°07.4	12.0	271°49.7	12.1'	06°12.1	-10.4'	57.1'
12	359°07.2	N23°11.8	286°20.8	12.2'	N06°01.7	-10.4'	57.1'
13	14°07.1	11.7	300°52.0	12.2'	05°51.3	-10.4'	57.1'
14	29°07.0	11.5	315°23.3	12.3'	05°40.8	-10.4'	57.0'
15	44°06.9	·· 11.4	329°54.6	12.3'	05°30.4	-10.5'	57.0'
16	59°06.7	11.3	344°25.9	12.4'	05°19.9	-10.5'	56.9'
17	74°06.6	11.1	358°57.4	12.5'	05°09.5	-10.5'	56.9'
18	89°06.5	N23°11.0	13°28.9	12.5'	N04°59.0	-10.5'	56.9'
19	104°06.4	10.8	28°00.4	12.6'	04°48.5	-10.5'	56.8'
20	119°06.2	10.7	42°32.0	12.6'	04°38.0	-10.5'	56.8'
21	134°06.1	·· 10.5	57°03.7	12.7'	04°27.5	-10.5'	56.8'
22	149°06.0	10.4	71°35.4	12.7'	04°17.0	-10.5'	56.7'
23	164°05.9	10.2	86°07.2	12.8'	04°06.5	-10.5'	56.7'
	SD.=15.7	d=-0.1	S.D.=15.6				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°						
64°			01:37	22:29		
62°			02:14	21:52		
60°		00:57	02:40	21:27	23:08	
N 58°		01:45	03:00	21:06	22:21	
56°		02:14	03:16	20:50	21:52	
54°	00:52	02:36	03:30	20:36	21:30	23:13
52°	01:37	02:54	03:43	20:24	21:12	22:29
50°	02:04	03:09	03:53	20:13	20:57	22:02
45°	02:49	03:38	04:16	19:51	20:28	21:17
N 40°	03:19	04:01	04:34	19:33	20:06	20:47
35°	03:42	04:19	04:49	19:18	19:48	20:24
30°	04:01	04:34	05:01	19:05	19:33	20:06
20°	04:30	04:59	05:23	18:43	19:08	19:37
N 10°	04:52	05:19	05:42	18:24	18:47	19:15
0°	05:11	05:37	06:00	18:07	18:29	18:56
S 10°	05:28	05:54	06:17	17:50	18:12	18:39
20°	05:44	06:11	06:35	17:31	17:55	18:23
30°	06:00	06:30	06:56	17:10	17:37	18:06
35°	06:09	06:41	07:09	16:58	17:26	17:58
40°	06:18	06:52	07:23	16:44	17:14	17:48
45°	06:29	07:06	07:40	16:27	17:01	17:38
S 50°	06:40	07:22	08:00	16:07	16:45	17:27
52°	06:45	07:29	08:10	15:57	16:38	17:21
54°	06:51	07:37	08:21	15:46	16:30	17:16
56°	06:57	07:46	08:33	15:33	16:21	17:10
58°	07:04	07:56	08:48	15:19	16:11	17:03
S 60°	07:11	08:08	09:05	15:02	15:59	16:56

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	05:32	07:37	09:30	00:36	00:23	00:13
N 70°	06:04	07:55	09:39	00:03	00:03	00:01
68°	06:27	08:09	09:47	23:47	23:52	23:55
66°	06:45	08:21	09:54	23:34	23:44	23:52
64°	07:00	08:31	09:59	23:24	23:38	23:49
62°	07:12	08:39	10:04	23:14	23:32	23:46
60°	07:22	08:46	10:08	23:06	23:27	23:44
N 58°	07:31	08:52	10:11	22:59	23:22	23:42
56°	07:39	08:58	10:14	22:53	23:18	23:40
54°	07:46	09:03	10:17	22:48	23:15	23:38
52°	07:52	09:07	10:20	22:43	23:11	23:36
50°	07:58	09:11	10:22	22:38	23:08	23:35
45°	08:10	09:20	10:27	22:28	23:02	23:32
N 40°	08:20	09:27	10:31	22:20	22:56	23:29
35°	08:29	09:33	10:35	22:13	22:52	23:27
30°	08:36	09:38	10:38	22:06	22:48	23:25
20°	08:49	09:48	10:44	21:55	22:40	23:22
N 10°	09:00	09:56	10:48	21:46	22:34	23:18
0°	09:11	10:04	10:53	21:37	22:28	23:16
S 10°	09:22	10:11	10:58	21:27	22:21	23:13
20°	09:33	10:20	11:02	21:18	22:15	23:09
30°	09:46	10:29	11:08	21:06	22:07	23:06
35°	09:53	10:34	11:11	21:00	22:03	23:04
40°	10:01	10:40	11:15	20:52	21:58	23:01
45°	10:11	10:47	11:19	20:43	21:52	22:58
S 50°	10:23	10:56	11:24	20:33	21:45	22:55
52°	10:28	10:59	11:26	20:28	21:42	22:53
54°	10:34	11:04	11:28	20:22	21:38	22:52
56°	10:41	11:08	11:31	20:16	21:34	22:50
58°	10:49	11:14	11:34	20:09	21:30	22:48
S 60°	10:57	11:19	11:38	20:02	21:25	22:45

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 3-5 16-35%
27	03:00	03:07	12:03	15:24	02:57	
28	03:13	03:19	12:03	16:16	03:50	
29	03:25	03:31	12:04	17:04	04:40	

June 30, 01, 02 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	278°15.1	225°23.1	N16°17.9	170°01.6	N23°23.8	85°00.9	S04°14.8	15°18.9	S21°56.6
1	293°17.6	240°22.9	18.6	185°02.3	23.6	100°03.3	14.8	30°21.6	56.6
2	308°20.1	255°22.6	19.3	200°03.0	23.4	115°05.6	14.9	45°24.2	56.6
3	323°22.5	270°22.4	·· 20.0	215°03.7	·· 23.2	130°07.9	·· 15.0	60°26.9	·· 56.6
4	338°25.0	285°22.1	20.7	230°04.4	23.0	145°10.3	15.0	75°29.5	56.6
5	353°27.4	300°21.8	21.3	245°05.1	22.9	160°12.6	15.1	90°32.2	56.6
6	8°29.9	315°21.6	N16°22.0	260°05.8	N23°22.7	175°14.9	S04°15.2	105°34.8	S21°56.6
7	23°32.4	330°21.3	22.7	275°06.5	22.5	190°17.2	15.2	120°37.5	56.6
8	38°34.8	345°21.0	23.4	290°07.2	22.3	205°19.6	15.3	135°40.1	56.6
9	53°37.3	0°20.8	·· 24.0	305°07.9	·· 22.1	220°21.9	·· 15.4	150°42.8	·· 56.6
10	68°39.8	15°20.5	24.7	320°08.6	21.9	235°24.2	15.4	165°45.4	56.6
11	83°42.2	30°20.2	25.4	335°09.3	21.7	250°26.6	15.5	180°48.1	56.6
12	98°44.7	45°20.0	N16°26.1	350°10.0	N23°21.5	265°28.9	S04°15.6	195°50.7	S21°56.6
13	113°47.2	60°19.7	26.7	5°10.7	21.3	280°31.2	15.6	210°53.4	56.6
14	128°49.6	75°19.4	27.4	20°11.4	21.1	295°33.5	15.7	225°56.0	56.6
15	143°52.1	90°19.2	·· 28.1	35°12.1	·· 20.9	310°35.9	·· 15.8	240°58.7	·· 56.6
16	158°54.6	105°18.9	28.8	50°12.8	20.7	325°38.2	15.9	256°01.3	56.6
17	173°57.0	120°18.6	29.4	65°13.5	20.5	340°40.5	15.9	271°04.0	56.6
18	188°59.5	135°18.4	N16°30.1	80°14.2	N23°20.3	355°42.9	S04°16.0	286°06.6	S21°56.6
19	204°01.9	150°18.1	30.8	95°14.9	20.1	10°45.2	16.1	301°09.3	56.6
20	219°04.4	165°17.8	31.4	110°15.6	19.9	25°47.5	16.1	316°11.9	56.6
21	234°06.9	180°17.5	·· 32.1	125°16.3	·· 19.7	40°49.8	·· 16.2	331°14.6	·· 56.6
22	249°09.3	195°17.3	32.8	140°17.0	19.5	55°52.2	16.3	346°17.2	56.6
23	264°11.8	210°17.0	33.5	155°17.7	19.3	70°54.5	16.3	1°19.9	56.6
Mer.pass.:05:26		v-0.3 d0.7 m-4.1		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.7 d0.0 m0.1	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	279°14.3	225°16.7	N16°34.1	170°18.4	N23°19.1	85°56.8	S04°16.4	16°22.6	S21°56.6
1	294°16.7	240°16.4	34.8	185°19.1	18.9	100°59.1	16.5	31°25.2	56.6
2	309°19.2	255°16.2	35.5	200°19.8	18.7	116°01.5	16.5	46°27.9	56.5
3	324°21.7	270°15.9	·· 36.1	215°20.5	·· 18.5	131°03.8	·· 16.6	61°30.5	·· 56.5
4	339°24.1	285°15.6	36.8	230°21.2	18.3	146°06.1	16.7	76°33.2	56.5
5	354°26.6	300°15.3	37.5	245°21.9	18.1	161°08.4	16.8	91°35.8	56.5
6	9°29.1	315°15.1	N16°38.1	260°22.6	N23°17.9	176°10.8	S04°16.8	106°38.5	S21°56.5
7	24°31.5	330°14.8	38.8	275°23.3	17.7	191°13.1	16.9	121°41.1	56.5
8	39°34.0	345°14.5	39.5	290°24.0	17.5	206°15.4	17.0	136°43.8	56.5
9	54°36.4	0°14.2	·· 40.1	305°24.7	·· 17.3	221°17.7	·· 17.0	151°46.4	·· 56.5
10	69°38.9	15°13.9	40.8	320°25.4	17.1	236°20.0	17.1	166°49.1	56.5
11	84°41.4	30°13.7	41.5	335°26.1	16.9	251°22.4	17.2	181°51.7	56.5
12	99°43.8	45°13.4	N16°42.1	350°26.8	N23°16.7	266°24.7	S04°17.3	196°54.4	S21°56.5
13	114°46.3	60°13.1	42.8	5°27.5	16.5	281°27.0	17.3	211°57.0	56.5
14	129°48.8	75°12.8	43.5	20°28.2	16.3	296°29.3	17.4	226°59.7	56.5
15	144°51.2	90°12.5	·· 44.1	35°28.9	·· 16.1	311°31.7	·· 17.5	242°02.3	·· 56.5
16	159°53.7	105°12.2	44.8	50°29.6	15.8	326°34.0	17.5	257°05.0	56.5
17	174°56.2	120°12.0	45.4	65°30.3	15.6	341°36.3	17.6	272°07.6	56.5
18	189°58.6	135°11.7	N16°46.1	80°31.0	N23°15.4	356°38.6	S04°17.7	287°10.3	S21°56.5
19	205°01.1	150°11.4	46.8	95°31.7	15.2	11°40.9	17.8	302°12.9	56.5
20	220°03.5	165°11.1	47.4	110°32.5	15.0	26°43.3	17.8	317°15.6	56.5
21	235°06.0	180°10.8	·· 48.1	125°33.2	·· 14.8	41°45.6	·· 17.9	332°18.2	·· 56.5
22	250°08.5	195°10.5	48.7	140°33.9	14.6	56°47.9	18.0	347°20.9	56.5
23	265°10.9	210°10.2	49.4	155°34.6	14.4	71°50.2	18.0	2°23.5	56.5
Mer.pass.:05:22		v-0.3 d0.7 m-4.1		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.7 d0.0 m0.1	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	280°13.4	225°10.0	N16°50.1	170°35.3	N23°14.2	86°52.5	S04°18.1	17°26.2	S21°56.5
1	295°15.9	240°09.7	50.7	185°36.0	14.0	101°54.9	18.2	32°28.8	56.5
2	310°18.3	255°09.4	51.4	200°36.7	13.8	116°57.2	18.3	47°31.5	56.5
3	325°20.8	270°09.1	·· 52.0	215°37.4	·· 13.6	131°59.5	·· 18.3	62°34.1	·· 56.5
4	340°23.3	285°08.8	52.7	230°38.1	13.4	147°01.8	18.4	77°36.8	56.5
5	355°25.7	300°08.5	53.3	245°38.8	13.1	162°04.1	18.5	92°39.4	56.4
6	10°28.2	315°08.2	N16°54.0	260°39.5	N23°12.9	177°06.4	S04°18.5	107°42.1	S21°56.4
7	25°30.7	330°07.9	54.7	275°40.2	12.7	192°08.8	18.6	122°44.7	56.4
8	40°33.1	345°07.6	55.3	290°40.9	12.5	207°11.1	18.7	137°47.4	56.4
9	55°35.6	0°07.3	·· 56.0	305°41.6	·· 12.3	222°13.4	·· 18.8	152°50.0	·· 56.4
10	70°38.0	15°07.0	56.6	320°42.3	12.1	237°15.7	18.8	167°52.6	56.4
11	85°40.5	30°06.7	57.3	335°43.0	11.9	252°18.0	18.9	182°55.3	56.4
12	100°43.0	45°06.4	N16°57.9	350°43.7	N23°11.7	267°20.3	S04°19.0	197°57.9	S21°56.4
13	115°45.4	60°06.1	58.6	5°44.4	11.5	282°22.7	19.1	213°00.6	56.4
14	130°47.9	75°05.8	59.2	20°45.1	11.2	297°25.0	19.1	228°03.2	56.4
15	145°50.4	90°05.5	16°59.9	35°45.8	·· 11.0	312°27.3	·· 19.2	243°05.9	·· 56.4
16	160°52.8	105°05.2	17°00.5	50°46.6	10.8	327°29.6	19.3	258°08.5	56.4
17	175°55.3	120°04.9	01.2	65°47.3	10.6	342°31.9	19.4	273°11.2	56.4
18	190°57.8	135°04.6	N17°01.8	80°48.0	N23°10.4	357°34.2	S04°19.4	288°13.8	S21°56.4
19	206°00.2	150°04.3	02.5	95°48.7	10.2	12°36.5	19.5	303°16.5	56.4
20	221°02.7	165°04.0	03.1	110°49.4	10.0	27°38.9	19.6	318°19.1	56.4
21	236°05.2	180°03.7	·· 03.8	125°50.1	·· 09.8	42°41.2	·· 19.7	333°21.8	·· 56.4
22	251°07.6	195°03.4	04.4	140°50.8	09.5	57°43.5	19.7	348°24.4	56.4
23	266°10.1	210°03.1	05.1	155°51.5	09.3	72°45.8	19.8	3°27.1	56.4
Mer.pass.:05:18		v-0.3 d0.7 m-4.0		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Stars

	SHA	Dec
Alpheratz	357°40.6	29°11.0
Ankaa	353°13.1	-42°12.5
Schedar	349°37.3	56°37.6
Diphda	348°53.2	-17°53.4
Achernar	335°25.0	-57°08.7
Hamal	327°57.8	23°32.4
Polaris	316°47.3	89°19.9
Acamar	315°16.6	-40°14.1
Menkar	314°12.4	4°09.3
Mirfak	308°36.7	49°55.0
Aldebaran	290°46.5	16°32.4
Rigel	281°09.8	-8°11.1
Capella	280°30.9	46°00.6
Bellatrix	278°29.4	6°21.7
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.6
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.4
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-28°59.9
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.4	-59°34.2
Suhail	222°50.8	-43°30.4
Miaplacidus	221°39.7	-69°47.6
Alphard	217°53.7	-8°44.2
Regulus	207°40.8	11°52.9
Dubhe	193°48.8	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.3
Acrux	173°06.2	-63°12.0
Gacrux	171°57.8	-57°12.8
Alioth	166°18.4	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.7	49°14.0
Hadar	148°43.6	-60°27.5
Menkent	148°04.1	-36°27.4
Arcturus	145°53.1	19°05.8
Rigil Kent.	139°47.6	-60°54.5
Kochab	137°19.6	74°05.4
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.4
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.3	51°29.4
Kaus Aust.	83°39.8	-34°22.3
Vega	80°36.7	38°48.2
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.0
Peacock	53°14.5	-56°40.4
Deneb	49°29.2	45°20.6
Enif	33°44.2	9°57.4
Al Na'ir	27°40.1	-46°52.3
Fomalhaut	15°20.9	-29°31.6
Scheat	13°50.5	28°10.5
Markab	13°35.5	15°17.9

Jun 30 Fri	SHA	Mer.pass
Venus	307°08.0	08:59
Mars	251°46.5	12:39
Jupiter	166°45.8	18:17
Saturn	97°03.8	22:55

Jul 01 Sat	SHA	Mer.pass
Venus	306°02.5	08:59
Mars	251°04.1	12:38
Jupiter	166°42.5	18:13
Saturn	97°08.3	22:50

Jul 02 Sun	SHA	Mer.pass
Venus	304°56.5	09:00
Mars	250°21.9	12:37
Jupiter	166°39.1	18:10
Saturn	97°12.8	22:46

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3602 sec ΔT = TT-UT1 = +68.8238 sec

2017 June 30 to Jul. 02 UT

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°05.7	N23°10.1	100°39.0	12.9'	N03°55.9	-10.5'	56.7'
1	194°05.6	09.9	115°10.9	12.9'	03°45.4	-10.5'	56.6'
2	209°05.5	09.8	129°42.8	13.0'	03°34.9	-10.5'	56.6'
3	224°05.4	·· 09.6	144°14.8	13.0'	03°24.3	-10.5'	56.5'
4	239°05.2	09.5	158°46.8	13.1'	03°13.8	-10.5'	56.5'
5	254°05.1	09.3	173°18.9	13.1'	03°03.2	-10.5'	56.5'
6	269°05.0	N23°09.1	187°51.0	13.2'	N02°52.7	-10.5'	56.4'
7	284°04.9	09.0	202°23.2	13.2'	02°42.1	-10.5'	56.4'
8	299°04.8	08.8	216°55.4	13.2'	02°31.6	-10.5'	56.4'
9	314°04.6	·· 08.7	231°27.7	13.3'	02°21.1	-10.5'	56.3'
10	329°04.5	08.5	246°00.0	13.3'	02°10.5	-10.5'	56.3'
11	344°04.4	08.4	260°32.4	13.4'	02°00.0	-10.5'	56.3'
12	359°04.3	N23°08.2	275°04.8	13.4'	N01°49.5	-10.5'	56.2'
13	14°04.1	08.0	289°37.2	13.5'	01°38.9	-10.5'	56.2'
14	29°04.0	07.9	304°09.7	13.5'	01°28.4	-10.5'	56.2'
15	44°03.9	·· 07.7	318°42.2	13.5'	01°17.9	-10.5'	56.1'
16	59°03.8	07.6	333°14.8	13.6'	01°07.4	-10.5'	56.1'
17	74°03.6	07.4	347°47.4	13.6'	00°56.9	-10.5'	56.1'
18	89°03.5	N23°07.2	2°20.0	13.7'	N00°46.4	-10.5'	56.0'
19	104°03.4	07.1	16°52.7	13.7'	00°35.9	-10.5'	56.0'
20	119°03.3	06.9	31°25.4	13.7'	00°25.4	-10.5'	56.0'
21	134°03.2	·· 06.7	45°58.1	13.8'	00°14.9	-10.5'	55.9'
22	149°03.0	06.6	60°30.9	13.8'	N00°04.5	-10.5'	55.9'
23	164°02.9	06.4	75°03.7	13.8'	00°06.0	-10.4'	55.9'
	SD.=15.7	d=-0.2		S.D.=15.3			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°02.8	N23°06.2	89°36.6	13.9'	S00°16.4	-10.4'	55.9'
1	194°02.7	06.1	104°09.5	13.9'	00°26.8	-10.4'	55.8'
2	209°02.6	05.9	118°42.4	13.9'	00°37.2	-10.4'	55.8'
3	224°02.4	·· 05.7	133°15.3	14.0'	00°47.6	-10.4'	55.8'
4	239°02.3	05.6	147°48.3	14.0'	00°58.0	-10.4'	55.7'
5	254°02.2	05.4	162°21.3	14.0'	01°08.4	-10.4'	55.7'
6	269°02.1	N23°05.2	176°54.3	14.0'	S01°18.7	-10.3'	55.7'
7	284°02.0	05.1	191°27.3	14.1'	01°29.1	-10.3'	55.6'
8	299°01.8	04.9	206°00.4	14.1'	01°39.4	-10.3'	55.6'
9	314°01.7	·· 04.7	220°33.5	14.1'	01°49.7	-10.3'	55.6'
10	329°01.6	04.5	235°06.7	14.1'	01°59.9	-10.3'	55.6'
11	344°01.5	04.4	249°39.8	14.2'	02°10.2	-10.2'	55.5'
12	359°01.4	N23°04.2	264°13.0	14.2'	S02°20.4	-10.2'	55.5'
13	14°01.2	04.0	278°46.2	14.2'	02°30.7	-10.2'	55.5'
14	29°01.1	03.8	293°19.4	14.2'	02°40.9	-10.2'	55.4'
15	44°01.0	·· 03.7	307°52.6	14.2'	02°51.0	-10.2'	55.4'
16	59°00.9	03.5	322°25.9	14.3'	03°01.2	-10.1'	55.4'
17	74°00.8	03.3	336°59.1	14.3'	03°11.3	-10.1'	55.4'
18	89°00.6	N23°03.1	351°32.4	14.3'	S03°21.4	-10.1'	55.3'
19	104°00.5	02.9	6°05.7	14.3'	03°31.5	-10.1'	55.3'
20	119°00.4	02.8	20°39.1	14.3'	03°41.6	-10.0'	55.3'
21	134°00.3	·· 02.6	35°12.4	14.3'	03°51.6	-10.0'	55.3'
22	149°00.2	02.4	49°45.8	14.4'	04°01.6	-10.0'	55.2'
23	164°00.0	02.2	64°19.1	14.4'	04°11.6	-10.0'	55.2'
	SD.=15.7	d=-0.2		S.D.=15.1			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°59.9	N23°02.0	78°52.5	14.4'	S04°21.6	-9.9'	55.2'
1	193°59.8	01.8	93°25.9	14.4'	04°31.5	-9.9'	55.2'
2	208°59.7	01.6	107°59.3	14.4'	04°41.4	-9.9'	55.1'
3	223°59.6	·· 01.5	122°32.7	14.4'	04°51.3	-9.9'	55.1'
4	238°59.5	01.3	137°06.1	14.4'	05°01.1	-9.8'	55.1'
5	253°59.3	01.1	151°39.6	14.4'	05°11.0	-9.8'	55.1'
6	268°59.2	N23°00.9	166°13.0	14.4'	S05°20.7	-9.8'	55.0'
7	283°59.1	00.7	180°46.5	14.5'	05°30.5	-9.7'	55.0'
8	298°59.0	00.5	195°19.9	14.5'	05°40.2	-9.7'	55.0'
9	313°58.9	·· 00.3	209°53.4	14.5'	05°49.9	-9.7'	55.0'
10	328°58.8	23°00.1	224°26.9	14.5'	05°59.6	-9.6'	55.0'
11	343°58.6	22°59.9	239°00.3	14.5'	06°09.2	-9.6'	54.9'
12	358°58.5	N22°59.8	253°33.8	14.5'	S06°18.8	-9.6'	54.9'
13	13°58.4	59.6	268°07.3	14.5'	06°28.4	-9.5'	54.9'
14	28°58.3	59.4	282°40.8	14.5'	06°37.9	-9.5'	54.9'
15	43°58.2	·· 59.2	297°14.3	14.5'	06°47.4	-9.5'	54.8'
16	58°58.1	59.0	311°47.8	14.5'	06°56.8	-9.4'	54.8'
17	73°57.9	58.8	326°21.3	14.5'	07°06.3	-9.4'	54.8'
18	88°57.8	N22°58.6	340°54.7	14.5'	S07°15.7	-9.4'	54.8'
19	103°57.7	58.4	355°28.2	14.5'	07°25.0	-9.3'	54.8'
20	118°57.6	58.2	10°01.7	14.5'	07°34.3	-9.3'	54.7'
21	133°57.5	·· 58.0	24°35.2	14.5'	07°43.6	-9.3'	54.7'
22	148°57.4	57.8	39°08.7	14.5'	07°52.8	-9.2'	54.7'
23	163°57.2	57.6	53°42.2	14.5'	08°02.0	-9.2'	54.7'
	SD.=15.7	d=-0.2		S.D.=15.0			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			00:22	23:38		
64°			01:42	22:25		
62°			02:17	21:50		
60°		01:04	02:42	21:25	23:02	
N 58°		01:49	03:02	21:05	22:18	
56°		02:17	03:19	20:49	21:50	
54°	00:59	02:39	03:32	20:35	21:29	23:07
52°	01:40	02:56	03:44	20:23	21:11	22:27
50°	02:07	03:11	03:55	20:12	20:56	22:00
45°	02:51	03:40	04:17	19:50	20:27	21:17
N 40°	03:21	04:02	04:35	19:33	20:05	20:47
35°	03:44	04:20	04:50	19:18	19:47	20:24
30°	04:02	04:35	05:03	19:05	19:32	20:06
20°	04:31	05:00	05:24	18:43	19:08	19:37
N 10°	04:53	05:20	05:43	18:25	18:48	19:15
0°	05:12	05:38	06:00	18:08	18:30	18:56
S 10°	05:28	05:55	06:17	17:50	18:13	18:39
20°	05:44	06:12	06:36	17:32	17:56	18:24
30°	06:00	06:30	06:57	17:11	17:38	18:07
35°	06:09	06:41	07:09	16:59	17:27	17:59
40°	06:18	06:52	07:23	16:45	17:16	17:50
45°	06:28	07:05	07:39	16:29	17:02	17:40
S 50°	06:40	07:21	08:00	16:08	16:47	17:28
52°	06:45	07:29	08:09	15:59	16:39	17:23
54°	06:51	07:37	08:20	15:48	16:31	17:17
56°	06:57	07:45	08:32	15:36	16:23	17:11
58°	07:03	07:55	08:47	15:21	16:13	17:05
S 60°	07:10	08:07	09:04	15:04	16:01	16:58

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	11:16	12:57	14:37	00:05 23:57	23:49	23:41
N 70°	11:18	12:53	14:27	00:00 23:57	23:55	23:53
68°	11:20	12:50	14:18	23:58	–:–	00:00
66°	11:22	12:48	14:11	23:58	–:–	00:04
64°	11:24	12:46	14:06	23:58	–:–	00:08
62°	11:25	12:44	14:01	23:59	–:–	00:11
60°	11:26	12:42	13:56	23:59	–:–	00:13
N 58°	11:27	12:41	13:53	23:59	–:–	00:16
56°	11:28	12:40	13:49	23:59	–:–	00:18
54°	11:29	12:38	13:46	23:59	–:–	00:20
52°	11:30	12:37	13:43	23:59	–:–	00:22
50°	11:30	12:37	13:41	–:–	00:00	00:23
45°	11:32	12:35	13:36	–:–	00:00	00:27
N 40°	11:33	12:33	13:31	–:–	00:00	00:30
35°	11:34	12:31	13:27	–:–	00:00	00:32
30°	11:35	12:30	13:24	–:–	00:00	00:35
20°	11:37	12:28	13:18	–:–	00:01	00:39
N 10°	11:38	12:26	13:13	–:–	00:01	00:42
0°	11:40	12:24	13:08	–:–	00:01	00:45
S 10°	11:41	12:23	13:03	–:–	00:01	00:49
20°	11:42	12:21	12:58	–:–	00:02	00:52
30°	11:44	12:19	12:53	–:–	00:02	00:56
35°	11:45	12:17	12:50	–:–	00:02	00:58
40°	11:46	12:16	12:46	–:–	00:02	01:01
45°	11:47	12:15	12:42	–:–	00:02	01:04
S 50°	11:49	12:13	12:37	–:–	00:02	01:08
52°	11:50	12:12	12:34	–:–	00:02	01:09
54°	11:50	12:11	12:32	–:–	00:02	01:11
56°	11:51	12:10	12:29	–:–	00:03	01:13
58°	11:52	12:09	12:26	–:–	00:03	01:15
S 60°	11:53	12:08	12:23	–:–	00:03	01:18

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 6-8 45-64%
30	03:37	03:43	12:04	17:50	05:28	
01	03:49	03:55	12:04	18:35	06:13	
02	04:00	04:06	12:04	19:19	06:57	

July 03, 04, 05 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	281°12.5	225°02.8	N17°05.7	170°52.2	N23°09.1	87°48.1	S04°19.9	18°29.7	S21°56.4
1	296°15.0	240°02.5	06.4	185°52.9	08.9	102°50.4	20.0	33°32.4	56.4
2	311°17.5	255°02.2	07.0	200°53.6	08.7	117°52.7	20.0	48°35.0	56.4
3	326°19.9	270°01.9	·· 07.7	215°54.3	·· 08.5	132°55.1	·· 20.1	63°37.7	·· 56.4
4	341°22.4	285°01.6	08.3	230°55.0	08.2	147°57.4	20.2	78°40.3	56.4
5	356°24.9	300°01.3	09.0	245°55.7	08.0	162°59.7	20.3	93°43.0	56.4
6	11°27.3	315°01.0	N17°09.6	260°56.5	N23°07.8	178°02.0	S04°20.3	108°45.6	S21°56.4
7	26°29.8	330°00.7	10.2	275°57.2	07.6	193°04.3	20.4	123°48.3	56.4
8	41°32.3	345°00.4	10.9	290°57.9	07.4	208°06.6	20.5	138°50.9	56.3
9	56°34.7	0°00.1	·· 11.5	305°58.6	·· 07.2	223°08.9	·· 20.6	153°53.5	·· 56.3
10	71°37.2	14°59.8	12.2	320°59.3	06.9	238°11.2	20.6	168°56.2	56.3
11	86°39.6	29°59.4	12.8	336°00.0	06.7	253°13.5	20.7	183°58.8	56.3
12	101°42.1	44°59.1	N17°13.5	351°00.7	N23°06.5	268°15.8	S04°20.8	199°01.5	S21°56.3
13	116°44.6	59°58.8	14.1	6°01.4	06.3	283°18.2	20.9	214°04.1	56.3
14	131°47.0	74°58.5	14.7	21°02.1	06.1	298°20.5	20.9	229°06.8	56.3
15	146°49.5	89°58.2	·· 15.4	36°02.8	·· 05.8	313°22.8	·· 21.0	244°09.4	·· 56.3
16	161°52.0	104°57.9	16.0	51°03.5	05.6	328°25.1	21.1	259°12.1	56.3
17	176°54.4	119°57.6	16.7	66°04.3	05.4	343°27.4	21.2	274°14.7	56.3
18	191°56.9	134°57.3	N17°17.3	81°05.0	N23°05.2	358°29.7	S04°21.2	289°17.4	S21°56.3
19	206°59.4	149°56.9	17.9	96°05.7	05.0	13°32.0	21.3	304°20.0	56.3
20	222°01.8	164°56.6	18.6	111°06.4	04.7	28°34.3	21.4	319°22.7	56.3
21	237°04.3	179°56.3	·· 19.2	126°07.1	·· 04.5	43°36.6	·· 21.5	334°25.3	·· 56.3
22	252°06.8	194°56.0	19.8	141°07.8	04.3	58°38.9	21.5	349°28.0	56.3
23	267°09.2	209°55.7	20.5	156°08.5	04.1	73°41.2	21.6	4°30.6	56.3
Mer.pass.:05:14		v-0.3 d0.6 m-4.0		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	282°11.7	224°55.4	N17°21.1	171°09.2	N23°03.8	88°43.5	S04°21.7	19°33.2	S21°56.3
1	297°14.1	239°55.0	21.7	186°09.9	03.6	103°45.9	21.8	34°35.9	56.3
2	312°16.6	254°54.7	22.4	201°10.7	03.4	118°48.2	21.9	49°38.5	56.3
3	327°19.1	269°54.4	·· 23.0	216°11.4	·· 03.2	133°50.5	·· 21.9	64°41.2	·· 56.3
4	342°21.5	284°54.1	23.6	231°12.1	02.9	148°52.8	22.0	79°43.8	56.3
5	357°24.0	299°53.8	24.3	246°12.8	02.7	163°55.1	22.1	94°46.5	56.3
6	12°26.5	314°53.4	N17°24.9	261°13.5	N23°02.5	178°57.4	S04°22.2	109°49.1	S21°56.3
7	27°28.9	329°53.1	25.5	276°14.2	02.3	193°59.7	22.2	124°51.8	56.3
8	42°31.4	344°52.8	26.2	291°14.9	02.0	209°02.0	22.3	139°54.4	56.3
9	57°33.9	359°52.5	·· 26.8	306°15.6	·· 01.8	224°04.3	·· 22.4	154°57.1	·· 56.3
10	72°36.3	14°52.1	27.4	321°16.3	01.6	239°06.6	22.5	169°59.7	56.3
11	87°38.8	29°51.8	28.1	336°17.1	01.4	254°08.9	22.6	185°02.3	56.3
12	102°41.3	44°51.5	N17°28.7	351°17.8	N23°01.1	269°11.2	S04°22.6	200°05.0	S21°56.3
13	117°43.7	59°51.2	29.3	6°18.5	00.9	284°13.5	22.7	215°07.6	56.2
14	132°46.2	74°50.8	30.0	21°19.2	00.7	299°15.8	22.8	230°10.3	56.2
15	147°48.6	89°50.5	·· 30.6	36°19.9	·· 00.5	314°18.1	·· 22.9	245°12.9	·· 56.2
16	162°51.1	104°50.2	31.2	51°20.6	00.2	329°20.4	23.0	260°15.6	56.2
17	177°53.6	119°49.9	31.8	66°21.3	23°00.0	344°22.7	23.0	275°18.2	56.2
18	192°56.0	134°49.5	N17°32.5	81°22.1	N22°59.8	359°25.0	S04°23.1	290°20.9	S21°56.2
19	207°58.5	149°49.2	33.1	96°22.8	59.5	14°27.3	23.2	305°23.5	56.2
20	223°01.0	164°48.9	33.7	111°23.5	59.3	29°29.6	23.3	320°26.2	56.2
21	238°03.4	179°48.5	·· 34.3	126°24.2	·· 59.1	44°31.9	·· 23.4	335°28.8	·· 56.2
22	253°05.9	194°48.2	35.0	141°24.9	58.9	59°34.2	23.4	350°31.4	56.2
23	268°08.4	209°47.9	35.6	156°25.6	58.6	74°36.5	23.5	5°34.1	56.2
Mer.pass.:05:10		v-0.3 d0.6 m-4.0		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	283°10.8	224°47.5	N17°36.2	171°26.3	N22°58.4	89°38.8	S04°23.6	20°36.7	S21°56.2
1	298°13.3	239°47.2	36.8	186°27.0	58.2	104°41.1	23.7	35°39.4	56.2
2	313°15.7	254°46.9	37.4	201°27.8	57.9	119°43.4	23.8	50°42.0	56.2
3	328°18.2	269°46.5	·· 38.1	216°28.5	·· 57.7	134°45.7	·· 23.8	65°44.7	·· 56.2
4	343°20.7	284°46.2	38.7	231°29.2	57.5	149°48.0	23.9	80°47.3	56.2
5	358°23.1	299°45.9	39.3	246°29.9	57.2	164°50.3	24.0	95°49.9	56.2
6	13°25.6	314°45.5	N17°39.9	261°30.6	N22°57.0	179°52.6	S04°24.1	110°52.6	S21°56.2
7	28°28.1	329°45.2	40.5	276°31.3	56.8	194°54.9	24.2	125°55.2	56.2
8	43°30.5	344°44.8	41.2	291°32.1	56.5	209°57.2	24.2	140°57.9	56.2
9	58°33.0	359°44.5	·· 41.8	306°32.8	·· 56.3	224°59.5	·· 24.3	156°00.5	·· 56.2
10	73°35.5	14°44.2	42.4	321°33.5	56.1	240°01.8	24.4	171°03.2	56.2
11	88°37.9	29°43.8	43.0	336°34.2	55.8	255°04.1	24.5	186°05.8	56.2
12	103°40.4	44°43.5	N17°43.6	351°34.9	N22°55.6	270°06.4	S04°24.6	201°08.5	S21°56.2
13	118°42.9	59°43.2	44.3	6°35.6	55.4	285°08.7	24.6	216°11.1	56.2
14	133°45.3	74°42.8	44.9	21°36.3	55.1	300°11.0	24.7	231°13.7	56.2
15	148°47.8	89°42.5	·· 45.5	36°37.1	·· 54.9	315°13.3	·· 24.8	246°16.4	·· 56.2
16	163°50.2	104°42.1	46.1	51°37.8	54.7	330°15.6	24.9	261°19.0	56.2
17	178°52.7	119°41.8	46.7	66°38.5	54.4	345°17.9	25.0	276°21.7	56.2
18	193°55.2	134°41.4	N17°47.3	81°39.2	N22°54.2	0°20.2	S04°25.0	291°24.3	S21°56.1
19	208°57.6	149°41.1	47.9	96°39.9	54.0	15°22.5	25.1	306°27.0	56.1
20	224°00.1	164°40.7	48.5	111°40.7	53.7	30°24.8	25.2	321°29.6	56.1
21	239°02.6	179°40.4	·· 49.2	126°41.4	·· 53.5	45°27.1	·· 25.3	336°32.2	·· 56.1
22	254°05.0	194°40.1	49.8	141°42.1	53.3	60°29.4	25.4	351°34.9	56.1
23	269°07.5	209°39.7	50.4	156°42.8	53.0	75°31.7	25.5	6°37.5	56.1
Mer.pass.:05:06		v-0.3 d0.6 m-4.0		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Stars

	SHA	**Dec**
Alpheratz	357°40.6	29°11.0
Ankaa	353°13.0	-42°12.5
Schedar	349°37.3	56°37.6
Diphda	348°53.2	-17°53.4
Achernar	335°25.0	-57°08.7
Hamal	327°57.8	23°32.4
Polaris	316°46.0	89°19.9
Acamar	315°16.6	-40°14.0
Menkar	314°12.4	4°09.3
Mirfak	308°36.7	49°55.0
Aldebaran	290°46.5	16°32.4
Rigel	281°09.7	-8°11.1
Capella	280°30.8	46°00.6
Bellatrix	278°29.4	6°21.7
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.6
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.4
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-28°59.9
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.4	-59°34.1
Suhail	222°50.8	-43°30.4
Miaplacidus	221°39.8	-69°47.6
Alphard	217°53.7	-8°44.2
Regulus	207°40.9	11°52.9
Dubhe	193°48.8	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.3
Acrux	173°06.2	-63°12.0
Gacrux	171°57.8	-57°12.8
Alioth	166°18.4	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.7	49°14.0
Hadar	148°43.7	-60°27.5
Menkent	148°04.2	-36°27.4
Arcturus	145°53.1	19°05.8
Rigil Kent.	139°47.6	-60°54.5
Kochab	137°19.6	74°05.5
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.4
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.3	51°29.5
Kaus Aust.	83°39.8	-34°22.3
Vega	80°36.7	38°48.2
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.0
Peacock	53°14.5	-56°40.4
Deneb	49°29.1	45°20.6
Enif	33°44.2	9°57.4
Al Na'ir	27°40.1	-46°52.3
Fomalhaut	15°20.8	-29°31.6
Scheat	13°50.5	28°10.5
Markab	13°35.4	15°17.9

Jul 03 Mon	**SHA**	**Mer.pass**
Venus	303°50.3	09:00
Mars	249°39.7	12:36
Jupiter	166°35.6	18:06
Saturn	97°17.2	22:42

Jul 04 Tue	**SHA**	**Mer.pass**
Venus	302°43.7	09:00
Mars	248°57.5	12:35
Jupiter	166°31.9	18:02
Saturn	97°21.6	22:38

Jul 05 Wed	**SHA**	**Mer.pass**
Venus	301°36.7	09:01
Mars	248°15.5	12:34
Jupiter	166°28.0	17:59
Saturn	97°25.9	22:34

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3587 sec ΔT = TT-UT1 = +68.8253 sec

2017 July 03 to Jul. 05 UT

h

Mon	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°57.1	N22°57.4	68°15.6	14.5'	S08°11.2	-9.1'	54.7'
1	193°57.0	57.2	82°49.1	14.5'	08°20.3	-9.1'	54.7'
2	208°56.9	57.0	97°22.6	14.5'	08°29.4	-9.1'	54.6'
3	223°56.8	·· 56.8	111°56.1	14.5'	08°38.4	-9.0'	54.6'
4	238°56.7	56.6	126°29.5	14.5'	08°47.4	-9.0'	54.6'
5	253°56.6	56.4	141°03.0	14.4'	08°56.4	-8.9'	54.6'
6	268°56.4	N22°56.2	155°36.4	14.4'	S09°05.3	-8.9'	54.6'
7	283°56.3	56.0	170°09.8	14.4'	09°14.1	-8.8'	54.5'
8	298°56.2	55.8	184°43.3	14.4'	09°23.0	-8.8'	54.5'
9	313°56.1	·· 55.6	199°16.7	14.4'	09°31.7	-8.8'	54.5'
10	328°56.0	55.3	213°50.1	14.4'	09°40.5	-8.7'	54.5'
11	343°55.9	55.1	228°23.5	14.4'	09°49.2	-8.7'	54.5'
12	358°55.8	N22°54.9	242°56.9	14.4'	S09°57.8	-8.6'	54.5'
13	13°55.6	54.7	257°30.2	14.4'	10°06.4	-8.6'	54.5'
14	28°55.5	54.5	272°03.6	14.4'	10°15.0	-8.5'	54.4'
15	43°55.4	·· 54.3	286°36.9	14.3'	10°23.5	-8.5'	54.4'
16	58°55.3	54.1	301°10.3	14.3'	10°31.9	-8.4'	54.4'
17	73°55.2	53.9	315°43.6	14.3'	10°40.3	-8.4'	54.4'
18	88°55.1	N22°53.7	330°16.9	14.3'	S10°48.7	-8.3'	54.4'
19	103°55.0	53.4	344°50.2	14.3'	10°57.0	-8.3'	54.4'
20	118°54.9	53.2	359°23.5	14.3'	11°05.3	-8.2'	54.4'
21	133°54.7	·· 53.0	13°56.7	14.3'	11°13.5	-8.2'	54.3'
22	148°54.6	52.8	28°30.0	14.2'	11°21.7	-8.1'	54.3'
23	163°54.5	52.6	43°03.2	14.2'	11°29.8	-8.1'	54.3'
	SD.=15.7	d=-0.2		S.D.=14.8			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°54.4	N22°52.4	57°36.4	14.2'	S11°37.8	-8.0'	54.3'
1	193°54.3	52.1	72°09.6	14.2'	11°45.8	-8.0'	54.3'
2	208°54.2	51.9	86°42.8	14.2'	11°53.8	-7.9'	54.3'
3	223°54.1	·· 51.7	101°16.0	14.2'	12°01.7	-7.9'	54.3'
4	238°54.0	51.5	115°49.1	14.1'	12°09.5	-7.8'	54.3'
5	253°53.9	51.3	130°22.2	14.1'	12°17.3	-7.8'	54.3'
6	268°53.7	N22°51.0	144°55.3	14.1'	S12°25.1	-7.7'	54.2'
7	283°53.6	50.8	159°28.4	14.1'	12°32.8	-7.7'	54.2'
8	298°53.5	50.6	174°01.5	14.1'	12°40.4	-7.6'	54.2'
9	313°53.4	·· 50.4	188°34.5	14.0'	12°48.0	-7.5'	54.2'
10	328°53.3	50.1	203°07.5	14.0'	12°55.5	-7.5'	54.2'
11	343°53.2	49.9	217°40.5	14.0'	13°02.9	-7.4'	54.2'
12	358°53.1	N22°49.7	232°13.5	14.0'	S13°10.4	-7.4'	54.2'
13	13°53.0	49.5	246°46.5	13.9'	13°17.7	-7.3'	54.2'
14	28°52.9	49.2	261°19.4	13.9'	13°25.0	-7.3'	54.2'
15	43°52.8	·· 49.0	275°52.3	13.9'	13°32.2	-7.2'	54.2'
16	58°52.6	48.8	290°25.2	13.9'	13°39.4	-7.1'	54.1'
17	73°52.5	48.6	304°58.0	13.9'	13°46.5	-7.1'	54.1'
18	88°52.4	N22°48.3	319°30.9	13.8'	S13°53.5	-7.0'	54.1'
19	103°52.3	48.1	334°03.7	13.8'	14°00.5	-7.0'	54.1'
20	118°52.2	47.9	348°36.5	13.8'	14°07.5	-6.9'	54.1'
21	133°52.1	·· 47.6	3°09.3	13.8'	14°14.3	-6.8'	54.1'
22	148°52.0	47.4	17°42.0	13.7'	14°21.1	-6.8'	54.1'
23	163°51.9	47.2	32°14.7	13.7'	14°27.9	-6.7'	54.1'
	SD.=15.7	d=-0.2		S.D.=14.8			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°51.8	N22°46.9	46°47.4	13.7'	S14°34.6	-6.6'	54.1'
1	193°51.7	46.7	61°20.1	13.7'	14°41.2	-6.6'	54.1'
2	208°51.6	46.5	75°52.7	13.6'	14°47.7	-6.5'	54.1'
3	223°51.5	·· 46.2	90°25.3	13.6'	14°54.2	-6.5'	54.1'
4	238°51.4	46.0	104°57.9	13.6'	15°00.6	-6.4'	54.1'
5	253°51.2	45.8	119°30.5	13.5'	15°07.0	-6.3'	54.1'
6	268°51.1	N22°45.5	134°03.0	13.5'	S15°13.3	-6.3'	54.1'
7	283°51.0	45.3	148°35.5	13.5'	15°19.5	-6.2'	54.1'
8	298°50.9	45.0	163°08.0	13.5'	15°25.7	-6.1'	54.0'
9	313°50.8	·· 44.8	177°40.4	13.4'	15°31.7	-6.1'	54.0'
10	328°50.7	44.6	192°12.9	13.4'	15°37.8	-6.0'	54.0'
11	343°50.6	44.3	206°45.3	13.4'	15°43.7	-5.9'	54.0'
12	358°50.5	N22°44.1	221°17.6	13.4'	S15°49.6	-5.8'	54.0'
13	13°50.4	43.8	235°50.0	13.3'	15°55.4	-5.8'	54.0'
14	28°50.3	43.6	250°22.3	13.3'	16°01.2	-5.7'	54.0'
15	43°50.2	·· 43.3	264°54.6	13.3'	16°06.8	-5.6'	54.0'
16	58°50.1	43.1	279°26.8	13.2'	16°12.4	-5.6'	54.0'
17	73°50.0	42.9	293°59.1	13.2'	16°18.0	-5.5'	54.0'
18	88°49.9	N22°42.6	308°31.3	13.2'	S16°23.4	-5.4'	54.0'
19	103°49.8	42.4	323°03.4	13.2'	16°28.8	-5.4'	54.0'
20	118°49.7	42.1	337°35.6	13.1'	16°34.1	-5.3'	54.0'
21	133°49.5	·· 41.9	352°07.7	13.1'	16°39.4	-5.2'	54.0'
22	148°49.4	41.6	6°39.8	13.1'	16°44.6	-5.1'	54.0'
23	163°49.3	41.4	21°11.8	13.0'	16°49.7	-5.1'	54.0'
	SD.=15.7	d=-0.2		S.D.=14.7			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			00:43	23:21		
64°			01:48	22:20		
62°			02:21	21:46		
60°		01:12	02:46	21:22	22:55	
N 58°		01:53	03:05	21:03	22:14	
56°		02:21	03:21	20:47	21:47	
54°	01:06	02:42	03:35	20:33	21:26	23:01
52°	01:44	02:59	03:47	20:22	21:09	22:23
50°	02:10	03:13	03:57	20:11	20:55	21:58
45°	02:53	03:42	04:19	19:50	20:26	21:15
N 40°	03:23	04:04	04:37	19:32	20:05	20:46
35°	03:45	04:22	04:51	19:18	19:47	20:23
30°	04:03	04:36	05:04	19:05	19:32	20:05
20°	04:32	05:01	05:25	18:44	19:08	19:37
N 10°	04:54	05:21	05:44	18:25	18:48	19:15
0°	05:12	05:38	06:01	18:08	18:31	18:57
S 10°	05:29	05:55	06:18	17:51	18:14	18:40
20°	05:45	06:12	06:36	17:33	17:57	18:24
30°	06:00	06:30	06:56	17:13	17:39	18:09
35°	06:09	06:40	07:08	17:01	17:29	18:00
40°	06:18	06:52	07:22	16:47	17:17	17:51
45°	06:28	07:05	07:39	16:31	17:04	17:41
S 50°	06:39	07:20	07:59	16:11	16:49	17:30
52°	06:44	07:28	08:08	16:01	16:42	17:25
54°	06:50	07:35	08:19	15:50	16:34	17:19
56°	06:56	07:44	08:31	15:38	16:25	17:14
58°	07:02	07:54	08:45	15:24	16:15	17:07
S 60°	07:09	08:05	09:02	15:08	16:04	17:00

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	16:18	18:02	19:58	23:31	23:19	22:58
N 70°	15:59	17:33	19:08	23:51	23:49	23:49
68°	15:45	17:11	18:36	00:02	00:06	00:11
66°	15:34	16:55	18:13	00:11	00:19	00:29
64°	15:24	16:41	17:55	00:18	00:29	00:43
62°	15:16	16:29	17:40	00:24	00:38	00:56
60°	15:09	16:20	17:28	00:29	00:46	01:06
N 58°	15:03	16:11	17:17	00:33	00:53	01:15
56°	14:57	16:04	17:08	00:38	00:59	01:23
54°	14:52	15:57	17:00	00:41	01:04	01:30
52°	14:48	15:51	16:52	00:45	01:09	01:36
50°	14:44	15:46	16:46	00:48	01:14	01:42
45°	14:35	15:34	16:32	00:54	01:23	01:55
N 40°	14:28	15:25	16:20	01:00	01:31	02:05
35°	14:22	15:16	16:10	01:05	01:38	02:14
30°	14:17	15:09	16:01	01:09	01:44	02:22
20°	14:08	14:57	15:46	01:17	01:55	02:35
N 10°	13:59	14:46	15:33	01:23	02:04	02:47
0°	13:52	14:36	15:21	01:29	02:13	02:58
S 10°	13:44	14:26	15:09	01:35	02:22	03:09
20°	13:36	14:16	14:57	01:42	02:31	03:21
30°	13:27	14:04	14:42	01:49	02:42	03:34
35°	13:22	13:57	14:33	01:54	02:48	03:42
40°	13:16	13:49	14:24	01:59	02:55	03:51
45°	13:10	13:40	14:13	02:04	03:04	04:02
S 50°	13:02	13:29	13:59	02:11	03:14	04:15
52°	12:58	13:24	13:53	02:15	03:18	04:21
54°	12:54	13:18	13:46	02:18	03:24	04:27
56°	12:49	13:12	13:38	02:22	03:29	04:35
58°	12:44	13:05	13:29	02:26	03:36	04:43
S 60°	12:39	12:57	13:19	02:31	03:43	04:52

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 9-11 73-88%
03	04:11	04:17	12:04	20:03	07:41	
04	04:22	04:28	12:04	20:47	08:25	
05	04:33	04:38	12:05	21:32	09:10	

July 06, 07, 08 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	284°10.0	224°39.4	N17°51.0	171°43.5	N22°52.8	90°34.0	S04°25.5	21°40.2	S21°56.1
1	299°12.4	239°39.0	51.6	186°44.2	52.5	105°36.3	25.6	36°42.8	56.1
2	314°14.9	254°38.7	52.2	201°45.0	52.3	120°38.5	25.7	51°45.4	56.1
3	329°17.4	269°38.3	·· 52.8	216°45.7	·· 52.1	135°40.8	·· 25.8	66°48.1	·· 56.1
4	344°19.8	284°38.0	53.4	231°46.4	51.8	150°43.1	25.9	81°50.7	56.1
5	359°22.3	299°37.6	54.0	246°47.1	51.6	165°45.4	26.0	96°53.4	56.1
6	14°24.7	314°37.3	N17°54.6	261°47.8	N22°51.3	180°47.7	S04°26.0	111°56.0	S21°56.1
7	29°27.2	329°36.9	55.2	276°48.6	51.1	195°50.0	26.1	126°58.7	56.1
8	44°29.7	344°36.6	55.8	291°49.3	50.9	210°52.3	26.2	142°01.3	56.1
9	59°32.1	359°36.2	·· 56.5	306°50.0	·· 50.6	225°54.6	·· 26.3	157°03.9	·· 56.1
10	74°34.6	14°35.9	57.1	321°50.7	50.4	240°56.9	26.4	172°06.6	56.1
11	89°37.1	29°35.5	57.7	336°51.4	50.1	255°59.2	26.4	187°09.2	56.1
12	104°39.5	44°35.1	N17°58.3	351°52.1	N22°49.9	271°01.5	S04°26.5	202°11.9	S21°56.1
13	119°42.0	59°34.8	58.9	6°52.9	49.7	286°03.8	26.6	217°14.5	56.1
14	134°44.5	74°34.4	17°59.5	21°53.6	49.4	301°06.1	26.7	232°17.1	56.1
15	149°46.9	89°34.1	18°00.1	36°54.3	·· 49.2	316°08.3	·· 26.8	247°19.8	·· 56.1
16	164°49.4	104°33.7	00.7	51°55.0	48.9	331°10.6	26.9	262°22.4	56.1
17	179°51.9	119°33.4	01.3	66°55.7	48.7	346°12.9	27.0	277°25.1	56.1
18	194°54.3	134°33.0	N18°01.9	81°56.5	N22°48.4	1°15.2	S04°27.0	292°27.7	S21°56.1
19	209°56.8	149°32.6	02.5	96°57.2	48.2	16°17.5	27.1	307°30.4	56.1
20	224°59.2	164°32.3	03.1	111°57.9	48.0	31°19.8	27.2	322°33.0	56.1
21	240°01.7	179°31.9	·· 03.7	126°58.6	·· 47.7	46°22.1	·· 27.3	337°35.6	·· 56.1
22	255°04.2	194°31.6	04.3	141°59.4	47.5	61°24.4	27.4	352°38.3	56.1
23	270°06.6	209°31.2	04.9	157°00.1	47.2	76°26.7	27.5	7°40.9	56.1
Mer.pass.:05:03		v-0.3 d0.6 m-4.0		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	285°09.1	224°30.8	N18°05.5	172°00.8	N22°47.0	91°29.0	S04°27.5	22°43.6	S21°56.1
1	300°11.6	239°30.5	06.1	187°01.5	46.7	106°31.2	27.6	37°46.2	56.0
2	315°14.0	254°30.1	06.6	202°02.2	46.5	121°33.5	27.7	52°48.8	56.0
3	330°16.5	269°29.8	·· 07.2	217°03.0	·· 46.2	136°35.8	·· 27.8	67°51.5	·· 56.0
4	345°19.0	284°29.4	07.8	232°03.7	46.0	151°38.1	27.9	82°54.1	56.0
5	0°21.4	299°29.0	08.4	247°04.4	45.8	166°40.4	28.0	97°56.8	56.0
6	15°23.9	314°28.7	N18°09.0	262°05.1	N22°45.5	181°42.7	S04°28.1	112°59.4	S21°56.0
7	30°26.3	329°28.3	09.6	277°05.8	45.3	196°45.0	28.1	128°02.0	56.0
8	45°28.8	344°27.9	10.2	292°06.6	45.0	211°47.2	28.2	143°04.7	56.0
9	60°31.3	359°27.6	·· 10.8	307°07.3	·· 44.8	226°49.5	·· 28.3	158°07.3	·· 56.0
10	75°33.7	14°27.2	11.4	322°08.0	44.5	241°51.8	28.4	173°10.0	56.0
11	90°36.2	29°26.8	12.0	337°08.7	44.3	256°54.1	28.5	188°12.6	56.0
12	105°38.7	44°26.5	N18°12.6	352°09.5	N22°44.0	271°56.4	S04°28.6	203°15.2	S21°56.0
13	120°41.1	59°26.1	13.2	7°10.2	43.8	286°58.7	28.7	218°17.9	56.0
14	135°43.6	74°25.7	13.7	22°10.9	43.5	302°01.0	28.7	233°20.5	56.0
15	150°46.1	89°25.4	·· 14.3	37°11.6	·· 43.3	317°03.2	·· 28.8	248°23.1	·· 56.0
16	165°48.5	104°25.0	14.9	52°12.4	43.0	332°05.5	28.9	263°25.8	56.0
17	180°51.0	119°24.6	15.5	67°13.1	42.8	347°07.8	29.0	278°28.4	56.0
18	195°53.5	134°24.2	N18°16.1	82°13.8	N22°42.5	2°10.1	S04°29.1	293°31.1	S21°56.0
19	210°55.9	149°23.9	16.7	97°14.5	42.3	17°12.4	29.2	308°33.7	56.0
20	225°58.4	164°23.5	17.3	112°15.3	42.0	32°14.7	29.3	323°36.3	56.0
21	241°00.8	179°23.1	·· 17.8	127°16.0	·· 41.8	47°16.9	·· 29.3	338°39.0	·· 56.0
22	256°03.3	194°22.7	18.4	142°16.7	41.5	62°19.2	29.4	353°41.6	56.0
23	271°05.8	209°22.4	19.0	157°17.4	41.3	77°21.5	29.5	8°44.3	56.0
Mer.pass.:04:59		v-0.4 d0.6 m-4.0		v0.7 d-0.2 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	286°08.2	224°22.0	N18°19.6	172°18.1	N22°41.0	92°23.8	S04°29.6	23°46.9	S21°56.0
1	301°10.7	239°21.6	20.2	187°18.9	40.8	107°26.1	29.7	38°49.5	56.0
2	316°13.2	254°21.2	20.8	202°19.6	40.5	122°28.4	29.8	53°52.2	56.0
3	331°15.6	269°20.9	·· 21.3	217°20.3	·· 40.3	137°30.6	·· 29.9	68°54.8	·· 56.0
4	346°18.1	284°20.5	21.9	232°21.1	40.0	152°32.9	30.0	83°57.4	56.0
5	1°20.6	299°20.1	22.5	247°21.8	39.7	167°35.2	30.0	99°00.1	56.0
6	16°23.0	314°19.7	N18°23.1	262°22.5	N22°39.5	182°37.5	S04°30.1	114°02.7	S21°56.0
7	31°25.5	329°19.3	23.7	277°23.2	39.2	197°39.8	30.2	129°05.4	56.0
8	46°28.0	344°19.0	24.2	292°24.0	39.0	212°42.0	30.3	144°08.0	56.0
9	61°30.4	359°18.6	·· 24.8	307°24.7	·· 38.7	227°44.3	·· 30.4	159°10.6	·· 55.9
10	76°32.9	14°18.2	25.4	322°25.4	38.5	242°46.6	30.5	174°13.3	55.9
11	91°35.3	29°17.8	26.0	337°26.1	38.2	257°48.9	30.6	189°15.9	55.9
12	106°37.8	44°17.4	N18°26.5	352°26.9	N22°38.0	272°51.2	S04°30.7	204°18.5	S21°55.9
13	121°40.3	59°17.0	27.1	7°27.6	37.7	287°53.4	30.7	219°21.2	55.9
14	136°42.7	74°16.7	27.7	22°28.3	37.5	302°55.7	30.8	234°23.8	55.9
15	151°45.2	89°16.3	·· 28.3	37°29.0	·· 37.2	317°58.0	·· 30.9	249°26.5	·· 55.9
16	166°47.7	104°15.9	28.8	52°29.8	36.9	333°00.3	31.0	264°29.1	55.9
17	181°50.1	119°15.5	29.4	67°30.5	36.7	348°02.6	31.1	279°31.7	55.9
18	196°52.6	134°15.1	N18°30.0	82°31.2	N22°36.4	3°04.8	S04°31.2	294°34.4	S21°55.9
19	211°55.1	149°14.7	30.6	97°31.9	36.2	18°07.1	31.3	309°37.0	55.9
20	226°57.5	164°14.3	31.1	112°32.7	35.9	33°09.4	31.4	324°39.6	55.9
21	242°00.0	179°14.0	·· 31.7	127°33.4	·· 35.7	48°11.7	·· 31.5	339°42.3	·· 55.9
22	257°02.5	194°13.6	32.3	142°34.1	35.4	63°13.9	31.5	354°44.9	55.9
23	272°04.9	209°13.2	32.8	157°34.9	35.1	78°16.2	31.6	9°47.5	55.9
Mer.pass.:04:55		v-0.4 d0.6 m-4.0		v0.7 d-0.3 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Stars

	SHA	Dec
Alpheratz	357°40.5	29°11.0
Ankaa	353°13.0	-42°12.5
Schedar	349°37.2	56°37.6
Diphda	348°53.1	-17°53.4
Achernar	335°24.9	-57°08.7
Hamal	327°57.7	23°32.4
Polaris	316°44.5	89°19.9
Acamar	315°16.5	-40°14.0
Menkar	314°12.4	4°09.3
Mirfak	308°36.7	49°55.0
Aldebaran	290°46.5	16°32.4
Rigel	281°09.7	-8°11.0
Capella	280°30.8	46°00.6
Bellatrix	278°29.4	6°21.7
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.6
Betelgeuse	270°58.7	7°24.4
Canopus	263°55.5	-52°42.4
Sirius	258°31.7	-16°44.6
Adhara	255°10.8	-28°59.9
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.5	-59°34.1
Suhail	222°50.8	-43°30.4
Miaplacidus	221°39.8	-69°47.6
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°48.8	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.3
Acrux	173°06.2	-63°12.0
Gacrux	171°57.8	-57°12.8
Alioth	166°18.4	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.7	49°14.0
Hadar	148°43.7	-60°27.5
Menkent	148°04.2	-36°27.4
Arcturus	145°53.1	19°05.8
Rigil Kent.	139°47.6	-60°54.5
Kochab	137°19.7	74°05.5
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.4
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.3	51°29.5
Kaus Aust.	83°39.8	-34°22.3
Vega	80°36.7	38°48.2
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.4	-56°40.4
Deneb	49°29.1	45°20.6
Enif	33°44.2	9°57.4
Al Na'ir	27°40.0	-46°52.3
Fomalhaut	15°20.8	-29°31.6
Scheat	13°50.5	28°10.6
Markab	13°35.4	15°17.9

Jul 06 Thu	SHA	Mer.pass
Venus	300°29.4	09:02
Mars	247°33.6	12:32
Jupiter	166°24.0	17:55
Saturn	97°30.2	22:29

Jul 07 Fri	SHA	Mer.pass
Venus	299°21.7	09:02
Mars	246°51.7	12:31
Jupiter	166°19.9	17:51
Saturn	97°34.5	22:25

Jul 08 Sat	SHA	Mer.pass
Venus	298°13.7	09:03
Mars	246°09.9	12:30
Jupiter	166°15.6	17:48
Saturn	97°38.7	22:21

Horizontal parallax	
Venus:	0.2
Mars:	0.1

DUT1 = UT1-UTC = +0.3574 sec ΔT = TT-UT1 = +68.8266 sec

2017 July 06 to Jul. 08 UT

h

Thu	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°49.2	N22°41.1	35°43.9	13.0'	S16°54.7	-5.0'	54.0'
1	193°49.1	40.9	50°15.9	13.0'	16°59.6	-4.9'	54.0'
2	208°49.0	40.6	64°47.9	13.0'	17°04.5	-4.8'	54.0'
3	223°48.9	·· 40.4	79°19.8	12.9'	17°09.3	-4.8'	54.0'
4	238°48.8	40.1	93°51.7	12.9'	17°14.0	-4.7'	54.0'
5	253°48.7	39.9	108°23.6	12.9'	17°18.7	-4.6'	54.0'
6	268°48.6	N22°39.6	122°55.5	12.9'	S17°23.2	-4.5'	54.0'
7	283°48.5	39.3	137°27.3	12.8'	17°27.7	-4.5'	54.0'
8	298°48.4	39.1	151°59.1	12.8'	17°32.2	-4.4'	54.0'
9	313°48.3	·· 38.8	166°30.9	12.8'	17°36.5	-4.3'	54.0'
10	328°48.2	38.6	181°02.7	12.7'	17°40.7	-4.2'	54.0'
11	343°48.1	38.3	195°34.4	12.7'	17°44.9	-4.1'	54.0'
12	358°48.0	N22°38.1	210°06.1	12.7'	S17°49.0	-4.1'	54.0'
13	13°47.9	37.8	224°37.8	12.7'	17°53.0	-4.0'	54.0'
14	28°47.8	37.5	239°09.4	12.6'	17°57.0	-3.9'	54.0'
15	43°47.7	·· 37.3	253°41.0	12.6'	18°00.9	-3.8'	54.0'
16	58°47.6	37.0	268°12.6	12.6'	18°04.6	-3.7'	54.0'
17	73°47.5	36.8	282°44.2	12.6'	18°08.3	-3.7'	54.0'
18	88°47.4	N22°36.5	297°15.7	12.5'	S18°12.0	-3.6'	54.0'
19	103°47.3	36.2	311°47.2	12.5'	18°15.5	-3.5'	54.0'
20	118°47.2	36.0	326°18.7	12.5'	18°18.9	-3.4'	54.0'
21	133°47.1	·· 35.7	340°50.2	12.4'	18°22.3	-3.3'	54.0'
22	148°47.0	35.4	355°21.6	12.4'	18°25.6	-3.2'	54.0'
23	163°46.9	35.2	9°53.0	12.4'	18°28.8	-3.2'	54.0'
	SD.=15.7	d=-0.3	S.D.=14.7				

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°46.8	N22°34.9	24°24.4	12.4'	S18°31.9	-3.1'	54.0'
1	193°46.7	34.6	38°55.8	12.3'	18°35.0	-3.0'	54.0'
2	208°46.6	34.4	53°27.1	12.3'	18°37.9	-2.9'	54.1'
3	223°46.5	·· 34.1	67°58.4	12.3'	18°40.8	-2.8'	54.1'
4	238°46.4	33.8	82°29.7	12.3'	18°43.6	-2.7'	54.1'
5	253°46.3	33.6	97°00.9	12.3'	18°46.3	-2.7'	54.1'
6	268°46.2	N22°33.3	111°32.2	12.2'	S18°48.9	-2.6'	54.1'
7	283°46.1	33.0	126°03.4	12.2'	18°51.4	-2.5'	54.1'
8	298°46.0	32.7	140°34.6	12.2'	18°53.9	-2.4'	54.1'
9	313°45.9	·· 32.5	155°05.8	12.2'	18°56.2	-2.3'	54.1'
10	328°45.8	32.2	169°36.9	12.1'	18°58.5	-2.2'	54.1'
11	343°45.7	31.9	184°08.0	12.1'	19°00.7	-2.1'	54.1'
12	358°45.6	N22°31.6	198°39.1	12.1'	S19°02.8	-2.1'	54.1'
13	13°45.5	31.4	213°10.2	12.1'	19°04.8	-2.0'	54.1'
14	28°45.4	31.1	227°41.3	12.1'	19°06.7	-1.9'	54.1'
15	43°45.3	·· 30.8	242°12.3	12.0'	19°08.5	-1.8'	54.1'
16	58°45.2	30.5	256°43.3	12.0'	19°10.3	-1.7'	54.1'
17	73°45.1	30.3	271°14.4	12.0'	19°11.9	-1.6'	54.1'
18	88°45.0	N22°30.0	285°45.3	12.0'	S19°13.5	-1.5'	54.1'
19	103°44.9	29.7	300°16.3	12.0'	19°15.0	-1.4'	54.1'
20	118°44.8	29.4	314°47.2	11.9'	19°16.4	-1.3'	54.2'
21	133°44.7	·· 29.1	329°18.2	11.9'	19°17.7	-1.3'	54.2'
22	148°44.6	28.9	343°49.1	11.9'	19°18.9	-1.2'	54.2'
23	163°44.5	28.6	358°20.0	11.9'	19°20.0	-1.1'	54.2'
	SD.=15.7	d=-0.3	S.D.=14.7				

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°44.4	N22°28.3	12°50.9	11.9'	S19°21.0	-1.0'	54.2'
1	193°44.3	28.0	27°21.7	11.9'	19°22.0	-0.9'	54.2'
2	208°44.2	27.7	41°52.6	11.8'	19°22.8	-0.8'	54.2'
3	223°44.1	·· 27.4	56°23.4	11.8'	19°23.6	-0.7'	54.2'
4	238°44.0	27.2	70°54.2	11.8'	19°24.2	-0.6'	54.2'
5	253°43.9	26.9	85°25.0	11.8'	19°24.8	-0.5'	54.2'
6	268°43.9	N22°26.6	99°55.8	11.8'	S19°25.3	-0.4'	54.2'
7	283°43.8	26.3	114°26.5	11.8'	19°25.7	-0.3'	54.2'
8	298°43.7	26.0	128°57.3	11.8'	19°26.0	-0.3'	54.2'
9	313°43.6	·· 25.7	143°28.0	11.7'	19°26.2	-0.2'	54.3'
10	328°43.5	25.4	157°58.8	11.7'	19°26.3	-0.1'	54.3'
11	343°43.4	25.1	172°29.5	11.7'	19°26.3	0.0'	54.3'
12	358°43.3	N22°24.8	187°00.2	11.7'	S19°26.3	0.1'	54.3'
13	13°43.2	24.6	201°30.9	11.7'	19°26.1	0.2'	54.3'
14	28°43.1	24.3	216°01.6	11.7'	19°25.9	0.3'	54.3'
15	43°43.0	·· 24.0	230°32.3	11.7'	19°25.5	0.4'	54.3'
16	58°42.9	23.7	245°02.9	11.7'	19°25.1	0.5'	54.3'
17	73°42.8	23.4	259°33.6	11.7'	19°24.6	0.6'	54.3'
18	88°42.7	N22°23.1	274°04.2	11.6'	S19°24.0	0.7'	54.3'
19	103°42.6	22.8	288°34.9	11.6'	19°23.3	0.8'	54.4'
20	118°42.5	22.5	303°05.5	11.6'	19°22.5	0.8'	54.4'
21	133°42.4	·· 22.2	317°36.2	11.6'	19°21.6	0.9'	54.4'
22	148°42.4	21.9	332°06.8	11.6'	19°20.6	1.0'	54.4'
23	163°42.3	21.6	346°37.4	11.6'	19°19.5	1.1'	54.4'
	SD.=15.7	d=-0.3	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			00:59	23:07		
64°			01:54	22:14		
62°			02:27	21:42		
60°		01:20	02:50	21:19	22:47	
N 58°		01:59	03:09	21:00	22:10	
56°		02:25	03:25	20:45	21:44	
54°	01:14	02:45	03:38	20:31	21:24	22:54
52°	01:49	03:02	03:49	20:20	21:07	22:19
50°	02:14	03:16	04:00	20:10	20:53	21:55
45°	02:56	03:44	04:21	19:48	20:25	21:13
N 40°	03:25	04:06	04:38	19:31	20:04	20:44
35°	03:47	04:23	04:53	19:17	19:46	20:22
30°	04:05	04:38	05:05	19:05	19:32	20:05
20°	04:33	05:02	05:26	18:44	19:08	19:37
N 10°	04:55	05:22	05:44	18:25	18:48	19:15
0°	05:13	05:39	06:01	18:09	18:31	18:57
S 10°	05:29	05:55	06:18	17:52	18:15	18:41
20°	05:45	06:12	06:36	17:34	17:58	18:25
30°	06:00	06:30	06:56	17:14	17:40	18:10
35°	06:09	06:40	07:08	17:02	17:30	18:01
40°	06:17	06:51	07:22	16:49	17:19	17:53
45°	06:27	07:04	07:38	16:33	17:06	17:43
S 50°	06:38	07:19	07:57	16:13	16:51	17:32
52°	06:43	07:26	08:07	16:04	16:44	17:27
54°	06:48	07:34	08:17	15:53	16:36	17:22
56°	06:54	07:43	08:29	15:41	16:28	17:16
58°	07:00	07:52	08:43	15:28	16:18	17:10
S 60°	07:07	08:03	08:59	15:12	16:07	17:03

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°						
N 70°	20:42	22:07	22:56	23:51	–:–	00:05
68°	19:56	21:05	21:55	00:21	00:37	01:07
66°	19:27	20:31	21:20	00:44	01:07	01:42
64°	19:04	20:05	20:55	01:03	01:29	02:07
62°	18:47	19:46	20:35	01:18	01:47	02:27
60°	18:32	19:30	20:19	01:31	02:02	02:43
N 58°	18:20	19:16	20:06	01:42	02:15	02:56
56°	18:09	19:05	19:54	01:52	02:26	03:08
54°	17:59	18:54	19:44	02:00	02:36	03:18
52°	17:51	18:45	19:35	02:08	02:44	03:27
50°	17:43	18:37	19:26	02:15	02:52	03:36
45°	17:27	18:20	19:09	02:29	03:09	03:53
N 40°	17:14	18:06	18:55	02:42	03:22	04:07
35°	17:03	17:54	18:43	02:52	03:34	04:19
30°	16:53	17:43	18:32	03:01	03:44	04:30
20°	16:36	17:25	18:14	03:17	04:01	04:48
N 10°	16:21	17:10	17:58	03:31	04:16	05:04
0°	16:08	16:55	17:44	03:44	04:31	05:19
S 10°	15:54	16:41	17:29	03:57	04:45	05:33
20°	15:40	16:25	17:13	04:10	05:00	05:49
30°	15:23	16:07	16:55	04:26	05:17	06:07
35°	15:13	15:57	16:45	04:36	05:27	06:18
40°	15:02	15:45	16:33	04:46	05:39	06:30
45°	14:50	15:31	16:18	04:58	05:53	06:44
S 50°	14:34	15:14	16:01	05:14	06:09	07:01
52°	14:27	15:07	15:53	05:21	06:17	07:09
54°	14:19	14:58	15:44	05:28	06:26	07:18
56°	14:10	14:48	15:34	05:37	06:36	07:28
58°	13:59	14:36	15:22	05:47	06:47	07:40
S 60°	13:47	14:23	15:08	05:59	07:00	07:54

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 12-14 93-99%
06	04:43	04:48	12:05	22:19	09:56	
07	04:53	04:58	12:05	23:07	10:43	
08	05:02	05:07	12:05	23:55	11:31	

July 09, 10, 11 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	287°07.4	224°12.8	N18°33.4	172°35.6	N22°34.9	93°18.5	S04°31.7	24°50.2	S21°55.9
1	302°09.8	239°12.4	34.0	187°36.3	34.6	108°20.8	31.8	39°52.8	55.9
2	317°12.3	254°12.0	34.5	202°37.0	34.4	123°23.1	31.9	54°55.5	55.9
3	332°14.8	269°11.6	·· 35.1	217°37.8	·· 34.1	138°25.3	·· 32.0	69°58.1	·· 55.9
4	347°17.2	284°11.2	35.7	232°38.5	33.8	153°27.6	32.1	85°00.7	55.9
5	2°19.7	299°10.8	36.2	247°39.2	33.6	168°29.9	32.2	100°03.4	55.9
6	17°22.2	314°10.4	N18°36.8	262°40.0	N22°33.3	183°32.2	S04°32.3	115°06.0	S21°55.9
7	32°24.6	329°10.0	37.4	277°40.7	33.1	198°34.4	32.4	130°08.6	55.9
8	47°27.1	344°09.6	37.9	292°41.4	32.8	213°36.7	32.4	145°11.3	55.9
9	62°29.6	359°09.2	·· 38.5	307°42.2	·· 32.5	228°39.0	·· 32.5	160°13.9	·· 55.9
10	77°32.0	14°08.9	39.0	322°42.9	32.3	243°41.3	32.6	175°16.5	55.9
11	92°34.5	29°08.5	39.6	337°43.6	32.0	258°43.5	32.7	190°19.2	55.9
12	107°37.0	44°08.1	N18°40.2	352°44.3	N22°31.7	273°45.8	S04°32.8	205°21.8	S21°55.9
13	122°39.4	59°07.7	40.7	7°45.1	31.5	288°48.1	32.9	220°24.4	55.9
14	137°41.9	74°07.3	41.3	22°45.8	31.2	303°50.3	33.0	235°27.1	55.9
15	152°44.3	89°06.9	·· 41.8	37°46.5	·· 31.0	318°52.6	·· 33.1	250°29.7	·· 55.9
16	167°46.8	104°06.5	42.4	52°47.3	30.7	333°54.9	33.2	265°32.3	55.9
17	182°49.3	119°06.1	43.0	67°48.0	30.4	348°57.2	33.3	280°35.0	55.9
18	197°51.7	134°05.7	N18°43.5	82°48.7	N22°30.2	3°59.4	S04°33.4	295°37.6	S21°55.9
19	212°54.2	149°05.3	44.1	97°49.5	29.9	19°01.7	33.4	310°40.2	55.9
20	227°56.7	164°04.9	44.6	112°50.2	29.6	34°04.0	33.5	325°42.9	55.8
21	242°59.1	179°04.5	·· 45.2	127°50.9	·· 29.4	49°06.3	·· 33.6	340°45.5	·· 55.8
22	258°01.6	194°04.1	45.7	142°51.7	29.1	64°08.5	33.7	355°48.1	55.8
23	273°04.1	209°03.7	46.3	157°52.4	28.8	79°10.8	33.8	10°50.8	55.8
Mer.pass.:04:51		v-0.4 d0.6 m-4.0		v0.7 d-0.3 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	288°06.5	224°03.2	N18°46.8	172°53.1	N22°28.6	94°13.1	S04°33.9	25°53.4	S21°55.8
1	303°09.0	239°02.8	47.4	187°53.8	28.3	109°15.3	34.0	40°56.0	55.8
2	318°11.4	254°02.4	47.9	202°54.6	28.0	124°17.6	34.1	55°58.7	55.8
3	333°13.9	269°02.0	·· 48.5	217°55.3	·· 27.8	139°19.9	·· 34.2	71°01.3	·· 55.8
4	348°16.4	284°01.6	49.0	232°56.0	27.5	154°22.1	34.3	86°03.9	55.8
5	3°18.8	299°01.2	49.6	247°56.8	27.2	169°24.4	34.4	101°06.6	55.8
6	18°21.3	314°00.8	N18°50.1	262°57.5	N22°27.0	184°26.7	S04°34.5	116°09.2	S21°55.8
7	33°23.8	329°00.4	50.7	277°58.2	26.7	199°29.0	34.5	131°11.8	55.8
8	48°26.2	344°00.0	51.2	292°59.0	26.4	214°31.2	34.6	146°14.5	55.8
9	63°28.7	358°59.6	·· 51.8	307°59.7	·· 26.2	229°33.5	·· 34.7	161°17.1	·· 55.8
10	78°31.2	13°59.2	52.3	323°00.4	25.9	244°35.8	34.8	176°19.7	55.8
11	93°33.6	28°58.8	52.9	338°01.2	25.6	259°38.0	34.9	191°22.4	55.8
12	108°36.1	43°58.4	N18°53.4	353°01.9	N22°25.3	274°40.3	S04°35.0	206°25.0	S21°55.8
13	123°38.6	58°57.9	54.0	8°02.6	25.1	289°42.6	35.1	221°27.6	55.8
14	138°41.0	73°57.5	54.5	23°03.4	24.8	304°44.8	35.2	236°30.3	55.8
15	153°43.5	88°57.1	·· 55.1	38°04.1	·· 24.5	319°47.1	·· 35.3	251°32.9	·· 55.8
16	168°45.9	103°56.7	55.6	53°04.9	24.3	334°49.4	35.4	266°35.5	55.8
17	183°48.4	118°56.3	56.1	68°05.6	24.0	349°51.6	35.5	281°38.2	55.8
18	198°50.9	133°55.9	N18°56.7	83°06.3	N22°23.7	4°53.9	S04°35.6	296°40.8	S21°55.8
19	213°53.3	148°55.5	57.2	98°07.1	23.4	19°56.2	35.7	311°43.4	55.8
20	228°55.8	163°55.0	57.8	113°07.8	23.2	34°58.4	35.8	326°46.1	55.8
21	243°58.3	178°54.6	·· 58.3	128°08.5	·· 22.9	50°00.7	·· 35.9	341°48.7	·· 55.8
22	259°00.7	193°54.2	58.8	143°09.3	22.6	65°03.0	35.9	356°51.3	55.8
23	274°03.2	208°53.8	59.4	158°10.0	22.4	80°05.2	36.0	11°54.0	55.8
Mer.pass.:04:47		v-0.4 d0.6 m-4.0		v0.7 d-0.3 m1.6		v2.3 d-0.1 m-1.9		v2.6 d0.0 m0.1	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	289°05.7	223°53.4	N18°59.9	173°10.7	N22°22.1	95°07.5	S04°36.1	26°56.6	S21°55.8
1	304°08.1	238°53.0	19°00.5	188°11.5	21.8	110°09.8	36.2	41°59.2	55.8
2	319°10.6	253°52.5	01.0	203°12.2	21.5	125°12.0	36.3	57°01.9	55.8
3	334°13.1	268°52.1	·· 01.5	218°12.9	·· 21.3	140°14.3	·· 36.4	72°04.5	·· 55.8
4	349°15.5	283°51.7	02.1	233°13.7	21.0	155°16.5	36.5	87°07.1	55.8
5	4°18.0	298°51.3	02.6	248°14.4	20.7	170°18.8	36.6	102°09.7	55.8
6	19°20.4	313°50.9	N19°03.1	263°15.1	N22°20.4	185°21.1	S04°36.7	117°12.4	S21°55.8
7	34°22.9	328°50.4	03.7	278°15.9	20.2	200°23.3	36.8	132°15.0	55.8
8	49°25.4	343°50.0	04.2	293°16.6	19.9	215°25.6	36.9	147°17.6	55.8
9	64°27.8	358°49.6	·· 04.7	308°17.4	·· 19.6	230°27.9	·· 37.0	162°20.3	·· 55.7
10	79°30.3	13°49.2	05.3	323°18.1	19.3	245°30.1	37.1	177°22.9	55.7
11	94°32.8	28°48.7	05.8	338°18.8	19.1	260°32.4	37.2	192°25.5	55.7
12	109°35.2	43°48.3	N19°06.3	353°19.6	N22°18.8	275°34.6	S04°37.3	207°28.2	S21°55.7
13	124°37.7	58°47.9	06.9	8°20.3	18.5	290°36.9	37.4	222°30.8	55.7
14	139°40.2	73°47.5	07.4	23°21.0	18.2	305°39.2	37.5	237°33.4	55.7
15	154°42.6	88°47.0	·· 07.9	38°21.8	·· 18.0	320°41.4	·· 37.6	252°36.1	·· 55.7
16	169°45.1	103°46.6	08.4	53°22.5	17.7	335°43.7	37.7	267°38.7	55.7
17	184°47.6	118°46.2	09.0	68°23.3	17.4	350°46.0	37.8	282°41.3	55.7
18	199°50.0	133°45.8	N19°09.5	83°24.0	N22°17.1	5°48.2	S04°37.8	297°43.9	S21°55.7
19	214°52.5	148°45.3	10.0	98°24.7	16.8	20°50.5	37.9	312°46.6	55.7
20	229°54.9	163°44.9	10.5	113°25.5	16.6	35°52.7	38.0	327°49.2	55.7
21	244°57.4	178°44.5	·· 11.1	128°26.2	·· 16.3	50°55.0	·· 38.1	342°51.8	·· 55.7
22	259°59.9	193°44.0	11.6	143°27.0	16.0	65°57.3	38.2	357°54.5	55.7
23	275°02.3	208°43.6	12.1	158°27.7	15.7	80°59.5	38.3	12°57.1	55.7
Mer.pass.:04:43		v-0.4 d0.5 m-4.0		v0.7 d-0.3 m1.6		v2.3 d-0.1 m-1.8		v2.6 d0.0 m0.1	

Stars

	SHA	Dec
Alpheratz	357°40.5	29°11.0
Ankaa	353°13.0	-42°12.5
Schedar	349°37.2	56°37.7
Diphda	348°53.1	-17°53.4
Achernar	335°24.9	-57°08.7
Hamal	327°57.7	23°32.5
Polaris	316°43.1	89°19.9
Acamar	315°16.5	-40°14.0
Menkar	314°12.3	4°09.3
Mirfak	308°36.6	49°55.0
Aldebaran	290°46.5	16°32.4
Rigel	281°09.7	-8°11.0
Capella	280°30.8	46°00.6
Bellatrix	278°29.4	6°21.7
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.6
Betelgeuse	270°58.6	7°24.4
Canopus	263°55.5	-52°42.4
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.9
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.5	-59°34.1
Suhail	222°50.8	-43°30.4
Miaplacidus	221°39.8	-69°47.6
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°48.8	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.3
Acrux	173°06.2	-63°12.0
Gacrux	171°57.8	-57°12.8
Alioth	166°18.4	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.7	49°14.0
Hadar	148°43.7	-60°27.5
Menkent	148°04.2	-36°27.4
Arcturus	145°53.1	19°05.8
Rigil Kent.	139°47.6	-60°54.5
Kochab	137°19.8	74°05.5
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.4	51°29.5
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.2
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.4	-56°40.5
Deneb	49°29.1	45°20.6
Enif	33°44.1	9°57.4
Al Na'ir	27°40.0	-46°52.3
Fomalhaut	15°20.8	-29°31.6
Scheat	13°50.5	28°10.6
Markab	13°35.4	15°17.9

Jul 09 Sun	**SHA**	**Mer.pass**
Venus	297°05.4	09:03
Mars	245°28.2	12:29
Jupiter	166°11.1	17:44
Saturn	97°42.8	22:17

Jul 10 Mon	**SHA**	**Mer.pass**
Venus	295°56.7	09:04
Mars	244°46.6	12:28
Jupiter	166°06.5	17:40
Saturn	97°46.9	22:13

Jul 11 Tue	**SHA**	**Mer.pass**
Venus	294°47.7	09:05
Mars	244°05.1	12:27
Jupiter	166°01.8	17:37
Saturn	97°50.9	22:08

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3562 sec ΔT = TT-UT1 = +68.8278 sec

2017 July 09 to Jul. 11 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°42.2	N22°21.3	1°08.0	11.6'	S19°18.3	1.2'	54.4'
1	193°42.1	21.0	15°38.6	11.6'	19°17.1	1.3'	54.4'
2	208°42.0	20.7	30°09.2	11.6'	19°15.7	1.4'	54.4'
3	223°41.9	·· 20.4	44°39.8	11.6'	19°14.3	1.5'	54.4'
4	238°41.8	20.1	59°10.4	11.6'	19°12.7	1.6'	54.5'
5	253°41.7	19.8	73°41.0	11.6'	19°11.1	1.7'	54.5'
6	268°41.6	N22°19.5	88°11.6	11.6'	S19°09.4	1.8'	54.5'
7	283°41.5	19.2	102°42.1	11.6'	19°07.6	1.9'	54.5'
8	298°41.4	18.9	117°12.7	11.6'	19°05.7	2.0'	54.5'
9	313°41.3	·· 18.6	131°43.3	11.6'	19°03.7	2.0'	54.5'
10	328°41.3	18.3	146°13.9	11.6'	19°01.6	2.1'	54.5'
11	343°41.2	18.0	160°44.5	11.6'	18°59.4	2.2'	54.5'
12	358°41.1	N22°17.7	175°15.0	11.6'	S18°57.1	2.3'	54.5'
13	13°41.0	17.3	189°45.6	11.6'	18°54.8	2.4'	54.6'
14	28°40.9	17.0	204°16.2	11.6'	18°52.3	2.5'	54.6'
15	43°40.8	·· 16.7	218°46.8	11.6'	18°49.7	2.6'	54.6'
16	58°40.7	16.4	233°17.4	11.6'	18°47.1	2.7'	54.6'
17	73°40.6	16.1	247°47.9	11.6'	18°44.4	2.8'	54.6'
18	88°40.5	N22°15.8	262°18.5	11.6'	S18°41.6	2.9'	54.6'
19	103°40.5	15.5	276°49.1	11.6'	18°38.6	3.0'	54.6'
20	118°40.4	15.2	291°19.7	11.6'	18°35.6	3.0'	54.7'
21	133°40.3	·· 14.9	305°50.3	11.6'	18°32.5	3.1'	54.7'
22	148°40.2	14.5	320°20.9	11.6'	18°29.4	3.2'	54.7'
23	163°40.1	14.2	334°51.5	11.6'	18°26.1	3.3'	54.7'
	SD.=15.7	d=-0.3	S.D.=14.9				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°40.0	N22°13.9	349°22.1	11.6'	S18°22.7	3.4'	54.7'
1	193°39.9	13.6	3°52.7	11.6'	18°19.3	3.5'	54.7'
2	208°39.8	13.3	18°23.4	11.6'	18°15.7	3.6'	54.7'
3	223°39.8	·· 13.0	32°54.0	11.6'	18°12.1	3.7'	54.8'
4	238°39.7	12.6	47°24.6	11.6'	18°08.4	3.8'	54.8'
5	253°39.6	12.3	61°55.3	11.6'	18°04.6	3.9'	54.8'
6	268°39.5	N22°12.0	76°25.9	11.7'	S18°00.7	3.9'	54.8'
7	283°39.4	11.7	90°56.6	11.7'	17°56.7	4.0'	54.8'
8	298°39.3	11.4	105°27.2	11.7'	17°52.6	4.1'	54.8'
9	313°39.2	·· 11.1	119°57.9	11.7'	17°48.4	4.2'	54.8'
10	328°39.2	10.7	134°28.6	11.7'	17°44.2	4.3'	54.9'
11	343°39.1	10.4	148°59.3	11.7'	17°39.8	4.4'	54.9'
12	358°39.0	N22°10.1	163°30.0	11.7'	S17°35.4	4.5'	54.9'
13	13°38.9	09.8	178°00.7	11.7'	17°30.9	4.6'	54.9'
14	28°38.8	09.4	192°31.4	11.7'	17°26.3	4.6'	54.9'
15	43°38.7	·· 09.1	207°02.2	11.7'	17°21.6	4.7'	54.9'
16	58°38.6	08.8	221°32.9	11.7'	17°16.8	4.8'	54.9'
17	73°38.6	08.5	236°03.7	11.8'	17°12.0	4.9'	55.0'
18	88°38.5	N22°08.1	250°34.4	11.8'	S17°07.1	5.0'	55.0'
19	103°38.4	07.8	265°05.2	11.8'	17°02.0	5.1'	55.0'
20	118°38.3	07.5	279°36.0	11.8'	16°56.9	5.2'	55.0'
21	133°38.2	·· 07.1	294°06.8	11.8'	16°51.7	5.2'	55.0'
22	148°38.1	06.8	308°37.6	11.8'	16°46.5	5.3'	55.0'
23	163°38.1	06.5	323°08.4	11.8'	16°41.1	5.4'	55.1'
	SD.=15.7	d=-0.3	S.D.=15.0				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°38.0	N22°06.2	337°39.2	11.8'	S16°35.7	5.5'	55.1'
1	193°37.9	05.8	352°10.1	11.9'	16°30.1	5.6'	55.1'
2	208°37.8	05.5	6°40.9	11.9'	16°24.5	5.6'	55.1'
3	223°37.7	·· 05.2	21°11.8	11.9'	16°18.8	5.7'	55.1'
4	238°37.6	04.8	35°42.7	11.9'	16°13.1	5.8'	55.1'
5	253°37.6	04.5	50°13.6	11.9'	16°07.2	5.9'	55.2'
6	268°37.5	N22°04.2	64°44.5	11.9'	S16°01.3	6.0'	55.2'
7	283°37.4	03.8	79°15.4	11.9'	15°55.3	6.1'	55.2'
8	298°37.3	03.5	93°46.4	11.9'	15°49.2	6.1'	55.2'
9	313°37.2	·· 03.1	108°17.3	12.0'	15°43.0	6.2'	55.2'
10	328°37.1	02.8	122°48.3	12.0'	15°36.8	6.3'	55.3'
11	343°37.1	02.5	137°19.3	12.0'	15°30.4	6.4'	55.3'
12	358°37.0	N22°02.1	151°50.3	12.0'	S15°24.0	6.4'	55.3'
13	13°36.9	01.8	166°21.3	12.0'	15°17.6	6.5'	55.3'
14	28°36.8	01.5	180°52.3	12.0'	15°11.0	6.6'	55.3'
15	43°36.7	·· 01.1	195°23.3	12.0'	15°04.4	6.7'	55.3'
16	58°36.7	00.8	209°54.4	12.1'	14°57.7	6.7'	55.4'
17	73°36.6	00.4	224°25.4	12.1'	14°50.9	6.8'	55.4'
18	88°36.5	N22°00.1	238°56.5	12.1'	S14°44.0	6.9'	55.4'
19	103°36.4	21°59.7	253°27.6	12.1'	14°37.1	7.0'	55.4'
20	118°36.3	59.4	267°58.7	12.1'	14°30.1	7.0'	55.4'
21	133°36.3	·· 59.0	282°29.8	12.1'	14°23.0	7.1'	55.5'
22	148°36.2	58.7	297°01.0	12.1'	14°15.8	7.2'	55.5'
23	163°36.1	58.4	311°32.1	12.2'	14°08.6	7.3'	55.5'
	SD.=15.7	d=-0.3	S.D.=15.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			01:14	22:53		
64°			02:02	22:07		
62°			02:32	21:37		
60°		01:29	02:55	21:15	22:39	
N 58°		02:05	03:13	20:57	22:04	
56°		02:30	03:28	20:42	21:40	
54°	01:22	02:50	03:41	20:29	21:20	22:46
52°	01:55	03:06	03:52	20:18	21:04	22:14
50°	02:18	03:19	04:02	20:08	20:51	21:51
45°	02:59	03:47	04:23	19:47	20:23	21:11
N 40°	03:27	04:08	04:40	19:30	20:02	20:43
35°	03:49	04:25	04:54	19:16	19:45	20:21
30°	04:07	04:39	05:07	19:04	19:31	20:04
20°	04:34	05:03	05:27	18:43	19:08	19:36
N 10°	04:56	05:22	05:45	18:26	18:48	19:15
0°	05:13	05:39	06:02	18:09	18:31	18:57
S 10°	05:29	05:56	06:18	17:53	18:15	18:41
20°	05:45	06:12	06:36	17:35	17:59	18:26
30°	06:00	06:30	06:56	17:15	17:41	18:11
35°	06:08	06:39	07:07	17:04	17:32	18:03
40°	06:17	06:50	07:21	16:51	17:21	17:54
45°	06:26	07:03	07:36	16:35	17:08	17:45
S 50°	06:37	07:18	07:55	16:16	16:53	17:34
52°	06:42	07:25	08:05	16:07	16:47	17:29
54°	06:47	07:32	08:15	15:56	16:39	17:24
56°	06:52	07:40	08:26	15:45	16:31	17:19
58°	06:58	07:50	08:40	15:32	16:21	17:13
S 60°	07:05	08:00	08:55	15:16	16:11	17:06

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°			23:39			03:16
N 70°	23:09	23:11	23:11	00:57	02:25	04:03
68°	22:24	22:40	22:50	01:58	03:09	04:33
66°	21:55	22:18	22:33	02:32	03:38	04:56
64°	21:32	21:59	22:19	02:57	04:00	05:13
62°	21:15	21:44	22:07	03:17	04:18	05:28
60°	21:00	21:32	21:57	03:33	04:32	05:40
N 58°	20:47	21:21	21:49	03:46	04:45	05:50
56°	20:36	21:11	21:41	03:58	04:56	05:59
54°	20:26	21:03	21:34	04:08	05:05	06:07
52°	20:18	20:55	21:28	04:17	05:13	06:15
50°	20:10	20:49	21:22	04:25	05:21	06:21
45°	19:54	20:34	21:10	04:43	05:37	06:35
N 40°	19:40	20:22	21:00	04:57	05:50	06:46
35°	19:29	20:12	20:52	05:09	06:01	06:56
30°	19:19	20:03	20:44	05:19	06:11	07:05
20°	19:01	19:47	20:31	05:37	06:28	07:19
N 10°	18:46	19:34	20:20	05:53	06:42	07:32
0°	18:32	19:21	20:09	06:07	06:56	07:44
S 10°	18:18	19:08	19:58	06:22	07:09	07:56
20°	18:03	18:54	19:46	06:37	07:24	08:08
30°	17:46	18:39	19:33	06:55	07:40	08:23
35°	17:36	18:29	19:26	07:05	07:50	08:31
40°	17:24	18:19	19:17	07:17	08:00	08:40
45°	17:10	18:07	19:07	07:31	08:13	08:51
S 50°	16:54	17:52	18:54	07:48	08:29	09:05
52°	16:46	17:45	18:48	07:56	08:36	09:11
54°	16:37	17:37	18:42	08:04	08:44	09:18
56°	16:28	17:29	18:35	08:14	08:53	09:25
58°	16:16	17:19	18:27	08:26	09:03	09:34
S 60°	16:04	17:07	18:18	08:39	09:15	09:43

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 15-17 100-95%
09	05:11	05:16	12:05	–:–	12:20	
10	05:20	05:24	12:05	00:44	13:08	
11	05:28	05:32	12:06	01:32	13:56	

July 12, 13, 14 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	290°04.8	223°43.2	N19°12.6	173°28.4	N22°15.4	96°01.8	S04°38.4	27°59.7	S21°55.7
1	305°07.3	238°42.7	13.1	188°29.2	15.2	111°04.0	38.5	43°02.3	55.7
2	320°09.7	253°42.3	13.7	203°29.9	14.9	126°06.3	38.6	58°05.0	55.7
3	335°12.2	268°41.9	·· 14.2	218°30.7	·· 14.6	141°08.5	·· 38.7	73°07.6	·· 55.7
4	350°14.7	283°41.4	14.7	233°31.4	14.3	156°10.8	38.8	88°10.2	55.7
5	5°17.1	298°41.0	15.2	248°32.1	14.0	171°13.1	38.9	103°12.9	55.7
6	20°19.6	313°40.6	N19°15.7	263°32.9	N22°13.8	186°15.3	S04°39.0	118°15.5	S21°55.7
7	35°22.0	328°40.1	16.3	278°33.6	13.5	201°17.6	39.1	133°18.1	55.7
8	50°24.5	343°39.7	16.8	293°34.4	13.2	216°19.8	39.2	148°20.7	55.7
9	65°27.0	358°39.3	·· 17.3	308°35.1	·· 12.9	231°22.1	·· 39.3	163°23.4	·· 55.7
10	80°29.4	13°38.8	17.8	323°35.8	12.6	246°24.3	39.4	178°26.0	55.7
11	95°31.9	28°38.4	18.3	338°36.6	12.3	261°26.6	39.5	193°28.6	55.7
12	110°34.4	43°37.9	N19°18.8	353°37.3	N22°12.1	276°28.9	S04°39.6	208°31.3	S21°55.7
13	125°36.8	58°37.5	19.3	8°38.1	11.8	291°31.1	39.7	223°33.9	55.7
14	140°39.3	73°37.1	19.9	23°38.8	11.5	306°33.4	39.8	238°36.5	55.7
15	155°41.8	88°36.6	·· 20.4	38°39.5	·· 11.2	321°35.6	·· 39.9	253°39.1	·· 55.7
16	170°44.2	103°36.2	20.9	53°40.3	10.9	336°37.9	40.0	268°41.8	55.7
17	185°46.7	118°35.7	21.4	68°41.0	10.6	351°40.1	40.1	283°44.4	55.7
18	200°49.2	133°35.3	N19°21.9	83°41.8	N22°10.3	6°42.4	S04°40.2	298°47.0	S21°55.7
19	215°51.6	148°34.9	22.4	98°42.5	10.1	21°44.6	40.3	313°49.6	55.7
20	230°54.1	163°34.4	22.9	113°43.2	09.8	36°46.9	40.4	328°52.3	55.7
21	245°56.5	178°34.0	·· 23.4	128°44.0	·· 09.5	51°49.2	·· 40.5	343°54.9	·· 55.7
22	260°59.0	193°33.5	23.9	143°44.7	09.2	66°51.4	40.6	358°57.5	55.7
23	276°01.5	208°33.1	24.4	158°45.5	08.9	81°53.7	40.7	14°00.2	55.7
Mer.pass.:04:39		v-0.4 d0.5 m-4.0		v0.7 d-0.3 m1.6		v2.3 d-0.1 m-1.8		v2.6 d0.0 m0.1	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	291°03.9	223°32.6	N19°24.9	173°46.2	N22°08.6	96°55.9	S04°40.8	29°02.8	S21°55.7
1	306°06.4	238°32.2	25.4	188°47.0	08.3	111°58.2	40.9	44°05.4	55.6
2	321°08.9	253°31.7	25.9	203°47.7	08.1	127°00.4	41.0	59°08.0	55.6
3	336°11.3	268°31.3	·· 26.5	218°48.4	·· 07.8	142°02.7	·· 41.1	74°10.7	·· 55.6
4	351°13.8	283°30.8	27.0	233°49.2	07.5	157°04.9	41.2	89°13.3	55.6
5	6°16.3	298°30.4	27.5	248°49.9	07.2	172°07.2	41.3	104°15.9	55.6
6	21°18.7	313°30.0	N19°28.0	263°50.7	N22°06.9	187°09.4	S04°41.4	119°18.5	S21°55.6
7	36°21.2	328°29.5	28.5	278°51.4	06.6	202°11.7	41.5	134°21.2	55.6
8	51°23.7	343°29.1	29.0	293°52.2	06.3	217°13.9	41.6	149°23.8	55.6
9	66°26.1	358°28.6	·· 29.5	308°52.9	·· 06.0	232°16.2	·· 41.7	164°26.4	·· 55.6
10	81°28.6	13°28.1	30.0	323°53.7	05.7	247°18.4	41.8	179°29.0	55.6
11	96°31.0	28°27.7	30.5	338°54.4	05.5	262°20.7	41.9	194°31.7	55.6
12	111°33.5	43°27.2	N19°31.0	353°55.1	N22°05.2	277°22.9	S04°42.0	209°34.3	S21°55.6
13	126°36.0	58°26.8	31.4	8°55.9	04.9	292°25.2	42.1	224°36.9	55.6
14	141°38.4	73°26.3	31.9	23°56.6	04.6	307°27.4	42.2	239°39.5	55.6
15	156°40.9	88°25.9	·· 32.4	38°57.4	·· 04.3	322°29.7	·· 42.3	254°42.2	·· 55.6
16	171°43.4	103°25.4	32.9	53°58.1	04.0	337°31.9	42.4	269°44.8	55.6
17	186°45.8	118°25.0	33.4	68°58.9	03.7	352°34.2	42.5	284°47.4	55.6
18	201°48.3	133°24.5	N19°33.9	83°59.6	N22°03.4	7°36.4	S04°42.6	299°50.0	S21°55.6
19	216°50.8	148°24.1	34.4	99°00.4	03.1	22°38.7	42.7	314°52.7	55.6
20	231°53.2	163°23.6	34.9	114°01.1	02.8	37°40.9	42.8	329°55.3	55.6
21	246°55.7	178°23.2	·· 35.4	129°01.9	·· 02.5	52°43.2	·· 42.9	344°57.9	·· 55.6
22	261°58.1	193°22.7	35.9	144°02.6	02.2	67°45.4	43.0	0°00.5	55.6
23	277°00.6	208°22.2	36.4	159°03.3	01.9	82°47.7	43.1	15°03.2	55.6
Mer.pass.:04:35		v-0.4 d0.5 m-4.0		v0.7 d-0.3 m1.6		v2.3 d-0.1 m-1.8		v2.6 d0.0 m0.1	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	292°03.1	223°21.8	N19°36.9	174°04.1	N22°01.7	97°49.9	S04°43.2	30°05.8	S21°55.6
1	307°05.5	238°21.3	37.3	189°04.8	01.4	112°52.2	43.3	45°08.4	55.6
2	322°08.0	253°20.9	37.8	204°05.6	01.1	127°54.4	43.4	60°11.0	55.6
3	337°10.5	268°20.4	·· 38.3	219°06.3	·· 00.8	142°56.7	·· 43.5	75°13.7	·· 55.6
4	352°12.9	283°19.9	38.8	234°07.1	00.5	157°58.9	43.6	90°16.3	55.6
5	7°15.4	298°19.5	39.3	249°07.8	22°00.2	173°01.2	43.7	105°18.9	55.6
6	22°17.9	313°19.0	N19°39.8	264°08.6	N21°59.9	188°03.4	S04°43.8	120°21.5	S21°55.6
7	37°20.3	328°18.6	40.3	279°09.3	59.6	203°05.7	43.9	135°24.1	55.6
8	52°22.8	343°18.1	40.7	294°10.1	59.3	218°07.9	44.0	150°26.8	55.6
9	67°25.3	358°17.6	·· 41.2	309°10.8	·· 59.0	233°10.1	·· 44.1	165°29.4	·· 55.6
10	82°27.7	13°17.2	41.7	324°11.6	58.7	248°12.4	44.2	180°32.0	55.6
11	97°30.2	28°16.7	42.2	339°12.3	58.4	263°14.6	44.3	195°34.6	55.6
12	112°32.6	43°16.2	N19°42.7	354°13.1	N21°58.1	278°16.9	S04°44.4	210°37.3	S21°55.6
13	127°35.1	58°15.8	43.1	9°13.8	57.8	293°19.1	44.5	225°39.9	55.6
14	142°37.6	73°15.3	43.6	24°14.6	57.5	308°21.4	44.6	240°42.5	55.6
15	157°40.0	88°14.8	·· 44.1	39°15.3	·· 57.2	323°23.6	·· 44.7	255°45.1	·· 55.6
16	172°42.5	103°14.4	44.6	54°16.1	56.9	338°25.9	44.8	270°47.8	55.6
17	187°45.0	118°13.9	45.1	69°16.8	56.6	353°28.1	44.9	285°50.4	55.6
18	202°47.4	133°13.4	N19°45.5	84°17.6	N21°56.3	8°30.3	S04°45.0	300°53.0	S21°55.6
19	217°49.9	148°13.0	46.0	99°18.3	56.0	23°32.6	45.1	315°55.6	55.6
20	232°52.4	163°12.5	46.5	114°19.1	55.7	38°34.8	45.2	330°58.2	55.6
21	247°54.8	178°12.0	·· 46.9	129°19.8	·· 55.4	53°37.1	·· 45.3	346°00.9	·· 55.6
22	262°57.3	193°11.5	47.4	144°20.6	55.1	68°39.3	45.4	1°03.5	55.5
23	277°59.7	208°11.1	47.9	159°21.3	54.8	83°41.6	45.5	16°06.1	55.5
Mer.pass.:04:31		v-0.5 d0.5 m-4.0		v0.7 d-0.3 m1.6		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.1	

Stars

	SHA	**Dec**
Alpheratz	357°40.5	29°11.1
Ankaa	353°12.9	-42°12.5
Schedar	349°37.2	56°37.7
Diphda	348°53.1	-17°53.4
Achernar	335°24.9	-57°08.7
Hamal	327°57.7	23°32.5
Polaris	316°41.8	89°19.8
Acamar	315°16.5	-40°14.0
Menkar	314°12.3	4°09.3
Mirfak	308°36.6	49°55.0
Aldebaran	290°46.5	16°32.4
Rigel	281°09.7	-8°11.0
Capella	280°30.8	46°00.6
Bellatrix	278°29.3	6°21.7
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.6
Betelgeuse	270°58.6	7°24.4
Canopus	263°55.5	-52°42.4
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.9
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.5	-59°34.1
Suhail	222°50.8	-43°30.4
Miaplacidus	221°39.8	-69°47.6
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°48.9	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.3
Acrux	173°06.3	-63°12.0
Gacrux	171°57.8	-57°12.8
Alioth	166°18.4	55°52.3
Spica	158°28.3	-11°15.1
Alkaid	152°56.7	49°14.0
Hadar	148°43.7	-60°27.5
Menkent	148°04.2	-36°27.4
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.7	-60°54.5
Kochab	137°19.8	74°05.5
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.4	51°29.5
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.3
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.4	-56°40.5
Deneb	49°29.1	45°20.6
Enif	33°44.1	9°57.4
Al Na'ir	27°40.0	-46°52.3
Fomalhaut	15°20.8	-29°31.6
Scheat	13°50.5	28°10.6
Markab	13°35.4	15°17.9

Jul 12 Wed	**SHA**	**Mer.pass**
Venus	293°38.4	09:05
Mars	243°23.6	12:25
Jupiter	165°57.0	17:33
Saturn	97°54.9	22:04

Jul 13 Thu	**SHA**	**Mer.pass**
Venus	292°28.7	09:06
Mars	242°42.3	12:24
Jupiter	165°52.0	17:30
Saturn	97°58.8	22:00

Jul 14 Fri	**SHA**	**Mer.pass**
Venus	291°18.7	09:07
Mars	242°01.0	12:23
Jupiter	165°46.9	17:26
Saturn	98°02.7	21:56

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3550 sec ΔT = TT-UT1 = +68.8290 sec

2017 July 12 to Jul. 14 UT

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°36.0	N21°58.0	326°03.3	12.2'	S14°01.3	7.3'	55.5'
1	193°36.0	57.7	340°34.4	12.2'	13°53.9	7.4'	55.5'
2	208°35.9	57.3	355°05.6	12.2'	13°46.5	7.5'	55.6'
3	223°35.8	·· 57.0	9°36.8	12.2'	13°39.0	7.5'	55.6'
4	238°35.7	56.6	24°08.0	12.2'	13°31.4	7.6'	55.6'
5	253°35.6	56.3	38°39.3	12.2'	13°23.7	7.7'	55.6'
6	268°35.6	N21°55.9	53°10.5	12.2'	S13°16.0	7.8'	55.6'
7	283°35.5	55.6	67°41.8	12.3'	13°08.2	7.8'	55.7'
8	298°35.4	55.2	82°13.0	12.3'	13°00.4	7.9'	55.7'
9	313°35.3	·· 54.9	96°44.3	12.3'	12°52.5	8.0'	55.7'
10	328°35.3	54.5	111°15.6	12.3'	12°44.5	8.0'	55.7'
11	343°35.2	54.2	125°46.9	12.3'	12°36.4	8.1'	55.7'
12	358°35.1	N21°53.8	140°18.2	12.3'	S12°28.3	8.2'	55.8'
13	13°35.0	53.4	154°49.6	12.3'	12°20.1	8.2'	55.8'
14	28°35.0	53.1	169°20.9	12.3'	12°11.9	8.3'	55.8'
15	43°34.9	·· 52.7	183°52.2	12.4'	12°03.6	8.3'	55.8'
16	58°34.8	52.4	198°23.6	12.4'	11°55.2	8.4'	55.8'
17	73°34.7	52.0	212°55.0	12.4'	11°46.7	8.5'	55.9'
18	88°34.7	N21°51.7	227°26.4	12.4'	S11°38.2	8.5'	55.9'
19	103°34.6	51.3	241°57.8	12.4'	11°29.7	8.6'	55.9'
20	118°34.5	50.9	256°29.2	12.4'	11°21.1	8.7'	55.9'
21	133°34.4	·· 50.6	271°00.6	12.4'	11°12.4	8.7'	55.9'
22	148°34.4	50.2	285°32.0	12.4'	11°03.6	8.8'	56.0'
23	163°34.3	49.9	300°03.4	12.4'	10°54.8	8.8'	56.0'
	SD.=15.7	d=-0.3		S.D.=15.2			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°34.2	N21°49.5	314°34.9	12.4'	S10°46.0	8.9'	56.0'
1	193°34.1	49.1	329°06.3	12.5'	10°37.1	8.9'	56.0'
2	208°34.1	48.8	343°37.8	12.5'	10°28.1	9.0'	56.1'
3	223°34.0	·· 48.4	358°09.2	12.5'	10°19.1	9.1'	56.1'
4	238°33.9	48.0	12°40.7	12.5'	10°10.0	9.1'	56.1'
5	253°33.8	47.7	27°12.2	12.5'	10°00.8	9.2'	56.1'
6	268°33.8	N21°47.3	41°43.7	12.5'	S09°51.7	9.2'	56.1'
7	283°33.7	46.9	56°15.2	12.5'	09°42.4	9.3'	56.2'
8	298°33.6	46.6	70°46.7	12.5'	09°33.1	9.3'	56.2'
9	313°33.6	·· 46.2	85°18.2	12.5'	09°23.8	9.4'	56.2'
10	328°33.5	45.8	99°49.7	12.5'	09°14.4	9.4'	56.2'
11	343°33.4	45.5	114°21.2	12.5'	09°04.9	9.5'	56.3'
12	358°33.3	N21°45.1	128°52.7	12.5'	S08°55.4	9.5'	56.3'
13	13°33.3	44.7	143°24.3	12.5'	08°45.8	9.6'	56.3'
14	28°33.2	44.4	157°55.8	12.5'	08°36.2	9.6'	56.3'
15	43°33.1	·· 44.0	172°27.3	12.5'	08°26.6	9.7'	56.4'
16	58°33.1	43.6	186°58.8	12.5'	08°16.9	9.7'	56.4'
17	73°33.0	43.2	201°30.4	12.5'	08°07.1	9.8'	56.4'
18	88°32.9	N21°42.9	216°01.9	12.5'	S07°57.4	9.8'	56.4'
19	103°32.8	42.5	230°33.4	12.5'	07°47.5	9.9'	56.4'
20	118°32.8	42.1	245°05.0	12.5'	07°37.6	9.9'	56.5'
21	133°32.7	·· 41.7	259°36.5	12.5'	07°27.7	9.9'	56.5'
22	148°32.6	41.4	274°08.0	12.5'	07°17.7	10.0'	56.5'
23	163°32.6	41.0	288°39.6	12.5'	07°07.7	10.0'	56.5'
	SD.=15.7	d=-0.4		S.D.=15.3			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°32.5	N21°40.6	303°11.1	12.5'	S06°57.7	10.1'	56.6'
1	193°32.4	40.2	317°42.6	12.5'	06°47.6	10.1'	56.6'
2	208°32.4	39.8	332°14.2	12.5'	06°37.4	10.2'	56.6'
3	223°32.3	·· 39.5	346°45.7	12.5'	06°27.3	10.2'	56.6'
4	238°32.2	39.1	1°17.2	12.5'	06°17.0	10.2'	56.7'
5	253°32.2	38.7	15°48.7	12.5'	06°06.8	10.3'	56.7'
6	268°32.1	N21°38.3	30°20.2	12.5'	S05°56.5	10.3'	56.7'
7	283°32.0	37.9	44°51.7	12.5'	05°46.2	10.3'	56.7'
8	298°32.0	37.6	59°23.2	12.5'	05°35.8	10.4'	56.8'
9	313°31.9	·· 37.2	73°54.7	12.5'	05°25.4	10.4'	56.8'
10	328°31.8	36.8	88°26.2	12.5'	05°15.0	10.5'	56.8'
11	343°31.8	36.4	102°57.6	12.5'	05°04.5	10.5'	56.8'
12	358°31.7	N21°36.0	117°29.1	12.5'	S04°54.0	10.5'	56.9'
13	13°31.6	35.6	132°00.5	12.4'	04°43.4	10.6'	56.9'
14	28°31.6	35.2	146°32.0	12.4'	04°32.9	10.6'	56.9'
15	43°31.5	·· 34.9	161°03.4	12.4'	04°22.3	10.6'	56.9'
16	58°31.4	34.5	175°34.8	12.4'	04°11.7	10.6'	57.0'
17	73°31.4	34.1	190°06.2	12.4'	04°01.0	10.7'	57.0'
18	88°31.3	N21°33.7	204°37.6	12.4'	S03°50.3	10.7'	57.0'
19	103°31.2	33.3	219°09.0	12.4'	03°39.6	10.7'	57.1'
20	118°31.2	32.9	233°40.4	12.4'	03°28.8	10.8'	57.1'
21	133°31.1	·· 32.5	248°11.7	12.3'	03°18.1	10.8'	57.1'
22	148°31.0	32.1	262°43.0	12.3'	03°07.3	10.8'	57.1'
23	163°31.0	31.7	277°14.4	12.3'	02°56.5	10.8'	57.2'
	SD.=15.7	d=-0.4		S.D.=15.5			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			01:27	22:40		
64°			02:10	21:59		
62°		00:33	02:39	21:31	23:29	
60°		01:39	03:00	21:10	22:30	
N 58°		02:12	03:18	20:53	21:58	
56°	00:31	02:35	03:32	20:38	21:35	23:32
54°	01:31	02:54	03:45	20:26	21:16	22:38
52°	02:01	03:10	03:56	20:15	21:01	22:09
50°	02:23	03:23	04:06	20:05	20:48	21:47
45°	03:03	03:50	04:26	19:45	20:21	21:08
N 40°	03:30	04:10	04:42	19:29	20:01	20:41
35°	03:51	04:27	04:56	19:15	19:44	20:20
30°	04:09	04:41	05:08	19:03	19:30	20:03
20°	04:35	05:04	05:28	18:43	19:07	19:36
N 10°	04:56	05:23	05:46	18:26	18:48	19:15
0°	05:14	05:40	06:02	18:09	18:32	18:58
S 10°	05:30	05:56	06:18	17:53	18:16	18:42
20°	05:44	06:12	06:35	17:36	18:00	18:27
30°	05:59	06:29	06:55	17:17	17:43	18:12
35°	06:07	06:39	07:06	17:06	17:33	18:04
40°	06:16	06:49	07:19	16:53	17:23	17:56
45°	06:25	07:01	07:34	16:37	17:10	17:47
S 50°	06:35	07:16	07:53	16:19	16:56	17:37
52°	06:40	07:23	08:02	16:10	16:49	17:32
54°	06:45	07:30	08:12	16:00	16:42	17:27
56°	06:50	07:38	08:23	15:49	16:34	17:22
58°	06:56	07:47	08:36	15:36	16:25	17:16
S 60°	07:02	07:57	08:51	15:21	16:15	17:10

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	23:27	23:17	23:09	05:16	07:07	08:54
N 70°	23:09	23:07	23:05	05:43	07:23	09:03
68°	22:55	22:59	23:02	06:03	07:36	09:09
66°	22:44	22:52	22:59	06:19	07:46	09:15
64°	22:34	22:46	22:56	06:32	07:55	09:19
62°	22:25	22:41	22:54	06:43	08:02	09:23
60°	22:18	22:36	22:52	06:53	08:09	09:27
N 58°	22:12	22:32	22:51	07:01	08:14	09:30
56°	22:06	22:28	22:49	07:08	08:19	09:33
54°	22:01	22:25	22:48	07:14	08:24	09:35
52°	21:57	22:22	22:47	07:20	08:28	09:37
50°	21:52	22:20	22:46	07:25	08:31	09:39
45°	21:43	22:14	22:43	07:36	08:39	09:44
N 40°	21:36	22:09	22:41	07:45	08:46	09:47
35°	21:29	22:05	22:39	07:53	08:51	09:51
30°	21:23	22:01	22:38	08:00	08:56	09:53
20°	21:13	21:55	22:35	08:12	09:05	09:58
N 10°	21:05	21:49	22:33	08:22	09:12	10:02
0°	20:56	21:43	22:31	08:32	09:19	10:06
S 10°	20:48	21:38	22:28	08:41	09:26	10:10
20°	20:39	21:32	22:26	08:51	09:33	10:14
30°	20:29	21:26	22:23	09:03	09:41	10:18
35°	20:23	21:22	22:22	09:10	09:46	10:21
40°	20:17	21:18	22:20	09:17	09:51	10:24
45°	20:09	21:13	22:18	09:26	09:57	10:27
S 50°	19:59	21:07	22:16	09:36	10:05	10:31
52°	19:55	21:04	22:15	09:41	10:08	10:33
54°	19:50	21:01	22:13	09:46	10:12	10:35
56°	19:45	20:58	22:12	09:52	10:16	10:37
58°	19:39	20:54	22:11	09:59	10:20	10:40
S 60°	19:32	20:50	22:09	10:06	10:26	10:42

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 18-20 90-74%
12	05:36	05:40	12:06	02:20	14:44	
13	05:43	05:47	12:06	03:08	15:31	
14	05:50	05:53	12:06	03:55	16:18	

July 15, 16, 17 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	293°02.2	223°10.6	N19°48.4	174°22.1	N21°54.5	98°43.8	S04°45.6	31°08.7	S21°55.5
1	308°04.7	238°10.1	48.8	189°22.8	54.2	113°46.0	45.7	46°11.3	55.5
2	323°07.1	253°09.7	49.3	204°23.6	53.9	128°48.3	45.8	61°14.0	55.5
3	338°09.6	268°09.2	·· 49.8	219°24.3	·· 53.6	143°50.5	·· 45.9	76°16.6	·· 55.5
4	353°12.1	283°08.7	50.2	234°25.1	53.3	158°52.8	46.0	91°19.2	55.5
5	8°14.5	298°08.2	50.7	249°25.8	53.0	173°55.0	46.1	106°21.8	55.5
6	23°17.0	313°07.8	N19°51.2	264°26.6	N21°52.7	188°57.2	S04°46.2	121°24.5	S21°55.5
7	38°19.5	328°07.3	51.6	279°27.3	52.4	203°59.5	46.3	136°27.1	55.5
8	53°21.9	343°06.8	52.1	294°28.1	52.1	219°01.7	46.4	151°29.7	55.5
9	68°24.4	358°06.3	·· 52.6	309°28.8	·· 51.8	234°04.0	·· 46.5	166°32.3	·· 55.5
10	83°26.9	13°05.9	53.0	324°29.6	51.5	249°06.2	46.7	181°34.9	55.5
11	98°29.3	28°05.4	53.5	339°30.3	51.2	264°08.4	46.8	196°37.6	55.5
12	113°31.8	43°04.9	N19°54.0	354°31.1	N21°50.9	279°10.7	S04°46.9	211°40.2	S21°55.5
13	128°34.2	58°04.4	54.4	9°31.8	50.6	294°12.9	47.0	226°42.8	55.5
14	143°36.7	73°03.9	54.9	24°32.6	50.3	309°15.2	47.1	241°45.4	55.5
15	158°39.2	88°03.5	·· 55.3	39°33.3	·· 50.0	324°17.4	·· 47.2	256°48.0	·· 55.5
16	173°41.6	103°03.0	55.8	54°34.1	49.7	339°19.6	47.3	271°50.7	55.5
17	188°44.1	118°02.5	56.3	69°34.8	49.4	354°21.9	47.4	286°53.3	55.5
18	203°46.6	133°02.0	N19°56.7	84°35.6	N21°49.0	9°24.1	S04°47.5	301°55.9	S21°55.5
19	218°49.0	148°01.5	57.2	99°36.3	48.7	24°26.4	47.6	316°58.5	55.5
20	233°51.5	163°01.1	57.6	114°37.1	48.4	39°28.6	47.7	332°01.1	55.5
21	248°54.0	178°00.6	·· 58.1	129°37.8	·· 48.1	54°30.8	·· 47.8	347°03.7	·· 55.5
22	263°56.4	193°00.1	58.5	144°38.6	47.8	69°33.1	47.9	2°06.4	55.5
23	278°58.9	207°59.6	59.0	159°39.4	47.5	84°35.3	48.0	17°09.0	55.5
Mer.pass.:04:27		v-0.5 d0.5 m-4.0		v0.8 d-0.3 m1.6		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.1	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	294°01.4	222°59.1	N19°59.4	174°40.1	N21°47.2	99°37.5	S04°48.1	32°11.6	S21°55.5
1	309°03.8	237°58.6	19°59.9	189°40.9	46.9	114°39.8	48.2	47°14.2	55.5
2	324°06.3	252°58.1	20°00.4	204°41.6	46.6	129°42.0	48.3	62°16.8	55.5
3	339°08.7	267°57.7	·· 00.8	219°42.4	·· 46.3	144°44.3	·· 48.4	77°19.5	·· 55.5
4	354°11.2	282°57.2	01.3	234°43.1	46.0	159°46.5	48.5	92°22.1	55.5
5	9°13.7	297°56.7	01.7	249°43.9	45.7	174°48.7	48.6	107°24.7	55.5
6	24°16.1	312°56.2	N20°02.2	264°44.6	N21°45.4	189°51.0	S04°48.8	122°27.3	S21°55.5
7	39°18.6	327°55.7	02.6	279°45.4	45.0	204°53.2	48.9	137°29.9	55.5
8	54°21.1	342°55.2	03.0	294°46.1	44.7	219°55.4	49.0	152°32.5	55.5
9	69°23.5	357°54.7	·· 03.5	309°46.9	·· 44.4	234°57.7	·· 49.1	167°35.2	·· 55.5
10	84°26.0	12°54.2	03.9	324°47.7	44.1	249°59.9	49.2	182°37.8	55.5
11	99°28.5	27°53.7	04.4	339°48.4	43.8	265°02.1	49.3	197°40.4	55.5
12	114°30.9	42°53.3	N20°04.8	354°49.2	N21°43.5	280°04.4	S04°49.4	212°43.0	S21°55.5
13	129°33.4	57°52.8	05.3	9°49.9	43.2	295°06.6	49.5	227°45.6	55.5
14	144°35.8	72°52.3	05.7	24°50.7	42.9	310°08.8	49.6	242°48.3	55.5
15	159°38.3	87°51.8	·· 06.2	39°51.4	·· 42.6	325°11.1	·· 49.7	257°50.9	·· 55.5
16	174°40.8	102°51.3	06.6	54°52.2	42.3	340°13.3	49.8	272°53.5	55.5
17	189°43.2	117°50.8	07.0	69°52.9	41.9	355°15.5	49.9	287°56.1	55.5
18	204°45.7	132°50.3	N20°07.5	84°53.7	N21°41.6	10°17.8	S04°50.0	302°58.7	S21°55.5
19	219°48.2	147°49.8	07.9	99°54.5	41.3	25°20.0	50.1	318°01.3	55.5
20	234°50.6	162°49.3	08.4	114°55.2	41.0	40°22.2	50.2	333°04.0	55.5
21	249°53.1	177°48.8	·· 08.8	129°56.0	·· 40.7	55°24.5	·· 50.3	348°06.6	·· 55.5
22	264°55.6	192°48.3	09.2	144°56.7	40.4	70°26.7	50.5	3°09.2	55.5
23	279°58.0	207°47.8	09.7	159°57.5	40.1	85°28.9	50.6	18°11.8	55.5
Mer.pass.:04:23		v-0.5 d0.5 m-4.0		v0.8 d-0.3 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.1	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	295°00.5	222°47.3	N20°10.1	174°58.2	N21°39.7	100°31.1	S04°50.7	33°14.4	S21°55.5
1	310°03.0	237°46.8	10.5	189°59.0	39.4	115°33.4	50.8	48°17.0	55.5
2	325°05.4	252°46.3	11.0	204°59.8	39.1	130°35.6	50.9	63°19.6	55.4
3	340°07.9	267°45.8	·· 11.4	220°00.5	·· 38.8	145°37.8	·· 51.0	78°22.3	·· 55.4
4	355°10.3	282°45.3	11.8	235°01.3	38.5	160°40.1	51.1	93°24.9	55.4
5	10°12.8	297°44.8	12.3	250°02.0	38.2	175°42.3	51.2	108°27.5	55.4
6	25°15.3	312°44.3	N20°12.7	265°02.8	N21°37.9	190°44.5	S04°51.3	123°30.1	S21°55.4
7	40°17.7	327°43.8	13.1	280°03.6	37.5	205°46.8	51.4	138°32.7	55.4
8	55°20.2	342°43.3	13.6	295°04.3	37.2	220°49.0	51.5	153°35.3	55.4
9	70°22.7	357°42.8	·· 14.0	310°05.1	·· 36.9	235°51.2	·· 51.6	168°38.0	·· 55.4
10	85°25.1	12°42.3	14.4	325°05.8	36.6	250°53.4	51.8	183°40.6	55.4
11	100°27.6	27°41.8	14.8	340°06.6	36.3	265°55.7	51.9	198°43.2	55.4
12	115°30.1	42°41.3	N20°15.3	355°07.4	N21°36.0	280°57.9	S04°52.0	213°45.8	S21°55.4
13	130°32.5	57°40.8	15.7	10°08.1	35.6	296°00.1	52.1	228°48.4	55.4
14	145°35.0	72°40.3	16.1	25°08.9	35.3	311°02.4	52.2	243°51.0	55.4
15	160°37.5	87°39.8	·· 16.5	40°09.6	·· 35.0	326°04.6	·· 52.3	258°53.6	·· 55.4
16	175°39.9	102°39.3	17.0	55°10.4	34.7	341°06.8	52.4	273°56.3	55.4
17	190°42.4	117°38.8	17.4	70°11.2	34.4	356°09.0	52.5	288°58.9	55.4
18	205°44.8	132°38.3	N20°17.8	85°11.9	N21°34.0	11°11.3	S04°52.6	304°01.5	S21°55.4
19	220°47.3	147°37.8	18.2	100°12.7	33.7	26°13.5	52.7	319°04.1	55.4
20	235°49.8	162°37.3	18.6	115°13.4	33.4	41°15.7	52.8	334°06.7	55.4
21	250°52.2	177°36.8	·· 19.1	130°14.2	·· 33.1	56°17.9	·· 52.9	349°09.3	·· 55.4
22	265°54.7	192°36.2	19.5	145°15.0	32.8	71°20.2	53.1	4°11.9	55.4
23	280°57.2	207°35.7	19.9	160°15.7	32.4	86°22.4	53.2	19°14.5	55.4
Mer.pass.:04:19		v-0.5 d0.4 m-4.0		v0.8 d-0.3 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°40.5	29°11.1
Ankaa	353°12.9	-42°12.5
Schedar	349°37.1	56°37.7
Diphda	348°53.1	-17°53.4
Achernar	335°24.8	-57°08.7
Hamal	327°57.7	23°32.5
Polaris	316°40.6	89°19.8
Acamar	315°16.5	-40°14.0
Menkar	314°12.3	4°09.3
Mirfak	308°36.6	49°55.0
Aldebaran	290°46.5	16°32.4
Rigel	281°09.7	-8°11.0
Capella	280°30.8	46°00.6
Bellatrix	278°29.3	6°21.7
Elnath	278°09.5	28°37.1
Alnilam	275°43.9	-1°11.6
Betelgeuse	270°58.6	7°24.4
Canopus	263°55.4	-52°42.4
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.9
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.5	-59°34.1
Suhail	222°50.8	-43°30.3
Miaplacidus	221°39.8	-69°47.5
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°48.9	61°39.7
Denebola	182°31.0	14°28.6
Gienah	175°49.5	-17°38.3
Acrux	173°06.3	-63°12.0
Gacrux	171°57.9	-57°12.8
Alioth	166°18.5	55°52.3
Spica	158°28.3	-11°15.0
Alkaid	152°56.8	49°14.0
Hadar	148°43.7	-60°27.5
Menkent	148°04.2	-36°27.4
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.7	-60°54.5
Kochab	137°19.9	74°05.5
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.4	51°29.5
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.3
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.4	-56°40.5
Deneb	49°29.1	45°20.6
Enif	33°44.1	9°57.4
Al Na'ir	27°40.0	-46°52.3
Fomalhaut	15°20.7	-29°31.6
Scheat	13°50.4	28°10.6
Markab	13°35.4	15°18.0

Jul 15 Sat	SHA	Mer.pass
Venus	290°08.4	09:08
Mars	241°19.8	12:22
Jupiter	165°41.6	17:22
Saturn	98°06.5	21:52

Jul 16 Sun	SHA	Mer.pass
Venus	288°57.8	09:08
Mars	240°38.8	12:21
Jupiter	165°36.2	17:19
Saturn	98°10.3	21:47

Jul 17 Mon	SHA	Mer.pass
Venus	287°46.8	09:09
Mars	239°57.8	12:19
Jupiter	165°30.7	17:15
Saturn	98°13.9	21:43

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3537 sec ΔT = TT-UT1 = +68.8303 sec

2017 July 15 to Jul. 17 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°30.9	N21°31.3	291°45.7	12.3'	S02°45.6	10.9'	57.2'
1	193°30.8	30.9	306°16.9	12.3'	02°34.8	10.9'	57.2'
2	208°30.8	30.5	320°48.2	12.3'	02°23.9	10.9'	57.2'
3	223°30.7	·· 30.2	335°19.4	12.2'	02°13.0	10.9'	57.3'
4	238°30.7	29.8	349°50.7	12.2'	02°02.0	10.9'	57.3'
5	253°30.6	29.4	4°21.9	12.2'	01°51.1	11.0'	57.3'
6	268°30.5	N21°29.0	18°53.0	12.2'	S01°40.1	11.0'	57.3'
7	283°30.5	28.6	33°24.2	12.1'	01°29.1	11.0'	57.4'
8	298°30.4	28.2	47°55.3	12.1'	01°18.1	11.0'	57.4'
9	313°30.3	·· 27.8	62°26.4	12.1'	01°07.1	11.0'	57.4'
10	328°30.3	27.4	76°57.5	12.1'	00°56.1	11.0'	57.5'
11	343°30.2	27.0	91°28.6	12.0'	00°45.0	11.1'	57.5'
12	358°30.2	N21°26.6	105°59.6	12.0'	S00°33.9	11.1'	57.5'
13	13°30.1	26.2	120°30.6	12.0'	00°22.9	11.1'	57.5'
14	28°30.0	25.8	135°01.6	12.0'	00°11.8	11.1'	57.6'
15	43°30.0	·· 25.4	149°32.5	11.9'	S00°00.7	11.1'	57.6'
16	58°29.9	25.0	164°03.4	11.9'	N00°10.4	11.1'	57.6'
17	73°29.9	24.6	178°34.3	11.9'	00°21.6	11.1'	57.7'
18	88°29.8	N21°24.1	193°05.2	11.8'	N00°32.7	11.1'	57.7'
19	103°29.7	23.7	207°36.0	11.8'	00°43.8	11.1'	57.7'
20	118°29.7	23.3	222°06.8	11.8'	00°55.0	11.1'	57.7'
21	133°29.6	·· 22.9	236°37.6	11.7'	01°06.1	11.2'	57.8'
22	148°29.6	22.5	251°08.3	11.7'	01°17.3	11.2'	57.8'
23	163°29.5	22.1	265°39.0	11.7'	01°28.4	11.2'	57.8'
	SD.=15.7	d=-0.4		S.D.=15.7			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°29.4	N21°21.7	280°09.6	11.6'	N01°39.6	11.2'	57.9'
1	193°29.4	21.3	294°40.3	11.6'	01°50.8	11.2'	57.9'
2	208°29.3	20.9	309°10.8	11.6'	02°01.9	11.2'	57.9'
3	223°29.3	·· 20.5	323°41.4	11.5'	02°13.1	11.2'	57.9'
4	238°29.2	20.1	338°11.9	11.5'	02°24.3	11.2'	58.0'
5	253°29.2	19.7	352°42.4	11.4'	02°35.4	11.2'	58.0'
6	268°29.1	N21°19.2	7°12.8	11.4'	N02°46.6	11.2'	58.0'
7	283°29.0	18.8	21°43.2	11.4'	02°57.8	11.2'	58.1'
8	298°29.0	18.4	36°13.5	11.3'	03°08.9	11.1'	58.1'
9	313°28.9	·· 18.0	50°43.8	11.3'	03°20.1	11.1'	58.1'
10	328°28.9	17.6	65°14.1	11.2'	03°31.2	11.1'	58.1'
11	343°28.8	17.2	79°44.3	11.2'	03°42.3	11.1'	58.2'
12	358°28.8	N21°16.8	94°14.4	11.1'	N03°53.4	11.1'	58.2'
13	13°28.7	16.3	108°44.5	11.1'	04°04.6	11.1'	58.2'
14	28°28.6	15.9	123°14.6	11.0'	04°15.7	11.1'	58.3'
15	43°28.6	·· 15.5	137°44.6	11.0'	04°26.8	11.1'	58.3'
16	58°28.5	15.1	152°14.6	11.0'	04°37.8	11.1'	58.3'
17	73°28.5	14.7	166°44.5	10.9'	04°48.9	11.1'	58.3'
18	88°28.4	N21°14.2	181°14.4	10.9'	N05°00.0	11.0'	58.4'
19	103°28.4	13.8	195°44.2	10.8'	05°11.0	11.0'	58.4'
20	118°28.3	13.4	210°14.0	10.7'	05°22.0	11.0'	58.4'
21	133°28.3	·· 13.0	224°43.7	10.7'	05°33.0	11.0'	58.5'
22	148°28.2	12.6	239°13.4	10.6'	05°44.0	11.0'	58.5'
23	163°28.1	12.1	253°43.0	10.6'	05°54.9	10.9'	58.5'
	SD.=15.7	d=-0.4		S.D.=15.9			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°28.1	N21°11.7	268°12.6	10.5'	N06°05.9	10.9'	58.5'
1	193°28.0	11.3	282°42.1	10.5'	06°16.8	10.9'	58.6'
2	208°28.0	10.9	297°11.6	10.4'	06°27.7	10.9'	58.6'
3	223°27.9	·· 10.4	311°41.0	10.4'	06°38.6	10.9'	58.6'
4	238°27.9	10.0	326°10.3	10.3'	06°49.4	10.8'	58.7'
5	253°27.8	09.6	340°39.6	10.3'	07°00.2	10.8'	58.7'
6	268°27.8	N21°09.2	355°08.8	10.2'	N07°11.0	10.8'	58.7'
7	283°27.7	08.7	9°38.0	10.1'	07°21.8	10.7'	58.7'
8	298°27.7	08.3	24°07.1	10.1'	07°32.5	10.7'	58.8'
9	313°27.6	·· 07.9	38°36.1	10.0'	07°43.2	10.7'	58.8'
10	328°27.6	07.4	53°05.1	9.9'	07°53.8	10.6'	58.8'
11	343°27.5	07.0	67°34.0	9.9'	08°04.5	10.6'	58.9'
12	358°27.5	N21°06.6	82°02.9	9.8'	N08°15.1	10.6'	58.9'
13	13°27.4	06.2	96°31.6	9.8'	08°25.6	10.5'	58.9'
14	28°27.4	05.7	111°00.4	9.7'	08°36.1	10.5'	58.9'
15	43°27.3	·· 05.3	125°29.0	9.6'	08°46.6	10.5'	59.0'
16	58°27.3	04.9	139°57.6	9.6'	08°57.1	10.4'	59.0'
17	73°27.2	04.4	154°26.2	9.5'	09°07.5	10.4'	59.0'
18	88°27.2	N21°04.0	168°54.6	9.4'	N09°17.8	10.3'	59.1'
19	103°27.1	03.5	183°23.0	9.4'	09°28.1	10.3'	59.1'
20	118°27.1	03.1	197°51.4	9.3'	09°38.4	10.2'	59.1'
21	133°27.0	·· 02.7	212°19.6	9.2'	09°48.6	10.2'	59.1'
22	148°27.0	02.2	226°47.8	9.2'	09°58.8	10.2'	59.2'
23	163°26.9	01.8	241°16.0	9.1'	10°08.9	10.1'	59.2'
	SD.=15.7	d=-0.4		S.D.=16.0			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°						
66°			01:41	22:28		
64°			02:19	21:51		
62°		00:58	02:45	21:25	23:08	
60°		01:49	03:06	21:05	22:21	
N 58°		02:19	03:23	20:48	21:52	
56°	00:53	02:41	03:37	20:35	21:30	23:14
54°	01:40	02:59	03:49	20:23	21:12	22:30
52°	02:08	03:14	03:59	20:12	20:57	22:03
50°	02:29	03:27	04:09	20:03	20:44	21:42
45°	03:06	03:53	04:29	19:43	20:19	21:05
N 40°	03:33	04:13	04:45	19:27	19:59	20:38
35°	03:54	04:29	04:58	19:14	19:43	20:18
30°	04:10	04:43	05:10	19:02	19:29	20:01
20°	04:37	05:05	05:30	18:42	19:07	19:35
N 10°	04:57	05:24	05:47	18:25	18:48	19:15
0°	05:14	05:40	06:03	18:10	18:32	18:58
S 10°	05:30	05:56	06:18	17:54	18:16	18:42
20°	05:44	06:11	06:35	17:37	18:01	18:28
30°	05:59	06:28	06:54	17:18	17:44	18:14
35°	06:06	06:37	07:05	17:07	17:35	18:06
40°	06:14	06:48	07:18	16:55	17:25	17:58
45°	06:23	07:00	07:32	16:40	17:13	17:49
S 50°	06:33	07:14	07:51	16:22	16:59	17:39
52°	06:38	07:20	07:59	16:13	16:53	17:35
54°	06:42	07:27	08:09	16:04	16:46	17:30
56°	06:47	07:35	08:20	15:53	16:38	17:25
58°	06:53	07:44	08:32	15:41	16:29	17:20
S 60°	06:59	07:53	08:47	15:26	16:19	17:14

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	23:01	22:53	22:44	10:42	12:32	14:27
N 70°	23:03	23:01	22:59	10:43	12:26	14:13
68°	23:04	23:07	23:12	10:44	12:22	14:02
66°	23:05	23:13	23:22	10:45	12:18	13:53
64°	23:07	23:18	23:31	10:46	12:15	13:46
62°	23:07	23:22	23:38	10:47	12:12	13:40
60°	23:08	23:25	23:45	10:47	12:10	13:34
N 58°	23:09	23:28	23:50	10:48	12:07	13:29
56°	23:10	23:31	23:55	10:48	12:05	13:25
54°	23:10	23:34	–:–	10:49	12:04	13:21
52°	23:11	23:36	–:–	10:49	12:02	13:18
50°	23:11	23:38	–:–	10:49	12:01	13:14
45°	23:13	23:43	–:–	10:50	11:58	13:07
N 40°	23:13	23:47	–:–	10:51	11:55	13:02
35°	23:14	23:50	–:–	10:51	11:53	12:57
30°	23:15	23:54	–:–	10:51	11:51	12:53
20°	23:16	23:59	–:–	10:52	11:48	12:45
N 10°	23:17	–:–	00:04	10:53	11:45	12:38
0°	23:19	–:–	00:08	10:53	11:42	12:32
S 10°	23:20	–:–	00:13	10:54	11:39	12:26
20°	23:21	–:–	00:17	10:54	11:36	12:20
30°	23:22	–:–	00:23	10:55	11:33	12:12
35°	23:23	–:–	00:26	10:55	11:31	12:08
40°	23:24	–:–	00:30	10:56	11:29	12:03
45°	23:25	–:–	00:34	10:56	11:26	11:58
S 50°	23:27	–:–	00:39	10:57	11:23	11:51
52°	23:27	–:–	00:42	10:57	11:22	11:48
54°	23:28	–:–	00:44	10:57	11:20	11:44
56°	23:29	–:–	00:47	10:58	11:18	11:41
58°	23:29	–:–	00:50	10:58	11:16	11:37
S 60°	23:30	–:–	00:54	10:58	11:14	11:32

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 21-23 64-42%
15	05:56	05:59	12:06	04:42	17:06	
16	06:02	06:05	12:06	05:30	17:55	
17	06:08	06:10	12:06	06:20	18:46	

July 18, 19, 20 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	295°59.6	222°35.2	N20°20.3	175°16.5	N21°32.1	101°24.6	S04°53.3	34°17.2	S21°55.4
1	311°02.1	237°34.7	20.7	190°17.2	31.8	116°26.9	53.4	49°19.8	55.4
2	326°04.6	252°34.2	21.1	205°18.0	31.5	131°29.1	53.5	64°22.4	55.4
3	341°07.0	267°33.7	·· 21.6	220°18.8	·· 31.2	146°31.3	·· 53.6	79°25.0	·· 55.4
4	356°09.5	282°33.2	22.0	235°19.5	30.8	161°33.5	53.7	94°27.6	55.4
5	11°11.9	297°32.7	22.4	250°20.3	30.5	176°35.7	53.8	109°30.2	55.4
6	26°14.4	312°32.2	N20°22.8	265°21.1	N21°30.2	191°38.0	S04°53.9	124°32.8	S21°55.4
7	41°16.9	327°31.6	23.2	280°21.8	29.9	206°40.2	54.0	139°35.4	55.4
8	56°19.3	342°31.1	23.6	295°22.6	29.5	221°42.4	54.2	154°38.1	55.4
9	71°21.8	357°30.6	·· 24.0	310°23.3	·· 29.2	236°44.6	·· 54.3	169°40.7	·· 55.4
10	86°24.3	12°30.1	24.4	325°24.1	28.9	251°46.9	54.4	184°43.3	55.4
11	101°26.7	27°29.6	24.8	340°24.9	28.6	266°49.1	54.5	199°45.9	55.4
12	116°29.2	42°29.1	N20°25.2	355°25.6	N21°28.3	281°51.3	S04°54.6	214°48.5	S21°55.4
13	131°31.7	57°28.6	25.7	10°26.4	27.9	296°53.5	54.7	229°51.1	55.4
14	146°34.1	72°28.0	26.1	25°27.2	27.6	311°55.8	54.8	244°53.7	55.4
15	161°36.6	87°27.5	·· 26.5	40°27.9	·· 27.3	326°58.0	·· 54.9	259°56.3	·· 55.4
16	176°39.1	102°27.0	26.9	55°28.7	27.0	342°00.2	55.0	274°58.9	55.4
17	191°41.5	117°26.5	27.3	70°29.4	26.6	357°02.4	55.2	290°01.6	55.4
18	206°44.0	132°26.0	N20°27.7	85°30.2	N21°26.3	12°04.6	S04°55.3	305°04.2	S21°55.4
19	221°46.4	147°25.4	28.1	100°31.0	26.0	27°06.9	55.4	320°06.8	55.4
20	236°48.9	162°24.9	28.5	115°31.7	25.7	42°09.1	55.5	335°09.4	55.4
21	251°51.4	177°24.4	·· 28.9	130°32.5	·· 25.3	57°11.3	·· 55.6	350°12.0	·· 55.4
22	266°53.8	192°23.9	29.3	145°33.3	25.0	72°13.5	55.7	5°14.6	55.4
23	281°56.3	207°23.4	29.7	160°34.0	24.7	87°15.7	55.8	20°17.2	55.4
Mer.pass.:04:15		v-0.5 d0.4 m-4.0		v0.8 d-0.3 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	296°58.8	222°22.8	N20°30.1	175°34.8	N21°24.3	102°18.0	S04°55.9	35°19.8	S21°55.4
1	312°01.2	237°22.3	30.5	190°35.6	24.0	117°20.2	56.0	50°22.4	55.4
2	327°03.7	252°21.8	30.9	205°36.3	23.7	132°22.4	56.2	65°25.1	55.4
3	342°06.2	267°21.3	·· 31.3	220°37.1	·· 23.4	147°24.6	·· 56.3	80°27.7	·· 55.4
4	357°08.6	282°20.8	31.6	235°37.9	23.0	162°26.8	56.4	95°30.3	55.4
5	12°11.1	297°20.2	32.0	250°38.6	22.7	177°29.1	56.5	110°32.9	55.4
6	27°13.6	312°19.7	N20°32.4	265°39.4	N21°22.4	192°31.3	S04°56.6	125°35.5	S21°55.4
7	42°16.0	327°19.2	32.8	280°40.2	22.0	207°33.5	56.7	140°38.1	55.4
8	57°18.5	342°18.7	33.2	295°40.9	21.7	222°35.7	56.8	155°40.7	55.4
9	72°20.9	357°18.1	·· 33.6	310°41.7	·· 21.4	237°37.9	·· 56.9	170°43.3	·· 55.4
10	87°23.4	12°17.6	34.0	325°42.5	21.1	252°40.2	57.1	185°45.9	55.4
11	102°25.9	27°17.1	34.4	340°43.2	20.7	267°42.4	57.2	200°48.5	55.4
12	117°28.3	42°16.5	N20°34.8	355°44.0	N21°20.4	282°44.6	S04°57.3	215°51.1	S21°55.4
13	132°30.8	57°16.0	35.2	10°44.8	20.1	297°46.8	57.4	230°53.8	55.4
14	147°33.3	72°15.5	35.5	25°45.5	19.7	312°49.0	57.5	245°56.4	55.4
15	162°35.7	87°15.0	·· 35.9	40°46.3	·· 19.4	327°51.2	·· 57.6	260°59.0	·· 55.4
16	177°38.2	102°14.4	36.3	55°47.1	19.1	342°53.5	57.7	276°01.6	55.4
17	192°40.7	117°13.9	36.7	70°47.8	18.7	357°55.7	57.9	291°04.2	55.4
18	207°43.1	132°13.4	N20°37.1	85°48.6	N21°18.4	12°57.9	S04°58.0	306°06.8	S21°55.3
19	222°45.6	147°12.8	37.5	100°49.4	18.1	28°00.1	58.1	321°09.4	55.3
20	237°48.0	162°12.3	37.8	115°50.1	17.7	43°02.3	58.2	336°12.0	55.3
21	252°50.5	177°11.8	·· 38.2	130°50.9	·· 17.4	58°04.5	·· 58.3	351°14.6	·· 55.3
22	267°53.0	192°11.2	38.6	145°51.7	17.1	73°06.8	58.4	6°17.2	55.3
23	282°55.4	207°10.7	39.0	160°52.4	16.7	88°09.0	58.5	21°19.8	55.3
Mer.pass.:04:11		v-0.5 d0.4 m-4.0		v0.8 d-0.3 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	297°57.9	222°10.2	N20°39.4	175°53.2	N21°16.4	103°11.2	S04°58.6	36°22.4	S21°55.3
1	313°00.4	237°09.6	39.7	190°54.0	16.1	118°13.4	58.8	51°25.0	55.3
2	328°02.8	252°09.1	40.1	205°54.7	15.7	133°15.6	58.9	66°27.6	55.3
3	343°05.3	267°08.6	·· 40.5	220°55.5	·· 15.4	148°17.8	·· 59.0	81°30.3	·· 55.3
4	358°07.8	282°08.0	40.9	235°56.3	15.1	163°20.0	59.1	96°32.9	55.3
5	13°10.2	297°07.5	41.2	250°57.1	14.7	178°22.3	59.2	111°35.5	55.3
6	28°12.7	312°07.0	N20°41.6	265°57.8	N21°14.4	193°24.5	S04°59.3	126°38.1	S21°55.3
7	43°15.2	327°06.4	42.0	280°58.6	14.1	208°26.7	59.4	141°40.7	55.3
8	58°17.6	342°05.9	42.4	295°59.4	13.7	223°28.9	59.6	156°43.3	55.3
9	73°20.1	357°05.4	·· 42.7	311°00.1	·· 13.4	238°31.1	·· 59.7	171°45.9	·· 55.3
10	88°22.5	12°04.8	43.1	326°00.9	13.1	253°33.3	59.8	186°48.5	55.3
11	103°25.0	27°04.3	43.5	341°01.7	12.7	268°35.5	04°59.9	201°51.1	55.3
12	118°27.5	42°03.7	N20°43.8	356°02.4	N21°12.4	283°37.7	S05°00.0	216°53.7	S21°55.3
13	133°29.9	57°03.2	44.2	11°03.2	12.0	298°40.0	00.1	231°56.3	55.3
14	148°32.4	72°02.7	44.6	26°04.0	11.7	313°42.2	00.2	246°58.9	55.3
15	163°34.9	87°02.1	·· 44.9	41°04.8	·· 11.4	328°44.4	·· 00.4	262°01.5	·· 55.3
16	178°37.3	102°01.6	45.3	56°05.5	11.0	343°46.6	00.5	277°04.1	55.3
17	193°39.8	117°01.0	45.7	71°06.3	10.7	358°48.8	00.6	292°06.7	55.3
18	208°42.3	132°00.5	N20°46.0	86°07.1	N21°10.4	13°51.0	S05°00.7	307°09.3	S21°55.3
19	223°44.7	146°59.9	46.4	101°07.8	10.0	28°53.2	00.8	322°11.9	55.3
20	238°47.2	161°59.4	46.7	116°08.6	09.7	43°55.4	00.9	337°14.5	55.3
21	253°49.7	176°58.9	·· 47.1	131°09.4	·· 09.3	58°57.6	·· 01.1	352°17.2	·· 55.3
22	268°52.1	191°58.3	47.5	146°10.2	09.0	73°59.9	01.2	7°19.8	55.3
23	283°54.6	206°57.8	47.8	161°10.9	08.7	89°02.1	01.3	22°22.4	55.3
Mer.pass.:04:07		v-0.5 d0.4 m-4.0		v0.8 d-0.3 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°40.4	29°11.1
Ankaa	353°12.9	-42°12.5
Schedar	349°37.1	56°37.7
Diphda	348°53.1	-17°53.4
Achernar	335°24.8	-57°08.7
Hamal	327°57.6	23°32.5
Polaris	316°39.0	89°19.8
Acamar	315°16.4	-40°14.0
Menkar	314°12.3	4°09.4
Mirfak	308°36.6	49°55.0
Aldebaran	290°46.4	16°32.4
Rigel	281°09.7	-8°11.0
Capella	280°30.7	46°00.6
Bellatrix	278°29.3	6°21.8
Elnath	278°09.4	28°37.1
Alnilam	275°43.9	-1°11.6
Betelgeuse	270°58.6	7°24.4
Canopus	263°55.4	-52°42.4
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.8
Procyon	244°57.2	5°10.7
Pollux	243°24.8	27°58.9
Avior	234°17.5	-59°34.1
Suhail	222°50.8	-43°30.3
Miaplacidus	221°39.9	-69°47.5
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°48.9	61°39.6
Denebola	182°31.0	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.3	-63°11.9
Gacrux	171°57.9	-57°12.8
Alioth	166°18.5	55°52.3
Spica	158°28.3	-11°15.0
Alkaid	152°56.8	49°14.0
Hadar	148°43.8	-60°27.5
Menkent	148°04.2	-36°27.4
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.7	-60°54.5
Kochab	137°19.9	74°05.5
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.4	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.1
Eltanin	90°44.4	51°29.5
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.3
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.4	-56°40.5
Deneb	49°29.1	45°20.7
Enif	33°44.1	9°57.4
Al Na'ir	27°39.9	-46°52.3
Fomalhaut	15°20.7	-29°31.6
Scheat	13°50.4	28°10.6
Markab	13°35.3	15°18.0

Jul 18 Tue	**SHA**	**Mer.pass**
Venus	286°35.6	09:10
Mars	239°16.9	12:18
Jupiter	165°25.0	17:12
Saturn	98°17.5	21:39

Jul 19 Wed	**SHA**	**Mer.pass**
Venus	285°24.1	09:11
Mars	238°36.0	12:17
Jupiter	165°19.2	17:08
Saturn	98°21.1	21:35

Jul 20 Thu	**SHA**	**Mer.pass**
Venus	284°12.3	09:12
Mars	237°55.3	12:16
Jupiter	165°13.3	17:05
Saturn	98°24.5	21:31

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3525 sec ΔT = TT-UT1 = +68.8315 sec

2017 July 18 to Jul. 20 UT

h

	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°26.9	N21°01.4	255°44.0	9.0′	N10°19.0	10.1′	59.2′
1	193°26.8	00.9	270°12.0	9.0′	10°29.0	10.0′	59.3′
2	208°26.8	00.5	284°39.9	8.9′	10°39.0	9.9′	59.3′
3	223°26.7	21°00.0	299°07.8	8.8′	10°48.9	9.9′	59.3′
4	238°26.7	20°59.6	313°35.6	8.7′	10°58.8	9.8′	59.3′
5	253°26.6	59.2	328°03.3	8.7′	11°08.6	9.8′	59.4′
6	268°26.6	N20°58.7	342°30.9	8.6′	N11°18.4	9.7′	59.4′
7	283°26.5	58.3	356°58.5	8.5′	11°28.1	9.7′	59.4′
8	298°26.5	57.8	11°26.0	8.5′	11°37.7	9.6′	59.4′
9	313°26.5	·· 57.4	25°53.4	8.4′	11°47.3	9.5′	59.5′
10	328°26.4	56.9	40°20.7	8.3′	11°56.8	9.5′	59.5′
11	343°26.4	56.5	54°48.0	8.2′	12°06.2	9.4′	59.5′
12	358°26.3	N20°56.1	69°15.2	8.2′	N12°15.6	9.3′	59.5′
13	13°26.3	55.6	83°42.3	8.1′	12°24.9	9.3′	59.6′
14	28°26.2	55.2	98°09.4	8.0′	12°34.2	9.2′	59.6′
15	43°26.2	·· 54.7	112°36.3	7.9′	12°43.3	9.1′	59.6′
16	58°26.1	54.3	127°03.2	7.9′	12°52.5	9.1′	59.6′
17	73°26.1	53.8	141°30.1	7.8′	13°01.5	9.0′	59.7′
18	88°26.0	N20°53.4	155°56.8	7.7′	N13°10.5	8.9′	59.7′
19	103°26.0	52.9	170°23.5	7.6′	13°19.3	8.8′	59.7′
20	118°26.0	52.5	184°50.1	7.6′	13°28.1	8.8′	59.7′
21	133°25.9	·· 52.0	199°16.6	7.5′	13°36.9	8.7′	59.8′
22	148°25.9	51.6	213°43.0	7.4′	13°45.5	8.6′	59.8′
23	163°25.8	51.1	228°09.4	7.3′	13°54.1	8.5′	59.8′
	SD.=15.7	d=-0.4	S.D.=16.2				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°25.8	N20°50.7	242°35.7	7.3′	N14°02.6	8.5′	59.8′
1	193°25.7	50.2	257°01.9	7.2′	14°11.0	8.4′	59.9′
2	208°25.7	49.7	271°28.1	7.1′	14°19.3	8.3′	59.9′
3	223°25.7	·· 49.3	285°54.2	7.0′	14°27.6	8.2′	59.9′
4	238°25.6	48.8	300°20.2	7.0′	14°35.7	8.1′	59.9′
5	253°25.6	48.4	314°46.1	6.9′	14°43.8	8.0′	60.0′
6	268°25.5	N20°47.9	329°11.9	6.8′	N14°51.8	7.9′	60.0′
7	283°25.5	47.5	343°37.7	6.7′	14°59.7	7.8′	60.0′
8	298°25.5	47.0	358°03.4	6.7′	15°07.5	7.8′	60.0′
9	313°25.4	·· 46.5	12°29.0	6.6′	15°15.2	7.7′	60.0′
10	328°25.4	46.1	26°54.6	6.5′	15°22.8	7.6′	60.1′
11	343°25.3	45.6	41°20.1	6.4′	15°30.3	7.5′	60.1′
12	358°25.3	N20°45.2	55°45.5	6.4′	N15°37.7	7.4′	60.1′
13	13°25.3	44.7	70°10.8	6.3′	15°45.0	7.3′	60.1′
14	28°25.2	44.2	84°36.1	6.2′	15°52.3	7.2′	60.1′
15	43°25.2	·· 43.8	99°01.3	6.2′	15°59.4	7.1′	60.2′
16	58°25.1	43.3	113°26.4	6.1′	16°06.4	7.0′	60.2′
17	73°25.1	42.9	127°51.5	6.0′	16°13.3	6.9′	60.2′
18	88°25.1	N20°42.4	142°16.4	5.9′	N16°20.1	6.8′	60.2′
19	103°25.0	41.9	156°41.4	5.9′	16°26.8	6.7′	60.2′
20	118°25.0	41.5	171°06.2	5.8′	16°33.4	6.5′	60.3′
21	133°24.9	·· 41.0	185°31.0	5.7′	16°39.9	6.4′	60.3′
22	148°24.9	40.5	199°55.7	5.7′	16°46.3	6.3′	60.3′
23	163°24.9	40.1	214°20.3	5.6′	16°52.6	6.2′	60.3′
	SD.=15.7	d=-0.5	S.D.=16.4				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°24.8	N20°39.6	228°44.9	5.5′	N16°58.7	6.1′	60.3′
1	193°24.8	39.1	243°09.4	5.5′	17°04.8	6.0′	60.3′
2	208°24.8	38.7	257°33.9	5.4′	17°10.7	5.9′	60.4′
3	223°24.7	·· 38.2	271°58.3	5.4′	17°16.5	5.8′	60.4′
4	238°24.7	37.7	286°22.6	5.3′	17°22.2	5.6′	60.4′
5	253°24.6	37.2	300°46.8	5.2′	17°27.8	5.5′	60.4′
6	268°24.6	N20°36.8	315°11.0	5.2′	N17°33.2	5.4′	60.4′
7	283°24.6	36.3	329°35.2	5.1′	17°38.6	5.3′	60.4′
8	298°24.5	35.8	343°59.3	5.1′	17°43.8	5.2′	60.5′
9	313°24.5	·· 35.4	358°23.3	5.0′	17°48.9	5.0′	60.5′
10	328°24.5	34.9	12°47.3	4.9′	17°53.9	4.9′	60.5′
11	343°24.4	34.4	27°11.2	4.9′	17°58.7	4.8′	60.5′
12	358°24.4	N20°33.9	41°35.0	4.8′	N18°03.5	4.7′	60.5′
13	13°24.4	33.5	55°58.8	4.8′	18°08.1	4.5′	60.5′
14	28°24.3	33.0	70°22.6	4.7′	18°12.6	4.4′	60.5′
15	43°24.3	·· 32.5	84°46.3	4.7′	18°16.9	4.3′	60.5′
16	58°24.3	32.0	99°10.0	4.6′	18°21.1	4.2′	60.6′
17	73°24.2	31.5	113°33.6	4.6′	18°25.2	4.0′	60.6′
18	88°24.2	N20°31.1	127°57.1	4.5′	N18°29.2	3.9′	60.6′
19	103°24.2	30.6	142°20.7	4.5′	18°33.0	3.8′	60.6′
20	118°24.1	30.1	156°44.1	4.5′	18°36.7	3.6′	60.6′
21	133°24.1	·· 29.6	171°07.6	4.4′	18°40.3	3.5′	60.6′
22	148°24.1	29.1	185°31.0	4.4′	18°43.7	3.4′	60.6′
23	163°24.0	28.7	199°54.3	4.3′	18°47.0	3.2′	60.6′
	SD.=15.7	d=-0.5	S.D.=16.5				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	00:48	23:15	▭	▭
66°	▭	▭	01:54	22:16	▭	▭
64°	▭	▭	02:28	21:42	▭	▭
62°	▭	01:16	02:53	21:18	22:52	▭
60°	▭	01:58	03:12	20:59	22:11	▭
N 58°	▭	02:26	03:28	20:44	21:45	▭
56°	01:10	02:47	03:41	20:30	21:24	22:59
54°	01:49	03:04	03:53	20:19	21:07	22:22
52°	02:14	03:19	04:03	20:09	20:53	21:57
50°	02:34	03:31	04:12	20:00	20:41	21:37
45°	03:10	03:56	04:32	19:41	20:16	21:01
N 40°	03:36	04:15	04:47	19:25	19:57	20:36
35°	03:56	04:31	05:00	19:12	19:41	20:16
30°	04:13	04:45	05:11	19:01	19:28	20:00
20°	04:38	05:07	05:31	18:42	19:06	19:34
N 10°	04:58	05:25	05:47	18:25	18:48	19:14
0°	05:15	05:41	06:03	18:10	18:32	18:58
S 10°	05:30	05:56	06:18	17:55	18:17	18:43
20°	05:44	06:11	06:34	17:38	18:02	18:29
30°	05:58	06:27	06:53	17:20	17:46	18:15
35°	06:05	06:36	07:04	17:09	17:37	18:08
40°	06:13	06:46	07:16	16:57	17:27	18:00
45°	06:21	06:58	07:30	16:43	17:15	17:52
S 50°	06:31	07:11	07:48	16:25	17:02	17:42
52°	06:35	07:17	07:56	16:17	16:56	17:38
54°	06:40	07:24	08:05	16:08	16:49	17:34
56°	06:44	07:31	08:16	15:57	16:42	17:29
58°	06:50	07:40	08:28	15:46	16:33	17:24
S 60°	06:55	07:49	08:41	15:32	16:24	17:18

Lat.	**Moonrise** Tue	**Moonrise** Wed	**Moonrise** Thu	**Moonset** Tue	**Moonset** Wed	**Moonset** Thu
N 72°	22:32	22:13	▭	16:30	18:48	▭
N 70°	22:59	23:00	23:09	16:05	18:02	19:59
68°	23:19	23:31	23:56	15:47	17:32	19:13
66°	23:35	23:54	–:–	15:32	17:10	18:43
64°	23:48	–:–	00:12	15:19	16:53	18:20
62°	23:59	–:–	00:27	15:09	16:38	18:02
60°	–:–	00:09	00:40	15:00	16:26	17:47
N 58°	–:–	00:17	00:51	14:53	16:16	17:35
56°	–:–	00:24	01:00	14:46	16:07	17:24
54°	00:00	00:31	01:09	14:40	15:59	17:14
52°	00:04	00:37	01:16	14:34	15:51	17:06
50°	00:08	00:42	01:23	14:29	15:45	16:58
45°	00:16	00:54	01:38	14:19	15:31	16:42
N 40°	00:23	01:04	01:50	14:10	15:20	16:28
35°	00:29	01:12	02:01	14:03	15:10	16:17
30°	00:35	01:20	02:10	13:56	15:01	16:07
20°	00:44	01:33	02:26	13:45	14:47	15:50
N 10°	00:52	01:44	02:39	13:35	14:34	15:35
0°	01:00	01:55	02:53	13:25	14:22	15:21
S 10°	01:08	02:05	03:06	13:16	14:10	15:07
20°	01:16	02:17	03:20	13:06	13:57	14:52
30°	01:26	02:30	03:36	12:55	13:42	14:35
35°	01:31	02:38	03:45	12:49	13:34	14:25
40°	01:37	02:47	03:56	12:41	13:24	14:14
45°	01:45	02:57	04:09	12:33	13:13	14:01
S 50°	01:54	03:10	04:24	12:22	13:00	13:44
52°	01:58	03:15	04:32	12:18	12:53	13:37
54°	02:03	03:22	04:40	12:13	12:46	13:28
56°	02:08	03:29	04:49	12:07	12:39	13:19
58°	02:13	03:37	04:59	12:00	12:30	13:08
S 60°	02:20	03:47	05:11	11:53	12:20	12:56

Day	**Sun** Eqn.of Time 00^h mm:ss	**Sun** Eqn.of Time 12^h mm:ss	**Sun** Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	**Moon** Mer.Pass. Lower hh:mm	Age 24-26 31-12%
18	06:12	06:15	12:06	07:13	19:40	
19	06:17	06:19	12:06	08:08	20:37	
20	06:21	06:22	12:06	09:07	21:37	

July 21, 22, 23 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	298°57.0	221°57.2	N20°48.2	176°11.7	N21°08.3	104°04.3	S05°01.4	37°25.0	S21°55.3
1	313°59.5	236°56.7	48.5	191°12.5	08.0	119°06.5	01.5	52°27.6	55.3
2	329°02.0	251°56.1	48.9	206°13.3	07.6	134°08.7	01.6	67°30.2	55.3
3	344°04.4	266°55.6	·· 49.3	221°14.0	·· 07.3	149°10.9	·· 01.8	82°32.8	·· 55.3
4	359°06.9	281°55.0	49.6	236°14.8	07.0	164°13.1	01.9	97°35.4	55.3
5	14°09.4	296°54.5	50.0	251°15.6	06.6	179°15.3	02.0	112°38.0	55.3
6	29°11.8	311°54.0	N20°50.3	266°16.3	N21°06.3	194°17.5	S05°02.1	127°40.6	S21°55.3
7	44°14.3	326°53.4	50.7	281°17.1	05.9	209°19.7	02.2	142°43.2	55.3
8	59°16.8	341°52.9	51.0	296°17.9	05.6	224°21.9	02.3	157°45.8	55.3
9	74°19.2	356°52.3	·· 51.4	311°18.7	·· 05.2	239°24.1	·· 02.5	172°48.4	·· 55.3
10	89°21.7	11°51.8	51.7	326°19.4	04.9	254°26.4	02.6	187°51.0	55.3
11	104°24.2	26°51.2	52.1	341°20.2	04.6	269°28.6	02.7	202°53.6	55.3
12	119°26.6	41°50.7	N20°52.4	356°21.0	N21°04.2	284°30.8	S05°02.8	217°56.2	S21°55.3
13	134°29.1	56°50.1	52.8	11°21.8	03.9	299°33.0	02.9	232°58.8	55.3
14	149°31.5	71°49.6	53.1	26°22.5	03.5	314°35.2	03.0	248°01.4	55.3
15	164°34.0	86°49.0	·· 53.5	41°23.3	·· 03.2	329°37.4	·· 03.2	263°04.0	·· 55.3
16	179°36.5	101°48.5	53.8	56°24.1	02.8	344°39.6	03.3	278°06.6	55.3
17	194°38.9	116°47.9	54.1	71°24.9	02.5	359°41.8	03.4	293°09.2	55.3
18	209°41.4	131°47.3	N20°54.5	86°25.6	N21°02.2	14°44.0	S05°03.5	308°11.8	S21°55.3
19	224°43.9	146°46.8	54.8	101°26.4	01.8	29°46.2	03.6	323°14.4	55.3
20	239°46.3	161°46.2	55.2	116°27.2	01.5	44°48.4	03.7	338°17.0	55.3
21	254°48.8	176°45.7	·· 55.5	131°28.0	·· 01.1	59°50.6	·· 03.9	353°19.6	·· 55.3
22	269°51.3	191°45.1	55.8	146°28.7	00.8	74°52.8	04.0	8°22.2	55.3
23	284°53.7	206°44.6	56.2	161°29.5	00.4	89°55.0	04.1	23°24.8	55.3
Mer.pass.:04:04		v-0.5 d0.4 m-4.0		v0.8 d-0.3 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	299°56.2	221°44.0	N20°56.5	176°30.3	N21°00.1	104°57.2	S05°04.2	38°27.4	S21°55.3
1	314°58.7	236°43.5	56.9	191°31.1	20°59.7	119°59.4	04.3	53°30.0	55.3
2	330°01.1	251°42.9	57.2	206°31.9	59.4	135°01.6	04.4	68°32.6	55.3
3	345°03.6	266°42.3	·· 57.5	221°32.6	·· 59.0	150°03.8	·· 04.6	83°35.2	·· 55.3
4	0°06.0	281°41.8	57.9	236°33.4	58.7	165°06.0	04.7	98°37.8	55.3
5	15°08.5	296°41.2	58.2	251°34.2	58.3	180°08.2	04.8	113°40.4	55.3
6	30°11.0	311°40.7	N20°58.5	266°35.0	N20°58.0	195°10.4	S05°04.9	128°43.0	S21°55.3
7	45°13.4	326°40.1	58.9	281°35.7	57.6	210°12.7	05.0	143°45.6	55.3
8	60°15.9	341°39.6	59.2	296°36.5	57.3	225°14.9	05.2	158°48.2	55.3
9	75°18.4	356°39.0	·· 59.5	311°37.3	·· 57.0	240°17.1	·· 05.3	173°50.8	·· 55.3
10	90°20.8	11°38.4	20°59.9	326°38.1	56.6	255°19.3	05.4	188°53.4	55.3
11	105°23.3	26°37.9	21°00.2	341°38.9	56.3	270°21.5	05.5	203°56.0	55.3
12	120°25.8	41°37.3	N21°00.5	356°39.6	N20°55.9	285°23.7	S05°05.6	218°58.6	S21°55.3
13	135°28.2	56°36.8	00.8	11°40.4	55.6	300°25.9	05.8	234°01.2	55.3
14	150°30.7	71°36.2	01.2	26°41.2	55.2	315°28.1	05.9	249°03.8	55.3
15	165°33.2	86°35.6	·· 01.5	41°42.0	·· 54.9	330°30.3	·· 06.0	264°06.4	·· 55.3
16	180°35.6	101°35.1	01.8	56°42.7	54.5	345°32.5	06.1	279°09.0	55.3
17	195°38.1	116°34.5	02.1	71°43.5	54.2	0°34.7	06.2	294°11.6	55.3
18	210°40.5	131°33.9	N21°02.5	86°44.3	N20°53.8	15°36.9	S05°06.4	309°14.2	S21°55.3
19	225°43.0	146°33.4	02.8	101°45.1	53.5	30°39.1	06.5	324°16.8	55.3
20	240°45.5	161°32.8	03.1	116°45.9	53.1	45°41.3	06.6	339°19.4	55.3
21	255°47.9	176°32.2	·· 03.4	131°46.6	·· 52.7	60°43.5	·· 06.7	354°22.0	·· 55.3
22	270°50.4	191°31.7	03.7	146°47.4	52.4	75°45.7	06.8	9°24.6	55.3
23	285°52.9	206°31.1	04.1	161°48.2	52.0	90°47.9	07.0	24°27.2	55.3
Mer.pass.:04:00		v-0.6 d0.3 m-4.0		v0.8 d-0.3 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	300°55.3	221°30.5	N21°04.4	176°49.0	N20°51.7	105°50.1	S05°07.1	39°29.8	S21°55.3
1	315°57.8	236°30.0	04.7	191°49.8	51.3	120°52.3	07.2	54°32.4	55.3
2	331°00.3	251°29.4	05.0	206°50.5	51.0	135°54.5	07.3	69°35.0	55.3
3	346°02.7	266°28.8	·· 05.3	221°51.3	·· 50.6	150°56.7	·· 07.4	84°37.6	·· 55.3
4	1°05.2	281°28.3	05.6	236°52.1	50.3	165°58.9	07.6	99°40.2	55.3
5	16°07.6	296°27.7	05.9	251°52.9	49.9	181°01.1	07.7	114°42.8	55.3
6	31°10.1	311°27.1	N21°06.3	266°53.7	N20°49.6	196°03.2	S05°07.8	129°45.4	S21°55.3
7	46°12.6	326°26.6	06.6	281°54.4	49.2	211°05.4	07.9	144°48.0	55.3
8	61°15.0	341°26.0	06.9	296°55.2	48.9	226°07.6	08.0	159°50.6	55.3
9	76°17.5	356°25.4	·· 07.2	311°56.0	·· 48.5	241°09.8	·· 08.2	174°53.2	·· 55.3
10	91°20.0	11°24.9	07.5	326°56.8	48.2	256°12.0	08.3	189°55.8	55.3
11	106°22.4	26°24.3	07.8	341°57.6	47.8	271°14.2	08.4	204°58.4	55.3
12	121°24.9	41°23.7	N21°08.1	356°58.4	N20°47.4	286°16.4	S05°08.5	220°01.0	S21°55.3
13	136°27.4	56°23.1	08.4	11°59.1	47.1	301°18.6	08.6	235°03.5	55.3
14	151°29.8	71°22.6	08.7	26°59.9	46.7	316°20.8	08.8	250°06.1	55.3
15	166°32.3	86°22.0	·· 09.0	42°00.7	·· 46.4	331°23.0	·· 08.9	265°08.7	·· 55.3
16	181°34.8	101°21.4	09.3	57°01.5	46.0	346°25.2	09.0	280°11.3	55.3
17	196°37.2	116°20.9	09.6	72°02.3	45.7	1°27.4	09.1	295°13.9	55.3
18	211°39.7	131°20.3	N21°09.9	87°03.1	N20°45.3	16°29.6	S05°09.2	310°16.5	S21°55.3
19	226°42.1	146°19.7	10.2	102°03.8	44.9	31°31.8	09.4	325°19.1	55.3
20	241°44.6	161°19.1	10.5	117°04.6	44.6	46°34.0	09.5	340°21.7	55.3
21	256°47.1	176°18.6	·· 10.8	132°05.4	·· 44.2	61°36.2	·· 09.6	355°24.3	·· 55.3
22	271°49.5	191°18.0	11.1	147°06.2	43.9	76°38.4	09.7	10°26.9	55.3
23	286°52.0	206°17.4	11.4	162°07.0	43.5	91°40.6	09.9	25°29.5	55.3
Mer.pass.:03:56		v-0.6 d0.3 m-4.0		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°40.4	29°11.1
Ankaa	353°12.9	-42°12.5
Schedar	349°37.1	56°37.7
Diphda	348°53.0	-17°53.4
Achernar	335°24.8	-57°08.7
Hamal	327°57.6	23°32.5
Polaris	316°37.4	89°19.8
Acamar	315°16.4	-40°14.0
Menkar	314°12.2	4°09.4
Mirfak	308°36.5	49°55.0
Aldebaran	290°46.4	16°32.4
Rigel	281°09.7	-8°11.0
Capella	280°30.7	46°00.6
Bellatrix	278°29.3	6°21.8
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.6
Betelgeuse	270°58.6	7°24.4
Canopus	263°55.4	-52°42.3
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.8
Procyon	244°57.2	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.5	-59°34.1
Suhail	222°50.8	-43°30.3
Miaplacidus	221°39.9	-69°47.5
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°48.9	61°39.6
Denebola	182°31.0	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.3	-63°11.9
Gacrux	171°57.9	-57°12.8
Alioth	166°18.5	55°52.3
Spica	158°28.3	-11°15.0
Alkaid	152°56.8	49°14.0
Hadar	148°43.8	-60°27.5
Menkent	148°04.2	-36°27.4
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.7	-60°54.5
Kochab	137°20.0	74°05.5
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.5	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.2
Eltanin	90°44.4	51°29.5
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.3
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.3	-56°40.5
Deneb	49°29.1	45°20.7
Enif	33°44.1	9°57.4
Al Na'ir	27°39.9	-46°52.3
Fomalhaut	15°20.7	-29°31.6
Scheat	13°50.4	28°10.6
Markab	13°35.3	15°18.0

Jul 21 Fri	SHA	Mer.pass
Venus	283°00.2	09:13
Mars	237°14.7	12:15
Jupiter	165°07.2	17:01
Saturn	98°27.9	21:27

Jul 22 Sat	SHA	Mer.pass
Venus	281°47.8	09:13
Mars	236°34.1	12:13
Jupiter	165°01.0	16:58
Saturn	98°31.2	21:22

Jul 23 Sun	SHA	Mer.pass
Venus	280°35.2	09:14
Mars	235°53.7	12:12
Jupiter	164°54.7	16:54
Saturn	98°34.5	21:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3512 sec ΔT = TT-UT1 = +68.8328 sec

2017 July 21 to Jul. 23 UT

h

Fri	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°24.0	N20°28.2	214°17.6	4.3′	N18°50.2	3.1′	60.6′
1	193°24.0	27.7	228°40.9	4.3′	18°53.2	3.0′	60.6′
2	208°23.9	27.2	243°04.1	4.2′	18°56.1	2.8′	60.6′
3	223°23.9	·· 26.7	257°27.3	4.2′	18°58.9	2.7′	60.6′
4	238°23.9	26.2	271°50.5	4.2′	19°01.5	2.6′	60.7′
5	253°23.9	25.8	286°13.7	4.1′	19°04.0	2.4′	60.7′
6	268°23.8	N20°25.3	300°36.8	4.1′	N19°06.3	2.3′	60.7′
7	283°23.8	24.8	314°59.9	4.1′	19°08.6	2.1′	60.7′
8	298°23.8	24.3	329°22.9	4.1′	19°10.6	2.0′	60.7′
9	313°23.7	·· 23.8	343°46.0	4.0′	19°12.6	1.9′	60.7′
10	328°23.7	23.3	358°09.0	4.0′	19°14.3	1.7′	60.7′
11	343°23.7	22.8	12°32.0	4.0′	19°16.0	1.6′	60.7′
12	358°23.6	N20°22.4	26°55.0	4.0′	N19°17.5	1.4′	60.7′
13	13°23.6	21.9	41°17.9	4.0′	19°18.9	1.3′	60.7′
14	28°23.6	21.4	55°40.9	3.9′	19°20.1	1.2′	60.7′
15	43°23.6	·· 20.9	70°03.8	3.9′	19°21.2	1.0′	60.7′
16	58°23.5	20.4	84°26.7	3.9′	19°22.1	0.9′	60.7′
17	73°23.5	19.9	98°49.7	3.9′	19°22.9	0.7′	60.7′
18	88°23.5	N20°19.4	113°12.6	3.9′	N19°23.6	0.6′	60.7′
19	103°23.5	18.9	127°35.5	3.9′	19°24.1	0.4′	60.7′
20	118°23.4	18.4	141°58.4	3.9′	19°24.5	0.3′	60.7′
21	133°23.4	·· 17.9	156°21.3	3.9′	19°24.7	0.2′	60.7′
22	148°23.4	17.4	170°44.1	3.9′	19°24.8	0.0′	60.7′
23	163°23.3	16.9	185°07.0	3.9′	19°24.7	-0.1′	60.7′
	SD.=15.7	d=-0.5	S.D.=16.5				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.3	N20°16.4	199°29.9	3.9′	N19°24.5	-0.3′	60.7′
1	193°23.3	15.9	213°52.8	3.9′	19°24.2	-0.4′	60.7′
2	208°23.3	15.4	228°15.7	3.9′	19°23.7	-0.6′	60.7′
3	223°23.2	·· 14.9	242°38.7	3.9′	19°23.1	-0.7′	60.7′
4	238°23.2	14.4	257°01.6	3.9′	19°22.3	-0.8′	60.7′
5	253°23.2	13.9	271°24.5	3.9′	19°21.4	-1.0′	60.7′
6	268°23.2	N20°13.4	285°47.5	4.0′	N19°20.4	-1.1′	60.7′
7	283°23.1	12.9	300°10.4	4.0′	19°19.2	-1.3′	60.6′
8	298°23.1	12.4	314°33.4	4.0′	19°17.8	-1.4′	60.6′
9	313°23.1	·· 11.9	328°56.4	4.0′	19°16.4	-1.5′	60.6′
10	328°23.1	11.4	343°19.4	4.0′	19°14.7	-1.7′	60.6′
11	343°23.1	10.9	357°42.5	4.1′	19°13.0	-1.8′	60.6′
12	358°23.0	N20°10.4	12°05.6	4.1′	N19°11.1	-2.0′	60.6′
13	13°23.0	09.9	26°28.7	4.1′	19°09.1	-2.1′	60.6′
14	28°23.0	09.4	40°51.8	4.1′	19°06.9	-2.2′	60.6′
15	43°23.0	·· 08.9	55°14.9	4.2′	19°04.6	-2.4′	60.6′
16	58°22.9	08.4	69°38.1	4.2′	19°02.1	-2.5′	60.6′
17	73°22.9	07.9	84°01.3	4.2′	18°59.5	-2.7′	60.6′
18	88°22.9	N20°07.4	98°24.6	4.3′	N18°56.8	-2.8′	60.5′
19	103°22.9	06.9	112°47.9	4.3′	18°54.0	-2.9′	60.5′
20	118°22.9	06.4	127°11.2	4.3′	18°51.0	-3.1′	60.5′
21	133°22.8	·· 05.9	141°34.6	4.4′	18°47.8	-3.2′	60.5′
22	148°22.8	05.4	155°58.0	4.4′	18°44.6	-3.3′	60.5′
23	163°22.8	04.9	170°21.4	4.5′	18°41.2	-3.5′	60.5′
	SD.=15.7	d=-0.5	S.D.=16.5				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.8	N20°04.3	184°44.9	4.5′	N18°37.6	-3.6′	60.5′
1	193°22.8	03.8	199°08.4	4.6′	18°34.0	-3.7′	60.5′
2	208°22.7	03.3	213°32.0	4.6′	18°30.2	-3.9′	60.4′
3	223°22.7	·· 02.8	227°55.7	4.7′	18°26.3	-4.0′	60.4′
4	238°22.7	02.3	242°19.3	4.7′	18°22.2	-4.1′	60.4′
5	253°22.7	01.8	256°43.1	4.8′	18°18.0	-4.2′	60.4′
6	268°22.7	N20°01.3	271°06.9	4.8′	N18°13.7	-4.4′	60.4′
7	283°22.6	00.8	285°30.7	4.9′	18°09.3	-4.5′	60.4′
8	298°22.6	20°00.2	299°54.6	4.9′	18°04.8	-4.6′	60.3′
9	313°22.6	19°59.7	314°18.6	5.0′	18°00.1	-4.7′	60.3′
10	328°22.6	59.2	328°42.6	5.0′	17°55.3	-4.9′	60.3′
11	343°22.6	58.7	343°06.6	5.1′	17°50.3	-5.0′	60.3′
12	358°22.6	N19°58.2	357°30.8	5.2′	N17°45.3	-5.1′	60.3′
13	13°22.5	57.7	11°55.0	5.2′	17°40.1	-5.2′	60.2′
14	28°22.5	57.1	26°19.2	5.3′	17°34.8	-5.3′	60.2′
15	43°22.5	·· 56.6	40°43.5	5.4′	17°29.4	-5.5′	60.2′
16	58°22.5	56.1	55°07.9	5.4′	17°23.9	-5.6′	60.2′
17	73°22.5	55.6	69°32.4	5.5′	17°18.2	-5.7′	60.2′
18	88°22.5	N19°55.1	83°56.9	5.5′	N17°12.5	-5.8′	60.1′
19	103°22.5	54.5	98°21.5	5.6′	17°06.6	-5.9′	60.1′
20	118°22.4	54.0	112°46.1	5.7′	17°00.6	-6.0′	60.1′
21	133°22.4	·· 53.5	127°10.8	5.8′	16°54.5	-6.1′	60.1′
22	148°22.4	53.0	141°35.6	5.8′	16°48.3	-6.3′	60.0′
23	163°22.4	52.4	156°00.5	5.9′	16°42.0	-6.4′	60.0′
	SD.=15.7	d=-0.5	S.D.=16.4				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	▭	▭	▭	▭
N 70°	▭	▭	▭	▭	▭	▭
68°	▭	▭	01:16	22:51	▭	▭
66°	▭	▭	02:06	22:03	▭	▭
64°	▭	▭	02:37	21:33	▭	▭
62°	▭	01:32	03:00	21:11	22:37	▭
60°	▭	02:08	03:18	20:53	22:02	▭
N 58°	▭	02:34	03:33	20:38	21:37	▭
56°	01:24	02:53	03:46	20:26	21:18	22:45
54°	01:57	03:10	03:57	20:14	21:02	22:13
52°	02:21	03:23	04:07	20:05	20:48	21:50
50°	02:40	03:35	04:16	19:56	20:37	21:32
45°	03:14	03:59	04:35	19:38	20:13	20:58
N 40°	03:39	04:18	04:50	19:23	19:54	20:33
35°	03:59	04:34	05:02	19:10	19:39	20:14
30°	04:15	04:47	05:13	18:59	19:26	19:58
20°	04:40	05:08	05:32	18:41	19:05	19:33
N 10°	04:59	05:25	05:48	18:25	18:47	19:14
0°	05:15	05:41	06:03	18:10	18:32	18:58
S 10°	05:30	05:55	06:18	17:55	18:18	18:43
20°	05:43	06:10	06:33	17:40	18:03	18:30
30°	05:57	06:26	06:51	17:22	17:47	18:17
35°	06:04	06:34	07:02	17:11	17:39	18:10
40°	06:11	06:44	07:14	17:00	17:29	18:02
45°	06:19	06:55	07:28	16:46	17:18	17:54
S 50°	06:28	07:08	07:44	16:29	17:05	17:45
52°	06:32	07:14	07:52	16:21	16:59	17:41
54°	06:36	07:20	08:01	16:12	16:53	17:37
56°	06:41	07:28	08:11	16:02	16:46	17:33
58°	06:46	07:36	08:23	15:51	16:38	17:28
S 60°	06:51	07:45	08:36	15:38	16:29	17:22

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	▭	▭	–:–	▭	▭	23:00
N 70°	23:47	–:–	01:21	21:30	22:06	22:15
68°	–:–	00:45	02:06	20:32	21:20	21:44
66°	00:26	01:19	02:35	19:58	20:50	21:22
64°	00:49	01:44	02:58	19:34	20:28	21:04
62°	01:07	02:03	03:16	19:14	20:09	20:49
60°	01:22	02:19	03:30	18:58	19:54	20:36
N 58°	01:35	02:33	03:43	18:45	19:42	20:25
56°	01:46	02:44	03:54	18:33	19:30	20:16
54°	01:56	02:55	04:03	18:23	19:21	20:07
52°	02:05	03:04	04:12	18:14	19:12	20:00
50°	02:13	03:12	04:20	18:05	19:04	19:53
45°	02:30	03:29	04:36	17:48	18:47	19:39
N 40°	02:43	03:44	04:49	17:34	18:34	19:26
35°	02:55	03:56	05:00	17:22	18:22	19:16
30°	03:05	04:06	05:10	17:11	18:12	19:07
20°	03:23	04:24	05:27	16:53	17:54	18:51
N 10°	03:39	04:40	05:42	16:37	17:39	18:37
0°	03:53	04:55	05:56	16:22	17:24	18:24
S 10°	04:08	05:10	06:10	16:08	17:10	18:11
20°	04:23	05:26	06:25	15:52	16:54	17:57
30°	04:41	05:44	06:42	15:33	16:36	17:41
35°	04:52	05:54	06:52	15:23	16:26	17:32
40°	05:04	06:07	07:03	15:11	16:14	17:21
45°	05:18	06:21	07:16	14:56	16:00	17:09
S 50°	05:35	06:38	07:32	14:39	15:42	16:53
52°	05:43	06:47	07:40	14:30	15:34	16:46
54°	05:52	06:56	07:48	14:21	15:25	16:38
56°	06:03	07:06	07:57	14:11	15:15	16:29
58°	06:14	07:18	08:08	13:59	15:03	16:19
S 60°	06:28	07:32	08:20	13:45	14:50	16:07

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 27-0 5-0%
21	06:24	06:25	12:06	10:08	22:39	
22	06:27	06:28	12:06	11:10	23:40	
23	06:29	06:30	12:06	12:10	–:–	

July 24, 25, 26 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	301°54.5	221°16.8	N21°11.7	177°07.8	N20°43.2	106°42.8	S05°10.0	40°32.1	S21°55.3
1	316°56.9	236°16.3	12.0	192°08.5	42.8	121°45.0	10.1	55°34.7	55.3
2	331°59.4	251°15.7	12.3	207°09.3	42.4	136°47.2	10.2	70°37.3	55.3
3	347°01.9	266°15.1	·· 12.6	222°10.1	·· 42.1	151°49.3	·· 10.3	85°39.9	·· 55.3
4	2°04.3	281°14.5	12.9	237°10.9	41.7	166°51.5	10.5	100°42.5	55.3
5	17°06.8	296°13.9	13.2	252°11.7	41.4	181°53.7	10.6	115°45.1	55.3
6	32°09.3	311°13.4	N21°13.5	267°12.5	N20°41.0	196°55.9	S05°10.7	130°47.7	S21°55.3
7	47°11.7	326°12.8	13.8	282°13.3	40.6	211°58.1	10.8	145°50.2	55.3
8	62°14.2	341°12.2	14.1	297°14.0	40.3	227°00.3	11.0	160°52.8	55.3
9	77°16.6	356°11.6	·· 14.4	312°14.8	·· 39.9	242°02.5	·· 11.1	175°55.4	·· 55.3
10	92°19.1	11°11.0	14.6	327°15.6	39.6	257°04.7	11.2	190°58.0	55.3
11	107°21.6	26°10.5	14.9	342°16.4	39.2	272°06.9	11.3	206°00.6	55.3
12	122°24.0	41°09.9	N21°15.2	357°17.2	N20°38.8	287°09.1	S05°11.4	221°03.2	S21°55.3
13	137°26.5	56°09.3	15.5	12°18.0	38.5	302°11.3	11.6	236°05.8	55.3
14	152°29.0	71°08.7	15.8	27°18.8	38.1	317°13.5	11.7	251°08.4	55.3
15	167°31.4	86°08.1	·· 16.1	42°19.5	·· 37.7	332°15.6	·· 11.8	266°11.0	·· 55.3
16	182°33.9	101°07.6	16.3	57°20.3	37.4	347°17.8	11.9	281°13.6	55.3
17	197°36.4	116°07.0	16.6	72°21.1	37.0	2°20.0	12.1	296°16.2	55.3
18	212°38.8	131°06.4	N21°16.9	87°21.9	N20°36.7	17°22.2	S05°12.2	311°18.8	S21°55.3
19	227°41.3	146°05.8	17.2	102°22.7	36.3	32°24.4	12.3	326°21.4	55.3
20	242°43.8	161°05.2	17.5	117°23.5	35.9	47°26.6	12.4	341°23.9	55.3
21	257°46.2	176°04.6	·· 17.7	132°24.3	·· 35.6	62°28.8	·· 12.6	356°26.5	·· 55.3
22	272°48.7	191°04.0	18.0	147°25.1	35.2	77°31.0	12.7	11°29.1	55.3
23	287°51.1	206°03.5	18.3	162°25.8	34.8	92°33.2	12.8	26°31.7	55.3
Mer.pass.:03:52		v-0.6 d0.3 m-4.0		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	302°53.6	221°02.9	N21°18.6	177°26.6	N20°34.5	107°35.4	S05°12.9	41°34.3	S21°55.3
1	317°56.1	236°02.3	18.8	192°27.4	34.1	122°37.5	13.1	56°36.9	55.3
2	332°58.5	251°01.7	19.1	207°28.2	33.7	137°39.7	13.2	71°39.5	55.3
3	348°01.0	266°01.1	·· 19.4	222°29.0	·· 33.4	152°41.9	·· 13.3	86°42.1	·· 55.3
4	3°03.5	281°00.5	19.7	237°29.8	33.0	167°44.1	13.4	101°44.7	55.3
5	18°05.9	295°59.9	19.9	252°30.6	32.6	182°46.3	13.5	116°47.3	55.3
6	33°08.4	310°59.3	N21°20.2	267°31.4	N20°32.3	197°48.5	S05°13.7	131°49.9	S21°55.3
7	48°10.9	325°58.8	20.5	282°32.2	31.9	212°50.7	13.8	146°52.4	55.3
8	63°13.3	340°58.2	20.7	297°32.9	31.5	227°52.9	13.9	161°55.0	55.3
9	78°15.8	355°57.6	·· 21.0	312°33.7	·· 31.2	242°55.0	·· 14.0	176°57.6	·· 55.3
10	93°18.2	10°57.0	21.3	327°34.5	30.8	257°57.2	14.2	192°00.2	55.3
11	108°20.7	25°56.4	21.5	342°35.3	30.4	272°59.4	14.3	207°02.8	55.3
12	123°23.2	40°55.8	N21°21.8	357°36.1	N20°30.1	288°01.6	S05°14.4	222°05.4	S21°55.3
13	138°25.6	55°55.2	22.1	12°36.9	29.7	303°03.8	14.5	237°08.0	55.3
14	153°28.1	70°54.6	22.3	27°37.7	29.3	318°06.0	14.7	252°10.6	55.3
15	168°30.6	85°54.0	·· 22.6	42°38.5	·· 29.0	333°08.2	·· 14.8	267°13.2	·· 55.3
16	183°33.0	100°53.4	22.8	57°39.3	28.6	348°10.3	14.9	282°15.7	55.2
17	198°35.5	115°52.8	23.1	72°40.1	28.2	3°12.5	15.0	297°18.3	55.2
18	213°38.0	130°52.3	N21°23.4	87°40.8	N20°27.9	18°14.7	S05°15.2	312°20.9	S21°55.2
19	228°40.4	145°51.7	23.6	102°41.6	27.5	33°16.9	15.3	327°23.5	55.2
20	243°42.9	160°51.1	23.9	117°42.4	27.1	48°19.1	15.4	342°26.1	55.2
21	258°45.4	175°50.5	·· 24.1	132°43.2	·· 26.7	63°21.3	·· 15.5	357°28.7	·· 55.2
22	273°47.8	190°49.9	24.4	147°44.0	26.4	78°23.4	15.7	12°31.3	55.2
23	288°50.3	205°49.3	24.6	162°44.8	26.0	93°25.6	15.8	27°33.9	55.2
Mer.pass.:03:48		v-0.6 d0.3 m-4.0		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	303°52.7	220°48.7	N21°24.9	177°45.6	N20°25.6	108°27.8	S05°15.9	42°36.4	S21°55.2
1	318°55.2	235°48.1	25.1	192°46.4	25.3	123°30.0	16.1	57°39.0	55.2
2	333°57.7	250°47.5	25.4	207°47.2	24.9	138°32.2	16.2	72°41.6	55.2
3	349°00.1	265°46.9	·· 25.6	222°48.0	·· 24.5	153°34.4	·· 16.3	87°44.2	·· 55.2
4	4°02.6	280°46.3	25.9	237°48.8	24.2	168°36.5	16.4	102°46.8	55.2
5	19°05.1	295°45.7	26.1	252°49.6	23.8	183°38.7	16.6	117°49.4	55.2
6	34°07.5	310°45.1	N21°26.4	267°50.4	N20°23.4	198°40.9	S05°16.7	132°52.0	S21°55.2
7	49°10.0	325°44.5	26.6	282°51.1	23.0	213°43.1	16.8	147°54.6	55.2
8	64°12.5	340°43.9	26.9	297°51.9	22.7	228°45.3	16.9	162°57.1	55.2
9	79°14.9	355°43.3	·· 27.1	312°52.7	·· 22.3	243°47.5	·· 17.1	177°59.7	·· 55.2
10	94°17.4	10°42.7	27.4	327°53.5	21.9	258°49.6	17.2	193°02.3	55.2
11	109°19.9	25°42.1	27.6	342°54.3	21.5	273°51.8	17.3	208°04.9	55.2
12	124°22.3	40°41.5	N21°27.9	357°55.1	N20°21.2	288°54.0	S05°17.4	223°07.5	S21°55.2
13	139°24.8	55°40.9	28.1	12°55.9	20.8	303°56.2	17.6	238°10.1	55.2
14	154°27.2	70°40.3	28.3	27°56.7	20.4	318°58.4	17.7	253°12.7	55.2
15	169°29.7	85°39.7	·· 28.6	42°57.5	·· 20.0	334°00.5	·· 17.8	268°15.2	·· 55.3
16	184°32.2	100°39.1	28.8	57°58.3	19.7	349°02.7	17.9	283°17.8	55.3
17	199°34.6	115°38.5	29.1	72°59.1	19.3	4°04.9	18.1	298°20.4	55.3
18	214°37.1	130°37.9	N21°29.3	87°59.9	N20°18.9	19°07.1	S05°18.2	313°23.0	S21°55.3
19	229°39.6	145°37.3	29.5	103°00.7	18.5	34°09.3	18.3	328°25.6	55.3
20	244°42.0	160°36.7	29.8	118°01.5	18.2	49°11.4	18.5	343°28.2	55.3
21	259°44.5	175°36.1	·· 30.0	133°02.3	·· 17.8	64°13.6	·· 18.6	358°30.8	·· 55.3
22	274°47.0	190°35.5	30.2	148°03.1	17.4	79°15.8	18.7	13°33.3	55.3
23	289°49.4	205°34.9	30.5	163°03.9	17.0	94°18.0	18.8	28°35.9	55.3
Mer.pass.:03:44		v-0.6 d0.3 m-4.0		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.8		v2.6 d0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°40.4	29°11.1
Ankaa	353°12.8	-42°12.5
Schedar	349°37.0	56°37.7
Diphda	348°53.0	-17°53.3
Achernar	335°24.7	-57°08.7
Hamal	327°57.6	23°32.5
Polaris	316°36.0	89°19.8
Acamar	315°16.4	-40°14.0
Menkar	314°12.2	4°09.4
Mirfak	308°36.5	49°55.0
Aldebaran	290°46.4	16°32.4
Rigel	281°09.6	-8°11.0
Capella	280°30.7	46°00.6
Bellatrix	278°29.3	6°21.8
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.6
Betelgeuse	270°58.6	7°24.5
Canopus	263°55.4	-52°42.3
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.8
Procyon	244°57.2	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.5	-59°34.0
Suhail	222°50.8	-43°30.3
Miaplacidus	221°39.9	-69°47.5
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°48.9	61°39.6
Denebola	182°31.0	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.4	-63°11.9
Gacrux	171°57.9	-57°12.8
Alioth	166°18.5	55°52.3
Spica	158°28.4	-11°15.0
Alkaid	152°56.8	49°14.0
Hadar	148°43.8	-60°27.5
Menkent	148°04.2	-36°27.4
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.7	-60°54.5
Kochab	137°20.0	74°05.5
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.5	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.2
Eltanin	90°44.4	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.3
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.3	-56°40.5
Deneb	49°29.1	45°20.7
Enif	33°44.1	9°57.4
Al Na'ir	27°39.9	-46°52.3
Fomalhaut	15°20.7	-29°31.6
Scheat	13°50.4	28°10.6
Markab	13°35.3	15°18.0

Jul 24 Mon	SHA	Mer.pass
Venus	279°22.4	09:15
Mars	235°13.3	12:11
Jupiter	164°48.3	16:51
Saturn	98°37.6	21:14

Jul 25 Tue	SHA	Mer.pass
Venus	278°09.3	09:16
Mars	234°33.0	12:10
Jupiter	164°41.7	16:47
Saturn	98°40.7	21:10

Jul 26 Wed	SHA	Mer.pass
Venus	276°55.9	09:17
Mars	233°52.9	12:08
Jupiter	164°35.1	16:44
Saturn	98°43.7	21:06

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3500 sec ΔT = TT-UT1 = +68.8340 sec

2017 July 24 to Jul. 26 UT

h

Mon	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°22.4	N19°51.9	170°25.4	6.0'	N16°35.6	-6.5'	60.0'
1	193°22.4	51.4	184°50.4	6.0'	16°29.1	-6.6'	60.0'
2	208°22.4	50.9	199°15.5	6.1'	16°22.5	-6.7'	59.9'
3	223°22.3	·· 50.3	213°40.7	6.2'	16°15.7	-6.8'	59.9'
4	238°22.3	49.8	228°05.9	6.3'	16°08.9	-6.9'	59.9'
5	253°22.3	49.3	242°31.2	6.3'	16°01.9	-7.0'	59.9'
6	268°22.3	N19°48.8	256°56.6	6.4'	N15°54.9	-7.1'	59.8'
7	283°22.3	48.2	271°22.1	6.5'	15°47.8	-7.2'	59.8'
8	298°22.3	47.7	285°47.6	6.6'	15°40.5	-7.3'	59.8'
9	313°22.3	·· 47.2	300°13.2	6.7'	15°33.2	-7.4'	59.8'
10	328°22.3	46.6	314°39.0	6.7'	15°25.8	-7.5'	59.7'
11	343°22.2	46.1	329°04.7	6.8'	15°18.3	-7.6'	59.7'
12	358°22.2	N19°45.6	343°30.6	6.9'	N15°10.6	-7.7'	59.7'
13	13°22.2	45.0	357°56.5	7.0'	15°02.9	-7.7'	59.6'
14	28°22.2	44.5	12°22.6	7.1'	14°55.2	-7.8'	59.6'
15	43°22.2	·· 44.0	26°48.7	7.1'	14°47.3	-7.9'	59.6'
16	58°22.2	43.4	41°14.8	7.2'	14°39.3	-8.0'	59.6'
17	73°22.2	42.9	55°41.1	7.3'	14°31.3	-8.1'	59.5'
18	88°22.2	N19°42.4	70°07.5	7.4'	N14°23.1	-8.2'	59.5'
19	103°22.2	41.8	84°33.9	7.5'	14°14.9	-8.3'	59.5'
20	118°22.2	41.3	99°00.4	7.6'	14°06.6	-8.3'	59.4'
21	133°22.2	·· 40.8	113°27.0	7.6'	13°58.2	-8.4'	59.4'
22	148°22.1	40.2	127°53.7	7.7'	13°49.8	-8.5'	59.4'
23	163°22.1	39.7	142°20.4	7.8'	13°41.3	-8.6'	59.3'
	SD.=15.7	d=-0.5		S.D.=16.3			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.1	N19°39.2	156°47.3	7.9'	N13°32.7	-8.6'	59.3'
1	193°22.1	38.6	171°14.2	8.0'	13°24.0	-8.7'	59.3'
2	208°22.1	38.1	185°41.2	8.1'	13°15.2	-8.8'	59.2'
3	223°22.1	·· 37.5	200°08.3	8.1'	13°06.4	-8.9'	59.2'
4	238°22.1	37.0	214°35.5	8.2'	12°57.5	-8.9'	59.2'
5	253°22.1	36.5	229°02.8	8.3'	12°48.6	-9.0'	59.1'
6	268°22.1	N19°35.9	243°30.1	8.4'	N12°39.5	-9.1'	59.1'
7	283°22.1	35.4	257°57.5	8.5'	12°30.4	-9.1'	59.1'
8	298°22.1	34.8	272°25.0	8.6'	12°21.3	-9.2'	59.0'
9	313°22.1	·· 34.3	286°52.6	8.6'	12°12.1	-9.3'	59.0'
10	328°22.1	33.7	301°20.3	8.7'	12°02.8	-9.3'	59.0'
11	343°22.1	33.2	315°48.1	8.8'	11°53.4	-9.4'	58.9'
12	358°22.1	N19°32.7	330°15.9	8.9'	N11°44.0	-9.4'	58.9'
13	13°22.1	32.1	344°43.8	9.0'	11°34.6	-9.5'	58.9'
14	28°22.1	31.6	359°11.8	9.0'	11°25.1	-9.5'	58.8'
15	43°22.1	·· 31.0	13°39.9	9.1'	11°15.5	-9.6'	58.8'
16	58°22.0	30.5	28°08.1	9.2'	11°05.9	-9.6'	58.8'
17	73°22.0	29.9	42°36.3	9.3'	10°56.2	-9.7'	58.7'
18	88°22.0	N19°29.4	57°04.7	9.4'	N10°46.5	-9.8'	58.7'
19	103°22.0	28.8	71°33.1	9.4'	10°36.7	-9.8'	58.7'
20	118°22.0	28.3	86°01.6	9.5'	10°26.9	-9.8'	58.6'
21	133°22.0	·· 27.7	100°30.1	9.6'	10°17.0	-9.9'	58.6'
22	148°22.0	27.2	114°58.8	9.7'	10°07.1	-9.9'	58.6'
23	163°22.0	26.6	129°27.5	9.8'	09°57.1	-10.0'	58.5'
	SD.=15.7	d=-0.5		S.D.=16.1			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.0	N19°26.1	143°56.3	9.8'	N09°47.1	-10.0'	58.5'
1	193°22.0	25.5	158°25.2	9.9'	09°37.1	-10.1'	58.4'
2	208°22.0	25.0	172°54.1	10.0'	09°27.0	-10.1'	58.4'
3	223°22.0	·· 24.4	187°23.2	10.1'	09°16.8	-10.1'	58.4'
4	238°22.0	23.9	201°52.3	10.1'	09°06.7	-10.2'	58.3'
5	253°22.0	23.3	216°21.5	10.2'	08°56.5	-10.2'	58.3'
6	268°22.0	N19°22.8	230°50.7	10.3'	N08°46.2	-10.3'	58.3'
7	283°22.0	22.2	245°20.1	10.4'	08°36.0	-10.3'	58.2'
8	298°22.0	21.6	259°49.5	10.4'	08°25.7	-10.3'	58.2'
9	313°22.0	·· 21.1	274°19.0	10.5'	08°15.3	-10.4'	58.2'
10	328°22.0	20.5	288°48.5	10.6'	08°05.0	-10.4'	58.1'
11	343°22.0	20.0	303°18.2	10.7'	07°54.6	-10.4'	58.1'
12	358°22.0	N19°19.4	317°47.9	10.7'	N07°44.1	-10.4'	58.0'
13	13°22.0	18.9	332°17.6	10.8'	07°33.7	-10.5'	58.0'
14	28°22.0	18.3	346°47.5	10.9'	07°23.2	-10.5'	58.0'
15	43°22.0	·· 17.7	1°17.4	10.9'	07°12.7	-10.5'	57.9'
16	58°22.1	17.2	15°47.4	11.0'	07°02.2	-10.5'	57.9'
17	73°22.1	16.6	30°17.4	11.1'	06°51.6	-10.6'	57.9'
18	88°22.1	N19°16.1	44°47.5	11.2'	N06°41.1	-10.6'	57.8'
19	103°22.1	15.5	59°17.7	11.2'	06°30.5	-10.6'	57.8'
20	118°22.1	14.9	73°48.0	11.3'	06°19.8	-10.6'	57.7'
21	133°22.1	·· 14.4	88°18.3	11.4'	06°09.2	-10.6'	57.7'
22	148°22.1	13.8	102°48.7	11.4'	05°58.6	-10.7'	57.7'
23	163°22.1	13.2	117°19.1	11.5'	05°47.9	-10.7'	57.6'
	SD.=15.7	d=-0.6		S.D.=15.8			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°						
68°			01:36	22:31		
66°			02:18	21:51		
64°		00:46	02:46	21:24	23:17	
62°		01:46	03:08	21:03	22:23	
60°		02:18	03:25	20:47	21:52	
N 58°	00:42	02:41	03:39	20:32	21:30	23:22
56°	01:37	03:00	03:51	20:20	21:11	22:33
54°	02:06	03:15	04:02	20:10	20:56	22:04
52°	02:28	03:28	04:12	20:01	20:43	21:43
50°	02:46	03:40	04:20	19:52	20:32	21:26
45°	03:19	04:03	04:38	19:35	20:09	20:53
N 40°	03:43	04:21	04:52	19:20	19:51	20:30
35°	04:01	04:36	05:04	19:08	19:37	20:11
30°	04:17	04:49	05:15	18:58	19:24	19:56
20°	04:41	05:09	05:33	18:40	19:04	19:32
N 10°	05:00	05:26	05:49	18:24	18:47	19:13
0°	05:16	05:41	06:03	18:10	18:32	18:57
S 10°	05:29	05:55	06:17	17:56	18:18	18:44
20°	05:42	06:09	06:33	17:41	18:04	18:31
30°	05:55	06:24	06:50	17:23	17:49	18:18
35°	06:02	06:33	07:00	17:14	17:41	18:11
40°	06:09	06:42	07:11	17:02	17:31	18:04
45°	06:17	06:52	07:25	16:49	17:21	17:57
S 50°	06:25	07:05	07:41	16:33	17:09	17:48
52°	06:29	07:10	07:49	16:25	17:03	17:45
54°	06:33	07:17	07:57	16:17	16:57	17:41
56°	06:37	07:23	08:07	16:07	16:50	17:37
58°	06:42	07:31	08:17	15:56	16:43	17:32
S 60°	06:47	07:39	08:30	15:44	16:34	17:27

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	02:32	04:48	06:49	22:42	22:31	22:22
N 70°	03:17	05:12	07:02	22:16	22:16	22:14
68°	03:46	05:31	07:13	21:56	22:03	22:07
66°	04:08	05:46	07:22	21:41	21:53	22:02
64°	04:25	05:58	07:29	21:28	21:44	21:57
62°	04:40	06:08	07:36	21:17	21:37	21:53
60°	04:52	06:17	07:41	21:07	21:30	21:49
N 58°	05:02	06:24	07:46	20:59	21:25	21:46
56°	05:11	06:31	07:50	20:51	21:20	21:43
54°	05:19	06:37	07:54	20:45	21:15	21:41
52°	05:26	06:42	07:58	20:39	21:11	21:38
50°	05:32	06:47	08:01	20:34	21:07	21:36
45°	05:46	06:58	08:08	20:22	20:59	21:31
N 40°	05:58	07:06	08:13	20:12	20:52	21:27
35°	06:07	07:14	08:18	20:04	20:46	21:24
30°	06:16	07:20	08:23	19:57	20:41	21:21
20°	06:30	07:32	08:30	19:44	20:32	21:16
N 10°	06:43	07:41	08:37	19:33	20:24	21:11
0°	06:55	07:51	08:43	19:22	20:16	21:06
S 10°	07:07	08:00	08:49	19:11	20:08	21:02
20°	07:20	08:10	08:55	19:00	20:00	20:57
30°	07:34	08:21	09:03	18:47	19:50	20:52
35°	07:42	08:27	09:07	18:39	19:45	20:48
40°	07:52	08:34	09:12	18:30	19:39	20:45
45°	08:03	08:43	09:17	18:20	19:31	20:40
S 50°	08:16	08:53	09:24	18:08	19:22	20:35
52°	08:23	08:58	09:27	18:02	19:18	20:33
54°	08:30	09:03	09:30	17:55	19:14	20:30
56°	08:37	09:09	09:34	17:48	19:09	20:27
58°	08:46	09:15	09:38	17:40	19:03	20:24
S 60°	08:56	09:22	09:43	17:31	18:57	20:21

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 1-3 2-12%
24	06:30	06:31	12:07	13:09	00:40	
25	06:31	06:32	12:07	14:03	01:36	
26	06:32	06:32	12:07	14:55	02:29	

July 27, 28, 29 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	304°51.9	220°34.3	N21°30.7	178°04.7	N20°16.7	109°20.2	S05°19.0	43°38.5	S21°55.3
1	319°54.3	235°33.7	30.9	193°05.5	16.3	124°22.3	19.1	58°41.1	55.3
2	334°56.8	250°33.1	31.2	208°06.3	15.9	139°24.5	19.2	73°43.7	55.3
3	349°59.3	265°32.5	·· 31.4	223°07.1	·· 15.5	154°26.7	·· 19.4	88°46.3	·· 55.3
4	5°01.7	280°31.9	31.6	238°07.8	15.2	169°28.9	19.5	103°48.8	55.3
5	20°04.2	295°31.3	31.8	253°08.6	14.8	184°31.0	19.6	118°51.4	55.3
6	35°06.7	310°30.6	N21°32.1	268°09.4	N20°14.4	199°33.2	S05°19.7	133°54.0	S21°55.3
7	50°09.1	325°30.0	32.3	283°10.2	14.0	214°35.4	19.9	148°56.6	55.3
8	65°11.6	340°29.4	32.5	298°11.0	13.6	229°37.6	20.0	163°59.2	55.3
9	80°14.1	355°28.8	·· 32.7	313°11.8	·· 13.3	244°39.8	·· 20.1	179°01.8	·· 55.3
10	95°16.5	10°28.2	33.0	328°12.6	12.9	259°41.9	20.3	194°04.3	55.3
11	110°19.0	25°27.6	33.2	343°13.4	12.5	274°44.1	20.4	209°06.9	55.3
12	125°21.5	40°27.0	N21°33.4	358°14.2	N20°12.1	289°46.3	S05°20.5	224°09.5	S21°55.3
13	140°23.9	55°26.4	33.6	13°15.0	11.7	304°48.5	20.6	239°12.1	55.3
14	155°26.4	70°25.8	33.8	28°15.8	11.4	319°50.6	20.8	254°14.7	55.3
15	170°28.8	85°25.2	·· 34.0	43°16.6	·· 11.0	334°52.8	·· 20.9	269°17.2	·· 55.3
16	185°31.3	100°24.6	34.3	58°17.4	10.6	349°55.0	21.0	284°19.8	55.3
17	200°33.8	115°24.0	34.5	73°18.2	10.2	4°57.2	21.2	299°22.4	55.3
18	215°36.2	130°23.3	N21°34.7	88°19.0	N20°09.8	19°59.3	S05°21.3	314°25.0	S21°55.3
19	230°38.7	145°22.7	34.9	103°19.8	09.5	35°01.5	21.4	329°27.6	55.3
20	245°41.2	160°22.1	35.1	118°20.6	09.1	50°03.7	21.5	344°30.2	55.3
21	260°43.6	175°21.5	·· 35.3	133°21.4	·· 08.7	65°05.9	·· 21.7	359°32.7	·· 55.3
22	275°46.1	190°20.9	35.5	148°22.2	08.3	80°08.0	21.8	14°35.3	55.3
23	290°48.6	205°20.3	35.8	163°23.0	07.9	95°10.2	21.9	29°37.9	55.3
Mer.pass.:03:40		v-0.6 d0.2 m-3.9		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.8		v2.6 d-0.0 m0.2	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	305°51.0	220°19.7	N21°36.0	178°23.8	N20°07.5	110°12.4	S05°22.1	44°40.5	S21°55.3
1	320°53.5	235°19.1	36.2	193°24.6	07.2	125°14.6	22.2	59°43.1	55.3
2	335°55.9	250°18.4	36.4	208°25.4	06.8	140°16.7	22.3	74°45.6	55.3
3	350°58.4	265°17.8	·· 36.6	223°26.2	·· 06.4	155°18.9	·· 22.4	89°48.2	·· 55.3
4	6°00.9	280°17.2	36.8	238°27.0	06.0	170°21.1	22.6	104°50.8	55.3
5	21°03.3	295°16.6	37.0	253°27.8	05.6	185°23.2	22.7	119°53.4	55.3
6	36°05.8	310°16.0	N21°37.2	268°28.6	N20°05.2	200°25.4	S05°22.8	134°56.0	S21°55.3
7	51°08.3	325°15.4	37.4	283°29.4	04.9	215°27.6	23.0	149°58.5	55.3
8	66°10.7	340°14.7	37.6	298°30.2	04.5	230°29.8	23.1	165°01.1	55.3
9	81°13.2	355°14.1	·· 37.8	313°31.0	·· 04.1	245°31.9	·· 23.2	180°03.7	·· 55.3
10	96°15.7	10°13.5	38.0	328°31.8	03.7	260°34.1	23.4	195°06.3	55.3
11	111°18.1	25°12.9	38.2	343°32.6	03.3	275°36.3	23.5	210°08.9	55.3
12	126°20.6	40°12.3	N21°38.4	358°33.4	N20°02.9	290°38.4	S05°23.6	225°11.4	S21°55.3
13	141°23.1	55°11.7	38.6	13°34.2	02.6	305°40.6	23.7	240°14.0	55.3
14	156°25.5	70°11.0	38.8	28°35.0	02.2	320°42.8	23.9	255°16.6	55.3
15	171°28.0	85°10.4	·· 39.0	43°35.8	·· 01.8	335°45.0	·· 24.0	270°19.2	·· 55.3
16	186°30.4	100°09.8	39.2	58°36.6	01.4	350°47.1	24.1	285°21.7	55.3
17	201°32.9	115°09.2	39.4	73°37.5	01.0	5°49.3	24.3	300°24.3	55.3
18	216°35.4	130°08.6	N21°39.6	88°38.3	N20°00.6	20°51.5	S05°24.4	315°26.9	S21°55.3
19	231°37.8	145°08.0	39.7	103°39.1	20°00.2	35°53.6	24.5	330°29.5	55.3
20	246°40.3	160°07.3	39.9	118°39.9	19°59.8	50°55.8	24.7	345°32.1	55.3
21	261°42.8	175°06.7	·· 40.1	133°40.7	·· 59.5	65°58.0	·· 24.8	0°34.6	·· 55.3
22	276°45.2	190°06.1	40.3	148°41.5	59.1	81°00.1	24.9	15°37.2	55.3
23	291°47.7	205°05.5	40.5	163°42.3	58.7	96°02.3	25.1	30°39.8	55.3
Mer.pass.:03:36		v-0.6 d0.2 m-3.9		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.7		v2.6 d-0.0 m0.2	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	306°50.2	220°04.8	N21°40.7	178°43.1	N19°58.3	111°04.5	S05°25.2	45°42.4	S21°55.3
1	321°52.6	235°04.2	40.9	193°43.9	57.9	126°06.7	25.3	60°44.9	55.3
2	336°55.1	250°03.6	41.1	208°44.7	57.5	141°08.8	25.5	75°47.5	55.3
3	351°57.6	265°03.0	·· 41.2	223°45.5	·· 57.1	156°11.0	·· 25.6	90°50.1	·· 55.3
4	7°00.0	280°02.4	41.4	238°46.3	56.7	171°13.2	25.7	105°52.7	55.3
5	22°02.5	295°01.7	41.6	253°47.1	56.3	186°15.3	25.8	120°55.2	55.3
6	37°04.9	310°01.1	N21°41.8	268°47.9	N19°56.0	201°17.5	S05°26.0	135°57.8	S21°55.3
7	52°07.4	325°00.5	42.0	283°48.7	55.6	216°19.7	26.1	151°00.4	55.3
8	67°09.9	339°59.9	42.1	298°49.5	55.2	231°21.8	26.2	166°03.0	55.3
9	82°12.3	354°59.2	·· 42.3	313°50.3	·· 54.8	246°24.0	·· 26.4	181°05.5	·· 55.3
10	97°14.8	9°58.6	42.5	328°51.1	54.4	261°26.2	26.5	196°08.1	55.3
11	112°17.3	24°58.0	42.7	343°51.9	54.0	276°28.3	26.6	211°10.7	55.3
12	127°19.7	39°57.4	N21°42.8	358°52.7	N19°53.6	291°30.5	S05°26.8	226°13.3	S21°55.3
13	142°22.2	54°56.7	43.0	13°53.5	53.2	306°32.7	26.9	241°15.8	55.3
14	157°24.7	69°56.1	43.2	28°54.4	52.8	321°34.8	27.0	256°18.4	55.3
15	172°27.1	84°55.5	·· 43.4	43°55.2	·· 52.4	336°37.0	·· 27.2	271°21.0	·· 55.3
16	187°29.6	99°54.9	43.5	58°56.0	52.0	351°39.2	27.3	286°23.6	55.3
17	202°32.0	114°54.2	43.7	73°56.8	51.6	6°41.3	27.4	301°26.1	55.3
18	217°34.5	129°53.6	N21°43.9	88°57.6	N19°51.3	21°43.5	S05°27.6	316°28.7	S21°55.3
19	232°37.0	144°53.0	44.0	103°58.4	50.9	36°45.7	27.7	331°31.3	55.3
20	247°39.4	159°52.4	44.2	118°59.2	50.5	51°47.8	27.8	346°33.9	55.3
21	262°41.9	174°51.7	·· 44.4	134°00.0	·· 50.1	66°50.0	·· 28.0	1°36.4	·· 55.3
22	277°44.4	189°51.1	44.5	149°00.8	49.7	81°52.1	28.1	16°39.0	55.3
23	292°46.8	204°50.5	44.7	164°01.6	49.3	96°54.3	28.2	31°41.6	55.3
Mer.pass.:03:32		v-0.6 d0.2 m-3.9		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.7		v2.6 d-0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°40.4	29°11.1
Ankaa	353°12.8	-42°12.5
Schedar	349°37.0	56°37.7
Diphda	348°53.0	-17°53.3
Achernar	335°24.7	-57°08.7
Hamal	327°57.6	23°32.5
Polaris	316°34.7	89°19.8
Acamar	315°16.3	-40°14.0
Menkar	314°12.2	4°09.4
Mirfak	308°36.5	49°55.0
Aldebaran	290°46.4	16°32.5
Rigel	281°09.6	-8°11.0
Capella	280°30.7	46°00.6
Bellatrix	278°29.3	6°21.8
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.6
Betelgeuse	270°58.6	7°24.5
Canopus	263°55.4	-52°42.3
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.8
Procyon	244°57.2	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.5	-59°34.0
Suhail	222°50.8	-43°30.3
Miaplacidus	221°39.9	-69°47.5
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°48.9	61°39.6
Denebola	182°31.0	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.4	-63°11.9
Gacrux	171°57.9	-57°12.8
Alioth	166°18.5	55°52.3
Spica	158°28.4	-11°15.0
Alkaid	152°56.8	49°14.0
Hadar	148°43.8	-60°27.5
Menkent	148°04.3	-36°27.4
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.8	-60°54.5
Kochab	137°20.1	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.5	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.5	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.2
Eltanin	90°44.4	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.3
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.3	-56°40.5
Deneb	49°29.1	45°20.7
Enif	33°44.1	9°57.5
Al Na'ir	27°39.9	-46°52.3
Fomalhaut	15°20.7	-29°31.6
Scheat	13°50.4	28°10.6
Markab	13°35.3	15°18.0

Jul 27 Thu	SHA	Mer.pass
Venus	275°42.4	09:18
Mars	233°12.8	12:07
Jupiter	164°28.3	16:40
Saturn	98°46.6	21:02

Jul 28 Fri	SHA	Mer.pass
Venus	274°28.6	09:19
Mars	232°32.8	12:06
Jupiter	164°21.4	16:37
Saturn	98°49.5	20:58

Jul 29 Sat	SHA	Mer.pass
Venus	273°14.7	09:20
Mars	231°52.9	12:04
Jupiter	164°14.3	16:33
Saturn	98°52.2	20:54

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3488 sec ΔT = TT-UT1 = +68.8352 sec

2017 July 27 to Jul. 29 UT

h

Thu	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°22.1	N19°12.7	131°49.6	11.5'	N05°37.2	-10.7'	57.6'
1	193°22.1	12.1	146°20.2	11.6'	05°26.5	-10.7'	57.6'
2	208°22.1	11.5	160°50.9	11.7'	05°15.8	-10.7'	57.5'
3	223°22.1	·· 11.0	175°21.6	11.7'	05°05.1	-10.7'	57.5'
4	238°22.1	10.4	189°52.3	11.8'	04°54.4	-10.7'	57.4'
5	253°22.1	09.8	204°23.1	11.9'	04°43.6	-10.7'	57.4'
6	268°22.1	N19°09.3	218°54.0	11.9'	N04°32.9	-10.8'	57.4'
7	283°22.1	08.7	233°25.0	12.0'	04°22.1	-10.8'	57.3'
8	298°22.1	08.1	247°56.0	12.0'	04°11.4	-10.8'	57.3'
9	313°22.1	·· 07.6	262°27.0	12.1'	04°00.6	-10.8'	57.3'
10	328°22.2	07.0	276°58.1	12.1'	03°49.8	-10.8'	57.2'
11	343°22.2	06.4	291°29.3	12.2'	03°39.0	-10.8'	57.2'
12	358°22.2	N19°05.9	306°00.5	12.2'	N03°28.3	-10.8'	57.2'
13	13°22.2	05.3	320°31.8	12.3'	03°17.5	-10.8'	57.1'
14	28°22.2	04.7	335°03.1	12.4'	03°06.7	-10.8'	57.1'
15	43°22.2	·· 04.1	349°34.5	12.4'	02°55.9	-10.8'	57.0'
16	58°22.2	03.6	4°05.9	12.5'	02°45.1	-10.8'	57.0'
17	73°22.2	03.0	18°37.4	12.5'	02°34.3	-10.8'	57.0'
18	88°22.2	N19°02.4	33°09.0	12.6'	N02°23.5	-10.8'	56.9'
19	103°22.2	01.8	47°40.5	12.6'	02°12.8	-10.8'	56.9'
20	118°22.2	01.3	62°12.2	12.7'	02°02.0	-10.8'	56.9'
21	133°22.3	·· 00.7	76°43.9	12.7'	01°51.2	-10.8'	56.8'
22	148°22.3	19°00.1	91°15.6	12.7'	01°40.4	-10.8'	56.8'
23	163°22.3	18°59.5	105°47.4	12.8'	01°29.7	-10.8'	56.8'
	SD.=15.7	d=-0.6	S.D.=15.6				

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°22.3	N18°59.0	120°19.2	12.8'	N01°18.9	-10.8'	56.7'
1	193°22.3	58.4	134°51.0	12.9'	01°08.2	-10.7'	56.7'
2	208°22.3	57.8	149°22.9	12.9'	00°57.4	-10.7'	56.7'
3	223°22.3	·· 57.2	163°54.9	13.0'	00°46.7	-10.7'	56.6'
4	238°22.3	56.6	178°26.9	13.0'	00°36.0	-10.7'	56.6'
5	253°22.4	56.1	192°58.9	13.1'	00°25.3	-10.7'	56.5'
6	268°22.4	N18°55.5	207°31.0	13.1'	N00°14.6	-10.7'	56.5'
7	283°22.4	54.9	222°03.1	13.1'	N00°03.9	-10.7'	56.5'
8	298°22.4	54.3	236°35.3	13.2'	S00°06.8	-10.7'	56.4'
9	313°22.4	·· 53.7	251°07.4	13.2'	00°17.4	-10.6'	56.4'
10	328°22.4	53.1	265°39.7	13.2'	00°28.1	-10.6'	56.4'
11	343°22.4	52.6	280°11.9	13.3'	00°38.7	-10.6'	56.3'
12	358°22.5	N18°52.0	294°44.2	13.3'	S00°49.3	-10.6'	56.3'
13	13°22.5	51.4	309°16.6	13.4'	00°59.9	-10.6'	56.3'
14	28°22.5	50.8	323°48.9	13.4'	01°10.5	-10.6'	56.2'
15	43°22.5	·· 50.2	338°21.3	13.4'	01°21.0	-10.5'	56.2'
16	58°22.5	49.6	352°53.8	13.4'	01°31.6	-10.5'	56.2'
17	73°22.5	49.0	7°26.2	13.5'	01°42.1	-10.5'	56.1'
18	88°22.5	N18°48.5	21°58.7	13.5'	S01°52.6	-10.5'	56.1'
19	103°22.6	47.9	36°31.2	13.5'	02°03.0	-10.5'	56.1'
20	118°22.6	47.3	51°03.8	13.6'	02°13.5	-10.4'	56.1'
21	133°22.6	·· 46.7	65°36.4	13.6'	02°23.9	-10.4'	56.0'
22	148°22.6	46.1	80°09.0	13.6'	02°34.3	-10.4'	56.0'
23	163°22.6	45.5	94°41.6	13.7'	02°44.7	-10.4'	56.0'
	SD.=15.7	d=-0.6	S.D.=15.3				

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°22.7	N18°44.9	109°14.3	13.7'	S02°55.1	-10.3'	55.9'
1	193°22.7	44.3	123°47.0	13.7'	03°05.4	-10.3'	55.9'
2	208°22.7	43.7	138°19.7	13.7'	03°15.7	-10.3'	55.9'
3	223°22.7	·· 43.1	152°52.4	13.7'	03°26.0	-10.3'	55.8'
4	238°22.7	42.5	167°25.2	13.8'	03°36.3	-10.2'	55.8'
5	253°22.7	42.0	181°58.0	13.8'	03°46.5	-10.2'	55.8'
6	268°22.8	N18°41.4	196°30.8	13.8'	S03°56.7	-10.2'	55.7'
7	283°22.8	40.8	211°03.6	13.8'	04°06.9	-10.2'	55.7'
8	298°22.8	40.2	225°36.4	13.9'	04°17.0	-10.1'	55.7'
9	313°22.8	·· 39.6	240°09.3	13.9'	04°27.1	-10.1'	55.7'
10	328°22.9	39.0	254°42.2	13.9'	04°37.2	-10.1'	55.6'
11	343°22.9	38.4	269°15.1	13.9'	04°47.2	-10.0'	55.6'
12	358°22.9	N18°37.8	283°48.0	13.9'	S04°57.3	-10.0'	55.6'
13	13°22.9	37.2	298°20.9	13.9'	05°07.2	-10.0'	55.5'
14	28°22.9	36.6	312°53.9	14.0'	05°17.2	-9.9'	55.5'
15	43°23.0	·· 36.0	327°26.8	14.0'	05°27.1	-9.9'	55.5'
16	58°23.0	35.4	341°59.8	14.0'	05°37.0	-9.9'	55.5'
17	73°23.0	34.8	356°32.8	14.0'	05°46.8	-9.8'	55.4'
18	88°23.0	N18°34.2	11°05.8	14.0'	S05°56.7	-9.8'	55.4'
19	103°23.1	33.6	25°38.8	14.0'	06°06.4	-9.8'	55.4'
20	118°23.1	33.0	40°11.8	14.0'	06°16.2	-9.7'	55.4'
21	133°23.1	·· 32.4	54°44.9	14.0'	06°25.9	-9.7'	55.3'
22	148°23.1	31.8	69°17.9	14.0'	06°35.6	-9.6'	55.3'
23	163°23.1	31.2	83°51.0	14.1'	06°45.2	-9.6'	55.3'
	SD.=15.7	d=-0.6	S.D.=15.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°			00:40	23:18		
68°			01:54	22:14		
66°			02:30	21:39		
64°		01:14	02:56	21:15	22:52	
62°		01:59	03:16	20:55	22:10	
60°		02:28	03:32	20:40	21:43	
N 58°	01:07	02:49	03:45	20:26	21:22	23:00
56°	01:49	03:07	03:57	20:15	21:05	22:21
54°	02:15	03:21	04:07	20:05	20:50	21:56
52°	02:35	03:34	04:16	19:56	20:38	21:36
50°	02:52	03:44	04:24	19:48	20:27	21:20
45°	03:23	04:07	04:41	19:31	20:06	20:49
N 40°	03:46	04:24	04:55	19:18	19:48	20:26
35°	04:04	04:38	05:07	19:06	19:34	20:08
30°	04:19	04:50	05:17	18:56	19:22	19:53
20°	04:42	05:10	05:34	18:39	19:02	19:30
N 10°	05:01	05:27	05:49	18:24	18:46	19:12
0°	05:16	05:41	06:03	18:10	18:32	18:57
S 10°	05:29	05:55	06:17	17:56	18:18	18:44
20°	05:41	06:08	06:31	17:42	18:05	18:32
30°	05:54	06:23	06:48	17:25	17:51	18:20
35°	06:00	06:31	06:58	17:16	17:43	18:13
40°	06:07	06:39	07:09	17:05	17:34	18:07
45°	06:14	06:50	07:21	16:52	17:24	18:00
S 50°	06:22	07:01	07:37	16:37	17:12	17:52
52°	06:25	07:07	07:44	16:29	17:07	17:48
54°	06:29	07:12	07:52	16:21	17:01	17:45
56°	06:33	07:19	08:01	16:12	16:55	17:41
58°	06:37	07:26	08:12	16:02	16:48	17:36
S 60°	06:42	07:34	08:23	15:50	16:40	17:32

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	08:41	10:26	12:09	22:14	22:06	21:58
N 70°	08:46	10:25	12:01	22:12	22:10	22:07
68°	08:51	10:25	11:55	22:10	22:13	22:15
66°	08:55	10:24	11:50	22:09	22:15	22:22
64°	08:58	10:24	11:46	22:08	22:17	22:27
62°	09:01	10:23	11:42	22:07	22:19	22:32
60°	09:03	10:23	11:39	22:06	22:21	22:36
N 58°	09:06	10:22	11:36	22:05	22:22	22:40
56°	09:08	10:22	11:34	22:04	22:24	22:43
54°	09:09	10:22	11:32	22:03	22:25	22:46
52°	09:11	10:21	11:30	22:03	22:26	22:49
50°	09:12	10:21	11:28	22:02	22:27	22:51
45°	09:16	10:21	11:24	22:01	22:29	22:57
N 40°	09:18	10:20	11:20	22:00	22:31	23:01
35°	09:20	10:20	11:18	21:59	22:32	23:05
30°	09:22	10:20	11:15	21:58	22:34	23:09
20°	09:26	10:19	11:11	21:57	22:36	23:15
N 10°	09:29	10:19	11:07	21:56	22:38	23:20
0°	09:32	10:18	11:04	21:54	22:40	23:25
S 10°	09:35	10:18	11:00	21:53	22:42	23:30
20°	09:38	10:18	10:56	21:52	22:44	23:35
30°	09:41	10:17	10:52	21:50	22:47	23:41
35°	09:43	10:17	10:50	21:49	22:48	23:45
40°	09:45	10:17	10:47	21:48	22:49	23:49
45°	09:48	10:16	10:44	21:47	22:51	23:53
S 50°	09:51	10:16	10:40	21:46	22:53	23:59
52°	09:52	10:16	10:39	21:45	22:54	–:–
54°	09:54	10:16	10:37	21:44	22:55	–:–
56°	09:56	10:16	10:35	21:43	22:57	–:–
58°	09:58	10:15	10:33	21:42	22:58	–:–
S 60°	10:00	10:15	10:30	21:41	22:59	–:–

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 4-6 20-39%
27	06:32	06:31	12:07	15:43	03:19	
28	06:31	06:30	12:07	16:29	04:06	
29	06:29	06:28	12:06	17:14	04:52	

July 30, 31, 01 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	307°49.3	219°49.8	N21°44.9	179°02.4	N19°48.9	111°56.5	S05°28.4	46°44.2	S21°55.3
1	322°51.8	234°49.2	45.0	194°03.2	48.5	126°58.6	28.5	61°46.7	55.3
2	337°54.2	249°48.6	45.2	209°04.0	48.1	142°00.8	28.6	76°49.3	55.3
3	352°56.7	264°48.0	·· 45.4	224°04.9	·· 47.7	157°03.0	·· 28.8	91°51.9	·· 55.3
4	7°59.2	279°47.3	45.5	239°05.7	47.3	172°05.1	28.9	106°54.5	55.3
5	23°01.6	294°46.7	45.7	254°06.5	46.9	187°07.3	29.0	121°57.0	55.3
6	38°04.1	309°46.1	N21°45.8	269°07.3	N19°46.5	202°09.5	S05°29.2	136°59.6	S21°55.3
7	53°06.5	324°45.4	46.0	284°08.1	46.1	217°11.6	29.3	152°02.2	55.3
8	68°09.0	339°44.8	46.1	299°08.9	45.7	232°13.8	29.4	167°04.7	55.3
9	83°11.5	354°44.2	·· 46.3	314°09.7	·· 45.3	247°15.9	·· 29.6	182°07.3	·· 55.3
10	98°13.9	9°43.5	46.5	329°10.5	44.9	262°18.1	29.7	197°09.9	55.3
11	113°16.4	24°42.9	46.6	344°11.3	44.5	277°20.3	29.8	212°12.5	55.3
12	128°18.9	39°42.3	N21°46.8	359°12.1	N19°44.1	292°22.4	S05°30.0	227°15.0	S21°55.3
13	143°21.3	54°41.6	46.9	14°12.9	43.7	307°24.6	30.1	242°17.6	55.3
14	158°23.8	69°41.0	47.1	29°13.8	43.3	322°26.7	30.2	257°20.2	55.3
15	173°26.3	84°40.4	·· 47.2	44°14.6	·· 43.0	337°28.9	·· 30.4	272°22.7	·· 55.3
16	188°28.7	99°39.7	47.4	59°15.4	42.6	352°31.1	30.5	287°25.3	55.3
17	203°31.2	114°39.1	47.5	74°16.2	42.2	7°33.2	30.6	302°27.9	55.3
18	218°33.7	129°38.5	N21°47.6	89°17.0	N19°41.8	22°35.4	S05°30.8	317°30.5	S21°55.3
19	233°36.1	144°37.8	47.8	104°17.8	41.4	37°37.6	30.9	332°33.0	55.3
20	248°38.6	159°37.2	47.9	119°18.6	41.0	52°39.7	31.0	347°35.6	55.3
21	263°41.0	174°36.6	·· 48.1	134°19.4	·· 40.6	67°41.9	·· 31.2	2°38.2	·· 55.3
22	278°43.5	189°35.9	48.2	149°20.2	40.2	82°44.0	31.3	17°40.7	55.3
23	293°46.0	204°35.3	48.4	164°21.1	39.8	97°46.2	31.5	32°43.3	55.3
Mer.pass.:03:28		v-0.6 d0.2 m-3.9		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.7		v2.6 d-0.0 m0.2	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	308°48.4	219°34.7	N21°48.5	179°21.9	N19°39.4	112°48.3	S05°31.6	47°45.9	S21°55.3
1	323°50.9	234°34.0	48.6	194°22.7	39.0	127°50.5	31.7	62°48.4	55.3
2	338°53.4	249°33.4	48.8	209°23.5	38.6	142°52.7	31.9	77°51.0	55.3
3	353°55.8	264°32.7	·· 48.9	224°24.3	·· 38.2	157°54.8	·· 32.0	92°53.6	·· 55.3
4	8°58.3	279°32.1	49.1	239°25.1	37.8	172°57.0	32.1	107°56.1	55.3
5	24°00.8	294°31.5	49.2	254°25.9	37.4	187°59.1	32.3	122°58.7	55.3
6	39°03.2	309°30.8	N21°49.3	269°26.8	N19°37.0	203°01.3	S05°32.4	138°01.3	S21°55.3
7	54°05.7	324°30.2	49.5	284°27.6	36.6	218°03.5	32.5	153°03.9	55.3
8	69°08.1	339°29.6	49.6	299°28.4	36.2	233°05.6	32.7	168°06.4	55.3
9	84°10.6	354°28.9	·· 49.7	314°29.2	·· 35.8	248°07.8	·· 32.8	183°09.0	·· 55.3
10	99°13.1	9°28.3	49.8	329°30.0	35.3	263°09.9	32.9	198°11.6	55.3
11	114°15.5	24°27.6	50.0	344°30.8	34.9	278°12.1	33.1	213°14.1	55.3
12	129°18.0	39°27.0	N21°50.1	359°31.6	N19°34.5	293°14.2	S05°33.2	228°16.7	S21°55.3
13	144°20.5	54°26.4	50.2	14°32.4	34.1	308°16.4	33.3	243°19.3	55.3
14	159°22.9	69°25.7	50.4	29°33.3	33.7	323°18.6	33.5	258°21.8	55.3
15	174°25.4	84°25.1	·· 50.5	44°34.1	·· 33.3	338°20.7	·· 33.6	273°24.4	·· 55.3
16	189°27.9	99°24.4	50.6	59°34.9	32.9	353°22.9	33.8	288°27.0	55.3
17	204°30.3	114°23.8	50.7	74°35.7	32.5	8°25.0	33.9	303°29.5	55.3
18	219°32.8	129°23.2	N21°50.9	89°36.5	N19°32.1	23°27.2	S05°34.0	318°32.1	S21°55.3
19	234°35.3	144°22.5	51.0	104°37.3	31.7	38°29.3	34.2	333°34.7	55.3
20	249°37.7	159°21.9	51.1	119°38.2	31.3	53°31.5	34.3	348°37.2	55.3
21	264°40.2	174°21.2	·· 51.2	134°39.0	·· 30.9	68°33.6	·· 34.4	3°39.8	·· 55.3
22	279°42.6	189°20.6	51.3	149°39.8	30.5	83°35.8	34.6	18°42.4	55.3
23	294°45.1	204°19.9	51.5	164°40.6	30.1	98°38.0	34.7	33°44.9	55.3
Mer.pass.:03:24		v-0.6 d0.1 m-3.9		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.7		v2.6 d-0.0 m0.2	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	309°47.6	219°19.3	N21°51.6	179°41.4	N19°29.7	113°40.1	S05°34.8	48°47.5	S21°55.3
1	324°50.0	234°18.7	51.7	194°42.2	29.3	128°42.3	35.0	63°50.1	55.3
2	339°52.5	249°18.0	51.8	209°43.0	28.9	143°44.4	35.1	78°52.6	55.3
3	354°55.0	264°17.4	·· 51.9	224°43.9	·· 28.5	158°46.6	·· 35.3	93°55.2	·· 55.3
4	9°57.4	279°16.7	52.0	239°44.7	28.1	173°48.7	35.4	108°57.8	55.3
5	24°59.9	294°16.1	52.1	254°45.5	27.7	188°50.9	35.5	124°00.3	55.3
6	40°02.4	309°15.4	N21°52.3	269°46.3	N19°27.3	203°53.0	S05°35.7	139°02.9	S21°55.3
7	55°04.8	324°14.8	52.4	284°47.1	26.8	218°55.2	35.8	154°05.4	55.3
8	70°07.3	339°14.1	52.5	299°48.0	26.4	233°57.3	35.9	169°08.0	55.3
9	85°09.8	354°13.5	·· 52.6	314°48.8	·· 26.0	248°59.5	·· 36.1	184°10.6	·· 55.4
10	100°12.2	9°12.8	52.7	329°49.6	25.6	264°01.6	36.2	199°13.1	55.4
11	115°14.7	24°12.2	52.8	344°50.4	25.2	279°03.8	36.4	214°15.7	55.4
12	130°17.1	39°11.6	N21°52.9	359°51.2	N19°24.8	294°06.0	S05°36.5	229°18.3	S21°55.4
13	145°19.6	54°10.9	53.0	14°52.0	24.4	309°08.1	36.6	244°20.8	55.4
14	160°22.1	69°10.3	53.1	29°52.9	24.0	324°10.3	36.8	259°23.4	55.4
15	175°24.5	84°09.6	·· 53.2	44°53.7	·· 23.6	339°12.4	·· 36.9	274°26.0	·· 55.4
16	190°27.0	99°09.0	53.3	59°54.5	23.2	354°14.6	37.0	289°28.5	55.4
17	205°29.5	114°08.3	53.4	74°55.3	22.8	9°16.7	37.2	304°31.1	55.4
18	220°31.9	129°07.7	N21°53.5	89°56.1	N19°22.4	24°18.9	S05°37.3	319°33.6	S21°55.4
19	235°34.4	144°07.0	53.6	104°57.0	21.9	39°21.0	37.5	334°36.2	55.4
20	250°36.9	159°06.4	53.7	119°57.8	21.5	54°23.2	37.6	349°38.8	55.4
21	265°39.3	174°05.7	·· 53.8	134°58.6	·· 21.1	69°25.3	·· 37.7	4°41.3	·· 55.4
22	280°41.8	189°05.1	53.9	149°59.4	20.7	84°27.5	37.9	19°43.9	55.4
23	295°44.2	204°04.4	54.0	165°00.2	20.3	99°29.6	38.0	34°46.5	55.4
Mer.pass.:03:20		v-0.6 d0.1 m-3.9		v0.8 d-0.4 m1.7		v2.2 d-0.1 m-1.7		v2.6 d-0.0 m0.2	

Stars

	SHA	Dec
Alpheratz	357°40.4	29°11.1
Ankaa	353°12.8	-42°12.5
Schedar	349°37.0	56°37.7
Diphda	348°53.0	-17°53.3
Achernar	335°24.7	-57°08.7
Hamal	327°57.5	23°32.5
Polaris	316°33.2	89°19.8
Acamar	315°16.3	-40°14.0
Menkar	314°12.2	4°09.4
Mirfak	308°36.4	49°55.0
Aldebaran	290°46.4	16°32.5
Rigel	281°09.6	-8°11.0
Capella	280°30.6	46°00.6
Bellatrix	278°29.2	6°21.8
Elnath	278°09.4	28°37.1
Alnilam	275°43.8	-1°11.6
Betelgeuse	270°58.5	7°24.5
Canopus	263°55.4	-52°42.3
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.8
Procyon	244°57.1	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.5	-59°34.0
Suhail	222°50.8	-43°30.3
Miaplacidus	221°39.9	-69°47.5
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°49.0	61°39.6
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.4	-63°11.9
Gacrux	171°58.0	-57°12.8
Alioth	166°18.6	55°52.3
Spica	158°28.4	-11°15.0
Alkaid	152°56.8	49°14.0
Hadar	148°43.9	-60°27.5
Menkent	148°04.3	-36°27.3
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.8	-60°54.5
Kochab	137°20.1	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.5	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.2
Eltanin	90°44.4	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.3
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.3	-56°40.5
Deneb	49°29.1	45°20.7
Enif	33°44.1	9°57.5
Al Na'ir	27°39.9	-46°52.3
Fomalhaut	15°20.6	-29°31.6
Scheat	13°50.3	28°10.7
Markab	13°35.3	15°18.0

Jul 30 Sun	**SHA**	**Mer.pass**
Venus	272°00.5	09:21
Mars	231°13.1	12:03
Jupiter	164°07.2	16:30
Saturn	98°54.9	20:49

Jul 31 Mon	**SHA**	**Mer.pass**
Venus	270°46.2	09:22
Mars	230°33.4	12:02
Jupiter	163°59.9	16:26
Saturn	98°57.4	20:45

Aug 01 Tue	**SHA**	**Mer.pass**
Venus	269°31.7	09:23
Mars	229°53.8	12:01
Jupiter	163°52.5	16:23
Saturn	98°59.9	20:41

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3475 sec ΔT = TT-UT1 = +68.8365 sec

2017 July 30 to Aug. 01 UT

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Sun

Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.2	N18°30.6	98°24.0	14.1′	S06°54.8	-9.6′	55.2′
1	193°23.2	30.0	112°57.1	14.1′	07°04.3	-9.5′	55.2′
2	208°23.2	29.4	127°30.2	14.1′	07°13.8	-9.5′	55.2′
3	223°23.2	·· 28.8	142°03.3	14.1′	07°23.3	-9.5′	55.2′
4	238°23.3	28.2	156°36.4	14.1′	07°32.7	-9.4′	55.2′
5	253°23.3	27.6	171°09.4	14.1′	07°42.1	-9.4′	55.1′
6	268°23.3	N18°26.9	185°42.5	14.1′	S07°51.5	-9.3′	55.1′
7	283°23.4	26.3	200°15.6	14.1′	08°00.8	-9.3′	55.1′
8	298°23.4	25.7	214°48.7	14.1′	08°10.1	-9.2′	55.1′
9	313°23.4	·· 25.1	229°21.9	14.1′	08°19.3	-9.2′	55.0′
10	328°23.4	24.5	243°55.0	14.1′	08°28.5	-9.2′	55.0′
11	343°23.5	23.9	258°28.1	14.1′	08°37.6	-9.1′	55.0′
12	358°23.5	N18°23.3	273°01.2	14.1′	S08°46.7	-9.1′	55.0′
13	13°23.5	22.7	287°34.3	14.1′	08°55.7	-9.0′	54.9′
14	28°23.5	22.1	302°07.4	14.1′	09°04.7	-9.0′	54.9′
15	43°23.6	·· 21.5	316°40.5	14.1′	09°13.7	-8.9′	54.9′
16	58°23.6	20.8	331°13.6	14.1′	09°22.6	-8.9′	54.9′
17	73°23.6	20.2	345°46.7	14.1′	09°31.4	-8.8′	54.9′
18	88°23.7	N18°19.6	0°19.8	14.1′	S09°40.3	-8.8′	54.8′
19	103°23.7	19.0	14°52.9	14.1′	09°49.0	-8.7′	54.8′
20	118°23.7	18.4	29°26.0	14.1′	09°57.7	-8.7′	54.8′
21	133°23.8	·· 17.8	43°59.0	14.1′	10°06.4	-8.6′	54.8′
22	148°23.8	17.2	58°32.1	14.1′	10°15.0	-8.6′	54.8′
23	163°23.8	16.6	73°05.2	14.1′	10°23.6	-8.5′	54.7′
	SD.=15.7	d=-0.6	S.D.=15.0				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.8	N18°15.9	87°38.3	14.1′	S10°32.1	-8.5′	54.7′
1	193°23.9	15.3	102°11.3	14.1′	10°40.6	-8.4′	54.7′
2	208°23.9	14.7	116°44.4	14.0′	10°49.0	-8.4′	54.7′
3	223°23.9	·· 14.1	131°17.4	14.0′	10°57.4	-8.3′	54.7′
4	238°24.0	13.5	145°50.4	14.0′	11°05.7	-8.3′	54.7′
5	253°24.0	12.8	160°23.5	14.0′	11°13.9	-8.2′	54.6′
6	268°24.0	N18°12.2	174°56.5	14.0′	S11°22.1	-8.2′	54.6′
7	283°24.1	11.6	189°29.5	14.0′	11°30.3	-8.1′	54.6′
8	298°24.1	11.0	204°02.4	14.0′	11°38.4	-8.1′	54.6′
9	313°24.1	·· 10.4	218°35.4	14.0′	11°46.4	-8.0′	54.6′
10	328°24.2	09.7	233°08.4	14.0′	11°54.4	-8.0′	54.6′
11	343°24.2	09.1	247°41.3	13.9′	12°02.3	-7.9′	54.5′
12	358°24.2	N18°08.5	262°14.3	13.9′	S12°10.2	-7.8′	54.5′
13	13°24.3	07.9	276°47.2	13.9′	12°18.0	-7.8′	54.5′
14	28°24.3	07.3	291°20.1	13.9′	12°25.8	-7.7′	54.5′
15	43°24.3	·· 06.6	305°53.0	13.9′	12°33.5	-7.7′	54.5′
16	58°24.4	06.0	320°25.9	13.9′	12°41.2	-7.6′	54.5′
17	73°24.4	05.4	334°58.8	13.9′	12°48.7	-7.6′	54.5′
18	88°24.5	N18°04.8	349°31.6	13.8′	S12°56.3	-7.5′	54.4′
19	103°24.5	04.1	4°04.4	13.8′	13°03.7	-7.4′	54.4′
20	118°24.5	03.5	18°37.3	13.8′	13°11.2	-7.4′	54.4′
21	133°24.6	·· 02.9	33°10.1	13.8′	13°18.5	-7.3′	54.4′
22	148°24.6	02.2	47°42.8	13.8′	13°25.8	-7.3′	54.4′
23	163°24.6	01.6	62°15.6	13.8′	13°33.0	-7.2′	54.4′
	SD.=15.7	d=-0.6	S.D.=14.9				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°24.7	N18°01.0	76°48.4	13.7′	S13°40.2	-7.1′	54.4′
1	193°24.7	18°00.4	91°21.1	13.7′	13°47.3	-7.1′	54.4′
2	208°24.8	17°59.7	105°53.8	13.7′	13°54.4	-7.0′	54.3′
3	223°24.8	·· 59.1	120°26.5	13.7′	14°01.3	-7.0′	54.3′
4	238°24.8	58.5	134°59.2	13.7′	14°08.3	-6.9′	54.3′
5	253°24.9	57.8	149°31.8	13.6′	14°15.1	-6.8′	54.3′
6	268°24.9	N17°57.2	164°04.4	13.6′	S14°21.9	-6.8′	54.3′
7	283°24.9	56.6	178°37.0	13.6′	14°28.6	-6.7′	54.3′
8	298°25.0	55.9	193°09.6	13.6′	14°35.3	-6.6′	54.3′
9	313°25.0	·· 55.3	207°42.2	13.6′	14°41.9	-6.6′	54.3′
10	328°25.1	54.7	222°14.7	13.5′	14°48.4	-6.5′	54.3′
11	343°25.1	54.0	236°47.3	13.5′	14°54.9	-6.4′	54.3′
12	358°25.2	N17°53.4	251°19.8	13.5′	S15°01.3	-6.4′	54.2′
13	13°25.2	52.8	265°52.2	13.5′	15°07.6	-6.3′	54.2′
14	28°25.2	52.1	280°24.7	13.4′	15°13.9	-6.2′	54.2′
15	43°25.3	·· 51.5	294°57.1	13.4′	15°20.1	-6.2′	54.2′
16	58°25.3	50.9	309°29.5	13.4′	15°26.2	-6.1′	54.2′
17	73°25.4	50.2	324°01.9	13.4′	15°32.3	-6.0′	54.2′
18	88°25.4	N17°49.6	338°34.3	13.4′	S15°38.3	-6.0′	54.2′
19	103°25.4	49.0	353°06.6	13.3′	15°44.2	-5.9′	54.2′
20	118°25.5	48.3	7°38.9	13.3′	15°50.1	-5.8′	54.2′
21	133°25.5	·· 47.7	22°11.2	13.3′	15°55.8	-5.7′	54.2′
22	148°25.6	47.0	36°43.5	13.3′	16°01.6	-5.7′	54.2′
23	163°25.6	46.4	51°15.7	13.2′	16°07.2	-5.6′	54.2′
	SD.=15.7	d=-0.6	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°			01:19	22:46		
68°			02:11	21:58		
66°			02:42	21:27		
64°		01:34	03:05	21:05	22:33	
62°		02:12	03:24	20:47	21:58	
60°		02:37	03:39	20:32	21:33	
N 58°	01:26	02:57	03:51	20:20	21:13	22:42
56°	02:00	03:13	04:02	20:09	20:58	22:10
54°	02:24	03:27	04:12	20:00	20:44	21:47
52°	02:42	03:39	04:20	19:51	20:33	21:29
50°	02:58	03:49	04:28	19:44	20:22	21:13
45°	03:28	04:10	04:44	19:28	20:01	20:44
N 40°	03:50	04:27	04:58	19:15	19:45	20:22
35°	04:07	04:41	05:09	19:04	19:31	20:05
30°	04:21	04:52	05:18	18:54	19:20	19:51
20°	04:44	05:12	05:35	18:37	19:01	19:29
N 10°	05:01	05:27	05:50	18:23	18:45	19:11
0°	05:16	05:41	06:03	18:10	18:32	18:57
S 10°	05:29	05:54	06:16	17:57	18:19	18:44
20°	05:40	06:07	06:30	17:43	18:06	18:33
30°	05:52	06:21	06:46	17:27	17:52	18:21
35°	05:58	06:28	06:55	17:18	17:45	18:15
40°	06:04	06:37	07:06	17:07	17:36	18:09
45°	06:11	06:46	07:18	16:55	17:27	18:02
S 50°	06:18	06:57	07:33	16:41	17:16	17:55
52°	06:21	07:02	07:40	16:34	17:11	17:52
54°	06:25	07:08	07:47	16:26	17:05	17:49
56°	06:28	07:14	07:56	16:18	16:59	17:45
58°	06:32	07:21	08:06	16:08	16:53	17:41
S 60°	06:37	07:28	08:17	15:57	16:45	17:37

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	13:50	15:34	17:23	21:49	21:38	21:23
N 70°	13:35	15:09	16:44	22:05	22:04	22:03
68°	13:24	14:51	16:17	22:18	22:23	22:31
66°	13:14	14:36	15:56	22:29	22:39	22:52
64°	13:06	14:24	15:40	22:38	22:51	23:09
62°	12:59	14:14	15:27	22:46	23:02	23:23
60°	12:53	14:06	15:15	22:53	23:12	23:35
N 58°	12:48	13:58	15:05	22:59	23:20	23:45
56°	12:44	13:51	14:57	23:04	23:27	23:54
54°	12:39	13:45	14:49	23:09	23:33	–:–
52°	12:36	13:40	14:42	23:13	23:39	–:–
50°	12:32	13:35	14:36	23:17	23:44	–:–
45°	12:25	13:25	14:23	23:25	23:56	–:–
N 40°	12:19	13:16	14:12	23:32	–:–	00:05
35°	12:14	13:09	14:03	23:39	–:–	00:13
30°	12:09	13:02	13:55	23:44	–:–	00:21
20°	12:01	12:51	13:41	23:53	–:–	00:33
N 10°	11:54	12:41	13:29	–:–	00:02	00:44
0°	11:48	12:32	13:17	–:–	00:09	00:54
S 10°	11:42	12:23	13:06	–:–	00:17	01:04
20°	11:35	12:14	12:54	–:–	00:25	01:15
30°	11:27	12:03	12:41	–:–	00:35	01:28
35°	11:23	11:57	12:33	–:–	00:40	01:35
40°	11:18	11:50	12:24	–:–	00:47	01:43
45°	11:12	11:41	12:13	–:–	00:54	01:53
S 50°	11:05	11:32	12:01	–:–	01:03	02:05
52°	11:02	11:27	11:55	00:02	01:07	02:10
54°	10:59	11:22	11:48	00:04	01:11	02:16
56°	10:55	11:16	11:41	00:07	01:16	02:23
58°	10:51	11:10	11:33	00:11	01:22	02:30
S 60°	10:46	11:03	11:24	00:15	01:28	02:39

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 7-9 49-68%
30	06:27	06:26	12:06	17:59	05:36	
31	06:25	06:23	12:06	18:43	06:21	
01	06:21	06:19	12:06	19:28	07:06	

August 02, 03, 04 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	310°46.7	219°03.8	N21°54.1	180°01.1	N19°19.9	114°31.8	S05°38.1	49°49.0	S21°55.4
1	325°49.2	234°03.1	54.2	195°01.9	19.5	129°33.9	38.3	64°51.6	55.4
2	340°51.6	249°02.5	54.3	210°02.7	19.1	144°36.1	38.4	79°54.1	55.4
3	355°54.1	264°01.8	·· 54.4	225°03.5	·· 18.7	159°38.2	·· 38.6	94°56.7	·· 55.4
4	10°56.6	279°01.2	54.4	240°04.3	18.2	174°40.4	38.7	109°59.3	55.4
5	25°59.0	294°00.5	54.5	255°05.2	17.8	189°42.5	38.8	125°01.8	55.4
6	41°01.5	308°59.9	N21°54.6	270°06.0	N19°17.4	204°44.7	S05°39.0	140°04.4	S21°55.4
7	56°04.0	323°59.2	54.7	285°06.8	17.0	219°46.8	39.1	155°07.0	55.4
8	71°06.4	338°58.6	54.8	300°07.6	16.6	234°49.0	39.3	170°09.5	55.4
9	86°08.9	353°57.9	·· 54.9	315°08.4	·· 16.2	249°51.1	·· 39.4	185°12.1	·· 55.4
10	101°11.4	8°57.3	55.0	330°09.3	15.8	264°53.3	39.5	200°14.6	55.4
11	116°13.8	23°56.6	55.0	345°10.1	15.4	279°55.4	39.7	215°17.2	55.4
12	131°16.3	38°56.0	N21°55.1	0°10.9	N19°14.9	294°57.5	S05°39.8	230°19.8	S21°55.4
13	146°18.7	53°55.3	55.2	15°11.7	14.5	309°59.7	40.0	245°22.3	55.4
14	161°21.2	68°54.7	55.3	30°12.6	14.1	325°01.8	40.1	260°24.9	55.4
15	176°23.7	83°54.0	·· 55.4	45°13.4	·· 13.7	340°04.0	·· 40.2	275°27.4	·· 55.4
16	191°26.1	98°53.3	55.4	60°14.2	13.3	355°06.1	40.4	290°30.0	55.4
17	206°28.6	113°52.7	55.5	75°15.0	12.9	10°08.3	40.5	305°32.6	55.4
18	221°31.1	128°52.0	N21°55.6	90°15.8	N19°12.5	25°10.4	S05°40.7	320°35.1	S21°55.4
19	236°33.5	143°51.4	55.7	105°16.7	12.0	40°12.6	40.8	335°37.7	55.4
20	251°36.0	158°50.7	55.7	120°17.5	11.6	55°14.7	40.9	350°40.2	55.4
21	266°38.5	173°50.1	·· 55.8	135°18.3	·· 11.2	70°16.9	·· 41.1	5°42.8	·· 55.4
22	281°40.9	188°49.4	55.9	150°19.1	10.8	85°19.0	41.2	20°45.3	55.4
23	296°43.4	203°48.8	56.0	165°20.0	10.4	100°21.2	41.4	35°47.9	55.4
Mer.pass.:03:16		v-0.6 d0.1 m-3.9		v0.8 d-0.4 m1.7		v2.1 d-0.1 m-1.7		v2.6 d-0.0 m0.3	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	311°45.9	218°48.1	N21°56.0	180°20.8	N19°10.0	115°23.3	S05°41.5	50°50.5	S21°55.4
1	326°48.3	233°47.5	56.1	195°21.6	09.5	130°25.5	41.6	65°53.0	55.4
2	341°50.8	248°46.8	56.2	210°22.4	09.1	145°27.6	41.8	80°55.6	55.4
3	356°53.2	263°46.1	·· 56.2	225°23.3	·· 08.7	160°29.7	·· 41.9	95°58.1	·· 55.4
4	11°55.7	278°45.5	56.3	240°24.1	08.3	175°31.9	42.1	111°00.7	55.4
5	26°58.2	293°44.8	56.4	255°24.9	07.9	190°34.0	42.2	126°03.3	55.4
6	42°00.6	308°44.2	N21°56.4	270°25.7	N19°07.5	205°36.2	S05°42.3	141°05.8	S21°55.4
7	57°03.1	323°43.5	56.5	285°26.6	07.0	220°38.3	42.5	156°08.4	55.4
8	72°05.6	338°42.9	56.5	300°27.4	06.6	235°40.5	42.6	171°10.9	55.4
9	87°08.0	353°42.2	·· 56.6	315°28.2	·· 06.2	250°42.6	·· 42.8	186°13.5	·· 55.4
10	102°10.5	8°41.5	56.7	330°29.0	05.8	265°44.7	42.9	201°16.0	55.4
11	117°13.0	23°40.9	56.7	345°29.9	05.4	280°46.9	43.0	216°18.6	55.4
12	132°15.4	38°40.2	N21°56.8	0°30.7	N19°04.9	295°49.0	S05°43.2	231°21.1	S21°55.4
13	147°17.9	53°39.6	56.8	15°31.5	04.5	310°51.2	43.3	246°23.7	55.4
14	162°20.3	68°38.9	56.9	30°32.3	04.1	325°53.3	43.5	261°26.3	55.4
15	177°22.8	83°38.2	·· 56.9	45°33.2	·· 03.7	340°55.5	·· 43.6	276°28.8	·· 55.4
16	192°25.3	98°37.6	57.0	60°34.0	03.3	355°57.6	43.7	291°31.4	55.4
17	207°27.7	113°36.9	57.0	75°34.8	02.8	10°59.7	43.9	306°33.9	55.4
18	222°30.2	128°36.3	N21°57.1	90°35.7	N19°02.4	26°01.9	S05°44.0	321°36.5	S21°55.4
19	237°32.7	143°35.6	57.2	105°36.5	02.0	41°04.0	44.2	336°39.0	55.4
20	252°35.1	158°34.9	57.2	120°37.3	01.6	56°06.2	44.3	351°41.6	55.5
21	267°37.6	173°34.3	·· 57.2	135°38.1	·· 01.2	71°08.3	·· 44.4	6°44.1	·· 55.5
22	282°40.1	188°33.6	57.3	150°39.0	00.7	86°10.5	44.6	21°46.7	55.5
23	297°42.5	203°33.0	57.3	165°39.8	00.3	101°12.6	44.7	36°49.3	55.5
Mer.pass.:03:12		v-0.7 d0.1 m-3.9		v0.8 d-0.4 m1.7		v2.1 d-0.1 m-1.7		v2.6 d-0.0 m0.3	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	312°45.0	218°32.3	N21°57.4	180°40.6	N18°59.9	116°14.7	S05°44.9	51°51.8	S21°55.5
1	327°47.5	233°31.6	57.4	195°41.4	59.5	131°16.9	45.0	66°54.4	55.5
2	342°49.9	248°31.0	57.5	210°42.3	59.0	146°19.0	45.2	81°56.9	55.5
3	357°52.4	263°30.3	·· 57.5	225°43.1	·· 58.6	161°21.2	·· 45.3	96°59.5	·· 55.5
4	12°54.8	278°29.7	57.6	240°43.9	58.2	176°23.3	45.4	112°02.0	55.5
5	27°57.3	293°29.0	57.6	255°44.8	57.8	191°25.4	45.6	127°04.6	55.5
6	42°59.8	308°28.3	N21°57.6	270°45.6	N18°57.4	206°27.6	S05°45.7	142°07.1	S21°55.5
7	58°02.2	323°27.7	57.7	285°46.4	56.9	221°29.7	45.9	157°09.7	55.5
8	73°04.7	338°27.0	57.7	300°47.2	56.5	236°31.9	46.0	172°12.2	55.5
9	88°07.2	353°26.3	·· 57.8	315°48.1	·· 56.1	251°34.0	·· 46.2	187°14.8	·· 55.5
10	103°09.6	8°25.7	57.8	330°48.9	55.7	266°36.1	46.3	202°17.3	55.5
11	118°12.1	23°25.0	57.8	345°49.7	55.2	281°38.3	46.4	217°19.9	55.5
12	133°14.6	38°24.3	N21°57.9	0°50.6	N18°54.8	296°40.4	S05°46.6	232°22.5	S21°55.5
13	148°17.0	53°23.7	57.9	15°51.4	54.4	311°42.6	46.7	247°25.0	55.5
14	163°19.5	68°23.0	57.9	30°52.2	54.0	326°44.7	46.9	262°27.6	55.5
15	178°22.0	83°22.4	·· 57.9	45°53.1	·· 53.5	341°46.8	·· 47.0	277°30.1	·· 55.5
16	193°24.4	98°21.7	58.0	60°53.9	53.1	356°49.0	47.2	292°32.7	55.5
17	208°26.9	113°21.0	58.0	75°54.7	52.7	11°51.1	47.3	307°35.2	55.5
18	223°29.3	128°20.4	N21°58.0	90°55.6	N18°52.3	26°53.2	S05°47.4	322°37.8	S21°55.5
19	238°31.8	143°19.7	58.1	105°56.4	51.8	41°55.4	47.6	337°40.3	55.5
20	253°34.3	158°19.0	58.1	120°57.2	51.4	56°57.5	47.7	352°42.9	55.5
21	268°36.7	173°18.4	·· 58.1	135°58.0	·· 51.0	71°59.7	·· 47.9	7°45.4	·· 55.5
22	283°39.2	188°17.7	58.1	150°58.9	50.6	87°01.8	48.0	22°48.0	55.5
23	298°41.7	203°17.0	58.2	165°59.7	50.1	102°03.9	48.2	37°50.5	55.5
Mer.pass.:03:08		v-0.7 d0.0 m-3.9		v0.8 d-0.4 m1.7		v2.1 d-0.1 m-1.7		v2.6 d-0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.1
Ankaa	353°12.8	-42°12.5
Schedar	349°36.9	56°37.7
Diphda	348°52.9	-17°53.3
Achernar	335°24.6	-57°08.7
Hamal	327°57.5	23°32.5
Polaris	316°31.6	89°19.8
Acamar	315°16.3	-40°13.9
Menkar	314°12.2	4°09.4
Mirfak	308°36.4	49°55.0
Aldebaran	290°46.3	16°32.5
Rigel	281°09.6	-8°11.0
Capella	280°30.6	46°00.6
Bellatrix	278°29.2	6°21.8
Elnath	278°09.3	28°37.1
Alnilam	275°43.8	-1°11.6
Betelgeuse	270°58.5	7°24.5
Canopus	263°55.3	-52°42.3
Sirius	258°31.6	-16°44.5
Adhara	255°10.7	-28°59.8
Procyon	244°57.1	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.5	-59°34.0
Suhail	222°50.8	-43°30.3
Miaplacidus	221°39.9	-69°47.4
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°49.0	61°39.6
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.4	-63°11.9
Gacrux	171°58.0	-57°12.8
Alioth	166°18.6	55°52.3
Spica	158°28.4	-11°15.0
Alkaid	152°56.9	49°14.0
Hadar	148°43.9	-60°27.5
Menkent	148°04.3	-36°27.3
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.8	-60°54.5
Kochab	137°20.2	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.6	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.2
Eltanin	90°44.4	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.3
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.3	-56°40.5
Deneb	49°29.1	45°20.7
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.3
Fomalhaut	15°20.6	-29°31.6
Scheat	13°50.3	28°10.7
Markab	13°35.3	15°18.0

Aug 02 Wed	SHA	Mer.pass
Venus	268°17.1	09:24
Mars	229°14.3	11:59
Jupiter	163°45.1	16:20
Saturn	99°02.3	20:37

Aug 03 Thu	SHA	Mer.pass
Venus	267°02.3	09:25
Mars	228°34.9	11:58
Jupiter	163°37.5	16:16
Saturn	99°04.6	20:33

Aug 04 Fri	SHA	Mer.pass
Venus	265°47.3	09:26
Mars	227°55.6	11:57
Jupiter	163°29.7	16:13
Saturn	99°06.8	20:29

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3464 sec ΔT = TT-UT1 = +68.8376 sec

2017 August 02 to Aug. 04 UT

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°25.7	N17°45.8	65°48.0	13.2'	S16°12.8	-5.5'	54.2'
1	193°25.7	45.1	80°20.1	13.2'	16°18.3	-5.5'	54.2'
2	208°25.8	44.5	94°52.3	13.2'	16°23.7	-5.4'	54.2'
3	223°25.8	·· 43.8	109°24.4	13.1'	16°29.0	-5.3'	54.2'
4	238°25.8	43.2	123°56.6	13.1'	16°34.3	-5.2'	54.2'
5	253°25.9	42.5	138°28.7	13.1'	16°39.5	-5.2'	54.1'
6	268°25.9	N17°41.9	153°00.7	13.1'	S16°44.7	-5.1'	54.1'
7	283°26.0	41.3	167°32.8	13.0'	16°49.7	-5.0'	54.1'
8	298°26.0	40.6	182°04.8	13.0'	16°54.7	-4.9'	54.1'
9	313°26.1	·· 40.0	196°36.7	13.0'	16°59.6	-4.9'	54.1'
10	328°26.1	39.3	211°08.7	12.9'	17°04.4	-4.8'	54.1'
11	343°26.2	38.7	225°40.6	12.9'	17°09.2	-4.7'	54.1'
12	358°26.2	N17°38.0	240°12.5	12.9'	S17°13.9	-4.6'	54.1'
13	13°26.3	37.4	254°44.4	12.9'	17°18.5	-4.6'	54.1'
14	28°26.3	36.7	269°16.3	12.8'	17°23.0	-4.5'	54.1'
15	43°26.4	·· 36.1	283°48.1	12.8'	17°27.4	-4.4'	54.1'
16	58°26.4	35.4	298°19.9	12.8'	17°31.8	-4.3'	54.1'
17	73°26.5	34.8	312°51.7	12.8'	17°36.1	-4.3'	54.1'
18	88°26.5	N17°34.1	327°23.4	12.7'	S17°40.3	-4.2'	54.1'
19	103°26.6	33.5	341°55.2	12.7'	17°44.5	-4.1'	54.1'
20	118°26.6	32.8	356°26.9	12.7'	17°48.5	-4.0'	54.1'
21	133°26.7	·· 32.2	10°58.5	12.7'	17°52.5	-3.9'	54.1'
22	148°26.7	31.5	25°30.2	12.6'	17°56.4	-3.9'	54.1'
23	163°26.8	30.9	40°01.8	12.6'	18°00.2	-3.8'	54.1'
	SD.=15.7	d=-0.6	S.D.=14.8				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°26.8	N17°30.2	54°33.4	12.6'	S18°03.9	-3.7'	54.1'
1	193°26.9	29.6	69°05.0	12.6'	18°07.6	-3.6'	54.1'
2	208°26.9	28.9	83°36.5	12.5'	18°11.1	-3.5'	54.1'
3	223°27.0	·· 28.3	98°08.0	12.5'	18°14.6	-3.4'	54.1'
4	238°27.0	27.6	112°39.5	12.5'	18°18.0	-3.4'	54.1'
5	253°27.1	27.0	127°11.0	12.5'	18°21.4	-3.3'	54.1'
6	268°27.1	N17°26.3	141°42.4	12.4'	S18°24.6	-3.2'	54.1'
7	283°27.2	25.7	156°13.8	12.4'	18°27.8	-3.1'	54.1'
8	298°27.2	25.0	170°45.2	12.4'	18°30.8	-3.0'	54.2'
9	313°27.3	·· 24.3	185°16.6	12.4'	18°33.8	-2.9'	54.2'
10	328°27.3	23.7	199°47.9	12.3'	18°36.7	-2.9'	54.2'
11	343°27.4	23.0	214°19.2	12.3'	18°39.6	-2.8'	54.2'
12	358°27.4	N17°22.4	228°50.5	12.3'	S18°42.3	-2.7'	54.2'
13	13°27.5	21.7	243°21.8	12.3'	18°44.9	-2.6'	54.2'
14	28°27.5	21.0	257°53.0	12.2'	18°47.5	-2.5'	54.2'
15	43°27.6	·· 20.4	272°24.2	12.2'	18°50.0	-2.4'	54.2'
16	58°27.7	19.7	286°55.4	12.2'	18°52.4	-2.4'	54.2'
17	73°27.7	19.1	301°26.6	12.2'	18°54.7	-2.3'	54.2'
18	88°27.8	N17°18.4	315°57.8	12.1'	S18°56.9	-2.2'	54.2'
19	103°27.8	17.7	330°28.9	12.1'	18°59.0	-2.1'	54.2'
20	118°27.9	17.1	345°00.0	12.1'	19°01.1	-2.0'	54.2'
21	133°27.9	·· 16.4	359°31.1	12.1'	19°03.0	-1.9'	54.2'
22	148°28.0	15.8	14°02.1	12.0'	19°04.9	-1.8'	54.2'
23	163°28.0	15.1	28°33.2	12.0'	19°06.7	-1.7'	54.2'
	SD.=15.8	d=-0.7	S.D.=14.8				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°28.1	N17°14.4	43°04.2	12.0'	S19°08.4	-1.7'	54.2'
1	193°28.2	13.8	57°35.2	12.0'	19°10.0	-1.6'	54.2'
2	208°28.2	13.1	72°06.1	12.0'	19°11.5	-1.5'	54.3'
3	223°28.3	·· 12.4	86°37.1	11.9'	19°12.9	-1.4'	54.3'
4	238°28.3	11.8	101°08.0	11.9'	19°14.3	-1.3'	54.3'
5	253°28.4	11.1	115°38.9	11.9'	19°15.5	-1.2'	54.3'
6	268°28.5	N17°10.4	130°09.8	11.9'	S19°16.7	-1.1'	54.3'
7	283°28.5	09.8	144°40.7	11.9'	19°17.8	-1.0'	54.3'
8	298°28.6	09.1	159°11.5	11.8'	19°18.7	-0.9'	54.3'
9	313°28.6	·· 08.4	173°42.4	11.8'	19°19.6	-0.8'	54.3'
10	328°28.7	07.8	188°13.2	11.8'	19°20.4	-0.8'	54.3'
11	343°28.8	07.1	202°44.0	11.8'	19°21.1	-0.7'	54.3'
12	358°28.8	N17°06.4	217°14.8	11.8'	S19°21.8	-0.6'	54.3'
13	13°28.9	05.7	231°45.5	11.8'	19°22.3	-0.5'	54.3'
14	28°28.9	05.1	246°16.3	11.7'	19°22.7	-0.4'	54.4'
15	43°29.0	·· 04.4	260°47.0	11.7'	19°23.1	-0.3'	54.4'
16	58°29.1	03.7	275°17.7	11.7'	19°23.3	-0.2'	54.4'
17	73°29.1	03.1	289°48.4	11.7'	19°23.5	-0.1'	54.4'
18	88°29.2	N17°02.4	304°19.1	11.7'	S19°23.5	-0.0'	54.4'
19	103°29.2	01.7	318°49.7	11.7'	19°23.5	0.1'	54.4'
20	118°29.3	01.0	333°20.4	11.6'	19°23.4	0.2'	54.4'
21	133°29.4	17°00.4	347°51.0	11.6'	19°23.2	0.3'	54.4'
22	148°29.4	16°59.7	2°21.6	11.6'	19°22.9	0.3'	54.4'
23	163°29.5	59.0	16°52.3	11.6'	19°22.5	0.4'	54.5'
	SD.=15.8	d=-0.7	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°						
N 70°			01:44	22:22		
68°			02:26	21:42		
66°		00:55	02:54	21:16	23:07	
64°		01:52	03:15	20:55	22:16	
62°		02:24	03:32	20:39	21:46	
60°	00:50	02:47	03:46	20:25	21:23	23:13
N 58°	01:41	03:05	03:58	20:13	21:05	22:27
56°	02:10	03:20	04:08	20:03	20:50	21:59
54°	02:32	03:33	04:17	19:54	20:38	21:38
52°	02:49	03:44	04:25	19:46	20:27	21:21
50°	03:04	03:54	04:32	19:39	20:17	21:07
45°	03:32	04:14	04:48	19:24	19:57	20:39
N 40°	03:53	04:30	05:00	19:11	19:41	20:18
35°	04:10	04:43	05:11	19:01	19:28	20:02
30°	04:24	04:54	05:20	18:52	19:17	19:48
20°	04:45	05:13	05:36	18:36	18:59	19:27
N 10°	05:02	05:28	05:50	18:22	18:44	19:10
0°	05:16	05:41	06:03	18:10	18:31	18:56
S 10°	05:28	05:53	06:15	17:57	18:19	18:44
20°	05:39	06:06	06:29	17:44	18:07	18:33
30°	05:50	06:19	06:44	17:29	17:54	18:23
35°	05:56	06:26	06:53	17:20	17:47	18:17
40°	06:01	06:34	07:03	17:10	17:39	18:11
45°	06:08	06:43	07:14	16:59	17:30	18:05
S 50°	06:14	06:53	07:28	16:45	17:20	17:59
52°	06:17	06:58	07:35	16:38	17:15	17:56
54°	06:20	07:03	07:42	16:31	17:10	17:53
56°	06:24	07:09	07:50	16:23	17:04	17:49
58°	06:27	07:15	07:59	16:14	16:58	17:46
S 60°	06:31	07:22	08:10	16:03	16:51	17:42

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	19:46			20:36		
N 70°	18:18	19:48	20:54	22:04	22:13	22:47
68°	17:39	18:53	19:51	22:44	23:08	23:50
66°	17:12	18:20	19:16	23:11	23:41	–:–
64°	16:52	17:56	18:50	23:32	–:–	00:05
62°	16:35	17:37	18:31	23:49	–:–	00:24
60°	16:21	17:22	18:14	–:–	00:03	00:40
N 58°	16:09	17:08	18:01	–:–	00:15	00:53
56°	15:59	16:57	17:49	–:–	00:26	01:05
54°	15:50	16:47	17:39	00:02	00:35	01:15
52°	15:42	16:38	17:30	00:09	00:44	01:24
50°	15:35	16:30	17:21	00:15	00:51	01:32
45°	15:19	16:13	17:04	00:29	01:07	01:49
N 40°	15:07	15:59	16:50	00:41	01:20	02:03
35°	14:56	15:48	16:38	00:51	01:31	02:15
30°	14:47	15:38	16:27	00:59	01:41	02:26
20°	14:31	15:20	16:09	01:14	01:58	02:43
N 10°	14:16	15:05	15:53	01:27	02:12	02:59
0°	14:03	14:50	15:39	01:40	02:26	03:14
S 10°	13:50	14:36	15:24	01:52	02:40	03:28
20°	13:36	14:21	15:08	02:05	02:54	03:44
30°	13:21	14:04	14:50	02:20	03:11	04:02
35°	13:11	13:54	14:40	02:29	03:21	04:12
40°	13:01	13:42	14:28	02:39	03:32	04:24
45°	12:49	13:29	14:14	02:50	03:46	04:38
S 50°	12:34	13:12	13:56	03:05	04:02	04:55
52°	12:27	13:04	13:48	03:11	04:09	05:03
54°	12:19	12:56	13:39	03:19	04:18	05:12
56°	12:11	12:46	13:29	03:27	04:27	05:22
58°	12:01	12:35	13:17	03:36	04:38	05:34
S 60°	11:50	12:22	13:04	03:47	04:50	05:47

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 10-12 76-90%
02	06:17	06:15	12:06	20:15	07:51	
03	06:13	06:10	12:06	21:02	08:38	
04	06:08	06:05	12:06	21:50	09:26	

August 05, 06, 07 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	313°44.1	218°16.4	N21°58.2	181°00.5	N18°49.7	117°06.1	S05°48.3	52°53.1	S21°55.5
1	328°46.6	233°15.7	58.2	196°01.4	49.3	132°08.2	48.4	67°55.6	55.5
2	343°49.1	248°15.0	58.2	211°02.2	48.8	147°10.3	48.6	82°58.2	55.5
3	358°51.5	263°14.4	·· 58.2	226°03.0	·· 48.4	162°12.5	·· 48.7	98°00.7	·· 55.5
4	13°54.0	278°13.7	58.3	241°03.9	48.0	177°14.6	48.9	113°03.3	55.5
5	28°56.5	293°13.0	58.3	256°04.7	47.6	192°16.7	49.0	128°05.8	55.5
6	43°58.9	308°12.4	N21°58.3	271°05.5	N18°47.1	207°18.9	S05°49.2	143°08.4	S21°55.5
7	59°01.4	323°11.7	58.3	286°06.4	46.7	222°21.0	49.3	158°10.9	55.5
8	74°03.8	338°11.0	58.3	301°07.2	46.3	237°23.1	49.4	173°13.5	55.5
9	89°06.3	353°10.4	·· 58.3	316°08.0	·· 45.8	252°25.3	·· 49.6	188°16.0	·· 55.5
10	104°08.8	8°09.7	58.3	331°08.9	45.4	267°27.4	49.7	203°18.6	55.5
11	119°11.2	23°09.0	58.3	346°09.7	45.0	282°29.6	49.9	218°21.1	55.5
12	134°13.7	38°08.4	N21°58.4	1°10.5	N18°44.6	297°31.7	S05°50.0	233°23.7	S21°55.5
13	149°16.2	53°07.7	58.4	16°11.4	44.1	312°33.8	50.2	248°26.2	55.5
14	164°18.6	68°07.0	58.4	31°12.2	43.7	327°36.0	50.3	263°28.8	55.5
15	179°21.1	83°06.3	·· 58.4	46°13.0	·· 43.3	342°38.1	·· 50.5	278°31.3	·· 55.5
16	194°23.6	98°05.7	58.4	61°13.9	42.8	357°40.2	50.6	293°33.9	55.6
17	209°26.0	113°05.0	58.4	76°14.7	42.4	12°42.4	50.7	308°36.4	55.6
18	224°28.5	128°04.3	N21°58.4	91°15.5	N18°42.0	27°44.5	S05°50.9	323°38.9	S21°55.6
19	239°30.9	143°03.7	58.4	106°16.4	41.5	42°46.6	51.0	338°41.5	55.6
20	254°33.4	158°03.0	58.4	121°17.2	41.1	57°48.8	51.2	353°44.0	55.6
21	269°35.9	173°02.3	·· 58.4	136°18.1	·· 40.7	72°50.9	·· 51.3	8°46.6	·· 55.6
22	284°38.3	188°01.7	58.4	151°18.9	40.2	87°53.0	51.5	23°49.1	55.6
23	299°40.8	203°01.0	58.4	166°19.7	39.8	102°55.2	51.6	38°51.7	55.6
Mer.pass.:03:05		v-0.7 d0.0 m-3.9		v0.8 d-0.4 m1.7		v2.1 d-0.1 m-1.7		v2.6 d-0.0 m0.3	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	314°43.3	218°00.3	N21°58.4	181°20.6	N18°39.4	117°57.3	S05°51.8	53°54.2	S21°55.6
1	329°45.7	232°59.6	58.4	196°21.4	38.9	132°59.4	51.9	68°56.8	55.6
2	344°48.2	247°59.0	58.4	211°22.2	38.5	148°01.5	52.0	83°59.3	55.6
3	359°50.7	262°58.3	·· 58.4	226°23.1	·· 38.1	163°03.7	·· 52.2	99°01.9	·· 55.6
4	14°53.1	277°57.6	58.4	241°23.9	37.6	178°05.8	52.3	114°04.4	55.6
5	29°55.6	292°57.0	58.4	256°24.7	37.2	193°07.9	52.5	129°07.0	55.6
6	44°58.1	307°56.3	N21°58.3	271°25.6	N18°36.8	208°10.1	S05°52.6	144°09.5	S21°55.6
7	60°00.5	322°55.6	58.3	286°26.4	36.3	223°12.2	52.8	159°12.1	55.6
8	75°03.0	337°54.9	58.3	301°27.3	35.9	238°14.3	52.9	174°14.6	55.6
9	90°05.4	352°54.3	·· 58.3	316°28.1	·· 35.5	253°16.5	·· 53.1	189°17.1	·· 55.6
10	105°07.9	7°53.6	58.3	331°28.9	35.0	268°18.6	53.2	204°19.7	55.6
11	120°10.4	22°52.9	58.3	346°29.8	34.6	283°20.7	53.4	219°22.2	55.6
12	135°12.8	37°52.2	N21°58.3	1°30.6	N18°34.2	298°22.9	S05°53.5	234°24.8	S21°55.6
13	150°15.3	52°51.6	58.3	16°31.4	33.7	313°25.0	53.6	249°27.3	55.6
14	165°17.8	67°50.9	58.2	31°32.3	33.3	328°27.1	53.8	264°29.9	55.6
15	180°20.2	82°50.2	·· 58.2	46°33.1	·· 32.9	343°29.2	·· 53.9	279°32.4	·· 55.6
16	195°22.7	97°49.6	58.2	61°34.0	32.4	358°31.4	54.1	294°35.0	55.6
17	210°25.2	112°48.9	58.2	76°34.8	32.0	13°33.5	54.2	309°37.5	55.6
18	225°27.6	127°48.2	N21°58.2	91°35.6	N18°31.6	28°35.6	S05°54.4	324°40.0	S21°55.6
19	240°30.1	142°47.5	58.1	106°36.5	31.1	43°37.8	54.5	339°42.6	55.6
20	255°32.6	157°46.9	58.1	121°37.3	30.7	58°39.9	54.7	354°45.1	55.6
21	270°35.0	172°46.2	·· 58.1	136°38.2	·· 30.3	73°42.0	·· 54.8	9°47.7	·· 55.6
22	285°37.5	187°45.5	58.1	151°39.0	29.8	88°44.1	55.0	24°50.2	55.6
23	300°39.9	202°44.8	58.0	166°39.8	29.4	103°46.3	55.1	39°52.8	55.6
Mer.pass.:03:01		v-0.7 d-0.0 m-3.9		v0.8 d-0.4 m1.7		v2.1 d-0.1 m-1.7		v2.5 d-0.0 m0.3	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	315°42.4	217°44.2	N21°58.0	181°40.7	N18°28.9	118°48.4	S05°55.3	54°55.3	S21°55.6
1	330°44.9	232°43.5	58.0	196°41.5	28.5	133°50.5	55.4	69°57.8	55.6
2	345°47.3	247°42.8	57.9	211°42.3	28.1	148°52.7	55.5	85°00.4	55.6
3	0°49.8	262°42.1	·· 57.9	226°43.2	·· 27.6	163°54.8	·· 55.7	100°02.9	·· 55.6
4	15°52.3	277°41.5	57.9	241°44.0	27.2	178°56.9	55.8	115°05.5	55.6
5	30°54.7	292°40.8	57.9	256°44.9	26.7	193°59.0	56.0	130°08.0	55.7
6	45°57.2	307°40.1	N21°57.8	271°45.7	N18°26.3	209°01.2	S05°56.1	145°10.6	S21°55.7
7	60°59.7	322°39.4	57.8	286°46.6	25.9	224°03.3	56.3	160°13.1	55.7
8	76°02.1	337°38.7	57.7	301°47.4	25.4	239°05.4	56.4	175°15.6	55.7
9	91°04.6	352°38.1	·· 57.7	316°48.2	·· 25.0	254°07.5	·· 56.6	190°18.2	·· 55.7
10	106°07.1	7°37.4	57.7	331°49.1	24.5	269°09.7	56.7	205°20.7	55.7
11	121°09.5	22°36.7	57.6	346°49.9	24.1	284°11.8	56.9	220°23.3	55.7
12	136°12.0	37°36.0	N21°57.6	1°50.8	N18°23.7	299°13.9	S05°57.0	235°25.8	S21°55.7
13	151°14.4	52°35.4	57.6	16°51.6	23.2	314°16.0	57.2	250°28.3	55.7
14	166°16.9	67°34.7	57.5	31°52.4	22.8	329°18.2	57.3	265°30.9	55.7
15	181°19.4	82°34.0	·· 57.5	46°53.3	·· 22.3	344°20.3	·· 57.5	280°33.4	·· 55.7
16	196°21.8	97°33.3	57.4	61°54.1	21.9	359°22.4	57.6	295°36.0	55.7
17	211°24.3	112°32.6	57.4	76°55.0	21.5	14°24.5	57.8	310°38.5	55.7
18	226°26.8	127°32.0	N21°57.3	91°55.8	N18°21.0	29°26.7	S05°57.9	325°41.0	S21°55.7
19	241°29.2	142°31.3	57.3	106°56.7	20.6	44°28.8	58.1	340°43.6	55.7
20	256°31.7	157°30.6	57.2	121°57.5	20.1	59°30.9	58.2	355°46.1	55.7
21	271°34.2	172°29.9	·· 57.2	136°58.3	·· 19.7	74°33.0	·· 58.3	10°48.7	·· 55.7
22	286°36.6	187°29.3	57.1	151°59.2	19.3	89°35.2	58.5	25°51.2	55.7
23	301°39.1	202°28.6	57.1	167°00.0	18.8	104°37.3	58.6	40°53.7	55.7
Mer.pass.:02:57		v-0.7 d-0.0 m-3.9		v0.8 d-0.4 m1.7		v2.1 d-0.1 m-1.7		v2.5 d-0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.1
Ankaa	353°12.7	-42°12.5
Schedar	349°36.9	56°37.8
Diphda	348°52.9	-17°53.3
Achernar	335°24.6	-57°08.7
Hamal	327°57.5	23°32.5
Polaris	316°30.1	89°19.9
Acamar	315°16.3	-40°13.9
Menkar	314°12.1	4°09.4
Mirfak	308°36.4	49°55.0
Aldebaran	290°46.3	16°32.5
Rigel	281°09.6	-8°11.0
Capella	280°30.6	46°00.6
Bellatrix	278°29.2	6°21.8
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.6
Betelgeuse	270°58.5	7°24.5
Canopus	263°55.3	-52°42.3
Sirius	258°31.5	-16°44.5
Adhara	255°10.6	-28°59.8
Procyon	244°57.1	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.5	-59°34.0
Suhail	222°50.8	-43°30.2
Miaplacidus	221°39.9	-69°47.4
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°49.0	61°39.6
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.5	-63°11.9
Gacrux	171°58.0	-57°12.8
Alioth	166°18.6	55°52.2
Spica	158°28.4	-11°15.0
Alkaid	152°56.9	49°14.0
Hadar	148°43.9	-60°27.5
Menkent	148°04.3	-36°27.3
Arcturus	145°53.2	19°05.8
Rigil Kent.	139°47.9	-60°54.5
Kochab	137°20.2	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.7
Antares	112°22.6	-26°28.1
Atria	107°21.6	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.2
Eltanin	90°44.5	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.4
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.1
Peacock	53°14.3	-56°40.5
Deneb	49°29.1	45°20.8
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.6	-29°31.6
Scheat	13°50.3	28°10.7
Markab	13°35.2	15°18.0

Aug 05 Sat	SHA	Mer.pass
Venus	264°32.2	09:27
Mars	227°16.4	11:55
Jupiter	163°21.9	16:09
Saturn	99°08.9	20:25

Aug 06 Sun	SHA	Mer.pass
Venus	263°17.0	09:28
Mars	226°37.3	11:54
Jupiter	163°14.0	16:06
Saturn	99°11.0	20:21

Aug 07 Mon	SHA	Mer.pass
Venus	262°01.7	09:29
Mars	225°58.3	11:53
Jupiter	163°06.0	16:02
Saturn	99°12.9	20:17

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3454 sec ΔT = TT-UT1 = +68.8386 sec

2017 August 05 to Aug. 07 UT

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°29.6	N16°58.3	31°22.9	11.6'	S19°22.0	0.5'	54.5'
1	193°29.6	57.7	45°53.4	11.6'	19°21.4	0.6'	54.5'
2	208°29.7	57.0	60°24.0	11.6'	19°20.8	0.7'	54.5'
3	223°29.8	·· 56.3	74°54.6	11.6'	19°20.0	0.8'	54.5'
4	238°29.8	55.6	89°25.1	11.5'	19°19.1	0.9'	54.5'
5	253°29.9	55.0	103°55.6	11.5'	19°18.2	1.0'	54.5'
6	268°29.9	N16°54.3	118°26.2	11.5'	S19°17.2	1.1'	54.5'
7	283°30.0	53.6	132°56.7	11.5'	19°16.0	1.2'	54.6'
8	298°30.1	52.9	147°27.2	11.5'	19°14.8	1.3'	54.6'
9	313°30.1	·· 52.2	161°57.7	11.5'	19°13.5	1.4'	54.6'
10	328°30.2	51.6	176°28.2	11.5'	19°12.1	1.5'	54.6'
11	343°30.3	50.9	190°58.7	11.5'	19°10.5	1.6'	54.6'
12	358°30.3	N16°50.2	205°29.1	11.5'	S19°08.9	1.6'	54.6'
13	13°30.4	49.5	219°59.6	11.5'	19°07.3	1.7'	54.6'
14	28°30.5	48.8	234°30.1	11.5'	19°05.5	1.8'	54.6'
15	43°30.5	·· 48.1	249°00.5	11.4'	19°03.6	1.9'	54.7'
16	58°30.6	47.5	263°31.0	11.4'	19°01.6	2.0'	54.7'
17	73°30.7	46.8	278°01.4	11.4'	18°59.5	2.1'	54.7'
18	88°30.7	N16°46.1	292°31.8	11.4'	S18°57.4	2.2'	54.7'
19	103°30.8	45.4	307°02.3	11.4'	18°55.1	2.3'	54.7'
20	118°30.9	44.7	321°32.7	11.4'	18°52.8	2.4'	54.7'
21	133°31.0	·· 44.0	336°03.1	11.4'	18°50.4	2.5'	54.7'
22	148°31.0	43.4	350°33.5	11.4'	18°47.8	2.6'	54.8'
23	163°31.1	42.7	5°03.9	11.4'	18°45.2	2.7'	54.8'
	SD.=15.8	d=-0.7	S.D.=14.9				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°31.2	N16°42.0	19°34.3	11.4'	S18°42.5	2.8'	54.8'
1	193°31.2	41.3	34°04.8	11.4'	18°39.7	2.9'	54.8'
2	208°31.3	40.6	48°35.2	11.4'	18°36.8	2.9'	54.8'
3	223°31.4	·· 39.9	63°05.6	11.4'	18°33.8	3.0'	54.8'
4	238°31.4	39.2	77°36.0	11.4'	18°30.7	3.1'	54.9'
5	253°31.5	38.5	92°06.4	11.4'	18°27.5	3.2'	54.9'
6	268°31.6	N16°37.9	106°36.8	11.4'	S18°24.3	3.3'	54.9'
7	283°31.7	37.2	121°07.2	11.4'	18°20.9	3.4'	54.9'
8	298°31.7	36.5	135°37.6	11.4'	18°17.4	3.5'	54.9'
9	313°31.8	·· 35.8	150°08.0	11.4'	18°13.9	3.6'	54.9'
10	328°31.9	35.1	164°38.4	11.4'	18°10.3	3.7'	55.0'
11	343°31.9	34.4	179°08.8	11.4'	18°06.5	3.8'	55.0'
12	358°32.0	N16°33.7	193°39.2	11.4'	S18°02.7	3.9'	55.0'
13	13°32.1	33.0	208°09.7	11.4'	17°58.8	4.0'	55.0'
14	28°32.2	32.3	222°40.1	11.4'	17°54.8	4.0'	55.0'
15	43°32.2	·· 31.6	237°10.5	11.4'	17°50.7	4.1'	55.0'
16	58°32.3	30.9	251°40.9	11.4'	17°46.6	4.2'	55.1'
17	73°32.4	30.2	266°11.3	11.4'	17°42.3	4.3'	55.1'
18	88°32.5	N16°29.5	280°41.8	11.4'	S17°37.9	4.4'	55.1'
19	103°32.5	28.8	295°12.2	11.4'	17°33.5	4.5'	55.1'
20	118°32.6	28.1	309°42.7	11.4'	17°29.0	4.6'	55.1'
21	133°32.7	·· 27.4	324°13.1	11.5'	17°24.3	4.7'	55.1'
22	148°32.8	26.8	338°43.6	11.5'	17°19.6	4.8'	55.2'
23	163°32.8	26.1	353°14.0	11.5'	17°14.8	4.8'	55.2'
	SD.=15.8	d=-0.7	S.D.=15.0				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°32.9	N16°25.4	7°44.5	11.5'	S17°10.0	4.9'	55.2'
1	193°33.0	24.7	22°15.0	11.5'	17°05.0	5.0'	55.2'
2	208°33.1	24.0	36°45.5	11.5'	16°59.9	5.1'	55.2'
3	223°33.1	·· 23.3	51°15.9	11.5'	16°54.8	5.2'	55.2'
4	238°33.2	22.6	65°46.4	11.5'	16°49.6	5.3'	55.3'
5	253°33.3	21.9	80°17.0	11.5'	16°44.2	5.4'	55.3'
6	268°33.4	N16°21.2	94°47.5	11.5'	S16°38.8	5.4'	55.3'
7	283°33.5	20.5	109°18.0	11.5'	16°33.4	5.5'	55.3'
8	298°33.5	19.8	123°48.5	11.5'	16°27.8	5.6'	55.3'
9	313°33.6	·· 19.1	138°19.1	11.5'	16°22.1	5.7'	55.4'
10	328°33.7	18.3	152°49.6	11.6'	16°16.4	5.8'	55.4'
11	343°33.8	17.6	167°20.2	11.6'	16°10.6	5.9'	55.4'
12	358°33.8	N16°16.9	181°50.7	11.6'	S16°04.7	5.9'	55.4'
13	13°33.9	16.2	196°21.3	11.6'	15°58.7	6.0'	55.4'
14	28°34.0	15.5	210°51.9	11.6'	15°52.6	6.1'	55.5'
15	43°34.1	·· 14.8	225°22.5	11.6'	15°46.4	6.2'	55.5'
16	58°34.2	14.1	239°53.1	11.6'	15°40.2	6.3'	55.5'
17	73°34.2	13.4	254°23.7	11.6'	15°33.9	6.4'	55.5'
18	88°34.3	N16°12.7	268°54.3	11.6'	S15°27.5	6.4'	55.5'
19	103°34.4	12.0	283°25.0	11.6'	15°21.0	6.5'	55.5'
20	118°34.5	11.3	297°55.6	11.7'	15°14.5	6.6'	55.6'
21	133°34.6	·· 10.6	312°26.3	11.7'	15°07.8	6.7'	55.6'
22	148°34.7	09.9	326°57.0	11.7'	15°01.1	6.8'	55.6'
23	163°34.7	09.2	341°27.7	11.7'	14°54.3	6.8'	55.6'
	SD.=15.8	d=-0.7	S.D.=15.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°			01:01	22:58		
N 70°			02:05	22:01		
68°			02:40	21:28		
66°		01:25	03:05	21:04	22:40	
64°		02:07	03:24	20:45	22:00	
62°		02:35	03:40	20:30	21:34	
60°	01:16	02:56	03:53	20:17	21:13	22:49
N 58°	01:55	03:13	04:04	20:06	20:57	22:13
56°	02:21	03:27	04:14	19:57	20:43	21:48
54°	02:40	03:39	04:22	19:48	20:31	21:29
52°	02:56	03:50	04:30	19:41	20:21	21:13
50°	03:10	03:59	04:37	19:34	20:12	21:00
45°	03:37	04:18	04:51	19:20	19:53	20:34
N 40°	03:57	04:33	05:03	19:08	19:38	20:14
35°	04:13	04:46	05:13	18:58	19:25	19:58
30°	04:26	04:56	05:22	18:49	19:15	19:45
20°	04:46	05:14	05:37	18:34	18:58	19:25
N 10°	05:03	05:28	05:50	18:21	18:43	19:09
0°	05:16	05:41	06:02	18:09	18:31	18:56
S 10°	05:27	05:53	06:14	17:57	18:19	18:45
20°	05:38	06:04	06:27	17:45	18:08	18:34
30°	05:48	06:17	06:42	17:30	17:55	18:24
35°	05:53	06:23	06:50	17:22	17:49	18:19
40°	05:58	06:31	06:59	17:13	17:41	18:14
45°	06:04	06:39	07:10	17:02	17:33	18:08
S 50°	06:10	06:49	07:23	16:49	17:24	18:02
52°	06:13	06:53	07:30	16:43	17:19	18:00
54°	06:16	06:58	07:36	16:36	17:14	17:57
56°	06:18	07:03	07:44	16:28	17:09	17:54
58°	06:22	07:09	07:53	16:20	17:04	17:51
S 60°	06:25	07:15	08:02	16:10	16:57	17:48

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°		22:24	21:57		–:–	00:41
N 70°	21:18	21:23	21:24	–:–	00:05	01:41
68°	20:28	20:48	21:00	–:–	00:55	02:15
66°	19:56	20:23	20:41	00:25	01:26	02:40
64°	19:33	20:03	20:26	00:51	01:49	02:59
62°	19:14	19:47	20:13	01:10	02:08	03:15
60°	18:58	19:34	20:02	01:26	02:23	03:28
N 58°	18:45	19:22	19:52	01:40	02:36	03:39
56°	18:34	19:12	19:44	01:52	02:47	03:49
54°	18:24	19:03	19:37	02:02	02:57	03:58
52°	18:15	18:55	19:30	02:11	03:05	04:05
50°	18:07	18:48	19:24	02:19	03:13	04:12
45°	17:51	18:33	19:11	02:37	03:30	04:27
N 40°	17:37	18:20	19:00	02:51	03:43	04:39
35°	17:25	18:09	18:51	03:03	03:55	04:49
30°	17:15	18:00	18:43	03:14	04:05	04:58
20°	16:57	17:44	18:29	03:32	04:22	05:14
N 10°	16:42	17:30	18:17	03:47	04:37	05:27
0°	16:27	17:16	18:05	04:02	04:51	05:40
S 10°	16:13	17:03	17:53	04:17	05:05	05:52
20°	15:57	16:49	17:41	04:32	05:20	06:06
30°	15:40	16:32	17:27	04:50	05:37	06:21
35°	15:29	16:23	17:19	05:01	05:47	06:29
40°	15:18	16:12	17:09	05:13	05:58	06:39
45°	15:04	15:59	16:58	05:27	06:11	06:51
S 50°	14:47	15:43	16:45	05:44	06:27	07:05
52°	14:39	15:36	16:39	05:52	06:35	07:12
54°	14:30	15:28	16:32	06:01	06:43	07:19
56°	14:20	15:19	16:24	06:11	06:52	07:27
58°	14:09	15:09	16:15	06:22	07:03	07:36
S 60°	13:55	14:57	16:05	06:36	07:15	07:47

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 13-15 95-100%
05	06:02	05:59	12:06	22:39	10:15	
06	05:55	05:52	12:06	23:28	11:04	
07	05:48	05:45	12:06	–:–	11:52	

August 08, 09, 10 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	316°41.5	217°27.9	N21°57.0	182°00.9	N18°18.4	119°39.4	S05°58.8	55°56.3	S21°55.7
1	331°44.0	232°27.2	57.0	197°01.7	17.9	134°41.5	58.9	70°58.8	55.7
2	346°46.5	247°26.5	56.9	212°02.6	17.5	149°43.7	59.1	86°01.4	55.7
3	1°48.9	262°25.9	·· 56.9	227°03.4	·· 17.0	164°45.8	·· 59.2	101°03.9	·· 55.7
4	16°51.4	277°25.2	56.8	242°04.2	16.6	179°47.9	59.4	116°06.4	55.7
5	31°53.9	292°24.5	56.8	257°05.1	16.2	194°50.0	59.5	131°09.0	55.7
6	46°56.3	307°23.8	N21°56.7	272°05.9	N18°15.7	209°52.1	S05°59.7	146°11.5	S21°55.7
7	61°58.8	322°23.1	56.6	287°06.8	15.3	224°54.3	05°59.8	161°14.0	55.7
8	77°01.3	337°22.5	56.6	302°07.6	14.8	239°56.4	06°00.0	176°16.6	55.7
9	92°03.7	352°21.8	·· 56.5	317°08.5	·· 14.4	254°58.5	·· 00.1	191°19.1	·· 55.7
10	107°06.2	7°21.1	56.5	332°09.3	13.9	270°00.6	00.3	206°21.7	55.7
11	122°08.7	22°20.4	56.4	347°10.2	13.5	285°02.8	00.4	221°24.2	55.7
12	137°11.1	37°19.7	N21°56.3	2°11.0	N18°13.0	300°04.9	S06°00.6	236°26.7	S21°55.7
13	152°13.6	52°19.1	56.3	17°11.9	12.6	315°07.0	00.7	251°29.3	55.7
14	167°16.0	67°18.4	56.2	32°12.7	12.2	330°09.1	00.9	266°31.8	55.8
15	182°18.5	82°17.7	·· 56.1	47°13.5	·· 11.7	345°11.2	·· 01.0	281°34.3	·· 55.8
16	197°21.0	97°17.0	56.1	62°14.4	11.3	0°13.4	01.2	296°36.9	55.8
17	212°23.4	112°16.3	56.0	77°15.2	10.8	15°15.5	01.3	311°39.4	55.8
18	227°25.9	127°15.7	N21°55.9	92°16.1	N18°10.4	30°17.6	S06°01.5	326°41.9	S21°55.8
19	242°28.4	142°15.0	55.9	107°16.9	09.9	45°19.7	01.6	341°44.5	55.8
20	257°30.8	157°14.3	55.8	122°17.8	09.5	60°21.8	01.8	356°47.0	55.8
21	272°33.3	172°13.6	·· 55.7	137°18.6	·· 09.0	75°24.0	·· 01.9	11°49.5	·· 55.8
22	287°35.8	187°12.9	55.6	152°19.5	08.6	90°26.1	02.1	26°52.1	55.8
23	302°38.2	202°12.2	55.6	167°20.3	08.1	105°28.2	02.2	41°54.6	55.8
Mer.pass.:02:53		v-0.7 d-0.1 m-3.9		v0.8 d-0.4 m1.7		v2.1 d-0.1 m-1.7		v2.5 d-0.0 m0.3	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	317°40.7	217°11.6	N21°55.5	182°21.2	N18°07.7	120°30.3	S06°02.4	56°57.2	S21°55.8
1	332°43.2	232°10.9	55.4	197°22.0	07.2	135°32.4	02.5	71°59.7	55.8
2	347°45.6	247°10.2	55.3	212°22.9	06.8	150°34.6	02.7	87°02.2	55.8
3	2°48.1	262°09.5	·· 55.2	227°23.7	·· 06.3	165°36.7	·· 02.8	102°04.8	·· 55.8
4	17°50.5	277°08.8	55.2	242°24.6	05.9	180°38.8	03.0	117°07.3	55.8
5	32°53.0	292°08.1	55.1	257°25.4	05.4	195°40.9	03.1	132°09.8	55.8
6	47°55.5	307°07.5	N21°55.0	272°26.3	N18°05.0	210°43.0	S06°03.3	147°12.4	S21°55.8
7	62°57.9	322°06.8	54.9	287°27.1	04.5	225°45.2	03.4	162°14.9	55.8
8	78°00.4	337°06.1	54.8	302°28.0	04.1	240°47.3	03.6	177°17.4	55.8
9	93°02.9	352°05.4	·· 54.7	317°28.8	·· 03.6	255°49.4	·· 03.7	192°20.0	·· 55.8
10	108°05.3	7°04.7	54.7	332°29.7	03.2	270°51.5	03.9	207°22.5	55.8
11	123°07.8	22°04.0	54.6	347°30.5	02.7	285°53.6	04.0	222°25.0	55.8
12	138°10.3	37°03.4	N21°54.5	2°31.4	N18°02.3	300°55.7	S06°04.2	237°27.6	S21°55.8
13	153°12.7	52°02.7	54.4	17°32.2	01.8	315°57.9	04.3	252°30.1	55.8
14	168°15.2	67°02.0	54.3	32°33.1	01.4	331°00.0	04.5	267°32.6	55.8
15	183°17.6	82°01.3	·· 54.2	47°33.9	·· 00.9	346°02.1	·· 04.6	282°35.2	·· 55.8
16	198°20.1	97°00.6	54.1	62°34.8	00.5	1°04.2	04.8	297°37.7	55.8
17	213°22.6	111°59.9	54.0	77°35.6	18°00.0	16°06.3	04.9	312°40.2	55.8
18	228°25.0	126°59.3	N21°53.9	92°36.5	N17°59.6	31°08.4	S06°05.1	327°42.7	S21°55.8
19	243°27.5	141°58.6	53.8	107°37.3	59.1	46°10.6	05.2	342°45.3	55.9
20	258°30.0	156°57.9	53.7	122°38.2	58.7	61°12.7	05.4	357°47.8	55.9
21	273°32.4	171°57.2	·· 53.6	137°39.0	·· 58.2	76°14.8	·· 05.5	12°50.3	·· 55.9
22	288°34.9	186°56.5	53.5	152°39.9	57.8	91°16.9	05.7	27°52.9	55.9
23	303°37.4	201°55.8	53.4	167°40.7	57.3	106°19.0	05.8	42°55.4	55.9
Mer.pass.:02:49		v-0.7 d-0.1 m-3.9		v0.8 d-0.4 m1.7		v2.1 d-0.1 m-1.7		v2.5 d-0.0 m0.3	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	318°39.8	216°55.1	N21°53.3	182°41.6	N17°56.9	121°21.1	S06°06.0	57°57.9	S21°55.9
1	333°42.3	231°54.5	53.2	197°42.4	56.4	136°23.2	06.1	73°00.5	55.9
2	348°44.8	246°53.8	53.1	212°43.3	56.0	151°25.4	06.3	88°03.0	55.9
3	3°47.2	261°53.1	·· 53.0	227°44.1	·· 55.5	166°27.5	·· 06.4	103°05.5	·· 55.9
4	18°49.7	276°52.4	52.9	242°45.0	55.1	181°29.6	06.6	118°08.1	55.9
5	33°52.1	291°51.7	52.8	257°45.8	54.6	196°31.7	06.7	133°10.6	55.9
6	48°54.6	306°51.0	N21°52.7	272°46.7	N17°54.2	211°33.8	S06°06.9	148°13.1	S21°55.9
7	63°57.1	321°50.4	52.6	287°47.5	53.7	226°35.9	07.0	163°15.6	55.9
8	78°59.5	336°49.7	52.5	302°48.4	53.2	241°38.0	07.2	178°18.2	55.9
9	94°02.0	351°49.0	·· 52.4	317°49.2	·· 52.8	256°40.2	·· 07.3	193°20.7	·· 55.9
10	109°04.5	6°48.3	52.3	332°50.1	52.3	271°42.3	07.5	208°23.2	55.9
11	124°06.9	21°47.6	52.1	347°50.9	51.9	286°44.4	07.6	223°25.8	55.9
12	139°09.4	36°46.9	N21°52.0	2°51.8	N17°51.4	301°46.5	S06°07.8	238°28.3	S21°55.9
13	154°11.9	51°46.2	51.9	17°52.6	51.0	316°48.6	07.9	253°30.8	55.9
14	169°14.3	66°45.5	51.8	32°53.5	50.5	331°50.7	08.1	268°33.3	55.9
15	184°16.8	81°44.9	·· 51.7	47°54.3	·· 50.1	346°52.8	·· 08.2	283°35.9	·· 55.9
16	199°19.2	96°44.2	51.6	62°55.2	49.6	1°55.0	08.4	298°38.4	55.9
17	214°21.7	111°43.5	51.4	77°56.1	49.1	16°57.1	08.5	313°40.9	55.9
18	229°24.2	126°42.8	N21°51.3	92°56.9	N17°48.7	31°59.2	S06°08.7	328°43.5	S21°55.9
19	244°26.6	141°42.1	51.2	107°57.8	48.2	47°01.3	08.8	343°46.0	55.9
20	259°29.1	156°41.4	51.1	122°58.6	47.8	62°03.4	09.0	358°48.5	55.9
21	274°31.6	171°40.7	·· 51.0	137°59.5	·· 47.3	77°05.5	·· 09.2	13°51.0	·· 55.9
22	289°34.0	186°40.1	50.8	153°00.3	46.9	92°07.6	09.3	28°53.6	56.0
23	304°36.5	201°39.4	50.7	168°01.2	46.4	107°09.7	09.5	43°56.1	56.0
Mer.pass.:02:45		v-0.7 d-0.1 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.7		v2.5 d-0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.2
Ankaa	353°12.7	-42°12.5
Schedar	349°36.9	56°37.8
Diphda	348°52.9	-17°53.3
Achernar	335°24.6	-57°08.7
Hamal	327°57.5	23°32.5
Polaris	316°28.7	89°19.9
Acamar	315°16.2	-40°13.9
Menkar	314°12.1	4°09.4
Mirfak	308°36.3	49°55.0
Aldebaran	290°46.3	16°32.5
Rigel	281°09.5	-8°10.9
Capella	280°30.5	46°00.6
Bellatrix	278°29.2	6°21.8
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.5
Betelgeuse	270°58.5	7°24.5
Canopus	263°55.3	-52°42.2
Sirius	258°31.5	-16°44.4
Adhara	255°10.6	-28°59.8
Procyon	244°57.1	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.5	-59°34.0
Suhail	222°50.8	-43°30.2
Miaplacidus	221°39.9	-69°47.4
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°49.0	61°39.6
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.5	-63°11.9
Gacrux	171°58.0	-57°12.8
Alioth	166°18.6	55°52.2
Spica	158°28.4	-11°15.0
Alkaid	152°56.9	49°14.0
Hadar	148°43.9	-60°27.5
Menkent	148°04.3	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°47.9	-60°54.5
Kochab	137°20.3	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.7
Antares	112°22.7	-26°28.1
Atria	107°21.6	-69°03.5
Sabik	102°09.1	-15°44.6
Shaula	96°17.8	-37°06.8
Rasalhague	96°03.6	12°33.2
Eltanin	90°44.5	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.4
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.5
Deneb	49°29.1	45°20.8
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.6	-29°31.6
Scheat	13°50.3	28°10.7
Markab	13°35.2	15°18.0

Aug 08 Tue	**SHA**	**Mer.pass**
Venus	260°46.3	09:31
Mars	225°19.3	11:51
Jupiter	162°57.9	15:59
Saturn	99°14.7	20:13

Aug 09 Wed	**SHA**	**Mer.pass**
Venus	259°30.9	09:32
Mars	224°40.5	11:50
Jupiter	162°49.6	15:56
Saturn	99°16.5	20:09

Aug 10 Thu	**SHA**	**Mer.pass**
Venus	258°15.3	09:33
Mars	224°01.7	11:49
Jupiter	162°41.3	15:52
Saturn	99°18.1	20:05

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3444 sec ΔT = TT-UT1 = +68.8396 sec

2017 August 08 to Aug. 10 UT

h

	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°34.8	N16°08.5	355°58.4	11.7'	S14°47.4	6.9'	55.6'
1	193°34.9	07.8	10°29.1	11.7'	14°40.5	7.0'	55.7'
2	208°35.0	07.0	24°59.8	11.7'	14°33.5	7.1'	55.7'
3	223°35.1	·· 06.3	39°30.5	11.7'	14°26.4	7.1'	55.7'
4	238°35.1	05.6	54°01.3	11.7'	14°19.2	7.2'	55.7'
5	253°35.2	04.9	68°32.0	11.8'	14°11.9	7.3'	55.7'
6	268°35.3	N16°04.2	83°02.8	11.8'	S14°04.6	7.4'	55.8'
7	283°35.4	03.5	97°33.6	11.8'	13°57.2	7.4'	55.8'
8	298°35.5	02.8	112°04.4	11.8'	13°49.7	7.5'	55.8'
9	313°35.6	·· 02.1	126°35.2	11.8'	13°42.2	7.6'	55.8'
10	328°35.7	01.3	141°06.0	11.8'	13°34.6	7.7'	55.8'
11	343°35.7	16°00.6	155°36.8	11.8'	13°26.9	7.7'	55.9'
12	358°35.8	N15°59.9	170°07.6	11.8'	S13°19.1	7.8'	55.9'
13	13°35.9	59.2	184°38.5	11.9'	13°11.3	7.9'	55.9'
14	28°36.0	58.5	199°09.4	11.9'	13°03.4	7.9'	55.9'
15	43°36.1	·· 57.8	213°40.2	11.9'	12°55.4	8.0'	55.9'
16	58°36.2	57.1	228°11.1	11.9'	12°47.4	8.1'	56.0'
17	73°36.3	56.3	242°42.0	11.9'	12°39.3	8.1'	56.0'
18	88°36.3	N15°55.6	257°12.9	11.9'	S12°31.1	8.2'	56.0'
19	103°36.4	54.9	271°43.8	11.9'	12°22.9	8.3'	56.0'
20	118°36.5	54.2	286°14.8	11.9'	12°14.6	8.3'	56.0'
21	133°36.6	·· 53.5	300°45.7	11.9'	12°06.2	8.4'	56.1'
22	148°36.7	52.8	315°16.7	12.0'	11°57.7	8.5'	56.1'
23	163°36.8	52.0	329°47.6	12.0'	11°49.2	8.5'	56.1'
	SD.=15.8	d=-0.7	S.D.=15.2				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°36.9	N15°51.3	344°18.6	12.0'	S11°40.7	8.6'	56.1'
1	193°37.0	50.6	358°49.6	12.0'	11°32.0	8.7'	56.1'
2	208°37.0	49.9	13°20.6	12.0'	11°23.3	8.7'	56.2'
3	223°37.1	·· 49.2	27°51.6	12.0'	11°14.6	8.8'	56.2'
4	238°37.2	48.4	42°22.6	12.0'	11°05.8	8.8'	56.2'
5	253°37.3	47.7	56°53.7	12.0'	10°56.9	8.9'	56.2'
6	268°37.4	N15°47.0	71°24.7	12.0'	S10°48.0	9.0'	56.3'
7	283°37.5	46.3	85°55.8	12.1'	10°39.0	9.0'	56.3'
8	298°37.6	45.5	100°26.8	12.1'	10°29.9	9.1'	56.3'
9	313°37.7	·· 44.8	114°57.9	12.1'	10°20.8	9.1'	56.3'
10	328°37.8	44.1	129°29.0	12.1'	10°11.6	9.2'	56.3'
11	343°37.9	43.4	144°00.0	12.1'	10°02.4	9.3'	56.4'
12	358°37.9	N15°42.6	158°31.1	12.1'	S09°53.1	9.3'	56.4'
13	13°38.0	41.9	173°02.2	12.1'	09°43.8	9.4'	56.4'
14	28°38.1	41.2	187°33.3	12.1'	09°34.4	9.4'	56.4'
15	43°38.2	·· 40.5	202°04.5	12.1'	09°25.0	9.5'	56.4'
16	58°38.3	39.7	216°35.6	12.1'	09°15.5	9.5'	56.5'
17	73°38.4	39.0	231°06.7	12.1'	09°05.9	9.6'	56.5'
18	88°38.5	N15°38.3	245°37.9	12.1'	S08°56.4	9.6'	56.5'
19	103°38.6	37.6	260°09.0	12.1'	08°46.7	9.7'	56.5'
20	118°38.7	36.8	274°40.2	12.2'	08°37.0	9.7'	56.5'
21	133°38.8	·· 36.1	289°11.3	12.2'	08°27.3	9.8'	56.6'
22	148°38.9	35.4	303°42.5	12.2'	08°17.5	9.8'	56.6'
23	163°39.0	34.6	318°13.6	12.2'	08°07.6	9.9'	56.6'
	SD.=15.8	d=-0.7	S.D.=15.4				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	178°39.1	N15°33.9	332°44.8	12.2'	S07°57.7	9.9'	56.6'
1	193°39.2	33.2	347°16.0	12.2'	07°47.8	10.0'	56.6'
2	208°39.2	32.4	1°47.2	12.2'	07°37.8	10.0'	56.7'
3	223°39.3	·· 31.7	16°18.3	12.2'	07°27.8	10.0'	56.7'
4	238°39.4	31.0	30°49.5	12.2'	07°17.8	10.1'	56.7'
5	253°39.5	30.3	45°20.7	12.2'	07°07.6	10.1'	56.7'
6	268°39.6	N15°29.5	59°51.9	12.2'	S06°57.5	10.2'	56.8'
7	283°39.7	28.8	74°23.1	12.2'	06°47.3	10.2'	56.8'
8	298°39.8	28.1	88°54.3	12.2'	06°37.1	10.2'	56.8'
9	313°39.9	·· 27.3	103°25.5	12.2'	06°26.8	10.3'	56.8'
10	328°40.0	26.6	117°56.7	12.2'	06°16.5	10.3'	56.8'
11	343°40.1	25.8	132°27.9	12.2'	06°06.2	10.4'	56.9'
12	358°40.2	N15°25.1	146°59.1	12.2'	S05°55.8	10.4'	56.9'
13	13°40.3	24.4	161°30.3	12.2'	05°45.4	10.4'	56.9'
14	28°40.4	23.6	176°01.4	12.2'	05°34.9	10.5'	56.9'
15	43°40.5	·· 22.9	190°32.6	12.2'	05°24.4	10.5'	56.9'
16	58°40.6	22.2	205°03.8	12.2'	05°13.9	10.5'	57.0'
17	73°40.7	21.4	219°35.0	12.2'	05°03.3	10.6'	57.0'
18	88°40.8	N15°20.7	234°06.2	12.2'	S04°52.8	10.6'	57.0'
19	103°40.9	20.0	248°37.4	12.2'	04°42.1	10.6'	57.0'
20	118°41.0	19.2	263°08.5	12.2'	04°31.5	10.7'	57.0'
21	133°41.1	·· 18.5	277°39.7	12.2'	04°20.8	10.7'	57.1'
22	148°41.2	17.7	292°10.8	12.2'	04°10.1	10.7'	57.1'
23	163°41.3	17.0	306°42.0	12.1'	03°59.4	10.7'	57.1'
	SD.=15.8	d=-0.7	S.D.=15.5				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	▭	▭	01:37	22:26	▭	▭
N 70°	▭	▭	02:24	21:42	▭	▭
68°	▭	00:33	02:54	21:13	23:19	▭
66°	▭	01:47	03:16	20:52	22:19	▭
64°	▭	02:22	03:34	20:35	21:46	▭
62°	00:30	02:46	03:48	20:21	21:22	23:24
60°	01:36	03:05	04:00	20:09	21:03	22:30
N 58°	02:08	03:21	04:10	19:59	20:48	22:00
56°	02:30	03:34	04:19	19:50	20:35	21:38
54°	02:49	03:45	04:27	19:42	20:24	21:20
52°	03:03	03:55	04:35	19:35	20:14	21:06
50°	03:16	04:04	04:41	19:29	20:06	20:53
45°	03:41	04:22	04:55	19:15	19:48	20:29
N 40°	04:00	04:36	05:06	19:04	19:34	20:10
35°	04:15	04:48	05:16	18:55	19:22	19:55
30°	04:28	04:58	05:24	18:47	19:12	19:42
20°	04:48	05:15	05:38	18:32	18:56	19:23
N 10°	05:03	05:29	05:51	18:20	18:42	19:08
0°	05:16	05:41	06:02	18:09	18:30	18:55
S 10°	05:26	05:52	06:13	17:58	18:19	18:45
20°	05:36	06:03	06:25	17:46	18:09	18:35
30°	05:46	06:14	06:39	17:32	17:57	18:26
35°	05:50	06:20	06:47	17:24	17:51	18:21
40°	05:55	06:27	06:56	17:16	17:44	18:16
45°	06:00	06:35	07:06	17:05	17:36	18:11
S 50°	06:06	06:44	07:18	16:53	17:27	18:06
52°	06:08	06:48	07:24	16:47	17:23	18:04
54°	06:10	06:53	07:31	16:41	17:19	18:01
56°	06:13	06:57	07:38	16:34	17:14	17:59
58°	06:16	07:03	07:46	16:26	17:09	17:56
S 60°	06:19	07:09	07:55	16:17	17:03	17:53

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	21:44	21:34	21:25	02:49	04:43	06:33
N 70°	21:23	21:21	21:19	03:21	05:03	06:44
68°	21:07	21:11	21:14	03:45	05:18	06:52
66°	20:53	21:02	21:10	04:03	05:30	06:59
64°	20:42	20:55	21:06	04:17	05:40	07:05
62°	20:33	20:49	21:03	04:30	05:49	07:10
60°	20:25	20:44	21:01	04:40	05:56	07:15
N 58°	20:17	20:39	20:58	04:49	06:02	07:19
56°	20:11	20:35	20:56	04:57	06:08	07:22
54°	20:05	20:31	20:54	05:04	06:13	07:25
52°	20:00	20:27	20:52	05:10	06:18	07:28
50°	19:56	20:24	20:51	05:16	06:22	07:30
45°	19:45	20:17	20:47	05:28	06:31	07:36
N 40°	19:37	20:11	20:44	05:38	06:38	07:41
35°	19:30	20:06	20:42	05:46	06:45	07:45
30°	19:23	20:02	20:39	05:54	06:50	07:48
20°	19:12	19:54	20:36	06:07	07:00	07:54
N 10°	19:02	19:48	20:32	06:18	07:08	07:59
0°	18:53	19:41	20:29	06:28	07:16	08:04
S 10°	18:44	19:35	20:26	06:39	07:24	08:09
20°	18:34	19:28	20:22	06:50	07:32	08:14
30°	18:23	19:20	20:18	07:02	07:42	08:20
35°	18:17	19:16	20:16	07:10	07:47	08:23
40°	18:09	19:11	20:13	07:18	07:53	08:27
45°	18:01	19:05	20:10	07:27	08:00	08:31
S 50°	17:50	18:58	20:07	07:39	08:09	08:36
52°	17:45	18:54	20:05	07:44	08:13	08:38
54°	17:40	18:51	20:03	07:50	08:17	08:41
56°	17:34	18:47	20:01	07:56	08:21	08:44
58°	17:27	18:42	19:59	08:04	08:27	08:47
S 60°	17:20	18:37	19:57	08:12	08:33	08:50

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 16-18 99-92%
08	05:41	05:37	12:06	00:17	12:41	
09	05:33	05:28	12:05	01:05	13:29	
10	05:24	05:19	12:05	01:53	14:16	

August 11, 12, 13 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	319°39.0	216°38.7	N21°50.6	183°02.0	N17°45.9	122°11.8	S06°09.6	58°58.6	S21°56.0
1	334°41.4	231°38.0	50.5	198°02.9	45.5	137°14.0	09.8	74°01.1	56.0
2	349°43.9	246°37.3	50.3	213°03.7	45.0	152°16.1	09.9	89°03.7	56.0
3	4°46.4	261°36.6	·· 50.2	228°04.6	·· 44.6	167°18.2	·· 10.1	104°06.2	·· 56.0
4	19°48.8	276°35.9	50.1	243°05.5	44.1	182°20.3	10.2	119°08.7	56.0
5	34°51.3	291°35.2	49.9	258°06.3	43.7	197°22.4	10.4	134°11.2	56.0
6	49°53.7	306°34.6	N21°49.8	273°07.2	N17°43.2	212°24.5	S06°10.5	149°13.8	S21°56.0
7	64°56.2	321°33.9	49.7	288°08.0	42.7	227°26.6	10.7	164°16.3	56.0
8	79°58.7	336°33.2	49.5	303°08.9	42.3	242°28.7	10.8	179°18.8	56.0
9	95°01.1	351°32.5	·· 49.4	318°09.7	·· 41.8	257°30.8	·· 11.0	194°21.3	·· 56.0
10	110°03.6	6°31.8	49.3	333°10.6	41.4	272°32.9	11.1	209°23.9	56.0
11	125°06.1	21°31.1	49.1	348°11.4	40.9	287°35.1	11.3	224°26.4	56.0
12	140°08.5	36°30.4	N21°49.0	3°12.3	N17°40.4	302°37.2	S06°11.4	239°28.9	S21°56.0
13	155°11.0	51°29.7	48.8	18°13.2	40.0	317°39.3	11.6	254°31.4	56.0
14	170°13.5	66°29.0	48.7	33°14.0	39.5	332°41.4	11.7	269°34.0	56.0
15	185°15.9	81°28.4	·· 48.6	48°14.9	·· 39.1	347°43.5	·· 11.9	284°36.5	·· 56.0
16	200°18.4	96°27.7	48.4	63°15.7	38.6	2°45.6	12.1	299°39.0	56.0
17	215°20.9	111°27.0	48.3	78°16.6	38.1	17°47.7	12.2	314°41.5	56.0
18	230°23.3	126°26.3	N21°48.1	93°17.5	N17°37.7	32°49.8	S06°12.4	329°44.1	S21°56.0
19	245°25.8	141°25.6	48.0	108°18.3	37.2	47°51.9	12.5	344°46.6	56.0
20	260°28.2	156°24.9	47.8	123°19.2	36.7	62°54.0	12.7	359°49.1	56.0
21	275°30.7	171°24.2	·· 47.7	138°20.0	·· 36.3	77°56.1	·· 12.8	14°51.6	·· 56.0
22	290°33.2	186°23.5	47.5	153°20.9	35.8	92°58.2	13.0	29°54.2	56.0
23	305°35.6	201°22.8	47.4	168°21.7	35.4	108°00.3	13.1	44°56.7	56.0
Mer.pass.:02:41		v-0.7 d-0.1 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.7		v2.5 d-0.0 m0.3	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	320°38.1	216°22.2	N21°47.2	183°22.6	N17°34.9	123°02.5	S06°13.3	59°59.2	S21°56.1
1	335°40.6	231°21.5	47.1	198°23.5	34.4	138°04.6	13.4	75°01.7	56.1
2	350°43.0	246°20.8	46.9	213°24.3	34.0	153°06.7	13.6	90°04.2	56.1
3	5°45.5	261°20.1	·· 46.8	228°25.2	·· 33.5	168°08.8	·· 13.7	105°06.8	·· 56.1
4	20°48.0	276°19.4	46.6	243°26.0	33.0	183°10.9	13.9	120°09.3	56.1
5	35°50.4	291°18.7	46.5	258°26.9	32.6	198°13.0	14.1	135°11.8	56.1
6	50°52.9	306°18.0	N21°46.3	273°27.8	N17°32.1	213°15.1	S06°14.2	150°14.3	S21°56.1
7	65°55.3	321°17.3	46.1	288°28.6	31.7	228°17.2	14.4	165°16.9	56.1
8	80°57.8	336°16.6	46.0	303°29.5	31.2	243°19.3	14.5	180°19.4	56.1
9	96°00.3	351°16.0	·· 45.8	318°30.3	·· 30.7	258°21.4	·· 14.7	195°21.9	·· 56.1
10	111°02.7	6°15.3	45.7	333°31.2	30.3	273°23.5	14.8	210°24.4	56.1
11	126°05.2	21°14.6	45.5	348°32.1	29.8	288°25.6	15.0	225°26.9	56.1
12	141°07.7	36°13.9	N21°45.3	3°32.9	N17°29.3	303°27.7	S06°15.1	240°29.5	S21°56.1
13	156°10.1	51°13.2	45.2	18°33.8	28.9	318°29.8	15.3	255°32.0	56.1
14	171°12.6	66°12.5	45.0	33°34.6	28.4	333°31.9	15.4	270°34.5	56.1
15	186°15.1	81°11.8	·· 44.8	48°35.5	·· 27.9	348°34.0	·· 15.6	285°37.0	·· 56.1
16	201°17.5	96°11.1	44.7	63°36.4	27.5	3°36.1	15.8	300°39.5	56.1
17	216°20.0	111°10.4	44.5	78°37.2	27.0	18°38.2	15.9	315°42.1	56.1
18	231°22.5	126°09.7	N21°44.3	93°38.1	N17°26.5	33°40.4	S06°16.1	330°44.6	S21°56.1
19	246°24.9	141°09.1	44.2	108°38.9	26.1	48°42.5	16.2	345°47.1	56.1
20	261°27.4	156°08.4	44.0	123°39.8	25.6	63°44.6	16.4	0°49.6	56.1
21	276°29.8	171°07.7	·· 43.8	138°40.7	·· 25.1	78°46.7	·· 16.5	15°52.1	·· 56.1
22	291°32.3	186°07.0	43.6	153°41.5	24.7	93°48.8	16.7	30°54.7	56.1
23	306°34.8	201°06.3	43.5	168°42.4	24.2	108°50.9	16.8	45°57.2	56.2
Mer.pass.:02:37		v-0.7 d-0.2 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.7		v2.5 d-0.0 m0.3	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	321°37.2	216°05.6	N21°43.3	183°43.3	N17°23.7	123°53.0	S06°17.0	60°59.7	S21°56.2
1	336°39.7	231°04.9	43.1	198°44.1	23.3	138°55.1	17.1	76°02.2	56.2
2	351°42.2	246°04.2	42.9	213°45.0	22.8	153°57.2	17.3	91°04.7	56.2
3	6°44.6	261°03.5	·· 42.8	228°45.8	·· 22.3	168°59.3	·· 17.5	106°07.2	·· 56.2
4	21°47.1	276°02.8	42.6	243°46.7	21.9	184°01.4	17.6	121°09.8	56.2
5	36°49.6	291°02.1	42.4	258°47.6	21.4	199°03.5	17.8	136°12.3	56.2
6	51°52.0	306°01.5	N21°42.2	273°48.4	N17°20.9	214°05.6	S06°17.9	151°14.8	S21°56.2
7	66°54.5	321°00.8	42.0	288°49.3	20.5	229°07.7	18.1	166°17.3	56.2
8	81°56.9	336°00.1	41.8	303°50.2	20.0	244°09.8	18.2	181°19.8	56.2
9	96°59.4	350°59.4	·· 41.7	318°51.0	·· 19.5	259°11.9	·· 18.4	196°22.3	·· 56.2
10	112°01.9	5°58.7	41.5	333°51.9	19.1	274°14.0	18.5	211°24.9	56.2
11	127°04.3	20°58.0	41.3	348°52.8	18.6	289°16.1	18.7	226°27.4	56.2
12	142°06.8	35°57.3	N21°41.1	3°53.6	N17°18.1	304°18.2	S06°18.9	241°29.9	S21°56.2
13	157°09.3	50°56.6	40.9	18°54.5	17.6	319°20.3	19.0	256°32.4	56.2
14	172°11.7	65°55.9	40.7	33°55.3	17.2	334°22.4	19.2	271°34.9	56.2
15	187°14.2	80°55.2	·· 40.5	48°56.2	·· 16.7	349°24.5	·· 19.3	286°37.4	·· 56.2
16	202°16.7	95°54.5	40.3	63°57.1	16.2	4°26.6	19.5	301°40.0	56.2
17	217°19.1	110°53.9	40.1	78°57.9	15.8	19°28.7	19.6	316°42.5	56.2
18	232°21.6	125°53.2	N21°39.9	93°58.8	N17°15.3	34°30.8	S06°19.8	331°45.0	S21°56.2
19	247°24.1	140°52.5	39.7	108°59.7	14.8	49°32.9	20.0	346°47.5	56.2
20	262°26.5	155°51.8	39.5	124°00.5	14.4	64°35.0	20.1	1°50.0	56.2
21	277°29.0	170°51.1	·· 39.3	139°01.4	·· 13.9	79°37.1	·· 20.3	16°52.5	·· 56.2
22	292°31.4	185°50.4	39.1	154°02.3	13.4	94°39.2	20.4	31°55.0	56.3
23	307°33.9	200°49.7	38.9	169°03.1	12.9	109°41.3	20.6	46°57.6	56.3
Mer.pass.:02:33		v-0.7 d-0.2 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.7		v2.5 d-0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.2
Ankaa	353°12.7	-42°12.5
Schedar	349°36.9	56°37.8
Diphda	348°52.9	-17°53.3
Achernar	335°24.5	-57°08.7
Hamal	327°57.5	23°32.6
Polaris	316°27.3	89°19.9
Acamar	315°16.2	-40°13.9
Menkar	314°12.1	4°09.4
Mirfak	308°36.3	49°55.0
Aldebaran	290°46.3	16°32.5
Rigel	281°09.5	-8°10.9
Capella	280°30.5	46°00.6
Bellatrix	278°29.2	6°21.8
Elnath	278°09.3	28°37.1
Alnilam	275°43.7	-1°11.5
Betelgeuse	270°58.5	7°24.5
Canopus	263°55.3	-52°42.2
Sirius	258°31.5	-16°44.4
Adhara	255°10.6	-28°59.7
Procyon	244°57.1	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.4	-59°33.9
Suhail	222°50.8	-43°30.2
Miaplacidus	221°39.9	-69°47.4
Alphard	217°53.7	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°49.0	61°39.6
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.5	-63°11.9
Gacrux	171°58.0	-57°12.8
Alioth	166°18.6	55°52.2
Spica	158°28.4	-11°15.0
Alkaid	152°56.9	49°14.0
Hadar	148°44.0	-60°27.5
Menkent	148°04.3	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°47.9	-60°54.5
Kochab	137°20.4	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.7
Antares	112°22.7	-26°28.1
Atria	107°21.7	-69°03.6
Sabik	102°09.1	-15°44.6
Shaula	96°17.9	-37°06.8
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.5	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.4
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.8
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.6	-29°31.6
Scheat	13°50.3	28°10.7
Markab	13°35.2	15°18.0

Aug 11 Fri	SHA	Mer.pass
Venus	256°59.7	09:34
Mars	223°23.1	11:47
Jupiter	162°32.9	15:49
Saturn	99°19.7	20:01

Aug 12 Sat	SHA	Mer.pass
Venus	255°44.1	09:35
Mars	222°44.5	11:46
Jupiter	162°24.4	15:46
Saturn	99°21.1	19:57

Aug 13 Sun	SHA	Mer.pass
Venus	254°28.4	09:36
Mars	222°06.0	11:44
Jupiter	162°15.7	15:42
Saturn	99°22.5	19:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3433 sec ΔT = TT-UT1 = +68.8407 sec

2017 August 11 to Aug. 13 UT

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	178°41.4	N15°16.3	321°13.1	12.1'	S03°48.6	10.8'	57.1'
1	193°41.5	15.5	335°44.3	12.1'	03°37.8	10.8'	57.1'
2	208°41.6	14.8	350°15.4	12.1'	03°27.0	10.8'	57.2'
3	223°41.7	·· 14.0	4°46.5	12.1'	03°16.2	10.8'	57.2'
4	238°41.8	13.3	19°17.7	12.1'	03°05.3	10.9'	57.2'
5	253°41.9	12.5	33°48.8	12.1'	02°54.4	10.9'	57.2'
6	268°42.0	N15°11.8	48°19.8	12.1'	S02°43.5	10.9'	57.3'
7	283°42.1	11.1	62°50.9	12.1'	02°32.6	10.9'	57.3'
8	298°42.2	10.3	77°22.0	12.1'	02°21.7	11.0'	57.3'
9	313°42.3	·· 09.6	91°53.1	12.1'	02°10.7	11.0'	57.3'
10	328°42.4	08.8	106°24.1	12.0'	01°59.7	11.0'	57.3'
11	343°42.5	08.1	120°55.1	12.0'	01°48.7	11.0'	57.4'
12	358°42.6	N15°07.3	135°26.2	12.0'	S01°37.7	11.0'	57.4'
13	13°42.7	06.6	149°57.2	12.0'	01°26.7	11.0'	57.4'
14	28°42.8	05.8	164°28.1	12.0'	01°15.7	11.0'	57.4'
15	43°42.9	·· 05.1	178°59.1	12.0'	01°04.6	11.1'	57.4'
16	58°43.0	04.3	193°30.1	11.9'	00°53.5	11.1'	57.5'
17	73°43.1	03.6	208°01.0	11.9'	00°42.5	11.1'	57.5'
18	88°43.2	N15°02.9	222°31.9	11.9'	S00°31.4	11.1'	57.5'
19	103°43.3	02.1	237°02.8	11.9'	00°20.3	11.1'	57.5'
20	118°43.4	01.4	251°33.7	11.9'	S00°09.2	11.1'	57.5'
21	133°43.6	15°00.6	266°04.6	11.9'	N00°02.0	11.1'	57.6'
22	148°43.7	14°59.9	280°35.4	11.8'	00°13.1	11.1'	57.6'
23	163°43.8	59.1	295°06.3	11.8'	00°24.2	11.1'	57.6'
	SD.=15.8	d=-0.7	S.D.=15.6				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°43.9	N14°58.4	309°37.1	11.8'	N00°35.3	11.1'	57.6'
1	193°44.0	57.6	324°07.8	11.8'	00°46.5	11.1'	57.6'
2	208°44.1	56.9	338°38.6	11.7'	00°57.6	11.1'	57.7'
3	223°44.2	·· 56.1	353°09.3	11.7'	01°08.8	11.1'	57.7'
4	238°44.3	55.3	7°40.0	11.7'	01°19.9	11.1'	57.7'
5	253°44.4	54.6	22°10.7	11.7'	01°31.1	11.1'	57.7'
6	268°44.5	N14°53.8	36°41.4	11.6'	N01°42.2	11.1'	57.7'
7	283°44.6	53.1	51°12.0	11.6'	01°53.4	11.1'	57.8'
8	298°44.7	52.3	65°42.6	11.6'	02°04.5	11.1'	57.8'
9	313°44.8	·· 51.6	80°13.2	11.6'	02°15.6	11.1'	57.8'
10	328°44.9	50.8	94°43.7	11.5'	02°26.8	11.1'	57.8'
11	343°45.0	50.1	109°14.2	11.5'	02°37.9	11.1'	57.8'
12	358°45.2	N14°49.3	123°44.7	11.5'	N02°49.0	11.1'	57.9'
13	13°45.3	48.6	138°15.2	11.4'	03°00.1	11.1'	57.9'
14	28°45.4	47.8	152°45.6	11.4'	03°11.2	11.1'	57.9'
15	43°45.5	·· 47.0	167°16.0	11.4'	03°22.3	11.1'	57.9'
16	58°45.6	46.3	181°46.4	11.3'	03°33.4	11.1'	58.0'
17	73°45.7	45.5	196°16.7	11.3'	03°44.5	11.1'	58.0'
18	88°45.8	N14°44.8	210°47.0	11.3'	N03°55.5	11.1'	58.0'
19	103°45.9	44.0	225°17.3	11.2'	04°06.6	11.0'	58.0'
20	118°46.0	43.3	239°47.5	11.2'	04°17.6	11.0'	58.0'
21	133°46.1	·· 42.5	254°17.7	11.2'	04°28.6	11.0'	58.1'
22	148°46.3	41.7	268°47.8	11.1'	04°39.6	11.0'	58.1'
23	163°46.4	41.0	283°17.9	11.1'	04°50.6	11.0'	58.1'
	SD.=15.8	d=-0.8	S.D.=15.8				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°46.5	N14°40.2	297°48.0	11.1'	N05°01.6	11.0'	58.1'
1	193°46.6	39.5	312°18.1	11.0'	05°12.5	10.9'	58.1'
2	208°46.7	38.7	326°48.1	11.0'	05°23.4	10.9'	58.2'
3	223°46.8	·· 37.9	341°18.0	10.9'	05°34.3	10.9'	58.2'
4	238°46.9	37.2	355°47.9	10.9'	05°45.2	10.9'	58.2'
5	253°47.0	36.4	10°17.8	10.9'	05°56.1	10.8'	58.2'
6	268°47.1	N14°35.6	24°47.7	10.8'	N06°06.9	10.8'	58.2'
7	283°47.3	34.9	39°17.5	10.8'	06°17.7	10.8'	58.3'
8	298°47.4	34.1	53°47.2	10.7'	06°28.5	10.8'	58.3'
9	313°47.5	·· 33.4	68°16.9	10.7'	06°39.2	10.7'	58.3'
10	328°47.6	32.6	82°46.6	10.6'	06°49.9	10.7'	58.3'
11	343°47.7	31.8	97°16.2	10.6'	07°00.6	10.7'	58.3'
12	358°47.8	N14°31.1	111°45.8	10.6'	N07°11.3	10.6'	58.3'
13	13°47.9	30.3	126°15.3	10.5'	07°21.9	10.6'	58.4'
14	28°48.1	29.5	140°44.8	10.5'	07°32.5	10.6'	58.4'
15	43°48.2	·· 28.8	155°14.2	10.4'	07°43.1	10.5'	58.4'
16	58°48.3	28.0	169°43.6	10.4'	07°53.6	10.5'	58.4'
17	73°48.4	27.2	184°12.9	10.3'	08°04.1	10.5'	58.4'
18	88°48.5	N14°26.5	198°42.2	10.3'	N08°14.5	10.4'	58.5'
19	103°48.6	25.7	213°11.5	10.2'	08°24.9	10.4'	58.5'
20	118°48.8	24.9	227°40.6	10.2'	08°35.3	10.3'	58.5'
21	133°48.9	·· 24.2	242°09.8	10.1'	08°45.6	10.3'	58.5'
22	148°49.0	23.4	256°38.9	10.1'	08°55.9	10.3'	58.5'
23	163°49.1	22.6	271°07.9	10.0'	09°06.1	10.2'	58.6'
	SD.=15.8	d=-0.8	S.D.=15.9				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°			02:03	22:00		
N 70°			02:41	21:24		
68°		01:18	03:07	20:59	22:43	
66°		02:05	03:27	20:40	22:00	
64°		02:35	03:43	20:25	21:32	
62°	01:09	02:57	03:56	20:12	21:10	22:53
60°	01:52	03:14	04:07	20:01	20:53	22:13
N 58°	02:19	03:29	04:17	19:52	20:39	21:47
56°	02:40	03:41	04:25	19:43	20:27	21:28
54°	02:56	03:51	04:33	19:36	20:17	21:11
52°	03:10	04:01	04:39	19:30	20:08	20:58
50°	03:22	04:09	04:45	19:24	20:00	20:46
45°	03:46	04:26	04:58	19:11	19:43	20:23
N 40°	04:04	04:39	05:09	19:01	19:30	20:05
35°	04:18	04:51	05:18	18:52	19:19	19:51
30°	04:30	05:00	05:26	18:44	19:09	19:39
20°	04:49	05:16	05:39	18:31	18:54	19:21
N 10°	05:03	05:29	05:51	18:19	18:41	19:06
0°	05:15	05:40	06:02	18:08	18:30	18:55
S 10°	05:26	05:51	06:12	17:58	18:19	18:45
20°	05:35	06:01	06:24	17:47	18:09	18:36
30°	05:43	06:12	06:36	17:34	17:59	18:27
35°	05:48	06:17	06:44	17:27	17:53	18:23
40°	05:52	06:24	06:52	17:18	17:47	18:19
45°	05:56	06:31	07:02	17:09	17:40	18:14
S 50°	06:01	06:39	07:13	16:57	17:31	18:10
52°	06:03	06:43	07:19	16:52	17:28	18:08
54°	06:05	06:47	07:25	16:46	17:24	18:06
56°	06:07	06:51	07:31	16:40	17:19	18:04
58°	06:10	06:56	07:39	16:32	17:15	18:01
S 60°	06:12	07:02	07:47	16:24	17:09	17:59

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	21:17	21:09	21:00	08:21	10:10	12:03
N 70°	21:17	21:15	21:13	08:25	10:07	11:52
68°	21:17	21:20	21:23	08:27	10:04	11:43
66°	21:17	21:24	21:32	08:30	10:02	11:36
64°	21:17	21:27	21:39	08:32	10:00	11:30
62°	21:17	21:30	21:46	08:34	09:58	11:25
60°	21:17	21:33	21:51	08:35	09:57	11:20
N 58°	21:17	21:36	21:56	08:36	09:56	11:16
56°	21:17	21:38	22:01	08:37	09:54	11:13
54°	21:17	21:40	22:05	08:39	09:53	11:09
52°	21:17	21:41	22:08	08:39	09:52	11:07
50°	21:17	21:43	22:11	08:40	09:52	11:04
45°	21:17	21:47	22:18	08:42	09:50	10:58
N 40°	21:17	21:50	22:24	08:44	09:48	10:54
35°	21:17	21:52	22:30	08:45	09:47	10:50
30°	21:17	21:55	22:34	08:46	09:46	10:46
20°	21:17	21:59	22:42	08:48	09:43	10:40
N 10°	21:17	22:02	22:49	08:50	09:42	10:34
0°	21:17	22:06	22:56	08:52	09:40	10:29
S 10°	21:17	22:09	23:03	08:53	09:38	10:24
20°	21:17	22:13	23:10	08:55	09:36	10:19
30°	21:17	22:17	23:18	08:57	09:34	10:13
35°	21:17	22:19	23:23	08:58	09:33	10:09
40°	21:17	22:22	23:28	08:59	09:32	10:05
45°	21:17	22:25	23:35	09:00	09:30	10:01
S 50°	21:17	22:29	23:42	09:02	09:28	09:55
52°	21:18	22:31	23:46	09:03	09:27	09:53
54°	21:18	22:33	23:50	09:04	09:26	09:50
56°	21:18	22:35	23:54	09:05	09:25	09:47
58°	21:18	22:38	23:59	09:06	09:24	09:43
S 60°	21:18	22:41	–:–	09:07	09:23	09:40

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 19-21 86-67%
11	05:14	05:10	12:05	02:40	15:04	
12	05:05	04:59	12:05	03:28	15:53	
13	04:54	04:49	12:05	04:17	16:43	

August 14, 15, 16 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	322°36.4	215°49.0	N21°38.7	184°04.0	N17°12.5	124°43.4	S06°20.7	62°00.1	S21°56.3
1	337°38.8	230°48.3	38.5	199°04.9	12.0	139°45.5	20.9	77°02.6	56.3
2	352°41.3	245°47.6	38.3	214°05.7	11.5	154°47.6	21.0	92°05.1	56.3
3	7°43.8	260°46.9	·· 38.1	229°06.6	·· 11.0	169°49.7	·· 21.2	107°07.6	·· 56.3
4	22°46.2	275°46.2	37.9	244°07.5	10.6	184°51.8	21.4	122°10.1	56.3
5	37°48.7	290°45.6	37.7	259°08.3	10.1	199°53.9	21.5	137°12.6	56.3
6	52°51.2	305°44.9	N21°37.5	274°09.2	N17°09.6	214°56.0	S06°21.7	152°15.2	S21°56.3
7	67°53.6	320°44.2	37.3	289°10.1	09.2	229°58.1	21.8	167°17.7	56.3
8	82°56.1	335°43.5	37.1	304°10.9	08.7	245°00.2	22.0	182°20.2	56.3
9	97°58.6	350°42.8	·· 36.9	319°11.8	·· 08.2	260°02.3	·· 22.1	197°22.7	·· 56.3
10	113°01.0	5°42.1	36.7	334°12.7	07.7	275°04.4	22.3	212°25.2	56.3
11	128°03.5	20°41.4	36.5	349°13.5	07.3	290°06.5	22.5	227°27.7	56.3
12	143°05.9	35°40.7	N21°36.3	4°14.4	N17°06.8	305°08.6	S06°22.6	242°30.2	S21°56.3
13	158°08.4	50°40.0	36.0	19°15.3	06.3	320°10.7	22.8	257°32.7	56.3
14	173°10.9	65°39.3	35.8	34°16.1	05.8	335°12.8	22.9	272°35.3	56.3
15	188°13.3	80°38.6	·· 35.6	49°17.0	·· 05.4	350°14.9	·· 23.1	287°37.8	·· 56.3
16	203°15.8	95°38.0	35.4	64°17.9	04.9	5°16.9	23.2	302°40.3	56.3
17	218°18.3	110°37.3	35.2	79°18.7	04.4	20°19.0	23.4	317°42.8	56.3
18	233°20.7	125°36.6	N21°34.9	94°19.6	N17°03.9	35°21.1	S06°23.6	332°45.3	S21°56.3
19	248°23.2	140°35.9	34.7	109°20.5	03.5	50°23.2	23.7	347°47.8	56.4
20	263°25.7	155°35.2	34.5	124°21.4	03.0	65°25.3	23.9	2°50.3	56.4
21	278°28.1	170°34.5	·· 34.3	139°22.2	·· 02.5	80°27.4	·· 24.0	17°52.8	·· 56.4
22	293°30.6	185°33.8	34.1	154°23.1	02.0	95°29.5	24.2	32°55.3	56.4
23	308°33.0	200°33.1	33.8	169°24.0	01.6	110°31.6	24.4	47°57.9	56.4
Mer.pass.:02:29		v-0.7 d-0.2 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.7		v2.5 d-0.0 m0.3	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	323°35.5	215°32.4	N21°33.6	184°24.8	N17°01.1	125°33.7	S06°24.5	63°00.4	S21°56.4
1	338°38.0	230°31.7	33.4	199°25.7	00.6	140°35.8	24.7	78°02.9	56.4
2	353°40.4	245°31.0	33.2	214°26.6	17°00.1	155°37.9	24.8	93°05.4	56.4
3	8°42.9	260°30.3	·· 32.9	229°27.4	16°59.6	170°40.0	·· 25.0	108°07.9	·· 56.4
4	23°45.4	275°29.7	32.7	244°28.3	59.2	185°42.1	25.1	123°10.4	56.4
5	38°47.8	290°29.0	32.5	259°29.2	58.7	200°44.2	25.3	138°12.9	56.4
6	53°50.3	305°28.3	N21°32.2	274°30.1	N16°58.2	215°46.3	S06°25.5	153°15.4	S21°56.4
7	68°52.8	320°27.6	32.0	289°30.9	57.7	230°48.4	25.6	168°17.9	56.4
8	83°55.2	335°26.9	31.8	304°31.8	57.3	245°50.5	25.8	183°20.4	56.4
9	98°57.7	350°26.2	·· 31.5	319°32.7	·· 56.8	260°52.6	·· 25.9	198°22.9	·· 56.4
10	114°00.2	5°25.5	31.3	334°33.5	56.3	275°54.7	26.1	213°25.5	56.4
11	129°02.6	20°24.8	31.0	349°34.4	55.8	290°56.7	26.2	228°28.0	56.4
12	144°05.1	35°24.1	N21°30.8	4°35.3	N16°55.3	305°58.8	S06°26.4	243°30.5	S21°56.4
13	159°07.5	50°23.4	30.6	19°36.1	54.9	321°00.9	26.6	258°33.0	56.4
14	174°10.0	65°22.7	30.3	34°37.0	54.4	336°03.0	26.7	273°35.5	56.4
15	189°12.5	80°22.0	·· 30.1	49°37.9	·· 53.9	351°05.1	·· 26.9	288°38.0	·· 56.5
16	204°14.9	95°21.3	29.8	64°38.8	53.4	6°07.2	27.0	303°40.5	56.5
17	219°17.4	110°20.7	29.6	79°39.6	52.9	21°09.3	27.2	318°43.0	56.5
18	234°19.9	125°20.0	N21°29.4	94°40.5	N16°52.5	36°11.4	S06°27.4	333°45.5	S21°56.5
19	249°22.3	140°19.3	29.1	109°41.4	52.0	51°13.5	27.5	348°48.0	56.5
20	264°24.8	155°18.6	28.9	124°42.3	51.5	66°15.6	27.7	3°50.5	56.5
21	279°27.3	170°17.9	·· 28.6	139°43.1	·· 51.0	81°17.7	·· 27.8	18°53.0	·· 56.5
22	294°29.7	185°17.2	28.4	154°44.0	50.5	96°19.8	28.0	33°55.5	56.5
23	309°32.2	200°16.5	28.1	169°44.9	50.1	111°21.9	28.2	48°58.0	56.5
Mer.pass.:02:25		v-0.7 d-0.2 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.7		v2.5 d-0.0 m0.3	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	324°34.7	215°15.8	N21°27.9	184°45.7	N16°49.6	126°23.9	S06°28.3	64°00.6	S21°56.5
1	339°37.1	230°15.1	27.6	199°46.6	49.1	141°26.0	28.5	79°03.1	56.5
2	354°39.6	245°14.4	27.4	214°47.5	48.6	156°28.1	28.6	94°05.6	56.5
3	9°42.0	260°13.7	·· 27.1	229°48.4	·· 48.1	171°30.2	·· 28.8	109°08.1	·· 56.5
4	24°44.5	275°13.1	26.9	244°49.2	47.7	186°32.3	29.0	124°10.6	56.5
5	39°47.0	290°12.4	26.6	259°50.1	47.2	201°34.4	29.1	139°13.1	56.5
6	54°49.4	305°11.7	N21°26.3	274°51.0	N16°46.7	216°36.5	S06°29.3	154°15.6	S21°56.5
7	69°51.9	320°11.0	26.1	289°51.9	46.2	231°38.6	29.4	169°18.1	56.5
8	84°54.4	335°10.3	25.8	304°52.7	45.7	246°40.7	29.6	184°20.6	56.5
9	99°56.8	350°09.6	·· 25.6	319°53.6	·· 45.2	261°42.8	·· 29.8	199°23.1	·· 56.5
10	114°59.3	5°08.9	25.3	334°54.5	44.8	276°44.8	29.9	214°25.6	56.5
11	130°01.8	20°08.2	25.0	349°55.4	44.3	291°46.9	30.1	229°28.1	56.6
12	145°04.2	35°07.5	N21°24.8	4°56.2	N16°43.8	306°49.0	S06°30.2	244°30.6	S21°56.6
13	160°06.7	50°06.8	24.5	19°57.1	43.3	321°51.1	30.4	259°33.1	56.6
14	175°09.1	65°06.1	24.2	34°58.0	42.8	336°53.2	30.6	274°35.6	56.6
15	190°11.6	80°05.4	·· 24.0	49°58.9	·· 42.3	351°55.3	·· 30.7	289°38.1	·· 56.6
16	205°14.1	95°04.8	23.7	64°59.7	41.9	6°57.4	30.9	304°40.6	56.6
17	220°16.5	110°04.1	23.4	80°00.6	41.4	21°59.5	31.0	319°43.1	56.6
18	235°19.0	125°03.4	N21°23.2	95°01.5	N16°40.9	37°01.6	S06°31.2	334°45.6	S21°56.6
19	250°21.5	140°02.7	22.9	110°02.4	40.4	52°03.6	31.4	349°48.1	56.6
20	265°23.9	155°02.0	22.6	125°03.2	39.9	67°05.7	31.5	4°50.6	56.6
21	280°26.4	170°01.3	·· 22.4	140°04.1	·· 39.4	82°07.8	·· 31.7	19°53.1	·· 56.6
22	295°28.9	185°00.6	22.1	155°05.0	38.9	97°09.9	31.8	34°55.6	56.6
23	310°31.3	199°59.9	21.8	170°05.9	38.5	112°12.0	32.0	49°58.1	56.6
Mer.pass.:02:21		v-0.7 d-0.3 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.2
Ankaa	353°12.7	-42°12.5
Schedar	349°36.8	56°37.8
Diphda	348°52.9	-17°53.3
Achernar	335°24.5	-57°08.7
Hamal	327°57.4	23°32.6
Polaris	316°25.8	89°19.9
Acamar	315°16.2	-40°13.9
Menkar	314°12.1	4°09.4
Mirfak	308°36.3	49°55.0
Aldebaran	290°46.2	16°32.5
Rigel	281°09.5	-8°10.9
Capella	280°30.5	46°00.6
Bellatrix	278°29.2	6°21.8
Elnath	278°09.2	28°37.1
Alnilam	275°43.7	-1°11.5
Betelgeuse	270°58.5	7°24.5
Canopus	263°55.3	-52°42.2
Sirius	258°31.5	-16°44.4
Adhara	255°10.6	-28°59.7
Procyon	244°57.1	5°10.7
Pollux	243°24.7	27°58.9
Avior	234°17.4	-59°33.9
Suhail	222°50.8	-43°30.2
Miaplacidus	221°39.9	-69°47.4
Alphard	217°53.6	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°49.0	61°39.5
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.5	-63°11.9
Gacrux	171°58.1	-57°12.8
Alioth	166°18.6	55°52.2
Spica	158°28.4	-11°15.0
Alkaid	152°56.9	49°13.9
Hadar	148°44.0	-60°27.5
Menkent	148°04.3	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°47.9	-60°54.5
Kochab	137°20.4	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.8
Antares	112°22.7	-26°28.1
Atria	107°21.7	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.8
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.5	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.4
Nunki	75°54.5	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.8
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.6	-29°31.6
Scheat	13°50.3	28°10.7
Markab	13°35.2	15°18.1

Aug 14 Mon	SHA	Mer.pass
Venus	253°12.6	09:37
Mars	221°27.6	11:43
Jupiter	162°07.0	15:39
Saturn	99°23.7	19:49

Aug 15 Tue	SHA	Mer.pass
Venus	251°56.9	09:38
Mars	220°49.3	11:42
Jupiter	161°58.2	15:36
Saturn	99°24.9	19:45

Aug 16 Wed	SHA	Mer.pass
Venus	250°41.2	09:39
Mars	220°11.1	11:40
Jupiter	161°49.3	15:32
Saturn	99°25.9	19:41

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3423 sec ΔT = TT-UT1 = +68.8417 sec

2017 August 14 to Aug. 16 UT

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°49.2	N14°21.8	285°36.9	10.0'	N09°16.3	10.2'	58.6'
1	193°49.3	21.1	300°05.8	9.9'	09°26.5	10.1'	58.6'
2	208°49.5	20.3	314°34.7	9.8'	09°36.6	10.1'	58.6'
3	223°49.6	·· 19.5	329°03.5	9.8'	09°46.6	10.0'	58.6'
4	238°49.7	18.8	343°32.3	9.7'	09°56.6	10.0'	58.7'
5	253°49.8	18.0	358°01.0	9.7'	10°06.6	9.9'	58.7'
6	268°49.9	N14°17.2	12°29.6	9.6'	N10°16.5	9.9'	58.7'
7	283°50.0	16.4	26°58.2	9.6'	10°26.3	9.8'	58.7'
8	298°50.2	15.7	41°26.8	9.5'	10°36.1	9.8'	58.7'
9	313°50.3	·· 14.9	55°55.3	9.5'	10°45.9	9.7'	58.8'
10	328°50.4	14.1	70°23.7	9.4'	10°55.5	9.7'	58.8'
11	343°50.5	13.3	84°52.1	9.3'	11°05.2	9.6'	58.8'
12	358°50.6	N14°12.6	99°20.4	9.3'	N11°14.7	9.5'	58.8'
13	13°50.8	11.8	113°48.6	9.2'	11°24.3	9.5'	58.8'
14	28°50.9	11.0	128°16.8	9.2'	11°33.7	9.4'	58.8'
15	43°51.0	·· 10.2	142°45.0	9.1'	11°43.1	9.4'	58.9'
16	58°51.1	09.5	157°13.1	9.0'	11°52.4	9.3'	58.9'
17	73°51.2	08.7	171°41.1	9.0'	12°01.7	9.2'	58.9'
18	88°51.4	N14°07.9	186°09.0	8.9'	N12°10.9	9.2'	58.9'
19	103°51.5	07.1	200°36.9	8.9'	12°20.0	9.1'	58.9'
20	118°51.6	06.4	215°04.8	8.8'	12°29.1	9.0'	58.9'
21	133°51.7	·· 05.6	229°32.5	8.7'	12°38.1	9.0'	59.0'
22	148°51.8	04.8	244°00.3	8.7'	12°47.0	8.9'	59.0'
23	163°52.0	04.0	258°27.9	8.6'	12°55.9	8.8'	59.0'
	SD.=15.8	d=-0.8	S.D.=16.0				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°52.1	N14°03.2	272°55.5	8.6'	N13°04.6	8.7'	59.0'
1	193°52.2	02.5	287°23.0	8.5'	13°13.4	8.7'	59.0'
2	208°52.3	01.7	301°50.5	8.4'	13°22.0	8.6'	59.1'
3	223°52.5	·· 00.9	316°17.9	8.4'	13°30.6	8.5'	59.1'
4	238°52.6	14°00.1	330°45.3	8.3'	13°39.0	8.4'	59.1'
5	253°52.7	13°59.3	345°12.6	8.3'	13°47.4	8.4'	59.1'
6	268°52.8	N13°58.6	359°39.8	8.2'	N13°55.8	8.3'	59.1'
7	283°53.0	57.8	14°06.9	8.1'	14°04.0	8.2'	59.1'
8	298°53.1	57.0	28°34.0	8.1'	14°12.2	8.1'	59.2'
9	313°53.2	·· 56.2	43°01.1	8.0'	14°20.3	8.0'	59.2'
10	328°53.3	55.4	57°28.1	7.9'	14°28.3	8.0'	59.2'
11	343°53.4	54.6	71°55.0	7.9'	14°36.2	7.9'	59.2'
12	358°53.6	N13°53.9	86°21.8	7.8'	N14°44.0	7.8'	59.2'
13	13°53.7	53.1	100°48.6	7.8'	14°51.8	7.7'	59.2'
14	28°53.8	52.3	115°15.3	7.7'	14°59.4	7.6'	59.2'
15	43°53.9	·· 51.5	129°42.0	7.6'	15°07.0	7.5'	59.3'
16	58°54.1	50.7	144°08.6	7.6'	15°14.5	7.4'	59.3'
17	73°54.2	49.9	158°35.1	7.5'	15°21.9	7.3'	59.3'
18	88°54.3	N13°49.1	173°01.6	7.4'	N15°29.2	7.3'	59.3'
19	103°54.5	48.4	187°28.0	7.4'	15°36.4	7.2'	59.3'
20	118°54.6	47.6	201°54.4	7.3'	15°43.5	7.1'	59.3'
21	133°54.7	·· 46.8	216°20.7	7.3'	15°50.5	7.0'	59.4'
22	148°54.8	46.0	230°46.9	7.2'	15°57.4	6.9'	59.4'
23	163°55.0	45.2	245°13.1	7.1'	16°04.2	6.8'	59.4'
	SD.=15.8	d=-0.8	S.D.=16.1				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°55.1	N13°44.4	259°39.2	7.1'	N16°11.0	6.7'	59.4'
1	193°55.2	43.6	274°05.3	7.0'	16°17.6	6.6'	59.4'
2	208°55.3	42.8	288°31.3	7.0'	16°24.1	6.5'	59.4'
3	223°55.5	·· 42.0	302°57.2	6.9'	16°30.5	6.4'	59.4'
4	238°55.6	41.3	317°23.1	6.8'	16°36.8	6.3'	59.5'
5	253°55.7	40.5	331°48.9	6.8'	16°43.0	6.2'	59.5'
6	268°55.9	N13°39.7	346°14.7	6.7'	N16°49.2	6.1'	59.5'
7	283°56.0	38.9	0°40.4	6.7'	16°55.2	5.9'	59.5'
8	298°56.1	38.1	15°06.0	6.6'	17°01.1	5.8'	59.5'
9	313°56.2	·· 37.3	29°31.6	6.6'	17°06.8	5.7'	59.5'
10	328°56.4	36.5	43°57.1	6.5'	17°12.5	5.6'	59.5'
11	343°56.5	35.7	58°22.6	6.5'	17°18.1	5.5'	59.5'
12	358°56.6	N13°34.9	72°48.1	6.4'	N17°23.5	5.4'	59.6'
13	13°56.8	34.1	87°13.4	6.3'	17°28.9	5.3'	59.6'
14	28°56.9	33.3	101°38.8	6.3'	17°34.1	5.2'	59.6'
15	43°57.0	·· 32.5	116°04.0	6.2'	17°39.3	5.1'	59.6'
16	58°57.2	31.7	130°29.3	6.2'	17°44.3	5.0'	59.6'
17	73°57.3	30.9	144°54.4	6.1'	17°49.2	4.8'	59.6'
18	88°57.4	N13°30.2	159°19.5	6.1'	N17°53.9	4.7'	59.6'
19	103°57.6	29.4	173°44.6	6.0'	17°58.6	4.6'	59.6'
20	118°57.7	28.6	188°09.6	6.0'	18°03.1	4.5'	59.7'
21	133°57.8	·· 27.8	202°34.6	6.0'	18°07.6	4.4'	59.7'
22	148°57.9	27.0	216°59.5	5.9'	18°11.9	4.2'	59.7'
23	163°58.1	26.2	231°24.4	5.9'	18°16.0	4.1'	59.7'
	SD.=15.8	d=-0.8	S.D.=16.2				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	02:25	21:38	▭	▭
N 70°	▭	▭	02:57	21:08	▭	▭
68°	▭	01:45	03:20	20:46	22:18	▭
66°	▭	02:22	03:38	20:28	21:43	▭
64°	▭	02:48	03:52	20:14	21:18	▭
62°	01:33	03:07	04:04	20:03	20:59	22:30
60°	02:07	03:23	04:15	19:53	20:44	21:58
N 58°	02:30	03:36	04:23	19:44	20:31	21:35
56°	02:49	03:48	04:31	19:36	20:20	21:17
54°	03:04	03:57	04:38	19:30	20:10	21:03
52°	03:17	04:06	04:44	19:24	20:01	20:50
50°	03:28	04:14	04:50	19:18	19:54	20:39
45°	03:50	04:30	05:02	19:06	19:38	20:17
N 40°	04:07	04:43	05:12	18:57	19:25	20:01
35°	04:21	04:53	05:20	18:48	19:15	19:47
30°	04:32	05:02	05:27	18:41	19:06	19:36
20°	04:50	05:17	05:40	18:29	18:51	19:18
N 10°	05:04	05:29	05:51	18:18	18:39	19:05
0°	05:15	05:40	06:01	18:08	18:29	18:54
S 10°	05:24	05:49	06:11	17:58	18:19	18:44
20°	05:33	05:59	06:22	17:47	18:10	18:36
30°	05:41	06:09	06:34	17:36	18:00	18:29
35°	05:44	06:14	06:40	17:29	17:55	18:25
40°	05:48	06:20	06:48	17:21	17:49	18:21
45°	05:52	06:27	06:57	17:12	17:43	18:17
S 50°	05:56	06:34	07:08	17:02	17:35	18:14
52°	05:58	06:37	07:13	16:57	17:32	18:12
54°	05:59	06:41	07:18	16:51	17:29	18:10
56°	06:01	06:45	07:24	16:45	17:25	18:09
58°	06:03	06:49	07:31	16:38	17:20	18:07
S 60°	06:05	06:54	07:39	16:31	17:16	18:05

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	20:50	20:36	19:53	14:01	16:09	18:50
N 70°	21:12	21:13	21:18	13:40	15:33	17:26
68°	21:29	21:39	21:57	13:24	15:07	16:48
66°	21:43	21:59	22:25	13:12	14:48	16:21
64°	21:55	22:15	22:46	13:01	14:32	16:00
62°	22:04	22:29	23:03	12:52	14:20	15:43
60°	22:13	22:40	23:17	12:44	14:09	15:30
N 58°	22:20	22:50	23:29	12:38	13:59	15:18
56°	22:27	22:59	23:40	12:32	13:51	15:07
54°	22:33	23:07	23:49	12:26	13:44	14:58
52°	22:38	23:14	23:57	12:22	13:37	14:50
50°	22:43	23:20	–:–	12:17	13:31	14:43
45°	22:54	23:34	–:–	12:08	13:18	14:28
N 40°	23:03	23:45	–:–	12:00	13:08	14:15
35°	23:10	23:55	–:–	11:54	12:59	14:04
30°	23:17	–:–	00:04	11:48	12:51	13:55
20°	23:29	–:–	00:18	11:38	12:37	13:38
N 10°	23:39	–:–	00:31	11:29	12:26	13:24
0°	23:48	–:–	00:44	11:21	12:14	13:11
S 10°	23:58	–:–	00:56	11:12	12:03	12:58
20°	–:–	00:09	01:09	11:04	11:52	12:43
30°	–:–	00:21	01:24	10:54	11:38	12:27
35°	–:–	00:28	01:33	10:48	11:30	12:18
40°	–:–	00:36	01:43	10:41	11:22	12:07
45°	–:–	00:45	01:55	10:34	11:11	11:55
S 50°	–:–	00:56	02:10	10:25	10:59	11:39
52°	–:–	01:02	02:16	10:21	10:53	11:32
54°	–:–	01:07	02:24	10:16	10:47	11:24
56°	–:–	01:14	02:32	10:11	10:40	11:16
58°	–:–	01:21	02:42	10:05	10:32	11:06
S 60°	00:05	01:29	02:53	09:59	10:23	10:54

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 22-24 56-34%
14	04:43	04:37	12:05	05:08	17:34	
15	04:32	04:26	12:04	06:01	18:29	
16	04:20	04:13	12:04	06:57	19:26	

August 17, 18, 19 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	325°33.8	214°59.2	N21°21.5	185°06.7	N16°38.0	127°14.1	S06°32.2	65°00.6	S21°56.6
1	340°36.3	229°58.5	21.3	200°07.6	37.5	142°16.2	32.3	80°03.1	56.6
2	355°38.7	244°57.8	21.0	215°08.5	37.0	157°18.3	32.5	95°05.6	56.6
3	10°41.2	259°57.2	·· 20.7	230°09.4	·· 36.5	172°20.3	·· 32.6	110°08.1	·· 56.6
4	25°43.6	274°56.5	20.4	245°10.3	36.0	187°22.4	32.8	125°10.6	56.6
5	40°46.1	289°55.8	20.1	260°11.1	35.5	202°24.5	33.0	140°13.1	56.7
6	55°48.6	304°55.1	N21°19.9	275°12.0	N16°35.1	217°26.6	S06°33.1	155°15.6	S21°56.7
7	70°51.0	319°54.4	19.6	290°12.9	34.6	232°28.7	33.3	170°18.1	56.7
8	85°53.5	334°53.7	19.3	305°13.8	34.1	247°30.8	33.4	185°20.6	56.7
9	100°56.0	349°53.0	·· 19.0	320°14.6	·· 33.6	262°32.9	·· 33.6	200°23.1	·· 56.7
10	115°58.4	4°52.3	18.7	335°15.5	33.1	277°34.9	33.8	215°25.6	56.7
11	131°00.9	19°51.6	18.4	350°16.4	32.6	292°37.0	33.9	230°28.1	56.7
12	146°03.4	34°50.9	N21°18.1	5°17.3	N16°32.1	307°39.1	S06°34.1	245°30.6	S21°56.7
13	161°05.8	49°50.2	17.8	20°18.2	31.6	322°41.2	34.2	260°33.1	56.7
14	176°08.3	64°49.6	17.6	35°19.0	31.2	337°43.3	34.4	275°35.6	56.7
15	191°10.8	79°48.9	·· 17.3	50°19.9	·· 30.7	352°45.4	·· 34.6	290°38.1	·· 56.7
16	206°13.2	94°48.2	17.0	65°20.8	30.2	7°47.4	34.7	305°40.6	56.7
17	221°15.7	109°47.5	16.7	80°21.7	29.7	22°49.5	34.9	320°43.1	56.7
18	236°18.1	124°46.8	N21°16.4	95°22.6	N16°29.2	37°51.6	S06°35.1	335°45.6	S21°56.7
19	251°20.6	139°46.1	16.1	110°23.4	28.7	52°53.7	35.2	350°48.1	56.7
20	266°23.1	154°45.4	15.8	125°24.3	28.2	67°55.8	35.4	5°50.6	56.7
21	281°25.5	169°44.7	·· 15.5	140°25.2	·· 27.7	82°57.9	·· 35.5	20°53.1	·· 56.7
22	296°28.0	184°44.0	15.2	155°26.1	27.2	98°00.0	35.7	35°55.6	56.7
23	311°30.5	199°43.3	14.9	170°27.0	26.7	113°02.0	35.9	50°58.1	56.8
Mer.pass.:02:17		v-0.7 d-0.3 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.3	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	326°32.9	214°42.7	N21°14.6	185°27.8	N16°26.3	128°04.1	S06°36.0	66°00.6	S21°56.8
1	341°35.4	229°42.0	14.3	200°28.7	25.8	143°06.2	36.2	81°03.1	56.8
2	356°37.9	244°41.3	14.0	215°29.6	25.3	158°08.3	36.3	96°05.6	56.8
3	11°40.3	259°40.6	·· 13.7	230°30.5	·· 24.8	173°10.4	·· 36.5	111°08.1	·· 56.8
4	26°42.8	274°39.9	13.4	245°31.4	24.3	188°12.5	36.7	126°10.6	56.8
5	41°45.3	289°39.2	13.1	260°32.2	23.8	203°14.5	36.8	141°13.1	56.8
6	56°47.7	304°38.5	N21°12.8	275°33.1	N16°23.3	218°16.6	S06°37.0	156°15.6	S21°56.8
7	71°50.2	319°37.8	12.5	290°34.0	22.8	233°18.7	37.2	171°18.1	56.8
8	86°52.6	334°37.1	12.2	305°34.9	22.3	248°20.8	37.3	186°20.6	56.8
9	101°55.1	349°36.5	·· 11.8	320°35.8	·· 21.8	263°22.9	·· 37.5	201°23.1	·· 56.8
10	116°57.6	4°35.8	11.5	335°36.6	21.3	278°24.9	37.6	216°25.6	56.8
11	132°00.0	19°35.1	11.2	350°37.5	20.9	293°27.0	37.8	231°28.1	56.8
12	147°02.5	34°34.4	N21°10.9	5°38.4	N16°20.4	308°29.1	S06°38.0	246°30.6	S21°56.8
13	162°05.0	49°33.7	10.6	20°39.3	19.9	323°31.2	38.1	261°33.1	56.8
14	177°07.4	64°33.0	10.3	35°40.2	19.4	338°33.3	38.3	276°35.6	56.8
15	192°09.9	79°32.3	·· 10.0	50°41.1	·· 18.9	353°35.4	·· 38.5	291°38.1	·· 56.8
16	207°12.4	94°31.6	09.6	65°41.9	18.4	8°37.4	38.6	306°40.6	56.9
17	222°14.8	109°30.9	09.3	80°42.8	17.9	23°39.5	38.8	321°43.0	56.9
18	237°17.3	124°30.3	N21°09.0	95°43.7	N16°17.4	38°41.6	S06°38.9	336°45.5	S21°56.9
19	252°19.8	139°29.6	08.7	110°44.6	16.9	53°43.7	39.1	351°48.0	56.9
20	267°22.2	154°28.9	08.4	125°45.5	16.4	68°45.8	39.3	6°50.5	56.9
21	282°24.7	169°28.2	·· 08.0	140°46.4	·· 15.9	83°47.8	·· 39.4	21°53.0	·· 56.9
22	297°27.1	184°27.5	07.7	155°47.2	15.4	98°49.9	39.6	36°55.5	56.9
23	312°29.6	199°26.8	07.4	170°48.1	14.9	113°52.0	39.8	51°58.0	56.9
Mer.pass.:02:13		v-0.7 d-0.3 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.3	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	327°32.1	214°26.1	N21°07.1	185°49.0	N16°14.4	128°54.1	S06°39.9	67°00.5	S21°56.9
1	342°34.5	229°25.4	06.7	200°49.9	13.9	143°56.2	40.1	82°03.0	56.9
2	357°37.0	244°24.7	06.4	215°50.8	13.5	158°58.2	40.3	97°05.5	56.9
3	12°39.5	259°24.1	·· 06.1	230°51.7	·· 13.0	174°00.3	·· 40.4	112°08.0	·· 56.9
4	27°41.9	274°23.4	05.8	245°52.5	12.5	189°02.4	40.6	127°10.5	56.9
5	42°44.4	289°22.7	05.4	260°53.4	12.0	204°04.5	40.7	142°13.0	56.9
6	57°46.9	304°22.0	N21°05.1	275°54.3	N16°11.5	219°06.5	S06°40.9	157°15.5	S21°56.9
7	72°49.3	319°21.3	04.8	290°55.2	11.0	234°08.6	41.1	172°17.9	56.9
8	87°51.8	334°20.6	04.4	305°56.1	10.5	249°10.7	41.2	187°20.4	56.9
9	102°54.2	349°19.9	·· 04.1	320°57.0	·· 10.0	264°12.8	·· 41.4	202°22.9	·· 57.0
10	117°56.7	4°19.2	03.8	335°57.9	09.5	279°14.9	41.6	217°25.4	57.0
11	132°59.2	19°18.6	03.4	350°58.7	09.0	294°16.9	41.7	232°27.9	57.0
12	148°01.6	34°17.9	N21°03.1	5°59.6	N16°08.5	309°19.0	S06°41.9	247°30.4	S21°57.0
13	163°04.1	49°17.2	02.7	21°00.5	08.0	324°21.1	42.0	262°32.9	57.0
14	178°06.6	64°16.5	02.4	36°01.4	07.5	339°23.2	42.2	277°35.4	57.0
15	193°09.0	79°15.8	·· 02.1	51°02.3	·· 07.0	354°25.2	·· 42.4	292°37.9	·· 57.0
16	208°11.5	94°15.1	01.7	66°03.2	06.5	9°27.3	42.5	307°40.4	57.0
17	223°14.0	109°14.4	01.4	81°04.1	06.0	24°29.4	42.7	322°42.9	57.0
18	238°16.4	124°13.8	N21°01.0	96°04.9	N16°05.5	39°31.5	S06°42.9	337°45.3	S21°57.0
19	253°18.9	139°13.1	00.7	111°05.8	05.0	54°33.6	43.0	352°47.8	57.0
20	268°21.4	154°12.4	00.3	126°06.7	04.5	69°35.6	43.2	7°50.3	57.0
21	283°23.8	169°11.7	21°00.0	141°07.6	·· 04.0	84°37.7	·· 43.4	22°52.8	·· 57.0
22	298°26.3	184°11.0	20°59.6	156°08.5	03.5	99°39.8	43.5	37°55.3	57.0
23	313°28.7	199°10.3	59.3	171°09.4	03.0	114°41.9	43.7	52°57.8	57.0
Mer.pass.:02:10		v-0.7 d-0.3 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.3	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.2
Ankaa	353°12.6	-42°12.5
Schedar	349°36.8	56°37.8
Diphda	348°52.8	-17°53.3
Achernar	335°24.5	-57°08.7
Hamal	327°57.4	23°32.6
Polaris	316°24.2	89°19.9
Acamar	315°16.2	-40°13.9
Menkar	314°12.0	4°09.4
Mirfak	308°36.2	49°55.0
Aldebaran	290°46.2	16°32.5
Rigel	281°09.5	-8°10.9
Capella	280°30.5	46°00.6
Bellatrix	278°29.1	6°21.8
Elnath	278°09.2	28°37.1
Alnilam	275°43.7	-1°11.5
Betelgeuse	270°58.4	7°24.5
Canopus	263°55.2	-52°42.2
Sirius	258°31.5	-16°44.4
Adhara	255°10.6	-28°59.7
Procyon	244°57.1	5°10.7
Pollux	243°24.6	27°58.9
Avior	234°17.4	-59°33.9
Suhail	222°50.8	-43°30.2
Miaplacidus	221°39.9	-69°47.4
Alphard	217°53.6	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°49.0	61°39.5
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.6	-63°11.9
Gacrux	171°58.1	-57°12.8
Alioth	166°18.7	55°52.2
Spica	158°28.4	-11°15.0
Alkaid	152°57.0	49°13.9
Hadar	148°44.0	-60°27.5
Menkent	148°04.3	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°48.0	-60°54.5
Kochab	137°20.5	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.8
Antares	112°22.7	-26°28.1
Atria	107°21.7	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.8
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.5	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.7	38°48.4
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.8
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.6	-29°31.6
Scheat	13°50.3	28°10.7
Markab	13°35.2	15°18.1

Aug 17 Thu	SHA	Mer.pass
Venus	249°25.4	09:40
Mars	219°33.0	11:39
Jupiter	161°40.3	15:29
Saturn	99°26.8	19:37

Aug 18 Fri	SHA	Mer.pass
Venus	248°09.7	09:42
Mars	218°54.9	11:37
Jupiter	161°31.2	15:26
Saturn	99°27.7	19:33

Aug 19 Sat	SHA	Mer.pass
Venus	246°54.1	09:43
Mars	218°16.9	11:36
Jupiter	161°22.0	15:22
Saturn	99°28.4	19:29

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3413 sec ΔT = TT-UT1 = +68.8427 sec

2017 August 17 to Aug. 19 UT

h

Thu	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	178°58.2	N13°25.4	245°49.3	5.8′	N18°20.1	4.0′	59.7′
1	193°58.3	24.6	260°14.1	5.8′	18°24.0	3.9′	59.7′
2	208°58.5	23.8	274°38.8	5.7′	18°27.9	3.8′	59.7′
3	223°58.6	·· 23.0	289°03.5	5.7′	18°31.6	3.6′	59.7′
4	238°58.7	22.2	303°28.2	5.7′	18°35.1	3.5′	59.7′
5	253°58.9	21.4	317°52.8	5.6′	18°38.6	3.4′	59.7′
6	268°59.0	N13°20.6	332°17.4	5.6′	N18°41.9	3.3′	59.7′
7	283°59.1	19.8	346°42.0	5.5′	18°45.1	3.1′	59.8′
8	298°59.3	19.0	1°06.5	5.5′	18°48.2	3.0′	59.8′
9	313°59.4	·· 18.2	15°31.0	5.5′	18°51.1	2.9′	59.8′
10	328°59.6	17.4	29°55.4	5.4′	18°53.9	2.8′	59.8′
11	343°59.7	16.6	44°19.8	5.4′	18°56.6	2.6′	59.8′
12	358°59.8	N13°15.8	58°44.2	5.4′	N18°59.2	2.5′	59.8′
13	14°00.0	15.0	73°08.6	5.3′	19°01.6	2.4′	59.8′
14	29°00.1	14.2	87°32.9	5.3′	19°03.9	2.2′	59.8′
15	44°00.2	·· 13.4	101°57.2	5.3′	19°06.1	2.1′	59.8′
16	59°00.4	12.6	116°21.5	5.3′	19°08.1	2.0′	59.8′
17	74°00.5	11.7	130°45.7	5.2′	19°10.0	1.8′	59.8′
18	89°00.6	N13°10.9	145°09.9	5.2′	N19°11.8	1.7′	59.8′
19	104°00.8	10.1	159°34.1	5.2′	19°13.5	1.6′	59.8′
20	119°00.9	09.3	173°58.3	5.2′	19°15.0	1.4′	59.8′
21	134°01.0	·· 08.5	188°22.5	5.1′	19°16.4	1.3′	59.8′
22	149°01.2	07.7	202°46.6	5.1′	19°17.6	1.2′	59.9′
23	164°01.3	06.9	217°10.7	5.1′	19°18.7	1.0′	59.9′
	SD.=15.8	d=-0.8	S.D.=16.3				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°01.5	N13°06.1	231°34.8	5.1′	N19°19.7	0.9′	59.9′
1	194°01.6	05.3	245°58.9	5.1′	19°20.6	0.8′	59.9′
2	209°01.7	04.5	260°23.0	5.1′	19°21.3	0.6′	59.9′
3	224°01.9	·· 03.7	274°47.0	5.1′	19°21.9	0.5′	59.9′
4	239°02.0	02.9	289°11.1	5.0′	19°22.3	0.4′	59.9′
5	254°02.2	02.1	303°35.1	5.0′	19°22.6	0.2′	59.9′
6	269°02.3	N13°01.3	317°59.2	5.0′	N19°22.8	0.1′	59.9′
7	284°02.4	13°00.5	332°23.2	5.0′	19°22.9	-0.0′	59.9′
8	299°02.6	12°59.6	346°47.2	5.0′	19°22.8	-0.2′	59.9′
9	314°02.7	·· 58.8	1°11.2	5.0′	19°22.5	-0.3′	59.9′
10	329°02.8	58.0	15°35.3	5.0′	19°22.2	-0.4′	59.9′
11	344°03.0	57.2	29°59.3	5.0′	19°21.7	-0.6′	59.9′
12	359°03.1	N12°56.4	44°23.3	5.0′	N19°21.1	-0.7′	59.9′
13	14°03.3	55.6	58°47.3	5.0′	19°20.3	-0.8′	59.9′
14	29°03.4	54.8	73°11.3	5.0′	19°19.4	-1.0′	59.9′
15	44°03.6	·· 54.0	87°35.4	5.0′	19°18.4	-1.1′	59.9′
16	59°03.7	53.2	101°59.4	5.0′	19°17.2	-1.2′	59.9′
17	74°03.8	52.3	116°23.5	5.0′	19°15.9	-1.4′	59.9′
18	89°04.0	N12°51.5	130°47.5	5.1′	N19°14.5	-1.5′	59.9′
19	104°04.1	50.7	145°11.6	5.1′	19°12.9	-1.6′	59.9′
20	119°04.3	49.9	159°35.6	5.1′	19°11.2	-1.8′	59.9′
21	134°04.4	·· 49.1	173°59.7	5.1′	19°09.4	-1.9′	59.9′
22	149°04.5	48.3	188°23.8	5.1′	19°07.4	-2.0′	59.9′
23	164°04.7	47.5	202°48.0	5.1′	19°05.3	-2.2′	59.9′
	SD.=15.8	d=-0.8	S.D.=16.3				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°04.8	N12°46.6	217°12.1	5.1′	N19°03.1	-2.3′	59.9′
1	194°05.0	45.8	231°36.3	5.2′	19°00.7	-2.4′	59.9′
2	209°05.1	45.0	246°00.4	5.2′	18°58.2	-2.6′	59.9′
3	224°05.3	·· 44.2	260°24.6	5.2′	18°55.6	-2.7′	59.9′
4	239°05.4	43.4	274°48.9	5.2′	18°52.8	-2.8′	59.9′
5	254°05.5	42.6	289°13.1	5.3′	18°50.0	-2.9′	59.8′
6	269°05.7	N12°41.7	303°37.4	5.3′	N18°46.9	-3.1′	59.8′
7	284°05.8	40.9	318°01.7	5.3′	18°43.8	-3.2′	59.8′
8	299°06.0	40.1	332°26.0	5.3′	18°40.5	-3.3′	59.8′
9	314°06.1	·· 39.3	346°50.4	5.4′	18°37.1	-3.5′	59.8′
10	329°06.3	38.5	1°14.8	5.4′	18°33.6	-3.6′	59.8′
11	344°06.4	37.6	15°39.2	5.4′	18°29.9	-3.7′	59.8′
12	359°06.6	N12°36.8	30°03.7	5.5′	N18°26.2	-3.8′	59.8′
13	14°06.7	36.0	44°28.2	5.5′	18°22.3	-4.0′	59.8′
14	29°06.8	35.2	58°52.7	5.6′	18°18.2	-4.1′	59.8′
15	44°07.0	·· 34.4	73°17.3	5.6′	18°14.1	-4.2′	59.8′
16	59°07.1	33.5	87°41.9	5.6′	18°09.8	-4.3′	59.8′
17	74°07.3	32.7	102°06.5	5.7′	18°05.4	-4.5′	59.8′
18	89°07.4	N12°31.9	116°31.2	5.7′	N18°00.9	-4.6′	59.8′
19	104°07.6	31.1	130°56.0	5.8′	17°56.3	-4.7′	59.7′
20	119°07.7	30.3	145°20.7	5.8′	17°51.5	-4.8′	59.7′
21	134°07.9	·· 29.4	159°45.6	5.8′	17°46.6	-4.9′	59.7′
22	149°08.0	28.6	174°10.4	5.9′	17°41.6	-5.1′	59.7′
23	164°08.2	27.8	188°35.3	5.9′	17°36.5	-5.2′	59.7′
	SD.=15.8	d=-0.8	S.D.=16.3				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	02:45	21:17	▭	▭
N 70°	▭	01:15	03:12	20:52	22:42	▭
68°	▭	02:06	03:33	20:32	21:56	▭
66°	▭	02:37	03:48	20:17	21:27	▭
64°	01:06	03:00	04:01	20:04	21:05	22:52
62°	01:52	03:17	04:12	19:53	20:48	22:11
60°	02:20	03:32	04:22	19:44	20:34	21:44
N 58°	02:41	03:44	04:30	19:36	20:22	21:24
56°	02:58	03:54	04:37	19:29	20:12	21:07
54°	03:12	04:03	04:43	19:23	20:03	20:54
52°	03:24	04:12	04:49	19:17	19:55	20:42
50°	03:34	04:19	04:54	19:12	19:48	20:32
45°	03:55	04:34	05:05	19:01	19:33	20:12
N 40°	04:11	04:46	05:15	18:52	19:21	19:56
35°	04:24	04:56	05:22	18:45	19:11	19:43
30°	04:35	05:04	05:29	18:38	19:03	19:32
20°	04:51	05:18	05:41	18:26	18:49	19:16
N 10°	05:04	05:29	05:51	18:16	18:38	19:03
0°	05:15	05:39	06:00	18:07	18:28	18:53
S 10°	05:23	05:48	06:10	17:58	18:19	18:44
20°	05:31	05:57	06:20	17:48	18:11	18:37
30°	05:38	06:06	06:31	17:37	18:02	18:30
35°	05:41	06:11	06:37	17:31	17:57	18:27
40°	05:44	06:16	06:44	17:24	17:52	18:24
45°	05:48	06:22	06:52	17:16	17:46	18:21
S 50°	05:51	06:29	07:02	17:06	17:40	18:17
52°	05:52	06:32	07:07	17:01	17:37	18:16
54°	05:54	06:35	07:12	16:56	17:33	18:15
56°	05:55	06:39	07:17	16:51	17:30	18:14
58°	05:56	06:42	07:24	16:45	17:26	18:12
S 60°	05:58	06:47	07:31	16:38	17:22	18:11

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	▭	▭	23:27	▭	▭	21:31
N 70°	21:39	22:46	–:–	19:09	20:07	20:24
68°	22:33	23:38	–:–	18:15	19:15	19:47
66°	23:06	–:–	00:11	17:42	18:42	19:21
64°	23:31	–:–	00:35	17:17	18:18	19:01
62°	23:50	–:–	00:54	16:58	17:59	18:44
60°	–:–	00:06	01:09	16:43	17:43	18:30
N 58°	–:–	00:19	01:22	16:29	17:30	18:18
56°	–:–	00:31	01:34	16:18	17:19	18:08
54°	–:–	00:41	01:44	16:08	17:08	17:59
52°	–:–	00:50	01:52	15:59	17:00	17:51
50°	00:05	00:58	02:00	15:51	16:51	17:43
45°	00:21	01:15	02:17	15:34	16:34	17:28
N 40°	00:34	01:30	02:31	15:20	16:20	17:15
35°	00:45	01:42	02:43	15:08	16:08	17:04
30°	00:55	01:52	02:53	14:57	15:58	16:54
20°	01:12	02:10	03:11	14:40	15:40	16:37
N 10°	01:27	02:26	03:26	14:24	15:24	16:23
0°	01:41	02:41	03:41	14:10	15:09	16:09
S 10°	01:55	02:56	03:55	13:55	14:55	15:55
20°	02:10	03:11	04:10	13:39	14:39	15:40
30°	02:28	03:30	04:28	13:22	14:21	15:23
35°	02:38	03:40	04:38	13:11	14:10	15:13
40°	02:50	03:53	04:50	12:59	13:58	15:02
45°	03:03	04:07	05:04	12:45	13:43	14:48
S 50°	03:20	04:24	05:21	12:28	13:26	14:32
52°	03:28	04:33	05:29	12:20	13:18	14:24
54°	03:37	04:42	05:38	12:11	13:08	14:16
56°	03:46	04:52	05:48	12:01	12:58	14:06
58°	03:58	05:04	05:59	11:50	12:46	13:55
S 60°	04:11	05:18	06:12	11:36	12:32	13:42

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 25-27 23-7%
17	04:07	04:01	12:04	07:55	20:25	
18	03:54	03:47	12:04	08:55	21:25	
19	03:41	03:34	12:04	09:55	22:24	

August 20, 21, 22 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	328°31.2	214°09.6	N20°58.9	186°10.3	N16°02.5	129°43.9	S06°43.9	68°00.3	S21°57.0
1	343°33.7	229°09.0	58.6	201°11.2	02.0	144°46.0	44.0	83°02.8	57.1
2	358°36.1	244°08.3	58.2	216°12.0	01.5	159°48.1	44.2	98°05.3	57.1
3	13°38.6	259°07.6	·· 57.9	231°12.9	·· 01.0	174°50.2	·· 44.3	113°07.7	·· 57.1
4	28°41.1	274°06.9	57.5	246°13.8	00.5	189°52.2	44.5	128°10.2	57.1
5	43°43.5	289°06.2	57.2	261°14.7	16°00.0	204°54.3	44.7	143°12.7	57.1
6	58°46.0	304°05.5	N20°56.8	276°15.6	N15°59.5	219°56.4	S06°44.8	158°15.2	S21°57.1
7	73°48.5	319°04.8	56.5	291°16.5	59.0	234°58.5	45.0	173°17.7	57.1
8	88°50.9	334°04.2	56.1	306°17.4	58.5	250°00.5	45.2	188°20.2	57.1
9	103°53.4	349°03.5	·· 55.7	321°18.3	·· 58.0	265°02.6	·· 45.3	203°22.7	·· 57.1
10	118°55.9	4°02.8	55.4	336°19.1	57.5	280°04.7	45.5	218°25.2	57.1
11	133°58.3	19°02.1	55.0	351°20.0	57.0	295°06.8	45.7	233°27.6	57.1
12	149°00.8	34°01.4	N20°54.7	6°20.9	N15°56.5	310°08.8	S06°45.8	248°30.1	S21°57.1
13	164°03.2	49°00.7	54.3	21°21.8	56.0	325°10.9	46.0	263°32.6	57.1
14	179°05.7	64°00.0	53.9	36°22.7	55.5	340°13.0	46.2	278°35.1	57.1
15	194°08.2	78°59.4	·· 53.6	51°23.6	·· 55.0	355°15.1	·· 46.3	293°37.6	·· 57.1
16	209°10.6	93°58.7	53.2	66°24.5	54.5	10°17.1	46.5	308°40.1	57.1
17	224°13.1	108°58.0	52.8	81°25.4	54.0	25°19.2	46.7	323°42.6	57.2
18	239°15.6	123°57.3	N20°52.5	96°26.3	N15°53.5	40°21.3	S06°46.8	338°45.0	S21°57.2
19	254°18.0	138°56.6	52.1	111°27.2	53.0	55°23.4	47.0	353°47.5	57.2
20	269°20.5	153°55.9	51.7	126°28.0	52.5	70°25.4	47.1	8°50.0	57.2
21	284°23.0	168°55.3	·· 51.4	141°28.9	·· 52.0	85°27.5	·· 47.3	23°52.5	·· 57.2
22	299°25.4	183°54.6	51.0	156°29.8	51.5	100°29.6	47.5	38°55.0	57.2
23	314°27.9	198°53.9	50.6	171°30.7	51.0	115°31.6	47.6	53°57.5	57.2
Mer.pass.:02:06		v-0.7 d-0.4 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	329°30.3	213°53.2	N20°50.2	186°31.6	N15°50.5	130°33.7	S06°47.8	69°00.0	S21°57.2
1	344°32.8	228°52.5	49.9	201°32.5	50.0	145°35.8	48.0	84°02.4	57.2
2	359°35.3	243°51.8	49.5	216°33.4	49.5	160°37.9	48.1	99°04.9	57.2
3	14°37.7	258°51.2	·· 49.1	231°34.3	·· 49.0	175°39.9	·· 48.3	114°07.4	·· 57.2
4	29°40.2	273°50.5	48.7	246°35.2	48.5	190°42.0	48.5	129°09.9	57.2
5	44°42.7	288°49.8	48.3	261°36.1	48.0	205°44.1	48.6	144°12.4	57.2
6	59°45.1	303°49.1	N20°48.0	276°37.0	N15°47.5	220°46.1	S06°48.8	159°14.9	S21°57.2
7	74°47.6	318°48.4	47.6	291°37.8	47.0	235°48.2	49.0	174°17.3	57.2
8	89°50.1	333°47.7	47.2	306°38.7	46.5	250°50.3	49.1	189°19.8	57.3
9	104°52.5	348°47.1	·· 46.8	321°39.6	·· 46.0	265°52.4	·· 49.3	204°22.3	·· 57.3
10	119°55.0	3°46.4	46.4	336°40.5	45.5	280°54.4	49.5	219°24.8	57.3
11	134°57.5	18°45.7	46.0	351°41.4	45.0	295°56.5	49.6	234°27.3	57.3
12	149°59.9	33°45.0	N20°45.7	6°42.3	N15°44.4	310°58.6	S06°49.8	249°29.8	S21°57.3
13	165°02.4	48°44.3	45.3	21°43.2	43.9	326°00.6	50.0	264°32.2	57.3
14	180°04.8	63°43.7	44.9	36°44.1	43.4	341°02.7	50.1	279°34.7	57.3
15	195°07.3	78°43.0	·· 44.5	51°45.0	·· 42.9	356°04.8	·· 50.3	294°37.2	·· 57.3
16	210°09.8	93°42.3	44.1	66°45.9	42.4	11°06.8	50.5	309°39.7	57.3
17	225°12.2	108°41.6	43.7	81°46.8	41.9	26°08.9	50.6	324°42.2	57.3
18	240°14.7	123°40.9	N20°43.3	96°47.7	N15°41.4	41°11.0	S06°50.8	339°44.6	S21°57.3
19	255°17.2	138°40.2	42.9	111°48.6	40.9	56°13.1	51.0	354°47.1	57.3
20	270°19.6	153°39.6	42.5	126°49.5	40.4	71°15.1	51.1	9°49.6	57.3
21	285°22.1	168°38.9	·· 42.1	141°50.4	·· 39.9	86°17.2	·· 51.3	24°52.1	·· 57.3
22	300°24.6	183°38.2	41.7	156°51.2	39.4	101°19.3	51.5	39°54.6	57.3
23	315°27.0	198°37.5	41.3	171°52.1	38.9	116°21.3	51.6	54°57.0	57.4
Mer.pass.:02:02		v-0.7 d-0.4 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	330°29.5	213°36.8	N20°40.9	186°53.0	N15°38.4	131°23.4	S06°51.8	69°59.5	S21°57.4
1	345°32.0	228°36.2	40.5	201°53.9	37.9	146°25.5	52.0	85°02.0	57.4
2	0°34.4	243°35.5	40.1	216°54.8	37.4	161°27.5	52.1	100°04.5	57.4
3	15°36.9	258°34.8	·· 39.7	231°55.7	·· 36.9	176°29.6	·· 52.3	115°07.0	·· 57.4
4	30°39.3	273°34.1	39.3	246°56.6	36.3	191°31.7	52.5	130°09.4	57.4
5	45°41.8	288°33.4	38.9	261°57.5	35.8	206°33.7	52.6	145°11.9	57.4
6	60°44.3	303°32.8	N20°38.5	276°58.4	N15°35.3	221°35.8	S06°52.8	160°14.4	S21°57.4
7	75°46.7	318°32.1	38.1	291°59.3	34.8	236°37.9	53.0	175°16.9	57.4
8	90°49.2	333°31.4	37.7	307°00.2	34.3	251°39.9	53.1	190°19.4	57.4
9	105°51.7	348°30.7	·· 37.3	322°01.1	·· 33.8	266°42.0	·· 53.3	205°21.8	·· 57.4
10	120°54.1	3°30.1	36.9	337°02.0	33.3	281°44.1	53.5	220°24.3	57.4
11	135°56.6	18°29.4	36.5	352°02.9	32.8	296°46.1	53.6	235°26.8	57.4
12	150°59.1	33°28.7	N20°36.1	7°03.8	N15°32.3	311°48.2	S06°53.8	250°29.3	S21°57.4
13	166°01.5	48°28.0	35.7	22°04.7	31.8	326°50.3	54.0	265°31.7	57.5
14	181°04.0	63°27.3	35.2	37°05.6	31.3	341°52.3	54.1	280°34.2	57.5
15	196°06.4	78°26.7	·· 34.8	52°06.5	·· 30.7	356°54.4	·· 54.3	295°36.7	·· 57.5
16	211°08.9	93°26.0	34.4	67°07.4	30.2	11°56.5	54.5	310°39.2	57.5
17	226°11.4	108°25.3	34.0	82°08.3	29.7	26°58.5	54.6	325°41.7	57.5
18	241°13.8	123°24.6	N20°33.6	97°09.2	N15°29.2	42°00.6	S06°54.8	340°44.1	S21°57.5
19	256°16.3	138°23.9	33.2	112°10.1	28.7	57°02.7	55.0	355°46.6	57.5
20	271°18.8	153°23.3	32.7	127°11.0	28.2	72°04.7	55.1	10°49.1	57.5
21	286°21.2	168°22.6	·· 32.3	142°11.8	·· 27.7	87°06.8	·· 55.3	25°51.6	·· 57.5
22	301°23.7	183°21.9	31.9	157°12.7	27.2	102°08.9	55.5	40°54.0	57.5
23	316°26.2	198°21.2	31.5	172°13.6	26.7	117°10.9	55.6	55°56.5	57.5
Mer.pass.:01:58		v-0.7 d-0.4 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.2
Ankaa	353°12.6	-42°12.5
Schedar	349°36.8	56°37.8
Diphda	348°52.8	-17°53.3
Achernar	335°24.4	-57°08.7
Hamal	327°57.4	23°32.6
Polaris	316°22.8	89°19.9
Acamar	315°16.1	-40°13.9
Menkar	314°12.0	4°09.4
Mirfak	308°36.2	49°55.1
Aldebaran	290°46.2	16°32.5
Rigel	281°09.5	-8°10.9
Capella	280°30.4	46°00.6
Bellatrix	278°29.1	6°21.8
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.5
Betelgeuse	270°58.4	7°24.5
Canopus	263°55.2	-52°42.2
Sirius	258°31.5	-16°44.4
Adhara	255°10.6	-28°59.7
Procyon	244°57.1	5°10.7
Pollux	243°24.6	27°58.9
Avior	234°17.4	-59°33.9
Suhail	222°50.8	-43°30.2
Miaplacidus	221°39.9	-69°47.3
Alphard	217°53.6	-8°44.1
Regulus	207°40.8	11°52.9
Dubhe	193°49.0	61°39.5
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.6	-63°11.9
Gacrux	171°58.1	-57°12.7
Alioth	166°18.7	55°52.2
Spica	158°28.4	-11°15.0
Alkaid	152°57.0	49°13.9
Hadar	148°44.0	-60°27.5
Menkent	148°04.4	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°48.0	-60°54.5
Kochab	137°20.5	74°05.5
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.6	26°39.8
Antares	112°22.7	-26°28.1
Atria	107°21.7	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.9
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.5	51°29.6
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.8	38°48.4
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.8
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.3	28°10.7
Markab	13°35.2	15°18.1

Aug 20 Sun	**SHA**	**Mer.pass**
Venus	245°38.4	09:44
Mars	217°39.1	11:35
Jupiter	161°12.7	15:19
Saturn	99°29.1	19:25

Aug 21 Mon	**SHA**	**Mer.pass**
Venus	244°22.9	09:45
Mars	217°01.3	11:33
Jupiter	161°03.4	15:16
Saturn	99°29.6	19:21

Aug 22 Tue	**SHA**	**Mer.pass**
Venus	243°07.4	09:46
Mars	216°23.5	11:32
Jupiter	160°53.9	15:12
Saturn	99°30.0	19:17

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3403 sec ΔT = TT-UT1 = +68.8437 sec

2017 August 20 to Aug. 22 UT

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Sun	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°08.3	N12°27.0	203°00.3	6.0'	N17°31.3	-5.3'	59.7'
1	194°08.5	26.1	217°25.3	6.0'	17°25.9	-5.4'	59.7'
2	209°08.6	25.3	231°50.4	6.1'	17°20.5	-5.5'	59.7'
3	224°08.8	·· 24.5	246°15.5	6.1'	17°14.9	-5.6'	59.7'
4	239°08.9	23.7	260°40.7	6.2'	17°09.2	-5.7'	59.6'
5	254°09.1	22.8	275°05.9	6.2'	17°03.4	-5.9'	59.6'
6	269°09.2	N12°22.0	289°31.1	6.3'	N16°57.5	-6.0'	59.6'
7	284°09.4	21.2	303°56.5	6.4'	16°51.5	-6.1'	59.6'
8	299°09.5	20.4	318°21.8	6.4'	16°45.3	-6.2'	59.6'
9	314°09.7	·· 19.5	332°47.3	6.5'	16°39.1	-6.3'	59.6'
10	329°09.8	18.7	347°12.8	6.5'	16°32.8	-6.4'	59.6'
11	344°10.0	17.9	1°38.3	6.6'	16°26.3	-6.5'	59.5'
12	359°10.1	N12°17.1	16°03.9	6.6'	N16°19.8	-6.6'	59.5'
13	14°10.3	16.2	30°29.6	6.7'	16°13.1	-6.7'	59.5'
14	29°10.4	15.4	44°55.3	6.8'	16°06.3	-6.8'	59.5'
15	44°10.6	·· 14.6	59°21.1	6.8'	15°59.5	-6.9'	59.5'
16	59°10.7	13.7	73°46.9	6.9'	15°52.5	-7.0'	59.5'
17	74°10.9	12.9	88°12.9	6.9'	15°45.5	-7.1'	59.4'
18	89°11.0	N12°12.1	102°38.8	7.0'	N15°38.3	-7.2'	59.4'
19	104°11.2	11.3	117°04.9	7.1'	15°31.1	-7.3'	59.4'
20	119°11.3	10.4	131°30.9	7.1'	15°23.7	-7.4'	59.4'
21	134°11.5	·· 09.6	145°57.1	7.2'	15°16.3	-7.5'	59.4'
22	149°11.6	08.8	160°23.3	7.3'	15°08.7	-7.6'	59.4'
23	164°11.8	07.9	174°49.6	7.3'	15°01.1	-7.7'	59.3'
	SD.=15.8	d=-0.8		S.D.=16.2			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°11.9	N12°07.1	189°16.0	7.4'	N14°53.4	-7.8'	59.3'
1	194°12.1	06.3	203°42.4	7.5'	14°45.6	-7.9'	59.3'
2	209°12.2	05.4	218°08.9	7.5'	14°37.7	-7.9'	59.3'
3	224°12.4	·· 04.6	232°35.4	7.6'	14°29.7	-8.0'	59.3'
4	239°12.5	03.8	247°02.1	7.7'	14°21.6	-8.1'	59.2'
5	254°12.7	02.9	261°28.7	7.7'	14°13.5	-8.2'	59.2'
6	269°12.8	N12°02.1	275°55.5	7.8'	N14°05.3	-8.3'	59.2'
7	284°13.0	01.3	290°22.3	7.9'	13°56.9	-8.4'	59.2'
8	299°13.1	12°00.4	304°49.2	7.9'	13°48.6	-8.4'	59.2'
9	314°13.3	11°59.6	319°16.2	8.0'	13°40.1	-8.5'	59.1'
10	329°13.5	58.8	333°43.2	8.1'	13°31.5	-8.6'	59.1'
11	344°13.6	57.9	348°10.3	8.1'	13°22.9	-8.7'	59.1'
12	359°13.8	N11°57.1	2°37.4	8.2'	N13°14.2	-8.7'	59.1'
13	14°13.9	56.3	17°04.7	8.3'	13°05.4	-8.8'	59.0'
14	29°14.1	55.4	31°32.0	8.3'	12°56.6	-8.9'	59.0'
15	44°14.2	·· 54.6	45°59.4	8.4'	12°47.6	-9.0'	59.0'
16	59°14.4	53.7	60°26.8	8.5'	12°38.6	-9.0'	59.0'
17	74°14.5	52.9	74°54.3	8.5'	12°29.6	-9.1'	59.0'
18	89°14.7	N11°52.1	89°21.9	8.6'	N12°20.5	-9.2'	58.9'
19	104°14.9	51.2	103°49.5	8.7'	12°11.3	-9.2'	58.9'
20	119°15.0	50.4	118°17.2	8.8'	12°02.0	-9.3'	58.9'
21	134°15.2	·· 49.6	132°45.0	8.8'	11°52.7	-9.4'	58.9'
22	149°15.3	48.7	147°12.9	8.9'	11°43.3	-9.4'	58.8'
23	164°15.5	47.9	161°40.8	9.0'	11°33.8	-9.5'	58.8'
	SD.=15.8	d=-0.8		S.D.=16.1			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°15.6	N11°47.0	176°08.8	9.0'	N11°24.3	-9.5'	58.8'
1	194°15.8	46.2	190°36.9	9.1'	11°14.8	-9.6'	58.8'
2	209°16.0	45.4	205°05.0	9.2'	11°05.1	-9.7'	58.7'
3	224°16.1	·· 44.5	219°33.2	9.2'	10°55.5	-9.7'	58.7'
4	239°16.3	43.7	234°01.4	9.3'	10°45.7	-9.8'	58.7'
5	254°16.4	42.8	248°29.8	9.4'	10°35.9	-9.8'	58.6'
6	269°16.6	N11°42.0	262°58.2	9.4'	N10°26.1	-9.9'	58.6'
7	284°16.7	41.2	277°26.7	9.5'	10°16.2	-9.9'	58.6'
8	299°16.9	40.3	291°55.2	9.6'	10°06.3	-10.0'	58.6'
9	314°17.1	·· 39.5	306°23.8	9.6'	09°56.3	-10.0'	58.5'
10	329°17.2	38.6	320°52.5	9.7'	09°46.2	-10.1'	58.5'
11	344°17.4	37.8	335°21.2	9.8'	09°36.2	-10.1'	58.5'
12	359°17.5	N11°36.9	349°50.0	9.8'	N09°26.0	-10.1'	58.5'
13	14°17.7	36.1	4°18.9	9.9'	09°15.9	-10.2'	58.4'
14	29°17.9	35.3	18°47.8	10.0'	09°05.6	-10.2'	58.4'
15	44°18.0	·· 34.4	33°16.8	10.0'	08°55.4	-10.3'	58.4'
16	59°18.2	33.6	47°45.9	10.1'	08°45.1	-10.3'	58.3'
17	74°18.3	32.7	62°15.0	10.2'	08°34.8	-10.3'	58.3'
18	89°18.5	N11°31.9	76°44.2	10.2'	N08°24.4	-10.4'	58.3'
19	104°18.7	31.0	91°13.5	10.3'	08°14.0	-10.4'	58.3'
20	119°18.8	30.2	105°42.8	10.4'	08°03.6	-10.5'	58.2'
21	134°19.0	·· 29.3	120°12.2	10.4'	07°53.1	-10.5'	58.2'
22	149°19.2	28.5	134°41.7	10.5'	07°42.6	-10.5'	58.2'
23	164°19.3	27.6	149°11.2	10.5'	07°32.1	-10.5'	58.1'
	SD.=15.8	d=-0.8		S.D.=15.9			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	▭	03:03	20:58	▭	▭
N 70°	▭	01:46	03:27	20:36	22:13	▭
68°	▭	02:25	03:45	20:19	21:37	▭
66°	▭	02:51	03:59	20:05	21:11	▭
64°	01:33	03:11	04:11	19:53	20:52	22:27
62°	02:08	03:27	04:20	19:44	20:37	21:54
60°	02:32	03:40	04:29	19:36	20:24	21:31
N 58°	02:51	03:51	04:36	19:28	20:13	21:12
56°	03:06	04:01	04:43	19:22	20:03	20:58
54°	03:19	04:10	04:49	19:16	19:55	20:45
52°	03:30	04:17	04:54	19:11	19:48	20:34
50°	03:40	04:24	04:59	19:06	19:41	20:25
45°	03:59	04:38	05:09	18:56	19:28	20:06
N 40°	04:14	04:49	05:17	18:48	19:17	19:51
35°	04:27	04:58	05:25	18:41	19:07	19:39
30°	04:37	05:06	05:31	18:35	19:00	19:29
20°	04:52	05:19	05:42	18:24	18:47	19:13
N 10°	05:04	05:30	05:51	18:15	18:36	19:02
0°	05:14	05:39	06:00	18:06	18:28	18:52
S 10°	05:22	05:47	06:08	17:58	18:19	18:44
20°	05:29	05:55	06:17	17:49	18:12	18:37
30°	05:35	06:03	06:27	17:39	18:03	18:32
35°	05:38	06:07	06:33	17:33	17:59	18:29
40°	05:41	06:12	06:40	17:27	17:55	18:26
45°	05:43	06:17	06:47	17:19	17:49	18:24
S 50°	05:46	06:23	06:57	17:10	17:44	18:21
52°	05:47	06:26	07:01	17:06	17:41	18:20
54°	05:48	06:29	07:05	17:02	17:38	18:20
56°	05:48	06:32	07:10	16:57	17:35	18:19
58°	05:49	06:35	07:16	16:51	17:32	18:18
S 60°	05:50	06:39	07:22	16:45	17:28	18:17

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	–:–	01:57	04:03	21:01	20:48	20:38
N 70°	00:34	02:29	04:21	20:28	20:28	20:27
68°	01:10	02:52	04:36	20:04	20:12	20:18
66°	01:35	03:10	04:47	19:45	20:00	20:10
64°	01:55	03:25	04:57	19:29	19:49	20:03
62°	02:11	03:37	05:05	19:16	19:40	19:58
60°	02:24	03:47	05:12	19:05	19:32	19:53
N 58°	02:36	03:56	05:18	18:56	19:25	19:48
56°	02:46	04:04	05:24	18:47	19:19	19:44
54°	02:55	04:11	05:29	18:40	19:13	19:41
52°	03:03	04:17	05:33	18:33	19:08	19:38
50°	03:10	04:23	05:37	18:27	19:03	19:35
45°	03:25	04:35	05:46	18:14	18:54	19:28
N 40°	03:37	04:45	05:53	18:03	18:45	19:23
35°	03:48	04:54	05:59	17:54	18:38	19:18
30°	03:57	05:01	06:05	17:45	18:32	19:14
20°	04:13	05:14	06:14	17:31	18:21	19:07
N 10°	04:27	05:25	06:22	17:19	18:11	19:00
0°	04:39	05:36	06:30	17:07	18:02	18:54
S 10°	04:52	05:47	06:37	16:55	17:53	18:48
20°	05:06	05:58	06:46	16:42	17:43	18:42
30°	05:22	06:11	06:55	16:28	17:32	18:34
35°	05:31	06:18	07:00	16:19	17:25	18:30
40°	05:42	06:27	07:06	16:09	17:18	18:25
45°	05:54	06:36	07:13	15:58	17:09	18:19
S 50°	06:08	06:48	07:21	15:44	16:58	18:12
52°	06:15	06:54	07:25	15:37	16:53	18:09
54°	06:23	07:00	07:30	15:30	16:48	18:05
56°	06:32	07:06	07:34	15:22	16:42	18:01
58°	06:41	07:14	07:39	15:13	16:35	17:57
S 60°	06:52	07:22	07:45	15:02	16:27	17:52

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 28-1 2-1%
20	03:27	03:20	12:03	10:53	23:21	
21	03:12	03:05	12:03	11:49	–:–	
22	02:57	02:50	12:03	12:42	00:16	

August 23, 24, 25 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	331°28.6	213°20.6	N20°31.1	187°14.5	N15°26.2	132°13.0	S06°55.8	70°59.0	S21°57.5
1	346°31.1	228°19.9	30.6	202°15.4	25.6	147°15.1	56.0	86°01.5	57.5
2	1°33.6	243°19.2	30.2	217°16.3	25.1	162°17.1	56.1	101°03.9	57.5
3	16°36.0	258°18.5	·· 29.8	232°17.2	·· 24.6	177°19.2	·· 56.3	116°06.4	·· 57.6
4	31°38.5	273°17.9	29.4	247°18.1	24.1	192°21.3	56.5	131°08.9	57.6
5	46°40.9	288°17.2	28.9	262°19.0	23.6	207°23.3	56.6	146°11.4	57.6
6	61°43.4	303°16.5	N20°28.5	277°19.9	N15°23.1	222°25.4	S06°56.8	161°13.8	S21°57.6
7	76°45.9	318°15.8	28.1	292°20.8	22.6	237°27.5	57.0	176°16.3	57.6
8	91°48.3	333°15.2	27.6	307°21.7	22.1	252°29.5	57.2	191°18.8	57.6
9	106°50.8	348°14.5	·· 27.2	322°22.6	·· 21.5	267°31.6	·· 57.3	206°21.3	·· 57.6
10	121°53.3	3°13.8	26.8	337°23.5	21.0	282°33.6	57.5	221°23.7	57.6
11	136°55.7	18°13.1	26.3	352°24.4	20.5	297°35.7	57.7	236°26.2	57.6
12	151°58.2	33°12.5	N20°25.9	7°25.3	N15°20.0	312°37.8	S06°57.8	251°28.7	S21°57.6
13	167°00.7	48°11.8	25.5	22°26.2	19.5	327°39.8	58.0	266°31.2	57.6
14	182°03.1	63°11.1	25.0	37°27.1	19.0	342°41.9	58.2	281°33.6	57.6
15	197°05.6	78°10.4	·· 24.6	52°28.0	·· 18.5	357°44.0	·· 58.3	296°36.1	·· 57.6
16	212°08.1	93°09.8	24.1	67°28.9	18.0	12°46.0	58.5	311°38.6	57.6
17	227°10.5	108°09.1	23.7	82°29.8	17.4	27°48.1	58.7	326°41.0	57.7
18	242°13.0	123°08.4	N20°23.3	97°30.7	N15°16.9	42°50.2	S06°58.8	341°43.5	S21°57.7
19	257°15.4	138°07.7	22.8	112°31.6	16.4	57°52.2	59.0	356°46.0	57.7
20	272°17.9	153°07.1	22.4	127°32.5	15.9	72°54.3	59.2	11°48.5	57.7
21	287°20.4	168°06.4	·· 21.9	142°33.4	·· 15.4	87°56.3	·· 59.3	26°50.9	·· 57.7
22	302°22.8	183°05.7	21.5	157°34.3	14.9	102°58.4	59.5	41°53.4	57.7
23	317°25.3	198°05.0	21.0	172°35.2	14.4	118°00.5	59.7	56°55.9	57.7
Mer.pass.:01:54		v-0.7 d-0.4 m-3.9		v0.9 d-0.5 m1.7		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	332°27.8	213°04.4	N20°20.6	187°36.1	N15°13.8	133°02.5	S06°59.8	71°58.3	S21°57.7
1	347°30.2	228°03.7	20.1	202°37.0	13.3	148°04.6	07°00.0	87°00.8	57.7
2	2°32.7	243°03.0	19.7	217°37.9	12.8	163°06.6	00.2	102°03.3	57.7
3	17°35.2	258°02.4	·· 19.2	232°38.8	·· 12.3	178°08.7	·· 00.4	117°05.8	·· 57.7
4	32°37.6	273°01.7	18.8	247°39.7	11.8	193°10.8	00.5	132°08.2	57.7
5	47°40.1	288°01.0	18.3	262°40.6	11.3	208°12.8	00.7	147°10.7	57.7
6	62°42.5	303°00.3	N20°17.9	277°41.5	N15°10.7	223°14.9	S07°00.9	162°13.2	S21°57.7
7	77°45.0	317°59.7	17.4	292°42.4	10.2	238°17.0	01.0	177°15.6	57.8
8	92°47.5	332°59.0	17.0	307°43.4	09.7	253°19.0	01.2	192°18.1	57.8
9	107°49.9	347°58.3	·· 16.5	322°44.3	·· 09.2	268°21.1	·· 01.4	207°20.6	·· 57.8
10	122°52.4	2°57.6	16.1	337°45.2	08.7	283°23.1	01.5	222°23.1	57.8
11	137°54.9	17°57.0	15.6	352°46.1	08.2	298°25.2	01.7	237°25.5	57.8
12	152°57.3	32°56.3	N20°15.1	7°47.0	N15°07.6	313°27.3	S07°01.9	252°28.0	S21°57.8
13	167°59.8	47°55.6	14.7	22°47.9	07.1	328°29.3	02.0	267°30.5	57.8
14	183°02.3	62°55.0	14.2	37°48.8	06.6	343°31.4	02.2	282°32.9	57.8
15	198°04.7	77°54.3	·· 13.8	52°49.7	·· 06.1	358°33.4	·· 02.4	297°35.4	·· 57.8
16	213°07.2	92°53.6	13.3	67°50.6	05.6	13°35.5	02.6	312°37.9	57.8
17	228°09.7	107°53.0	12.8	82°51.5	05.1	28°37.6	02.7	327°40.3	57.8
18	243°12.1	122°52.3	N20°12.4	97°52.4	N15°04.5	43°39.6	S07°02.9	342°42.8	S21°57.8
19	258°14.6	137°51.6	11.9	112°53.3	04.0	58°41.7	03.1	357°45.3	57.8
20	273°17.0	152°50.9	11.4	127°54.2	03.5	73°43.7	03.2	12°47.7	57.9
21	288°19.5	167°50.3	·· 11.0	142°55.1	·· 03.0	88°45.8	·· 03.4	27°50.2	·· 57.9
22	303°22.0	182°49.6	10.5	157°56.0	02.5	103°47.8	03.6	42°52.7	57.9
23	318°24.4	197°48.9	10.0	172°56.9	01.9	118°49.9	03.7	57°55.1	57.9
Mer.pass.:01:50		v-0.7 d-0.4 m-3.9		v0.9 d-0.5 m1.8		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	333°26.9	212°48.3	N20°09.6	187°57.8	N15°01.4	133°52.0	S07°03.9	72°57.6	S21°57.9
1	348°29.4	227°47.6	09.1	202°58.7	00.9	148°54.0	04.1	88°00.1	57.9
2	3°31.8	242°46.9	08.6	217°59.6	15°00.4	163°56.1	04.3	103°02.5	57.9
3	18°34.3	257°46.3	·· 08.1	233°00.5	14°59.9	178°58.1	·· 04.4	118°05.0	·· 57.9
4	33°36.8	272°45.6	07.7	248°01.4	59.3	194°00.2	04.6	133°07.5	57.9
5	48°39.2	287°44.9	07.2	263°02.3	58.8	209°02.2	04.8	148°09.9	57.9
6	63°41.7	302°44.3	N20°06.7	278°03.2	N14°58.3	224°04.3	S07°04.9	163°12.4	S21°57.9
7	78°44.1	317°43.6	06.2	293°04.1	57.8	239°06.4	05.1	178°14.9	57.9
8	93°46.6	332°42.9	05.8	308°05.1	57.3	254°08.4	05.3	193°17.3	57.9
9	108°49.1	347°42.3	·· 05.3	323°06.0	·· 56.7	269°10.5	·· 05.4	208°19.8	·· 58.0
10	123°51.5	2°41.6	04.8	338°06.9	56.2	284°12.5	05.6	223°22.3	58.0
11	138°54.0	17°40.9	04.3	353°07.8	55.7	299°14.6	05.8	238°24.7	58.0
12	153°56.5	32°40.3	N20°03.8	8°08.7	N14°55.2	314°16.6	S07°06.0	253°27.2	S21°58.0
13	168°58.9	47°39.6	03.3	23°09.6	54.7	329°18.7	06.1	268°29.7	58.0
14	184°01.4	62°38.9	02.9	38°10.5	54.1	344°20.8	06.3	283°32.1	58.0
15	199°03.9	77°38.3	·· 02.4	53°11.4	·· 53.6	359°22.8	·· 06.5	298°34.6	·· 58.0
16	214°06.3	92°37.6	01.9	68°12.3	53.1	14°24.9	06.6	313°37.1	58.0
17	229°08.8	107°36.9	01.4	83°13.2	52.6	29°26.9	06.8	328°39.5	58.0
18	244°11.3	122°36.3	N20°00.9	98°14.1	N14°52.1	44°29.0	S07°07.0	343°42.0	S21°58.0
19	259°13.7	137°35.6	20°00.4	113°15.0	51.5	59°31.0	07.1	358°44.4	58.0
20	274°16.2	152°34.9	19°59.9	128°15.9	51.0	74°33.1	07.3	13°46.9	58.0
21	289°18.6	167°34.3	·· 59.4	143°16.8	·· 50.5	89°35.2	·· 07.5	28°49.4	·· 58.0
22	304°21.1	182°33.6	58.9	158°17.8	50.0	104°37.2	07.7	43°51.8	58.1
23	319°23.6	197°32.9	58.4	173°18.7	49.4	119°39.3	07.8	58°54.3	58.1
Mer.pass.:01:46		v-0.7 d-0.5 m-3.9		v0.9 d-0.5 m1.8		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.2
Ankaa	353°12.6	-42°12.5
Schedar	349°36.8	56°37.8
Diphda	348°52.8	-17°53.3
Achernar	335°24.4	-57°08.7
Hamal	327°57.4	23°32.6
Polaris	316°21.5	89°19.9
Acamar	315°16.1	-40°13.9
Menkar	314°12.0	4°09.4
Mirfak	308°36.2	49°55.1
Aldebaran	290°46.2	16°32.5
Rigel	281°09.4	-8°10.9
Capella	280°30.4	46°00.6
Bellatrix	278°29.1	6°21.8
Elnath	278°09.2	28°37.1
Alnilam	275°43.6	-1°11.5
Betelgeuse	270°58.4	7°24.5
Canopus	263°55.2	-52°42.2
Sirius	258°31.4	-16°44.4
Adhara	255°10.6	-28°59.7
Procyon	244°57.0	5°10.7
Pollux	243°24.6	27°58.9
Avior	234°17.4	-59°33.9
Suhail	222°50.8	-43°30.2
Miaplacidus	221°39.9	-69°47.3
Alphard	217°53.6	-8°44.1
Regulus	207°40.9	11°52.9
Dubhe	193°49.0	61°39.5
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.6	-63°11.8
Gacrux	171°58.1	-57°12.7
Alioth	166°18.7	55°52.2
Spica	158°28.5	-11°15.0
Alkaid	152°57.0	49°13.9
Hadar	148°44.1	-60°27.5
Menkent	148°04.4	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°48.0	-60°54.5
Kochab	137°20.6	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.8
Antares	112°22.7	-26°28.1
Atria	107°21.8	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.9
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.6	51°29.7
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.8	38°48.4
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.9
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.8
Markab	13°35.2	15°18.1

Aug 23 Wed	SHA	Mer.pass
Venus	241°51.9	09:47
Mars	215°45.9	11:30
Jupiter	160°44.4	15:09
Saturn	99°30.4	19:13

Aug 24 Thu	SHA	Mer.pass
Venus	240°36.6	09:48
Mars	215°08.4	11:29
Jupiter	160°34.8	15:06
Saturn	99°30.6	19:09

Aug 25 Fri	SHA	Mer.pass
Venus	239°21.4	09:49
Mars	214°30.9	11:27
Jupiter	160°25.1	15:02
Saturn	99°30.7	19:05

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3393 sec ΔT = TT-UT1 = +68.8447 sec

2017 August 23 to Aug. 25 UT

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°19.5	N11°26.8	163°40.7	10.6′	N07°21.5	-10.6′	58.1′
1	194°19.6	25.9	178°10.4	10.7′	07°10.9	-10.6′	58.1′
2	209°19.8	25.1	192°40.1	10.7′	07°00.3	-10.6′	58.0′
3	224°20.0	·· 24.2	207°09.8	10.8′	06°49.6	-10.7′	58.0′
4	239°20.1	23.4	221°39.7	10.8′	06°39.0	-10.7′	58.0′
5	254°20.3	22.6	236°09.5	10.9′	06°28.3	-10.7′	58.0′
6	269°20.5	N11°21.7	250°39.5	11.0′	N06°17.6	-10.7′	57.9′
7	284°20.6	20.9	265°09.5	11.0′	06°06.8	-10.7′	57.9′
8	299°20.8	20.0	279°39.5	11.1′	05°56.1	-10.8′	57.9′
9	314°20.9	·· 19.2	294°09.6	11.1′	05°45.3	-10.8′	57.8′
10	329°21.1	18.3	308°39.8	11.2′	05°34.5	-10.8′	57.8′
11	344°21.3	17.5	323°10.0	11.3′	05°23.7	-10.8′	57.8′
12	359°21.4	N11°16.6	337°40.3	11.3′	N05°12.8	-10.8′	57.7′
13	14°21.6	15.8	352°10.6	11.4′	05°02.0	-10.9′	57.7′
14	29°21.8	14.9	6°41.0	11.4′	04°51.1	-10.9′	57.7′
15	44°21.9	·· 14.0	21°11.5	11.5′	04°40.3	-10.9′	57.6′
16	59°22.1	13.2	35°42.0	11.5′	04°29.4	-10.9′	57.6′
17	74°22.3	12.3	50°12.5	11.6′	04°18.5	-10.9′	57.6′
18	89°22.4	N11°11.5	64°43.1	11.6′	N04°07.6	-10.9′	57.5′
19	104°22.6	10.6	79°13.8	11.7′	03°56.7	-10.9′	57.5′
20	119°22.8	09.8	93°44.5	11.7′	03°45.8	-10.9′	57.5′
21	134°22.9	·· 08.9	108°15.2	11.8′	03°34.8	-10.9′	57.5′
22	149°23.1	08.1	122°46.0	11.8′	03°23.9	-10.9′	57.4′
23	164°23.3	07.2	137°16.9	11.9′	03°13.0	-10.9′	57.4′
	SD.=15.8	d=-0.8	S.D.=15.7				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°23.4	N11°06.4	151°47.8	11.9′	N03°02.0	-10.9′	57.4′
1	194°23.6	05.5	166°18.7	12.0′	02°51.1	-10.9′	57.3′
2	209°23.8	04.7	180°49.7	12.0′	02°40.1	-10.9′	57.3′
3	224°23.9	·· 03.8	195°20.8	12.1′	02°29.2	-10.9′	57.3′
4	239°24.1	02.9	209°51.8	12.1′	02°18.2	-10.9′	57.2′
5	254°24.3	02.1	224°23.0	12.2′	02°07.3	-10.9′	57.2′
6	269°24.4	N11°01.2	238°54.2	12.2′	N01°56.4	-10.9′	57.2′
7	284°24.6	11°00.4	253°25.4	12.2′	01°45.4	-10.9′	57.1′
8	299°24.8	10°59.5	267°56.7	12.3′	01°34.5	-10.9′	57.1′
9	314°24.9	·· 58.7	282°28.0	12.3′	01°23.6	-10.9′	57.1′
10	329°25.1	57.8	296°59.3	12.4′	01°12.7	-10.9′	57.0′
11	344°25.3	56.9	311°30.7	12.4′	01°01.7	-10.9′	57.0′
12	359°25.4	N10°56.1	326°02.1	12.5′	N00°50.8	-10.9′	57.0′
13	14°25.6	55.2	340°33.6	12.5′	00°39.9	-10.9′	56.9′
14	29°25.8	54.4	355°05.1	12.5′	00°29.0	-10.9′	56.9′
15	44°25.9	·· 53.5	9°36.7	12.6′	00°18.2	-10.9′	56.9′
16	59°26.1	52.6	24°08.3	12.6′	N00°07.3	-10.9′	56.8′
17	74°26.3	51.8	38°39.9	12.6′	S00°03.5	-10.8′	56.8′
18	89°26.4	N10°50.9	53°11.5	12.7′	S00°14.4	-10.8′	56.8′
19	104°26.6	50.1	67°43.2	12.7′	00°25.2	-10.8′	56.7′
20	119°26.8	49.2	82°15.0	12.8′	00°36.0	-10.8′	56.7′
21	134°27.0	·· 48.3	96°46.7	12.8′	00°46.8	-10.8′	56.7′
22	149°27.1	47.5	111°18.5	12.8′	00°57.6	-10.8′	56.7′
23	164°27.3	46.6	125°50.4	12.9′	01°08.4	-10.8′	56.6′
	SD.=15.8	d=-0.9	S.D.=15.5				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°27.5	N10°45.8	140°22.3	12.9′	S01°19.1	-10.7′	56.6′
1	194°27.6	44.9	154°54.2	12.9′	01°29.8	-10.7′	56.6′
2	209°27.8	44.0	169°26.1	12.9′	01°40.5	-10.7′	56.5′
3	224°28.0	·· 43.2	183°58.0	13.0′	01°51.2	-10.7′	56.5′
4	239°28.2	42.3	198°30.0	13.0′	02°01.9	-10.7′	56.5′
5	254°28.3	41.4	213°02.1	13.0′	02°12.5	-10.6′	56.4′
6	269°28.5	N10°40.6	227°34.1	13.1′	S02°23.1	-10.6′	56.4′
7	284°28.7	39.7	242°06.2	13.1′	02°33.7	-10.6′	56.4′
8	299°28.8	38.9	256°38.3	13.1′	02°44.3	-10.6′	56.3′
9	314°29.0	·· 38.0	271°10.4	13.1′	02°54.8	-10.5′	56.3′
10	329°29.2	37.1	285°42.6	13.2′	03°05.4	-10.5′	56.3′
11	344°29.4	36.3	300°14.8	13.2′	03°15.8	-10.5′	56.3′
12	359°29.5	N10°35.4	314°47.0	13.2′	S03°26.3	-10.5′	56.2′
13	14°29.7	34.5	329°19.2	13.2′	03°36.7	-10.4′	56.2′
14	29°29.9	33.7	343°51.4	13.3′	03°47.2	-10.4′	56.2′
15	44°30.1	·· 32.8	358°23.7	13.3′	03°57.5	-10.4′	56.1′
16	59°30.2	31.9	12°56.0	13.3′	04°07.9	-10.3′	56.1′
17	74°30.4	31.1	27°28.3	13.3′	04°18.2	-10.3′	56.1′
18	89°30.6	N10°30.2	42°00.7	13.3′	S04°28.5	-10.3′	56.0′
19	104°30.8	29.3	56°33.0	13.4′	04°38.7	-10.2′	56.0′
20	119°30.9	28.5	71°05.4	13.4′	04°49.0	-10.2′	56.0′
21	134°31.1	·· 27.6	85°37.8	13.4′	04°59.2	-10.2′	56.0′
22	149°31.3	26.7	100°10.2	13.4′	05°09.3	-10.1′	55.9′
23	164°31.5	25.9	114°42.6	13.4′	05°19.4	-10.1′	55.9′
	SD.=15.8	d=-0.9	S.D.=15.3				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	01:17	03:20	20:40	22:36	▭
N 70°	▭	02:10	03:41	20:21	21:49	▭
68°	▭	02:42	03:56	20:05	21:19	▭
66°	01:07	03:04	04:09	19:53	20:57	22:48
64°	01:54	03:22	04:20	19:43	20:40	22:06
62°	02:22	03:37	04:28	19:34	20:26	21:38
60°	02:44	03:49	04:36	19:27	20:14	21:18
N 58°	03:01	03:59	04:43	19:20	20:04	21:01
56°	03:15	04:08	04:49	19:14	19:55	20:48
54°	03:26	04:15	04:54	19:09	19:48	20:36
52°	03:37	04:22	04:59	19:05	19:41	20:26
50°	03:46	04:29	05:03	19:00	19:35	20:18
45°	04:04	04:42	05:13	18:51	19:22	20:00
N 40°	04:18	04:52	05:20	18:44	19:12	19:46
35°	04:29	05:01	05:27	18:37	19:03	19:35
30°	04:39	05:08	05:33	18:32	18:56	19:25
20°	04:53	05:20	05:43	18:22	18:44	19:11
N 10°	05:05	05:30	05:51	18:13	18:35	19:00
0°	05:13	05:38	05:59	18:06	18:27	18:51
S 10°	05:21	05:45	06:07	17:58	18:19	18:44
20°	05:27	05:53	06:15	17:50	18:12	18:38
30°	05:32	06:00	06:24	17:41	18:05	18:33
35°	05:34	06:04	06:30	17:36	18:01	18:31
40°	05:36	06:08	06:35	17:30	17:57	18:29
45°	05:38	06:12	06:42	17:23	17:53	18:27
S 50°	05:40	06:18	06:51	17:15	17:48	18:25
52°	05:41	06:20	06:54	17:11	17:46	18:25
54°	05:41	06:22	06:59	17:07	17:43	18:24
56°	05:42	06:25	07:03	17:02	17:41	18:24
58°	05:42	06:28	07:08	16:57	17:38	18:24
S 60°	05:43	06:31	07:14	16:52	17:35	18:23

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	06:00	07:50	09:35	20:30	20:22	20:14
N 70°	06:09	07:52	09:31	20:25	20:23	20:21
68°	06:17	07:54	09:27	20:21	20:24	20:26
66°	06:23	07:55	09:24	20:18	20:25	20:31
64°	06:28	07:56	09:21	20:15	20:25	20:35
62°	06:32	07:57	09:19	20:12	20:26	20:39
60°	06:36	07:58	09:17	20:10	20:26	20:42
N 58°	06:40	07:59	09:16	20:08	20:27	20:44
56°	06:43	08:00	09:14	20:07	20:27	20:47
54°	06:46	08:00	09:13	20:05	20:27	20:49
52°	06:48	08:01	09:12	20:04	20:28	20:51
50°	06:50	08:02	09:10	20:02	20:28	20:53
45°	06:55	08:03	09:08	19:59	20:28	20:57
N 40°	06:59	08:04	09:06	19:57	20:29	21:00
35°	07:03	08:05	09:04	19:55	20:29	21:03
30°	07:06	08:05	09:03	19:53	20:30	21:06
20°	07:11	08:07	09:00	19:50	20:30	21:10
N 10°	07:16	08:08	08:58	19:47	20:31	21:14
0°	07:21	08:09	08:56	19:44	20:32	21:18
S 10°	07:25	08:10	08:54	19:41	20:32	21:21
20°	07:30	08:11	08:51	19:38	20:33	21:25
30°	07:35	08:13	08:49	19:35	20:33	21:30
35°	07:38	08:14	08:47	19:33	20:33	21:32
40°	07:42	08:14	08:46	19:30	20:34	21:35
45°	07:46	08:16	08:44	19:28	20:34	21:38
S 50°	07:50	08:17	08:42	19:25	20:35	21:43
52°	07:53	08:17	08:41	19:23	20:35	21:44
54°	07:55	08:18	08:40	19:21	20:35	21:46
56°	07:58	08:19	08:39	19:20	20:35	21:49
58°	08:01	08:19	08:37	19:18	20:36	21:51
S 60°	08:04	08:20	08:36	19:15	20:36	21:54

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 2-4 / 4-16%
23	02:42	02:34	12:03	13:32	01:08	
24	02:26	02:18	12:02	14:20	01:57	
25	02:10	02:02	12:02	15:07	02:44	

August 26, 27, 28 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	334°26.0	212°32.3	N19°57.9	188°19.6	N14°48.9	134°41.3	S07°08.0	73°56.8	S21°58.1
1	349°28.5	227°31.6	57.5	203°20.5	48.4	149°43.4	08.2	88°59.2	58.1
2	4°31.0	242°31.0	57.0	218°21.4	47.9	164°45.4	08.3	104°01.7	58.1
3	19°33.4	257°30.3	·· 56.5	233°22.3	·· 47.4	179°47.5	·· 08.5	119°04.1	·· 58.1
4	34°35.9	272°29.6	56.0	248°23.2	46.8	194°49.5	08.7	134°06.6	58.1
5	49°38.4	287°29.0	55.5	263°24.1	46.3	209°51.6	08.9	149°09.1	58.1
6	64°40.8	302°28.3	N19°55.0	278°25.0	N14°45.8	224°53.6	S07°09.0	164°11.5	S21°58.1
7	79°43.3	317°27.6	54.5	293°25.9	45.3	239°55.7	09.2	179°14.0	58.1
8	94°45.7	332°27.0	54.0	308°26.8	44.7	254°57.7	09.4	194°16.4	58.1
9	109°48.2	347°26.3	·· 53.4	323°27.7	·· 44.2	269°59.8	·· 09.5	209°18.9	·· 58.1
10	124°50.7	2°25.7	52.9	338°28.7	43.7	285°01.9	09.7	224°21.4	58.1
11	139°53.1	17°25.0	52.4	353°29.6	43.2	300°03.9	09.9	239°23.8	58.2
12	154°55.6	32°24.3	N19°51.9	8°30.5	N14°42.6	315°06.0	S07°10.1	254°26.3	S21°58.2
13	169°58.1	47°23.7	51.4	23°31.4	42.1	330°08.0	10.2	269°28.8	58.2
14	185°00.5	62°23.0	50.9	38°32.3	41.6	345°10.1	10.4	284°31.2	58.2
15	200°03.0	77°22.4	·· 50.4	53°33.2	·· 41.1	0°12.1	·· 10.6	299°33.7	·· 58.2
16	215°05.5	92°21.7	49.9	68°34.1	40.5	15°14.2	10.7	314°36.1	58.2
17	230°07.9	107°21.0	49.4	83°35.0	40.0	30°16.2	10.9	329°38.6	58.2
18	245°10.4	122°20.4	N19°48.9	98°35.9	N14°39.5	45°18.3	S07°11.1	344°41.1	S21°58.2
19	260°12.9	137°19.7	48.4	113°36.9	39.0	60°20.3	11.3	359°43.5	58.2
20	275°15.3	152°19.0	47.8	128°37.8	38.4	75°22.4	11.4	14°46.0	58.2
21	290°17.8	167°18.4	·· 47.3	143°38.7	·· 37.9	90°24.4	·· 11.6	29°48.4	·· 58.2
22	305°20.2	182°17.7	46.8	158°39.6	37.4	105°26.5	11.8	44°50.9	58.2
23	320°22.7	197°17.1	46.3	173°40.5	36.9	120°28.5	11.9	59°53.3	58.3
Mer.pass.:01:42		v-0.7 d-0.5 m-3.9		v0.9 d-0.5 m1.8		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	335°25.2	212°16.4	N19°45.8	188°41.4	N14°36.3	135°30.6	S07°12.1	74°55.8	S21°58.3
1	350°27.6	227°15.8	45.3	203°42.3	35.8	150°32.6	12.3	89°58.3	58.3
2	5°30.1	242°15.1	44.7	218°43.2	35.3	165°34.7	12.5	105°00.7	58.3
3	20°32.6	257°14.4	·· 44.2	233°44.1	·· 34.7	180°36.7	·· 12.6	120°03.2	·· 58.3
4	35°35.0	272°13.8	43.7	248°45.1	34.2	195°38.8	12.8	135°05.6	58.3
5	50°37.5	287°13.1	43.2	263°46.0	33.7	210°40.8	13.0	150°08.1	58.3
6	65°40.0	302°12.5	N19°42.6	278°46.9	N14°33.2	225°42.9	S07°13.2	165°10.5	S21°58.3
7	80°42.4	317°11.8	42.1	293°47.8	32.6	240°44.9	13.3	180°13.0	58.3
8	95°44.9	332°11.1	41.6	308°48.7	32.1	255°47.0	13.5	195°15.5	58.3
9	110°47.4	347°10.5	·· 41.1	323°49.6	·· 31.6	270°49.0	·· 13.7	210°17.9	·· 58.3
10	125°49.8	2°09.8	40.5	338°50.5	31.1	285°51.1	13.8	225°20.4	58.3
11	140°52.3	17°09.2	40.0	353°51.4	30.5	300°53.1	14.0	240°22.8	58.4
12	155°54.7	32°08.5	N19°39.5	8°52.4	N14°30.0	315°55.2	S07°14.2	255°25.3	S21°58.4
13	170°57.2	47°07.9	38.9	23°53.3	29.5	330°57.2	14.4	270°27.7	58.4
14	185°59.7	62°07.2	38.4	38°54.2	28.9	345°59.3	14.5	285°30.2	58.4
15	201°02.1	77°06.6	·· 37.9	53°55.1	·· 28.4	1°01.3	·· 14.7	300°32.7	·· 58.4
16	216°04.6	92°05.9	37.3	68°56.0	27.9	16°03.4	14.9	315°35.1	58.4
17	231°07.1	107°05.2	36.8	83°56.9	27.4	31°05.4	15.0	330°37.6	58.4
18	246°09.5	122°04.6	N19°36.3	98°57.8	N14°26.8	46°07.5	S07°15.2	345°40.0	S21°58.4
19	261°12.0	137°03.9	35.7	113°58.8	26.3	61°09.5	15.4	0°42.5	58.4
20	276°14.5	152°03.3	35.2	128°59.7	25.8	76°11.6	15.6	15°44.9	58.4
21	291°16.9	167°02.6	·· 34.7	144°00.6	·· 25.2	91°13.6	·· 15.7	30°47.4	·· 58.4
22	306°19.4	182°02.0	34.1	159°01.5	24.7	106°15.7	15.9	45°49.8	58.4
23	321°21.8	197°01.3	33.6	174°02.4	24.2	121°17.7	16.1	60°52.3	58.5
Mer.pass.:01:38		v-0.7 d-0.5 m-3.9		v0.9 d-0.5 m1.8		v2.1 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	336°24.3	212°00.7	N19°33.0	189°03.3	N14°23.6	136°19.8	S07°16.3	75°54.7	S21°58.5
1	351°26.8	227°00.0	32.5	204°04.2	23.1	151°21.8	16.4	90°57.2	58.5
2	6°29.2	241°59.4	31.9	219°05.2	22.6	166°23.9	16.6	105°59.6	58.5
3	21°31.7	256°58.7	·· 31.4	234°06.1	·· 22.0	181°25.9	·· 16.8	121°02.1	·· 58.5
4	36°34.2	271°58.1	30.9	249°07.0	21.5	196°28.0	16.9	136°04.6	58.5
5	51°36.6	286°57.4	30.3	264°07.9	21.0	211°30.0	17.1	151°07.0	58.5
6	66°39.1	301°56.7	N19°29.8	279°08.8	N14°20.5	226°32.1	S07°17.3	166°09.5	S21°58.5
7	81°41.6	316°56.1	29.2	294°09.7	19.9	241°34.1	17.5	181°11.9	58.5
8	96°44.0	331°55.4	28.7	309°10.7	19.4	256°36.2	17.6	196°14.4	58.5
9	111°46.5	346°54.8	·· 28.1	324°11.6	·· 18.9	271°38.2	·· 17.8	211°16.8	·· 58.5
10	126°49.0	1°54.1	27.6	339°12.5	18.3	286°40.3	18.0	226°19.3	58.5
11	141°51.4	16°53.5	27.0	354°13.4	17.8	301°42.3	18.2	241°21.7	58.6
12	156°53.9	31°52.8	N19°26.5	9°14.3	N14°17.3	316°44.4	S07°18.3	256°24.2	S21°58.6
13	171°56.3	46°52.2	25.9	24°15.2	16.7	331°46.4	18.5	271°26.6	58.6
14	186°58.8	61°51.5	25.3	39°16.2	16.2	346°48.4	18.7	286°29.1	58.6
15	202°01.3	76°50.9	·· 24.8	54°17.1	·· 15.7	1°50.5	·· 18.9	301°31.5	·· 58.6
16	217°03.7	91°50.2	24.2	69°18.0	15.1	16°52.5	19.0	316°34.0	58.6
17	232°06.2	106°49.6	23.7	84°18.9	14.6	31°54.6	19.2	331°36.4	58.6
18	247°08.7	121°48.9	N19°23.1	99°19.8	N14°14.1	46°56.6	S07°19.4	346°38.9	S21°58.6
19	262°11.1	136°48.3	22.6	114°20.7	13.5	61°58.7	19.5	1°41.3	58.6
20	277°13.6	151°47.6	22.0	129°21.7	13.0	77°00.7	19.7	16°43.8	58.6
21	292°16.1	166°47.0	·· 21.4	144°22.6	·· 12.5	92°02.8	·· 19.9	31°46.2	·· 58.6
22	307°18.5	181°46.3	20.9	159°23.5	11.9	107°04.8	20.1	46°48.7	58.6
23	322°21.0	196°45.7	20.3	174°24.4	11.4	122°06.9	20.2	61°51.1	58.7
Mer.pass.:01:34		v-0.7 d-0.5 m-3.9		v0.9 d-0.5 m1.8		v2.0 d-0.2 m-1.6		v2.5 d-0.0 m0.4	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.2
Ankaa	353°12.6	-42°12.5
Schedar	349°36.7	56°37.9
Diphda	348°52.8	-17°53.3
Achernar	335°24.4	-57°08.7
Hamal	327°57.4	23°32.6
Polaris	316°20.1	89°19.9
Acamar	315°16.1	-40°13.9
Menkar	314°12.0	4°09.5
Mirfak	308°36.1	49°55.1
Aldebaran	290°46.2	16°32.5
Rigel	281°09.4	-8°10.9
Capella	280°30.4	46°00.6
Bellatrix	278°29.1	6°21.8
Elnath	278°09.1	28°37.1
Alnilam	275°43.6	-1°11.5
Betelgeuse	270°58.4	7°24.5
Canopus	263°55.2	-52°42.2
Sirius	258°31.4	-16°44.4
Adhara	255°10.5	-28°59.7
Procyon	244°57.0	5°10.7
Pollux	243°24.6	27°58.9
Avior	234°17.4	-59°33.9
Suhail	222°50.7	-43°30.2
Miaplacidus	221°39.9	-69°47.3
Alphard	217°53.6	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°49.0	61°39.5
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.3
Acrux	173°06.6	-63°11.8
Gacrux	171°58.1	-57°12.7
Alioth	166°18.7	55°52.2
Spica	158°28.5	-11°15.0
Alkaid	152°57.0	49°13.9
Hadar	148°44.1	-60°27.5
Menkent	148°04.4	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°48.1	-60°54.5
Kochab	137°20.6	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.8
Antares	112°22.7	-26°28.1
Atria	107°21.8	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.9
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.6	51°29.7
Kaus Aust.	83°39.8	-34°22.4
Vega	80°36.8	38°48.4
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.9
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.8
Markab	13°35.2	15°18.1

Aug 26 Sat	SHA	Mer.pass
Venus	238°06.2	09:50
Mars	213°53.5	11:26
Jupiter	160°15.3	14:59
Saturn	99°30.7	19:01

Aug 27 Sun	SHA	Mer.pass
Venus	236°51.2	09:51
Mars	213°16.2	11:25
Jupiter	160°05.4	14:56
Saturn	99°30.6	18:57

Aug 28 Mon	SHA	Mer.pass
Venus	235°36.4	09:52
Mars	212°39.0	11:23
Jupiter	159°55.5	14:53
Saturn	99°30.4	18:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3383 sec ΔT = TT-UT1 = +68.8457 sec

2017 August 26 to Aug. 28 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°31.6	N10°25.0	129°15.1	13.5'	S05°29.5	-10.1'	55.9'
1	194°31.8	24.1	143°47.6	13.5'	05°39.6	-10.0'	55.8'
2	209°32.0	23.3	158°20.0	13.5'	05°49.6	-10.0'	55.8'
3	224°32.2	·· 22.4	172°52.5	13.5'	05°59.5	-10.0'	55.8'
4	239°32.3	21.5	187°25.0	13.5'	06°09.5	-9.9'	55.8'
5	254°32.5	20.6	201°57.6	13.5'	06°19.4	-9.9'	55.7'
6	269°32.7	N10°19.8	216°30.1	13.5'	S06°29.2	-9.8'	55.7'
7	284°32.9	18.9	231°02.6	13.6'	06°39.1	-9.8'	55.7'
8	299°33.0	18.0	245°35.2	13.6'	06°48.8	-9.8'	55.6'
9	314°33.2	·· 17.2	260°07.8	13.6'	06°58.6	-9.7'	55.6'
10	329°33.4	16.3	274°40.3	13.6'	07°08.3	-9.7'	55.6'
11	344°33.6	15.4	289°12.9	13.6'	07°17.9	-9.6'	55.6'
12	359°33.7	N10°14.5	303°45.5	13.6'	S07°27.6	-9.6'	55.5'
13	14°33.9	13.7	318°18.1	13.6'	07°37.1	-9.5'	55.5'
14	29°34.1	12.8	332°50.8	13.6'	07°46.6	-9.5'	55.5'
15	44°34.3	·· 11.9	347°23.4	13.6'	07°56.1	-9.5'	55.5'
16	59°34.5	11.0	1°56.0	13.6'	08°05.6	-9.4'	55.4'
17	74°34.6	10.2	16°28.6	13.6'	08°15.0	-9.4'	55.4'
18	89°34.8	N10°09.3	31°01.3	13.6'	S08°24.3	-9.3'	55.4'
19	104°35.0	08.4	45°33.9	13.6'	08°33.6	-9.3'	55.4'
20	119°35.2	07.6	60°06.6	13.7'	08°42.9	-9.2'	55.3'
21	134°35.4	·· 06.7	74°39.2	13.7'	08°52.1	-9.2'	55.3'
22	149°35.5	05.8	89°11.9	13.7'	09°01.2	-9.1'	55.3'
23	164°35.7	04.9	103°44.5	13.7'	09°10.3	-9.1'	55.3'
	SD.=15.8	d=-0.9		S.D.=15.1			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°35.9	N10°04.1	118°17.2	13.7'	S09°19.4	-9.0'	55.2'
1	194°36.1	03.2	132°49.9	13.7'	09°28.4	-9.0'	55.2'
2	209°36.2	02.3	147°22.5	13.7'	09°37.4	-8.9'	55.2'
3	224°36.4	·· 01.4	161°55.2	13.7'	09°46.3	-8.9'	55.2'
4	239°36.6	10°00.5	176°27.9	13.7'	09°55.1	-8.8'	55.1'
5	254°36.8	09°59.7	191°00.5	13.7'	10°03.9	-8.8'	55.1'
6	269°37.0	N09°58.8	205°33.2	13.7'	S10°12.7	-8.7'	55.1'
7	284°37.2	57.9	220°05.9	13.7'	10°21.4	-8.7'	55.1'
8	299°37.3	57.0	234°38.5	13.7'	10°30.0	-8.6'	55.1'
9	314°37.5	·· 56.2	249°11.2	13.7'	10°38.6	-8.6'	55.0'
10	329°37.7	55.3	263°43.8	13.7'	10°47.2	-8.5'	55.0'
11	344°37.9	54.4	278°16.5	13.7'	10°55.7	-8.5'	55.0'
12	359°38.1	N09°53.5	292°49.1	13.6'	S11°04.1	-8.4'	55.0'
13	14°38.2	52.6	307°21.8	13.6'	11°12.5	-8.3'	55.0'
14	29°38.4	51.8	321°54.4	13.6'	11°20.8	-8.3'	54.9'
15	44°38.6	·· 50.9	336°27.1	13.6'	11°29.1	-8.2'	54.9'
16	59°38.8	50.0	350°59.7	13.6'	11°37.3	-8.2'	54.9'
17	74°39.0	49.1	5°32.3	13.6'	11°45.4	-8.1'	54.9'
18	89°39.1	N09°48.2	20°04.9	13.6'	S11°53.5	-8.1'	54.9'
19	104°39.3	47.4	34°37.5	13.6'	12°01.5	-8.0'	54.8'
20	119°39.5	46.5	49°10.1	13.6'	12°09.5	-7.9'	54.8'
21	134°39.7	·· 45.6	63°42.7	13.6'	12°17.4	-7.9'	54.8'
22	149°39.9	44.7	78°15.3	13.6'	12°25.3	-7.8'	54.8'
23	164°40.1	43.8	92°47.9	13.6'	12°33.1	-7.8'	54.8'
	SD.=15.8	d=-0.9		S.D.=15.0			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°40.2	N09°43.0	107°20.4	13.6'	S12°40.8	-7.7'	54.7'
1	194°40.4	42.1	121°53.0	13.5'	12°48.5	-7.6'	54.7'
2	209°40.6	41.2	136°25.5	13.5'	12°56.1	-7.6'	54.7'
3	224°40.8	·· 40.3	150°58.1	13.5'	13°03.7	-7.5'	54.7'
4	239°41.0	39.4	165°30.6	13.5'	13°11.2	-7.5'	54.7'
5	254°41.2	38.5	180°03.1	13.5'	13°18.6	-7.4'	54.7'
6	269°41.4	N09°37.7	194°35.6	13.5'	S13°26.0	-7.3'	54.6'
7	284°41.5	36.8	209°08.1	13.5'	13°33.3	-7.3'	54.6'
8	299°41.7	35.9	223°40.6	13.5'	13°40.5	-7.2'	54.6'
9	314°41.9	·· 35.0	238°13.0	13.5'	13°47.7	-7.1'	54.6'
10	329°42.1	34.1	252°45.5	13.4'	13°54.8	-7.1'	54.6'
11	344°42.3	33.2	267°17.9	13.4'	14°01.8	-7.0'	54.6'
12	359°42.5	N09°32.4	281°50.3	13.4'	S14°08.8	-6.9'	54.6'
13	14°42.6	31.5	296°22.7	13.4'	14°15.7	-6.9'	54.5'
14	29°42.8	30.6	310°55.1	13.4'	14°22.5	-6.8'	54.5'
15	44°43.0	·· 29.7	325°27.5	13.4'	14°29.3	-6.7'	54.5'
16	59°43.2	28.8	339°59.9	13.4'	14°36.0	-6.7'	54.5'
17	74°43.4	27.9	354°32.2	13.3'	14°42.7	-6.6'	54.5'
18	89°43.6	N09°27.0	9°04.6	13.3'	S14°49.2	-6.5'	54.5'
19	104°43.8	26.1	23°36.9	13.3'	14°55.8	-6.5'	54.5'
20	119°44.0	25.3	38°09.2	13.3'	15°02.2	-6.4'	54.5'
21	134°44.1	·· 24.4	52°41.5	13.3'	15°08.6	-6.3'	54.4'
22	149°44.3	23.5	67°13.7	13.3'	15°14.9	-6.3'	54.4'
23	164°44.5	22.6	81°46.0	13.2'	15°21.1	-6.2'	54.4'
	SD.=15.8	d=-0.9		S.D.=14.9			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	01:51	03:37	20:22	22:04	▭
N 70°	▭	02:30	03:54	20:06	21:27	▭
68°	▭	02:57	04:08	19:52	21:02	▭
66°	01:36	03:17	04:19	19:42	20:43	22:20
64°	02:11	03:33	04:28	19:32	20:27	21:47
62°	02:36	03:46	04:36	19:25	20:15	21:24
60°	02:55	03:57	04:43	19:18	20:04	21:05
N 58°	03:10	04:06	04:49	19:12	19:55	20:51
56°	03:23	04:14	04:55	19:07	19:47	20:38
54°	03:33	04:21	04:59	19:02	19:40	20:28
52°	03:43	04:28	05:04	18:58	19:34	20:18
50°	03:51	04:33	05:08	18:54	19:28	20:10
45°	04:08	04:45	05:16	18:46	19:17	19:54
N 40°	04:21	04:55	05:23	18:39	19:07	19:41
35°	04:32	05:03	05:29	18:33	18:59	19:30
30°	04:41	05:10	05:34	18:28	18:53	19:22
20°	04:54	05:21	05:43	18:19	18:42	19:08
N 10°	05:05	05:30	05:51	18:12	18:33	18:58
0°	05:13	05:37	05:58	18:05	18:26	18:50
S 10°	05:19	05:44	06:05	17:58	18:19	18:44
20°	05:25	05:50	06:13	17:51	18:13	18:39
30°	05:29	05:57	06:21	17:42	18:07	18:34
35°	05:31	06:00	06:26	17:38	18:03	18:33
40°	05:32	06:04	06:31	17:32	18:00	18:31
45°	05:33	06:07	06:37	17:26	17:56	18:30
S 50°	05:34	06:12	06:45	17:19	17:52	18:30
52°	05:35	06:14	06:48	17:16	17:50	18:29
54°	05:35	06:16	06:52	17:12	17:48	18:29
56°	05:35	06:18	06:56	17:08	17:46	18:29
58°	05:35	06:20	07:00	17:04	17:44	18:29
S 60°	05:35	06:23	07:05	16:59	17:41	18:30

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	11:19	13:03	14:50	20:05	19:56	19:42
N 70°	11:07	12:43	14:18	20:19	20:17	20:15
68°	10:58	12:27	13:55	20:29	20:33	20:40
66°	10:51	12:15	13:37	20:38	20:47	20:58
64°	10:44	12:05	13:22	20:46	20:58	21:14
62°	10:39	11:56	13:10	20:52	21:08	21:26
60°	10:34	11:48	13:00	20:58	21:16	21:37
N 58°	10:30	11:42	12:51	21:03	21:23	21:47
56°	10:26	11:36	12:43	21:07	21:30	21:55
54°	10:23	11:31	12:36	21:11	21:35	22:02
52°	10:20	11:26	12:30	21:15	21:40	22:09
50°	10:17	11:22	12:24	21:18	21:45	22:15
45°	10:11	11:13	12:12	21:25	21:55	22:28
N 40°	10:06	11:05	12:02	21:31	22:04	22:39
35°	10:02	10:58	11:54	21:37	22:11	22:48
30°	09:58	10:53	11:46	21:41	22:18	22:56
20°	09:52	10:43	11:33	21:49	22:29	23:10
N 10°	09:46	10:34	11:22	21:56	22:39	23:22
0°	09:41	10:26	11:12	22:03	22:48	23:34
S 10°	09:36	10:18	11:01	22:10	22:57	23:45
20°	09:31	10:10	10:50	22:17	23:07	23:57
30°	09:24	10:00	10:37	22:25	23:19	–:–
35°	09:21	09:55	10:30	22:29	23:25	–:–
40°	09:17	09:49	10:22	22:35	23:33	–:–
45°	09:12	09:41	10:12	22:41	23:41	–:–
S 50°	09:07	09:33	10:01	22:48	23:52	–:–
52°	09:04	09:29	09:56	22:52	23:57	–:–
54°	09:01	09:24	09:50	22:55	–:–	00:02
56°	08:58	09:20	09:43	23:00	–:–	00:08
58°	08:55	09:14	09:36	23:04	–:–	00:15
S 60°	08:51	09:08	09:28	23:10	–:–	00:23

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 5-7 24-42%
26	01:53	01:45	12:02	15:52	03:29	
27	01:36	01:28	12:01	16:37	04:15	
28	01:19	01:10	12:01	17:23	05:00	

August 29, 30, 31 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	337°23.4	211°45.0	N19°19.7	189°25.3	N14°10.9	137°08.9	S07°20.4	76°53.6	S21°58.7
1	352°25.9	226°44.4	19.2	204°26.2	10.3	152°11.0	20.6	91°56.0	58.7
2	7°28.4	241°43.7	18.6	219°27.2	09.8	167°13.0	20.8	106°58.5	58.7
3	22°30.8	256°43.1	·· 18.0	234°28.1	·· 09.3	182°15.0	·· 20.9	122°00.9	·· 58.7
4	37°33.3	271°42.5	17.5	249°29.0	08.7	197°17.1	21.1	137°03.4	58.7
5	52°35.8	286°41.8	16.9	264°29.9	08.2	212°19.1	21.3	152°05.8	58.7
6	67°38.2	301°41.2	N19°16.3	279°30.8	N14°07.7	227°21.2	S07°21.5	167°08.3	S21°58.7
7	82°40.7	316°40.5	15.8	294°31.8	07.1	242°23.2	21.6	182°10.7	58.7
8	97°43.2	331°39.9	15.2	309°32.7	06.6	257°25.3	21.8	197°13.2	58.7
9	112°45.6	346°39.2	·· 14.6	324°33.6	·· 06.1	272°27.3	·· 22.0	212°15.6	·· 58.7
10	127°48.1	1°38.6	14.0	339°34.5	05.5	287°29.4	22.2	227°18.1	58.8
11	142°50.6	16°37.9	13.5	354°35.4	05.0	302°31.4	22.3	242°20.5	58.8
12	157°53.0	31°37.3	N19°12.9	9°36.4	N14°04.5	317°33.4	S07°22.5	257°23.0	S21°58.8
13	172°55.5	46°36.6	12.3	24°37.3	03.9	332°35.5	22.7	272°25.4	58.8
14	187°57.9	61°36.0	11.7	39°38.2	03.4	347°37.5	22.9	287°27.8	58.8
15	203°00.4	76°35.4	·· 11.2	54°39.1	·· 02.8	2°39.6	·· 23.0	302°30.3	·· 58.8
16	218°02.9	91°34.7	10.6	69°40.0	02.3	17°41.6	23.2	317°32.7	58.8
17	233°05.3	106°34.1	10.0	84°41.0	01.8	32°43.7	23.4	332°35.2	58.8
18	248°07.8	121°33.4	N19°09.4	99°41.9	N14°01.2	47°45.7	S07°23.6	347°37.6	S21°58.8
19	263°10.3	136°32.8	08.8	114°42.8	00.7	62°47.7	23.7	2°40.1	58.8
20	278°12.7	151°32.1	08.2	129°43.7	14°00.2	77°49.8	23.9	17°42.5	58.8
21	293°15.2	166°31.5	·· 07.7	144°44.6	13°59.6	92°51.8	·· 24.1	32°45.0	·· 58.9
22	308°17.7	181°30.8	07.1	159°45.6	59.1	107°53.9	24.3	47°47.4	58.9
23	323°20.1	196°30.2	06.5	174°46.5	58.5	122°55.9	24.4	62°49.9	58.9
Mer.pass.:01:30		v-0.6 d-0.6 m-3.9		v0.9 d-0.5 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	338°22.6	211°29.6	N19°05.9	189°47.4	N13°58.0	137°57.9	S07°24.6	77°52.3	S21°58.9
1	353°25.1	226°28.9	05.3	204°48.3	57.5	153°00.0	24.8	92°54.8	58.9
2	8°27.5	241°28.3	04.7	219°49.2	56.9	168°02.0	25.0	107°57.2	58.9
3	23°30.0	256°27.6	·· 04.1	234°50.2	·· 56.4	183°04.1	·· 25.1	122°59.6	·· 58.9
4	38°32.4	271°27.0	03.5	249°51.1	55.9	198°06.1	25.3	138°02.1	58.9
5	53°34.9	286°26.4	02.9	264°52.0	55.3	213°08.2	25.5	153°04.5	58.9
6	68°37.4	301°25.7	N19°02.4	279°52.9	N13°54.8	228°10.2	S07°25.7	168°07.0	S21°58.9
7	83°39.8	316°25.1	01.8	294°53.9	54.2	243°12.2	25.8	183°09.4	58.9
8	98°42.3	331°24.4	01.2	309°54.8	53.7	258°14.3	26.0	198°11.9	59.0
9	113°44.8	346°23.8	·· 00.6	324°55.7	·· 53.2	273°16.3	·· 26.2	213°14.3	·· 59.0
10	128°47.2	1°23.2	19°00.0	339°56.6	52.6	288°18.4	26.4	228°16.7	59.0
11	143°49.7	16°22.5	18°59.4	354°57.6	52.1	303°20.4	26.5	243°19.2	59.0
12	158°52.2	31°21.9	N18°58.8	9°58.5	N13°51.5	318°22.4	S07°26.7	258°21.6	S21°59.0
13	173°54.6	46°21.2	58.2	24°59.4	51.0	333°24.5	26.9	273°24.1	59.0
14	188°57.1	61°20.6	57.6	40°00.3	50.5	348°26.5	27.1	288°26.5	59.0
15	203°59.6	76°20.0	·· 57.0	55°01.2	·· 49.9	3°28.6	·· 27.2	303°29.0	·· 59.0
16	219°02.0	91°19.3	56.4	70°02.2	49.4	18°30.6	27.4	318°31.4	59.0
17	234°04.5	106°18.7	55.8	85°03.1	48.9	33°32.6	27.6	333°33.8	59.0
18	249°06.9	121°18.0	N18°55.2	100°04.0	N13°48.3	48°34.7	S07°27.8	348°36.3	S21°59.0
19	264°09.4	136°17.4	54.6	115°04.9	47.8	63°36.7	27.9	3°38.7	59.1
20	279°11.9	151°16.8	54.0	130°05.9	47.2	78°38.8	28.1	18°41.2	59.1
21	294°14.3	166°16.1	·· 53.3	145°06.8	·· 46.7	93°40.8	·· 28.3	33°43.6	·· 59.1
22	309°16.8	181°15.5	52.7	160°07.7	46.1	108°42.8	28.5	48°46.1	59.1
23	324°19.3	196°14.9	52.1	175°08.6	45.6	123°44.9	28.6	63°48.5	59.1
Mer.pass.:01:26		v-0.6 d-0.6 m-3.9		v0.9 d-0.5 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	339°21.7	211°14.2	N18°51.5	190°09.6	N13°45.1	138°46.9	S07°28.8	78°50.9	S21°59.1
1	354°24.2	226°13.6	50.9	205°10.5	44.5	153°49.0	29.0	93°53.4	59.1
2	9°26.7	241°13.0	50.3	220°11.4	44.0	168°51.0	29.2	108°55.8	59.1
3	24°29.1	256°12.3	·· 49.7	235°12.3	·· 43.4	183°53.0	·· 29.3	123°58.3	·· 59.1
4	39°31.6	271°11.7	49.1	250°13.3	42.9	198°55.1	29.5	139°00.7	59.1
5	54°34.0	286°11.0	48.5	265°14.2	42.4	213°57.1	29.7	154°03.1	59.1
6	69°36.5	301°10.4	N18°47.8	280°15.1	N13°41.8	228°59.1	S07°29.9	169°05.6	S21°59.2
7	84°39.0	316°09.8	47.2	295°16.0	41.3	244°01.2	30.0	184°08.0	59.2
8	99°41.4	331°09.1	46.6	310°17.0	40.7	259°03.2	30.2	199°10.5	59.2
9	114°43.9	346°08.5	·· 46.0	325°17.9	·· 40.2	274°05.3	·· 30.4	214°12.9	·· 59.2
10	129°46.4	1°07.9	45.4	340°18.8	39.6	289°07.3	30.6	229°15.3	59.2
11	144°48.8	16°07.2	44.7	355°19.7	39.1	304°09.3	30.7	244°17.8	59.2
12	159°51.3	31°06.6	N18°44.1	10°20.7	N13°38.6	319°11.4	S07°30.9	259°20.2	S21°59.2
13	174°53.8	46°06.0	43.5	25°21.6	38.0	334°13.4	31.1	274°22.6	59.2
14	189°56.2	61°05.3	42.9	40°22.5	37.5	349°15.4	31.3	289°25.1	59.2
15	204°58.7	76°04.7	·· 42.3	55°23.4	·· 36.9	4°17.5	·· 31.4	304°27.5	·· 59.2
16	220°01.2	91°04.1	41.6	70°24.4	36.4	19°19.5	31.6	319°30.0	59.2
17	235°03.6	106°03.4	41.0	85°25.3	35.8	34°21.6	31.8	334°32.4	59.3
18	250°06.1	121°02.8	N18°40.4	100°26.2	N13°35.3	49°23.6	S07°32.0	349°34.8	S21°59.3
19	265°08.5	136°02.2	39.7	115°27.2	34.8	64°25.6	32.2	4°37.3	59.3
20	280°11.0	151°01.6	39.1	130°28.1	34.2	79°27.7	32.3	19°39.7	59.3
21	295°13.5	166°00.9	·· 38.5	145°29.0	·· 33.7	94°29.7	·· 32.5	34°42.1	·· 59.3
22	310°15.9	181°00.3	37.9	160°29.9	33.1	109°31.7	32.7	49°44.6	59.3
23	325°18.4	195°59.7	37.2	175°30.9	32.6	124°33.8	32.9	64°47.0	59.3
Mer.pass.:01:22		v-0.6 d-0.6 m-3.9		v0.9 d-0.5 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.2
Ankaa	353°12.6	-42°12.5
Schedar	349°36.7	56°37.9
Diphda	348°52.8	-17°53.3
Achernar	335°24.3	-57°08.7
Hamal	327°57.3	23°32.6
Polaris	316°18.6	89°19.9
Acamar	315°16.1	-40°13.9
Menkar	314°12.0	4°09.5
Mirfak	308°36.1	49°55.1
Aldebaran	290°46.1	16°32.5
Rigel	281°09.4	-8°10.9
Capella	280°30.3	46°00.6
Bellatrix	278°29.0	6°21.8
Elnath	278°09.1	28°37.1
Alnilam	275°43.6	-1°11.5
Betelgeuse	270°58.4	7°24.5
Canopus	263°55.1	-52°42.2
Sirius	258°31.4	-16°44.4
Adhara	255°10.5	-28°59.7
Procyon	244°57.0	5°10.7
Pollux	243°24.6	27°58.9
Avior	234°17.4	-59°33.9
Suhail	222°50.7	-43°30.1
Miaplacidus	221°39.9	-69°47.3
Alphard	217°53.6	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°49.0	61°39.5
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.6	-63°11.8
Gacrux	171°58.1	-57°12.7
Alioth	166°18.7	55°52.2
Spica	158°28.5	-11°15.0
Alkaid	152°57.0	49°13.9
Hadar	148°44.1	-60°27.5
Menkent	148°04.4	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°48.1	-60°54.5
Kochab	137°20.7	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.8
Antares	112°22.7	-26°28.1
Atria	107°21.9	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.9
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.6	51°29.7
Kaus Aust.	83°39.9	-34°22.4
Vega	80°36.8	38°48.4
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.9
Enif	33°44.0	9°57.5
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.8
Markab	13°35.2	15°18.1

Aug 29 Tue	SHA	Mer.pass
Venus	234°21.6	09:53
Mars	212°01.9	11:22
Jupiter	159°45.5	14:49
Saturn	99°30.1	18:49

Aug 30 Wed	SHA	Mer.pass
Venus	233°07.0	09:54
Mars	211°24.8	11:20
Jupiter	159°35.4	14:46
Saturn	99°29.7	18:45

Aug 31 Thu	SHA	Mer.pass
Venus	231°52.5	09:55
Mars	210°47.8	11:19
Jupiter	159°25.2	14:43
Saturn	99°29.2	18:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3373 sec ΔT = TT-UT1 = +68.8467 sec

2017 August 29 to Aug. 31 UT

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°44.7	N09°21.7	96°18.2	13.2′	S15°27.2	-6.1′	54.4′
1	194°44.9	20.8	110°50.4	13.2′	15°33.3	-6.1′	54.4′
2	209°45.1	19.9	125°22.6	13.2′	15°39.3	-6.0′	54.4′
3	224°45.3	·· 19.0	139°54.8	13.2′	15°45.3	-5.9′	54.4′
4	239°45.5	18.2	154°26.9	13.1′	15°51.2	-5.8′	54.4′
5	254°45.6	17.3	168°59.1	13.1′	15°57.0	-5.8′	54.4′
6	269°45.8	N09°16.4	183°31.2	13.1′	S16°02.7	-5.7′	54.4′
7	284°46.0	15.5	198°03.3	13.1′	16°08.3	-5.6′	54.3′
8	299°46.2	14.6	212°35.4	13.1′	16°13.9	-5.5′	54.3′
9	314°46.4	·· 13.7	227°07.4	13.1′	16°19.4	-5.5′	54.3′
10	329°46.6	12.8	241°39.5	13.0′	16°24.9	-5.4′	54.3′
11	344°46.8	11.9	256°11.5	13.0′	16°30.2	-5.3′	54.3′
12	359°47.0	N09°11.0	270°43.5	13.0′	S16°35.5	-5.2′	54.3′
13	14°47.2	10.1	285°15.5	13.0′	16°40.7	-5.2′	54.3′
14	29°47.3	09.2	299°47.5	13.0′	16°45.8	-5.1′	54.3′
15	44°47.5	·· 08.4	314°19.4	12.9′	16°50.9	-5.0′	54.3′
16	59°47.7	07.5	328°51.3	12.9′	16°55.9	-4.9′	54.3′
17	74°47.9	06.6	343°23.2	12.9′	17°00.8	-4.9′	54.3′
18	89°48.1	N09°05.7	357°55.1	12.9′	S17°05.6	-4.8′	54.3′
19	104°48.3	04.8	12°27.0	12.9′	17°10.4	-4.7′	54.3′
20	119°48.5	03.9	26°58.8	12.8′	17°15.0	-4.6′	54.3′
21	134°48.7	·· 03.0	41°30.7	12.8′	17°19.6	-4.6′	54.3′
22	149°48.9	02.1	56°02.5	12.8′	17°24.1	-4.5′	54.2′
23	164°49.1	01.2	70°34.2	12.8′	17°28.6	-4.4′	54.2′
	SD.=15.8	d=-0.9	S.D.=14.8				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°49.2	N09°00.3	85°06.0	12.7′	S17°32.9	-4.3′	54.2′
1	194°49.4	08°59.4	99°37.7	12.7′	17°37.2	-4.2′	54.2′
2	209°49.6	58.5	114°09.4	12.7′	17°41.4	-4.2′	54.2′
3	224°49.8	·· 57.6	128°41.1	12.7′	17°45.5	-4.1′	54.2′
4	239°50.0	56.7	143°12.8	12.7′	17°49.6	-4.0′	54.2′
5	254°50.2	55.8	157°44.5	12.6′	17°53.5	-3.9′	54.2′
6	269°50.4	N08°54.9	172°16.1	12.6′	S17°57.4	-3.8′	54.2′
7	284°50.6	54.0	186°47.7	12.6′	18°01.2	-3.8′	54.2′
8	299°50.8	53.1	201°19.3	12.6′	18°04.9	-3.7′	54.2′
9	314°51.0	·· 52.2	215°50.8	12.6′	18°08.6	-3.6′	54.2′
10	329°51.2	51.4	230°22.4	12.5′	18°12.1	-3.5′	54.2′
11	344°51.4	50.5	244°53.9	12.5′	18°15.6	-3.4′	54.2′
12	359°51.6	N08°49.6	259°25.4	12.5′	S18°19.0	-3.3′	54.2′
13	14°51.7	48.7	273°56.9	12.5′	18°22.3	-3.3′	54.2′
14	29°51.9	47.8	288°28.3	12.4′	18°25.5	-3.2′	54.2′
15	44°52.1	·· 46.9	302°59.8	12.4′	18°28.6	-3.1′	54.2′
16	59°52.3	46.0	317°31.2	12.4′	18°31.7	-3.0′	54.2′
17	74°52.5	45.1	332°02.6	12.4′	18°34.6	-2.9′	54.2′
18	89°52.7	N08°44.2	346°34.0	12.4′	S18°37.5	-2.8′	54.2′
19	104°52.9	43.3	1°05.3	12.3′	18°40.3	-2.8′	54.2′
20	119°53.1	42.4	15°36.6	12.3′	18°43.0	-2.7′	54.2′
21	134°53.3	·· 41.5	30°08.0	12.3′	18°45.6	-2.6′	54.2′
22	149°53.5	40.6	44°39.3	12.3′	18°48.2	-2.5′	54.2′
23	164°53.7	39.7	59°10.5	12.3′	18°50.6	-2.4′	54.2′
	SD.=15.8	d=-0.9	S.D.=14.8				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°53.9	N08°38.8	73°41.8	12.2′	S18°53.0	-2.3′	54.2′
1	194°54.1	37.9	88°13.0	12.2′	18°55.3	-2.2′	54.2′
2	209°54.3	37.0	102°44.2	12.2′	18°57.5	-2.2′	54.3′
3	224°54.5	·· 36.1	117°15.4	12.2′	18°59.6	-2.1′	54.3′
4	239°54.7	35.2	131°46.6	12.2′	19°01.6	-2.0′	54.3′
5	254°54.9	34.3	146°17.7	12.1′	19°03.5	-1.9′	54.3′
6	269°55.1	N08°33.4	160°48.8	12.1′	S19°05.4	-1.8′	54.3′
7	284°55.2	32.5	175°20.0	12.1′	19°07.1	-1.7′	54.3′
8	299°55.4	31.6	189°51.1	12.1′	19°08.8	-1.6′	54.3′
9	314°55.6	·· 30.7	204°22.1	12.1′	19°10.4	-1.5′	54.3′
10	329°55.8	29.8	218°53.2	12.0′	19°11.9	-1.4′	54.3′
11	344°56.0	28.9	233°24.2	12.0′	19°13.3	-1.4′	54.3′
12	359°56.2	N08°27.9	247°55.2	12.0′	S19°14.6	-1.3′	54.3′
13	14°56.4	27.0	262°26.2	12.0′	19°15.8	-1.2′	54.3′
14	29°56.6	26.1	276°57.2	12.0′	19°17.0	-1.1′	54.3′
15	44°56.8	·· 25.2	291°28.2	12.0′	19°18.0	-1.0′	54.3′
16	59°57.0	24.3	305°59.1	11.9′	19°19.0	-0.9′	54.3′
17	74°57.2	23.4	320°30.0	11.9′	19°19.8	-0.8′	54.3′
18	89°57.4	N08°22.5	335°01.0	11.9′	S19°20.6	-0.7′	54.4′
19	104°57.6	21.6	349°31.8	11.9′	19°21.3	-0.6′	54.4′
20	119°57.8	20.7	4°02.7	11.9′	19°21.9	-0.6′	54.4′
21	134°58.0	·· 19.8	18°33.6	11.9′	19°22.4	-0.5′	54.4′
22	149°58.2	18.9	33°04.4	11.8′	19°22.8	-0.4′	54.4′
23	164°58.4	18.0	47°35.3	11.8′	19°23.1	-0.3′	54.4′
	SD.=15.8	d=-0.9	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	02:17	03:52	20:05	21:38	▭
N 70°	▭	02:49	04:07	19:51	21:08	▭
68°	01:11	03:12	04:19	19:39	20:46	22:40
66°	01:58	03:29	04:29	19:30	20:29	21:58
64°	02:27	03:43	04:37	19:22	20:15	21:30
62°	02:48	03:55	04:44	19:15	20:04	21:10
60°	03:05	04:05	04:50	19:09	19:54	20:54
N 58°	03:19	04:13	04:56	19:04	19:46	20:40
56°	03:30	04:21	05:01	18:59	19:39	20:29
54°	03:40	04:27	05:05	18:55	19:32	20:19
52°	03:49	04:33	05:09	18:51	19:27	20:11
50°	03:57	04:38	05:12	18:48	19:22	20:03
45°	04:12	04:49	05:20	18:41	19:11	19:48
N 40°	04:25	04:58	05:26	18:35	19:02	19:36
35°	04:35	05:05	05:31	18:29	18:55	19:26
30°	04:43	05:11	05:36	18:25	18:49	19:18
20°	04:55	05:22	05:44	18:17	18:39	19:05
N 10°	05:05	05:30	05:51	18:10	18:31	18:56
0°	05:12	05:36	05:57	18:04	18:25	18:49
S 10°	05:18	05:42	06:04	17:58	18:19	18:43
20°	05:22	05:48	06:10	17:51	18:13	18:39
30°	05:26	05:53	06:18	17:44	18:08	18:36
35°	05:27	05:56	06:22	17:40	18:05	18:35
40°	05:28	05:59	06:26	17:35	18:03	18:34
45°	05:28	06:02	06:32	17:30	18:00	18:34
S 50°	05:28	06:06	06:38	17:24	17:56	18:34
52°	05:28	06:07	06:41	17:21	17:55	18:34
54°	05:28	06:09	06:45	17:17	17:53	18:34
56°	05:28	06:11	06:48	17:14	17:52	18:35
58°	05:27	06:12	06:52	17:10	17:50	18:35
S 60°	05:26	06:14	06:57	17:06	17:48	18:36

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	16:51	▬	▬	19:18	▬	▬
N 70°	15:53	17:26	18:45	20:16	20:20	20:41
68°	15:19	16:38	17:43	20:50	21:09	21:43
66°	14:55	16:07	17:08	21:15	21:40	22:18
64°	14:36	15:44	16:43	21:34	22:03	22:43
62°	14:21	15:26	16:23	21:50	22:22	23:03
60°	14:08	15:11	16:07	22:04	22:37	23:19
N 58°	13:57	14:58	15:53	22:15	22:50	23:33
56°	13:47	14:47	15:41	22:25	23:01	23:44
54°	13:39	14:37	15:31	22:34	23:11	23:55
52°	13:31	14:29	15:22	22:42	23:20	–:–
50°	13:24	14:21	15:14	22:49	23:27	–:–
45°	13:10	14:05	14:57	23:04	23:44	–:–
N 40°	12:58	13:51	14:42	23:16	23:58	–:–
35°	12:47	13:40	14:30	23:27	–:–	00:10
30°	12:39	13:30	14:20	23:36	–:–	00:20
20°	12:23	13:13	14:02	23:53	–:–	00:37
N 10°	12:10	12:58	13:46	–:–	00:07	00:53
0°	11:57	12:44	13:32	–:–	00:20	01:07
S 10°	11:45	12:30	13:17	–:–	00:33	01:21
20°	11:32	12:16	13:01	–:–	00:47	01:37
30°	11:17	11:59	12:44	00:11	01:03	01:54
35°	11:08	11:49	12:33	00:20	01:13	02:04
40°	10:58	11:38	12:21	00:29	01:24	02:16
45°	10:47	11:25	12:07	00:40	01:36	02:30
S 50°	10:33	11:09	11:50	00:53	01:52	02:47
52°	10:26	11:01	11:42	00:59	01:59	02:55
54°	10:19	10:53	11:33	01:06	02:07	03:03
56°	10:11	10:44	11:23	01:14	02:16	03:13
58°	10:02	10:33	11:12	01:23	02:26	03:25
S 60°	09:51	10:21	10:59	01:33	02:38	03:38

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 8-10 52-70%
29	01:01	00:52	12:01	18:09	05:45	
30	00:43	00:34	12:01	18:56	06:32	
31	00:24	00:15	12:00	19:43	07:19	

September 01, 02, 03 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	340°20.9	210°59.0	N18°36.6	190°31.8	N13°32.0	139°35.8	S07°33.0	79°49.5	S21°59.3
1	355°23.3	225°58.4	36.0	205°32.7	31.5	154°37.9	33.2	94°51.9	59.3
2	10°25.8	240°57.8	35.3	220°33.6	31.0	169°39.9	33.4	109°54.3	59.3
3	25°28.3	255°57.1	·· 34.7	235°34.6	·· 30.4	184°41.9	·· 33.6	124°56.8	·· 59.4
4	40°30.7	270°56.5	34.1	250°35.5	29.9	199°44.0	33.7	139°59.2	59.4
5	55°33.2	285°55.9	33.4	265°36.4	29.3	214°46.0	33.9	155°01.6	59.4
6	70°35.7	300°55.3	N18°32.8	280°37.4	N13°28.8	229°48.0	S07°34.1	170°04.1	S21°59.4
7	85°38.1	315°54.6	32.1	295°38.3	28.2	244°50.1	34.3	185°06.5	59.4
8	100°40.6	330°54.0	31.5	310°39.2	27.7	259°52.1	34.5	200°08.9	59.4
9	115°43.0	345°53.4	·· 30.9	325°40.1	·· 27.1	274°54.1	·· 34.6	215°11.4	·· 59.4
10	130°45.5	0°52.8	30.2	340°41.1	26.6	289°56.2	34.8	230°13.8	59.4
11	145°48.0	15°52.1	29.6	355°42.0	26.0	304°58.2	35.0	245°16.2	59.4
12	160°50.4	30°51.5	N18°28.9	10°42.9	N13°25.5	320°00.2	S07°35.2	260°18.7	S21°59.4
13	175°52.9	45°50.9	28.3	25°43.9	25.0	335°02.3	35.3	275°21.1	59.4
14	190°55.4	60°50.2	27.6	40°44.8	24.4	350°04.3	35.5	290°23.5	59.5
15	205°57.8	75°49.6	·· 27.0	55°45.7	·· 23.9	5°06.3	·· 35.7	305°26.0	·· 59.5
16	221°00.3	90°49.0	26.4	70°46.7	23.3	20°08.4	35.9	320°28.4	59.5
17	236°02.8	105°48.4	25.7	85°47.6	22.8	35°10.4	36.0	335°30.8	59.5
18	251°05.2	120°47.7	N18°25.1	100°48.5	N13°22.2	50°12.4	S07°36.2	350°33.3	S21°59.5
19	266°07.7	135°47.1	24.4	115°49.4	21.7	65°14.5	36.4	5°35.7	59.5
20	281°10.1	150°46.5	23.8	130°50.4	21.1	80°16.5	36.6	20°38.1	59.5
21	296°12.6	165°45.9	·· 23.1	145°51.3	·· 20.6	95°18.5	·· 36.8	35°40.6	·· 59.5
22	311°15.1	180°45.2	22.4	160°52.2	20.0	110°20.6	36.9	50°43.0	59.5
23	326°17.5	195°44.6	21.8	175°53.2	19.5	125°22.6	37.1	65°45.4	59.5
Mer.pass.:01:18		v-0.6 d-0.6 m-3.9		v0.9 d-0.5 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	341°20.0	210°44.0	N18°21.1	190°54.1	N13°18.9	140°24.6	S07°37.3	80°47.9	S21°59.6
1	356°22.5	225°43.4	20.5	205°55.0	18.4	155°26.7	37.5	95°50.3	59.6
2	11°24.9	240°42.8	19.8	220°56.0	17.8	170°28.7	37.6	110°52.7	59.6
3	26°27.4	255°42.1	·· 19.2	235°56.9	·· 17.3	185°30.7	·· 37.8	125°55.2	·· 59.6
4	41°29.9	270°41.5	18.5	250°57.8	16.7	200°32.8	38.0	140°57.6	59.6
5	56°32.3	285°40.9	17.9	265°58.8	16.2	215°34.8	38.2	156°00.0	59.6
6	71°34.8	300°40.3	N18°17.2	280°59.7	N13°15.6	230°36.8	S07°38.4	171°02.5	S21°59.6
7	86°37.3	315°39.6	16.5	296°00.6	15.1	245°38.9	38.5	186°04.9	59.6
8	101°39.7	330°39.0	15.9	311°01.6	14.5	260°40.9	38.7	201°07.3	59.6
9	116°42.2	345°38.4	·· 15.2	326°02.5	·· 14.0	275°42.9	·· 38.9	216°09.7	·· 59.6
10	131°44.6	0°37.8	14.5	341°03.4	13.4	290°45.0	39.1	231°12.2	59.7
11	146°47.1	15°37.2	13.9	356°04.3	12.9	305°47.0	39.2	246°14.6	59.7
12	161°49.6	30°36.5	N18°13.2	11°05.3	N13°12.4	320°49.0	S07°39.4	261°17.0	S21°59.7
13	176°52.0	45°35.9	12.6	26°06.2	11.8	335°51.1	39.6	276°19.5	59.7
14	191°54.5	60°35.3	11.9	41°07.1	11.3	350°53.1	39.8	291°21.9	59.7
15	206°57.0	75°34.7	·· 11.2	56°08.1	·· 10.7	5°55.1	·· 40.0	306°24.3	·· 59.7
16	221°59.4	90°34.1	10.5	71°09.0	10.2	20°57.1	40.1	321°26.8	59.7
17	237°01.9	105°33.4	09.9	86°09.9	09.6	35°59.2	40.3	336°29.2	59.7
18	252°04.4	120°32.8	N18°09.2	101°10.9	N13°09.1	51°01.2	S07°40.5	351°31.6	S21°59.7
19	267°06.8	135°32.2	08.5	116°11.8	08.5	66°03.2	40.7	6°34.0	59.7
20	282°09.3	150°31.6	07.9	131°12.7	08.0	81°05.3	40.8	21°36.5	59.8
21	297°11.8	165°31.0	·· 07.2	146°13.7	·· 07.4	96°07.3	·· 41.0	36°38.9	·· 59.8
22	312°14.2	180°30.4	06.5	161°14.6	06.8	111°09.3	41.2	51°41.3	59.8
23	327°16.7	195°29.7	05.8	176°15.5	06.3	126°11.4	41.4	66°43.8	59.8
Mer.pass.:01:14		v-0.6 d-0.7 m-3.9		v0.9 d-0.5 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	342°19.1	210°29.1	N18°05.2	191°16.5	N13°05.7	141°13.4	S07°41.6	81°46.2	S21°59.8
1	357°21.6	225°28.5	04.5	206°17.4	05.2	156°15.4	41.7	96°48.6	59.8
2	12°24.1	240°27.9	03.8	221°18.3	04.6	171°17.5	41.9	111°51.0	59.8
3	27°26.5	255°27.3	·· 03.1	236°19.3	·· 04.1	186°19.5	·· 42.1	126°53.5	·· 59.8
4	42°29.0	270°26.7	02.5	251°20.2	03.5	201°21.5	42.3	141°55.9	59.8
5	57°31.5	285°26.0	01.8	266°21.2	03.0	216°23.5	42.4	156°58.3	59.8
6	72°33.9	300°25.4	N18°01.1	281°22.1	N13°02.4	231°25.6	S07°42.6	172°00.7	S21°59.9
7	87°36.4	315°24.8	18°00.4	296°23.0	01.9	246°27.6	42.8	187°03.2	59.9
8	102°38.9	330°24.2	17°59.7	311°24.0	01.3	261°29.6	43.0	202°05.6	59.9
9	117°41.3	345°23.6	·· 59.0	326°24.9	·· 00.8	276°31.7	·· 43.2	217°08.0	·· 59.9
10	132°43.8	0°23.0	58.4	341°25.8	13°00.2	291°33.7	43.3	232°10.4	59.9
11	147°46.2	15°22.4	57.7	356°26.8	12°59.7	306°35.7	43.5	247°12.9	59.9
12	162°48.7	30°21.7	N17°57.0	11°27.7	N12°59.1	321°37.7	S07°43.7	262°15.3	S21°59.9
13	177°51.2	45°21.1	56.3	26°28.6	58.6	336°39.8	43.9	277°17.7	59.9
14	192°53.6	60°20.5	55.6	41°29.6	58.0	351°41.8	44.1	292°20.1	59.9
15	207°56.1	75°19.9	·· 54.9	56°30.5	·· 57.5	6°43.8	·· 44.2	307°22.6	21°59.9
16	222°58.6	90°19.3	54.2	71°31.4	56.9	21°45.9	44.4	322°25.0	22°00.0
17	238°01.0	105°18.7	53.5	86°32.4	56.4	36°47.9	44.6	337°27.4	00.0
18	253°03.5	120°18.1	N17°52.8	101°33.3	N12°55.8	51°49.9	S07°44.8	352°29.8	S22°00.0
19	268°06.0	135°17.5	52.2	116°34.2	55.3	66°51.9	44.9	7°32.3	00.0
20	283°08.4	150°16.9	51.5	131°35.2	54.7	81°54.0	45.1	22°34.7	00.0
21	298°10.9	165°16.2	·· 50.8	146°36.1	·· 54.1	96°56.0	·· 45.3	37°37.1	·· 00.0
22	313°13.4	180°15.6	50.1	161°37.1	53.6	111°58.0	45.5	52°39.5	00.0
23	328°15.8	195°15.0	49.4	176°38.0	53.0	127°00.0	45.7	67°42.0	00.0
Mer.pass.:01:11		v-0.6 d-0.7 m-3.9		v0.9 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.3
Ankaa	353°12.6	-42°12.5
Schedar	349°36.7	56°37.9
Diphda	348°52.8	-17°53.3
Achernar	335°24.3	-57°08.7
Hamal	327°57.3	23°32.6
Polaris	316°17.1	89°19.9
Acamar	315°16.0	-40°13.9
Menkar	314°11.9	4°09.5
Mirfak	308°36.1	49°55.1
Aldebaran	290°46.1	16°32.5
Rigel	281°09.4	-8°10.9
Capella	280°30.3	46°00.6
Bellatrix	278°29.0	6°21.8
Elnath	278°09.1	28°37.1
Alnilam	275°43.6	-1°11.5
Betelgeuse	270°58.3	7°24.5
Canopus	263°55.1	-52°42.2
Sirius	258°31.4	-16°44.4
Adhara	255°10.5	-28°59.7
Procyon	244°57.0	5°10.7
Pollux	243°24.5	27°58.9
Avior	234°17.3	-59°33.8
Suhail	222°50.7	-43°30.1
Miaplacidus	221°39.8	-69°47.3
Alphard	217°53.6	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°49.0	61°39.5
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.6	-63°11.8
Gacrux	171°58.1	-57°12.7
Alioth	166°18.7	55°52.2
Spica	158°28.5	-11°15.0
Alkaid	152°57.0	49°13.9
Hadar	148°44.1	-60°27.5
Menkent	148°04.4	-36°27.3
Arcturus	145°53.3	19°05.8
Rigil Kent.	139°48.1	-60°54.5
Kochab	137°20.7	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.7
Antares	112°22.8	-26°28.1
Atria	107°21.9	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°17.9	-37°06.9
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.6	51°29.7
Kaus Aust.	83°39.9	-34°22.4
Vega	80°36.8	38°48.4
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.9
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.8
Markab	13°35.2	15°18.1

Sep 01 Fri	SHA	Mer.pass
Venus	230°38.2	09:56
Mars	210°10.9	11:17
Jupiter	159°14.9	14:40
Saturn	99°28.6	18:38

Sep 02 Sat	SHA	Mer.pass
Venus	229°24.0	09:57
Mars	209°34.1	11:16
Jupiter	159°04.6	14:36
Saturn	99°27.9	18:34

Sep 03 Sun	SHA	Mer.pass
Venus	228°10.0	09:58
Mars	208°57.3	11:14
Jupiter	158°54.2	14:33
Saturn	99°27.0	18:30

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3363 sec ΔT = TT-UT1 = +68.8477 sec

2017 September 01 to Sep. 03 UT

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	179°58.6	N08°17.1	62°06.1	11.8'	S19°23.4	-0.2'	54.4'
1	194°58.8	16.2	76°36.9	11.8'	19°23.5	-0.1'	54.4'
2	209°59.0	15.3	91°07.7	11.8'	19°23.6	-0.0'	54.4'
3	224°59.2	·· 14.4	105°38.4	11.8'	19°23.5	0.1'	54.4'
4	239°59.4	13.5	120°09.2	11.7'	19°23.4	0.2'	54.5'
5	254°59.6	12.6	134°39.9	11.7'	19°23.2	0.3'	54.5'
6	269°59.8	N08°11.7	149°10.6	11.7'	S19°22.8	0.4'	54.5'
7	285°00.0	10.7	163°41.3	11.7'	19°22.4	0.5'	54.5'
8	300°00.2	09.8	178°12.0	11.7'	19°21.9	0.5'	54.5'
9	315°00.4	·· 08.9	192°42.7	11.7'	19°21.3	0.6'	54.5'
10	330°00.6	08.0	207°13.4	11.7'	19°20.7	0.7'	54.5'
11	345°00.8	07.1	221°44.1	11.7'	19°19.9	0.8'	54.5'
12	0°01.0	N08°06.2	236°14.7	11.6'	S19°19.0	0.9'	54.6'
13	15°01.2	05.3	250°45.3	11.6'	19°18.0	1.0'	54.6'
14	30°01.4	04.4	265°16.0	11.6'	19°17.0	1.1'	54.6'
15	45°01.6	·· 03.5	279°46.6	11.6'	19°15.8	1.2'	54.6'
16	60°01.8	02.6	294°17.2	11.6'	19°14.6	1.3'	54.6'
17	75°02.0	01.7	308°47.8	11.6'	19°13.3	1.4'	54.6'
18	90°02.2	N08°00.7	323°18.3	11.6'	S19°11.8	1.5'	54.6'
19	105°02.4	07°59.8	337°48.9	11.6'	19°10.3	1.6'	54.7'
20	120°02.6	58.9	352°19.5	11.6'	19°08.7	1.7'	54.7'
21	135°02.8	·· 58.0	6°50.0	11.5'	19°07.0	1.8'	54.7'
22	150°03.0	57.1	21°20.6	11.5'	19°05.2	1.8'	54.7'
23	165°03.2	56.2	35°51.1	11.5'	19°03.3	1.9'	54.7'
	SD.=15.8	d=-0.9	S.D.=14.9				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°03.4	N07°55.3	50°21.6	11.5'	S19°01.3	2.0'	54.7'
1	195°03.6	54.4	64°52.1	11.5'	18°59.2	2.1'	54.7'
2	210°03.8	53.5	79°22.6	11.5'	18°57.1	2.2'	54.8'
3	225°04.0	·· 52.5	93°53.1	11.5'	18°54.8	2.3'	54.8'
4	240°04.2	51.6	108°23.6	11.5'	18°52.5	2.4'	54.8'
5	255°04.4	50.7	122°54.1	11.5'	18°50.0	2.5'	54.8'
6	270°04.6	N07°49.8	137°24.6	11.5'	S18°47.5	2.6'	54.8'
7	285°04.8	48.9	151°55.1	11.5'	18°44.8	2.7'	54.8'
8	300°05.0	48.0	166°25.5	11.5'	18°42.1	2.8'	54.9'
9	315°05.2	·· 47.1	180°56.0	11.5'	18°39.3	2.9'	54.9'
10	330°05.4	46.2	195°26.4	11.5'	18°36.4	3.0'	54.9'
11	345°05.6	45.2	209°56.9	11.4'	18°33.4	3.1'	54.9'
12	0°05.8	N07°44.3	224°27.3	11.4'	S18°30.3	3.1'	54.9'
13	15°06.0	43.4	238°57.8	11.4'	18°27.1	3.2'	55.0'
14	30°06.2	42.5	253°28.2	11.4'	18°23.8	3.3'	55.0'
15	45°06.4	·· 41.6	267°58.7	11.4'	18°20.4	3.4'	55.0'
16	60°06.6	40.7	282°29.1	11.4'	18°17.0	3.5'	55.0'
17	75°06.8	39.8	296°59.5	11.4'	18°13.4	3.6'	55.0'
18	90°07.0	N07°38.8	311°29.9	11.4'	S18°09.8	3.7'	55.0'
19	105°07.2	37.9	326°00.4	11.4'	18°06.0	3.8'	55.1'
20	120°07.4	37.0	340°30.8	11.4'	18°02.2	3.9'	55.1'
21	135°07.6	·· 36.1	355°01.2	11.4'	17°58.3	4.0'	55.1'
22	150°07.8	35.2	9°31.6	11.4'	17°54.3	4.1'	55.1'
23	165°08.1	34.3	24°02.0	11.4'	17°50.2	4.1'	55.1'
	SD.=15.8	d=-0.9	S.D.=15.0				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°08.3	N07°33.3	38°32.4	11.4'	S17°46.0	4.2'	55.2'
1	195°08.5	32.4	53°02.9	11.4'	17°41.7	4.3'	55.2'
2	210°08.7	31.5	67°33.3	11.4'	17°37.3	4.4'	55.2'
3	225°08.9	·· 30.6	82°03.7	11.4'	17°32.8	4.5'	55.2'
4	240°09.1	29.7	96°34.1	11.4'	17°28.3	4.6'	55.2'
5	255°09.3	28.8	111°04.5	11.4'	17°23.6	4.7'	55.3'
6	270°09.5	N07°27.8	125°34.9	11.4'	S17°18.9	4.8'	55.3'
7	285°09.7	26.9	140°05.3	11.4'	17°14.1	4.9'	55.3'
8	300°09.9	26.0	154°35.7	11.4'	17°09.2	5.0'	55.3'
9	315°10.1	·· 25.1	169°06.2	11.4'	17°04.2	5.0'	55.4'
10	330°10.3	24.2	183°36.6	11.4'	16°59.1	5.1'	55.4'
11	345°10.5	23.3	198°07.0	11.4'	16°53.9	5.2'	55.4'
12	0°10.7	N07°22.3	212°37.4	11.4'	S16°48.6	5.3'	55.4'
13	15°10.9	21.4	227°07.8	11.4'	16°43.3	5.4'	55.4'
14	30°11.1	20.5	241°38.3	11.4'	16°37.9	5.5'	55.5'
15	45°11.3	·· 19.6	256°08.7	11.4'	16°32.3	5.6'	55.5'
16	60°11.5	18.7	270°39.1	11.4'	16°26.7	5.7'	55.5'
17	75°11.7	17.7	285°09.5	11.4'	16°21.0	5.7'	55.5'
18	90°12.0	N07°16.8	299°40.0	11.4'	S16°15.2	5.8'	55.6'
19	105°12.2	15.9	314°10.4	11.4'	16°09.4	5.9'	55.6'
20	120°12.4	15.0	328°40.9	11.4'	16°03.4	6.0'	55.6'
21	135°12.6	·· 14.1	343°11.3	11.4'	15°57.4	6.1'	55.6'
22	150°12.8	13.1	357°41.8	11.5'	15°51.2	6.2'	55.6'
23	165°13.0	12.2	12°12.2	11.5'	15°45.0	6.2'	55.7'
	SD.=15.8	d=-0.9	S.D.=15.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°		02:39	04:07	19:49	21:14	
N 70°	00:21	03:06	04:20	19:36	20:49	23:11
68°	01:41	03:25	04:30	19:26	20:30	22:11
66°	02:17	03:41	04:39	19:18	20:16	21:38
64°	02:41	03:53	04:46	19:11	20:03	21:15
62°	03:00	04:04	04:52	19:05	19:53	20:56
60°	03:15	04:13	04:58	19:00	19:45	20:42
N 58°	03:27	04:20	05:02	18:56	19:37	20:30
56°	03:38	04:27	05:06	18:51	19:31	20:19
54°	03:47	04:33	05:10	18:48	19:25	20:10
52°	03:55	04:38	05:14	18:45	19:20	20:03
50°	04:02	04:43	05:17	18:42	19:15	19:56
45°	04:17	04:53	05:23	18:35	19:05	19:41
N 40°	04:28	05:01	05:29	18:30	18:57	19:30
35°	04:37	05:08	05:33	18:25	18:51	19:21
30°	04:45	05:13	05:38	18:21	18:45	19:14
20°	04:56	05:22	05:45	18:14	18:37	19:03
N 10°	05:05	05:30	05:51	18:08	18:30	18:54
0°	05:11	05:35	05:56	18:03	18:24	18:48
S 10°	05:16	05:41	06:02	17:58	18:19	18:43
20°	05:20	05:45	06:08	17:52	18:14	18:40
30°	05:22	05:50	06:14	17:46	18:10	18:37
35°	05:23	05:52	06:18	17:42	18:07	18:37
40°	05:23	05:55	06:22	17:38	18:05	18:37
45°	05:23	05:57	06:27	17:33	18:03	18:37
S 50°	05:22	06:00	06:32	17:28	18:00	18:38
52°	05:22	06:01	06:35	17:25	17:59	18:38
54°	05:21	06:02	06:37	17:23	17:58	18:39
56°	05:20	06:03	06:41	17:20	17:57	18:40
58°	05:19	06:05	06:44	17:16	17:56	18:41
S 60°	05:18	06:06	06:48	17:13	17:55	18:43

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°			20:17			–:–
N 70°	19:24	19:34	19:36	21:42	23:14	–:–
68°	18:28	18:54	19:08	22:39	23:54	–:–
66°	17:54	18:26	18:47	23:12	–:–	00:21
64°	17:29	18:04	18:30	23:36	–:–	00:42
62°	17:10	17:47	18:16	23:56	–:–	00:59
60°	16:54	17:33	18:04	–:–	00:11	01:13
N 58°	16:41	17:21	17:53	–:–	00:25	01:25
56°	16:29	17:10	17:44	–:–	00:36	01:36
54°	16:19	17:01	17:36	–:–	00:46	01:45
52°	16:10	16:52	17:29	00:04	00:55	01:53
50°	16:02	16:45	17:22	00:12	01:03	02:00
45°	15:45	16:29	17:08	00:30	01:20	02:16
N 40°	15:31	16:15	16:57	00:44	01:34	02:28
35°	15:19	16:04	16:47	00:56	01:46	02:39
30°	15:08	15:54	16:38	01:06	01:56	02:49
20°	14:50	15:37	16:23	01:24	02:14	03:05
N 10°	14:35	15:23	16:10	01:40	02:29	03:19
0°	14:20	15:09	15:58	01:55	02:44	03:32
S 10°	14:05	14:55	15:45	02:10	02:58	03:46
20°	13:50	14:40	15:32	02:25	03:13	04:00
30°	13:32	14:23	15:17	02:43	03:31	04:16
35°	13:21	14:13	15:08	02:54	03:41	04:25
40°	13:09	14:02	14:58	03:06	03:52	04:35
45°	12:55	13:49	14:46	03:20	04:06	04:48
S 50°	12:38	13:32	14:32	03:37	04:23	05:03
52°	12:30	13:25	14:25	03:45	04:30	05:10
54°	12:21	13:16	14:18	03:54	04:39	05:17
56°	12:11	13:07	14:10	04:05	04:49	05:26
58°	11:59	12:56	14:00	04:16	05:00	05:36
S 60°	11:46	12:43	13:49	04:30	05:13	05:47

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 11-13 78-92%
01	00:06	00:04	12:00	20:32	08:07	
02	00:14	00:23	12:00	21:21	08:56	
03	00:33	00:43	11:59	22:10	09:45	

September 04, 05, 06 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	343°18.3	210°14.4	N17°48.7	191°38.9	N12°52.5	142°02.1	S07°45.8	82°44.4	S22°00.0
1	358°20.7	225°13.8	48.0	206°39.9	51.9	157°04.1	46.0	97°46.8	00.0
2	13°23.2	240°13.2	47.3	221°40.8	51.4	172°06.1	46.2	112°49.2	00.1
3	28°25.7	255°12.6	·· 46.6	236°41.7	·· 50.8	187°08.2	·· 46.4	127°51.7	·· 00.1
4	43°28.1	270°12.0	45.9	251°42.7	50.3	202°10.2	46.6	142°54.1	00.1
5	58°30.6	285°11.4	45.2	266°43.6	49.7	217°12.2	46.7	157°56.5	00.1
6	73°33.1	300°10.8	N17°44.5	281°44.6	N12°49.2	232°14.2	S07°46.9	172°58.9	S22°00.1
7	88°35.5	315°10.2	43.8	296°45.5	48.6	247°16.3	47.1	188°01.3	00.1
8	103°38.0	330°09.5	43.1	311°46.4	48.0	262°18.3	47.3	203°03.8	00.1
9	118°40.5	345°08.9	·· 42.4	326°47.4	·· 47.5	277°20.3	·· 47.5	218°06.2	·· 00.1
10	133°42.9	0°08.3	41.7	341°48.3	46.9	292°22.3	47.6	233°08.6	00.1
11	148°45.4	15°07.7	40.9	356°49.2	46.4	307°24.4	47.8	248°11.0	00.1
12	163°47.9	30°07.1	N17°40.2	11°50.2	N12°45.8	322°26.4	S07°48.0	263°13.5	S22°00.2
13	178°50.3	45°06.5	39.5	26°51.1	45.3	337°28.4	48.2	278°15.9	00.2
14	193°52.8	60°05.9	38.8	41°52.1	44.7	352°30.4	48.3	293°18.3	00.2
15	208°55.2	75°05.3	·· 38.1	56°53.0	·· 44.2	7°32.5	·· 48.5	308°20.7	·· 00.2
16	223°57.7	90°04.7	37.4	71°53.9	43.6	22°34.5	48.7	323°23.1	00.2
17	239°00.2	105°04.1	36.7	86°54.9	43.0	37°36.5	48.9	338°25.6	00.2
18	254°02.6	120°03.5	N17°36.0	101°55.8	N12°42.5	52°38.5	S07°49.1	353°28.0	S22°00.2
19	269°05.1	135°02.9	35.3	116°56.8	41.9	67°40.6	49.2	8°30.4	00.2
20	284°07.6	150°02.3	34.5	131°57.7	41.4	82°42.6	49.4	23°32.8	00.2
21	299°10.0	165°01.7	·· 33.8	146°58.6	·· 40.8	97°44.6	·· 49.6	38°35.2	·· 00.3
22	314°12.5	180°01.1	33.1	161°59.6	40.3	112°46.6	49.8	53°37.7	00.3
23	329°15.0	195°00.5	32.4	177°00.5	39.7	127°48.7	50.0	68°40.1	00.3
Mer.pass.:01:07		v-0.6 d-0.7 m-3.9		v0.9 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	344°17.4	209°59.9	N17°31.7	192°01.5	N12°39.1	142°50.7	S07°50.1	83°42.5	S22°00.3
1	359°19.9	224°59.3	31.0	207°02.4	38.6	157°52.7	50.3	98°44.9	00.3
2	14°22.3	239°58.7	30.2	222°03.3	38.0	172°54.7	50.5	113°47.3	00.3
3	29°24.8	254°58.1	·· 29.5	237°04.3	·· 37.5	187°56.8	·· 50.7	128°49.7	·· 00.3
4	44°27.3	269°57.5	28.8	252°05.2	36.9	202°58.8	50.9	143°52.2	00.3
5	59°29.7	284°56.9	28.1	267°06.2	36.4	218°00.8	51.0	158°54.6	00.3
6	74°32.2	299°56.3	N17°27.3	282°07.1	N12°35.8	233°02.8	S07°51.2	173°57.0	S22°00.3
7	89°34.7	314°55.7	26.6	297°08.0	35.2	248°04.9	51.4	188°59.4	00.4
8	104°37.1	329°55.1	25.9	312°09.0	34.7	263°06.9	51.6	204°01.8	00.4
9	119°39.6	344°54.5	·· 25.2	327°09.9	·· 34.1	278°08.9	·· 51.8	219°04.3	·· 00.4
10	134°42.1	359°53.9	24.4	342°10.9	33.6	293°10.9	51.9	234°06.7	00.4
11	149°44.5	14°53.3	23.7	357°11.8	33.0	308°12.9	52.1	249°09.1	00.4
12	164°47.0	29°52.7	N17°23.0	12°12.7	N12°32.4	323°15.0	S07°52.3	264°11.5	S22°00.4
13	179°49.5	44°52.1	22.3	27°13.7	31.9	338°17.0	52.5	279°13.9	00.4
14	194°51.9	59°51.5	21.5	42°14.6	31.3	353°19.0	52.7	294°16.3	00.4
15	209°54.4	74°50.9	·· 20.8	57°15.6	·· 30.8	8°21.0	·· 52.8	309°18.8	·· 00.4
16	224°56.8	89°50.3	20.1	72°16.5	30.2	23°23.1	53.0	324°21.2	00.5
17	239°59.3	104°49.7	19.3	87°17.5	29.6	38°25.1	53.2	339°23.6	00.5
18	255°01.8	119°49.1	N17°18.6	102°18.4	N12°29.1	53°27.1	S07°53.4	354°26.0	S22°00.5
19	270°04.2	134°48.5	17.9	117°19.3	28.5	68°29.1	53.6	9°28.4	00.5
20	285°06.7	149°47.9	17.1	132°20.3	28.0	83°31.1	53.7	24°30.8	00.5
21	300°09.2	164°47.3	·· 16.4	147°21.2	·· 27.4	98°33.2	·· 53.9	39°33.2	·· 00.5
22	315°11.6	179°46.7	15.7	162°22.2	26.8	113°35.2	54.1	54°35.7	00.5
23	330°14.1	194°46.1	14.9	177°23.1	26.3	128°37.2	54.3	69°38.1	00.5
Mer.pass.:01:03		v-0.6 d-0.7 m-3.9		v0.9 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	345°16.6	209°45.5	N17°14.2	192°24.1	N12°25.7	143°39.2	S07°54.5	84°40.5	S22°00.5
1	0°19.0	224°44.9	13.4	207°25.0	25.2	158°41.3	54.6	99°42.9	00.6
2	15°21.5	239°44.3	12.7	222°25.9	24.6	173°43.3	54.8	114°45.3	00.6
3	30°24.0	254°43.7	·· 12.0	237°26.9	·· 24.0	188°45.3	·· 55.0	129°47.7	·· 00.6
4	45°26.4	269°43.1	11.2	252°27.8	23.5	203°47.3	55.2	144°50.1	00.6
5	60°28.9	284°42.5	10.5	267°28.8	22.9	218°49.3	55.4	159°52.6	00.6
6	75°31.3	299°41.9	N17°09.7	282°29.7	N12°22.4	233°51.4	S07°55.6	174°55.0	S22°00.6
7	90°33.8	314°41.3	09.0	297°30.7	21.8	248°53.4	55.7	189°57.4	00.6
8	105°36.3	329°40.7	08.2	312°31.6	21.2	263°55.4	55.9	204°59.8	00.6
9	120°38.7	344°40.1	·· 07.5	327°32.5	·· 20.7	278°57.4	·· 56.1	220°02.2	·· 00.6
10	135°41.2	359°39.6	06.7	342°33.5	20.1	293°59.4	56.3	235°04.6	00.6
11	150°43.7	14°39.0	06.0	357°34.4	19.6	309°01.5	56.5	250°07.0	00.7
12	165°46.1	29°38.4	N17°05.2	12°35.4	N12°19.0	324°03.5	S07°56.6	265°09.5	S22°00.7
13	180°48.6	44°37.8	04.5	27°36.3	18.4	339°05.5	56.8	280°11.9	00.7
14	195°51.1	59°37.2	03.7	42°37.3	17.9	354°07.5	57.0	295°14.3	00.7
15	210°53.5	74°36.6	·· 03.0	57°38.2	·· 17.3	9°09.5	·· 57.2	310°16.7	·· 00.7
16	225°56.0	89°36.0	02.2	72°39.2	16.7	24°11.6	57.4	325°19.1	00.7
17	240°58.4	104°35.4	01.5	87°40.1	16.2	39°13.6	57.5	340°21.5	00.7
18	256°00.9	119°34.8	N17°00.7	102°41.0	N12°15.6	54°15.6	S07°57.7	355°23.9	S22°00.7
19	271°03.4	134°34.2	17°00.0	117°42.0	15.1	69°17.6	57.9	10°26.3	00.7
20	286°05.8	149°33.6	16°59.2	132°42.9	14.5	84°19.6	58.1	25°28.7	00.8
21	301°08.3	164°33.1	·· 58.5	147°43.9	·· 13.9	99°21.7	·· 58.3	40°31.2	·· 00.8
22	316°10.8	179°32.5	57.7	162°44.8	13.4	114°23.7	58.4	55°33.6	00.8
23	331°13.2	194°31.9	56.9	177°45.8	12.8	129°25.7	58.6	70°36.0	00.8
Mer.pass.:00:59		v-0.6 d-0.7 m-3.9		v0.9 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.3
Ankaa	353°12.5	-42°12.5
Schedar	349°36.7	56°37.9
Diphda	348°52.8	-17°53.3
Achernar	335°24.3	-57°08.7
Hamal	327°57.3	23°32.6
Polaris	316°15.9	89°19.9
Acamar	315°16.0	-40°13.9
Menkar	314°11.9	4°09.5
Mirfak	308°36.0	49°55.1
Aldebaran	290°46.1	16°32.5
Rigel	281°09.4	-8°10.9
Capella	280°30.3	46°00.6
Bellatrix	278°29.0	6°21.8
Elnath	278°09.1	28°37.1
Alnilam	275°43.5	-1°11.5
Betelgeuse	270°58.3	7°24.5
Canopus	263°55.1	-52°42.2
Sirius	258°31.4	-16°44.4
Adhara	255°10.5	-28°59.7
Procyon	244°57.0	5°10.7
Pollux	243°24.5	27°58.9
Avior	234°17.3	-59°33.8
Suhail	222°50.7	-43°30.1
Miaplacidus	221°39.8	-69°47.3
Alphard	217°53.6	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°49.0	61°39.4
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.7	-63°11.8
Gacrux	171°58.2	-57°12.7
Alioth	166°18.7	55°52.1
Spica	158°28.5	-11°15.0
Alkaid	152°57.0	49°13.9
Hadar	148°44.2	-60°27.5
Menkent	148°04.4	-36°27.3
Arcturus	145°53.4	19°05.8
Rigil Kent.	139°48.1	-60°54.5
Kochab	137°20.8	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.7
Antares	112°22.8	-26°28.1
Atria	107°21.9	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°18.0	-37°06.9
Rasalhague	96°03.7	12°33.2
Eltanin	90°44.7	51°29.7
Kaus Aust.	83°39.9	-34°22.4
Vega	80°36.8	38°48.4
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.3	-56°40.6
Deneb	49°29.1	45°20.9
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.8
Markab	13°35.2	15°18.1

Sep 04 Mon	SHA	Mer.pass
Venus	226°56.1	09:59
Mars	208°20.7	11:13
Jupiter	158°43.8	14:30
Saturn	99°26.1	18:26

Sep 05 Tue	SHA	Mer.pass
Venus	225°42.4	10:00
Mars	207°44.0	11:11
Jupiter	158°33.3	14:27
Saturn	99°25.1	18:22

Sep 06 Wed	SHA	Mer.pass
Venus	224°28.9	10:01
Mars	207°07.5	11:10
Jupiter	158°22.7	14:23
Saturn	99°23.9	18:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3342 sec ΔT = TT-UT1 = +68.8498 sec

2017 September 04 to Sep. 06 UT

h

Mon	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°13.2	N07°11.3	26°42.7	11.5'	S15°38.7	6.3'	55.7'
1	195°13.4	10.4	41°13.1	11.5'	15°32.4	6.4'	55.7'
2	210°13.6	09.4	55°43.6	11.5'	15°25.9	6.5'	55.7'
3	225°13.8	·· 08.5	70°14.1	11.5'	15°19.4	6.6'	55.8'
4	240°14.0	07.6	84°44.5	11.5'	15°12.8	6.7'	55.8'
5	255°14.2	06.7	99°15.0	11.5'	15°06.1	6.7'	55.8'
6	270°14.4	N07°05.8	113°45.5	11.5'	S14°59.3	6.8'	55.8'
7	285°14.6	04.8	128°16.0	11.5'	14°52.4	6.9'	55.9'
8	300°14.9	03.9	142°46.5	11.5'	14°45.5	7.0'	55.9'
9	315°15.1	·· 03.0	157°17.0	11.5'	14°38.4	7.1'	55.9'
10	330°15.3	02.1	171°47.5	11.5'	14°31.3	7.1'	55.9'
11	345°15.5	01.1	186°18.0	11.5'	14°24.1	7.2'	56.0'
12	0°15.7	N07°00.2	200°48.5	11.5'	S14°16.9	7.3'	56.0'
13	15°15.9	06°59.3	215°19.0	11.5'	14°09.5	7.4'	56.0'
14	30°16.1	58.4	229°49.5	11.5'	14°02.1	7.5'	56.0'
15	45°16.3	·· 57.4	244°20.1	11.5'	13°54.6	7.5'	56.1'
16	60°16.5	56.5	258°50.6	11.5'	13°47.1	7.6'	56.1'
17	75°16.7	55.6	273°21.1	11.5'	13°39.4	7.7'	56.1'
18	90°16.9	N06°54.7	287°51.7	11.5'	S13°31.7	7.8'	56.1'
19	105°17.1	53.7	302°22.2	11.6'	13°23.9	7.8'	56.1'
20	120°17.4	52.8	316°52.8	11.6'	13°16.0	7.9'	56.2'
21	135°17.6	·· 51.9	331°23.4	11.6'	13°08.1	8.0'	56.2'
22	150°17.8	51.0	345°53.9	11.6'	13°00.1	8.1'	56.2'
23	165°18.0	50.0	0°24.5	11.6'	12°52.0	8.1'	56.2'
	SD.=15.8	d=-0.9		S.D.=15.3			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°18.2	N06°49.1	14°55.1	11.6'	S12°43.8	8.2'	56.3'
1	195°18.4	48.2	29°25.6	11.6'	12°35.6	8.3'	56.3'
2	210°18.6	47.3	43°56.2	11.6'	12°27.3	8.3'	56.3'
3	225°18.8	·· 46.3	58°26.8	11.6'	12°18.9	8.4'	56.3'
4	240°19.0	45.4	72°57.4	11.6'	12°10.5	8.5'	56.4'
5	255°19.2	44.5	87°28.0	11.6'	12°02.0	8.5'	56.4'
6	270°19.5	N06°43.6	101°58.6	11.6'	S11°53.4	8.6'	56.4'
7	285°19.7	42.6	116°29.2	11.6'	11°44.8	8.7'	56.4'
8	300°19.9	41.7	130°59.9	11.6'	11°36.0	8.7'	56.5'
9	315°20.1	·· 40.8	145°30.5	11.6'	11°27.3	8.8'	56.5'
10	330°20.3	39.8	160°01.1	11.6'	11°18.4	8.9'	56.5'
11	345°20.5	38.9	174°31.7	11.6'	11°09.5	8.9'	56.5'
12	0°20.7	N06°38.0	189°02.4	11.6'	S11°00.5	9.0'	56.6'
13	15°20.9	37.1	203°33.0	11.6'	10°51.5	9.1'	56.6'
14	30°21.1	36.1	218°03.6	11.6'	10°42.4	9.1'	56.6'
15	45°21.3	·· 35.2	232°34.3	11.6'	10°33.2	9.2'	56.6'
16	60°21.6	34.3	247°04.9	11.6'	10°24.0	9.3'	56.7'
17	75°21.8	33.3	261°35.6	11.7'	10°14.7	9.3'	56.7'
18	90°22.0	N06°32.4	276°06.2	11.7'	S10°05.4	9.4'	56.7'
19	105°22.2	31.5	290°36.9	11.7'	09°56.0	9.4'	56.7'
20	120°22.4	30.6	305°07.5	11.7'	09°46.5	9.5'	56.8'
21	135°22.6	·· 29.6	319°38.2	11.7'	09°37.0	9.5'	56.8'
22	150°22.8	28.7	334°08.9	11.7'	09°27.4	9.6'	56.8'
23	165°23.0	27.8	348°39.5	11.7'	09°17.8	9.7'	56.8'
	SD.=15.9	d=-0.9		S.D.=15.4			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°23.3	N06°26.8	3°10.2	11.7'	S09°08.1	9.7'	56.9'
1	195°23.5	25.9	17°40.9	11.7'	08°58.4	9.8'	56.9'
2	210°23.7	25.0	32°11.5	11.7'	08°48.6	9.8'	56.9'
3	225°23.9	·· 24.0	46°42.2	11.7'	08°38.7	9.9'	56.9'
4	240°24.1	23.1	61°12.9	11.7'	08°28.8	9.9'	57.0'
5	255°24.3	22.2	75°43.5	11.7'	08°18.9	10.0'	57.0'
6	270°24.5	N06°21.3	90°14.2	11.7'	S08°08.9	10.0'	57.0'
7	285°24.7	20.3	104°44.9	11.7'	07°58.8	10.1'	57.0'
8	300°25.0	19.4	119°15.5	11.7'	07°48.7	10.1'	57.1'
9	315°25.2	·· 18.5	133°46.2	11.7'	07°38.6	10.2'	57.1'
10	330°25.4	17.5	148°16.9	11.7'	07°28.4	10.2'	57.1'
11	345°25.6	16.6	162°47.5	11.7'	07°18.1	10.3'	57.1'
12	0°25.8	N06°15.7	177°18.2	11.7'	S07°07.8	10.3'	57.2'
13	15°26.0	14.7	191°48.9	11.7'	06°57.5	10.4'	57.2'
14	30°26.2	13.8	206°19.5	11.7'	06°47.1	10.4'	57.2'
15	45°26.4	·· 12.9	220°50.2	11.7'	06°36.7	10.4'	57.2'
16	60°26.7	11.9	235°20.8	11.7'	06°26.2	10.5'	57.3'
17	75°26.9	11.0	249°51.5	11.6'	06°15.7	10.5'	57.3'
18	90°27.1	N06°10.1	264°22.1	11.6'	S06°05.2	10.6'	57.3'
19	105°27.3	09.1	278°52.8	11.6'	05°54.6	10.6'	57.3'
20	120°27.5	08.2	293°23.4	11.6'	05°44.0	10.6'	57.3'
21	135°27.7	·· 07.3	307°54.0	11.6'	05°33.3	10.7'	57.4'
22	150°27.9	06.3	322°24.7	11.6'	05°22.6	10.7'	57.4'
23	165°28.1	05.4	336°55.3	11.6'	05°11.9	10.8'	57.4'
	SD.=15.9	d=-0.9		S.D.=15.6			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	▭	02:59	04:22	19:32	20:53	▭
N 70°	01:19	03:21	04:32	19:22	20:32	22:28
68°	02:04	03:39	04:41	19:14	20:16	21:47
66°	02:33	03:52	04:49	19:07	20:02	21:20
64°	02:54	04:03	04:55	19:01	19:52	21:00
62°	03:11	04:13	05:00	18:56	19:43	20:44
60°	03:24	04:21	05:05	18:51	19:35	20:31
N 58°	03:36	04:27	05:09	18:47	19:28	20:20
56°	03:45	04:33	05:12	18:44	19:22	20:10
54°	03:54	04:39	05:16	18:41	19:17	20:02
52°	04:01	04:44	05:18	18:38	19:12	19:55
50°	04:07	04:48	05:21	18:35	19:08	19:48
45°	04:21	04:57	05:27	18:30	19:00	19:35
N 40°	04:31	05:04	05:32	18:25	18:52	19:25
35°	04:40	05:10	05:36	18:21	18:47	19:17
30°	04:46	05:15	05:39	18:18	18:42	19:10
20°	04:57	05:23	05:45	18:12	18:34	19:00
N 10°	05:05	05:29	05:51	18:07	18:28	18:52
0°	05:10	05:35	05:55	18:02	18:23	18:47
S 10°	05:15	05:39	06:00	17:57	18:18	18:43
20°	05:17	05:43	06:05	17:53	18:15	18:40
30°	05:19	05:46	06:10	17:47	18:11	18:39
35°	05:19	05:48	06:14	17:44	18:10	18:39
40°	05:19	05:50	06:17	17:41	18:08	18:39
45°	05:18	05:52	06:21	17:37	18:06	18:40
S 50°	05:16	05:53	06:26	17:32	18:05	18:42
52°	05:15	05:54	06:28	17:30	18:04	18:43
54°	05:14	05:55	06:30	17:28	18:03	18:44
56°	05:13	05:56	06:33	17:25	18:03	18:46
58°	05:11	05:56	06:36	17:23	18:02	18:47
S 60°	05:09	05:57	06:39	17:19	18:01	18:49

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	20:01	19:50	19:40	00:13	02:12	04:04
N 70°	19:36	19:34	19:32	00:53	02:35	04:18
68°	19:17	19:22	19:25	01:21	02:54	04:29
66°	19:01	19:12	19:20	01:41	03:08	04:38
64°	18:49	19:03	19:15	01:58	03:20	04:45
62°	18:38	18:55	19:11	02:11	03:30	04:52
60°	18:29	18:49	19:07	02:23	03:38	04:57
N 58°	18:20	18:43	19:04	02:33	03:46	05:02
56°	18:13	18:38	19:01	02:41	03:52	05:06
54°	18:07	18:34	18:58	02:49	03:58	05:10
52°	18:01	18:30	18:56	02:56	04:03	05:14
50°	17:56	18:26	18:54	03:02	04:08	05:17
45°	17:45	18:18	18:49	03:15	04:18	05:24
N 40°	17:35	18:11	18:45	03:26	04:27	05:30
35°	17:27	18:05	18:41	03:36	04:34	05:34
30°	17:20	18:00	18:38	03:44	04:41	05:39
20°	17:08	17:51	18:33	03:58	04:52	05:46
N 10°	16:57	17:43	18:28	04:10	05:01	05:52
0°	16:47	17:35	18:24	04:21	05:10	05:59
S 10°	16:36	17:28	18:19	04:33	05:19	06:04
20°	16:26	17:20	18:15	04:45	05:28	06:11
30°	16:13	17:11	18:09	04:58	05:39	06:18
35°	16:06	17:05	18:06	05:06	05:45	06:22
40°	15:58	16:59	18:03	05:15	05:52	06:27
45°	15:48	16:52	17:59	05:26	06:00	06:32
S 50°	15:36	16:44	17:54	05:38	06:10	06:38
52°	15:31	16:40	17:52	05:44	06:14	06:41
54°	15:25	16:36	17:49	05:50	06:19	06:44
56°	15:18	16:31	17:46	05:58	06:24	06:48
58°	15:11	16:26	17:43	06:06	06:30	06:52
S 60°	15:02	16:20	17:40	06:15	06:37	06:56

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 14-16 97-100%
04	00:53	01:03	11:59	22:58	10:34	
05	01:13	01:23	11:59	23:47	11:23	
06	01:33	01:43	11:58	–:–	12:11	

September 07, 08, 09 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	346°15.7	209°31.3	N16°56.2	192°46.7	N12°12.2	144°27.7	S07°58.8	85°38.4	S22°00.8
1	1°18.2	224°30.7	55.4	207°47.7	11.7	159°29.7	59.0	100°40.8	00.8
2	16°20.6	239°30.1	54.7	222°48.6	11.1	174°31.8	59.2	115°43.2	00.8
3	31°23.1	254°29.5	·· 53.9	237°49.6	·· 10.6	189°33.8	·· 59.4	130°45.6	·· 00.8
4	46°25.6	269°28.9	53.1	252°50.5	10.0	204°35.8	59.5	145°48.0	00.8
5	61°28.0	284°28.3	52.4	267°51.4	09.4	219°37.8	59.7	160°50.4	00.9
6	76°30.5	299°27.8	N16°51.6	282°52.4	N12°08.9	234°39.8	S07°59.9	175°52.8	S22°00.9
7	91°32.9	314°27.2	50.8	297°53.3	08.3	249°41.8	08°00.1	190°55.3	00.9
8	106°35.4	329°26.6	50.1	312°54.3	07.7	264°43.9	00.3	205°57.7	00.9
9	121°37.9	344°26.0	·· 49.3	327°55.2	·· 07.2	279°45.9	·· 00.4	221°00.1	·· 00.9
10	136°40.3	359°25.4	48.5	342°56.2	06.6	294°47.9	00.6	236°02.5	00.9
11	151°42.8	14°24.8	47.8	357°57.1	06.0	309°49.9	00.8	251°04.9	00.9
12	166°45.3	29°24.3	N16°47.0	12°58.1	N12°05.5	324°51.9	S08°01.0	266°07.3	S22°00.9
13	181°47.7	44°23.7	46.2	27°59.0	04.9	339°53.9	01.2	281°09.7	00.9
14	196°50.2	59°23.1	45.5	43°00.0	04.3	354°56.0	01.3	296°12.1	01.0
15	211°52.7	74°22.5	·· 44.7	58°00.9	·· 03.8	9°58.0	·· 01.5	311°14.5	·· 01.0
16	226°55.1	89°21.9	43.9	73°01.9	03.2	25°00.0	01.7	326°16.9	01.0
17	241°57.6	104°21.3	43.2	88°02.8	02.6	40°02.0	01.9	341°19.3	01.0
18	257°00.0	119°20.7	N16°42.4	103°03.8	N12°02.1	55°04.0	S08°02.1	356°21.7	S22°01.0
19	272°02.5	134°20.2	41.6	118°04.7	01.5	70°06.1	02.3	11°24.1	01.0
20	287°05.0	149°19.6	40.8	133°05.6	00.9	85°08.1	02.4	26°26.6	01.0
21	302°07.4	164°19.0	·· 40.0	148°06.6	12°00.4	100°10.1	·· 02.6	41°29.0	·· 01.0
22	317°09.9	179°18.4	39.3	163°07.5	11°59.8	115°12.1	02.8	56°31.4	01.0
23	332°12.4	194°17.8	38.5	178°08.5	59.2	130°14.1	03.0	71°33.8	01.1
Mer.pass.:00:55		v-0.6 d-0.8 m-3.9		v0.9 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	347°14.8	209°17.3	N16°37.7	193°09.4	N11°58.7	145°16.1	S08°03.2	86°36.2	S22°01.1
1	2°17.3	224°16.7	36.9	208°10.4	58.1	160°18.1	03.3	101°38.6	01.1
2	17°19.8	239°16.1	36.2	223°11.3	57.5	175°20.2	03.5	116°41.0	01.1
3	32°22.2	254°15.5	·· 35.4	238°12.3	·· 57.0	190°22.2	·· 03.7	131°43.4	·· 01.1
4	47°24.7	269°14.9	34.6	253°13.2	56.4	205°24.2	03.9	146°45.8	01.1
5	62°27.2	284°14.4	33.8	268°14.2	55.8	220°26.2	04.1	161°48.2	01.1
6	77°29.6	299°13.8	N16°33.0	283°15.1	N11°55.3	235°28.2	S08°04.3	176°50.6	S22°01.1
7	92°32.1	314°13.2	32.2	298°16.1	54.7	250°30.2	04.4	191°53.0	01.1
8	107°34.5	329°12.6	31.4	313°17.0	54.1	265°32.3	04.6	206°55.4	01.2
9	122°37.0	344°12.0	·· 30.7	328°18.0	·· 53.6	280°34.3	·· 04.8	221°57.8	·· 01.2
10	137°39.5	359°11.5	29.9	343°18.9	53.0	295°36.3	05.0	237°00.2	01.2
11	152°41.9	14°10.9	29.1	358°19.9	52.4	310°38.3	05.2	252°02.6	01.2
12	167°44.4	29°10.3	N16°28.3	13°20.8	N11°51.9	325°40.3	S08°05.3	267°05.0	S22°01.2
13	182°46.9	44°09.7	27.5	28°21.8	51.3	340°42.3	05.5	282°07.4	01.2
14	197°49.3	59°09.2	26.7	43°22.7	50.7	355°44.3	05.7	297°09.8	01.2
15	212°51.8	74°08.6	·· 25.9	58°23.7	·· 50.2	10°46.4	·· 05.9	312°12.2	·· 01.2
16	227°54.3	89°08.0	25.1	73°24.6	49.6	25°48.4	06.1	327°14.7	01.2
17	242°56.7	104°07.4	24.3	88°25.6	49.0	40°50.4	06.3	342°17.1	01.3
18	257°59.2	119°06.9	N16°23.5	103°26.5	N11°48.5	55°52.4	S08°06.4	357°19.5	S22°01.3
19	273°01.6	134°06.3	22.7	118°27.5	47.9	70°54.4	06.6	12°21.9	01.3
20	288°04.1	149°05.7	22.0	133°28.4	47.3	85°56.4	06.8	27°24.3	01.3
21	303°06.6	164°05.1	·· 21.2	148°29.4	·· 46.8	100°58.4	·· 07.0	42°26.7	·· 01.3
22	318°09.0	179°04.6	20.4	163°30.3	46.2	116°00.5	07.2	57°29.1	01.3
23	333°11.5	194°04.0	19.6	178°31.3	45.6	131°02.5	07.4	72°31.5	01.3
Mer.pass.:00:51		v-0.6 d-0.8 m-3.9		v0.9 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.4	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	348°14.0	209°03.4	N16°18.8	193°32.2	N11°45.1	146°04.5	S08°07.5	87°33.9	S22°01.3
1	3°16.4	224°02.8	18.0	208°33.2	44.5	161°06.5	07.7	102°36.3	01.4
2	18°18.9	239°02.3	17.2	223°34.1	43.9	176°08.5	07.9	117°38.7	01.4
3	33°21.4	254°01.7	·· 16.4	238°35.1	·· 43.3	191°10.5	·· 08.1	132°41.1	·· 01.4
4	48°23.8	269°01.1	15.6	253°36.0	42.8	206°12.5	08.3	147°43.5	01.4
5	63°26.3	284°00.5	14.8	268°37.0	42.2	221°14.5	08.4	162°45.9	01.4
6	78°28.8	299°00.0	N16°14.0	283°37.9	N11°41.6	236°16.6	S08°08.6	177°48.3	S22°01.4
7	93°31.2	313°59.4	13.1	298°38.9	41.1	251°18.6	08.8	192°50.7	01.4
8	108°33.7	328°58.8	12.3	313°39.8	40.5	266°20.6	09.0	207°53.1	01.4
9	123°36.1	343°58.3	·· 11.5	328°40.8	·· 39.9	281°22.6	·· 09.2	222°55.5	·· 01.4
10	138°38.6	358°57.7	10.7	343°41.8	39.4	296°24.6	09.4	237°57.9	01.5
11	153°41.1	13°57.1	09.9	358°42.7	38.8	311°26.6	09.5	253°00.3	01.5
12	168°43.5	28°56.5	N16°09.1	13°43.7	N11°38.2	326°28.6	S08°09.7	268°02.7	S22°01.5
13	183°46.0	43°56.0	08.3	28°44.6	37.6	341°30.6	09.9	283°05.1	01.5
14	198°48.5	58°55.4	07.5	43°45.6	37.1	356°32.7	10.1	298°07.5	01.5
15	213°50.9	73°54.8	·· 06.7	58°46.5	·· 36.5	11°34.7	·· 10.3	313°09.9	·· 01.5
16	228°53.4	88°54.3	05.9	73°47.5	35.9	26°36.7	10.5	328°12.3	01.5
17	243°55.9	103°53.7	05.1	88°48.4	35.4	41°38.7	10.6	343°14.7	01.5
18	258°58.3	118°53.1	N16°04.2	103°49.4	N11°34.8	56°40.7	S08°10.8	358°17.1	S22°01.5
19	274°00.8	133°52.6	03.4	118°50.3	34.2	71°42.7	11.0	13°19.5	01.6
20	289°03.2	148°52.0	02.6	133°51.3	33.6	86°44.7	11.2	28°21.9	01.6
21	304°05.7	163°51.4	·· 01.8	148°52.2	·· 33.1	101°46.7	·· 11.4	43°24.3	·· 01.6
22	319°08.2	178°50.9	01.0	163°53.2	32.5	116°48.7	11.6	58°26.7	01.6
23	334°10.6	193°50.3	00.2	178°54.1	31.9	131°50.8	11.7	73°29.1	01.6
Mer.pass.:00:47		v-0.6 d-0.8 m-3.9		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.3
Ankaa	353°12.5	-42°12.5
Schedar	349°36.7	56°37.9
Diphda	348°52.7	-17°53.3
Achernar	335°24.3	-57°08.7
Hamal	327°57.3	23°32.6
Polaris	316°14.7	89°19.9
Acamar	315°16.0	-40°13.9
Menkar	314°11.9	4°09.5
Mirfak	308°36.0	49°55.1
Aldebaran	290°46.1	16°32.5
Rigel	281°09.3	-8°10.9
Capella	280°30.3	46°00.6
Bellatrix	278°29.0	6°21.8
Elnath	278°09.0	28°37.1
Alnilam	275°43.5	-1°11.5
Betelgeuse	270°58.3	7°24.5
Canopus	263°55.1	-52°42.1
Sirius	258°31.3	-16°44.4
Adhara	255°10.5	-28°59.7
Procyon	244°57.0	5°10.7
Pollux	243°24.5	27°58.9
Avior	234°17.3	-59°33.8
Suhail	222°50.7	-43°30.1
Miaplacidus	221°39.8	-69°47.3
Alphard	217°53.6	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°49.0	61°39.4
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.7	-63°11.8
Gacrux	171°58.2	-57°12.7
Alioth	166°18.7	55°52.1
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.9
Hadar	148°44.2	-60°27.5
Menkent	148°04.4	-36°27.3
Arcturus	145°53.4	19°05.8
Rigil Kent.	139°48.2	-60°54.4
Kochab	137°20.8	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.7	26°39.7
Antares	112°22.8	-26°28.1
Atria	107°22.0	-69°03.6
Sabik	102°09.2	-15°44.6
Shaula	96°18.0	-37°06.9
Rasalhague	96°03.8	12°33.2
Eltanin	90°44.7	51°29.7
Kaus Aust.	83°39.9	-34°22.4
Vega	80°36.9	38°48.4
Nunki	75°54.6	-26°16.3
Altair	62°05.2	8°55.2
Peacock	53°14.4	-56°40.7
Deneb	49°29.1	45°20.9
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.4
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.8
Markab	13°35.2	15°18.1

Sep 07 Thu	SHA	Mer.pass
Venus	223°15.6	10:02
Mars	206°31.0	11:08
Jupiter	158°12.0	14:20
Saturn	99°22.7	18:15

Sep 08 Fri	SHA	Mer.pass
Venus	222°02.4	10:03
Mars	205°54.6	11:07
Jupiter	158°01.3	14:17
Saturn	99°21.3	18:11

Sep 09 Sat	SHA	Mer.pass
Venus	220°49.4	10:04
Mars	205°18.3	11:05
Jupiter	157°50.5	14:14
Saturn	99°19.9	18:07

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3321 sec ΔT = TT-UT1 = +68.8519 sec

2017 September 07 to Sep. 09 UT

h

Thu	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°28.4	N06°04.4	351°25.9	11.6'	S05°01.1	10.8'	57.4'
1	195°28.6	03.5	5°56.5	11.6'	04°50.3	10.8'	57.5'
2	210°28.8	02.6	20°27.1	11.6'	04°39.4	10.9'	57.5'
3	225°29.0	·· 01.6	34°57.7	11.6'	04°28.6	10.9'	57.5'
4	240°29.2	06°00.7	49°28.3	11.6'	04°17.7	10.9'	57.5'
5	255°29.4	05°59.8	63°58.8	11.6'	04°06.7	10.9'	57.5'
6	270°29.6	N05°58.8	78°29.4	11.6'	S03°55.8	11.0'	57.6'
7	285°29.9	57.9	92°59.9	11.6'	03°44.8	11.0'	57.6'
8	300°30.1	57.0	107°30.5	11.5'	03°33.8	11.0'	57.6'
9	315°30.3	·· 56.0	122°01.0	11.5'	03°22.7	11.1'	57.6'
10	330°30.5	55.1	136°31.6	11.5'	03°11.7	11.1'	57.7'
11	345°30.7	54.2	151°02.1	11.5'	03°00.6	11.1'	57.7'
12	0°30.9	N05°53.2	165°32.6	11.5'	S02°49.4	11.1'	57.7'
13	15°31.2	52.3	180°03.1	11.5'	02°38.3	11.2'	57.7'
14	30°31.4	51.3	194°33.5	11.5'	02°27.1	11.2'	57.7'
15	45°31.6	·· 50.4	209°04.0	11.5'	02°16.0	11.2'	57.8'
16	60°31.8	49.5	223°34.4	11.4'	02°04.7	11.2'	57.8'
17	75°32.0	48.5	238°04.9	11.4'	01°53.5	11.2'	57.8'
18	90°32.2	N05°47.6	252°35.3	11.4'	S01°42.3	11.2'	57.8'
19	105°32.4	46.7	267°05.7	11.4'	01°31.0	11.3'	57.8'
20	120°32.7	45.7	281°36.1	11.4'	01°19.8	11.3'	57.9'
21	135°32.9	·· 44.8	296°06.5	11.4'	01°08.5	11.3'	57.9'
22	150°33.1	43.8	310°36.8	11.3'	00°57.2	11.3'	57.9'
23	165°33.3	42.9	325°07.2	11.3'	00°45.9	11.3'	57.9'
	SD.=15.9	d=-0.9		S.D.=15.7			

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°33.5	N05°42.0	339°37.5	11.3'	S00°34.5	11.3'	57.9'
1	195°33.7	41.0	354°07.8	11.3'	00°23.2	11.3'	58.0'
2	210°34.0	40.1	8°38.1	11.3'	00°11.9	11.3'	58.0'
3	225°34.2	·· 39.1	23°08.3	11.3'	S00°00.5	11.4'	58.0'
4	240°34.4	38.2	37°38.6	11.2'	N00°10.8	11.4'	58.0'
5	255°34.6	37.3	52°08.8	11.2'	00°22.2	11.4'	58.0'
6	270°34.8	N05°36.3	66°39.0	11.2'	N00°33.6	11.4'	58.1'
7	285°35.0	35.4	81°09.2	11.2'	00°44.9	11.4'	58.1'
8	300°35.3	34.4	95°39.4	11.1'	00°56.3	11.4'	58.1'
9	315°35.5	·· 33.5	110°09.5	11.1'	01°07.7	11.4'	58.1'
10	330°35.7	32.6	124°39.6	11.1'	01°19.1	11.4'	58.1'
11	345°35.9	31.6	139°09.7	11.1'	01°30.5	11.4'	58.2'
12	0°36.1	N05°30.7	153°39.8	11.1'	N01°41.8	11.4'	58.2'
13	15°36.3	29.7	168°09.8	11.0'	01°53.2	11.4'	58.2'
14	30°36.5	28.8	182°39.8	11.0'	02°04.6	11.4'	58.2'
15	45°36.8	·· 27.9	197°09.8	11.0'	02°15.9	11.4'	58.2'
16	60°37.0	26.9	211°39.8	11.0'	02°27.3	11.4'	58.3'
17	75°37.2	26.0	226°09.7	10.9'	02°38.7	11.3'	58.3'
18	90°37.4	N05°25.0	240°39.6	10.9'	N02°50.0	11.3'	58.3'
19	105°37.6	24.1	255°09.5	10.9'	03°01.3	11.3'	58.3'
20	120°37.9	23.1	269°39.4	10.8'	03°12.7	11.3'	58.3'
21	135°38.1	·· 22.2	284°09.2	10.8'	03°24.0	11.3'	58.3'
22	150°38.3	21.3	298°39.0	10.8'	03°35.3	11.3'	58.4'
23	165°38.5	20.3	313°08.8	10.8'	03°46.6	11.3'	58.4'
	SD.=15.9	d=-0.9		S.D.=15.9			

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	180°38.7	N05°19.4	327°38.5	10.7'	N03°57.9	11.3'	58.4'
1	195°38.9	18.4	342°08.2	10.7'	04°09.1	11.3'	58.4'
2	210°39.2	17.5	356°37.9	10.7'	04°20.4	11.2'	58.4'
3	225°39.4	·· 16.5	11°07.5	10.6'	04°31.6	11.2'	58.4'
4	240°39.6	15.6	25°37.2	10.6'	04°42.8	11.2'	58.5'
5	255°39.8	14.7	40°06.7	10.6'	04°54.0	11.2'	58.5'
6	270°40.0	N05°13.7	54°36.3	10.5'	N05°05.1	11.2'	58.5'
7	285°40.2	12.8	69°05.8	10.5'	05°16.3	11.1'	58.5'
8	300°40.5	11.8	83°35.3	10.5'	05°27.4	11.1'	58.5'
9	315°40.7	·· 10.9	98°04.7	10.4'	05°38.5	11.1'	58.5'
10	330°40.9	09.9	112°34.1	10.4'	05°49.5	11.1'	58.5'
11	345°41.1	09.0	127°03.5	10.4'	06°00.6	11.0'	58.6'
12	0°41.3	N05°08.1	141°32.8	10.3'	N06°11.6	11.0'	58.6'
13	15°41.6	07.1	156°02.1	10.3'	06°22.6	11.0'	58.6'
14	30°41.8	06.2	170°31.4	10.2'	06°33.5	10.9'	58.6'
15	45°42.0	·· 05.2	185°00.6	10.2'	06°44.4	10.9'	58.6'
16	60°42.2	04.3	199°29.8	10.2'	06°55.3	10.9'	58.6'
17	75°42.4	03.3	213°58.9	10.1'	07°06.2	10.8'	58.6'
18	90°42.6	N05°02.4	228°28.0	10.1'	N07°17.0	10.8'	58.7'
19	105°42.9	01.4	242°57.1	10.0'	07°27.8	10.8'	58.7'
20	120°43.1	05°00.5	257°26.1	10.0'	07°38.5	10.7'	58.7'
21	135°43.3	04°59.5	271°55.1	10.0'	07°49.2	10.7'	58.7'
22	150°43.5	58.6	286°24.0	9.9'	07°59.9	10.6'	58.7'
23	165°43.7	57.6	300°52.9	9.9'	08°10.5	10.6'	58.7'
	SD.=15.9	d=-0.9		S.D.=16.0			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	00:41	03:17	04:36	19:16	20:33	22:55
N 70°	01:49	03:36	04:45	19:08	20:15	21:58
68°	02:24	03:51	04:52	19:01	20:01	21:26
66°	02:48	04:03	04:58	18:55	19:50	21:03
64°	03:07	04:13	05:03	18:50	19:40	20:45
62°	03:21	04:21	05:08	18:46	19:32	20:31
60°	03:33	04:28	05:12	18:42	19:25	20:19
N 58°	03:44	04:34	05:15	18:39	19:19	20:10
56°	03:52	04:40	05:18	18:36	19:14	20:01
54°	04:00	04:44	05:21	18:33	19:09	19:54
52°	04:07	04:49	05:23	18:31	19:05	19:47
50°	04:13	04:52	05:26	18:29	19:02	19:41
45°	04:25	05:01	05:30	18:24	18:54	19:29
N 40°	04:34	05:07	05:34	18:20	18:47	19:20
35°	04:42	05:12	05:38	18:17	18:42	19:12
30°	04:48	05:17	05:41	18:14	18:38	19:06
20°	04:58	05:24	05:46	18:09	18:31	18:57
N 10°	05:05	05:29	05:50	18:05	18:26	18:50
0°	05:09	05:34	05:54	18:01	18:22	18:46
S 10°	05:13	05:37	05:58	17:57	18:18	18:43
20°	05:15	05:40	06:02	17:53	18:15	18:41
30°	05:15	05:43	06:07	17:49	18:13	18:40
35°	05:15	05:44	06:09	17:46	18:12	18:41
40°	05:14	05:45	06:12	17:44	18:11	18:42
45°	05:12	05:46	06:15	17:40	18:10	18:44
S 50°	05:10	05:47	06:19	17:37	18:09	18:46
52°	05:08	05:47	06:21	17:35	18:09	18:48
54°	05:07	05:48	06:23	17:33	18:09	18:50
56°	05:05	05:48	06:25	17:31	18:08	18:51
58°	05:03	05:48	06:27	17:29	18:08	18:54
S 60°	05:00	05:49	06:30	17:26	18:08	18:56

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	19:32	19:24	19:15	05:55	07:46	09:39
N 70°	19:30	19:28	19:26	06:01	07:45	09:31
68°	19:28	19:31	19:34	06:06	07:44	09:24
66°	19:27	19:34	19:41	06:10	07:43	09:19
64°	19:25	19:36	19:48	06:13	07:43	09:14
62°	19:24	19:38	19:53	06:16	07:42	09:10
60°	19:23	19:40	19:58	06:19	07:42	09:06
N 58°	19:23	19:42	20:02	06:21	07:41	09:03
56°	19:22	19:43	20:06	06:23	07:41	09:00
54°	19:21	19:44	20:09	06:25	07:41	08:58
52°	19:21	19:46	20:12	06:26	07:40	08:56
50°	19:20	19:47	20:15	06:28	07:40	08:54
45°	19:19	19:49	20:21	06:31	07:39	08:49
N 40°	19:18	19:51	20:26	06:34	07:39	08:45
35°	19:17	19:53	20:30	06:36	07:38	08:42
30°	19:16	19:54	20:34	06:38	07:38	08:39
20°	19:15	19:57	20:41	06:41	07:37	08:34
N 10°	19:14	20:00	20:47	06:44	07:37	08:30
0°	19:13	20:02	20:53	06:47	07:36	08:26
S 10°	19:11	20:04	20:58	06:50	07:35	08:22
20°	19:10	20:07	21:05	06:53	07:35	08:18
30°	19:09	20:10	21:12	06:56	07:34	08:13
35°	19:08	20:12	21:16	06:58	07:33	08:10
40°	19:08	20:13	21:20	07:00	07:33	08:07
45°	19:07	20:16	21:26	07:02	07:32	08:03
S 50°	19:05	20:18	21:33	07:05	07:32	07:59
52°	19:05	20:20	21:36	07:06	07:31	07:57
54°	19:04	20:21	21:39	07:08	07:31	07:54
56°	19:04	20:23	21:43	07:09	07:30	07:52
58°	19:03	20:24	21:47	07:11	07:30	07:49
S 60°	19:02	20:26	21:51	07:13	07:29	07:46

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 17-19 98-88%
07	01:53	02:04	11:58	00:35	13:00	
08	02:14	02:24	11:58	01:24	13:49	
09	02:35	02:45	11:57	02:14	14:39	

September 10, 11, 12 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	349°13.1	208°49.7	N15°59.3	193°55.1	N11°31.4	146°52.8	S08°11.9	88°31.5	S22°01.6
1	4°15.6	223°49.2	58.5	208°56.0	30.8	161°54.8	12.1	103°33.9	01.6
2	19°18.0	238°48.6	57.7	223°57.0	30.2	176°56.8	12.3	118°36.3	01.6
3	34°20.5	253°48.0	·· 56.9	238°58.0	·· 29.6	191°58.8	·· 12.5	133°38.6	·· 01.7
4	49°23.0	268°47.5	56.1	253°58.9	29.1	207°00.8	12.7	148°41.0	01.7
5	64°25.4	283°46.9	55.2	268°59.9	28.5	222°02.8	12.8	163°43.4	01.7
6	79°27.9	298°46.3	N15°54.4	284°00.8	N11°27.9	237°04.8	S08°13.0	178°45.8	S22°01.7
7	94°30.4	313°45.8	53.6	299°01.8	27.3	252°06.8	13.2	193°48.2	01.7
8	109°32.8	328°45.2	52.8	314°02.7	26.8	267°08.9	13.4	208°50.6	01.7
9	124°35.3	343°44.6	·· 51.9	329°03.7	·· 26.2	282°10.9	·· 13.6	223°53.0	·· 01.7
10	139°37.7	358°44.1	51.1	344°04.6	25.6	297°12.9	13.8	238°55.4	01.7
11	154°40.2	13°43.5	50.3	359°05.6	25.1	312°14.9	13.9	253°57.8	01.7
12	169°42.7	28°43.0	N15°49.5	14°06.5	N11°24.5	327°16.9	S08°14.1	269°00.2	S22°01.8
13	184°45.1	43°42.4	48.6	29°07.5	23.9	342°18.9	14.3	284°02.6	01.8
14	199°47.6	58°41.8	47.8	44°08.5	23.3	357°20.9	14.5	299°05.0	01.8
15	214°50.1	73°41.3	·· 47.0	59°09.4	·· 22.8	12°22.9	·· 14.7	314°07.4	·· 01.8
16	229°52.5	88°40.7	46.1	74°10.4	22.2	27°24.9	14.9	329°09.8	01.8
17	244°55.0	103°40.2	45.3	89°11.3	21.6	42°26.9	15.0	344°12.2	01.8
18	259°57.5	118°39.6	N15°44.5	104°12.3	N11°21.0	57°28.9	S08°15.2	359°14.6	S22°01.8
19	274°59.9	133°39.0	43.6	119°13.2	20.5	72°31.0	15.4	14°17.0	01.8
20	290°02.4	148°38.5	42.8	134°14.2	19.9	87°33.0	15.6	29°19.4	01.8
21	305°04.9	163°37.9	·· 42.0	149°15.1	·· 19.3	102°35.0	·· 15.8	44°21.8	·· 01.9
22	320°07.3	178°37.4	41.1	164°16.1	18.7	117°37.0	16.0	59°24.2	01.9
23	335°09.8	193°36.8	40.3	179°17.1	18.2	132°39.0	16.1	74°26.5	01.9
Mer.pass.:00:43		v-0.6 d-0.8 m-3.9		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	350°12.2	208°36.2	N15°39.5	194°18.0	N11°17.6	147°41.0	S08°16.3	89°28.9	S22°01.9
1	5°14.7	223°35.7	38.6	209°19.0	17.0	162°43.0	16.5	104°31.3	01.9
2	20°17.2	238°35.1	37.8	224°19.9	16.4	177°45.0	16.7	119°33.7	01.9
3	35°19.6	253°34.6	·· 37.0	239°20.9	·· 15.9	192°47.0	·· 16.9	134°36.1	·· 01.9
4	50°22.1	268°34.0	36.1	254°21.8	15.3	207°49.0	17.1	149°38.5	01.9
5	65°24.6	283°33.4	35.3	269°22.8	14.7	222°51.0	17.2	164°40.9	02.0
6	80°27.0	298°32.9	N15°34.4	284°23.7	N11°14.1	237°53.0	S08°17.4	179°43.3	S22°02.0
7	95°29.5	313°32.3	33.6	299°24.7	13.6	252°55.0	17.6	194°45.7	02.0
8	110°32.0	328°31.8	32.7	314°25.7	13.0	267°57.1	17.8	209°48.1	02.0
9	125°34.4	343°31.2	·· 31.9	329°26.6	·· 12.4	282°59.1	·· 18.0	224°50.5	·· 02.0
10	140°36.9	358°30.7	31.1	344°27.6	11.8	298°01.1	18.2	239°52.9	02.0
11	155°39.3	13°30.1	30.2	359°28.5	11.3	313°03.1	18.3	254°55.3	02.0
12	170°41.8	28°29.6	N15°29.4	14°29.5	N11°10.7	328°05.1	S08°18.5	269°57.6	S22°02.0
13	185°44.3	43°29.0	28.5	29°30.4	10.1	343°07.1	18.7	285°00.0	02.1
14	200°46.7	58°28.4	27.7	44°31.4	09.5	358°09.1	18.9	300°02.4	02.1
15	215°49.2	73°27.9	·· 26.8	59°32.4	·· 08.9	13°11.1	·· 19.1	315°04.8	·· 02.1
16	230°51.7	88°27.3	26.0	74°33.3	08.4	28°13.1	19.3	330°07.2	02.1
17	245°54.1	103°26.8	25.1	89°34.3	07.8	43°15.1	19.5	345°09.6	02.1
18	260°56.6	118°26.2	N15°24.3	104°35.2	N11°07.2	58°17.1	S08°19.6	0°12.0	S22°02.1
19	275°59.1	133°25.7	23.4	119°36.2	06.6	73°19.1	19.8	15°14.4	02.1
20	291°01.5	148°25.1	22.6	134°37.2	06.1	88°21.1	20.0	30°16.8	02.1
21	306°04.0	163°24.6	·· 21.7	149°38.1	·· 05.5	103°23.1	·· 20.2	45°19.2	·· 02.1
22	321°06.5	178°24.0	20.9	164°39.1	04.9	118°25.1	20.4	60°21.5	02.2
23	336°08.9	193°23.5	20.0	179°40.0	04.3	133°27.2	20.6	75°23.9	02.2
Mer.pass.:00:39		v-0.6 d-0.8 m-3.9		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	351°11.4	208°22.9	N15°19.1	194°41.0	N11°03.8	148°29.2	S08°20.7	90°26.3	S22°02.2
1	6°13.8	223°22.4	18.3	209°41.9	03.2	163°31.2	20.9	105°28.7	02.2
2	21°16.3	238°21.8	17.4	224°42.9	02.6	178°33.2	21.1	120°31.1	02.2
3	36°18.8	253°21.3	·· 16.6	239°43.9	·· 02.0	193°35.2	·· 21.3	135°33.5	·· 02.2
4	51°21.2	268°20.7	15.7	254°44.8	01.4	208°37.2	21.5	150°35.9	02.2
5	66°23.7	283°20.2	14.9	269°45.8	00.9	223°39.2	21.7	165°38.3	02.2
6	81°26.2	298°19.6	N15°14.0	284°46.7	N11°00.3	238°41.2	S08°21.9	180°40.7	S22°02.3
7	96°28.6	313°19.1	13.1	299°47.7	10°59.7	253°43.2	22.0	195°43.0	02.3
8	111°31.1	328°18.5	12.3	314°48.7	59.1	268°45.2	22.2	210°45.4	02.3
9	126°33.6	343°18.0	·· 11.4	329°49.6	·· 58.5	283°47.2	·· 22.4	225°47.8	·· 02.3
10	141°36.0	358°17.4	10.5	344°50.6	58.0	298°49.2	22.6	240°50.2	02.3
11	156°38.5	13°16.9	09.7	359°51.5	57.4	313°51.2	22.8	255°52.6	02.3
12	171°41.0	28°16.3	N15°08.8	14°52.5	N10°56.8	328°53.2	S08°23.0	270°55.0	S22°02.3
13	186°43.4	43°15.8	08.0	29°53.5	56.2	343°55.2	23.1	285°57.4	02.3
14	201°45.9	58°15.2	07.1	44°54.4	55.7	358°57.2	23.3	300°59.7	02.4
15	216°48.3	73°14.7	·· 06.2	59°55.4	·· 55.1	13°59.2	·· 23.5	316°02.1	·· 02.4
16	231°50.8	88°14.1	05.4	74°56.3	54.5	29°01.2	23.7	331°04.5	02.4
17	246°53.3	103°13.6	04.5	89°57.3	53.9	44°03.2	23.9	346°06.9	02.4
18	261°55.7	118°13.0	N15°03.6	104°58.3	N10°53.3	59°05.2	S08°24.1	1°09.3	S22°02.4
19	276°58.2	133°12.5	02.7	119°59.2	52.8	74°07.2	24.3	16°11.7	02.4
20	292°00.7	148°12.0	01.9	135°00.2	52.2	89°09.2	24.4	31°14.1	02.4
21	307°03.1	163°11.4	·· 01.0	150°01.1	·· 51.6	104°11.2	·· 24.6	46°16.4	·· 02.4
22	322°05.6	178°10.9	15°00.1	165°02.1	51.0	119°13.3	24.8	61°18.8	02.5
23	337°08.1	193°10.3	14°59.3	180°03.1	50.4	134°15.3	25.0	76°21.2	02.5
Mer.pass.:00:35		v-0.6 d-0.9 m-3.9		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°40.2	29°11.3
Ankaa	353°12.5	-42°12.5
Schedar	349°36.6	56°37.9
Diphda	348°52.7	-17°53.3
Achernar	335°24.2	-57°08.7
Hamal	327°57.3	23°32.6
Polaris	316°13.4	89°19.9
Acamar	315°16.0	-40°13.9
Menkar	314°11.9	4°09.5
Mirfak	308°36.0	49°55.1
Aldebaran	290°46.0	16°32.5
Rigel	281°09.3	-8°10.9
Capella	280°30.2	46°00.6
Bellatrix	278°29.0	6°21.8
Elnath	278°09.0	28°37.1
Alnilam	275°43.5	-1°11.5
Betelgeuse	270°58.3	7°24.5
Canopus	263°55.0	-52°42.1
Sirius	258°31.3	-16°44.4
Adhara	255°10.4	-28°59.7
Procyon	244°56.9	5°10.7
Pollux	243°24.5	27°58.9
Avior	234°17.3	-59°33.8
Suhail	222°50.7	-43°30.1
Miaplacidus	221°39.8	-69°47.2
Alphard	217°53.6	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°49.0	61°39.4
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.7	-63°11.8
Gacrux	171°58.2	-57°12.7
Alioth	166°18.8	55°52.1
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.9
Hadar	148°44.2	-60°27.4
Menkent	148°04.5	-36°27.3
Arcturus	145°53.4	19°05.8
Rigil Kent.	139°48.2	-60°54.4
Kochab	137°20.9	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.8	-26°28.1
Atria	107°22.0	-69°03.6
Sabik	102°09.3	-15°44.6
Shaula	96°18.0	-37°06.9
Rasalhague	96°03.8	12°33.2
Eltanin	90°44.7	51°29.7
Kaus Aust.	83°39.9	-34°22.4
Vega	80°36.9	38°48.5
Nunki	75°54.6	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.4	-56°40.7
Deneb	49°29.1	45°20.9
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.8
Markab	13°35.1	15°18.1

Sep 10 Sun	**SHA**	**Mer.pass**
Venus	219°36.6	10:05
Mars	204°42.0	11:04
Jupiter	157°39.7	14:11
Saturn	99°18.4	18:03

Sep 11 Mon	**SHA**	**Mer.pass**
Venus	218°24.0	10:06
Mars	204°05.8	11:02
Jupiter	157°28.8	14:07
Saturn	99°16.7	17:59

Sep 12 Tue	**SHA**	**Mer.pass**
Venus	217°11.5	10:07
Mars	203°29.6	11:01
Jupiter	157°17.8	14:04
Saturn	99°14.9	17:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3299 sec ΔT = TT-UT1 = +68.8541 sec

2017 September 10 to Sep. 12 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°44.0	N04°56.7	315°21.8	9.8'	N08°21.1	10.6'	58.7'
1	195°44.2	55.8	329°50.6	9.8'	08°31.6	10.5'	58.7'
2	210°44.4	54.8	344°19.4	9.8'	08°42.1	10.5'	58.8'
3	225°44.6	·· 53.9	358°48.1	9.7'	08°52.5	10.4'	58.8'
4	240°44.8	52.9	13°16.8	9.7'	09°02.9	10.4'	58.8'
5	255°45.1	52.0	27°45.4	9.6'	09°13.3	10.3'	58.8'
6	270°45.3	N04°51.0	42°14.0	9.6'	N09°23.6	10.3'	58.8'
7	285°45.5	50.1	56°42.6	9.5'	09°33.8	10.2'	58.8'
8	300°45.7	49.1	71°11.1	9.5'	09°44.0	10.2'	58.8'
9	315°45.9	·· 48.2	85°39.6	9.4'	09°54.2	10.1'	58.8'
10	330°46.1	47.2	100°08.0	9.4'	10°04.3	10.1'	58.9'
11	345°46.4	46.3	114°36.4	9.4'	10°14.3	10.0'	58.9'
12	0°46.6	N04°45.3	129°04.7	9.3'	N10°24.3	10.0'	58.9'
13	15°46.8	44.4	143°33.0	9.3'	10°34.2	9.9'	58.9'
14	30°47.0	43.4	158°01.2	9.2'	10°44.1	9.8'	58.9'
15	45°47.2	·· 42.5	172°29.4	9.2'	10°53.9	9.8'	58.9'
16	60°47.5	41.5	186°57.5	9.1'	11°03.7	9.7'	58.9'
17	75°47.7	40.6	201°25.6	9.1'	11°13.3	9.7'	58.9'
18	90°47.9	N04°39.6	215°53.7	9.0'	N11°23.0	9.6'	58.9'
19	105°48.1	38.7	230°21.7	9.0'	11°32.5	9.5'	58.9'
20	120°48.3	37.7	244°49.6	8.9'	11°42.0	9.5'	59.0'
21	135°48.6	·· 36.8	259°17.5	8.9'	11°51.4	9.4'	59.0'
22	150°48.8	35.8	273°45.4	8.8'	12°00.8	9.3'	59.0'
23	165°49.0	34.9	288°13.2	8.8'	12°10.1	9.3'	59.0'
	SD.=15.9	d=-0.9		S.D.=16.0			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°49.2	N04°33.9	302°40.9	8.7'	N12°19.3	9.2'	59.0'
1	195°49.4	33.0	317°08.6	8.7'	12°28.5	9.1'	59.0'
2	210°49.7	32.0	331°36.3	8.6'	12°37.5	9.0'	59.0'
3	225°49.9	·· 31.1	346°03.9	8.6'	12°46.5	9.0'	59.0'
4	240°50.1	30.1	0°31.5	8.5'	12°55.5	8.9'	59.0'
5	255°50.3	29.2	14°59.0	8.5'	13°04.3	8.8'	59.0'
6	270°50.5	N04°28.2	29°26.4	8.4'	N13°13.1	8.7'	59.0'
7	285°50.8	27.3	43°53.8	8.4'	13°21.8	8.7'	59.1'
8	300°51.0	26.3	58°21.2	8.3'	13°30.4	8.6'	59.1'
9	315°51.2	·· 25.4	72°48.5	8.3'	13°39.0	8.5'	59.1'
10	330°51.4	24.4	87°15.8	8.2'	13°47.4	8.4'	59.1'
11	345°51.6	23.5	101°43.0	8.2'	13°55.8	8.3'	59.1'
12	0°51.9	N04°22.5	116°10.2	8.1'	N14°04.1	8.3'	59.1'
13	15°52.1	21.6	130°37.3	8.1'	14°12.3	8.2'	59.1'
14	30°52.3	20.6	145°04.3	8.0'	14°20.5	8.1'	59.1'
15	45°52.5	·· 19.7	159°31.4	8.0'	14°28.5	8.0'	59.1'
16	60°52.7	18.7	173°58.3	7.9'	14°36.4	7.9'	59.1'
17	75°53.0	17.8	188°25.2	7.9'	14°44.3	7.8'	59.1'
18	90°53.2	N04°16.8	202°52.1	7.8'	N14°52.1	7.7'	59.1'
19	105°53.4	15.9	217°18.9	7.8'	14°59.8	7.6'	59.1'
20	120°53.6	14.9	231°45.7	7.7'	15°07.4	7.6'	59.1'
21	135°53.9	·· 14.0	246°12.4	7.7'	15°14.9	7.5'	59.2'
22	150°54.1	13.0	260°39.1	7.7'	15°22.3	7.4'	59.2'
23	165°54.3	12.1	275°05.7	7.6'	15°29.6	7.3'	59.2'
	SD.=15.9	d=-1.0		S.D.=16.1			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°54.5	N04°11.1	289°32.3	7.6'	N15°36.8	7.2'	59.2'
1	195°54.7	10.1	303°58.9	7.5'	15°44.0	7.1'	59.2'
2	210°55.0	09.2	318°25.3	7.5'	15°51.0	7.0'	59.2'
3	225°55.2	·· 08.2	332°51.8	7.4'	15°57.9	6.9'	59.2'
4	240°55.4	07.3	347°18.2	7.4'	16°04.8	6.8'	59.2'
5	255°55.6	06.3	1°44.5	7.3'	16°11.5	6.7'	59.2'
6	270°55.8	N04°05.4	16°10.8	7.3'	N16°18.1	6.6'	59.2'
7	285°56.1	04.4	30°37.1	7.2'	16°24.6	6.5'	59.2'
8	300°56.3	03.5	45°03.3	7.2'	16°31.1	6.4'	59.2'
9	315°56.5	·· 02.5	59°29.5	7.1'	16°37.4	6.3'	59.2'
10	330°56.7	01.6	73°55.6	7.1'	16°43.6	6.2'	59.2'
11	345°56.9	04°00.6	88°21.7	7.1'	16°49.7	6.1'	59.2'
12	0°57.2	N03°59.7	102°47.7	7.0'	N16°55.7	6.0'	59.2'
13	15°57.4	58.7	117°13.7	7.0'	17°01.6	5.8'	59.2'
14	30°57.6	57.7	131°39.7	6.9'	17°07.4	5.7'	59.2'
15	45°57.8	·· 56.8	146°05.6	6.9'	17°13.1	5.6'	59.2'
16	60°58.1	55.8	160°31.5	6.9'	17°18.7	5.5'	59.2'
17	75°58.3	54.9	174°57.3	6.8'	17°24.2	5.4'	59.2'
18	90°58.5	N03°53.9	189°23.1	6.8'	N17°29.5	5.3'	59.2'
19	105°58.7	53.0	203°48.9	6.7'	17°34.8	5.2'	59.3'
20	120°58.9	52.0	218°14.6	6.7'	17°39.9	5.1'	59.3'
21	135°59.2	·· 51.1	232°40.3	6.7'	17°44.9	5.0'	59.3'
22	150°59.4	50.1	247°05.9	6.6'	17°49.8	4.8'	59.3'
23	165°59.6	49.1	261°31.5	6.6'	17°54.6	4.7'	59.3'
	SD.=15.9	d=-1.0		S.D.=16.1			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	01:29	03:34	04:50	19:01	20:15	22:14
N 70°	02:13	03:51	04:57	18:54	19:59	21:34
68°	02:41	04:03	05:03	18:48	19:47	21:07
66°	03:02	04:14	05:08	18:43	19:37	20:47
64°	03:18	04:22	05:12	18:39	19:29	20:32
62°	03:31	04:30	05:16	18:36	19:22	20:19
60°	03:42	04:36	05:19	18:33	19:16	20:09
N 58°	03:51	04:41	05:21	18:30	19:10	20:00
56°	03:59	04:46	05:24	18:28	19:06	19:52
54°	04:06	04:50	05:26	18:26	19:02	19:45
52°	04:12	04:54	05:28	18:24	18:58	19:39
50°	04:18	04:57	05:30	18:22	18:55	19:34
45°	04:29	05:04	05:34	18:18	18:48	19:23
N 40°	04:38	05:10	05:37	18:15	18:42	19:15
35°	04:45	05:15	05:40	18:13	18:38	19:08
30°	04:50	05:18	05:42	18:10	18:34	19:02
20°	04:59	05:24	05:47	18:06	18:28	18:54
N 10°	05:05	05:29	05:50	18:03	18:24	18:48
0°	05:09	05:33	05:53	18:00	18:21	18:45
S 10°	05:11	05:35	05:56	17:57	18:18	18:42
20°	05:12	05:38	06:00	17:54	18:16	18:41
30°	05:12	05:39	06:03	17:50	18:14	18:42
35°	05:11	05:40	06:05	17:48	18:14	18:43
40°	05:09	05:40	06:07	17:46	18:13	18:45
45°	05:07	05:41	06:10	17:44	18:13	18:47
S 50°	05:03	05:41	06:13	17:41	18:13	18:51
52°	05:02	05:41	06:14	17:40	18:14	18:53
54°	05:00	05:40	06:16	17:38	18:14	18:55
56°	04:57	05:40	06:17	17:37	18:14	18:57
58°	04:54	05:40	06:19	17:35	18:14	19:00
S 60°	04:51	05:40	06:21	17:33	18:15	19:03

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	19:05	18:52	18:26	11:37	13:43	16:06
N 70°	19:24	19:24	19:26	11:20	13:12	15:06
68°	19:39	19:47	20:02	11:06	12:50	14:32
66°	19:51	20:05	20:27	10:55	12:33	14:07
64°	20:02	20:20	20:47	10:46	12:18	13:48
62°	20:11	20:33	21:03	10:38	12:07	13:32
60°	20:18	20:44	21:17	10:32	11:57	13:19
N 58°	20:25	20:53	21:28	10:26	11:48	13:08
56°	20:31	21:01	21:38	10:21	11:40	12:58
54°	20:36	21:08	21:47	10:16	11:34	12:49
52°	20:41	21:15	21:55	10:12	11:28	12:41
50°	20:46	21:21	22:03	10:08	11:22	12:34
45°	20:55	21:34	22:18	10:00	11:10	12:20
N 40°	21:03	21:44	22:31	09:53	11:00	12:07
35°	21:10	21:54	22:42	09:47	10:52	11:57
30°	21:16	22:02	22:51	09:42	10:45	11:48
20°	21:27	22:16	23:08	09:33	10:32	11:32
N 10°	21:36	22:28	23:22	09:25	10:21	11:19
0°	21:45	22:39	23:36	09:17	10:11	11:06
S 10°	21:54	22:51	23:50	09:10	10:00	10:53
20°	22:04	23:04	–:–	09:02	09:49	10:40
30°	22:15	23:18	–:–	08:53	09:37	10:24
35°	22:21	23:26	–:–	08:48	09:30	10:15
40°	22:28	23:36	–:–	08:42	09:22	10:05
45°	22:37	23:47	–:–	08:36	09:12	09:53
S 50°	22:47	–:–	00:01	08:28	09:01	09:39
52°	22:52	–:–	00:07	08:24	08:55	09:32
54°	22:57	–:–	00:14	08:20	08:49	09:24
56°	23:03	–:–	00:22	08:16	08:43	09:16
58°	23:10	–:–	00:31	08:11	08:36	09:07
S 60°	23:17	–:–	00:41	08:05	08:27	08:56

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 20-22 80-59%
10	02:56	03:06	11:57	03:05	15:31	
11	03:17	03:27	11:57	03:58	16:25	
12	03:38	03:49	11:56	04:53	17:21	

September 13, 14, 15 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	352°10.5	208°09.8	N14°58.4	195°04.0	N10°49.9	149°17.3	S08°25.2	91°23.6	S22°02.5
1	7°13.0	223°09.2	57.5	210°05.0	49.3	164°19.3	25.4	106°26.0	02.5
2	22°15.4	238°08.7	56.6	225°05.9	48.7	179°21.3	25.5	121°28.4	02.5
3	37°17.9	253°08.1	·· 55.8	240°06.9	·· 48.1	194°23.3	·· 25.7	136°30.8	·· 02.5
4	52°20.4	268°07.6	54.9	255°07.9	47.5	209°25.3	25.9	151°33.1	02.5
5	67°22.8	283°07.1	54.0	270°08.8	47.0	224°27.3	26.1	166°35.5	02.5
6	82°25.3	298°06.5	N14°53.1	285°09.8	N10°46.4	239°29.3	S08°26.3	181°37.9	S22°02.6
7	97°27.8	313°06.0	52.2	300°10.8	45.8	254°31.3	26.5	196°40.3	02.6
8	112°30.2	328°05.4	51.4	315°11.7	45.2	269°33.3	26.7	211°42.7	02.6
9	127°32.7	343°04.9	·· 50.5	330°12.7	·· 44.6	284°35.3	·· 26.8	226°45.1	·· 02.6
10	142°35.2	358°04.4	49.6	345°13.6	44.0	299°37.3	27.0	241°47.4	02.6
11	157°37.6	13°03.8	48.7	0°14.6	43.5	314°39.3	27.2	256°49.8	02.6
12	172°40.1	28°03.3	N14°47.8	15°15.6	N10°42.9	329°41.3	S08°27.4	271°52.2	S22°02.6
13	187°42.6	43°02.7	47.0	30°16.5	42.3	344°43.3	27.6	286°54.6	02.6
14	202°45.0	58°02.2	46.1	45°17.5	41.7	359°45.3	27.8	301°57.0	02.6
15	217°47.5	73°01.7	·· 45.2	60°18.5	·· 41.1	14°47.3	·· 28.0	316°59.4	·· 02.7
16	232°49.9	88°01.1	44.3	75°19.4	40.6	29°49.3	28.1	332°01.7	02.7
17	247°52.4	103°00.6	43.4	90°20.4	40.0	44°51.3	28.3	347°04.1	02.7
18	262°54.9	118°00.0	N14°42.5	105°21.3	N10°39.4	59°53.3	S08°28.5	2°06.5	S22°02.7
19	277°57.3	132°59.5	41.6	120°22.3	38.8	74°55.3	28.7	17°08.9	02.7
20	292°59.8	147°59.0	40.8	135°23.3	38.2	89°57.3	28.9	32°11.3	02.7
21	308°02.3	162°58.4	·· 39.9	150°24.2	·· 37.6	104°59.3	·· 29.1	47°13.6	·· 02.7
22	323°04.7	177°57.9	39.0	165°25.2	37.1	120°01.3	29.3	62°16.0	02.7
23	338°07.2	192°57.4	38.1	180°26.2	36.5	135°03.3	29.4	77°18.4	02.8
Mer.pass.:00:31		v-0.5 d-0.9 m-3.9		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	353°09.7	207°56.8	N14°37.2	195°27.1	N10°35.9	150°05.3	S08°29.6	92°20.8	S22°02.8
1	8°12.1	222°56.3	36.3	210°28.1	35.3	165°07.3	29.8	107°23.2	02.8
2	23°14.6	237°55.7	35.4	225°29.0	34.7	180°09.3	30.0	122°25.5	02.8
3	38°17.1	252°55.2	·· 34.5	240°30.0	·· 34.1	195°11.3	·· 30.2	137°27.9	·· 02.8
4	53°19.5	267°54.7	33.6	255°31.0	33.6	210°13.3	30.4	152°30.3	02.8
5	68°22.0	282°54.1	32.7	270°31.9	33.0	225°15.3	30.5	167°32.7	02.8
6	83°24.4	297°53.6	N14°31.8	285°32.9	N10°32.4	240°17.3	S08°30.7	182°35.1	S22°02.8
7	98°26.9	312°53.1	30.9	300°33.9	31.8	255°19.3	30.9	197°37.4	02.9
8	113°29.4	327°52.5	30.0	315°34.8	31.2	270°21.3	31.1	212°39.8	02.9
9	128°31.8	342°52.0	·· 29.1	330°35.8	·· 30.6	285°23.3	·· 31.3	227°42.2	·· 02.9
10	143°34.3	357°51.5	28.2	345°36.8	30.1	300°25.3	31.5	242°44.6	02.9
11	158°36.8	12°50.9	27.3	0°37.7	29.5	315°27.3	31.7	257°47.0	02.9
12	173°39.2	27°50.4	N14°26.4	15°38.7	N10°28.9	330°29.3	S08°31.8	272°49.3	S22°02.9
13	188°41.7	42°49.9	25.5	30°39.7	28.3	345°31.3	32.0	287°51.7	02.9
14	203°44.2	57°49.3	24.6	45°40.6	27.7	0°33.3	32.2	302°54.1	03.0
15	218°46.6	72°48.8	·· 23.7	60°41.6	·· 27.1	15°35.3	·· 32.4	317°56.5	·· 03.0
16	233°49.1	87°48.3	22.8	75°42.5	26.6	30°37.3	32.6	332°58.8	03.0
17	248°51.6	102°47.8	21.9	90°43.5	26.0	45°39.3	32.8	348°01.2	03.0
18	263°54.0	117°47.2	N14°21.0	105°44.5	N10°25.4	60°41.3	S08°33.0	3°03.6	S22°03.0
19	278°56.5	132°46.7	20.1	120°45.4	24.8	75°43.3	33.2	18°06.0	03.0
20	293°58.9	147°46.2	19.2	135°46.4	24.2	90°45.3	33.3	33°08.4	03.0
21	309°01.4	162°45.6	·· 18.3	150°47.4	·· 23.6	105°47.3	·· 33.5	48°10.7	·· 03.0
22	324°03.9	177°45.1	17.4	165°48.3	23.0	120°49.3	33.7	63°13.1	03.1
23	339°06.3	192°44.6	16.5	180°49.3	22.5	135°51.3	33.9	78°15.5	03.1
Mer.pass.:00:27		v-0.5 d-0.9 m-3.9		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	354°08.8	207°44.0	N14°15.6	195°50.3	N10°21.9	150°53.3	S08°34.1	93°17.9	S22°03.1
1	9°11.3	222°43.5	14.7	210°51.2	21.3	165°55.3	34.3	108°20.2	03.1
2	24°13.7	237°43.0	13.8	225°52.2	20.7	180°57.3	34.5	123°22.6	03.1
3	39°16.2	252°42.5	·· 12.9	240°53.2	·· 20.1	195°59.3	·· 34.6	138°25.0	·· 03.1
4	54°18.7	267°41.9	11.9	255°54.1	19.5	211°01.3	34.8	153°27.4	03.1
5	69°21.1	282°41.4	11.0	270°55.1	18.9	226°03.3	35.0	168°29.7	03.1
6	84°23.6	297°40.9	N14°10.1	285°56.1	N10°18.4	241°05.3	S08°35.2	183°32.1	S22°03.2
7	99°26.0	312°40.4	09.2	300°57.0	17.8	256°07.3	35.4	198°34.5	03.2
8	114°28.5	327°39.8	08.3	315°58.0	17.2	271°09.3	35.6	213°36.9	03.2
9	129°31.0	342°39.3	·· 07.4	330°59.0	·· 16.6	286°11.3	·· 35.8	228°39.2	·· 03.2
10	144°33.4	357°38.8	06.5	345°59.9	16.0	301°13.3	35.9	243°41.6	03.2
11	159°35.9	12°38.2	05.5	1°00.9	15.4	316°15.3	36.1	258°44.0	03.2
12	174°38.4	27°37.7	N14°04.6	16°01.9	N10°14.8	331°17.3	S08°36.3	273°46.4	S22°03.2
13	189°40.8	42°37.2	03.7	31°02.8	14.3	346°19.3	36.5	288°48.7	03.2
14	204°43.3	57°36.7	02.8	46°03.8	13.7	1°21.2	36.7	303°51.1	03.3
15	219°45.8	72°36.1	·· 01.9	61°04.8	·· 13.1	16°23.2	·· 36.9	318°53.5	·· 03.3
16	234°48.2	87°35.6	00.9	76°05.7	12.5	31°25.2	37.1	333°55.9	03.3
17	249°50.7	102°35.1	14°00.0	91°06.7	11.9	46°27.2	37.2	348°58.2	03.3
18	264°53.2	117°34.6	N13°59.1	106°07.7	N10°11.3	61°29.2	S08°37.4	4°00.6	S22°03.3
19	279°55.6	132°34.1	58.2	121°08.6	10.7	76°31.2	37.6	19°03.0	03.3
20	294°58.1	147°33.5	57.3	136°09.6	10.1	91°33.2	37.8	34°05.3	03.3
21	310°00.5	162°33.0	·· 56.3	151°10.6	·· 09.6	106°35.2	·· 38.0	49°07.7	·· 03.3
22	325°03.0	177°32.5	55.4	166°11.5	09.0	121°37.2	38.2	64°10.1	03.4
23	340°05.5	192°32.0	54.5	181°12.5	08.4	136°39.2	38.4	79°12.5	03.4
Mer.pass.:00:23		v-0.5 d-0.9 m-3.9		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.3
Ankaa	353°12.5	-42°12.5
Schedar	349°36.6	56°38.0
Diphda	348°52.7	-17°53.3
Achernar	335°24.2	-57°08.7
Hamal	327°57.2	23°32.6
Polaris	316°12.0	89°20.0
Acamar	315°16.0	-40°13.9
Menkar	314°11.9	4°09.5
Mirfak	308°36.0	49°55.1
Aldebaran	290°46.0	16°32.5
Rigel	281°09.3	-8°10.9
Capella	280°30.2	46°00.6
Bellatrix	278°28.9	6°21.8
Elnath	278°09.0	28°37.1
Alnilam	275°43.5	-1°11.5
Betelgeuse	270°58.2	7°24.5
Canopus	263°55.0	-52°42.1
Sirius	258°31.3	-16°44.4
Adhara	255°10.4	-28°59.7
Procyon	244°56.9	5°10.7
Pollux	243°24.5	27°58.8
Avior	234°17.2	-59°33.8
Suhail	222°50.7	-43°30.1
Miaplacidus	221°39.7	-69°47.2
Alphard	217°53.6	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°49.0	61°39.4
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.7	-63°11.7
Gacrux	171°58.2	-57°12.6
Alioth	166°18.8	55°52.1
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.9
Hadar	148°44.2	-60°27.4
Menkent	148°04.5	-36°27.3
Arcturus	145°53.4	19°05.8
Rigil Kent.	139°48.2	-60°54.4
Kochab	137°20.9	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.8	-26°28.1
Atria	107°22.1	-69°03.6
Sabik	102°09.3	-15°44.6
Shaula	96°18.0	-37°06.9
Rasalhague	96°03.8	12°33.2
Eltanin	90°44.7	51°29.7
Kaus Aust.	83°39.9	-34°22.4
Vega	80°36.9	38°48.5
Nunki	75°54.6	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.4	-56°40.7
Deneb	49°29.2	45°20.9
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.8
Markab	13°35.1	15°18.1

Sep 13 Wed	SHA	Mer.pass
Venus	215°59.3	10:08
Mars	202°53.5	10:59
Jupiter	157°06.7	14:01
Saturn	99°13.1	17:52

Sep 14 Thu	SHA	Mer.pass
Venus	214°47.2	10:09
Mars	202°17.5	10:57
Jupiter	156°55.6	13:58
Saturn	99°11.1	17:48

Sep 15 Fri	SHA	Mer.pass
Venus	213°35.2	10:09
Mars	201°41.5	10:56
Jupiter	156°44.5	13:55
Saturn	99°09.1	17:44

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3278 sec ΔT = TT-UT1 = +68.8562 sec

2017 September 13 to Sep. 15 UT

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°59.8	N03°48.2	275°57.1	6.6′	N17°59.3	4.6′	59.3′
1	196°00.0	47.2	290°22.6	6.5′	18°03.8	4.5′	59.3′
2	211°00.3	46.3	304°48.1	6.5′	18°08.3	4.4′	59.3′
3	226°00.5	·· 45.3	319°13.6	6.5′	18°12.6	4.3′	59.3′
4	241°00.7	44.4	333°39.1	6.4′	18°16.8	4.1′	59.3′
5	256°00.9	43.4	348°04.5	6.4′	18°20.9	4.0′	59.3′
6	271°01.2	N03°42.4	2°29.8	6.4′	N18°24.8	3.9′	59.3′
7	286°01.4	41.5	16°55.2	6.3′	18°28.7	3.8′	59.3′
8	301°01.6	40.5	31°20.5	6.3′	18°32.4	3.7′	59.3′
9	316°01.8	·· 39.6	45°45.8	6.3′	18°36.0	3.5′	59.3′
10	331°02.0	38.6	60°11.1	6.3′	18°39.5	3.4′	59.3′
11	346°02.3	37.7	74°36.3	6.2′	18°42.9	3.3′	59.3′
12	1°02.5	N03°36.7	89°01.5	6.2′	N18°46.1	3.2′	59.3′
13	16°02.7	35.7	103°26.7	6.2′	18°49.2	3.1′	59.3′
14	31°02.9	34.8	117°51.9	6.2′	18°52.2	2.9′	59.3′
15	46°03.1	·· 33.8	132°17.0	6.1′	18°55.1	2.8′	59.3′
16	61°03.4	32.9	146°42.1	6.1′	18°57.8	2.7′	59.3′
17	76°03.6	31.9	161°07.2	6.1′	19°00.4	2.6′	59.3′
18	91°03.8	N03°31.0	175°32.3	6.1′	N19°02.9	2.4′	59.3′
19	106°04.0	30.0	189°57.4	6.1′	19°05.3	2.3′	59.3′
20	121°04.3	29.0	204°22.4	6.0′	19°07.5	2.2′	59.3′
21	136°04.5	·· 28.1	218°47.4	6.0′	19°09.7	2.1′	59.3′
22	151°04.7	27.1	233°12.4	6.0′	19°11.6	1.9′	59.3′
23	166°04.9	26.2	247°37.4	6.0′	19°13.5	1.8′	59.3′
	SD.=15.9	d=-1.0	S.D.=16.2				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	181°05.1	N03°25.2	262°02.4	6.0′	N19°15.2	1.7′	59.3′
1	196°05.4	24.2	276°27.4	6.0′	19°16.9	1.5′	59.3′
2	211°05.6	23.3	290°52.4	6.0′	19°18.3	1.4′	59.3′
3	226°05.8	·· 22.3	305°17.3	5.9′	19°19.7	1.3′	59.3′
4	241°06.0	21.4	319°42.2	5.9′	19°20.9	1.2′	59.3′
5	256°06.3	20.4	334°07.2	5.9′	19°22.0	1.0′	59.3′
6	271°06.5	N03°19.4	348°32.1	5.9′	N19°23.0	0.9′	59.3′
7	286°06.7	18.5	2°57.0	5.9′	19°23.8	0.8′	59.3′
8	301°06.9	17.5	17°21.9	5.9′	19°24.5	0.6′	59.3′
9	316°07.1	·· 16.6	31°46.9	5.9′	19°25.1	0.5′	59.3′
10	331°07.4	15.6	46°11.8	5.9′	19°25.6	0.4′	59.3′
11	346°07.6	14.6	60°36.7	5.9′	19°25.9	0.3′	59.3′
12	1°07.8	N03°13.7	75°01.6	5.9′	N19°26.1	0.1′	59.3′
13	16°08.0	12.7	89°26.5	5.9′	19°26.2	0.0′	59.3′
14	31°08.3	11.8	103°51.4	5.9′	19°26.1	-0.1′	59.2′
15	46°08.5	·· 10.8	118°16.3	5.9′	19°25.9	-0.3′	59.2′
16	61°08.7	09.8	132°41.3	5.9′	19°25.6	-0.4′	59.2′
17	76°08.9	08.9	147°06.2	5.9′	19°25.2	-0.5′	59.2′
18	91°09.1	N03°07.9	161°31.1	5.9′	N19°24.6	-0.6′	59.2′
19	106°09.4	07.0	175°56.1	5.9′	19°23.9	-0.8′	59.2′
20	121°09.6	06.0	190°21.0	6.0′	19°23.1	-0.9′	59.2′
21	136°09.8	·· 05.0	204°46.0	6.0′	19°22.1	-1.0′	59.2′
22	151°10.0	04.1	219°10.9	6.0′	19°21.0	-1.2′	59.2′
23	166°10.3	03.1	233°35.9	6.0′	19°19.8	-1.3′	59.2′
	SD.=15.9	d=-1.0	S.D.=16.1				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	181°10.5	N03°02.2	248°00.9	6.0′	N19°18.5	-1.4′	59.2′
1	196°10.7	01.2	262°25.9	6.0′	19°17.0	-1.5′	59.2′
2	211°10.9	03°00.2	276°51.0	6.0′	19°15.4	-1.7′	59.2′
3	226°11.1	02°59.3	291°16.0	6.1′	19°13.7	-1.8′	59.2′
4	241°11.4	58.3	305°41.1	6.1′	19°11.8	-1.9′	59.2′
5	256°11.6	57.3	320°06.2	6.1′	19°09.8	-2.0′	59.2′
6	271°11.8	N02°56.4	334°31.3	6.1′	N19°07.7	-2.2′	59.2′
7	286°12.0	55.4	348°56.4	6.1′	19°05.5	-2.3′	59.2′
8	301°12.3	54.5	3°21.5	6.2′	19°03.2	-2.4′	59.2′
9	316°12.5	·· 53.5	17°46.7	6.2′	19°00.7	-2.5′	59.2′
10	331°12.7	52.5	32°11.9	6.2′	18°58.1	-2.7′	59.2′
11	346°12.9	51.6	46°37.1	6.2′	18°55.4	-2.8′	59.1′
12	1°13.2	N02°50.6	61°02.4	6.3′	N18°52.5	-2.9′	59.1′
13	16°13.4	49.6	75°27.6	6.3′	18°49.5	-3.0′	59.1′
14	31°13.6	48.7	89°52.9	6.3′	18°46.4	-3.2′	59.1′
15	46°13.8	·· 47.7	104°18.3	6.3′	18°43.2	-3.3′	59.1′
16	61°14.0	46.8	118°43.6	6.4′	18°39.9	-3.4′	59.1′
17	76°14.3	45.8	133°09.0	6.4′	18°36.4	-3.5′	59.1′
18	91°14.5	N02°44.8	147°34.5	6.4′	N18°32.8	-3.6′	59.1′
19	106°14.7	43.9	161°59.9	6.5′	18°29.2	-3.8′	59.1′
20	121°14.9	42.9	176°25.4	6.5′	18°25.3	-3.9′	59.1′
21	136°15.2	·· 41.9	190°51.0	6.5′	18°21.4	-4.0′	59.1′
22	151°15.4	41.0	205°16.5	6.6′	18°17.3	-4.1′	59.1′
23	166°15.6	40.0	219°42.1	6.6′	18°13.2	-4.2′	59.1′
	SD.=15.9	d=-1.0	S.D.=16.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:00	03:50	05:03	18:45	19:57	21:43
N 70°	02:34	04:04	05:09	18:40	19:44	21:12
68°	02:57	04:15	05:13	18:35	19:33	20:50
66°	03:15	04:24	05:17	18:32	19:25	20:32
64°	03:29	04:32	05:20	18:29	19:17	20:19
62°	03:41	04:38	05:23	18:26	19:11	20:08
60°	03:51	04:43	05:26	18:24	19:06	19:58
N 58°	03:59	04:48	05:28	18:22	19:02	19:50
56°	04:06	04:52	05:30	18:20	18:58	19:43
54°	04:12	04:56	05:32	18:18	18:54	19:37
52°	04:18	04:59	05:33	18:17	18:51	19:32
50°	04:23	05:02	05:34	18:16	18:48	19:27
45°	04:33	05:08	05:38	18:13	18:42	19:17
N 40°	04:41	05:13	05:40	18:10	18:37	19:09
35°	04:47	05:17	05:42	18:08	18:34	19:03
30°	04:52	05:20	05:44	18:06	18:30	18:58
20°	04:59	05:25	05:47	18:03	18:26	18:51
N 10°	05:04	05:29	05:50	18:01	18:22	18:46
0°	05:08	05:32	05:52	17:59	18:19	18:43
S 10°	05:09	05:34	05:55	17:57	18:18	18:42
20°	05:09	05:35	05:57	17:54	18:16	18:42
30°	05:08	05:36	05:59	17:52	18:16	18:44
35°	05:06	05:36	06:01	17:51	18:16	18:45
40°	05:04	05:35	06:02	17:49	18:16	18:48
45°	05:01	05:35	06:04	17:48	18:17	18:51
S 50°	04:57	05:34	06:06	17:46	18:18	18:55
52°	04:54	05:34	06:07	17:45	18:18	18:58
54°	04:52	05:33	06:08	17:44	18:19	19:00
56°	04:49	05:32	06:09	17:43	18:20	19:03
58°	04:46	05:32	06:11	17:42	18:21	19:07
S 60°	04:42	05:31	06:12	17:40	18:22	19:11

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°						
N 70°	19:39	20:26	22:02	16:54	18:09	18:34
68°	20:30	21:23	22:45	16:03	17:12	17:51
66°	21:02	21:57	23:13	15:31	16:38	17:22
64°	21:26	22:22	23:35	15:08	16:13	17:00
62°	21:45	22:41	23:53	14:49	15:53	16:42
60°	22:00	22:57	–:–	14:34	15:37	16:28
N 58°	22:14	23:11	–:–	14:21	15:24	16:15
56°	22:25	23:23	–:–	14:09	15:12	16:04
54°	22:35	23:33	–:–	14:00	15:02	15:55
52°	22:44	23:42	–:–	13:51	14:53	15:46
50°	22:52	23:50	–:–	13:43	14:45	15:38
45°	23:09	–:–	00:07	13:26	14:27	15:22
N 40°	23:23	–:–	00:21	13:12	14:13	15:08
35°	23:35	–:–	00:33	13:01	14:01	14:57
30°	23:46	–:–	00:44	12:50	13:50	14:47
20°	–:–	00:03	01:02	12:33	13:32	14:29
N 10°	–:–	00:19	01:17	12:18	13:16	14:14
0°	–:–	00:34	01:32	12:03	13:02	14:00
S 10°	–:–	00:49	01:47	11:49	12:47	13:46
20°	00:04	01:04	02:03	11:34	12:31	13:30
30°	00:21	01:22	02:21	11:16	12:13	13:13
35°	00:31	01:33	02:31	11:06	12:02	13:02
40°	00:42	01:45	02:43	10:54	11:50	12:50
45°	00:55	01:59	02:57	10:41	11:35	12:36
S 50°	01:12	02:17	03:15	10:24	11:18	12:19
52°	01:19	02:25	03:23	10:16	11:09	12:11
54°	01:28	02:34	03:32	10:08	11:00	12:02
56°	01:37	02:45	03:42	09:58	10:50	11:52
58°	01:48	02:57	03:54	09:47	10:38	11:41
S 60°	02:01	03:11	04:07	09:34	10:24	11:28

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 23-25 47-26%
13	03:59	04:10	11:56	05:50	18:19	
14	04:21	04:31	11:55	06:48	19:17	
15	04:42	04:53	11:55	07:46	20:15	

September 16, 17, 18 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	355°07.9	207°31.4	N13°53.6	196°13.5	N10°07.8	151°41.2	S08°38.6	94°14.8	S22°03.4
1	10°10.4	222°30.9	52.6	211°14.4	07.2	166°43.2	38.7	109°17.2	03.4
2	25°12.9	237°30.4	51.7	226°15.4	06.6	181°45.2	38.9	124°19.6	03.4
3	40°15.3	252°29.9	·· 50.8	241°16.4	·· 06.0	196°47.2	·· 39.1	139°21.9	·· 03.4
4	55°17.8	267°29.4	49.9	256°17.4	05.4	211°49.2	39.3	154°24.3	03.4
5	70°20.3	282°28.8	48.9	271°18.3	04.9	226°51.2	39.5	169°26.7	03.5
6	85°22.7	297°28.3	N13°48.0	286°19.3	N10°04.3	241°53.2	S08°39.7	184°29.1	S22°03.5
7	100°25.2	312°27.8	47.1	301°20.3	03.7	256°55.2	39.9	199°31.4	03.5
8	115°27.7	327°27.3	46.1	316°21.2	03.1	271°57.2	40.0	214°33.8	03.5
9	130°30.1	342°26.8	·· 45.2	331°22.2	·· 02.5	286°59.2	·· 40.2	229°36.2	·· 03.5
10	145°32.6	357°26.2	44.3	346°23.2	01.9	302°01.2	40.4	244°38.5	03.5
11	160°35.0	12°25.7	43.3	1°24.1	01.3	317°03.2	40.6	259°40.9	03.5
12	175°37.5	27°25.2	N13°42.4	16°25.1	N10°00.7	332°05.2	S08°40.8	274°43.3	S22°03.5
13	190°40.0	42°24.7	41.5	31°26.1	10°00.1	347°07.1	41.0	289°45.7	03.6
14	205°42.4	57°24.2	40.5	46°27.0	09°59.6	2°09.1	41.2	304°48.0	03.6
15	220°44.9	72°23.7	·· 39.6	61°28.0	·· 59.0	17°11.1	·· 41.4	319°50.4	·· 03.6
16	235°47.4	87°23.1	38.7	76°29.0	58.4	32°13.1	41.5	334°52.8	03.6
17	250°49.8	102°22.6	37.7	91°30.0	57.8	47°15.1	41.7	349°55.1	03.6
18	265°52.3	117°22.1	N13°36.8	106°30.9	N09°57.2	62°17.1	S08°41.9	4°57.5	S22°03.6
19	280°54.8	132°21.6	35.8	121°31.9	56.6	77°19.1	42.1	19°59.9	03.6
20	295°57.2	147°21.1	34.9	136°32.9	56.0	92°21.1	42.3	35°02.2	03.6
21	310°59.7	162°20.6	·· 34.0	151°33.8	·· 55.4	107°23.1	·· 42.5	50°04.6	·· 03.7
22	326°02.2	177°20.1	33.0	166°34.8	54.8	122°25.1	42.7	65°07.0	03.7
23	341°04.6	192°19.5	32.1	181°35.8	54.3	137°27.1	42.8	80°09.3	03.7
Mer.pass.:00:19		v-0.5 d-0.9 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	356°07.1	207°19.0	N13°31.1	196°36.7	N09°53.7	152°29.1	S08°43.0	95°11.7	S22°03.7
1	11°09.5	222°18.5	30.2	211°37.7	53.1	167°31.1	43.2	110°14.1	03.7
2	26°12.0	237°18.0	29.3	226°38.7	52.5	182°33.1	43.4	125°16.4	03.7
3	41°14.5	252°17.5	·· 28.3	241°39.7	·· 51.9	197°35.1	·· 43.6	140°18.8	·· 03.7
4	56°16.9	267°17.0	27.4	256°40.6	51.3	212°37.1	43.8	155°21.2	03.8
5	71°19.4	282°16.5	26.4	271°41.6	50.7	227°39.0	44.0	170°23.5	03.8
6	86°21.9	297°16.0	N13°25.5	286°42.6	N09°50.1	242°41.0	S08°44.2	185°25.9	S22°03.8
7	101°24.3	312°15.4	24.5	301°43.5	49.5	257°43.0	44.3	200°28.3	03.8
8	116°26.8	327°14.9	23.6	316°44.5	48.9	272°45.0	44.5	215°30.6	03.8
9	131°29.3	342°14.4	·· 22.6	331°45.5	·· 48.3	287°47.0	·· 44.7	230°33.0	·· 03.8
10	146°31.7	357°13.9	21.7	346°46.4	47.8	302°49.0	44.9	245°35.4	03.8
11	161°34.2	12°13.4	20.7	1°47.4	47.2	317°51.0	45.1	260°37.7	03.8
12	176°36.6	27°12.9	N13°19.8	16°48.4	N09°46.6	332°53.0	S08°45.3	275°40.1	S22°03.9
13	191°39.1	42°12.4	18.8	31°49.4	46.0	347°55.0	45.5	290°42.5	03.9
14	206°41.6	57°11.9	17.9	46°50.3	45.4	2°57.0	45.7	305°44.8	03.9
15	221°44.0	72°11.4	·· 16.9	61°51.3	·· 44.8	17°59.0	·· 45.8	320°47.2	·· 03.9
16	236°46.5	87°10.8	16.0	76°52.3	44.2	33°01.0	46.0	335°49.6	03.9
17	251°49.0	102°10.3	15.0	91°53.3	43.6	48°03.0	46.2	350°51.9	03.9
18	266°51.4	117°09.8	N13°14.1	106°54.2	N09°43.0	63°04.9	S08°46.4	5°54.3	S22°03.9
19	281°53.9	132°09.3	13.1	121°55.2	42.4	78°06.9	46.6	20°56.7	04.0
20	296°56.4	147°08.8	12.2	136°56.2	41.8	93°08.9	46.8	35°59.0	04.0
21	311°58.8	162°08.3	·· 11.2	151°57.1	·· 41.2	108°10.9	·· 47.0	51°01.4	·· 04.0
22	327°01.3	177°07.8	10.3	166°58.1	40.7	123°12.9	47.2	66°03.8	04.0
23	342°03.8	192°07.3	09.3	181°59.1	40.1	138°14.9	47.3	81°06.1	04.0
Mer.pass.:00:15		v-0.5 d-0.9 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	357°06.2	207°06.8	N13°08.3	197°00.1	N09°39.5	153°16.9	S08°47.5	96°08.5	S22°04.0
1	12°08.7	222°06.3	07.4	212°01.0	38.9	168°18.9	47.7	111°10.8	04.0
2	27°11.1	237°05.8	06.4	227°02.0	38.3	183°20.9	47.9	126°13.2	04.0
3	42°13.6	252°05.3	·· 05.5	242°03.0	·· 37.7	198°22.9	·· 48.1	141°15.6	·· 04.1
4	57°16.1	267°04.8	04.5	257°03.9	37.1	213°24.9	48.3	156°17.9	04.1
5	72°18.5	282°04.3	03.5	272°04.9	36.5	228°26.9	48.5	171°20.3	04.1
6	87°21.0	297°03.8	N13°02.6	287°05.9	N09°35.9	243°28.8	S08°48.7	186°22.7	S22°04.1
7	102°23.5	312°03.2	01.6	302°06.9	35.3	258°30.8	48.8	201°25.0	04.1
8	117°25.9	327°02.7	13°00.6	317°07.8	34.7	273°32.8	49.0	216°27.4	04.1
9	132°28.4	342°02.2	12°59.7	332°08.8	·· 34.1	288°34.8	·· 49.2	231°29.7	·· 04.1
10	147°30.9	357°01.7	58.7	347°09.8	33.5	303°36.8	49.4	246°32.1	04.2
11	162°33.3	12°01.2	57.8	2°10.8	32.9	318°38.8	49.6	261°34.5	04.2
12	177°35.8	27°00.7	N12°56.8	17°11.7	N09°32.4	333°40.8	S08°49.8	276°36.8	S22°04.2
13	192°38.2	42°00.2	55.8	32°12.7	31.8	348°42.8	50.0	291°39.2	04.2
14	207°40.7	56°59.7	54.9	47°13.7	31.2	3°44.8	50.2	306°41.6	04.2
15	222°43.2	71°59.2	·· 53.9	62°14.7	·· 30.6	18°46.8	·· 50.3	321°43.9	·· 04.2
16	237°45.6	86°58.7	52.9	77°15.6	30.0	33°48.7	50.5	336°46.3	04.2
17	252°48.1	101°58.2	52.0	92°16.6	29.4	48°50.7	50.7	351°48.6	04.2
18	267°50.6	116°57.7	N12°51.0	107°17.6	N09°28.8	63°52.7	S08°50.9	6°51.0	S22°04.3
19	282°53.0	131°57.2	50.0	122°18.6	28.2	78°54.7	51.1	21°53.4	04.3
20	297°55.5	146°56.7	49.0	137°19.5	27.6	93°56.7	51.3	36°55.7	04.3
21	312°58.0	161°56.2	·· 48.1	152°20.5	·· 27.0	108°58.7	·· 51.5	51°58.1	·· 04.3
22	328°00.4	176°55.7	47.1	167°21.5	26.4	124°00.7	51.7	67°00.4	04.3
23	343°02.9	191°55.2	46.1	182°22.5	25.8	139°02.7	51.8	82°02.8	04.3
Mer.pass.:00:12		v-0.5 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.3
Ankaa	353°12.5	-42°12.5
Schedar	349°36.6	56°38.0
Diphda	348°52.7	-17°53.3
Achernar	335°24.2	-57°08.7
Hamal	327°57.2	23°32.7
Polaris	316°10.7	89°20.0
Acamar	315°15.9	-40°13.9
Menkar	314°11.8	4°09.5
Mirfak	308°35.9	49°55.1
Aldebaran	290°46.0	16°32.5
Rigel	281°09.3	-8°10.9
Capella	280°30.2	46°00.6
Bellatrix	278°28.9	6°21.8
Elnath	278°09.0	28°37.1
Alnilam	275°43.5	-1°11.5
Betelgeuse	270°58.2	7°24.5
Canopus	263°55.0	-52°42.1
Sirius	258°31.3	-16°44.4
Adhara	255°10.4	-28°59.7
Procyon	244°56.9	5°10.7
Pollux	243°24.4	27°58.8
Avior	234°17.2	-59°33.8
Suhail	222°50.6	-43°30.1
Miaplacidus	221°39.7	-69°47.2
Alphard	217°53.5	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°48.9	61°39.4
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.7	-63°11.7
Gacrux	171°58.2	-57°12.6
Alioth	166°18.8	55°52.1
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.8
Hadar	148°44.2	-60°27.4
Menkent	148°04.5	-36°27.3
Arcturus	145°53.4	19°05.8
Rigil Kent.	139°48.2	-60°54.4
Kochab	137°21.0	74°05.4
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.8	-26°28.1
Atria	107°22.1	-69°03.6
Sabik	102°09.3	-15°44.6
Shaula	96°18.0	-37°06.9
Rasalhague	96°03.8	12°33.2
Eltanin	90°44.8	51°29.7
Kaus Aust.	83°39.9	-34°22.4
Vega	80°36.9	38°48.5
Nunki	75°54.7	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.4	-56°40.7
Deneb	49°29.2	45°20.9
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.9
Markab	13°35.1	15°18.2

Sep 16 Sat	SHA	Mer.pass
Venus	212°23.5	10:10
Mars	201°05.5	10:54
Jupiter	156°33.3	13:51
Saturn	99°06.9	17:40

Sep 17 Sun	SHA	Mer.pass
Venus	211°11.9	10:11
Mars	200°29.7	10:53
Jupiter	156°22.0	13:48
Saturn	99°04.6	17:36

Sep 18 Mon	SHA	Mer.pass
Venus	210°00.6	10:12
Mars	199°53.8	10:51
Jupiter	156°10.7	13:45
Saturn	99°02.3	17:33

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3257 sec ΔT = TT-UT1 = +68.8583 sec

2017 September 16 to Sep. 18 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	ν	Moon Dec	d	HP
0	181°15.8	N02°39.0	234°07.8	6.7'	N18°08.9	-4.3'	59.0'
1	196°16.0	38.1	248°33.4	6.7'	18°04.5	-4.5'	59.0'
2	211°16.3	37.1	262°59.2	6.7'	18°00.0	-4.6'	59.0'
3	226°16.5	·· 36.2	277°24.9	6.8'	17°55.3	-4.7'	59.0'
4	241°16.7	35.2	291°50.7	6.8'	17°50.6	-4.8'	59.0'
5	256°16.9	34.2	306°16.6	6.9'	17°45.7	-4.9'	59.0'
6	271°17.2	N02°33.3	320°42.5	6.9'	N17°40.8	-5.0'	59.0'
7	286°17.4	32.3	335°08.4	7.0'	17°35.7	-5.1'	59.0'
8	301°17.6	31.3	349°34.4	7.0'	17°30.5	-5.2'	59.0'
9	316°17.8	·· 30.4	4°00.4	7.0'	17°25.2	-5.4'	59.0'
10	331°18.0	29.4	18°26.4	7.1'	17°19.8	-5.5'	59.0'
11	346°18.3	28.4	32°52.5	7.1'	17°14.3	-5.6'	58.9'
12	1°18.5	N02°27.5	47°18.7	7.2'	N17°08.6	-5.7'	58.9'
13	16°18.7	26.5	61°44.9	7.2'	17°02.9	-5.8'	58.9'
14	31°18.9	25.5	76°11.2	7.3'	16°57.1	-5.9'	58.9'
15	46°19.2	·· 24.6	90°37.5	7.3'	16°51.1	-6.0'	58.9'
16	61°19.4	23.6	105°03.8	7.4'	16°45.1	-6.1'	58.9'
17	76°19.6	22.6	119°30.2	7.4'	16°38.9	-6.2'	58.9'
18	91°19.8	N02°21.7	133°56.7	7.5'	N16°32.7	-6.3'	58.9'
19	106°20.0	20.7	148°23.2	7.5'	16°26.3	-6.4'	58.9'
20	121°20.3	19.7	162°49.7	7.6'	16°19.9	-6.5'	58.8'
21	136°20.5	·· 18.8	177°16.3	7.6'	16°13.3	-6.6'	58.8'
22	151°20.7	17.8	191°43.0	7.7'	16°06.7	-6.7'	58.8'
23	166°20.9	16.9	206°09.7	7.7'	15°59.9	-6.8'	58.8'
	SD.=15.9	d=-1.0	S.D.=16.1				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°21.2	N02°15.9	220°36.5	7.8'	N15°53.1	-6.9'	58.8'
1	196°21.4	14.9	235°03.3	7.8'	15°46.1	-7.0'	58.8'
2	211°21.6	14.0	249°30.2	7.9'	15°39.1	-7.1'	58.8'
3	226°21.8	·· 13.0	263°57.1	8.0'	15°32.0	-7.2'	58.7'
4	241°22.1	12.0	278°24.1	8.0'	15°24.8	-7.3'	58.7'
5	256°22.3	11.1	292°51.1	8.1'	15°17.5	-7.4'	58.7'
6	271°22.5	N02°10.1	307°18.2	8.1'	N15°10.1	-7.4'	58.7'
7	286°22.7	09.1	321°45.3	8.2'	15°02.6	-7.5'	58.7'
8	301°22.9	08.2	336°12.5	8.2'	14°55.0	-7.6'	58.7'
9	316°23.2	·· 07.2	350°39.8	8.3'	14°47.3	-7.7'	58.7'
10	331°23.4	06.2	5°07.1	8.3'	14°39.6	-7.8'	58.6'
11	346°23.6	05.3	19°34.5	8.4'	14°31.8	-7.9'	58.6'
12	1°23.8	N02°04.3	34°01.9	8.5'	N14°23.8	-8.0'	58.6'
13	16°24.1	03.3	48°29.4	8.5'	14°15.8	-8.0'	58.6'
14	31°24.3	02.4	62°57.0	8.6'	14°07.8	-8.1'	58.6'
15	46°24.5	·· 01.4	77°24.6	8.6'	13°59.6	-8.2'	58.6'
16	61°24.7	02°00.4	91°52.2	8.7'	13°51.4	-8.3'	58.6'
17	76°24.9	01°59.5	106°20.0	8.7'	13°43.1	-8.4'	58.5'
18	91°25.2	N01°58.5	120°47.7	8.8'	N13°34.7	-8.4'	58.5'
19	106°25.4	57.5	135°15.6	8.9'	13°26.2	-8.5'	58.5'
20	121°25.6	56.5	149°43.5	8.9'	13°17.6	-8.6'	58.5'
21	136°25.8	·· 55.6	164°11.4	9.0'	13°09.0	-8.7'	58.5'
22	151°26.1	54.6	178°39.4	9.0'	13°00.3	-8.7'	58.5'
23	166°26.3	53.6	193°07.5	9.1'	12°51.6	-8.8'	58.4'
	SD.=15.9	d=-1.0	S.D.=16.0				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°26.5	N01°52.7	207°35.6	9.2'	N12°42.7	-8.9'	58.4'
1	196°26.7	51.7	222°03.8	9.2'	12°33.8	-8.9'	58.4'
2	211°26.9	50.7	236°32.0	9.3'	12°24.9	-9.0'	58.4'
3	226°27.2	·· 49.8	251°00.3	9.3'	12°15.8	-9.1'	58.4'
4	241°27.4	48.8	265°28.7	9.4'	12°06.7	-9.1'	58.4'
5	256°27.6	47.8	279°57.1	9.4'	11°57.6	-9.2'	58.3'
6	271°27.8	N01°46.9	294°25.6	9.5'	N11°48.3	-9.3'	58.3'
7	286°28.1	45.9	308°54.1	9.6'	11°39.1	-9.3'	58.3'
8	301°28.3	44.9	323°22.7	9.6'	11°29.7	-9.4'	58.3'
9	316°28.5	·· 44.0	337°51.4	9.7'	11°20.3	-9.4'	58.3'
10	331°28.7	43.0	352°20.1	9.7'	11°10.8	-9.5'	58.2'
11	346°28.9	42.0	6°48.8	9.8'	11°01.3	-9.6'	58.2'
12	1°29.2	N01°41.1	21°17.6	9.8'	N10°51.7	-9.6'	58.2'
13	16°29.4	40.1	35°46.5	9.9'	10°42.1	-9.7'	58.2'
14	31°29.6	39.1	50°15.4	10.0'	10°32.4	-9.7'	58.2'
15	46°29.8	·· 38.2	64°44.4	10.0'	10°22.6	-9.8'	58.1'
16	61°30.0	37.2	79°13.5	10.1'	10°12.8	-9.8'	58.1'
17	76°30.3	36.2	93°42.6	10.1'	10°03.0	-9.9'	58.1'
18	91°30.5	N01°35.2	108°11.7	10.2'	N09°53.1	-9.9'	58.1'
19	106°30.7	34.3	122°40.9	10.2'	09°43.1	-10.0'	58.1'
20	121°30.9	33.3	137°10.2	10.3'	09°33.1	-10.0'	58.0'
21	136°31.2	·· 32.3	151°39.5	10.3'	09°23.1	-10.1'	58.0'
22	151°31.4	31.4	166°08.9	10.4'	09°13.0	-10.1'	58.0'
23	166°31.6	30.4	180°38.3	10.5'	09°02.9	-10.1'	58.0'
	SD.=15.9	d=-1.0	S.D.=15.9				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:25	04:06	05:17	18:29	19:39	21:18
N 70°	02:52	04:17	05:21	18:26	19:28	20:52
68°	03:12	04:27	05:24	18:23	19:20	20:33
66°	03:28	04:34	05:27	18:20	19:12	20:18
64°	03:40	04:41	05:29	18:18	19:06	20:06
62°	03:50	04:46	05:31	18:16	19:01	19:56
60°	03:59	04:51	05:33	18:15	18:57	19:48
N 58°	04:07	04:55	05:34	18:13	18:53	19:40
56°	04:13	04:58	05:36	18:12	18:49	19:34
54°	04:19	05:01	05:37	18:11	18:46	19:29
52°	04:23	05:04	05:38	18:10	18:44	19:24
50°	04:28	05:06	05:39	18:09	18:41	19:20
45°	04:37	05:12	05:41	18:07	18:36	19:11
N 40°	04:44	05:16	05:43	18:05	18:32	19:04
35°	04:49	05:19	05:44	18:04	18:29	18:59
30°	04:54	05:22	05:46	18:03	18:27	18:55
20°	05:00	05:26	05:48	18:01	18:23	18:48
N 10°	05:04	05:29	05:50	17:59	18:20	18:45
0°	05:06	05:30	05:51	17:58	18:18	18:42
S 10°	05:07	05:32	05:53	17:56	18:17	18:42
20°	05:07	05:32	05:54	17:55	18:17	18:43
30°	05:04	05:32	05:56	17:54	18:17	18:45
35°	05:02	05:31	05:57	17:53	18:18	18:47
40°	04:59	05:30	05:57	17:52	18:19	18:51
45°	04:55	05:29	05:58	17:51	18:20	18:55
S 50°	04:50	05:28	06:00	17:50	18:22	19:00
52°	04:47	05:27	06:00	17:50	18:23	19:03
54°	04:44	05:26	06:01	17:49	18:24	19:06
56°	04:41	05:24	06:01	17:49	18:26	19:09
58°	04:37	05:23	06:02	17:48	18:27	19:13
S 60°	04:33	05:22	06:03	17:47	18:29	19:18

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	23:13	–:–	01:23	19:22	19:06	18:54
N 70°	23:54	–:–	01:46	18:40	18:41	18:40
68°	–:–	00:22	02:04	18:11	18:22	18:28
66°	–:–	00:43	02:18	17:50	18:07	18:18
64°	–:–	01:00	02:30	17:32	17:54	18:10
62°	–:–	01:14	02:40	17:18	17:43	18:03
60°	00:07	01:25	02:48	17:05	17:34	17:56
N 58°	00:19	01:35	02:55	16:55	17:26	17:51
56°	00:30	01:44	03:02	16:46	17:19	17:46
54°	00:39	01:52	03:08	16:37	17:12	17:41
52°	00:48	01:59	03:13	16:30	17:07	17:37
50°	00:55	02:05	03:18	16:23	17:01	17:34
45°	01:11	02:19	03:28	16:09	16:50	17:26
N 40°	01:24	02:30	03:36	15:57	16:41	17:19
35°	01:35	02:39	03:44	15:47	16:33	17:13
30°	01:45	02:47	03:50	15:38	16:25	17:08
20°	02:02	03:02	04:01	15:23	16:13	16:59
N 10°	02:16	03:14	04:10	15:09	16:02	16:51
0°	02:30	03:26	04:19	14:57	15:52	16:44
S 10°	02:43	03:37	04:28	14:44	15:41	16:37
20°	02:58	03:50	04:38	14:30	15:30	16:29
30°	03:15	04:04	04:49	14:15	15:17	16:19
35°	03:24	04:12	04:55	14:05	15:10	16:14
40°	03:35	04:21	05:02	13:55	15:01	16:08
45°	03:48	04:32	05:10	13:43	14:51	16:01
S 50°	04:04	04:45	05:20	13:28	14:39	15:52
52°	04:11	04:51	05:25	13:20	14:34	15:48
54°	04:20	04:58	05:30	13:13	14:27	15:44
56°	04:29	05:06	05:35	13:04	14:20	15:39
58°	04:39	05:14	05:41	12:54	14:13	15:34
S 60°	04:51	05:23	05:48	12:42	14:04	15:27

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 26-28 16-4%
16	05:03	05:14	11:55	08:43	21:11	
17	05:25	05:35	11:54	09:39	22:06	
18	05:46	05:57	11:54	10:32	22:57	

September 19, 20, 21 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	358°05.4	206°54.7	N12°45.2	197°23.4	N09°25.2	154°04.7	S08°52.0	97°05.2	S22°04.3
1	13°07.8	221°54.2	44.2	212°24.4	24.6	169°06.6	52.2	112°07.5	04.4
2	28°10.3	236°53.7	43.2	227°25.4	24.0	184°08.6	52.4	127°09.9	04.4
3	43°12.7	251°53.2	·· 42.2	242°26.4	·· 23.4	199°10.6	·· 52.6	142°12.2	·· 04.4
4	58°15.2	266°52.7	41.3	257°27.3	22.8	214°12.6	52.8	157°14.6	04.4
5	73°17.7	281°52.2	40.3	272°28.3	22.2	229°14.6	53.0	172°16.9	04.4
6	88°20.1	296°51.7	N12°39.3	287°29.3	N09°21.7	244°16.6	S08°53.2	187°19.3	S22°04.4
7	103°22.6	311°51.2	38.3	302°30.3	21.1	259°18.6	53.3	202°21.7	04.4
8	118°25.1	326°50.7	37.3	317°31.2	20.5	274°20.6	53.5	217°24.0	04.4
9	133°27.5	341°50.2	·· 36.4	332°32.2	·· 19.9	289°22.6	·· 53.7	232°26.4	·· 04.5
10	148°30.0	356°49.7	35.4	347°33.2	19.3	304°24.5	53.9	247°28.7	04.5
11	163°32.5	11°49.3	34.4	2°34.2	18.7	319°26.5	54.1	262°31.1	04.5
12	178°34.9	26°48.8	N12°33.4	17°35.1	N09°18.1	334°28.5	S08°54.3	277°33.5	S22°04.5
13	193°37.4	41°48.3	32.4	32°36.1	17.5	349°30.5	54.5	292°35.8	04.5
14	208°39.9	56°47.8	31.5	47°37.1	16.9	4°32.5	54.7	307°38.2	04.5
15	223°42.3	71°47.3	·· 30.5	62°38.1	·· 16.3	19°34.5	·· 54.8	322°40.5	·· 04.5
16	238°44.8	86°46.8	29.5	77°39.0	15.7	34°36.5	55.0	337°42.9	04.6
17	253°47.2	101°46.3	28.5	92°40.0	15.1	49°38.5	55.2	352°45.2	04.6
18	268°49.7	116°45.8	N12°27.5	107°41.0	N09°14.5	64°40.4	S08°55.4	7°47.6	S22°04.6
19	283°52.2	131°45.3	26.5	122°42.0	13.9	79°42.4	55.6	22°50.0	04.6
20	298°54.6	146°44.8	25.5	137°42.9	13.3	94°44.4	55.8	37°52.3	04.6
21	313°57.1	161°44.3	·· 24.6	152°43.9	·· 12.7	109°46.4	·· 56.0	52°54.7	·· 04.6
22	328°59.6	176°43.8	23.6	167°44.9	12.1	124°48.4	56.2	67°57.0	04.6
23	344°02.0	191°43.3	22.6	182°45.9	11.5	139°50.4	56.4	82°59.4	04.7
Mer.pass.	:00:08	v-0.5 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	359°04.5	206°42.8	N12°21.6	197°46.8	N09°10.9	154°52.4	S08°56.5	98°01.7	S22°04.7
1	14°07.0	221°42.3	20.6	212°47.8	10.3	169°54.4	56.7	113°04.1	04.7
2	29°09.4	236°41.8	19.6	227°48.8	09.7	184°56.3	56.9	128°06.4	04.7
3	44°11.9	251°41.4	·· 18.6	242°49.8	·· 09.1	199°58.3	·· 57.1	143°08.8	·· 04.7
4	59°14.3	266°40.9	17.6	257°50.8	08.5	215°00.3	57.3	158°11.1	04.7
5	74°16.8	281°40.4	16.6	272°51.7	07.9	230°02.3	57.5	173°13.5	04.7
6	89°19.3	296°39.9	N12°15.7	287°52.7	N09°07.3	245°04.3	S08°57.7	188°15.9	S22°04.7
7	104°21.7	311°39.4	14.7	302°53.7	06.7	260°06.3	57.9	203°18.2	04.8
8	119°24.2	326°38.9	13.7	317°54.7	06.1	275°08.3	58.0	218°20.6	04.8
9	134°26.7	341°38.4	·· 12.7	332°55.6	·· 05.5	290°10.2	·· 58.2	233°22.9	·· 04.8
10	149°29.1	356°37.9	11.7	347°56.6	05.0	305°12.2	58.4	248°25.3	04.8
11	164°31.6	11°37.4	10.7	2°57.6	04.4	320°14.2	58.6	263°27.6	04.8
12	179°34.1	26°37.0	N12°09.7	17°58.6	N09°03.8	335°16.2	S08°58.8	278°30.0	S22°04.8
13	194°36.5	41°36.5	08.7	32°59.6	03.2	350°18.2	59.0	293°32.3	04.8
14	209°39.0	56°36.0	07.7	48°00.5	02.6	5°20.2	59.2	308°34.7	04.9
15	224°41.5	71°35.5	·· 06.7	63°01.5	·· 02.0	20°22.2	·· 59.4	323°37.0	·· 04.9
16	239°43.9	86°35.0	05.7	78°02.5	01.4	35°24.1	59.6	338°39.4	04.9
17	254°46.4	101°34.5	04.7	93°03.5	00.8	50°26.1	59.7	353°41.7	04.9
18	269°48.8	116°34.0	N12°03.7	108°04.4	N09°00.2	65°28.1	S08°59.9	8°44.1	S22°04.9
19	284°51.3	131°33.5	02.7	123°05.4	08°59.6	80°30.1	09°00.1	23°46.4	04.9
20	299°53.8	146°33.1	01.7	138°06.4	59.0	95°32.1	00.3	38°48.8	04.9
21	314°56.2	161°32.6	12°00.7	153°07.4	·· 58.4	110°34.1	·· 00.5	53°51.2	·· 05.0
22	329°58.7	176°32.1	11°59.7	168°08.4	57.8	125°36.1	00.7	68°53.5	05.0
23	345°01.2	191°31.6	58.7	183°09.3	57.2	140°38.0	00.9	83°55.9	05.0
Mer.pass.	:00:00	v-0.5 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.6		v2.4 d-0.0 m0.5	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	0°03.6	206°31.1	N11°57.7	198°10.3	N08°56.6	155°40.0	S09°01.1	98°58.2	S22°05.0
1	15°06.1	221°30.6	56.7	213°11.3	56.0	170°42.0	01.3	114°00.6	05.0
2	30°08.6	236°30.1	55.7	228°12.3	55.4	185°44.0	01.4	129°02.9	05.0
3	45°11.0	251°29.7	·· 54.7	243°13.3	·· 54.8	200°46.0	·· 01.6	144°05.3	·· 05.0
4	60°13.5	266°29.2	53.7	258°14.2	54.2	215°48.0	01.8	159°07.6	05.1
5	75°15.9	281°28.7	52.7	273°15.2	53.6	230°49.9	02.0	174°10.0	05.1
6	90°18.4	296°28.2	N11°51.7	288°16.2	N08°53.0	245°51.9	S09°02.2	189°12.3	S22°05.1
7	105°20.9	311°27.7	50.7	303°17.2	52.4	260°53.9	02.4	204°14.7	05.1
8	120°23.3	326°27.2	49.6	318°18.2	51.8	275°55.9	02.6	219°17.0	05.1
9	135°25.8	341°26.8	·· 48.6	333°19.1	·· 51.2	290°57.9	·· 02.8	234°19.4	·· 05.1
10	150°28.3	356°26.3	47.6	348°20.1	50.6	305°59.9	03.0	249°21.7	05.1
11	165°30.7	11°25.8	46.6	3°21.1	50.0	321°01.8	03.1	264°24.1	05.1
12	180°33.2	26°25.3	N11°45.6	18°22.1	N08°49.4	336°03.8	S09°03.3	279°26.4	S22°05.2
13	195°35.7	41°24.8	44.6	33°23.1	48.8	351°05.8	03.5	294°28.8	05.2
14	210°38.1	56°24.4	43.6	48°24.0	48.2	6°07.8	03.7	309°31.1	05.2
15	225°40.6	71°23.9	·· 42.6	63°25.0	·· 47.6	21°09.8	·· 03.9	324°33.5	·· 05.2
16	240°43.1	86°23.4	41.6	78°26.0	47.0	36°11.8	04.1	339°35.8	05.2
17	255°45.5	101°22.9	40.5	93°27.0	46.4	51°13.7	04.3	354°38.1	05.2
18	270°48.0	116°22.4	N11°39.5	108°28.0	N08°45.8	66°15.7	S09°04.5	9°40.5	S22°05.2
19	285°50.4	131°22.0	38.5	123°28.9	45.2	81°17.7	04.6	24°42.8	05.3
20	300°52.9	146°21.5	37.5	138°29.9	44.6	96°19.7	04.8	39°45.2	05.3
21	315°55.4	161°21.0	·· 36.5	153°30.9	·· 44.0	111°21.7	·· 05.0	54°47.5	·· 05.3
22	330°57.8	176°20.5	35.5	168°31.9	43.4	126°23.7	05.2	69°49.9	05.3
23	346°00.3	191°20.0	34.5	183°32.9	42.8	141°25.6	05.4	84°52.2	05.3
Mer.pass.	:23:56	v-0.5 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.4 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.3
Ankaa	353°12.5	-42°12.5
Schedar	349°36.6	56°38.0
Diphda	348°52.7	-17°53.3
Achernar	335°24.2	-57°08.8
Hamal	327°57.2	23°32.7
Polaris	316°09.7	89°20.0
Acamar	315°15.9	-40°13.9
Menkar	314°11.8	4°09.5
Mirfak	308°35.9	49°55.1
Aldebaran	290°46.0	16°32.5
Rigel	281°09.2	-8°10.9
Capella	280°30.1	46°00.6
Bellatrix	278°28.9	6°21.8
Elnath	278°08.9	28°37.1
Alnilam	275°43.4	-1°11.5
Betelgeuse	270°58.2	7°24.5
Canopus	263°54.9	-52°42.1
Sirius	258°31.3	-16°44.4
Adhara	255°10.4	-28°59.7
Procyon	244°56.9	5°10.7
Pollux	243°24.4	27°58.8
Avior	234°17.2	-59°33.8
Suhail	222°50.6	-43°30.1
Miaplacidus	221°39.7	-69°47.2
Alphard	217°53.5	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°48.9	61°39.4
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.7	-63°11.7
Gacrux	171°58.2	-57°12.6
Alioth	166°18.8	55°52.1
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.8
Hadar	148°44.3	-60°27.4
Menkent	148°04.5	-36°27.3
Arcturus	145°53.4	19°05.8
Rigil Kent.	139°48.2	-60°54.4
Kochab	137°21.0	74°05.4
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.8	-26°28.1
Atria	107°22.2	-69°03.6
Sabik	102°09.3	-15°44.6
Shaula	96°18.0	-37°06.9
Rasalhague	96°03.8	12°33.2
Eltanin	90°44.8	51°29.7
Kaus Aust.	83°40.0	-34°22.4
Vega	80°36.9	38°48.5
Nunki	75°54.7	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.4	-56°40.7
Deneb	49°29.2	45°21.0
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.9
Markab	13°35.1	15°18.2

Sep 19 Tue	SHA	Mer.pass
Venus	208°49.4	10:13
Mars	199°18.1	10:50
Jupiter	155°59.3	13:42
Saturn	98°59.8	17:29

Sep 20 Wed	SHA	Mer.pass
Venus	207°38.3	10:13
Mars	198°42.4	10:48
Jupiter	155°47.9	13:39
Saturn	98°57.2	17:25

Sep 21 Thu	SHA	Mer.pass
Venus	206°27.5	10:14
Mars	198°06.7	10:47
Jupiter	155°36.4	13:36
Saturn	98°54.6	17:21

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3236 sec ΔT = TT-UT1 = +68.8604 sec

2017 September 19 to Sep. 21 UT

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	181°31.8	N01°29.4	195°07.8	10.5'	N08°52.7	-10.2'	58.0'
1	196°32.0	28.5	209°37.3	10.6'	08°42.5	-10.2'	57.9'
2	211°32.3	27.5	224°06.9	10.6'	08°32.3	-10.3'	57.9'
3	226°32.5	·· 26.5	238°36.5	10.7'	08°22.0	-10.3'	57.9'
4	241°32.7	25.6	253°06.2	10.7'	08°11.6	-10.3'	57.9'
5	256°32.9	24.6	267°36.0	10.8'	08°01.3	-10.4'	57.9'
6	271°33.2	N01°23.6	282°05.8	10.8'	N07°50.9	-10.4'	57.8'
7	286°33.4	22.6	296°35.6	10.9'	07°40.4	-10.5'	57.8'
8	301°33.6	21.7	311°05.5	10.9'	07°30.0	-10.5'	57.8'
9	316°33.8	·· 20.7	325°35.5	11.0'	07°19.5	-10.5'	57.8'
10	331°34.0	19.7	340°05.5	11.0'	07°08.9	-10.5'	57.7'
11	346°34.3	18.8	354°35.5	11.1'	06°58.4	-10.6'	57.7'
12	1°34.5	N01°17.8	9°05.6	11.1'	N06°47.8	-10.6'	57.7'
13	16°34.7	16.8	23°35.7	11.2'	06°37.2	-10.6'	57.7'
14	31°34.9	15.9	38°05.9	11.2'	06°26.5	-10.7'	57.7'
15	46°35.1	·· 14.9	52°36.2	11.3'	06°15.8	-10.7'	57.6'
16	61°35.4	13.9	67°06.5	11.3'	06°05.1	-10.7'	57.6'
17	76°35.6	12.9	81°36.8	11.4'	05°54.4	-10.7'	57.6'
18	91°35.8	N01°12.0	96°07.2	11.4'	N05°43.7	-10.8'	57.6'
19	106°36.0	11.0	110°37.6	11.4'	05°32.9	-10.8'	57.5'
20	121°36.3	10.0	125°08.1	11.5'	05°22.1	-10.8'	57.5'
21	136°36.5	·· 09.1	139°38.6	11.5'	05°11.3	-10.8'	57.5'
22	151°36.7	08.1	154°09.1	11.6'	05°00.5	-10.8'	57.5'
23	166°36.9	07.1	168°39.8	11.6'	04°49.7	-10.8'	57.4'
	SD.=15.9	d=-1.0		S.D.=15.7			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	181°37.1	N01°06.1	183°10.4	11.7'	N04°38.8	-10.9'	57.4'
1	196°37.4	05.2	197°41.1	11.7'	04°27.9	-10.9'	57.4'
2	211°37.6	04.2	212°11.8	11.8'	04°17.0	-10.9'	57.4'
3	226°37.8	·· 03.2	226°42.6	11.8'	04°06.1	-10.9'	57.3'
4	241°38.0	02.3	241°13.4	11.8'	03°55.2	-10.9'	57.3'
5	256°38.2	01.3	255°44.3	11.9'	03°44.3	-10.9'	57.3'
6	271°38.5	N01°00.3	270°15.2	11.9'	N03°33.4	-10.9'	57.3'
7	286°38.7	00°59.4	284°46.1	12.0'	03°22.5	-10.9'	57.2'
8	301°38.9	58.4	299°17.1	12.0'	03°11.5	-10.9'	57.2'
9	316°39.1	·· 57.4	313°48.1	12.0'	03°00.6	-11.0'	57.2'
10	331°39.4	56.4	328°19.2	12.1'	02°49.6	-11.0'	57.2'
11	346°39.6	55.5	342°50.2	12.1'	02°38.6	-11.0'	57.1'
12	1°39.8	N00°54.5	357°21.4	12.1'	N02°27.7	-11.0'	57.1'
13	16°40.0	53.5	11°52.5	12.2'	02°16.7	-11.0'	57.1'
14	31°40.2	52.6	26°23.7	12.2'	02°05.7	-11.0'	57.1'
15	46°40.5	·· 51.6	40°55.0	12.3'	01°54.8	-11.0'	57.0'
16	61°40.7	50.6	55°26.2	12.3'	01°43.8	-11.0'	57.0'
17	76°40.9	49.6	69°57.5	12.3'	01°32.8	-11.0'	57.0'
18	91°41.1	N00°48.7	84°28.9	12.4'	N01°21.8	-11.0'	57.0'
19	106°41.3	47.7	99°00.3	12.4'	01°10.9	-11.0'	56.9'
20	121°41.6	46.7	113°31.7	12.4'	00°59.9	-11.0'	56.9'
21	136°41.8	·· 45.8	128°03.1	12.5'	00°49.0	-11.0'	56.9'
22	151°42.0	44.8	142°34.6	12.5'	00°38.0	-10.9'	56.9'
23	166°42.2	43.8	157°06.1	12.5'	00°27.1	-10.9'	56.8'
	SD.=15.9	d=-1.0		S.D.=15.6			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	181°42.4	N00°42.8	171°37.6	12.5'	N00°16.1	-10.9'	56.8'
1	196°42.7	41.9	186°09.1	12.6'	N00°05.2	-10.9'	56.8'
2	211°42.9	40.9	200°40.7	12.6'	S00°05.7	-10.9'	56.8'
3	226°43.1	·· 39.9	215°12.3	12.6'	00°16.6	-10.9'	56.7'
4	241°43.3	38.9	229°44.0	12.7'	00°27.5	-10.9'	56.7'
5	256°43.5	38.0	244°15.7	12.7'	00°38.4	-10.9'	56.7'
6	271°43.8	N00°37.0	258°47.4	12.7'	S00°49.3	-10.9'	56.7'
7	286°44.0	36.0	273°19.1	12.7'	01°00.1	-10.9'	56.6'
8	301°44.2	35.1	287°50.8	12.8'	01°11.0	-10.8'	56.6'
9	316°44.4	·· 34.1	302°22.6	12.8'	01°21.8	-10.8'	56.6'
10	331°44.6	33.1	316°54.4	12.8'	01°32.6	-10.8'	56.6'
11	346°44.9	32.1	331°26.2	12.8'	01°43.4	-10.8'	56.5'
12	1°45.1	N00°31.2	345°58.1	12.9'	S01°54.2	-10.8'	56.5'
13	16°45.3	30.2	0°30.0	12.9'	02°04.9	-10.7'	56.5'
14	31°45.5	29.2	15°01.9	12.9'	02°15.7	-10.7'	56.5'
15	46°45.7	·· 28.3	29°33.8	12.9'	02°26.4	-10.7'	56.4'
16	61°46.0	27.3	44°05.7	12.9'	02°37.1	-10.7'	56.4'
17	76°46.2	26.3	58°37.7	13.0'	02°47.8	-10.7'	56.4'
18	91°46.4	N00°25.3	73°09.6	13.0'	S02°58.4	-10.6'	56.4'
19	106°46.6	24.4	87°41.6	13.0'	03°09.0	-10.6'	56.3'
20	121°46.8	23.4	102°13.7	13.0'	03°19.6	-10.6'	56.3'
21	136°47.1	·· 22.4	116°45.7	13.0'	03°30.2	-10.6'	56.3'
22	151°47.3	21.4	131°17.7	13.1'	03°40.8	-10.5'	56.2'
23	166°47.5	20.5	145°49.8	13.1'	03°51.3	-10.5'	56.2'
	SD.=15.9	d=-1.0		S.D.=15.4			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	02:46	04:21	05:30	18:14	19:23	20:55
N 70°	03:09	04:30	05:33	18:12	19:14	20:34
68°	03:26	04:38	05:35	18:10	19:06	20:17
66°	03:39	04:44	05:36	18:09	19:00	20:04
64°	03:50	04:50	05:38	18:07	18:55	19:54
62°	04:00	04:54	05:39	18:06	18:51	19:45
60°	04:07	04:58	05:40	18:06	18:47	19:38
N 58°	04:14	05:01	05:41	18:05	18:44	19:31
56°	04:20	05:04	05:42	18:04	18:41	19:26
54°	04:25	05:07	05:42	18:03	18:39	19:21
52°	04:29	05:09	05:43	18:03	18:37	19:16
50°	04:33	05:11	05:43	18:02	18:35	19:13
45°	04:41	05:15	05:45	18:01	18:30	19:05
N 40°	04:47	05:19	05:46	18:00	18:27	18:59
35°	04:52	05:21	05:47	18:00	18:25	18:54
30°	04:55	05:23	05:47	17:59	18:23	18:51
20°	05:01	05:26	05:48	17:58	18:20	18:46
N 10°	05:04	05:28	05:49	17:57	18:18	18:43
0°	05:05	05:29	05:50	17:57	18:17	18:41
S 10°	05:05	05:30	05:51	17:56	18:17	18:41
20°	05:04	05:29	05:51	17:56	18:18	18:43
30°	05:00	05:28	05:52	17:55	18:19	18:47
35°	04:58	05:27	05:52	17:55	18:20	18:50
40°	04:54	05:26	05:52	17:55	18:22	18:53
45°	04:49	05:24	05:53	17:55	18:24	18:58
S 50°	04:43	05:21	05:53	17:55	18:27	19:05
52°	04:40	05:20	05:53	17:54	18:28	19:08
54°	04:37	05:18	05:53	17:54	18:30	19:11
56°	04:33	05:16	05:53	17:54	18:31	19:16
58°	04:28	05:15	05:54	17:54	18:34	19:20
S 60°	04:23	05:12	05:54	17:54	18:36	19:26

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	03:21	05:13	07:01	18:45	18:37	18:29
N 70°	03:34	05:18	06:59	18:38	18:36	18:33
68°	03:45	05:23	06:58	18:32	18:34	18:37
66°	03:53	05:26	06:57	18:26	18:33	18:40
64°	04:00	05:29	06:56	18:22	18:32	18:42
62°	04:06	05:32	06:55	18:18	18:32	18:44
60°	04:12	05:34	06:54	18:15	18:31	18:46
N 58°	04:16	05:36	06:54	18:12	18:30	18:48
56°	04:20	05:38	06:53	18:09	18:30	18:50
54°	04:24	05:39	06:53	18:06	18:29	18:51
52°	04:27	05:41	06:52	18:04	18:29	18:52
50°	04:30	05:42	06:52	18:02	18:28	18:53
45°	04:37	05:45	06:51	17:58	18:27	18:56
N 40°	04:42	05:47	06:50	17:54	18:27	18:58
35°	04:47	05:49	06:50	17:51	18:26	19:00
30°	04:51	05:51	06:49	17:48	18:25	19:01
20°	04:58	05:54	06:48	17:43	18:24	19:04
N 10°	05:05	05:57	06:48	17:38	18:23	19:07
0°	05:10	05:59	06:47	17:34	18:22	19:09
S 10°	05:16	06:02	06:46	17:30	18:21	19:11
20°	05:23	06:05	06:45	17:25	18:20	19:14
30°	05:30	06:08	06:45	17:20	18:19	19:17
35°	05:34	06:10	06:44	17:17	18:18	19:18
40°	05:38	06:12	06:44	17:14	18:18	19:20
45°	05:44	06:14	06:43	17:09	18:17	19:22
S 50°	05:50	06:17	06:42	17:05	18:16	19:25
52°	05:53	06:18	06:42	17:02	18:15	19:26
54°	05:56	06:20	06:42	17:00	18:14	19:27
56°	06:00	06:21	06:41	16:57	18:14	19:29
58°	06:04	06:23	06:41	16:54	18:13	19:30
S 60°	06:08	06:25	06:41	16:51	18:12	19:32

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 29-1 1-2%
19	06:07	06:18	11:54	11:22	23:47	
20	06:29	06:39	11:53	12:11	–:–	
21	06:50	07:00	11:53	12:58	00:35	

September 22, 23, 24 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	1°02.8	206°19.6	N11°33.4	198°33.8	N08°42.2	156°27.6	S09°05.6	99°54.6	S22°05.3
1	16°05.2	221°19.1	32.4	213°34.8	41.6	171°29.6	05.8	114°56.9	05.3
2	31°07.7	236°18.6	31.4	228°35.8	41.0	186°31.6	06.0	129°59.3	05.4
3	46°10.2	251°18.1	·· 30.4	243°36.8	·· 40.4	201°33.6	·· 06.2	145°01.6	·· 05.4
4	61°12.6	266°17.7	29.4	258°37.8	39.8	216°35.6	06.3	160°04.0	05.4
5	76°15.1	281°17.2	28.3	273°38.8	39.2	231°37.5	06.5	175°06.3	05.4
6	91°17.5	296°16.7	N11°27.3	288°39.7	N08°38.6	246°39.5	S09°06.7	190°08.7	S22°05.4
7	106°20.0	311°16.2	26.3	303°40.7	38.0	261°41.5	06.9	205°11.0	05.4
8	121°22.5	326°15.8	25.3	318°41.7	37.4	276°43.5	07.1	220°13.4	05.4
9	136°24.9	341°15.3	·· 24.3	333°42.7	·· 36.8	291°45.5	·· 07.3	235°15.7	·· 05.5
10	151°27.4	356°14.8	23.2	348°43.7	36.2	306°47.4	07.5	250°18.0	05.5
11	166°29.9	11°14.3	22.2	3°44.6	35.6	321°49.4	07.7	265°20.4	05.5
12	181°32.3	26°13.9	N11°21.2	18°45.6	N08°35.0	336°51.4	S09°07.9	280°22.7	S22°05.5
13	196°34.8	41°13.4	20.2	33°46.6	34.4	351°53.4	08.1	295°25.1	05.5
14	211°37.3	56°12.9	19.1	48°47.6	33.8	6°55.4	08.2	310°27.4	05.5
15	226°39.7	71°12.4	·· 18.1	63°48.6	·· 33.2	21°57.4	·· 08.4	325°29.8	·· 05.5
16	241°42.2	86°12.0	17.1	78°49.6	32.6	36°59.3	08.6	340°32.1	05.6
17	256°44.7	101°11.5	16.1	93°50.5	32.0	52°01.3	08.8	355°34.5	05.6
18	271°47.1	116°11.0	N11°15.0	108°51.5	N08°31.3	67°03.3	S09°09.0	10°36.8	S22°05.6
19	286°49.6	131°10.5	14.0	123°52.5	30.7	82°05.3	09.2	25°39.1	05.6
20	301°52.0	146°10.1	13.0	138°53.5	30.1	97°07.3	09.4	40°41.5	05.6
21	316°54.5	161°09.6	·· 11.9	153°54.5	·· 29.5	112°09.2	·· 09.6	55°43.8	·· 05.6
22	331°57.0	176°09.1	10.9	168°55.5	28.9	127°11.2	09.8	70°46.2	05.6
23	346°59.4	191°08.7	09.9	183°56.4	28.3	142°13.2	09.9	85°48.5	05.7
Mer.pass.:23:52		v-0.5 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	2°01.9	206°08.2	N11°08.8	198°57.4	N08°27.7	157°15.2	S09°10.1	100°50.9	S22°05.7
1	17°04.4	221°07.7	07.8	213°58.4	27.1	172°17.2	10.3	115°53.2	05.7
2	32°06.8	236°07.2	06.8	228°59.4	26.5	187°19.1	10.5	130°55.5	05.7
3	47°09.3	251°06.8	·· 05.8	244°00.4	·· 25.9	202°21.1	·· 10.7	145°57.9	·· 05.7
4	62°11.8	266°06.3	04.7	259°01.4	25.3	217°23.1	10.9	161°00.2	05.7
5	77°14.2	281°05.8	03.7	274°02.3	24.7	232°25.1	11.1	176°02.6	05.7
6	92°16.7	296°05.4	N11°02.7	289°03.3	N08°24.1	247°27.1	S09°11.3	191°04.9	S22°05.8
7	107°19.1	311°04.9	01.6	304°04.3	23.5	262°29.0	11.5	206°07.3	05.8
8	122°21.6	326°04.4	11°00.6	319°05.3	22.9	277°31.0	11.6	221°09.6	05.8
9	137°24.1	341°04.0	10°59.5	334°06.3	·· 22.3	292°33.0	·· 11.8	236°11.9	·· 05.8
10	152°26.5	356°03.5	58.5	349°07.3	21.7	307°35.0	12.0	251°14.3	05.8
11	167°29.0	11°03.0	57.5	4°08.2	21.1	322°37.0	12.2	266°16.6	05.8
12	182°31.5	26°02.6	N10°56.4	19°09.2	N08°20.5	337°38.9	S09°12.4	281°19.0	S22°05.8
13	197°33.9	41°02.1	55.4	34°10.2	19.9	352°40.9	12.6	296°21.3	05.9
14	212°36.4	56°01.6	54.4	49°11.2	19.3	7°42.9	12.8	311°23.6	05.9
15	227°38.9	71°01.2	·· 53.3	64°12.2	·· 18.7	22°44.9	·· 13.0	326°26.0	·· 05.9
16	242°41.3	86°00.7	52.3	79°13.2	18.1	37°46.9	13.2	341°28.3	05.9
17	257°43.8	101°00.2	51.2	94°14.1	17.5	52°48.8	13.4	356°30.7	05.9
18	272°46.3	115°59.8	N10°50.2	109°15.1	N08°16.9	67°50.8	S09°13.5	11°33.0	S22°05.9
19	287°48.7	130°59.3	49.2	124°16.1	16.3	82°52.8	13.7	26°35.3	05.9
20	302°51.2	145°58.8	48.1	139°17.1	15.7	97°54.8	13.9	41°37.7	06.0
21	317°53.6	160°58.4	·· 47.1	154°18.1	·· 15.1	112°56.8	·· 14.1	56°40.0	·· 06.0
22	332°56.1	175°57.9	46.0	169°19.1	14.5	127°58.7	14.3	71°42.4	06.0
23	347°58.6	190°57.4	45.0	184°20.1	13.8	143°00.7	14.5	86°44.7	06.0
Mer.pass.:23:48		v-0.5 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	3°01.0	205°57.0	N10°43.9	199°21.0	N08°13.2	158°02.7	S09°14.7	101°47.0	S22°06.0
1	18°03.5	220°56.5	42.9	214°22.0	12.6	173°04.7	14.9	116°49.4	06.0
2	33°06.0	235°56.0	41.8	229°23.0	12.0	188°06.7	15.1	131°51.7	06.0
3	48°08.4	250°55.6	·· 40.8	244°24.0	·· 11.4	203°08.6	·· 15.2	146°54.1	·· 06.1
4	63°10.9	265°55.1	39.8	259°25.0	10.8	218°10.6	15.4	161°56.4	06.1
5	78°13.4	280°54.6	38.7	274°26.0	10.2	233°12.6	15.6	176°58.7	06.1
6	93°15.8	295°54.2	N10°37.7	289°27.0	N08°09.6	248°14.6	S09°15.8	192°01.1	S22°06.1
7	108°18.3	310°53.7	36.6	304°27.9	09.0	263°16.5	16.0	207°03.4	06.1
8	123°20.8	325°53.3	35.6	319°28.9	08.4	278°18.5	16.2	222°05.7	06.1
9	138°23.2	340°52.8	·· 34.5	334°29.9	·· 07.8	293°20.5	·· 16.4	237°08.1	·· 06.1
10	153°25.7	355°52.3	33.5	349°30.9	07.2	308°22.5	16.6	252°10.4	06.2
11	168°28.1	10°51.9	32.4	4°31.9	06.6	323°24.5	16.8	267°12.8	06.2
12	183°30.6	25°51.4	N10°31.4	19°32.9	N08°06.0	338°26.4	S09°17.0	282°15.1	S22°06.2
13	198°33.1	40°51.0	30.3	34°33.9	05.4	353°28.4	17.1	297°17.4	06.2
14	213°35.5	55°50.5	29.3	49°34.8	04.8	8°30.4	17.3	312°19.8	06.2
15	228°38.0	70°50.0	·· 28.2	64°35.8	·· 04.2	23°32.4	·· 17.5	327°22.1	·· 06.2
16	243°40.5	85°49.6	27.2	79°36.8	03.6	38°34.3	17.7	342°24.4	06.2
17	258°42.9	100°49.1	26.1	94°37.8	02.9	53°36.3	17.9	357°26.8	06.3
18	273°45.4	115°48.6	N10°25.0	109°38.8	N08°02.3	68°38.3	S09°18.1	12°29.1	S22°06.3
19	288°47.9	130°48.2	24.0	124°39.8	01.7	83°40.3	18.3	27°31.5	06.3
20	303°50.3	145°47.7	22.9	139°40.8	01.1	98°42.3	18.5	42°33.8	06.3
21	318°52.8	160°47.3	·· 21.9	154°41.8	08°00.5	113°44.2	·· 18.7	57°36.1	·· 06.3
22	333°55.2	175°46.8	20.8	169°42.7	07°59.9	128°46.2	18.8	72°38.5	06.3
23	348°57.7	190°46.4	19.8	184°43.7	59.3	143°48.2	19.0	87°40.8	06.3
Mer.pass.:23:44		v-0.5 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.3
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.0
Diphda	348°52.7	-17°53.3
Achernar	335°24.2	-57°08.8
Hamal	327°57.2	23°32.7
Polaris	316°08.6	89°20.0
Acamar	315°15.9	-40°14.0
Menkar	314°11.8	4°09.5
Mirfak	308°35.9	49°55.1
Aldebaran	290°46.0	16°32.5
Rigel	281°09.2	-8°10.9
Capella	280°30.1	46°00.6
Bellatrix	278°28.9	6°21.8
Elnath	278°08.9	28°37.1
Alnilam	275°43.4	-1°11.5
Betelgeuse	270°58.2	7°24.5
Canopus	263°54.9	-52°42.1
Sirius	258°31.2	-16°44.4
Adhara	255°10.4	-28°59.7
Procyon	244°56.9	5°10.7
Pollux	243°24.4	27°58.8
Avior	234°17.2	-59°33.8
Suhail	222°50.6	-43°30.1
Miaplacidus	221°39.7	-69°47.2
Alphard	217°53.5	-8°44.0
Regulus	207°40.8	11°52.9
Dubhe	193°48.9	61°39.3
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.7	-63°11.7
Gacrux	171°58.2	-57°12.6
Alioth	166°18.8	55°52.1
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.8
Hadar	148°44.3	-60°27.4
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.8
Rigil Kent.	139°48.3	-60°54.4
Kochab	137°21.1	74°05.3
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.9	-26°28.1
Atria	107°22.2	-69°03.6
Sabik	102°09.3	-15°44.6
Shaula	96°18.1	-37°06.9
Rasalhague	96°03.8	12°33.2
Eltanin	90°44.8	51°29.7
Kaus Aust.	83°40.0	-34°22.4
Vega	80°37.0	38°48.5
Nunki	75°54.7	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.4	-56°40.7
Deneb	49°29.2	45°21.0
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.6
Scheat	13°50.2	28°10.9
Markab	13°35.1	15°18.2

Sep 22 Fri	SHA	Mer.pass
Venus	205°16.8	10:15
Mars	197°31.1	10:45
Jupiter	155°24.9	13:32
Saturn	98°51.8	17:18

Sep 23 Sat	SHA	Mer.pass
Venus	204°06.3	10:16
Mars	196°55.5	10:43
Jupiter	155°13.3	13:29
Saturn	98°49.0	17:14

Sep 24 Sun	SHA	Mer.pass
Venus	202°55.9	10:17
Mars	196°20.0	10:42
Jupiter	155°01.7	13:26
Saturn	98°46.0	17:10

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3215 sec ΔT = TT-UT1 = +68.8625 sec

2017 September 22 to Sep. 24 UT

h — Sun — Moon

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	181°47.7	N00°19.5	160°21.9	13.1'	S04°01.8	-10.5'	56.2'
1	196°47.9	18.5	174°54.0	13.1'	04°12.2	-10.4'	56.2'
2	211°48.2	17.6	189°26.1	13.1'	04°22.7	-10.4'	56.1'
3	226°48.4	·· 16.6	203°58.3	13.1'	04°33.1	-10.4'	56.1'
4	241°48.6	15.6	218°30.4	13.2'	04°43.4	-10.4'	56.1'
5	256°48.8	14.6	233°02.6	13.2'	04°53.8	-10.3'	56.1'
6	271°49.0	N00°13.7	247°34.7	13.2'	S05°04.1	-10.3'	56.0'
7	286°49.3	12.7	262°06.9	13.2'	05°14.4	-10.3'	56.0'
8	301°49.5	11.7	276°39.1	13.2'	05°24.6	-10.2'	56.0'
9	316°49.7	·· 10.7	291°11.4	13.2'	05°34.8	-10.2'	56.0'
10	331°49.9	09.8	305°43.6	13.2'	05°45.0	-10.2'	55.9'
11	346°50.1	08.8	320°15.8	13.2'	05°55.1	-10.1'	55.9'
12	1°50.4	N00°07.8	334°48.1	13.3'	S06°05.2	-10.1'	55.9'
13	16°50.6	06.9	349°20.3	13.3'	06°15.3	-10.0'	55.9'
14	31°50.8	05.9	3°52.6	13.3'	06°25.3	-10.0'	55.8'
15	46°51.0	·· 04.9	18°24.9	13.3'	06°35.3	-10.0'	55.8'
16	61°51.2	03.9	32°57.2	13.3'	06°45.2	-9.9'	55.8'
17	76°51.5	03.0	47°29.5	13.3'	06°55.1	-9.9'	55.8'
18	91°51.7	N00°02.0	62°01.8	13.3'	S07°05.0	-9.8'	55.7'
19	106°51.9	01.0	76°34.1	13.3'	07°14.8	-9.8'	55.7'
20	121°52.1	N00°00.0	91°06.4	13.3'	07°24.6	-9.8'	55.7'
21	136°52.3	S00°00.9	105°38.7	13.3'	07°34.3	-9.7'	55.7'
22	151°52.5	01.9	120°11.0	13.3'	07°44.0	-9.7'	55.6'
23	166°52.8	02.9	134°43.4	13.3'	07°53.7	-9.6'	55.6'
	SD.=15.9	d=-1.0		S.D.=15.2			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	181°53.0	S00°03.9	149°15.7	13.3'	S08°03.3	-9.6'	55.6'
1	196°53.2	04.8	163°48.0	13.3'	08°12.9	-9.5'	55.6'
2	211°53.4	05.8	178°20.4	13.3'	08°22.4	-9.5'	55.6'
3	226°53.6	·· 06.8	192°52.7	13.4'	08°31.8	-9.4'	55.5'
4	241°53.9	07.7	207°25.1	13.4'	08°41.3	-9.4'	55.5'
5	256°54.1	08.7	221°57.4	13.4'	08°50.6	-9.3'	55.5'
6	271°54.3	S00°09.7	236°29.8	13.4'	S09°00.0	-9.3'	55.5'
7	286°54.5	10.7	251°02.2	13.4'	09°09.2	-9.3'	55.4'
8	301°54.7	11.6	265°34.5	13.4'	09°18.5	-9.2'	55.4'
9	316°54.9	·· 12.6	280°06.9	13.4'	09°27.6	-9.2'	55.4'
10	331°55.2	13.6	294°39.2	13.4'	09°36.8	-9.1'	55.4'
11	346°55.4	14.6	309°11.6	13.4'	09°45.8	-9.0'	55.3'
12	1°55.6	S00°15.5	323°44.0	13.4'	S09°54.9	-9.0'	55.3'
13	16°55.8	16.5	338°16.3	13.4'	10°03.8	-8.9'	55.3'
14	31°56.0	17.5	352°48.7	13.4'	10°12.7	-8.9'	55.3'
15	46°56.3	·· 18.5	7°21.0	13.4'	10°21.6	-8.8'	55.3'
16	61°56.5	19.4	21°53.4	13.4'	10°30.4	-8.8'	55.2'
17	76°56.7	20.4	36°25.7	13.3'	10°39.2	-8.7'	55.2'
18	91°56.9	S00°21.4	50°58.1	13.3'	S10°47.9	-8.7'	55.2'
19	106°57.1	22.3	65°30.4	13.3'	10°56.5	-8.6'	55.2'
20	121°57.3	23.3	80°02.8	13.3'	11°05.1	-8.6'	55.2'
21	136°57.6	·· 24.3	94°35.1	13.3'	11°13.6	-8.5'	55.1'
22	151°57.8	25.3	109°07.4	13.3'	11°22.1	-8.4'	55.1'
23	166°58.0	26.2	123°39.8	13.3'	11°30.5	-8.4'	55.1'
	SD.=15.9	d=-1.0		S.D.=15.1			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°58.2	S00°27.2	138°12.1	13.3'	S11°38.9	-8.3'	55.1'
1	196°58.4	28.2	152°44.4	13.3'	11°47.2	-8.3'	55.1'
2	211°58.6	29.2	167°16.7	13.3'	11°55.4	-8.2'	55.0'
3	226°58.9	·· 30.1	181°49.0	13.3'	12°03.6	-8.1'	55.0'
4	241°59.1	31.1	196°21.3	13.3'	12°11.7	-8.1'	55.0'
5	256°59.3	32.1	210°53.6	13.3'	12°19.8	-8.0'	55.0'
6	271°59.5	S00°33.1	225°25.9	13.3'	S12°27.8	-8.0'	55.0'
7	286°59.7	34.0	239°58.2	13.3'	12°35.7	-7.9'	54.9'
8	301°59.9	35.0	254°30.4	13.3'	12°43.6	-7.8'	54.9'
9	317°00.2	·· 36.0	269°02.7	13.3'	12°51.4	-7.8'	54.9'
10	332°00.4	37.0	283°34.9	13.2'	12°59.1	-7.7'	54.9'
11	347°00.6	37.9	298°07.2	13.2'	13°06.8	-7.7'	54.9'
12	2°00.8	S00°38.9	312°39.4	13.2'	S13°14.4	-7.6'	54.8'
13	17°01.0	39.9	327°11.6	13.2'	13°22.0	-7.5'	54.8'
14	32°01.2	40.8	341°43.9	13.2'	13°29.5	-7.5'	54.8'
15	47°01.5	·· 41.8	356°16.1	13.2'	13°36.9	-7.4'	54.8'
16	62°01.7	42.8	10°48.3	13.2'	13°44.3	-7.3'	54.8'
17	77°01.9	43.8	25°20.4	13.2'	13°51.6	-7.3'	54.8'
18	92°02.1	S00°44.7	39°52.6	13.2'	S13°58.8	-7.2'	54.7'
19	107°02.3	45.7	54°24.8	13.2'	14°05.9	-7.1'	54.7'
20	122°02.5	46.7	68°56.9	13.1'	14°13.0	-7.1'	54.7'
21	137°02.8	·· 47.7	83°29.1	13.1'	14°20.0	-7.0'	54.7'
22	152°03.0	48.6	98°01.2	13.1'	14°27.0	-6.9'	54.7'
23	167°03.2	49.6	112°33.3	13.1'	14°33.9	-6.8'	54.7'
	SD.=15.9	d=-1.0		S.D.=14.9			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	03:05	04:35	05:44	17:59	19:06	20:35
N 70°	03:24	04:43	05:44	17:58	18:59	20:16
68°	03:39	04:49	05:45	17:58	18:53	20:02
66°	03:51	04:54	05:46	17:57	18:48	19:51
64°	04:00	04:58	05:46	17:57	18:44	19:42
62°	04:08	05:02	05:47	17:57	18:41	19:34
60°	04:15	05:05	05:47	17:56	18:38	19:28
N 58°	04:21	05:08	05:47	17:56	18:35	19:22
56°	04:26	05:10	05:47	17:56	18:33	19:17
54°	04:30	05:12	05:48	17:56	18:31	19:13
52°	04:34	05:14	05:48	17:56	18:29	19:09
50°	04:38	05:16	05:48	17:56	18:28	19:06
45°	04:45	05:19	05:48	17:55	18:25	18:59
N 40°	04:50	05:22	05:49	17:55	18:22	18:54
35°	04:54	05:24	05:49	17:55	18:20	18:50
30°	04:57	05:25	05:49	17:55	18:19	18:47
20°	05:01	05:27	05:49	17:55	18:17	18:43
N 10°	05:04	05:28	05:49	17:55	18:16	18:41
0°	05:04	05:28	05:49	17:56	18:16	18:40
S 10°	05:04	05:28	05:49	17:56	18:17	18:41
20°	05:01	05:27	05:49	17:56	18:18	18:44
30°	04:56	05:24	05:48	17:57	18:21	18:49
35°	04:53	05:23	05:48	17:57	18:23	18:52
40°	04:49	05:21	05:48	17:58	18:25	18:56
45°	04:43	05:18	05:47	17:58	18:28	19:02
S 50°	04:36	05:14	05:46	17:59	18:31	19:10
52°	04:33	05:13	05:46	17:59	18:33	19:13
54°	04:29	05:11	05:46	18:00	18:35	19:17
56°	04:24	05:08	05:46	18:00	18:37	19:22
58°	04:19	05:06	05:45	18:01	18:40	19:27
S 60°	04:13	05:03	05:45	18:01	18:43	19:33

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	08:46	10:31	12:18	18:20	18:11	17:58
N 70°	08:37	10:15	11:51	18:31	18:28	18:26
68°	08:31	10:02	11:31	18:39	18:42	18:47
66°	08:25	09:51	11:16	18:46	18:54	19:04
64°	08:20	09:43	11:03	18:52	19:04	19:18
62°	08:16	09:35	10:52	18:57	19:12	19:29
60°	08:13	09:29	10:43	19:02	19:19	19:39
N 58°	08:10	09:23	10:35	19:06	19:25	19:48
56°	08:07	09:18	10:28	19:10	19:31	19:55
54°	08:04	09:14	10:21	19:13	19:36	20:02
52°	08:02	09:10	10:16	19:16	19:41	20:08
50°	08:00	09:06	10:11	19:19	19:45	20:14
45°	07:56	08:58	10:00	19:24	19:54	20:25
N 40°	07:52	08:52	09:50	19:29	20:01	20:35
35°	07:49	08:46	09:43	19:34	20:08	20:44
30°	07:46	08:41	09:36	19:37	20:14	20:51
20°	07:41	08:33	09:24	19:44	20:24	21:04
N 10°	07:37	08:26	09:14	19:50	20:32	21:16
0°	07:33	08:19	09:04	19:55	20:41	21:26
S 10°	07:29	08:12	08:55	20:00	20:49	21:37
20°	07:25	08:05	08:45	20:06	20:58	21:49
30°	07:20	07:56	08:33	20:13	21:08	22:02
35°	07:18	07:52	08:27	20:17	21:14	22:09
40°	07:15	07:46	08:19	20:21	21:20	22:18
45°	07:11	07:40	08:11	20:26	21:28	22:28
S 50°	07:07	07:33	08:00	20:32	21:37	22:40
52°	07:05	07:29	07:55	20:35	21:42	22:46
54°	07:03	07:26	07:50	20:38	21:46	22:53
56°	07:01	07:22	07:44	20:41	21:52	23:00
58°	06:59	07:17	07:38	20:45	21:58	23:08
S 60°	06:56	07:12	07:30	20:49	22:04	23:17

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 2-4 6-18%
22	07:11	07:21	11:53	13:44	01:21	
23	07:32	07:42	11:52	14:30	02:07	
24	07:53	08:03	11:52	15:15	02:53	

September 25, 26, 27 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	4°00.2	205°45.9	N10°18.7	199°44.7	N07°58.7	158°50.2	S09°19.2	102°43.1	S22°06.4
1	19°02.6	220°45.4	17.7	214°45.7	58.1	173°52.1	19.4	117°45.5	06.4
2	34°05.1	235°45.0	16.6	229°46.7	57.5	188°54.1	19.6	132°47.8	06.4
3	49°07.6	250°44.5	·· 15.5	244°47.7	·· 56.9	203°56.1	·· 19.8	147°50.1	·· 06.4
4	64°10.0	265°44.1	14.5	259°48.7	56.3	218°58.1	20.0	162°52.5	06.4
5	79°12.5	280°43.6	13.4	274°49.6	55.7	234°00.0	20.2	177°54.8	06.4
6	94°15.0	295°43.2	N10°12.4	289°50.6	N07°55.1	249°02.0	S09°20.4	192°57.1	S22°06.4
7	109°17.4	310°42.7	11.3	304°51.6	54.5	264°04.0	20.6	207°59.5	06.5
8	124°19.9	325°42.2	10.2	319°52.6	53.9	279°06.0	20.7	223°01.8	06.5
9	139°22.4	340°41.8	·· 09.2	334°53.6	·· 53.2	294°07.9	·· 20.9	238°04.1	·· 06.5
10	154°24.8	355°41.3	08.1	349°54.6	52.6	309°09.9	21.1	253°06.5	06.5
11	169°27.3	10°40.9	07.1	4°55.6	52.0	324°11.9	21.3	268°08.8	06.5
12	184°29.7	25°40.4	N10°06.0	19°56.6	N07°51.4	339°13.9	S09°21.5	283°11.1	S22°06.5
13	199°32.2	40°40.0	04.9	34°57.6	50.8	354°15.8	21.7	298°13.5	06.5
14	214°34.7	55°39.5	03.9	49°58.5	50.2	9°17.8	21.9	313°15.8	06.6
15	229°37.1	70°39.1	·· 02.8	64°59.5	·· 49.6	24°19.8	·· 22.1	328°18.1	·· 06.6
16	244°39.6	85°38.6	01.7	80°00.5	49.0	39°21.8	22.3	343°20.5	06.6
17	259°42.1	100°38.2	10°00.7	95°01.5	48.4	54°23.8	22.5	358°22.8	06.6
18	274°44.5	115°37.7	N09°59.6	110°02.5	N07°47.8	69°25.7	S09°22.6	13°25.1	S22°06.6
19	289°47.0	130°37.2	58.5	125°03.5	47.2	84°27.7	22.8	28°27.5	06.6
20	304°49.5	145°36.8	57.5	140°04.5	46.6	99°29.7	23.0	43°29.8	06.6
21	319°51.9	160°36.3	·· 56.4	155°05.5	·· 46.0	114°31.7	·· 23.2	58°32.1	·· 06.7
22	334°54.4	175°35.9	55.3	170°06.4	45.3	129°33.6	23.4	73°34.5	06.7
23	349°56.9	190°35.4	54.3	185°07.4	44.7	144°35.6	23.6	88°36.8	06.7
Mer.pass.:23:40		v-0.5 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	4°59.3	205°35.0	N09°53.2	200°08.4	N07°44.1	159°37.6	S09°23.8	103°39.1	S22°06.7
1	20°01.8	220°34.5	52.1	215°09.4	43.5	174°39.6	24.0	118°41.4	06.7
2	35°04.2	235°34.1	51.0	230°10.4	42.9	189°41.5	24.2	133°43.8	06.7
3	50°06.7	250°33.6	·· 50.0	245°11.4	·· 42.3	204°43.5	·· 24.4	148°46.1	·· 06.7
4	65°09.2	265°33.2	48.9	260°12.4	41.7	219°45.5	24.5	163°48.4	06.8
5	80°11.6	280°32.7	47.8	275°13.4	41.1	234°47.4	24.7	178°50.8	06.8
6	95°14.1	295°32.3	N09°46.8	290°14.4	N07°40.5	249°49.4	S09°24.9	193°53.1	S22°06.8
7	110°16.6	310°31.8	45.7	305°15.4	39.9	264°51.4	25.1	208°55.4	06.8
8	125°19.0	325°31.4	44.6	320°16.3	39.3	279°53.4	25.3	223°57.8	06.8
9	140°21.5	340°30.9	·· 43.5	335°17.3	·· 38.7	294°55.3	·· 25.5	239°00.1	·· 06.8
10	155°24.0	355°30.5	42.5	350°18.3	38.0	309°57.3	25.7	254°02.4	06.8
11	170°26.4	10°30.0	41.4	5°19.3	37.4	324°59.3	25.9	269°04.7	06.9
12	185°28.9	25°29.6	N09°40.3	20°20.3	N07°36.8	340°01.3	S09°26.1	284°07.1	S22°06.9
13	200°31.3	40°29.1	39.2	35°21.3	36.2	355°03.2	26.3	299°09.4	06.9
14	215°33.8	55°28.7	38.2	50°22.3	35.6	10°05.2	26.4	314°11.7	06.9
15	230°36.3	70°28.2	·· 37.1	65°23.3	·· 35.0	25°07.2	·· 26.6	329°14.1	·· 06.9
16	245°38.7	85°27.8	36.0	80°24.3	34.4	40°09.2	26.8	344°16.4	06.9
17	260°41.2	100°27.3	34.9	95°25.3	33.8	55°11.1	27.0	359°18.7	07.0
18	275°43.7	115°26.9	N09°33.9	110°26.2	N07°33.2	70°13.1	S09°27.2	14°21.0	S22°07.0
19	290°46.1	130°26.5	32.8	125°27.2	32.6	85°15.1	27.4	29°23.4	07.0
20	305°48.6	145°26.0	31.7	140°28.2	31.9	100°17.1	27.6	44°25.7	07.0
21	320°51.1	160°25.6	·· 30.6	155°29.2	·· 31.3	115°19.0	·· 27.8	59°28.0	·· 07.0
22	335°53.5	175°25.1	29.5	170°30.2	30.7	130°21.0	28.0	74°30.4	07.0
23	350°56.0	190°24.7	28.5	185°31.2	30.1	145°23.0	28.2	89°32.7	07.0
Mer.pass.:23:36		v-0.5 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	5°58.5	205°24.2	N09°27.4	200°32.2	N07°29.5	160°25.0	S09°28.4	104°35.0	S22°07.1
1	21°00.9	220°23.8	26.3	215°33.2	28.9	175°26.9	28.5	119°37.3	07.1
2	36°03.4	235°23.3	25.2	230°34.2	28.3	190°28.9	28.7	134°39.7	07.1
3	51°05.8	250°22.9	·· 24.1	245°35.2	·· 27.7	205°30.9	·· 28.9	149°42.0	·· 07.1
4	66°08.3	265°22.4	23.0	260°36.2	27.1	220°32.8	29.1	164°44.3	07.1
5	81°10.8	280°22.0	22.0	275°37.1	26.5	235°34.8	29.3	179°46.6	07.1
6	96°13.2	295°21.6	N09°20.9	290°38.1	N07°25.8	250°36.8	S09°29.5	194°49.0	S22°07.1
7	111°15.7	310°21.1	19.8	305°39.1	25.2	265°38.8	29.7	209°51.3	07.2
8	126°18.2	325°20.7	18.7	320°40.1	24.6	280°40.7	29.9	224°53.6	07.2
9	141°20.6	340°20.2	·· 17.6	335°41.1	·· 24.0	295°42.7	·· 30.1	239°55.9	·· 07.2
10	156°23.1	355°19.8	16.5	350°42.1	23.4	310°44.7	30.3	254°58.3	07.2
11	171°25.6	10°19.3	15.4	5°43.1	22.8	325°46.6	30.4	270°00.6	07.2
12	186°28.0	25°18.9	N09°14.4	20°44.1	N07°22.2	340°48.6	S09°30.6	285°02.9	S22°07.2
13	201°30.5	40°18.5	13.3	35°45.1	21.6	355°50.6	30.8	300°05.2	07.2
14	216°33.0	55°18.0	12.2	50°46.1	21.0	10°52.6	31.0	315°07.6	07.3
15	231°35.4	70°17.6	·· 11.1	65°47.1	·· 20.4	25°54.5	·· 31.2	330°09.9	·· 07.3
16	246°37.9	85°17.1	10.0	80°48.1	19.7	40°56.5	31.4	345°12.2	07.3
17	261°40.3	100°16.7	08.9	95°49.0	19.1	55°58.5	31.6	0°14.5	07.3
18	276°42.8	115°16.2	N09°07.8	110°50.0	N07°18.5	71°00.5	S09°31.8	15°16.9	S22°07.3
19	291°45.3	130°15.8	06.7	125°51.0	17.9	86°02.4	32.0	30°19.2	07.3
20	306°47.7	145°15.4	05.6	140°52.0	17.3	101°04.4	32.2	45°21.5	07.4
21	321°50.2	160°14.9	·· 04.6	155°53.0	·· 16.7	116°06.4	·· 32.3	60°23.8	·· 07.4
22	336°52.7	175°14.5	03.5	170°54.0	16.1	131°08.3	32.5	75°26.2	07.4
23	351°55.1	190°14.0	02.4	185°55.0	15.5	146°10.3	32.7	90°28.5	07.4
Mer.pass.:23:32		v-0.4 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.3
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.0
Diphda	348°52.7	-17°53.3
Achernar	335°24.2	-57°08.8
Hamal	327°57.2	23°32.7
Polaris	316°07.4	89°20.0
Acamar	315°15.9	-40°14.0
Menkar	314°11.8	4°09.5
Mirfak	308°35.9	49°55.2
Aldebaran	290°45.9	16°32.5
Rigel	281°09.2	-8°10.9
Capella	280°30.1	46°00.6
Bellatrix	278°28.9	6°21.8
Elnath	278°08.9	28°37.1
Alnilam	275°43.4	-1°11.5
Betelgeuse	270°58.2	7°24.5
Canopus	263°54.9	-52°42.1
Sirius	258°31.2	-16°44.4
Adhara	255°10.3	-28°59.7
Procyon	244°56.8	5°10.7
Pollux	243°24.4	27°58.8
Avior	234°17.1	-59°33.8
Suhail	222°50.6	-43°30.1
Miaplacidus	221°39.6	-69°47.2
Alphard	217°53.5	-8°44.0
Regulus	207°40.7	11°52.9
Dubhe	193°48.9	61°39.3
Denebola	182°31.1	14°28.6
Gienah	175°49.7	-17°38.2
Acrux	173°06.7	-63°11.7
Gacrux	171°58.2	-57°12.6
Alioth	166°18.8	55°52.0
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.8
Hadar	148°44.3	-60°27.4
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.4
Kochab	137°21.1	74°05.3
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.9	-26°28.1
Atria	107°22.2	-69°03.6
Sabik	102°09.3	-15°44.6
Shaula	96°18.1	-37°06.9
Rasalhague	96°03.8	12°33.2
Eltanin	90°44.9	51°29.7
Kaus Aust.	83°40.0	-34°22.4
Vega	80°37.0	38°48.5
Nunki	75°54.7	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.5	-56°40.7
Deneb	49°29.2	45°21.0
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.2	28°10.9
Markab	13°35.1	15°18.2

Sep 25 Mon	SHA	Mer.pass
Venus	201°45.7	10:17
Mars	195°44.5	10:40
Jupiter	154°50.0	13:23
Saturn	98°43.0	17:06

Sep 26 Tue	SHA	Mer.pass
Venus	200°35.7	10:18
Mars	195°09.1	10:39
Jupiter	154°38.3	13:20
Saturn	98°39.8	17:03

Sep 27 Wed	SHA	Mer.pass
Venus	199°25.8	10:19
Mars	194°33.7	10:37
Jupiter	154°26.5	13:17
Saturn	98°36.6	16:59

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3193 sec ΔT = TT-UT1 = +68.8647 sec

2017 September 25 to Sep. 27 UT

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°03.4	S00°50.6	127°05.4	13.1'	S14°40.7	-6.8'	54.6'
1	197°03.6	51.6	141°37.5	13.1'	14°47.4	-6.7'	54.6'
2	212°03.8	52.5	156°09.6	13.1'	14°54.1	-6.6'	54.6'
3	227°04.1	·· 53.5	170°41.7	13.1'	15°00.7	-6.6'	54.6'
4	242°04.3	54.5	185°13.7	13.1'	15°07.2	-6.5'	54.6'
5	257°04.5	55.5	199°45.8	13.0'	15°13.7	-6.4'	54.6'
6	272°04.7	S00°56.4	214°17.8	13.0'	S15°20.1	-6.4'	54.6'
7	287°04.9	57.4	228°49.8	13.0'	15°26.4	-6.3'	54.5'
8	302°05.1	58.4	243°21.8	13.0'	15°32.7	-6.2'	54.5'
9	317°05.3	00°59.4	257°53.8	13.0'	15°38.8	-6.1'	54.5'
10	332°05.6	01°00.3	272°25.8	13.0'	15°44.9	-6.1'	54.5'
11	347°05.8	01.3	286°57.8	13.0'	15°50.9	-6.0'	54.5'
12	2°06.0	S01°02.3	301°29.7	12.9'	S15°56.9	-5.9'	54.5'
13	17°06.2	03.2	316°01.7	12.9'	16°02.8	-5.8'	54.5'
14	32°06.4	04.2	330°33.6	12.9'	16°08.6	-5.8'	54.5'
15	47°06.6	·· 05.2	345°05.5	12.9'	16°14.3	-5.7'	54.4'
16	62°06.8	06.2	359°37.4	12.9'	16°19.9	-5.6'	54.4'
17	77°07.1	07.1	14°09.3	12.9'	16°25.5	-5.5'	54.4'
18	92°07.3	S01°08.1	28°41.1	12.9'	S16°31.0	-5.5'	54.4'
19	107°07.5	09.1	43°13.0	12.8'	16°36.4	-5.4'	54.4'
20	122°07.7	10.1	57°44.8	12.8'	16°41.8	-5.3'	54.4'
21	137°07.9	·· 11.0	72°16.6	12.8'	16°47.0	-5.2'	54.4'
22	152°08.1	12.0	86°48.4	12.8'	16°52.2	-5.1'	54.4'
23	167°08.4	13.0	101°20.2	12.8'	16°57.3	-5.1'	54.4'
	SD.=15.9	d=-1.0	S.D.=14.8				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	182°08.6	S01°14.0	115°52.0	12.8'	S17°02.4	-5.0'	54.4'
1	197°08.8	14.9	130°23.8	12.8'	17°07.3	-4.9'	54.3'
2	212°09.0	15.9	144°55.5	12.7'	17°12.2	-4.8'	54.3'
3	227°09.2	·· 16.9	159°27.2	12.7'	17°17.0	-4.8'	54.3'
4	242°09.4	17.9	173°58.9	12.7'	17°21.7	-4.7'	54.3'
5	257°09.6	18.8	188°30.6	12.7'	17°26.3	-4.6'	54.3'
6	272°09.8	S01°19.8	203°02.3	12.7'	S17°30.9	-4.5'	54.3'
7	287°10.1	20.8	217°34.0	12.7'	17°35.4	-4.4'	54.3'
8	302°10.3	21.7	232°05.6	12.6'	17°39.8	-4.4'	54.3'
9	317°10.5	·· 22.7	246°37.3	12.6'	17°44.1	-4.3'	54.3'
10	332°10.7	23.7	261°08.9	12.6'	17°48.3	-4.2'	54.3'
11	347°10.9	24.7	275°40.5	12.6'	17°52.5	-4.1'	54.3'
12	2°11.1	S01°25.6	290°12.1	12.6'	S17°56.5	-4.0'	54.3'
13	17°11.3	26.6	304°43.6	12.6'	18°00.5	-3.9'	54.3'
14	32°11.6	27.6	319°15.2	12.5'	18°04.4	-3.9'	54.3'
15	47°11.8	·· 28.6	333°46.7	12.5'	18°08.2	-3.8'	54.3'
16	62°12.0	29.5	348°18.3	12.5'	18°12.0	-3.7'	54.2'
17	77°12.2	30.5	2°49.8	12.5'	18°15.6	-3.6'	54.2'
18	92°12.4	S01°31.5	17°21.3	12.5'	S18°19.2	-3.5'	54.2'
19	107°12.6	32.5	31°52.8	12.5'	18°22.7	-3.4'	54.2'
20	122°12.8	33.4	46°24.2	12.5'	18°26.1	-3.4'	54.2'
21	137°13.0	·· 34.4	60°55.7	12.4'	18°29.4	-3.3'	54.2'
22	152°13.3	35.4	75°27.1	12.4'	18°32.6	-3.2'	54.2'
23	167°13.5	36.3	89°58.5	12.4'	18°35.8	-3.1'	54.2'
	SD.=15.9	d=-1.0	S.D.=14.8				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	182°13.7	S01°37.3	104°29.9	12.4'	S18°38.8	-3.0'	54.2'
1	197°13.9	38.3	119°01.3	12.4'	18°41.8	-2.9'	54.2'
2	212°14.1	39.3	133°32.7	12.4'	18°44.7	-2.8'	54.2'
3	227°14.3	·· 40.2	148°04.0	12.4'	18°47.5	-2.8'	54.2'
4	242°14.5	41.2	162°35.4	12.3'	18°50.2	-2.7'	54.2'
5	257°14.7	42.2	177°06.7	12.3'	18°52.9	-2.6'	54.2'
6	272°15.0	S01°43.2	191°38.0	12.3'	S18°55.4	-2.5'	54.2'
7	287°15.2	44.1	206°09.3	12.3'	18°57.9	-2.4'	54.2'
8	302°15.4	45.1	220°40.6	12.3'	19°00.3	-2.3'	54.2'
9	317°15.6	·· 46.1	235°11.9	12.3'	19°02.5	-2.2'	54.2'
10	332°15.8	47.1	249°43.2	12.3'	19°04.7	-2.2'	54.2'
11	347°16.0	48.0	264°14.4	12.2'	19°06.9	-2.1'	54.2'
12	2°16.2	S01°49.0	278°45.6	12.2'	S19°08.9	-2.0'	54.2'
13	17°16.4	50.0	293°16.8	12.2'	19°10.8	-1.9'	54.2'
14	32°16.6	50.9	307°48.1	12.2'	19°12.7	-1.8'	54.2'
15	47°16.9	·· 51.9	322°19.2	12.2'	19°14.4	-1.7'	54.2'
16	62°17.1	52.9	336°50.4	12.2'	19°16.1	-1.6'	54.2'
17	77°17.3	53.9	351°21.6	12.2'	19°17.7	-1.5'	54.2'
18	92°17.5	S01°54.8	5°52.7	12.1'	S19°19.2	-1.5'	54.2'
19	107°17.7	55.8	20°23.9	12.1'	19°20.6	-1.4'	54.2'
20	122°17.9	56.8	34°55.0	12.1'	19°21.9	-1.3'	54.2'
21	137°18.1	·· 57.8	49°26.1	12.1'	19°23.1	-1.2'	54.2'
22	152°18.3	58.7	63°57.2	12.1'	19°24.3	-1.1'	54.3'
23	167°18.5	59.7	78°28.3	12.1'	19°25.3	-1.0'	54.3'
	SD.=15.9	d=-1.0	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	03:23	04:49	05:57	17:43	18:50	20:15
N 70°	03:39	04:55	05:56	17:44	18:45	20:00
68°	03:52	05:00	05:56	17:45	18:40	19:48
66°	04:02	05:04	05:55	17:46	18:37	19:38
64°	04:10	05:07	05:55	17:46	18:33	19:30
62°	04:17	05:10	05:54	17:47	18:31	19:24
60°	04:23	05:12	05:54	17:47	18:29	19:18
N 58°	04:28	05:14	05:54	17:48	18:27	19:13
56°	04:32	05:16	05:53	17:48	18:25	19:09
54°	04:36	05:18	05:53	17:48	18:24	19:05
52°	04:39	05:19	05:53	17:49	18:22	19:02
50°	04:42	05:20	05:53	17:49	18:21	18:59
45°	04:48	05:23	05:52	17:50	18:19	18:53
N 40°	04:53	05:24	05:51	17:50	18:17	18:49
35°	04:56	05:26	05:51	17:51	18:16	18:46
30°	04:59	05:27	05:51	17:51	18:15	18:43
20°	05:02	05:28	05:50	17:52	18:14	18:40
N 10°	05:04	05:28	05:49	17:53	18:14	18:39
0°	05:03	05:27	05:48	17:54	18:15	18:39
S 10°	05:02	05:26	05:47	17:56	18:17	18:41
20°	04:58	05:24	05:46	17:57	18:19	18:45
30°	04:53	05:21	05:44	17:59	18:22	18:50
35°	04:49	05:18	05:44	18:00	18:25	18:54
40°	04:44	05:16	05:43	18:01	18:28	19:00
45°	04:37	05:12	05:41	18:02	18:31	19:06
S 50°	04:29	05:08	05:40	18:04	18:36	19:14
52°	04:25	05:05	05:39	18:04	18:38	19:19
54°	04:21	05:03	05:38	18:05	18:41	19:23
56°	04:16	05:00	05:38	18:06	18:44	19:28
58°	04:10	04:57	05:37	18:07	18:47	19:34
S 60°	04:03	04:54	05:36	18:08	18:50	19:41

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	14:13	▬	▬	17:39	▬	▬
N 70°	13:28	15:04	16:34	18:25	18:26	18:35
68°	12:59	14:21	15:33	18:55	19:10	19:36
66°	12:37	13:53	14:59	19:18	19:39	20:11
64°	12:20	13:31	14:34	19:36	20:01	20:36
62°	12:05	13:13	14:14	19:51	20:18	20:55
60°	11:53	12:59	13:58	20:03	20:33	21:11
N 58°	11:43	12:47	13:45	20:14	20:46	21:25
56°	11:34	12:36	13:33	20:23	20:57	21:37
54°	11:26	12:27	13:23	20:31	21:06	21:47
52°	11:19	12:19	13:14	20:39	21:15	21:56
50°	11:12	12:11	13:06	20:46	21:22	22:04
45°	10:59	11:55	12:48	21:00	21:39	22:22
N 40°	10:47	11:42	12:34	21:12	21:52	22:36
35°	10:38	11:31	12:22	21:22	22:03	22:48
30°	10:29	11:21	12:12	21:31	22:13	22:59
20°	10:15	11:05	11:54	21:47	22:31	23:17
N 10°	10:02	10:50	11:39	22:00	22:46	23:33
0°	09:50	10:37	11:24	22:13	23:00	23:47
S 10°	09:39	10:24	11:10	22:25	23:14	–:–
20°	09:26	10:09	10:54	22:39	23:29	–:–
30°	09:12	09:53	10:37	22:55	23:46	–:–
35°	09:04	09:43	10:26	23:04	23:56	–:–
40°	08:54	09:33	10:15	23:14	–:–	00:08
45°	08:44	09:20	10:01	23:26	–:–	00:21
S 50°	08:30	09:05	09:44	23:41	–:–	00:38
52°	08:24	08:57	09:36	23:48	–:–	00:45
54°	08:18	08:50	09:27	23:55	–:–	00:54
56°	08:10	08:41	09:17	–:–	00:04	01:04
58°	08:02	08:31	09:06	–:–	00:14	01:15
S 60°	07:52	08:19	08:53	–:–	00:25	01:28

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 5-7 26-44%
25	08:14	08:24	11:52	16:02	03:38	
26	08:34	08:45	11:51	16:48	04:25	
27	08:55	09:05	11:51	17:36	05:12	

September 28, 29, 30 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	6°57.6	205°13.6	N09°01.3	200°56.0	N07°14.9	161°12.3	S09°32.9	105°30.8	S22°07.4
1	22°00.1	220°13.2	09°00.2	215°57.0	14.2	176°14.3	33.1	120°33.1	07.4
2	37°02.5	235°12.7	08°59.1	230°58.0	13.6	191°16.2	33.3	135°35.5	07.4
3	52°05.0	250°12.3	·· 58.0	245°59.0	·· 13.0	206°18.2	·· 33.5	150°37.8	·· 07.5
4	67°07.4	265°11.8	56.9	261°00.0	12.4	221°20.2	33.7	165°40.1	07.5
5	82°09.9	280°11.4	55.8	276°01.0	11.8	236°22.1	33.9	180°42.4	07.5
6	97°12.4	295°11.0	N08°54.7	291°01.9	N07°11.2	251°24.1	S09°34.1	195°44.7	S22°07.5
7	112°14.8	310°10.5	53.6	306°02.9	10.6	266°26.1	34.3	210°47.1	07.5
8	127°17.3	325°10.1	52.5	321°03.9	10.0	281°28.0	34.4	225°49.4	07.5
9	142°19.8	340°09.6	·· 51.4	336°04.9	·· 09.3	296°30.0	·· 34.6	240°51.7	·· 07.5
10	157°22.2	355°09.2	50.3	351°05.9	08.7	311°32.0	34.8	255°54.0	07.6
11	172°24.7	10°08.8	49.2	6°06.9	08.1	326°34.0	35.0	270°56.4	07.6
12	187°27.2	25°08.3	N08°48.1	21°07.9	N07°07.5	341°35.9	S09°35.2	285°58.7	S22°07.6
13	202°29.6	40°07.9	47.0	36°08.9	06.9	356°37.9	35.4	301°01.0	07.6
14	217°32.1	55°07.5	45.9	51°09.9	06.3	11°39.9	35.6	316°03.3	07.6
15	232°34.6	70°07.0	·· 44.8	66°10.9	·· 05.7	26°41.8	·· 35.8	331°05.6	·· 07.6
16	247°37.0	85°06.6	43.7	81°11.9	05.1	41°43.8	36.0	346°08.0	07.6
17	262°39.5	100°06.2	42.6	96°12.9	04.4	56°45.8	36.2	1°10.3	07.7
18	277°41.9	115°05.7	N08°41.5	111°13.9	N07°03.8	71°47.8	S09°36.3	16°12.6	S22°07.7
19	292°44.4	130°05.3	40.4	126°14.9	03.2	86°49.7	36.5	31°14.9	07.7
20	307°46.9	145°04.8	39.3	141°15.9	02.6	101°51.7	36.7	46°17.2	07.7
21	322°49.3	160°04.4	·· 38.2	156°16.9	·· 02.0	116°53.7	·· 36.9	61°19.6	·· 07.7
22	337°51.8	175°04.0	37.1	171°17.8	01.4	131°55.6	37.1	76°21.9	07.7
23	352°54.3	190°03.5	36.0	186°18.8	00.8	146°57.6	37.3	91°24.2	07.8
Mer.pass.:23:28		v-0.4 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	7°56.7	205°03.1	N08°34.9	201°19.8	N07°00.2	161°59.6	S09°37.5	106°26.5	S22°07.8
1	22°59.2	220°02.7	33.8	216°20.8	06°59.5	177°01.5	37.7	121°28.8	07.8
2	38°01.7	235°02.2	32.7	231°21.8	58.9	192°03.5	37.9	136°31.2	07.8
3	53°04.1	250°01.8	·· 31.6	246°22.8	·· 58.3	207°05.5	·· 38.1	151°33.5	·· 07.8
4	68°06.6	265°01.4	30.5	261°23.8	57.7	222°07.4	38.3	166°35.8	07.8
5	83°09.1	280°00.9	29.4	276°24.8	57.1	237°09.4	38.4	181°38.1	07.8
6	98°11.5	295°00.5	N08°28.3	291°25.8	N06°56.5	252°11.4	S09°38.6	196°40.4	S22°07.9
7	113°14.0	310°00.1	27.2	306°26.8	55.9	267°13.4	38.8	211°42.7	07.9
8	128°16.4	324°59.6	26.1	321°27.8	55.2	282°15.3	39.0	226°45.1	07.9
9	143°18.9	339°59.2	·· 25.0	336°28.8	·· 54.6	297°17.3	·· 39.2	241°47.4	·· 07.9
10	158°21.4	354°58.8	23.9	351°29.8	54.0	312°19.3	39.4	256°49.7	07.9
11	173°23.8	9°58.3	22.7	6°30.8	53.4	327°21.2	39.6	271°52.0	07.9
12	188°26.3	24°57.9	N08°21.6	21°31.8	N06°52.8	342°23.2	S09°39.8	286°54.3	S22°07.9
13	203°28.8	39°57.5	20.5	36°32.8	52.2	357°25.2	40.0	301°56.7	08.0
14	218°31.2	54°57.1	19.4	51°33.8	51.6	12°27.1	40.2	316°59.0	08.0
15	233°33.7	69°56.6	·· 18.3	66°34.8	·· 51.0	27°29.1	·· 40.4	332°01.3	·· 08.0
16	248°36.2	84°56.2	17.2	81°35.8	50.3	42°31.1	40.5	347°03.6	08.0
17	263°38.6	99°55.8	16.1	96°36.8	49.7	57°33.0	40.7	2°05.9	08.0
18	278°41.1	114°55.3	N08°15.0	111°37.7	N06°49.1	72°35.0	S09°40.9	17°08.2	S22°08.0
19	293°43.5	129°54.9	13.9	126°38.7	48.5	87°37.0	41.1	32°10.6	08.1
20	308°46.0	144°54.5	12.7	141°39.7	47.9	102°38.9	41.3	47°12.9	08.1
21	323°48.5	159°54.0	·· 11.6	156°40.7	·· 47.3	117°40.9	·· 41.5	62°15.2	·· 08.1
22	338°50.9	174°53.6	10.5	171°41.7	46.7	132°42.9	41.7	77°17.5	08.1
23	353°53.4	189°53.2	09.4	186°42.7	46.0	147°44.9	41.9	92°19.8	08.1
Mer.pass.:23:24		v-0.4 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	8°55.9	204°52.8	N08°08.3	201°43.7	N06°45.4	162°46.8	S09°42.1	107°22.1	S22°08.1
1	23°58.3	219°52.3	07.2	216°44.7	44.8	177°48.8	42.3	122°24.4	08.1
2	39°00.8	234°51.9	06.1	231°45.7	44.2	192°50.8	42.4	137°26.8	08.2
3	54°03.3	249°51.5	·· 04.9	246°46.7	·· 43.6	207°52.7	·· 42.6	152°29.1	·· 08.2
4	69°05.7	264°51.0	03.8	261°47.7	43.0	222°54.7	42.8	167°31.4	08.2
5	84°08.2	279°50.6	02.7	276°48.7	42.3	237°56.7	43.0	182°33.7	08.2
6	99°10.7	294°50.2	N08°01.6	291°49.7	N06°41.7	252°58.6	S09°43.2	197°36.0	S22°08.2
7	114°13.1	309°49.8	08°00.5	306°50.7	41.1	268°00.6	43.4	212°38.3	08.2
8	129°15.6	324°49.3	07°59.4	321°51.7	40.5	283°02.6	43.6	227°40.6	08.3
9	144°18.0	339°48.9	·· 58.2	336°52.7	·· 39.9	298°04.5	·· 43.8	242°43.0	·· 08.3
10	159°20.5	354°48.5	57.1	351°53.7	39.3	313°06.5	44.0	257°45.3	08.3
11	174°23.0	9°48.0	56.0	6°54.7	38.7	328°08.5	44.2	272°47.6	08.3
12	189°25.4	24°47.6	N07°54.9	21°55.7	N06°38.0	343°10.4	S09°44.4	287°49.9	S22°08.3
13	204°27.9	39°47.2	53.8	36°56.7	37.4	358°12.4	44.5	302°52.2	08.3
14	219°30.4	54°46.8	52.7	51°57.7	36.8	13°14.4	44.7	317°54.5	08.3
15	234°32.8	69°46.3	·· 51.5	66°58.7	·· 36.2	28°16.3	·· 44.9	332°56.8	·· 08.4
16	249°35.3	84°45.9	50.4	81°59.7	35.6	43°18.3	45.1	347°59.2	08.4
17	264°37.8	99°45.5	49.3	97°00.7	35.0	58°20.3	45.3	3°01.5	08.4
18	279°40.2	114°45.1	N07°48.2	112°01.7	N06°34.4	73°22.2	S09°45.5	18°03.8	S22°08.4
19	294°42.7	129°44.6	47.0	127°02.7	33.7	88°24.2	45.7	33°06.1	08.4
20	309°45.2	144°44.2	45.9	142°03.7	33.1	103°26.2	45.9	48°08.4	08.4
21	324°47.6	159°43.8	·· 44.8	157°04.7	·· 32.5	118°28.1	·· 46.1	63°10.7	·· 08.4
22	339°50.1	174°43.4	43.7	172°05.7	31.9	133°30.1	46.3	78°13.0	08.5
23	354°52.5	189°42.9	42.6	187°06.6	31.3	148°32.1	46.5	93°15.3	08.5
Mer.pass.:23:20		v-0.4 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.0
Diphda	348°52.7	-17°53.3
Achernar	335°24.1	-57°08.8
Hamal	327°57.2	23°32.7
Polaris	316°06.3	89°20.0
Acamar	315°15.9	-40°14.0
Menkar	314°11.8	4°09.5
Mirfak	308°35.8	49°55.2
Aldebaran	290°45.9	16°32.5
Rigel	281°09.2	-8°10.9
Capella	280°30.0	46°00.6
Bellatrix	278°28.8	6°21.8
Elnath	278°08.9	28°37.1
Alnilam	275°43.4	-1°11.5
Betelgeuse	270°58.1	7°24.5
Canopus	263°54.8	-52°42.1
Sirius	258°31.2	-16°44.4
Adhara	255°10.3	-28°59.7
Procyon	244°56.8	5°10.7
Pollux	243°24.4	27°58.8
Avior	234°17.1	-59°33.8
Suhail	222°50.6	-43°30.0
Miaplacidus	221°39.6	-69°47.2
Alphard	217°53.5	-8°44.0
Regulus	207°40.7	11°52.9
Dubhe	193°48.9	61°39.3
Denebola	182°31.1	14°28.6
Gienah	175°49.6	-17°38.2
Acrux	173°06.7	-63°11.7
Gacrux	171°58.2	-57°12.6
Alioth	166°18.8	55°52.0
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.8
Hadar	148°44.3	-60°27.4
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.4
Kochab	137°21.2	74°05.3
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.9	-26°28.1
Atria	107°22.3	-69°03.6
Sabik	102°09.3	-15°44.6
Shaula	96°18.1	-37°06.9
Rasalhague	96°03.9	12°33.2
Eltanin	90°44.9	51°29.7
Kaus Aust.	83°40.0	-34°22.4
Vega	80°37.0	38°48.5
Nunki	75°54.7	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.5	-56°40.7
Deneb	49°29.2	45°21.0
Enif	33°44.0	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.2	28°10.9
Markab	13°35.1	15°18.2

Sep 28 Thu	SHA	Mer.pass
Venus	198°16.0	10:19
Mars	193°58.4	10:36
Jupiter	154°14.7	13:13
Saturn	98°33.2	16:55

Sep 29 Fri	SHA	Mer.pass
Venus	197°06.4	10:20
Mars	193°23.1	10:34
Jupiter	154°02.8	13:10
Saturn	98°29.8	16:52

Sep 30 Sat	SHA	Mer.pass
Venus	195°56.9	10:21
Mars	192°47.9	10:32
Jupiter	153°51.0	13:07
Saturn	98°26.3	16:48

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3172 sec ΔT = TT-UT1 = +68.8668 sec

2017 September 28 to Sep. 30 UT

h

	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	**ν**	**Dec**	**d**	**HP**
0	182°18.7	S02°00.7	92°59.4	12.1'	S19°26.3	-0.9'	54.3'
1	197°19.0	01.6	107°30.4	12.1'	19°27.1	-0.8'	54.3'
2	212°19.2	02.6	122°01.5	12.0'	19°27.9	-0.7'	54.3'
3	227°19.4	· · 03.6	136°32.5	12.0'	19°28.6	-0.6'	54.3'
4	242°19.6	04.6	151°03.6	12.0'	19°29.2	-0.6'	54.3'
5	257°19.8	05.5	165°34.6	12.0'	19°29.7	-0.5'	54.3'
6	272°20.0	S02°06.5	180°05.6	12.0'	S19°30.1	-0.4'	54.3'
7	287°20.2	07.5	194°36.6	12.0'	19°30.5	-0.3'	54.3'
8	302°20.4	08.5	209°07.6	12.0'	19°30.7	-0.2'	54.3'
9	317°20.6	· · 09.4	223°38.6	12.0'	19°30.8	-0.1'	54.3'
10	332°20.8	10.4	238°09.5	12.0'	19°30.9	-0.0'	54.3'
11	347°21.1	11.4	252°40.5	12.0'	19°30.9	0.1'	54.3'
12	2°21.3	S02°12.3	267°11.4	11.9'	S19°30.7	0.2'	54.3'
13	17°21.5	13.3	281°42.4	11.9'	19°30.5	0.3'	54.4'
14	32°21.7	14.3	296°13.3	11.9'	19°30.2	0.4'	54.4'
15	47°21.9	· · 15.3	310°44.2	11.9'	19°29.8	0.4'	54.4'
16	62°22.1	16.2	325°15.1	11.9'	19°29.3	0.5'	54.4'
17	77°22.3	17.2	339°46.0	11.9'	19°28.7	0.6'	54.4'
18	92°22.5	S02°18.2	354°16.9	11.9'	S19°28.1	0.7'	54.4'
19	107°22.7	19.1	8°47.8	11.9'	19°27.3	0.8'	54.4'
20	122°22.9	20.1	23°18.7	11.9'	19°26.5	0.9'	54.4'
21	137°23.1	· · 21.1	37°49.6	11.9'	19°25.5	1.0'	54.4'
22	152°23.4	22.1	52°20.4	11.9'	19°24.5	1.1'	54.4'
23	167°23.6	23.0	66°51.3	11.8'	19°23.3	1.2'	54.5'
	SD.=16.0	d=-1.0	S.D.=14.8				

Fri	**GHA**	**Dec**	**GHA**	**ν**	**Dec**	**d**	**HP**
0	182°23.8	S02°24.0	81°22.1	11.8'	S19°22.1	1.3'	54.5'
1	197°24.0	25.0	95°53.0	11.8'	19°20.8	1.4'	54.5'
2	212°24.2	26.0	110°23.8	11.8'	19°19.4	1.5'	54.5'
3	227°24.4	· · 26.9	124°54.6	11.8'	19°17.9	1.5'	54.5'
4	242°24.6	27.9	139°25.4	11.8'	19°16.3	1.6'	54.5'
5	257°24.8	28.9	153°56.2	11.8'	19°14.6	1.7'	54.5'
6	272°25.0	S02°29.8	168°27.1	11.8'	S19°12.8	1.8'	54.6'
7	287°25.2	30.8	182°57.9	11.8'	19°11.0	1.9'	54.6'
8	302°25.4	31.8	197°28.7	11.8'	19°09.0	2.0'	54.6'
9	317°25.6	· · 32.8	211°59.4	11.8'	19°07.0	2.1'	54.6'
10	332°25.8	33.7	226°30.2	11.8'	19°04.8	2.2'	54.6'
11	347°26.0	34.7	241°01.0	11.8'	19°02.6	2.3'	54.6'
12	2°26.3	S02°35.7	255°31.8	11.8'	S19°00.3	2.4'	54.6'
13	17°26.5	36.6	270°02.5	11.8'	18°57.9	2.5'	54.7'
14	32°26.7	37.6	284°33.3	11.8'	18°55.4	2.6'	54.7'
15	47°26.9	· · 38.6	299°04.1	11.8'	18°52.8	2.6'	54.7'
16	62°27.1	39.6	313°34.8	11.8'	18°50.1	2.7'	54.7'
17	77°27.3	40.5	328°05.6	11.8'	18°47.3	2.8'	54.7'
18	92°27.5	S02°41.5	342°36.3	11.7'	S18°44.4	2.9'	54.7'
19	107°27.7	42.5	357°07.1	11.7'	18°41.5	3.0'	54.8'
20	122°27.9	43.4	11°37.8	11.7'	18°38.4	3.1'	54.8'
21	137°28.1	· · 44.4	26°08.6	11.7'	18°35.3	3.2'	54.8'
22	152°28.3	45.4	40°39.3	11.7'	18°32.0	3.3'	54.8'
23	167°28.5	46.3	55°10.0	11.7'	18°28.7	3.4'	54.8'
	SD.=16.0	d=-1.0	S.D.=14.9				

Sat	**GHA**	**Dec**	**GHA**	**ν**	**Dec**	**d**	**HP**
0	182°28.7	S02°47.3	69°40.8	11.7'	S18°25.3	3.5'	54.9'
1	197°28.9	48.3	84°11.5	11.7'	18°21.8	3.6'	54.9'
2	212°29.1	49.3	98°42.2	11.7'	18°18.2	3.6'	54.9'
3	227°29.3	· · 50.2	113°12.9	11.7'	18°14.5	3.7'	54.9'
4	242°29.5	51.2	127°43.7	11.7'	18°10.7	3.8'	54.9'
5	257°29.8	52.2	142°14.4	11.7'	18°06.8	3.9'	54.9'
6	272°30.0	S02°53.1	156°45.1	11.7'	S18°02.9	4.0'	55.0'
7	287°30.2	54.1	171°15.8	11.7'	17°58.8	4.1'	55.0'
8	302°30.4	55.1	185°46.5	11.7'	17°54.7	4.2'	55.0'
9	317°30.6	· · 56.1	200°17.2	11.7'	17°50.5	4.3'	55.0'
10	332°30.8	57.0	214°47.9	11.7'	17°46.2	4.4'	55.1'
11	347°31.0	58.0	229°18.6	11.7'	17°41.8	4.4'	55.1'
12	2°31.2	S02°59.0	243°49.4	11.7'	S17°37.3	4.5'	55.1'
13	17°31.4	02°59.9	258°20.1	11.7'	17°32.7	4.6'	55.1'
14	32°31.6	03°00.9	272°50.8	11.7'	17°28.0	4.7'	55.1'
15	47°31.8	· · 01.9	287°21.5	11.7'	17°23.2	4.8'	55.2'
16	62°32.0	02.8	301°52.2	11.7'	17°18.4	4.9'	55.2'
17	77°32.2	03.8	316°22.9	11.7'	17°13.5	5.0'	55.2'
18	92°32.4	S03°04.8	330°53.6	11.7'	S17°08.4	5.1'	55.2'
19	107°32.6	05.8	345°24.3	11.7'	17°03.3	5.2'	55.3'
20	122°32.8	06.7	359°55.0	11.7'	16°58.1	5.2'	55.3'
21	137°33.0	· · 07.7	14°25.7	11.7'	16°52.8	5.3'	55.3'
22	152°33.2	08.7	28°56.4	11.7'	16°47.5	5.4'	55.3'
23	167°33.4	09.6	43°27.1	11.7'	16°42.0	5.5'	55.4'
	SD.=16.0	d=-1.0	S.D.=15.0				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	03:39	05:03	06:10	17:28	18:35	19:57
N 70°	03:53	05:07	06:08	17:30	18:31	19:44
68°	04:04	05:11	06:06	17:32	18:28	19:34
66°	04:12	05:14	06:05	17:34	18:25	19:26
64°	04:19	05:16	06:03	17:36	18:23	19:19
62°	04:25	05:18	06:02	17:37	18:21	19:13
60°	04:31	05:20	06:01	17:38	18:19	19:08
N 58°	04:35	05:21	06:00	17:39	18:18	19:04
56°	04:39	05:22	05:59	17:40	18:17	19:00
54°	04:42	05:23	05:58	17:41	18:16	18:57
52°	04:45	05:24	05:58	17:42	18:15	18:55
50°	04:47	05:25	05:57	17:43	18:15	18:52
45°	04:52	05:26	05:56	17:44	18:13	18:47
N 40°	04:56	05:27	05:54	17:45	18:12	18:44
35°	04:59	05:28	05:53	17:47	18:12	18:41
30°	05:01	05:28	05:52	17:48	18:12	18:39
20°	05:03	05:28	05:50	17:50	18:12	18:37
N 10°	05:03	05:28	05:49	17:52	18:13	18:37
0°	05:02	05:26	05:47	17:53	18:14	18:38
S 10°	05:00	05:24	05:45	17:55	18:16	18:41
20°	04:55	05:21	05:43	17:58	18:20	18:45
30°	04:49	05:17	05:41	18:00	18:24	18:52
35°	04:44	05:14	05:39	18:02	18:27	18:57
40°	04:39	05:11	05:38	18:04	18:31	19:03
45°	04:31	05:06	05:36	18:06	18:35	19:10
S 50°	04:22	05:01	05:33	18:08	18:41	19:20
52°	04:18	04:58	05:32	18:09	18:43	19:24
54°	04:13	04:55	05:31	18:11	18:46	19:29
56°	04:07	04:52	05:30	18:12	18:50	19:35
58°	04:00	04:48	05:28	18:14	18:54	19:42
S 60°	03:53	04:44	05:26	18:16	18:58	19:50

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▬	▬	18:46	▬	▬	21:24
N 70°	17:32	17:48	17:50	19:16	20:41	22:19
68°	16:27	16:59	17:17	20:22	21:30	22:52
66°	15:51	16:28	16:52	20:58	22:00	23:16
64°	15:25	16:05	16:33	21:23	22:23	23:35
62°	15:05	15:46	16:17	21:43	22:42	23:50
60°	14:49	15:31	16:04	21:59	22:57	–:–
N 58°	14:35	15:18	15:53	22:13	23:09	–:–
56°	14:23	15:07	15:43	22:25	23:21	–:–
54°	14:13	14:57	15:34	22:35	23:30	–:–
52°	14:04	14:48	15:26	22:44	23:39	–:–
50°	13:56	14:40	15:19	22:52	23:47	–:–
45°	13:38	14:23	15:04	23:10	–:–	00:03
N 40°	13:24	14:09	14:52	23:24	–:–	00:16
35°	13:11	13:58	14:41	23:36	–:–	00:28
30°	13:01	13:48	14:32	23:47	–:–	00:38
20°	12:43	13:30	14:16	–:–	00:05	00:55
N 10°	12:27	13:15	14:02	–:–	00:21	01:10
0°	12:12	13:00	13:49	–:–	00:35	01:24
S 10°	11:57	12:46	13:36	00:02	00:50	01:37
20°	11:41	12:31	13:21	00:18	01:06	01:52
30°	11:23	12:13	13:05	00:36	01:24	02:09
35°	11:13	12:03	12:56	00:46	01:34	02:19
40°	11:01	11:51	12:45	00:58	01:46	02:30
45°	10:46	11:37	12:33	01:13	02:00	02:43
S 50°	10:29	11:20	12:17	01:30	02:17	02:59
52°	10:21	11:12	12:10	01:38	02:25	03:06
54°	10:12	11:03	12:02	01:47	02:34	03:15
56°	10:01	10:53	11:53	01:57	02:44	03:24
58°	09:50	10:42	11:43	02:09	02:56	03:34
S 60°	09:36	10:29	11:31	02:23	03:09	03:46

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 8-10 54-72%
28	09:15	09:25	11:51	18:24	06:00	
29	09:35	09:45	11:50	19:12	06:48	
30	09:55	10:05	11:50	20:00	07:36	

October 01, 02, 03 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	9°55.0	204°42.5	N07°41.4	202°07.6	N06°30.7	163°34.0	S09°46.6	108°17.7	S22°08.5
1	24°57.5	219°42.1	40.3	217°08.6	30.0	178°36.0	46.8	123°20.0	08.5
2	39°59.9	234°41.7	39.2	232°09.6	29.4	193°38.0	47.0	138°22.3	08.5
3	55°02.4	249°41.2	·· 38.1	247°10.6	·· 28.8	208°39.9	·· 47.2	153°24.6	·· 08.5
4	70°04.9	264°40.8	36.9	262°11.6	28.2	223°41.9	47.4	168°26.9	08.6
5	85°07.3	279°40.4	35.8	277°12.6	27.6	238°43.9	47.6	183°29.2	08.6
6	100°09.8	294°40.0	N07°34.7	292°13.6	N06°27.0	253°45.8	S09°47.8	198°31.5	S22°08.6
7	115°12.3	309°39.6	33.6	307°14.6	26.3	268°47.8	48.0	213°33.8	08.6
8	130°14.7	324°39.1	32.4	322°15.6	25.7	283°49.8	48.2	228°36.1	08.6
9	145°17.2	339°38.7	·· 31.3	337°16.6	·· 25.1	298°51.7	·· 48.4	243°38.5	·· 08.6
10	160°19.6	354°38.3	30.2	352°17.6	24.5	313°53.7	48.6	258°40.8	08.6
11	175°22.1	9°37.9	29.0	7°18.6	23.9	328°55.7	48.7	273°43.1	08.7
12	190°24.6	24°37.4	N07°27.9	22°19.6	N06°23.3	343°57.6	S09°48.9	288°45.4	S22°08.7
13	205°27.0	39°37.0	26.8	37°20.6	22.6	358°59.6	49.1	303°47.7	08.7
14	220°29.5	54°36.6	25.7	52°21.6	22.0	14°01.6	49.3	318°50.0	08.7
15	235°32.0	69°36.2	·· 24.5	67°22.6	·· 21.4	29°03.5	·· 49.5	333°52.3	·· 08.7
16	250°34.4	84°35.8	23.4	82°23.6	20.8	44°05.5	49.7	348°54.6	08.7
17	265°36.9	99°35.3	22.3	97°24.6	20.2	59°07.4	49.9	3°56.9	08.8
18	280°39.4	114°34.9	N07°21.1	112°25.6	N06°19.6	74°09.4	S09°50.1	18°59.2	S22°08.8
19	295°41.8	129°34.5	20.0	127°26.6	18.9	89°11.4	50.3	34°01.5	08.8
20	310°44.3	144°34.1	18.9	142°27.6	18.3	104°13.3	50.5	49°03.9	08.8
21	325°46.8	159°33.7	·· 17.7	157°28.6	·· 17.7	119°15.3	·· 50.7	64°06.2	·· 08.8
22	340°49.2	174°33.2	16.6	172°29.6	17.1	134°17.3	50.8	79°08.5	08.8
23	355°51.7	189°32.8	15.5	187°30.6	16.5	149°19.2	51.0	94°10.8	08.8
Mer.pass.:23:17		v-0.4 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	10°54.1	204°32.4	N07°14.3	202°31.6	N06°15.9	164°21.2	S09°51.2	109°13.1	S22°08.9
1	25°56.6	219°32.0	13.2	217°32.6	15.2	179°23.2	51.4	124°15.4	08.9
2	40°59.1	234°31.6	12.1	232°33.6	14.6	194°25.1	51.6	139°17.7	08.9
3	56°01.5	249°31.1	·· 10.9	247°34.6	·· 14.0	209°27.1	·· 51.8	154°20.0	·· 08.9
4	71°04.0	264°30.7	09.8	262°35.6	13.4	224°29.1	52.0	169°22.3	08.9
5	86°06.5	279°30.3	08.7	277°36.6	12.8	239°31.0	52.2	184°24.6	08.9
6	101°08.9	294°29.9	N07°07.5	292°37.6	N06°12.2	254°33.0	S09°52.4	199°26.9	S22°09.0
7	116°11.4	309°29.5	06.4	307°38.6	11.5	269°35.0	52.6	214°29.2	09.0
8	131°13.9	324°29.0	05.3	322°39.6	10.9	284°36.9	52.8	229°31.5	09.0
9	146°16.3	339°28.6	·· 04.1	337°40.6	·· 10.3	299°38.9	·· 52.9	244°33.8	·· 09.0
10	161°18.8	354°28.2	03.0	352°41.6	09.7	314°40.8	53.1	259°36.2	09.0
11	176°21.3	9°27.8	01.8	7°42.6	09.1	329°42.8	53.3	274°38.5	09.0
12	191°23.7	24°27.4	N07°00.7	22°43.6	N06°08.4	344°44.8	S09°53.5	289°40.8	S22°09.0
13	206°26.2	39°27.0	06°59.6	37°44.6	07.8	359°46.7	53.7	304°43.1	09.1
14	221°28.6	54°26.5	58.4	52°45.6	07.2	14°48.7	53.9	319°45.4	09.1
15	236°31.1	69°26.1	·· 57.3	67°46.6	·· 06.6	29°50.7	·· 54.1	334°47.7	·· 09.1
16	251°33.6	84°25.7	56.1	82°47.6	06.0	44°52.6	54.3	349°50.0	09.1
17	266°36.0	99°25.3	55.0	97°48.6	05.4	59°54.6	54.5	4°52.3	09.1
18	281°38.5	114°24.9	N06°53.9	112°49.6	N06°04.7	74°56.6	S09°54.7	19°54.6	S22°09.1
19	296°41.0	129°24.5	52.7	127°50.6	04.1	89°58.5	54.9	34°56.9	09.2
20	311°43.4	144°24.0	51.6	142°51.6	03.5	105°00.5	55.0	49°59.2	09.2
21	326°45.9	159°23.6	·· 50.4	157°52.6	·· 02.9	120°02.5	·· 55.2	65°01.5	·· 09.2
22	341°48.4	174°23.2	49.3	172°53.6	02.3	135°04.4	55.4	80°03.8	09.2
23	356°50.8	189°22.8	48.2	187°54.6	01.6	150°06.4	55.6	95°06.1	09.2
Mer.pass.:23:13		v-0.4 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	11°53.3	204°22.4	N06°47.0	202°55.6	N06°01.0	165°08.3	S09°55.8	110°08.4	S22°09.2
1	26°55.7	219°22.0	45.9	217°56.6	06°00.4	180°10.3	56.0	125°10.7	09.2
2	41°58.2	234°21.5	44.7	232°57.6	05°59.8	195°12.3	56.2	140°13.0	09.3
3	57°00.7	249°21.1	·· 43.6	247°58.6	·· 59.2	210°14.2	·· 56.4	155°15.3	·· 09.3
4	72°03.1	264°20.7	42.4	262°59.6	58.6	225°16.2	56.6	170°17.6	09.3
5	87°05.6	279°20.3	41.3	278°00.6	57.9	240°18.2	56.8	185°19.9	09.3
6	102°08.1	294°19.9	N06°40.2	293°01.6	N05°57.3	255°20.1	S09°57.0	200°22.2	S22°09.3
7	117°10.5	309°19.5	39.0	308°02.6	56.7	270°22.1	57.1	215°24.6	09.3
8	132°13.0	324°19.1	37.9	323°03.6	56.1	285°24.0	57.3	230°26.9	09.4
9	147°15.5	339°18.6	·· 36.7	338°04.6	·· 55.5	300°26.0	·· 57.5	245°29.2	·· 09.4
10	162°17.9	354°18.2	35.6	353°05.6	54.8	315°28.0	57.7	260°31.5	09.4
11	177°20.4	9°17.8	34.4	8°06.6	54.2	330°29.9	57.9	275°33.8	09.4
12	192°22.9	24°17.4	N06°33.3	23°07.6	N05°53.6	345°31.9	S09°58.1	290°36.1	S22°09.4
13	207°25.3	39°17.0	32.1	38°08.6	53.0	0°33.9	58.3	305°38.4	09.4
14	222°27.8	54°16.6	31.0	53°09.6	52.4	15°35.8	58.5	320°40.7	09.4
15	237°30.2	69°16.2	·· 29.8	68°10.6	·· 51.7	30°37.8	·· 58.7	335°43.0	·· 09.5
16	252°32.7	84°15.8	28.7	83°11.6	51.1	45°39.7	58.9	350°45.3	09.5
17	267°35.2	99°15.3	27.5	98°12.6	50.5	60°41.7	59.1	5°47.6	09.5
18	282°37.6	114°14.9	N06°26.4	113°13.6	N05°49.9	75°43.7	S09°59.2	20°49.9	S22°09.5
19	297°40.1	129°14.5	25.2	128°14.6	49.3	90°45.6	59.4	35°52.2	09.5
20	312°42.6	144°14.1	24.1	143°15.6	48.6	105°47.6	59.6	50°54.5	09.5
21	327°45.0	159°13.7	·· 22.9	158°16.6	·· 48.0	120°49.6	09°59.8	65°56.8	·· 09.6
22	342°47.5	174°13.3	21.8	173°17.6	47.4	135°51.5	10°00.0	80°59.1	09.6
23	357°50.0	189°12.9	20.6	188°18.6	46.8	150°53.5	00.2	96°01.4	09.6
Mer.pass.:23:09		v-0.4 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.0
Diphda	348°52.7	-17°53.3
Achernar	335°24.1	-57°08.8
Hamal	327°57.2	23°32.7
Polaris	316°05.4	89°20.0
Acamar	315°15.8	-40°14.0
Menkar	314°11.8	4°09.5
Mirfak	308°35.8	49°55.2
Aldebaran	290°45.9	16°32.5
Rigel	281°09.2	-8°10.9
Capella	280°30.0	46°00.6
Bellatrix	278°28.8	6°21.8
Elnath	278°08.9	28°37.1
Alnilam	275°43.4	-1°11.5
Betelgeuse	270°58.1	7°24.5
Canopus	263°54.8	-52°42.1
Sirius	258°31.2	-16°44.4
Adhara	255°10.3	-28°59.7
Procyon	244°56.8	5°10.7
Pollux	243°24.3	27°58.8
Avior	234°17.1	-59°33.8
Suhail	222°50.6	-43°30.0
Miaplacidus	221°39.5	-69°47.2
Alphard	217°53.5	-8°44.0
Regulus	207°40.7	11°52.9
Dubhe	193°48.9	61°39.3
Denebola	182°31.1	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.7	-63°11.7
Gacrux	171°58.2	-57°12.6
Alioth	166°18.8	55°52.0
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.8
Hadar	148°44.3	-60°27.4
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.4
Kochab	137°21.2	74°05.3
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.9	-26°28.1
Atria	107°22.3	-69°03.5
Sabik	102°09.4	-15°44.6
Shaula	96°18.1	-37°06.9
Rasalhague	96°03.9	12°33.2
Eltanin	90°44.9	51°29.7
Kaus Aust.	83°40.0	-34°22.4
Vega	80°37.0	38°48.5
Nunki	75°54.7	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.5	-56°40.7
Deneb	49°29.3	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.2	28°10.9
Markab	13°35.1	15°18.2

Oct 01 Sun	**SHA**	**Mer.pass**
Venus	194°47.5	10:21
Mars	192°12.6	10:31
Jupiter	153°39.0	13:04
Saturn	98°22.6	16:44

Oct 02 Mon	**SHA**	**Mer.pass**
Venus	193°38.2	10:22
Mars	191°37.5	10:29
Jupiter	153°27.1	13:01
Saturn	98°18.9	16:41

Oct 03 Tue	**SHA**	**Mer.pass**
Venus	192°29.1	10:23
Mars	191°02.3	10:28
Jupiter	153°15.1	12:58
Saturn	98°15.1	16:37

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3151 sec ΔT = TT-UT1 = +68.8689 sec

2017 October 01 to Oct. 03 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	182°33.6	S03°10.6	57°57.8	11.7'	S16°36.5	5.6'	55.4'
1	197°33.8	11.6	72°28.5	11.7'	16°30.8	5.7'	55.4'
2	212°34.0	12.5	86°59.2	11.7'	16°25.1	5.8'	55.4'
3	227°34.2	·· 13.5	101°29.9	11.7'	16°19.3	5.8'	55.5'
4	242°34.4	14.5	116°00.6	11.7'	16°13.4	5.9'	55.5'
5	257°34.6	15.4	130°31.3	11.7'	16°07.5	6.0'	55.5'
6	272°34.8	S03°16.4	145°02.0	11.7'	S16°01.4	6.1'	55.5'
7	287°35.0	17.4	159°32.7	11.7'	15°55.3	6.2'	55.6'
8	302°35.2	18.4	174°03.4	11.7'	15°49.0	6.3'	55.6'
9	317°35.4	·· 19.3	188°34.2	11.7'	15°42.7	6.3'	55.6'
10	332°35.6	20.3	203°04.9	11.7'	15°36.3	6.4'	55.6'
11	347°35.8	21.3	217°35.6	11.7'	15°29.9	6.5'	55.7'
12	2°36.0	S03°22.2	232°06.3	11.7'	S15°23.3	6.6'	55.7'
13	17°36.2	23.2	246°37.0	11.7'	15°16.7	6.7'	55.7'
14	32°36.4	24.2	261°07.7	11.7'	15°10.0	6.8'	55.7'
15	47°36.6	·· 25.1	275°38.4	11.7'	15°03.2	6.8'	55.8'
16	62°36.8	26.1	290°09.1	11.7'	14°56.3	6.9'	55.8'
17	77°37.0	27.1	304°39.8	11.7'	14°49.3	7.0'	55.8'
18	92°37.2	S03°28.0	319°10.5	11.7'	S14°42.3	7.1'	55.9'
19	107°37.4	29.0	333°41.2	11.7'	14°35.1	7.2'	55.9'
20	122°37.6	30.0	348°11.9	11.7'	14°27.9	7.2'	55.9'
21	137°37.8	·· 30.9	2°42.6	11.7'	14°20.7	7.3'	55.9'
22	152°38.0	31.9	17°13.3	11.7'	14°13.3	7.4'	56.0'
23	167°38.2	32.9	31°44.0	11.7'	14°05.9	7.5'	56.0'
	SD.=16.0	d=-1.0		S.D.=15.2			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°38.4	S03°33.8	46°14.7	11.7'	S13°58.3	7.6'	56.0'
1	197°38.6	34.8	60°45.4	11.7'	13°50.7	7.6'	56.1'
2	212°38.8	35.8	75°16.1	11.7'	13°43.1	7.7'	56.1'
3	227°39.0	·· 36.7	89°46.8	11.7'	13°35.3	7.8'	56.1'
4	242°39.2	37.7	104°17.5	11.7'	13°27.5	7.9'	56.1'
5	257°39.4	38.7	118°48.2	11.7'	13°19.6	7.9'	56.2'
6	272°39.6	S03°39.6	133°18.9	11.7'	S13°11.6	8.0'	56.2'
7	287°39.8	40.6	147°49.6	11.7'	13°03.6	8.1'	56.2'
8	302°40.0	41.6	162°20.3	11.7'	12°55.4	8.2'	56.3'
9	317°40.2	·· 42.6	176°51.0	11.7'	12°47.2	8.2'	56.3'
10	332°40.4	43.5	191°21.7	11.7'	12°39.0	8.3'	56.3'
11	347°40.6	44.5	205°52.4	11.7'	12°30.6	8.4'	56.4'
12	2°40.8	S03°45.5	220°23.1	11.7'	S12°22.2	8.5'	56.4'
13	17°41.0	46.4	234°53.8	11.7'	12°13.7	8.5'	56.4'
14	32°41.2	47.4	249°24.5	11.7'	12°05.2	8.6'	56.4'
15	47°41.4	·· 48.4	263°55.2	11.7'	11°56.5	8.7'	56.5'
16	62°41.6	49.3	278°25.8	11.7'	11°47.9	8.7'	56.5'
17	77°41.8	50.3	292°56.5	11.7'	11°39.1	8.8'	56.5'
18	92°42.0	S03°51.3	307°27.2	11.7'	S11°30.3	8.9'	56.6'
19	107°42.2	52.2	321°57.8	11.7'	11°21.3	8.9'	56.6'
20	122°42.4	53.2	336°28.5	11.7'	11°12.4	9.0'	56.6'
21	137°42.6	·· 54.1	350°59.2	11.7'	11°03.3	9.1'	56.7'
22	152°42.8	55.1	5°29.8	11.7'	10°54.2	9.1'	56.7'
23	167°43.0	56.1	20°00.5	11.6'	10°45.1	9.2'	56.7'
	SD.=16.0	d=-1.0		S.D.=15.4			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	182°43.2	S03°57.0	34°31.1	11.6'	S10°35.8	9.3'	56.8'
1	197°43.4	58.0	49°01.8	11.6'	10°26.5	9.3'	56.8'
2	212°43.6	59.0	63°32.4	11.6'	10°17.2	9.4'	56.8'
3	227°43.8	03°59.9	78°03.0	11.6'	10°07.7	9.5'	56.8'
4	242°44.0	04°00.9	92°33.7	11.6'	09°58.3	9.5'	56.9'
5	257°44.2	01.9	107°04.3	11.6'	09°48.7	9.6'	56.9'
6	272°44.4	S04°02.8	121°34.9	11.6'	S09°39.1	9.6'	56.9'
7	287°44.6	03.8	136°05.5	11.6'	09°29.4	9.7'	57.0'
8	302°44.8	04.8	150°36.1	11.6'	09°19.7	9.8'	57.0'
9	317°45.0	·· 05.7	165°06.7	11.6'	09°09.9	9.8'	57.0'
10	332°45.2	06.7	179°37.3	11.6'	09°00.1	9.9'	57.1'
11	347°45.4	07.7	194°07.8	11.6'	08°50.1	9.9'	57.1'
12	2°45.6	S04°08.6	208°38.4	11.6'	S08°40.2	10.0'	57.1'
13	17°45.7	09.6	223°09.0	11.6'	08°30.2	10.0'	57.2'
14	32°45.9	10.6	237°39.5	11.5'	08°20.1	10.1'	57.2'
15	47°46.1	·· 11.5	252°10.0	11.5'	08°10.0	10.2'	57.2'
16	62°46.3	12.5	266°40.6	11.5'	07°59.8	10.2'	57.3'
17	77°46.5	13.5	281°11.1	11.5'	07°49.6	10.3'	57.3'
18	92°46.7	S04°14.4	295°41.6	11.5'	S07°39.3	10.3'	57.3'
19	107°46.9	15.4	310°12.1	11.5'	07°28.9	10.4'	57.3'
20	122°47.1	16.3	324°42.6	11.5'	07°18.5	10.4'	57.4'
21	137°47.3	·· 17.3	339°13.1	11.5'	07°08.1	10.5'	57.4'
22	152°47.5	18.3	353°43.5	11.5'	06°57.6	10.5'	57.4'
23	167°47.7	19.2	8°14.0	11.4'	06°47.1	10.6'	57.5'
	SD.=16.0	d=-1.0		S.D.=15.6			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	03:55	05:17	06:24	17:12	18:19	19:40
N 70°	04:06	05:19	06:20	17:17	18:17	19:29
68°	04:15	05:21	06:17	17:20	18:15	19:21
66°	04:23	05:23	06:14	17:23	18:14	19:14
64°	04:29	05:25	06:12	17:25	18:12	19:08
62°	04:34	05:26	06:10	17:27	18:11	19:03
60°	04:38	05:27	06:08	17:29	18:10	18:59
N 58°	04:42	05:27	06:07	17:31	18:10	18:55
56°	04:45	05:28	06:05	17:32	18:09	18:52
54°	04:47	05:29	06:04	17:34	18:09	18:50
52°	04:50	05:29	06:03	17:35	18:08	18:48
50°	04:52	05:29	06:02	17:36	18:08	18:46
45°	04:56	05:30	05:59	17:38	18:08	18:42
N 40°	04:59	05:30	05:57	17:41	18:08	18:39
35°	05:01	05:30	05:56	17:42	18:08	18:37
30°	05:02	05:30	05:54	17:44	18:08	18:36
20°	05:04	05:29	05:51	17:47	18:09	18:35
N 10°	05:03	05:28	05:49	17:50	18:11	18:35
0°	05:01	05:25	05:46	17:53	18:13	18:37
S 10°	04:58	05:22	05:43	17:55	18:16	18:41
20°	04:53	05:18	05:40	17:58	18:20	18:46
30°	04:45	05:13	05:37	18:02	18:26	18:54
35°	04:40	05:10	05:35	18:04	18:30	18:59
40°	04:33	05:06	05:33	18:07	18:34	19:06
45°	04:25	05:00	05:30	18:09	18:39	19:14
S 50°	04:15	04:54	05:27	18:13	18:46	19:25
52°	04:10	04:51	05:25	18:14	18:49	19:30
54°	04:05	04:48	05:24	18:16	18:52	19:36
56°	03:58	04:44	05:22	18:18	18:56	19:42
58°	03:51	04:40	05:20	18:20	19:00	19:50
S 60°	03:42	04:35	05:17	18:23	19:05	19:58

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	18:21	18:07	17:57	23:31	–:–	01:26
N 70°	17:50	17:48	17:46	–:–	00:01	01:43
68°	17:27	17:33	17:36	–:–	00:23	01:57
66°	17:09	17:20	17:29	–:–	00:40	02:09
64°	16:54	17:10	17:22	–:–	00:54	02:18
62°	16:42	17:01	17:16	–:–	01:06	02:26
60°	16:31	16:53	17:12	00:03	01:16	02:33
N 58°	16:22	16:46	17:07	00:14	01:24	02:39
56°	16:14	16:40	17:03	00:23	01:32	02:45
54°	16:07	16:35	17:00	00:32	01:39	02:49
52°	16:00	16:30	16:57	00:39	01:45	02:54
50°	15:54	16:25	16:54	00:46	01:50	02:58
45°	15:41	16:16	16:47	01:00	02:02	03:06
N 40°	15:31	16:07	16:42	01:12	02:11	03:13
35°	15:22	16:01	16:37	01:22	02:20	03:19
30°	15:14	15:54	16:33	01:31	02:27	03:24
20°	15:00	15:44	16:26	01:46	02:39	03:34
N 10°	14:48	15:34	16:20	02:00	02:50	03:42
0°	14:37	15:26	16:14	02:12	03:00	03:49
S 10°	14:26	15:17	16:08	02:24	03:10	03:56
20°	14:14	15:07	16:02	02:37	03:21	04:04
30°	14:00	14:57	15:55	02:52	03:33	04:13
35°	13:52	14:50	15:51	03:01	03:40	04:18
40°	13:43	14:43	15:46	03:11	03:48	04:24
45°	13:32	14:35	15:41	03:22	03:57	04:30
S 50°	13:19	14:25	15:34	03:36	04:09	04:38
52°	13:13	14:20	15:31	03:42	04:14	04:42
54°	13:06	14:15	15:28	03:49	04:19	04:46
56°	12:59	14:10	15:24	03:57	04:26	04:50
58°	12:50	14:03	15:20	04:06	04:33	04:55
S 60°	12:41	13:56	15:16	04:16	04:40	05:00

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 11-13 81-94%
01	10:14	10:24	11:50	20:49	08:25	
02	10:34	10:43	11:49	21:37	09:13	
03	10:53	11:02	11:49	22:26	10:02	

October 04, 05, 06 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	12°52.4	204°12.5	N06°19.5	203°19.6	N05°46.2	165°55.4	S10°00.4	111°03.7	S22°09.6
1	27°54.9	219°12.1	18.3	218°20.6	45.5	180°57.4	00.6	126°06.0	09.6
2	42°57.3	234°11.6	17.2	233°21.6	44.9	195°59.4	00.8	141°08.3	09.6
3	57°59.8	249°11.2	·· 16.0	248°22.6	·· 44.3	211°01.3	·· 01.0	156°10.6	·· 09.7
4	73°02.3	264°10.8	14.9	263°23.6	43.7	226°03.3	01.2	171°12.9	09.7
5	88°04.7	279°10.4	13.7	278°24.6	43.1	241°05.2	01.3	186°15.2	09.7
6	103°07.2	294°10.0	N06°12.6	293°25.7	N05°42.4	256°07.2	S10°01.5	201°17.5	S22°09.7
7	118°09.7	309°09.6	11.4	308°26.7	41.8	271°09.2	01.7	216°19.8	09.7
8	133°12.1	324°09.2	10.3	323°27.7	41.2	286°11.1	01.9	231°22.1	09.7
9	148°14.6	339°08.8	·· 09.1	338°28.7	·· 40.6	301°13.1	·· 02.1	246°24.4	·· 09.7
10	163°17.1	354°08.4	08.0	353°29.7	40.0	316°15.1	02.3	261°26.7	09.8
11	178°19.5	9°08.0	06.8	8°30.7	39.3	331°17.0	02.5	276°29.0	09.8
12	193°22.0	24°07.5	N06°05.6	23°31.7	N05°38.7	346°19.0	S10°02.7	291°31.3	S22°09.8
13	208°24.5	39°07.1	04.5	38°32.7	38.1	1°20.9	02.9	306°33.6	09.8
14	223°26.9	54°06.7	03.3	53°33.7	37.5	16°22.9	03.1	321°35.9	09.8
15	238°29.4	69°06.3	·· 02.2	68°34.7	·· 36.9	31°24.9	·· 03.3	336°38.2	·· 09.8
16	253°31.8	84°05.9	06°01.0	83°35.7	36.2	46°26.8	03.4	351°40.5	09.9
17	268°34.3	99°05.5	05°59.9	98°36.7	35.6	61°28.8	03.6	6°42.8	09.9
18	283°36.8	114°05.1	N05°58.7	113°37.7	N05°35.0	76°30.7	S10°03.8	21°45.1	S22°09.9
19	298°39.2	129°04.7	57.6	128°38.7	34.4	91°32.7	04.0	36°47.4	09.9
20	313°41.7	144°04.3	56.4	143°39.7	33.8	106°34.7	04.2	51°49.7	09.9
21	328°44.2	159°03.9	·· 55.2	158°40.7	·· 33.1	121°36.6	·· 04.4	66°52.0	·· 09.9
22	343°46.6	174°03.5	54.1	173°41.7	32.5	136°38.6	04.6	81°54.3	09.9
23	358°49.1	189°03.1	52.9	188°42.7	31.9	151°40.5	04.8	96°56.5	10.0
Mer.pass.:23:05		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	13°51.6	204°02.6	N05°51.8	203°43.7	N05°31.3	166°42.5	S10°05.0	111°58.8	S22°10.0
1	28°54.0	219°02.2	50.6	218°44.7	30.7	181°44.5	05.2	127°01.1	10.0
2	43°56.5	234°01.8	49.4	233°45.7	30.0	196°46.4	05.4	142°03.4	10.0
3	58°58.9	249°01.4	·· 48.3	248°46.7	·· 29.4	211°48.4	·· 05.6	157°05.7	·· 10.0
4	74°01.4	264°01.0	47.1	263°47.7	28.8	226°50.3	05.7	172°08.0	10.0
5	89°03.9	279°00.6	46.0	278°48.7	28.2	241°52.3	05.9	187°10.3	10.1
6	104°06.3	294°00.2	N05°44.8	293°49.7	N05°27.5	256°54.3	S10°06.1	202°12.6	S22°10.1
7	119°08.8	308°59.8	43.6	308°50.7	26.9	271°56.2	06.3	217°14.9	10.1
8	134°11.3	323°59.4	42.5	323°51.7	26.3	286°58.2	06.5	232°17.2	10.1
9	149°13.7	338°59.0	·· 41.3	338°52.7	·· 25.7	302°00.1	·· 06.7	247°19.5	·· 10.1
10	164°16.2	353°58.6	40.1	353°53.7	25.1	317°02.1	06.9	262°21.8	10.1
11	179°18.7	8°58.2	39.0	8°54.7	24.4	332°04.1	07.1	277°24.1	10.1
12	194°21.1	23°57.8	N05°37.8	23°55.7	N05°23.8	347°06.0	S10°07.3	292°26.4	S22°10.2
13	209°23.6	38°57.4	36.7	38°56.7	23.2	2°08.0	07.5	307°28.7	10.2
14	224°26.1	53°57.0	35.5	53°57.8	22.6	17°09.9	07.7	322°31.0	10.2
15	239°28.5	68°56.5	·· 34.3	68°58.8	·· 22.0	32°11.9	·· 07.8	337°33.3	·· 10.2
16	254°31.0	83°56.1	33.2	83°59.8	21.3	47°13.9	08.0	352°35.6	10.2
17	269°33.4	98°55.7	32.0	99°00.8	20.7	62°15.8	08.2	7°37.9	10.2
18	284°35.9	113°55.3	N05°30.8	114°01.8	N05°20.1	77°17.8	S10°08.4	22°40.2	S22°10.3
19	299°38.4	128°54.9	29.7	129°02.8	19.5	92°19.7	08.6	37°42.5	10.3
20	314°40.8	143°54.5	28.5	144°03.8	18.8	107°21.7	08.8	52°44.7	10.3
21	329°43.3	158°54.1	·· 27.3	159°04.8	·· 18.2	122°23.7	·· 09.0	67°47.0	·· 10.3
22	344°45.8	173°53.7	26.2	174°05.8	17.6	137°25.6	09.2	82°49.3	10.3
23	359°48.2	188°53.3	25.0	189°06.8	17.0	152°27.6	09.4	97°51.6	10.3
Mer.pass.:23:01		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	14°50.7	203°52.9	N05°23.8	204°07.8	N05°16.4	167°29.5	S10°09.6	112°53.9	S22°10.4
1	29°53.2	218°52.5	22.7	219°08.8	15.7	182°31.5	09.8	127°56.2	10.4
2	44°55.6	233°52.1	21.5	234°09.8	15.1	197°33.5	09.9	142°58.5	10.4
3	59°58.1	248°51.7	·· 20.3	249°10.8	·· 14.5	212°35.4	·· 10.1	158°00.8	·· 10.4
4	75°00.6	263°51.3	19.2	264°11.8	13.9	227°37.4	10.3	173°03.1	10.4
5	90°03.0	278°50.9	18.0	279°12.8	13.2	242°39.3	10.5	188°05.4	10.4
6	105°05.5	293°50.5	N05°16.8	294°13.8	N05°12.6	257°41.3	S10°10.7	203°07.7	S22°10.4
7	120°07.9	308°50.1	15.7	309°14.8	12.0	272°43.2	10.9	218°10.0	10.5
8	135°10.4	323°49.7	14.5	324°15.8	11.4	287°45.2	11.1	233°12.3	10.5
9	150°12.9	338°49.3	·· 13.3	339°16.8	·· 10.8	302°47.2	·· 11.3	248°14.6	·· 10.5
10	165°15.3	353°48.9	12.2	354°17.8	10.1	317°49.1	11.5	263°16.8	10.5
11	180°17.8	8°48.5	11.0	9°18.8	09.5	332°51.1	11.7	278°19.1	10.5
12	195°20.3	23°48.1	N05°09.8	24°19.9	N05°08.9	347°53.0	S10°11.9	293°21.4	S22°10.5
13	210°22.7	38°47.7	08.6	39°20.9	08.3	2°55.0	12.0	308°23.7	10.6
14	225°25.2	53°47.3	07.5	54°21.9	07.6	17°57.0	12.2	323°26.0	10.6
15	240°27.7	68°46.9	·· 06.3	69°22.9	·· 07.0	32°58.9	·· 12.4	338°28.3	·· 10.6
16	255°30.1	83°46.5	05.1	84°23.9	06.4	48°00.9	12.6	353°30.6	10.6
17	270°32.6	98°46.1	04.0	99°24.9	05.8	63°02.8	12.8	8°32.9	10.6
18	285°35.0	113°45.7	N05°02.8	114°25.9	N05°05.2	78°04.8	S10°13.0	23°35.2	S22°10.6
19	300°37.5	128°45.2	01.6	129°26.9	04.5	93°06.7	13.2	38°37.5	10.6
20	315°40.0	143°44.8	05°00.4	144°27.9	03.9	108°08.7	13.4	53°39.8	10.7
21	330°42.4	158°44.4	04°59.3	159°28.9	·· 03.3	123°10.7	·· 13.6	68°42.0	·· 10.7
22	345°44.9	173°44.0	58.1	174°29.9	02.7	138°12.6	13.8	83°44.3	10.7
23	0°47.4	188°43.6	56.9	189°30.9	02.0	153°14.6	14.0	98°46.6	10.7
Mer.pass.:22:57		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.1
Diphda	348°52.7	-17°53.3
Achernar	335°24.1	-57°08.8
Hamal	327°57.1	23°32.7
Polaris	316°04.6	89°20.1
Acamar	315°15.8	-40°14.0
Menkar	314°11.8	4°09.5
Mirfak	308°35.8	49°55.2
Aldebaran	290°45.9	16°32.5
Rigel	281°09.1	-8°10.9
Capella	280°30.0	46°00.6
Bellatrix	278°28.8	6°21.8
Elnath	278°08.8	28°37.1
Alnilam	275°43.3	-1°11.5
Betelgeuse	270°58.1	7°24.5
Canopus	263°54.8	-52°42.1
Sirius	258°31.2	-16°44.4
Adhara	255°10.3	-28°59.7
Procyon	244°56.8	5°10.7
Pollux	243°24.3	27°58.8
Avior	234°17.0	-59°33.7
Suhail	222°50.5	-43°30.0
Miaplacidus	221°39.5	-69°47.2
Alphard	217°53.5	-8°44.0
Regulus	207°40.7	11°52.9
Dubhe	193°48.9	61°39.3
Denebola	182°31.1	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.7	-63°11.7
Gacrux	171°58.2	-57°12.6
Alioth	166°18.8	55°52.0
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.8
Hadar	148°44.3	-60°27.4
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.4
Kochab	137°21.2	74°05.3
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.8	26°39.7
Antares	112°22.9	-26°28.1
Atria	107°22.3	-69°03.5
Sabik	102°09.4	-15°44.6
Shaula	96°18.1	-37°06.9
Rasalhague	96°03.9	12°33.2
Eltanin	90°44.9	51°29.7
Kaus Aust.	83°40.0	-34°22.4
Vega	80°37.0	38°48.5
Nunki	75°54.8	-26°16.3
Altair	62°05.3	8°55.2
Peacock	53°14.5	-56°40.7
Deneb	49°29.3	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.2	28°10.9
Markab	13°35.2	15°18.2

Oct 04 Wed	**SHA**	**Mer.pass**
Venus	191°20.0	10:23
Mars	190°27.2	10:26
Jupiter	153°03.0	12:55
Saturn	98°11.3	16:33

Oct 05 Thu	**SHA**	**Mer.pass**
Venus	190°11.1	10:24
Mars	189°52.1	10:24
Jupiter	152°50.9	12:51
Saturn	98°07.3	16:30

Oct 06 Fri	**SHA**	**Mer.pass**
Venus	189°02.2	10:25
Mars	189°17.1	10:23
Jupiter	152°38.8	12:48
Saturn	98°03.2	16:26

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3120 sec ΔT = TT-UT1 = +68.8720 sec

2017 October 04 to Oct. 06 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	182°47.9	S04°20.2	22°44.4	11.4'	S06°36.5	10.6'	57.5'
1	197°48.1	21.2	37°14.8	11.4'	06°25.9	10.7'	57.5'
2	212°48.3	22.1	51°45.2	11.4'	06°15.2	10.7'	57.6'
3	227°48.5	·· 23.1	66°15.6	11.4'	06°04.5	10.7'	57.6'
4	242°48.7	24.1	80°46.0	11.4'	05°53.7	10.8'	57.6'
5	257°48.8	25.0	95°16.4	11.4'	05°42.9	10.8'	57.7'
6	272°49.0	S04°26.0	109°46.7	11.3'	S05°32.1	10.9'	57.7'
7	287°49.2	26.9	124°17.1	11.3'	05°21.2	10.9'	57.7'
8	302°49.4	27.9	138°47.4	11.3'	05°10.2	10.9'	57.7'
9	317°49.6	·· 28.9	153°17.7	11.3'	04°59.3	11.0'	57.8'
10	332°49.8	29.8	167°48.0	11.3'	04°48.3	11.0'	57.8'
11	347°50.0	30.8	182°18.3	11.3'	04°37.2	11.1'	57.8'
12	2°50.2	S04°31.8	196°48.5	11.2'	S04°26.1	11.1'	57.9'
13	17°50.4	32.7	211°18.8	11.2'	04°15.0	11.1'	57.9'
14	32°50.6	33.7	225°49.0	11.2'	04°03.9	11.2'	57.9'
15	47°50.8	·· 34.6	240°19.2	11.2'	03°52.7	11.2'	58.0'
16	62°50.9	35.6	254°49.3	11.2'	03°41.5	11.2'	58.0'
17	77°51.1	36.6	269°19.5	11.1'	03°30.2	11.3'	58.0'
18	92°51.3	S04°37.5	283°49.6	11.1'	S03°18.9	11.3'	58.0'
19	107°51.5	38.5	298°19.7	11.1'	03°07.6	11.3'	58.1'
20	122°51.7	39.5	312°49.8	11.1'	02°56.3	11.4'	58.1'
21	137°51.9	·· 40.4	327°19.9	11.1'	02°44.9	11.4'	58.1'
22	152°52.1	41.4	341°50.0	11.0'	02°33.5	11.4'	58.2'
23	167°52.3	42.3	356°20.0	11.0'	02°22.1	11.4'	58.2'
	SD.=16.0	d=-1.0	S.D.=15.8				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	182°52.5	S04°43.3	10°50.0	11.0'	S02°10.7	11.5'	58.2'
1	197°52.7	44.3	25°20.0	11.0'	01°59.2	11.5'	58.2'
2	212°52.8	45.2	39°49.9	10.9'	01°47.7	11.5'	58.3'
3	227°53.0	·· 46.2	54°19.8	10.9'	01°36.2	11.5'	58.3'
4	242°53.2	47.2	68°49.7	10.9'	01°24.7	11.5'	58.3'
5	257°53.4	48.1	83°19.6	10.9'	01°13.1	11.6'	58.4'
6	272°53.6	S04°49.1	97°49.5	10.8'	S01°01.6	11.6'	58.4'
7	287°53.8	50.0	112°19.3	10.8'	00°50.0	11.6'	58.4'
8	302°54.0	51.0	126°49.1	10.8'	00°38.4	11.6'	58.4'
9	317°54.2	·· 52.0	141°18.9	10.8'	00°26.8	11.6'	58.5'
10	332°54.4	52.9	155°48.6	10.7'	00°15.2	11.6'	58.5'
11	347°54.5	53.9	170°18.3	10.7'	S00°03.5	11.6'	58.5'
12	2°54.7	S04°54.8	184°48.0	10.7'	N00°08.1	11.7'	58.5'
13	17°54.9	55.8	199°17.7	10.6'	00°19.8	11.7'	58.6'
14	32°55.1	56.8	213°47.3	10.6'	00°31.5	11.7'	58.6'
15	47°55.3	·· 57.7	228°16.9	10.6'	00°43.1	11.7'	58.6'
16	62°55.5	58.7	242°46.4	10.5'	00°54.8	11.7'	58.6'
17	77°55.7	04°59.6	257°16.0	10.5'	01°06.5	11.7'	58.7'
18	92°55.9	S05°00.6	271°45.5	10.5'	N01°18.2	11.7'	58.7'
19	107°56.0	01.6	286°14.9	10.4'	01°29.9	11.7'	58.7'
20	122°56.2	02.5	300°44.3	10.4'	01°41.6	11.7'	58.7'
21	137°56.4	·· 03.5	315°13.7	10.4'	01°53.3	11.7'	58.8'
22	152°56.6	04.4	329°43.1	10.3'	02°05.0	11.7'	58.8'
23	167°56.8	05.4	344°12.4	10.3'	02°16.7	11.7'	58.8'
	SD.=16.0	d=-1.0	S.D.=16.0				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	182°57.0	S05°06.3	358°41.7	10.3'	N02°28.4	11.7'	58.8'
1	197°57.2	07.3	13°11.0	10.2'	02°40.1	11.7'	58.9'
2	212°57.3	08.3	27°40.2	10.2'	02°51.7	11.7'	58.9'
3	227°57.5	·· 09.2	42°09.4	10.2'	03°03.4	11.7'	58.9'
4	242°57.7	10.2	56°38.5	10.1'	03°15.1	11.7'	58.9'
5	257°57.9	11.1	71°07.6	10.1'	03°26.7	11.7'	59.0'
6	272°58.1	S05°12.1	85°36.7	10.1'	N03°38.4	11.6'	59.0'
7	287°58.3	13.1	100°05.8	10.0'	03°50.0	11.6'	59.0'
8	302°58.4	14.0	114°34.7	10.0'	04°01.7	11.6'	59.0'
9	317°58.6	·· 15.0	129°03.7	9.9'	04°13.3	11.6'	59.0'
10	332°58.8	15.9	143°32.6	9.9'	04°24.9	11.6'	59.1'
11	347°59.0	16.9	158°01.5	9.9'	04°36.4	11.6'	59.1'
12	2°59.2	S05°17.8	172°30.3	9.8'	N04°48.0	11.5'	59.1'
13	17°59.4	18.8	186°59.1	9.8'	04°59.5	11.5'	59.1'
14	32°59.5	19.8	201°27.9	9.7'	05°11.0	11.5'	59.1'
15	47°59.7	·· 20.7	215°56.6	9.7'	05°22.5	11.5'	59.2'
16	62°59.9	21.7	230°25.3	9.6'	05°34.0	11.5'	59.2'
17	78°00.1	22.6	244°53.9	9.6'	05°45.4	11.4'	59.2'
18	93°00.3	S05°23.6	259°22.5	9.6'	N05°56.9	11.4'	59.2'
19	108°00.5	24.5	273°51.0	9.5'	06°08.3	11.4'	59.2'
20	123°00.6	25.5	288°19.5	9.5'	06°19.6	11.3'	59.3'
21	138°00.8	·· 26.5	302°48.0	9.4'	06°31.0	11.3'	59.3'
22	153°01.0	27.4	317°16.4	9.4'	06°42.3	11.3'	59.3'
23	168°01.2	28.4	331°44.7	9.3'	06°53.5	11.3'	59.3'
	SD.=16.0	d=-1.0	S.D.=16.1				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	04:10	05:30	06:38	16:57	18:04	19:24
N 70°	04:19	05:31	06:32	17:03	18:03	19:15
68°	04:27	05:32	06:28	17:07	18:03	19:08
66°	04:33	05:33	06:24	17:11	18:02	19:02
64°	04:38	05:33	06:21	17:15	18:02	18:57
62°	04:42	05:34	06:18	17:18	18:02	18:53
60°	04:45	05:34	06:15	17:20	18:02	18:50
N 58°	04:48	05:34	06:13	17:22	18:01	18:47
56°	04:51	05:34	06:11	17:24	18:01	18:44
54°	04:53	05:34	06:09	17:26	18:02	18:42
52°	04:55	05:34	06:08	17:28	18:02	18:41
50°	04:57	05:34	06:06	17:30	18:02	18:39
45°	05:00	05:34	06:03	17:33	18:02	18:36
N 40°	05:02	05:33	06:00	17:36	18:03	18:34
35°	05:03	05:33	05:58	17:38	18:04	18:33
30°	05:04	05:32	05:56	17:41	18:04	18:32
20°	05:04	05:30	05:52	17:45	18:07	18:32
N 10°	05:03	05:27	05:48	17:48	18:09	18:34
0°	05:00	05:24	05:45	17:52	18:12	18:36
S 10°	04:56	05:21	05:42	17:55	18:16	18:41
20°	04:50	05:16	05:38	17:59	18:21	18:47
30°	04:41	05:09	05:33	18:04	18:28	18:56
35°	04:35	05:05	05:31	18:06	18:32	19:02
40°	04:28	05:01	05:28	18:10	18:37	19:09
45°	04:19	04:55	05:24	18:13	18:43	19:18
S 50°	04:08	04:47	05:20	18:18	18:50	19:30
52°	04:03	04:44	05:18	18:20	18:54	19:36
54°	03:56	04:40	05:16	18:22	18:58	19:42
56°	03:49	04:36	05:14	18:24	19:02	19:49
58°	03:41	04:31	05:11	18:27	19:07	19:58
S 60°	03:32	04:25	05:08	18:30	19:13	20:07

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	17:48	17:39	17:30	03:18	05:11	07:06
N 70°	17:43	17:40	17:38	03:27	05:13	07:00
68°	17:39	17:42	17:44	03:35	05:14	06:56
66°	17:36	17:43	17:50	03:41	05:15	06:52
64°	17:33	17:43	17:55	03:46	05:16	06:49
62°	17:31	17:44	17:59	03:50	05:17	06:47
60°	17:28	17:45	18:02	03:54	05:18	06:44
N 58°	17:27	17:46	18:05	03:58	05:19	06:42
56°	17:25	17:46	18:08	04:01	05:19	06:40
54°	17:23	17:47	18:11	04:04	05:20	06:39
52°	17:22	17:47	18:13	04:06	05:21	06:37
50°	17:21	17:47	18:15	04:08	05:21	06:36
45°	17:18	17:48	18:20	04:13	05:22	06:33
N 40°	17:16	17:49	18:24	04:17	05:23	06:30
35°	17:14	17:50	18:27	04:21	05:24	06:28
30°	17:12	17:50	18:30	04:24	05:24	06:26
20°	17:09	17:51	18:36	04:29	05:25	06:23
N 10°	17:06	17:52	18:40	04:33	05:26	06:20
0°	17:03	17:53	18:45	04:38	05:27	06:18
S 10°	17:01	17:54	18:49	04:42	05:28	06:15
20°	16:58	17:55	18:54	04:46	05:29	06:12
30°	16:55	17:57	19:00	04:51	05:30	06:09
35°	16:53	17:57	19:03	04:54	05:30	06:07
40°	16:51	17:58	19:06	04:57	05:31	06:05
45°	16:49	17:59	19:11	05:01	05:31	06:02
S 50°	16:46	18:00	19:16	05:06	05:32	05:59
52°	16:45	18:01	19:18	05:08	05:33	05:58
54°	16:43	18:01	19:21	05:10	05:33	05:56
56°	16:42	18:02	19:24	05:12	05:33	05:55
58°	16:40	18:03	19:27	05:15	05:34	05:53
S 60°	16:38	18:03	19:31	05:18	05:34	05:51

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 14-16 98-99%
04	11:12	11:21	11:49	23:15	10:50	
05	11:30	11:39	11:48	–:–	11:40	
06	11:48	11:57	11:48	00:05	12:31	

October 07, 08, 09 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	15°49.8	203°43.2	N04°55.7	204°31.9	N05°01.4	168°16.5	S10°14.1	113°48.9	S22°10.7
1	30°52.3	218°42.8	54.6	219°32.9	00.8	183°18.5	14.3	128°51.2	10.7
2	45°54.8	233°42.4	53.4	234°33.9	05°00.2	198°20.4	14.5	143°53.5	10.8
3	60°57.2	248°42.0	·· 52.2	249°34.9	04°59.5	213°22.4	·· 14.7	158°55.8	·· 10.8
4	75°59.7	263°41.6	51.1	264°35.9	58.9	228°24.4	14.9	173°58.1	10.8
5	91°02.2	278°41.2	49.9	279°36.9	58.3	243°26.3	15.1	189°00.4	10.8
6	106°04.6	293°40.8	N04°48.7	294°38.0	N04°57.7	258°28.3	S10°15.3	204°02.6	S22°10.8
7	121°07.1	308°40.4	47.5	309°39.0	57.1	273°30.2	15.5	219°04.9	10.8
8	136°09.5	323°40.0	46.3	324°40.0	56.4	288°32.2	15.7	234°07.2	10.9
9	151°12.0	338°39.6	·· 45.2	339°41.0	·· 55.8	303°34.1	·· 15.9	249°09.5	·· 10.9
10	166°14.5	353°39.2	44.0	354°42.0	55.2	318°36.1	16.1	264°11.8	10.9
11	181°16.9	8°38.8	42.8	9°43.0	54.6	333°38.1	16.2	279°14.1	10.9
12	196°19.4	23°38.4	N04°41.6	24°44.0	N04°53.9	348°40.0	S10°16.4	294°16.4	S22°10.9
13	211°21.9	38°38.0	40.5	39°45.0	53.3	3°42.0	16.6	309°18.7	10.9
14	226°24.3	53°37.6	39.3	54°46.0	52.7	18°43.9	16.8	324°21.0	10.9
15	241°26.8	68°37.2	·· 38.1	69°47.0	·· 52.1	33°45.9	·· 17.0	339°23.2	·· 11.0
16	256°29.3	83°36.8	36.9	84°48.0	51.4	48°47.8	17.2	354°25.5	11.0
17	271°31.7	98°36.4	35.7	99°49.0	50.8	63°49.8	17.4	9°27.8	11.0
18	286°34.2	113°36.0	N04°34.6	114°50.0	N04°50.2	78°51.8	S10°17.6	24°30.1	S22°11.0
19	301°36.6	128°35.6	33.4	129°51.0	49.6	93°53.7	17.8	39°32.4	11.0
20	316°39.1	143°35.2	32.2	144°52.0	48.9	108°55.7	18.0	54°34.7	11.0
21	331°41.6	158°34.8	·· 31.0	159°53.0	·· 48.3	123°57.6	·· 18.2	69°37.0	·· 11.1
22	346°44.0	173°34.4	29.9	174°54.1	47.7	138°59.6	18.3	84°39.2	11.1
23	1°46.5	188°34.0	28.7	189°55.1	47.1	154°01.5	18.5	99°41.5	11.1
Mer.pass.:22:53		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	16°49.0	203°33.6	N04°27.5	204°56.1	N04°46.4	169°03.5	S10°18.7	114°43.8	S22°11.1
1	31°51.4	218°33.2	26.3	219°57.1	45.8	184°05.5	18.9	129°46.1	11.1
2	46°53.9	233°32.8	25.1	234°58.1	45.2	199°07.4	19.1	144°48.4	11.1
3	61°56.4	248°32.5	·· 23.9	249°59.1	·· 44.6	214°09.4	·· 19.3	159°50.7	·· 11.2
4	76°58.8	263°32.1	22.8	265°00.1	43.9	229°11.3	19.5	174°53.0	11.2
5	92°01.3	278°31.7	21.6	280°01.1	43.3	244°13.3	19.7	189°55.2	11.2
6	107°03.8	293°31.3	N04°20.4	295°02.1	N04°42.7	259°15.2	S10°19.9	204°57.5	S22°11.2
7	122°06.2	308°30.9	19.2	310°03.1	42.1	274°17.2	20.1	219°59.8	11.2
8	137°08.7	323°30.5	18.0	325°04.1	41.5	289°19.1	20.3	235°02.1	11.2
9	152°11.1	338°30.1	·· 16.9	340°05.1	·· 40.8	304°21.1	·· 20.4	250°04.4	·· 11.2
10	167°13.6	353°29.7	15.7	355°06.1	40.2	319°23.1	20.6	265°06.7	11.3
11	182°16.1	8°29.3	14.5	10°07.1	39.6	334°25.0	20.8	280°09.0	11.3
12	197°18.5	23°28.9	N04°13.3	25°08.1	N04°39.0	349°27.0	S10°21.0	295°11.2	S22°11.3
13	212°21.0	38°28.5	12.1	40°09.2	38.3	4°28.9	21.2	310°13.5	11.3
14	227°23.5	53°28.1	10.9	55°10.2	37.7	19°30.9	21.4	325°15.8	11.3
15	242°25.9	68°27.7	·· 09.8	70°11.2	·· 37.1	34°32.8	·· 21.6	340°18.1	·· 11.3
16	257°28.4	83°27.3	08.6	85°12.2	36.5	49°34.8	21.8	355°20.4	11.4
17	272°30.9	98°26.9	07.4	100°13.2	35.8	64°36.7	22.0	10°22.7	11.4
18	287°33.3	113°26.5	N04°06.2	115°14.2	N04°35.2	79°38.7	S10°22.2	25°24.9	S22°11.4
19	302°35.8	128°26.1	05.0	130°15.2	34.6	94°40.7	22.4	40°27.2	11.4
20	317°38.3	143°25.7	03.8	145°16.2	34.0	109°42.6	22.5	55°29.5	11.4
21	332°40.7	158°25.3	·· 02.6	160°17.2	·· 33.3	124°44.6	·· 22.7	70°31.8	·· 11.4
22	347°43.2	173°24.9	01.5	175°18.2	32.7	139°46.5	22.9	85°34.1	11.5
23	2°45.6	188°24.5	00.3	190°19.2	32.1	154°48.5	23.1	100°36.4	11.5
Mer.pass.:22:49		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	17°48.1	203°24.1	N03°59.1	205°20.2	N04°31.5	169°50.4	S10°23.3	115°38.6	S22°11.5
1	32°50.6	218°23.7	57.9	220°21.2	30.8	184°52.4	23.5	130°40.9	11.5
2	47°53.0	233°23.3	56.7	235°22.3	30.2	199°54.3	23.7	145°43.2	11.5
3	62°55.5	248°22.9	·· 55.5	250°23.3	·· 29.6	214°56.3	·· 23.9	160°45.5	·· 11.5
4	77°58.0	263°22.5	54.3	265°24.3	29.0	229°58.3	24.1	175°47.8	11.5
5	93°00.4	278°22.1	53.1	280°25.3	28.3	245°00.2	24.3	190°50.0	11.6
6	108°02.9	293°21.7	N03°52.0	295°26.3	N04°27.7	260°02.2	S10°24.5	205°52.3	S22°11.6
7	123°05.4	308°21.3	50.8	310°27.3	27.1	275°04.1	24.6	220°54.6	11.6
8	138°07.8	323°20.9	49.6	325°28.3	26.5	290°06.1	24.8	235°56.9	11.6
9	153°10.3	338°20.5	·· 48.4	340°29.3	·· 25.8	305°08.0	·· 25.0	250°59.2	·· 11.6
10	168°12.7	353°20.1	47.2	355°30.3	25.2	320°10.0	25.2	266°01.5	11.6
11	183°15.2	8°19.8	46.0	10°31.3	24.6	335°11.9	25.4	281°03.7	11.7
12	198°17.7	23°19.4	N03°44.8	25°32.3	N04°23.9	350°13.9	S10°25.6	296°06.0	S22°11.7
13	213°20.1	38°19.0	43.6	40°33.3	23.3	5°15.8	25.8	311°08.3	11.7
14	228°22.6	53°18.6	42.4	55°34.4	22.7	20°17.8	26.0	326°10.6	11.7
15	243°25.1	68°18.2	·· 41.3	70°35.4	·· 22.1	35°19.7	·· 26.2	341°12.9	·· 11.7
16	258°27.5	83°17.8	40.1	85°36.4	21.4	50°21.7	26.4	356°15.1	11.7
17	273°30.0	98°17.4	38.9	100°37.4	20.8	65°23.7	26.6	11°17.4	11.8
18	288°32.5	113°17.0	N03°37.7	115°38.4	N04°20.2	80°25.6	S10°26.7	26°19.7	S22°11.8
19	303°34.9	128°16.6	36.5	130°39.4	19.6	95°27.6	26.9	41°22.0	11.8
20	318°37.4	143°16.2	35.3	145°40.4	18.9	110°29.5	27.1	56°24.3	11.8
21	333°39.9	158°15.8	·· 34.1	160°41.4	·· 18.3	125°31.5	·· 27.3	71°26.5	·· 11.8
22	348°42.3	173°15.4	32.9	175°42.4	17.7	140°33.4	27.5	86°28.8	11.8
23	3°44.8	188°15.0	31.7	190°43.4	17.1	155°35.4	27.7	101°31.1	11.8
Mer.pass.:22:45		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.1
Diphda	348°52.7	-17°53.3
Achernar	335°24.1	-57°08.8
Hamal	327°57.1	23°32.7
Polaris	316°03.6	89°20.1
Acamar	315°15.8	-40°14.0
Menkar	314°11.7	4°09.5
Mirfak	308°35.8	49°55.2
Aldebaran	290°45.9	16°32.5
Rigel	281°09.1	-8°10.9
Capella	280°30.0	46°00.6
Bellatrix	278°28.8	6°21.8
Elnath	278°08.8	28°37.1
Alnilam	275°43.3	-1°11.5
Betelgeuse	270°58.1	7°24.5
Canopus	263°54.8	-52°42.1
Sirius	258°31.1	-16°44.4
Adhara	255°10.2	-28°59.7
Procyon	244°56.8	5°10.7
Pollux	243°24.3	27°58.8
Avior	234°17.0	-59°33.7
Suhail	222°50.5	-43°30.0
Miaplacidus	221°39.5	-69°47.1
Alphard	217°53.4	-8°44.0
Regulus	207°40.7	11°52.9
Dubhe	193°48.8	61°39.3
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.7	-63°11.6
Gacrux	171°58.2	-57°12.5
Alioth	166°18.8	55°52.0
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.7
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.3
Kochab	137°21.3	74°05.3
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.7
Antares	112°22.9	-26°28.1
Atria	107°22.4	-69°03.5
Sabik	102°09.4	-15°44.5
Shaula	96°18.1	-37°06.9
Rasalhague	96°03.9	12°33.2
Eltanin	90°45.0	51°29.7
Kaus Aust.	83°40.1	-34°22.4
Vega	80°37.1	38°48.5
Nunki	75°54.8	-26°16.3
Altair	62°05.4	8°55.2
Peacock	53°14.6	-56°40.7
Deneb	49°29.3	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.8	-46°52.5
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.2	28°10.9
Markab	13°35.2	15°18.2

Oct 07 Sat	SHA	Mer.pass
Venus	187°53.4	10:25
Mars	188°42.1	10:21
Jupiter	152°26.7	12:45
Saturn	97°59.1	16:22

Oct 08 Sun	SHA	Mer.pass
Venus	186°44.7	10:26
Mars	188°07.1	10:20
Jupiter	152°14.5	12:42
Saturn	97°54.8	16:19

Oct 09 Mon	SHA	Mer.pass
Venus	185°36.0	10:27
Mars	187°32.1	10:18
Jupiter	152°02.3	12:39
Saturn	97°50.5	16:15

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3090 sec ΔT = TT-UT1 = +68.8750 sec

2017 October 07 to Oct. 09 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	183°01.4	S05°29.3	346°13.1	9.3'	N07°04.8	11.2'	59.3'
1	198°01.6	30.3	0°41.3	9.3'	07°16.0	11.2'	59.3'
2	213°01.7	31.2	15°09.6	9.2'	07°27.1	11.1'	59.4'
3	228°01.9	·· 32.2	29°37.8	9.2'	07°38.3	11.1'	59.4'
4	243°02.1	33.2	44°05.9	9.1'	07°49.3	11.1'	59.4'
5	258°02.3	34.1	58°34.0	9.1'	08°00.4	11.0'	59.4'
6	273°02.5	S05°35.1	73°02.0	9.0'	N08°11.4	11.0'	59.4'
7	288°02.6	36.0	87°30.0	9.0'	08°22.4	10.9'	59.4'
8	303°02.8	37.0	101°58.0	8.9'	08°33.3	10.9'	59.4'
9	318°03.0	·· 37.9	116°25.9	8.9'	08°44.1	10.8'	59.5'
10	333°03.2	38.9	130°53.7	8.8'	08°55.0	10.8'	59.5'
11	348°03.4	39.8	145°21.5	8.8'	09°05.7	10.7'	59.5'
12	3°03.5	S05°40.8	159°49.3	8.7'	N09°16.5	10.7'	59.5'
13	18°03.7	41.7	174°17.0	8.7'	09°27.1	10.6'	59.5'
14	33°03.9	42.7	188°44.7	8.6'	09°37.7	10.6'	59.5'
15	48°04.1	·· 43.7	203°12.3	8.6'	09°48.3	10.5'	59.5'
16	63°04.2	44.6	217°39.8	8.5'	09°58.8	10.5'	59.5'
17	78°04.4	45.6	232°07.3	8.5'	10°09.3	10.4'	59.6'
18	93°04.6	S05°46.5	246°34.8	8.4'	N10°19.7	10.4'	59.6'
19	108°04.8	47.5	261°02.2	8.4'	10°30.0	10.3'	59.6'
20	123°05.0	48.4	275°29.6	8.3'	10°40.3	10.2'	59.6'
21	138°05.1	·· 49.4	289°56.9	8.3'	10°50.5	10.2'	59.6'
22	153°05.3	50.3	304°24.2	8.2'	11°00.6	10.1'	59.6'
23	168°05.5	51.3	318°51.4	8.2'	11°10.7	10.1'	59.6'
	SD.=16.0	d=-1.0		S.D.=16.2			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°05.7	S05°52.2	333°18.6	8.1'	N11°20.7	10.0'	59.6'
1	198°05.8	53.2	347°45.7	8.1'	11°30.7	9.9'	59.6'
2	213°06.0	54.1	2°12.8	8.0'	11°40.6	9.8'	59.6'
3	228°06.2	·· 55.1	16°39.8	8.0'	11°50.4	9.8'	59.7'
4	243°06.4	56.1	31°06.7	7.9'	12°00.1	9.7'	59.7'
5	258°06.5	57.0	45°33.7	7.9'	12°09.8	9.6'	59.7'
6	273°06.7	S05°58.0	60°00.5	7.8'	N12°19.4	9.6'	59.7'
7	288°06.9	58.9	74°27.4	7.8'	12°28.9	9.5'	59.7'
8	303°07.1	05°59.9	88°54.1	7.7'	12°38.3	9.4'	59.7'
9	318°07.3	06°00.8	103°20.8	7.7'	12°47.7	9.3'	59.7'
10	333°07.4	01.8	117°47.5	7.6'	12°57.0	9.2'	59.7'
11	348°07.6	02.7	132°14.1	7.6'	13°06.2	9.2'	59.7'
12	3°07.8	S06°03.7	146°40.7	7.6'	N13°15.3	9.1'	59.7'
13	18°08.0	04.6	161°07.3	7.5'	13°24.4	9.0'	59.7'
14	33°08.1	05.6	175°33.7	7.5'	13°33.3	8.9'	59.7'
15	48°08.3	·· 06.5	190°00.2	7.4'	13°42.2	8.8'	59.7'
16	63°08.5	07.5	204°26.5	7.4'	13°51.0	8.7'	59.7'
17	78°08.6	08.4	218°52.9	7.3'	13°59.7	8.7'	59.7'
18	93°08.8	S06°09.4	233°19.2	7.3'	N14°08.3	8.6'	59.7'
19	108°09.0	10.3	247°45.4	7.2'	14°16.8	8.5'	59.7'
20	123°09.2	11.3	262°11.6	7.2'	14°25.3	8.4'	59.8'
21	138°09.3	·· 12.2	276°37.8	7.1'	14°33.6	8.3'	59.8'
22	153°09.5	13.2	291°03.9	7.1'	14°41.9	8.2'	59.8'
23	168°09.7	14.1	305°29.9	7.0'	14°50.0	8.1'	59.8'
	SD.=16.0	d=-1.0		S.D.=16.3			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°09.9	S06°15.1	319°55.9	7.0'	N14°58.1	8.0'	59.8'
1	198°10.0	16.0	334°21.9	6.9'	15°06.0	7.9'	59.8'
2	213°10.2	17.0	348°47.8	6.9'	15°13.9	7.8'	59.8'
3	228°10.4	·· 17.9	3°13.7	6.9'	15°21.7	7.7'	59.8'
4	243°10.5	18.9	17°39.5	6.8'	15°29.3	7.6'	59.8'
5	258°10.7	19.8	32°05.3	6.8'	15°36.9	7.5'	59.8'
6	273°10.9	S06°20.8	46°31.1	6.7'	N15°44.4	7.4'	59.8'
7	288°11.1	21.7	60°56.8	6.7'	15°51.7	7.3'	59.8'
8	303°11.2	22.7	75°22.4	6.6'	15°59.0	7.2'	59.8'
9	318°11.4	·· 23.6	89°48.1	6.6'	16°06.1	7.1'	59.8'
10	333°11.6	24.6	104°13.7	6.6'	16°13.2	7.0'	59.8'
11	348°11.7	25.5	118°39.2	6.5'	16°20.1	6.9'	59.8'
12	3°11.9	S06°26.5	133°04.7	6.5'	N16°27.0	6.8'	59.8'
13	18°12.1	27.4	147°30.2	6.5'	16°33.7	6.7'	59.8'
14	33°12.2	28.4	161°55.6	6.4'	16°40.3	6.6'	59.8'
15	48°12.4	·· 29.3	176°21.0	6.4'	16°46.8	6.4'	59.8'
16	63°12.6	30.3	190°46.4	6.3'	16°53.2	6.3'	59.8'
17	78°12.8	31.2	205°11.7	6.3'	16°59.5	6.2'	59.7'
18	93°12.9	S06°32.1	219°37.0	6.3'	N17°05.6	6.1'	59.7'
19	108°13.1	33.1	234°02.2	6.2'	17°11.7	6.0'	59.7'
20	123°13.3	34.0	248°27.4	6.2'	17°17.6	5.9'	59.7'
21	138°13.4	·· 35.0	262°52.6	6.2'	17°23.5	5.8'	59.7'
22	153°13.6	35.9	277°17.8	6.1'	17°29.2	5.6'	59.7'
23	168°13.8	36.9	291°42.9	6.1'	17°34.8	5.5'	59.7'
	SD.=16.0	d=-0.9		S.D.=16.3			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:24	05:43	06:51	16:42	17:49	19:08
N 70°	04:32	05:43	06:44	16:49	17:50	19:01
68°	04:38	05:43	06:38	16:55	17:51	18:55
66°	04:43	05:42	06:34	17:00	17:51	18:50
64°	04:47	05:42	06:29	17:04	17:52	18:47
62°	04:50	05:41	06:26	17:08	17:52	18:43
60°	04:53	05:41	06:23	17:11	17:53	18:41
N 58°	04:55	05:40	06:20	17:14	17:53	18:39
56°	04:57	05:40	06:17	17:17	17:54	18:37
54°	04:59	05:40	06:15	17:19	17:54	18:35
52°	05:00	05:39	06:13	17:21	17:55	18:34
50°	05:01	05:39	06:11	17:23	17:55	18:33
45°	05:03	05:37	06:07	17:27	17:57	18:31
N 40°	05:05	05:36	06:03	17:31	17:58	18:29
35°	05:06	05:35	06:00	17:34	18:00	18:29
30°	05:06	05:34	05:58	17:37	18:01	18:29
20°	05:05	05:31	05:53	17:42	18:04	18:30
N 10°	05:03	05:27	05:48	17:46	18:08	18:32
0°	04:59	05:23	05:44	17:51	18:12	18:36
S 10°	04:54	05:19	05:40	17:55	18:16	18:41
20°	04:47	05:13	05:35	18:00	18:22	18:48
30°	04:37	05:06	05:30	18:06	18:30	18:58
35°	04:31	05:01	05:27	18:09	18:34	19:05
40°	04:23	04:56	05:23	18:13	18:40	19:13
45°	04:13	04:49	05:19	18:17	18:47	19:23
S 50°	04:01	04:41	05:14	18:22	18:55	19:35
52°	03:55	04:37	05:11	18:25	18:59	19:42
54°	03:48	04:32	05:09	18:27	19:04	19:49
56°	03:40	04:28	05:06	18:30	19:09	19:57
58°	03:31	04:22	05:03	18:34	19:15	20:06
S 60°	03:21	04:16	04:59	18:37	19:21	20:17

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	17:20	17:07	16:45	09:05	11:12	13:33
N 70°	17:36	17:34	17:34	08:52	10:47	12:45
68°	17:48	17:55	18:06	08:41	10:27	12:14
66°	17:59	18:11	18:29	08:32	10:12	11:51
64°	18:08	18:24	18:48	08:24	10:00	11:33
62°	18:15	18:36	19:03	08:18	09:49	11:19
60°	18:22	18:45	19:16	08:12	09:40	11:06
N 58°	18:28	18:54	19:27	08:07	09:32	10:56
56°	18:33	19:02	19:37	08:03	09:25	10:46
54°	18:37	19:08	19:45	07:59	09:19	10:38
52°	18:42	19:14	19:53	07:55	09:14	10:31
50°	18:45	19:20	20:00	07:52	09:09	10:24
45°	18:54	19:32	20:15	07:45	08:58	10:10
N 40°	19:01	19:42	20:27	07:39	08:49	09:59
35°	19:07	19:50	20:38	07:34	08:42	09:49
30°	19:12	19:58	20:47	07:30	08:35	09:40
20°	19:22	20:11	21:03	07:23	08:23	09:25
N 10°	19:30	20:22	21:17	07:16	08:13	09:12
0°	19:38	20:33	21:30	07:10	08:04	09:00
S 10°	19:46	20:44	21:44	07:04	07:54	08:48
20°	19:54	20:56	21:58	06:57	07:44	08:35
30°	20:04	21:09	22:14	06:49	07:33	08:20
35°	20:10	21:17	22:24	06:45	07:26	08:12
40°	20:16	21:26	22:35	06:40	07:19	08:02
45°	20:24	21:36	22:47	06:35	07:10	07:51
S 50°	20:33	21:49	23:03	06:28	07:00	07:37
52°	20:37	21:55	23:10	06:25	06:55	07:31
54°	20:41	22:02	23:19	06:21	06:50	07:24
56°	20:47	22:09	23:28	06:18	06:44	07:16
58°	20:52	22:17	23:38	06:14	06:38	07:07
S 60°	20:59	22:27	23:50	06:09	06:30	06:57

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 17-19 96-82%
07	12:05	12:14	11:48	00:57	13:24	
08	12:23	12:31	11:47	01:51	14:18	
09	12:39	12:48	11:47	02:47	15:15	

October 10, 11, 12 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	18°47.2	203°14.6	N03°30.5	205°44.4	N04°16.4	170°37.3	S10°27.9	116°33.4	S22°11.9
1	33°49.7	218°14.2	29.3	220°45.4	15.8	185°39.3	28.1	131°35.7	11.9
2	48°52.2	233°13.8	28.1	235°46.5	15.2	200°41.2	28.3	146°37.9	11.9
3	63°54.6	248°13.4	·· 26.9	250°47.5	·· 14.6	215°43.2	·· 28.5	161°40.2	·· 11.9
4	78°57.1	263°13.0	25.8	265°48.5	13.9	230°45.1	28.7	176°42.5	11.9
5	93°59.6	278°12.6	24.6	280°49.5	13.3	245°47.1	28.8	191°44.8	11.9
6	109°02.0	293°12.3	N03°23.4	295°50.5	N04°12.7	260°49.1	S10°29.0	206°47.0	S22°12.0
7	124°04.5	308°11.9	22.2	310°51.5	12.1	275°51.0	29.2	221°49.3	12.0
8	139°07.0	323°11.5	21.0	325°52.5	11.4	290°53.0	29.4	236°51.6	12.0
9	154°09.4	338°11.1	·· 19.8	340°53.5	·· 10.8	305°54.9	·· 29.6	251°53.9	·· 12.0
10	169°11.9	353°10.7	18.6	355°54.5	10.2	320°56.9	29.8	266°56.2	12.0
11	184°14.4	8°10.3	17.4	10°55.5	09.5	335°58.8	30.0	281°58.4	12.0
12	199°16.8	23°09.9	N03°16.2	25°56.5	N04°08.9	351°00.8	S10°30.2	297°00.7	S22°12.1
13	214°19.3	38°09.5	15.0	40°57.6	08.3	6°02.7	30.4	312°03.0	12.1
14	229°21.7	53°09.1	13.8	55°58.6	07.7	21°04.7	30.6	327°05.3	12.1
15	244°24.2	68°08.7	·· 12.6	70°59.6	·· 07.0	36°06.6	·· 30.8	342°07.5	·· 12.1
16	259°26.7	83°08.3	11.4	86°00.6	06.4	51°08.6	30.9	357°09.8	12.1
17	274°29.1	98°07.9	10.2	101°01.6	05.8	66°10.5	31.1	12°12.1	12.1
18	289°31.6	113°07.5	N03°09.0	116°02.6	N04°05.2	81°12.5	S10°31.3	27°14.4	S22°12.1
19	304°34.1	128°07.1	07.8	131°03.6	04.5	96°14.4	31.5	42°16.6	12.2
20	319°36.5	143°06.7	06.6	146°04.6	03.9	111°16.4	31.7	57°18.9	12.2
21	334°39.0	158°06.4	·· 05.4	161°05.6	·· 03.3	126°18.4	·· 31.9	72°21.2	·· 12.2
22	349°41.5	173°06.0	04.2	176°06.6	02.7	141°20.3	32.1	87°23.5	12.2
23	4°43.9	188°05.6	03.0	191°07.6	02.0	156°22.3	32.3	102°25.7	12.2
Mer.pass.:22:41		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	19°46.4	203°05.2	N03°01.8	206°08.7	N04°01.4	171°24.2	S10°32.5	117°28.0	S22°12.2
1	34°48.9	218°04.8	03°00.6	221°09.7	00.8	186°26.2	32.7	132°30.3	12.3
2	49°51.3	233°04.4	02°59.4	236°10.7	04°00.1	201°28.1	32.8	147°32.6	12.3
3	64°53.8	248°04.0	·· 58.3	251°11.7	03°59.5	216°30.1	·· 33.0	162°34.8	·· 12.3
4	79°56.2	263°03.6	57.1	266°12.7	58.9	231°32.0	33.2	177°37.1	12.3
5	94°58.7	278°03.2	55.9	281°13.7	58.3	246°34.0	33.4	192°39.4	12.3
6	110°01.2	293°02.8	N02°54.7	296°14.7	N03°57.6	261°35.9	S10°33.6	207°41.7	S22°12.3
7	125°03.6	308°02.4	53.5	311°15.7	57.0	276°37.9	33.8	222°43.9	12.4
8	140°06.1	323°02.0	52.3	326°16.7	56.4	291°39.8	34.0	237°46.2	12.4
9	155°08.6	338°01.6	·· 51.1	341°17.7	·· 55.8	306°41.8	·· 34.2	252°48.5	·· 12.4
10	170°11.0	353°01.2	49.9	356°18.8	55.1	321°43.7	34.4	267°50.8	12.4
11	185°13.5	8°00.9	48.7	11°19.8	54.5	336°45.7	34.6	282°53.0	12.4
12	200°16.0	23°00.5	N02°47.5	26°20.8	N03°53.9	351°47.6	S10°34.8	297°55.3	S22°12.4
13	215°18.4	38°00.1	46.3	41°21.8	53.3	6°49.6	34.9	312°57.6	12.4
14	230°20.9	52°59.7	45.1	56°22.8	52.6	21°51.5	35.1	327°59.9	12.5
15	245°23.3	67°59.3	·· 43.9	71°23.8	·· 52.0	36°53.5	·· 35.3	343°02.1	·· 12.5
16	260°25.8	82°58.9	42.7	86°24.8	51.4	51°55.4	35.5	358°04.4	12.5
17	275°28.3	97°58.5	41.5	101°25.8	50.7	66°57.4	35.7	13°06.7	12.5
18	290°30.7	112°58.1	N02°40.3	116°26.8	N03°50.1	81°59.3	S10°35.9	28°09.0	S22°12.5
19	305°33.2	127°57.7	39.1	131°27.8	49.5	97°01.3	36.1	43°11.2	12.5
20	320°35.7	142°57.3	37.9	146°28.9	48.9	112°03.2	36.3	58°13.5	12.6
21	335°38.1	157°56.9	·· 36.7	161°29.9	·· 48.2	127°05.2	·· 36.5	73°15.8	·· 12.6
22	350°40.6	172°56.5	35.4	176°30.9	47.6	142°07.2	36.7	88°18.0	12.6
23	5°43.1	187°56.1	34.2	191°31.9	47.0	157°09.1	36.9	103°20.3	12.6
Mer.pass.:22:37		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	20°45.5	202°55.8	N02°33.0	206°32.9	N03°46.3	172°11.1	S10°37.0	118°22.6	S22°12.6
1	35°48.0	217°55.4	31.8	221°33.9	45.7	187°13.0	37.2	133°24.9	12.6
2	50°50.5	232°55.0	30.6	236°34.9	45.1	202°15.0	37.4	148°27.1	12.7
3	65°52.9	247°54.6	·· 29.4	251°35.9	·· 44.5	217°16.9	·· 37.6	163°29.4	·· 12.7
4	80°55.4	262°54.2	28.2	266°36.9	43.8	232°18.9	37.8	178°31.7	12.7
5	95°57.8	277°53.8	27.0	281°37.9	43.2	247°20.8	38.0	193°33.9	12.7
6	111°00.3	292°53.4	N02°25.8	296°39.0	N03°42.6	262°22.8	S10°38.2	208°36.2	S22°12.7
7	126°02.8	307°53.0	24.6	311°40.0	42.0	277°24.7	38.4	223°38.5	12.7
8	141°05.2	322°52.6	23.4	326°41.0	41.3	292°26.7	38.6	238°40.8	12.8
9	156°07.7	337°52.2	·· 22.2	341°42.0	·· 40.7	307°28.6	·· 38.8	253°43.0	·· 12.8
10	171°10.2	352°51.8	21.0	356°43.0	40.1	322°30.6	38.9	268°45.3	12.8
11	186°12.6	7°51.4	19.8	11°44.0	39.4	337°32.5	39.1	283°47.6	12.8
12	201°15.1	22°51.1	N02°18.6	26°45.0	N03°38.8	352°34.5	S10°39.3	298°49.8	S22°12.8
13	216°17.6	37°50.7	17.4	41°46.0	38.2	7°36.4	39.5	313°52.1	12.8
14	231°20.0	52°50.3	16.2	56°47.0	37.6	22°38.4	39.7	328°54.4	12.8
15	246°22.5	67°49.9	·· 15.0	71°48.1	·· 36.9	37°40.3	·· 39.9	343°56.7	·· 12.9
16	261°25.0	82°49.5	13.8	86°49.1	36.3	52°42.3	40.1	358°58.9	12.9
17	276°27.4	97°49.1	12.6	101°50.1	35.7	67°44.2	40.3	14°01.2	12.9
18	291°29.9	112°48.7	N02°11.4	116°51.1	N03°35.0	82°46.2	S10°40.5	29°03.5	S22°12.9
19	306°32.3	127°48.3	10.2	131°52.1	34.4	97°48.1	40.7	44°05.7	12.9
20	321°34.8	142°47.9	09.0	146°53.1	33.8	112°50.1	40.9	59°08.0	12.9
21	336°37.3	157°47.5	·· 07.8	161°54.1	·· 33.2	127°52.0	·· 41.0	74°10.3	·· 13.0
22	351°39.7	172°47.1	06.6	176°55.1	32.5	142°54.0	41.2	89°12.5	13.0
23	6°42.2	187°46.8	05.3	191°56.1	31.9	157°55.9	41.4	104°14.8	13.0
Mer.pass.:22:33		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.1
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°08.8
Hamal	327°57.1	23°32.7
Polaris	316°02.6	89°20.1
Acamar	315°15.8	-40°14.0
Menkar	314°11.7	4°09.5
Mirfak	308°35.7	49°55.2
Aldebaran	290°45.8	16°32.5
Rigel	281°09.1	-8°10.9
Capella	280°29.9	46°00.6
Bellatrix	278°28.7	6°21.8
Elnath	278°08.8	28°37.1
Alnilam	275°43.3	-1°11.5
Betelgeuse	270°58.1	7°24.5
Canopus	263°54.7	-52°42.1
Sirius	258°31.1	-16°44.4
Adhara	255°10.2	-28°59.7
Procyon	244°56.7	5°10.7
Pollux	243°24.3	27°58.8
Avior	234°17.0	-59°33.7
Suhail	222°50.5	-43°30.0
Miaplacidus	221°39.4	-69°47.1
Alphard	217°53.4	-8°44.0
Regulus	207°40.7	11°52.9
Dubhe	193°48.8	61°39.2
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.7	-63°11.6
Gacrux	171°58.2	-57°12.5
Alioth	166°18.8	55°52.0
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.7
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.3
Kochab	137°21.3	74°05.3
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.7
Antares	112°22.9	-26°28.1
Atria	107°22.4	-69°03.5
Sabik	102°09.4	-15°44.5
Shaula	96°18.2	-37°06.9
Rasalhague	96°03.9	12°33.2
Eltanin	90°45.0	51°29.7
Kaus Aust.	83°40.1	-34°22.4
Vega	80°37.1	38°48.5
Nunki	75°54.8	-26°16.3
Altair	62°05.4	8°55.2
Peacock	53°14.6	-56°40.7
Deneb	49°29.3	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.8	-46°52.6
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.2	28°10.9
Markab	13°35.2	15°18.2

Oct 10 Tue	**SHA**	**Mer.pass**
Venus	184°27.4	10:27
Mars	186°57.2	10:16
Jupiter	151°50.1	12:36
Saturn	97°46.1	16:11

Oct 11 Wed	**SHA**	**Mer.pass**
Venus	183°18.8	10:28
Mars	186°22.3	10:15
Jupiter	151°37.8	12:33
Saturn	97°41.6	16:08

Oct 12 Thu	**SHA**	**Mer.pass**
Venus	182°10.2	10:29
Mars	185°47.4	10:13
Jupiter	151°25.5	12:30
Saturn	97°37.1	16:04

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3059 sec ΔT = TT-UT1 = +68.8781 sec

2017 October 10 to Oct. 12 UT

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	183°13.9	S06°37.8	306°08.0	6.1′	N17°40.2	5.4′	59.7′
1	198°14.1	38.8	320°33.1	6.1′	17°45.6	5.3′	59.7′
2	213°14.3	39.7	334°58.1	6.0′	17°50.8	5.2′	59.7′
3	228°14.4	·· 40.7	349°23.1	6.0′	17°55.9	5.1′	59.7′
4	243°14.6	41.6	3°48.1	6.0′	18°00.9	4.9′	59.7′
5	258°14.8	42.6	18°13.1	5.9′	18°05.8	4.8′	59.7′
6	273°14.9	S06°43.5	32°38.0	5.9′	N18°10.5	4.7′	59.7′
7	288°15.1	44.4	47°02.9	5.9′	18°15.2	4.6′	59.7′
8	303°15.3	45.4	61°27.8	5.9′	18°19.7	4.4′	59.7′
9	318°15.4	·· 46.3	75°52.7	5.9′	18°24.1	4.3′	59.7′
10	333°15.6	47.3	90°17.5	5.8′	18°28.3	4.2′	59.7′
11	348°15.8	48.2	104°42.4	5.8′	18°32.4	4.1′	59.7′
12	3°15.9	S06°49.2	119°07.2	5.8′	N18°36.4	3.9′	59.6′
13	18°16.1	50.1	133°32.0	5.8′	18°40.3	3.8′	59.6′
14	33°16.3	51.1	147°56.8	5.8′	18°44.1	3.7′	59.6′
15	48°16.4	·· 52.0	162°21.5	5.8′	18°47.7	3.6′	59.6′
16	63°16.6	53.0	176°46.3	5.7′	18°51.2	3.4′	59.6′
17	78°16.7	53.9	191°11.0	5.7′	18°54.6	3.3′	59.6′
18	93°16.9	S06°54.8	205°35.7	5.7′	N18°57.8	3.2′	59.6′
19	108°17.1	55.8	220°00.4	5.7′	19°00.9	3.1′	59.6′
20	123°17.2	56.7	234°25.1	5.7′	19°03.9	2.9′	59.6′
21	138°17.4	·· 57.7	248°49.8	5.7′	19°06.8	2.8′	59.6′
22	153°17.6	58.6	263°14.5	5.7′	19°09.5	2.7′	59.6′
23	168°17.7	59.6	277°39.2	5.7′	19°12.1	2.5′	59.6′
	SD.=16.0	d=-0.9	S.D.=16.3				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°17.9	S07°00.5	292°03.9	5.7′	N19°14.6	2.4′	59.5′
1	198°18.0	01.4	306°28.5	5.7′	19°16.9	2.3′	59.5′
2	213°18.2	02.4	320°53.2	5.7′	19°19.1	2.1′	59.5′
3	228°18.4	·· 03.3	335°17.9	5.7′	19°21.2	2.0′	59.5′
4	243°18.5	04.3	349°42.5	5.7′	19°23.2	1.9′	59.5′
5	258°18.7	05.2	4°07.2	5.7′	19°25.0	1.8′	59.5′
6	273°18.9	S07°06.1	18°31.9	5.7′	N19°26.7	1.6′	59.5′
7	288°19.0	07.1	32°56.5	5.7′	19°28.2	1.5′	59.5′
8	303°19.2	08.0	47°21.2	5.7′	19°29.6	1.4′	59.5′
9	318°19.3	·· 09.0	61°45.9	5.7′	19°30.9	1.2′	59.4′
10	333°19.5	09.9	76°10.6	5.7′	19°32.1	1.1′	59.4′
11	348°19.7	10.9	90°35.3	5.7′	19°33.1	1.0′	59.4′
12	3°19.8	S07°11.8	105°00.0	5.7′	N19°34.0	0.8′	59.4′
13	18°20.0	12.7	119°24.7	5.7′	19°34.8	0.7′	59.4′
14	33°20.1	13.7	133°49.4	5.7′	19°35.4	0.6′	59.4′
15	48°20.3	·· 14.6	148°14.2	5.7′	19°35.9	0.4′	59.4′
16	63°20.4	15.6	162°38.9	5.8′	19°36.3	0.3′	59.4′
17	78°20.6	16.5	177°03.7	5.8′	19°36.6	0.2′	59.4′
18	93°20.8	S07°17.4	191°28.5	5.8′	N19°36.7	0.0′	59.3′
19	108°20.9	18.4	205°53.3	5.8′	19°36.7	-0.1′	59.3′
20	123°21.1	19.3	220°18.1	5.8′	19°36.5	-0.2′	59.3′
21	138°21.2	·· 20.3	234°42.9	5.8′	19°36.2	-0.3′	59.3′
22	153°21.4	21.2	249°07.8	5.9′	19°35.8	-0.5′	59.3′
23	168°21.6	22.1	263°32.6	5.9′	19°35.3	-0.6′	59.3′
	SD.=16.0	d=-0.9	S.D.=16.2				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	183°21.7	S07°23.1	277°57.5	5.9′	N19°34.6	-0.7′	59.3′
1	198°21.9	24.0	292°22.5	5.9′	19°33.8	-0.9′	59.2′
2	213°22.0	24.9	306°47.4	6.0′	19°32.9	-1.0′	59.2′
3	228°22.2	·· 25.9	321°12.4	6.0′	19°31.9	-1.1′	59.2′
4	243°22.3	26.8	335°37.4	6.0′	19°30.7	-1.2′	59.2′
5	258°22.5	27.8	350°02.4	6.0′	19°29.4	-1.4′	59.2′
6	273°22.6	S07°28.7	4°27.5	6.1′	N19°27.9	-1.5′	59.2′
7	288°22.8	29.6	18°52.5	6.1′	19°26.4	-1.6′	59.2′
8	303°23.0	30.6	33°17.7	6.1′	19°24.7	-1.8′	59.1′
9	318°23.1	·· 31.5	47°42.8	6.2′	19°22.9	-1.9′	59.1′
10	333°23.3	32.4	62°08.0	6.2′	19°20.9	-2.0′	59.1′
11	348°23.4	33.4	76°33.2	6.2′	19°18.9	-2.1′	59.1′
12	3°23.6	S07°34.3	90°58.5	6.3′	N19°16.7	-2.3′	59.1′
13	18°23.7	35.3	105°23.8	6.3′	19°14.4	-2.4′	59.1′
14	33°23.9	36.2	119°49.1	6.3′	19°11.9	-2.5′	59.1′
15	48°24.0	·· 37.1	134°14.4	6.4′	19°09.4	-2.6′	59.0′
16	63°24.2	38.1	148°39.8	6.4′	19°06.7	-2.7′	59.0′
17	78°24.3	39.0	163°05.3	6.5′	19°03.9	-2.9′	59.0′
18	93°24.5	S07°39.9	177°30.8	6.5′	N19°00.9	-3.0′	59.0′
19	108°24.6	40.9	191°56.3	6.5′	18°57.9	-3.1′	59.0′
20	123°24.8	41.8	206°21.9	6.6′	18°54.7	-3.2′	59.0′
21	138°25.0	·· 42.7	220°47.5	6.6′	18°51.4	-3.3′	58.9′
22	153°25.1	43.7	235°13.1	6.7′	18°48.0	-3.5′	58.9′
23	168°25.3	44.6	249°38.8	6.7′	18°44.5	-3.6′	58.9′
	SD.=16.0	d=-0.9	S.D.=16.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:38	05:57	07:06	16:26	17:35	18:53
N 70°	04:44	05:55	06:57	16:35	17:37	18:47
68°	04:48	05:53	06:49	16:42	17:39	18:43
66°	04:52	05:52	06:43	16:49	17:40	18:39
64°	04:55	05:50	06:38	16:54	17:42	18:36
62°	04:58	05:49	06:34	16:58	17:43	18:34
60°	05:00	05:48	06:30	17:02	17:44	18:32
N 58°	05:01	05:47	06:26	17:06	17:45	18:31
56°	05:03	05:46	06:23	17:09	17:46	18:29
54°	05:04	05:45	06:20	17:12	17:47	18:28
52°	05:05	05:44	06:18	17:14	17:48	18:27
50°	05:06	05:43	06:16	17:17	17:49	18:27
45°	05:07	05:41	06:11	17:22	17:51	18:25
N 40°	05:08	05:39	06:06	17:26	17:54	18:25
35°	05:08	05:37	06:03	17:30	17:56	18:25
30°	05:08	05:35	05:59	17:34	17:58	18:25
20°	05:06	05:31	05:54	17:40	18:02	18:27
N 10°	05:03	05:27	05:48	17:45	18:06	18:30
0°	04:58	05:23	05:43	17:50	18:11	18:35
S 10°	04:52	05:17	05:38	17:55	18:16	18:41
20°	04:45	05:11	05:33	18:01	18:23	18:49
30°	04:34	05:02	05:26	18:07	18:32	19:00
35°	04:27	04:57	05:23	18:11	18:37	19:07
40°	04:18	04:51	05:18	18:16	18:43	19:16
45°	04:07	04:43	05:13	18:21	18:51	19:27
S 50°	03:54	04:34	05:07	18:27	19:00	19:41
52°	03:47	04:30	05:05	18:30	19:05	19:48
54°	03:40	04:25	05:02	18:33	19:10	19:56
56°	03:31	04:19	04:58	18:37	19:16	20:04
58°	03:21	04:13	04:54	18:40	19:22	20:14
S 60°	03:10	04:06	04:50	18:45	19:29	20:26

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	▭	▭	▭	▭	▭	▭
N 70°	17:40	18:10	19:37	14:41	16:14	16:49
68°	18:28	19:13	20:27	13:53	15:11	15:58
66°	19:00	19:48	20:59	13:22	14:36	15:26
64°	19:23	20:14	21:22	12:59	14:10	15:03
62°	19:41	20:34	21:41	12:41	13:51	14:44
60°	19:57	20:50	21:56	12:26	13:34	14:28
N 58°	20:10	21:04	22:09	12:13	13:21	14:15
56°	20:21	21:16	22:20	12:02	13:09	14:04
54°	20:31	21:26	22:30	11:52	12:58	13:54
52°	20:40	21:35	22:39	11:44	12:49	13:45
50°	20:48	21:43	22:46	11:36	12:41	13:37
45°	21:05	22:01	23:03	11:19	12:23	13:20
N 40°	21:19	22:15	23:17	11:06	12:09	13:06
35°	21:30	22:28	23:28	10:54	11:57	12:54
30°	21:41	22:38	23:39	10:44	11:46	12:44
20°	21:59	22:57	23:56	10:27	11:28	12:26
N 10°	22:14	23:13	–:–	10:12	11:12	12:10
0°	22:29	23:28	–:–	09:58	10:57	11:55
S 10°	22:43	23:43	–:–	09:44	10:42	11:41
20°	22:59	23:59	–:–	09:29	10:26	11:25
30°	23:17	–:–	00:17	09:12	10:08	11:07
35°	23:28	–:–	00:28	09:02	09:57	10:56
40°	23:40	–:–	00:40	08:50	09:45	10:44
45°	23:54	–:–	00:55	08:37	09:30	10:30
S 50°	–:–	00:12	01:12	08:21	09:12	10:12
52°	–:–	00:20	01:21	08:13	09:04	10:04
54°	–:–	00:29	01:30	08:05	08:55	09:54
56°	–:–	00:40	01:41	07:55	08:44	09:44
58°	–:–	00:51	01:53	07:44	08:32	09:32
S 60°	–:–	01:05	02:06	07:32	08:18	09:18

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 20-22 73-50%
10	12:56	13:04	11:47	03:44	16:13	
11	13:12	13:19	11:47	04:43	17:12	
12	13:27	13:34	11:46	05:41	18:10	

October 13, 14, 15 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	21°44.7	202°46.4	N02°04.1	206°57.2	N03°31.3	172°57.9	S10°41.6	119°17.1	S22°13.0
1	36°47.1	217°46.0	02.9	221°58.2	30.6	187°59.8	41.8	134°19.3	13.0
2	51°49.6	232°45.6	01.7	236°59.2	30.0	203°01.8	42.0	149°21.6	13.0
3	66°52.1	247°45.2	02°00.5	252°00.2	·· 29.4	218°03.7	·· 42.2	164°23.9	·· 13.1
4	81°54.5	262°44.8	01°59.3	267°01.2	28.8	233°05.7	42.4	179°26.2	13.1
5	96°57.0	277°44.4	58.1	282°02.2	28.1	248°07.6	42.6	194°28.4	13.1
6	111°59.5	292°44.0	N01°56.9	297°03.2	N03°27.5	263°09.6	S10°42.8	209°30.7	S22°13.1
7	127°01.9	307°43.6	55.7	312°04.2	26.9	278°11.5	42.9	224°33.0	13.1
8	142°04.4	322°43.2	54.5	327°05.2	26.3	293°13.5	43.1	239°35.2	13.1
9	157°06.8	337°42.8	·· 53.3	342°06.3	·· 25.6	308°15.4	·· 43.3	254°37.5	·· 13.2
10	172°09.3	352°42.5	52.1	357°07.3	25.0	323°17.4	43.5	269°39.8	13.2
11	187°11.8	7°42.1	50.9	12°08.3	24.4	338°19.3	43.7	284°42.0	13.2
12	202°14.2	22°41.7	N01°49.6	27°09.3	N03°23.7	353°21.3	S10°43.9	299°44.3	S22°13.2
13	217°16.7	37°41.3	48.4	42°10.3	23.1	8°23.2	44.1	314°46.6	13.2
14	232°19.2	52°40.9	47.2	57°11.3	22.5	23°25.2	44.3	329°48.8	13.2
15	247°21.6	67°40.5	·· 46.0	72°12.3	·· 21.9	38°27.1	·· 44.5	344°51.1	·· 13.2
16	262°24.1	82°40.1	44.8	87°13.3	21.2	53°29.1	44.7	359°53.4	13.3
17	277°26.6	97°39.7	43.6	102°14.3	20.6	68°31.0	44.9	14°55.6	13.3
18	292°29.0	112°39.3	N01°42.4	117°15.4	N03°20.0	83°33.0	S10°45.0	29°57.9	S22°13.3
19	307°31.5	127°38.9	41.2	132°16.4	19.3	98°34.9	45.2	45°00.2	13.3
20	322°33.9	142°38.5	40.0	147°17.4	18.7	113°36.9	45.4	60°02.4	13.3
21	337°36.4	157°38.2	·· 38.8	162°18.4	·· 18.1	128°38.8	·· 45.6	75°04.7	·· 13.3
22	352°38.9	172°37.8	37.6	177°19.4	17.4	143°40.8	45.8	90°07.0	13.4
23	7°41.3	187°37.4	36.3	192°20.4	16.8	158°42.7	46.0	105°09.2	13.4
Mer.pass.:22:29		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v2.0 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	22°43.8	202°37.0	N01°35.1	207°21.4	N03°16.2	173°44.7	S10°46.2	120°11.5	S22°13.4
1	37°46.3	217°36.6	33.9	222°22.4	15.6	188°46.6	46.4	135°13.7	13.4
2	52°48.7	232°36.2	32.7	237°23.5	14.9	203°48.6	46.6	150°16.0	13.4
3	67°51.2	247°35.8	·· 31.5	252°24.5	·· 14.3	218°50.5	·· 46.8	165°18.3	·· 13.4
4	82°53.7	262°35.4	30.3	267°25.5	13.7	233°52.5	46.9	180°20.5	13.5
5	97°56.1	277°35.0	29.1	282°26.5	13.0	248°54.4	47.1	195°22.8	13.5
6	112°58.6	292°34.6	N01°27.9	297°27.5	N03°12.4	263°56.4	S10°47.3	210°25.1	S22°13.5
7	128°01.1	307°34.2	26.7	312°28.5	11.8	278°58.3	47.5	225°27.3	13.5
8	143°03.5	322°33.9	25.5	327°29.5	11.2	294°00.3	47.7	240°29.6	13.5
9	158°06.0	337°33.5	·· 24.2	342°30.5	·· 10.5	309°02.2	·· 47.9	255°31.9	·· 13.5
10	173°08.4	352°33.1	23.0	357°31.5	09.9	324°04.2	48.1	270°34.1	13.6
11	188°10.9	7°32.7	21.8	12°32.6	09.3	339°06.1	48.3	285°36.4	13.6
12	203°13.4	22°32.3	N01°20.6	27°33.6	N03°08.6	354°08.1	S10°48.5	300°38.7	S22°13.6
13	218°15.8	37°31.9	19.4	42°34.6	08.0	9°10.0	48.7	315°40.9	13.6
14	233°18.3	52°31.5	18.2	57°35.6	07.4	24°11.9	48.8	330°43.2	13.6
15	248°20.8	67°31.1	·· 17.0	72°36.6	·· 06.8	39°13.9	·· 49.0	345°45.4	·· 13.6
16	263°23.2	82°30.7	15.8	87°37.6	06.1	54°15.8	49.2	0°47.7	13.6
17	278°25.7	97°30.3	14.5	102°38.6	05.5	69°17.8	49.4	15°50.0	13.7
18	293°28.2	112°30.0	N01°13.3	117°39.6	N03°04.9	84°19.7	S10°49.6	30°52.2	S22°13.7
19	308°30.6	127°29.6	12.1	132°40.7	04.2	99°21.7	49.8	45°54.5	13.7
20	323°33.1	142°29.2	10.9	147°41.7	03.6	114°23.6	50.0	60°56.8	13.7
21	338°35.6	157°28.8	·· 09.7	162°42.7	·· 03.0	129°25.6	·· 50.2	75°59.0	·· 13.7
22	353°38.0	172°28.4	08.5	177°43.7	02.3	144°27.5	50.4	91°01.3	13.7
23	8°40.5	187°28.0	07.3	192°44.7	01.7	159°29.5	50.6	106°03.5	13.8
Mer.pass.:22:25		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	23°42.9	202°27.6	N01°06.1	207°45.7	N03°01.1	174°31.4	S10°50.7	121°05.8	S22°13.8
1	38°45.4	217°27.2	04.8	222°46.7	03°00.5	189°33.4	50.9	136°08.1	13.8
2	53°47.9	232°26.8	03.6	237°47.7	02°59.8	204°35.3	51.1	151°10.3	13.8
3	68°50.3	247°26.4	·· 02.4	252°48.8	·· 59.2	219°37.3	·· 51.3	166°12.6	·· 13.8
4	83°52.8	262°26.0	01.2	267°49.8	58.6	234°39.2	51.5	181°14.9	13.8
5	98°55.3	277°25.7	01°00.0	282°50.8	57.9	249°41.2	51.7	196°17.1	13.9
6	113°57.7	292°25.3	N00°58.8	297°51.8	N02°57.3	264°43.1	S10°51.9	211°19.4	S22°13.9
7	129°00.2	307°24.9	57.6	312°52.8	56.7	279°45.1	52.1	226°21.6	13.9
8	144°02.7	322°24.5	56.3	327°53.8	56.1	294°47.0	52.3	241°23.9	13.9
9	159°05.1	337°24.1	·· 55.1	342°54.8	·· 55.4	309°49.0	·· 52.5	256°26.2	·· 13.9
10	174°07.6	352°23.7	53.9	357°55.8	54.8	324°50.9	52.6	271°28.4	13.9
11	189°10.0	7°23.3	52.7	12°56.9	54.2	339°52.9	52.8	286°30.7	14.0
12	204°12.5	22°22.9	N00°51.5	27°57.9	N02°53.5	354°54.8	S10°53.0	301°32.9	S22°14.0
13	219°15.0	37°22.5	50.3	42°58.9	52.9	9°56.8	53.2	316°35.2	14.0
14	234°17.4	52°22.1	49.1	57°59.9	52.3	24°58.7	53.4	331°37.5	14.0
15	249°19.9	67°21.8	·· 47.8	73°00.9	·· 51.6	40°00.6	·· 53.6	346°39.7	·· 14.0
16	264°22.4	82°21.4	46.6	88°01.9	51.0	55°02.6	53.8	1°42.0	14.0
17	279°24.8	97°21.0	45.4	103°02.9	50.4	70°04.5	54.0	16°44.2	14.0
18	294°27.3	112°20.6	N00°44.2	118°03.9	N02°49.8	85°06.5	S10°54.2	31°46.5	S22°14.1
19	309°29.8	127°20.2	43.0	133°05.0	49.1	100°08.4	54.4	46°48.8	14.1
20	324°32.2	142°19.8	41.8	148°06.0	48.5	115°10.4	54.5	61°51.0	14.1
21	339°34.7	157°19.4	·· 40.6	163°07.0	·· 47.9	130°12.3	·· 54.7	76°53.3	·· 14.1
22	354°37.2	172°19.0	39.3	178°08.0	47.2	145°14.3	54.9	91°55.5	14.1
23	9°39.6	187°18.6	38.1	193°09.0	46.6	160°16.2	55.1	106°57.8	14.1
Mer.pass.:22:21		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.1
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°08.9
Hamal	327°57.1	23°32.7
Polaris	316°01.8	89°20.1
Acamar	315°15.8	-40°14.0
Menkar	314°11.7	4°09.5
Mirfak	308°35.7	49°55.2
Aldebaran	290°45.8	16°32.5
Rigel	281°09.1	-8°10.9
Capella	280°29.9	46°00.6
Bellatrix	278°28.7	6°21.8
Elnath	278°08.8	28°37.1
Alnilam	275°43.3	-1°11.5
Betelgeuse	270°58.0	7°24.5
Canopus	263°54.7	-52°42.1
Sirius	258°31.1	-16°44.4
Adhara	255°10.2	-28°59.7
Procyon	244°56.7	5°10.7
Pollux	243°24.2	27°58.8
Avior	234°16.9	-59°33.7
Suhail	222°50.5	-43°30.0
Miaplacidus	221°39.4	-69°47.1
Alphard	217°53.4	-8°44.0
Regulus	207°40.7	11°52.9
Dubhe	193°48.8	61°39.2
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.6	-63°11.6
Gacrux	171°58.1	-57°12.5
Alioth	166°18.8	55°51.9
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.7
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.3
Kochab	137°21.3	74°05.2
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.7
Antares	112°22.9	-26°28.1
Atria	107°22.4	-69°03.5
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°03.9	12°33.2
Eltanin	90°45.0	51°29.7
Kaus Aust.	83°40.1	-34°22.4
Vega	80°37.1	38°48.5
Nunki	75°54.8	-26°16.3
Altair	62°05.4	8°55.2
Peacock	53°14.6	-56°40.7
Deneb	49°29.3	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.9	-46°52.6
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.2	28°10.9
Markab	13°35.2	15°18.2

Oct 13 Fri	SHA	Mer.pass
Venus	181°01.7	10:29
Mars	185°12.5	10:11
Jupiter	151°13.2	12:27
Saturn	97°32.4	16:00

Oct 14 Sat	SHA	Mer.pass
Venus	179°53.2	10:30
Mars	184°37.6	10:10
Jupiter	151°00.9	12:23
Saturn	97°27.7	15:57

Oct 15 Sun	SHA	Mer.pass
Venus	178°44.7	10:30
Mars	184°02.8	10:08
Jupiter	150°48.5	12:20
Saturn	97°22.9	15:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.3028 sec ΔT = TT-UT1 = +68.8812 sec

2017 October 13 to Oct. 15 UT

h — Sun — Moon

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	183°25.4	S07°45.5	264°04.6	6.8′	N18°40.8	-3.7′	58.9′
1	198°25.6	46.5	278°30.3	6.8′	18°37.1	-3.8′	58.9′
2	213°25.7	47.4	292°56.2	6.9′	18°33.2	-3.9′	58.9′
3	228°25.9	·· 48.3	307°22.1	6.9′	18°29.2	-4.1′	58.9′
4	243°26.0	49.3	321°48.0	7.0′	18°25.1	-4.2′	58.8′
5	258°26.2	50.2	336°14.0	7.0′	18°20.9	-4.3′	58.8′
6	273°26.3	S07°51.1	350°40.0	7.1′	N18°16.6	-4.4′	58.8′
7	288°26.5	52.1	5°06.1	7.1′	18°12.1	-4.5′	58.8′
8	303°26.6	53.0	19°32.2	7.2′	18°07.5	-4.6′	58.8′
9	318°26.8	·· 53.9	33°58.4	7.2′	18°02.9	-4.7′	58.8′
10	333°26.9	54.9	48°24.6	7.3′	17°58.1	-4.8′	58.7′
11	348°27.1	55.8	62°50.9	7.3′	17°53.2	-4.9′	58.7′
12	3°27.2	S07°56.7	77°17.3	7.4′	N17°48.2	-5.1′	58.7′
13	18°27.4	57.7	91°43.7	7.4′	17°43.1	-5.2′	58.7′
14	33°27.5	58.6	106°10.1	7.5′	17°37.9	-5.3′	58.7′
15	48°27.6	07°59.5	120°36.6	7.5′	17°32.6	-5.4′	58.6′
16	63°27.8	08°00.5	135°03.2	7.6′	17°27.2	-5.5′	58.6′
17	78°27.9	01.4	149°29.8	7.6′	17°21.6	-5.6′	58.6′
18	93°28.1	S08°02.3	163°56.5	7.7′	N17°16.0	-5.7′	58.6′
19	108°28.2	03.3	178°23.2	7.8′	17°10.3	-5.8′	58.6′
20	123°28.4	04.2	192°50.0	7.8′	17°04.4	-5.9′	58.6′
21	138°28.5	·· 05.1	207°16.8	7.9′	16°58.5	-6.0′	58.5′
22	153°28.7	06.1	221°43.7	7.9′	16°52.5	-6.1′	58.5′
23	168°28.8	07.0	236°10.7	8.0′	16°46.3	-6.2′	58.5′
	SD.=16.0	d=-0.9		S.D.=16.0			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°29.0	S08°07.9	250°37.7	8.0′	N16°40.1	-6.3′	58.5′
1	198°29.1	08.8	265°04.8	8.1′	16°33.8	-6.4′	58.5′
2	213°29.3	09.8	279°31.9	8.2′	16°27.3	-6.5′	58.5′
3	228°29.4	·· 10.7	293°59.1	8.2′	16°20.8	-6.6′	58.4′
4	243°29.5	11.6	308°26.3	8.3′	16°14.2	-6.7′	58.4′
5	258°29.7	12.6	322°53.7	8.3′	16°07.5	-6.8′	58.4′
6	273°29.8	S08°13.5	337°21.0	8.4′	N16°00.7	-6.8′	58.4′
7	288°30.0	14.4	351°48.5	8.5′	15°53.8	-6.9′	58.4′
8	303°30.1	15.3	6°16.0	8.5′	15°46.8	-7.0′	58.3′
9	318°30.3	·· 16.3	20°43.5	8.6′	15°39.8	-7.1′	58.3′
10	333°30.4	17.2	35°11.1	8.6′	15°32.6	-7.2′	58.3′
11	348°30.6	18.1	49°38.8	8.7′	15°25.4	-7.3′	58.3′
12	3°30.7	S08°19.1	64°06.5	8.8′	N15°18.0	-7.4′	58.3′
13	18°30.8	20.0	78°34.3	8.8′	15°10.6	-7.5′	58.3′
14	33°31.0	20.9	93°02.2	8.9′	15°03.1	-7.5′	58.2′
15	48°31.1	·· 21.8	107°30.1	8.9′	14°55.5	-7.6′	58.2′
16	63°31.3	22.8	121°58.1	9.0′	14°47.9	-7.7′	58.2′
17	78°31.4	23.7	136°26.1	9.1′	14°40.1	-7.8′	58.2′
18	93°31.5	S08°24.6	150°54.2	9.1′	N14°32.3	-7.9′	58.2′
19	108°31.7	25.5	165°22.3	9.2′	14°24.4	-7.9′	58.1′
20	123°31.8	26.5	179°50.6	9.2′	14°16.4	-8.0′	58.1′
21	138°32.0	·· 27.4	194°18.8	9.3′	14°08.3	-8.1′	58.1′
22	153°32.1	28.3	208°47.2	9.4′	14°00.2	-8.2′	58.1′
23	168°32.2	29.2	223°15.6	9.4′	13°52.0	-8.2′	58.1′
	SD.=16.0	d=-0.9		S.D.=15.9			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°32.4	S08°30.2	237°44.0	9.5′	N13°43.7	-8.3′	58.1′
1	198°32.5	31.1	252°12.6	9.5′	13°35.4	-8.4′	58.0′
2	213°32.7	32.0	266°41.1	9.6′	13°26.9	-8.5′	58.0′
3	228°32.8	·· 32.9	281°09.8	9.7′	13°18.4	-8.5′	58.0′
4	243°32.9	33.9	295°38.5	9.7′	13°09.9	-8.6′	58.0′
5	258°33.1	34.8	310°07.2	9.8′	13°01.2	-8.7′	58.0′
6	273°33.2	S08°35.7	324°36.0	9.8′	N12°52.5	-8.7′	57.9′
7	288°33.4	36.6	339°04.9	9.9′	12°43.7	-8.8′	57.9′
8	303°33.5	37.6	353°33.8	10.0′	12°34.9	-8.9′	57.9′
9	318°33.6	·· 38.5	8°02.8	10.0′	12°26.0	-8.9′	57.9′
10	333°33.8	39.4	22°31.9	10.1′	12°17.0	-9.0′	57.9′
11	348°33.9	40.3	37°01.0	10.1′	12°08.0	-9.1′	57.8′
12	3°34.0	S08°41.3	51°30.2	10.2′	N11°58.9	-9.1′	57.8′
13	18°34.2	42.2	65°59.4	10.3′	11°49.8	-9.2′	57.8′
14	33°34.3	43.1	80°28.7	10.3′	11°40.6	-9.2′	57.8′
15	48°34.5	·· 44.0	94°58.0	10.4′	11°31.3	-9.3′	57.8′
16	63°34.6	44.9	109°27.4	10.4′	11°22.0	-9.4′	57.7′
17	78°34.7	45.9	123°56.8	10.5′	11°12.6	-9.4′	57.7′
18	93°34.9	S08°46.8	138°26.3	10.5′	N11°03.2	-9.5′	57.7′
19	108°35.0	47.7	152°55.9	10.6′	10°53.7	-9.5′	57.7′
20	123°35.1	48.6	167°25.5	10.6′	10°44.1	-9.6′	57.7′
21	138°35.3	·· 49.6	181°55.2	10.7′	10°34.5	-9.6′	57.6′
22	153°35.4	50.5	196°24.9	10.7′	10°24.9	-9.7′	57.6′
23	168°35.5	51.4	210°54.7	10.8′	10°15.2	-9.7′	57.6′
	SD.=16.0	d=-0.9		S.D.=15.8			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	04:51	06:10	07:20	16:10	17:20	18:38
N 70°	04:56	06:06	07:09	16:21	17:24	18:34
68°	04:59	06:03	07:00	16:30	17:27	18:31
66°	05:02	06:01	06:53	16:37	17:29	18:28
64°	05:04	05:59	06:47	16:43	17:32	18:26
62°	05:05	05:57	06:42	16:49	17:34	18:25
60°	05:07	05:55	06:37	16:54	17:36	18:24
N 58°	05:08	05:53	06:33	16:58	17:37	18:23
56°	05:09	05:52	06:29	17:01	17:39	18:22
54°	05:09	05:50	06:26	17:05	17:40	18:21
52°	05:10	05:49	06:23	17:08	17:42	18:21
50°	05:10	05:48	06:20	17:11	17:43	18:21
45°	05:11	05:45	06:14	17:17	17:46	18:20
N 40°	05:11	05:42	06:09	17:22	17:49	18:20
35°	05:10	05:40	06:05	17:26	17:52	18:21
30°	05:09	05:37	06:01	17:30	17:54	18:22
20°	05:07	05:32	05:54	17:37	17:59	18:25
N 10°	05:03	05:27	05:48	17:43	18:05	18:29
0°	04:58	05:22	05:43	17:49	18:10	18:34
S 10°	04:51	05:16	05:37	17:55	18:17	18:41
20°	04:42	05:08	05:30	18:02	18:24	18:50
30°	04:30	04:59	05:23	18:09	18:34	19:03
35°	04:22	04:53	05:19	18:14	18:40	19:10
40°	04:13	04:46	05:14	18:19	18:47	19:20
45°	04:01	04:38	05:08	18:25	18:55	19:32
S 50°	03:46	04:27	05:01	18:32	19:06	19:47
52°	03:39	04:23	04:58	18:35	19:11	19:54
54°	03:31	04:17	04:54	18:39	19:16	20:03
56°	03:22	04:11	04:50	18:43	19:22	20:12
58°	03:11	04:04	04:46	18:47	19:29	20:23
S 60°	02:58	03:56	04:41	18:52	19:38	20:37

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	20:34	22:51	–:–	17:51	17:26	17:12
N 70°	21:28	23:20	–:–	16:55	16:56	16:54
68°	22:01	23:41	–:–	16:22	16:34	16:40
66°	22:25	23:57	–:–	15:57	16:16	16:28
64°	22:43	–:–	00:11	15:38	16:02	16:18
62°	22:59	–:–	00:22	15:22	15:50	16:10
60°	23:11	–:–	00:32	15:09	15:39	16:03
N 58°	23:22	–:–	00:40	14:58	15:30	15:56
56°	23:32	–:–	00:48	14:48	15:22	15:50
54°	23:40	–:–	00:54	14:39	15:15	15:45
52°	23:48	–:–	01:00	14:31	15:09	15:41
50°	23:55	–:–	01:05	14:24	15:03	15:36
45°	–:–	00:09	01:17	14:09	14:51	15:27
N 40°	–:–	00:21	01:26	13:56	14:40	15:19
35°	–:–	00:31	01:34	13:46	14:31	15:13
30°	–:–	00:40	01:41	13:36	14:24	15:07
20°	–:–	00:55	01:54	13:20	14:10	14:56
N 10°	00:11	01:09	02:04	13:06	13:58	14:47
0°	00:25	01:21	02:14	12:52	13:47	14:39
S 10°	00:39	01:33	02:24	12:39	13:35	14:30
20°	00:55	01:47	02:35	12:24	13:23	14:21
30°	01:12	02:02	02:47	12:08	13:09	14:10
35°	01:22	02:11	02:54	11:58	13:01	14:04
40°	01:34	02:21	03:02	11:47	12:52	13:57
45°	01:47	02:32	03:11	11:34	12:41	13:49
S 50°	02:04	02:47	03:22	11:18	12:28	13:39
52°	02:11	02:53	03:27	11:10	12:22	13:35
54°	02:20	03:00	03:33	11:02	12:15	13:30
56°	02:30	03:09	03:39	10:53	12:07	13:24
58°	02:41	03:18	03:46	10:42	11:58	13:18
S 60°	02:53	03:28	03:54	10:30	11:49	13:10

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 23-25 39-19%
13	13:42	13:49	11:46	06:39	19:07	
14	13:56	14:03	11:46	07:34	20:01	
15	14:10	14:16	11:46	08:27	20:52	

October 16, 17, 18 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	24°42.1	202°18.2	N00°36.9	208°10.0	N02°46.0	175°18.2	S10°55.3	122°00.1	S22°14.2
1	39°44.5	217°17.8	35.7	223°11.0	45.3	190°20.1	55.5	137°02.3	14.2
2	54°47.0	232°17.5	34.5	238°12.1	44.7	205°22.1	55.7	152°04.6	14.2
3	69°49.5	247°17.1	·· 33.3	253°13.1	·· 44.1	220°24.0	·· 55.9	167°06.8	·· 14.2
4	84°51.9	262°16.7	32.0	268°14.1	43.5	235°26.0	56.1	182°09.1	14.2
5	99°54.4	277°16.3	30.8	283°15.1	42.8	250°27.9	56.3	197°11.3	14.2
6	114°56.9	292°15.9	N00°29.6	298°16.1	N02°42.2	265°29.9	S10°56.4	212°13.6	S22°14.3
7	129°59.3	307°15.5	28.4	313°17.1	41.6	280°31.8	56.6	227°15.9	14.3
8	145°01.8	322°15.1	27.2	328°18.1	40.9	295°33.7	56.8	242°18.1	14.3
9	160°04.3	337°14.7	·· 26.0	343°19.1	·· 40.3	310°35.7	·· 57.0	257°20.4	·· 14.3
10	175°06.7	352°14.3	24.7	358°20.2	39.7	325°37.6	57.2	272°22.6	14.3
11	190°09.2	7°13.9	23.5	13°21.2	39.0	340°39.6	57.4	287°24.9	14.3
12	205°11.6	22°13.5	N00°22.3	28°22.2	N02°38.4	355°41.5	S10°57.6	302°27.1	S22°14.3
13	220°14.1	37°13.2	21.1	43°23.2	37.8	10°43.5	57.8	317°29.4	14.4
14	235°16.6	52°12.8	19.9	58°24.2	37.2	25°45.4	58.0	332°31.7	14.4
15	250°19.0	67°12.4	·· 18.7	73°25.2	·· 36.5	40°47.4	·· 58.2	347°33.9	·· 14.4
16	265°21.5	82°12.0	17.4	88°26.2	35.9	55°49.3	58.3	2°36.2	14.4
17	280°24.0	97°11.6	16.2	103°27.3	35.3	70°51.3	58.5	17°38.4	14.4
18	295°26.4	112°11.2	N00°15.0	118°28.3	N02°34.6	85°53.2	S10°58.7	32°40.7	S22°14.4
19	310°28.9	127°10.8	13.8	133°29.3	34.0	100°55.2	58.9	47°42.9	14.5
20	325°31.4	142°10.4	12.6	148°30.3	33.4	115°57.1	59.1	62°45.2	14.5
21	340°33.8	157°10.0	·· 11.4	163°31.3	·· 32.7	130°59.1	·· 59.3	77°47.5	·· 14.5
22	355°36.3	172°09.6	10.1	178°32.3	32.1	146°01.0	59.5	92°49.7	14.5
23	10°38.8	187°09.2	08.9	193°33.3	31.5	161°02.9	59.7	107°52.0	14.5
Mer.pass.:22:18		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	25°41.2	202°08.8	N00°07.7	208°34.4	N02°30.9	176°04.9	S10°59.9	122°54.2	S22°14.5
1	40°43.7	217°08.5	06.5	223°35.4	30.2	191°06.8	11°00.1	137°56.5	14.6
2	55°46.1	232°08.1	05.3	238°36.4	29.6	206°08.8	00.2	152°58.7	14.6
3	70°48.6	247°07.7	·· 04.0	253°37.4	·· 29.0	221°10.7	·· 00.4	168°01.0	·· 14.6
4	85°51.1	262°07.3	02.8	268°38.4	28.3	236°12.7	00.6	183°03.2	14.6
5	100°53.5	277°06.9	01.6	283°39.4	27.7	251°14.6	00.8	198°05.5	14.6
6	115°56.0	292°06.5	N00°00.4	298°40.4	N02°27.1	266°16.6	S11°01.0	213°07.7	S22°14.6
7	130°58.5	307°06.1	S00°00.8	313°41.4	26.4	281°18.5	01.2	228°10.0	14.7
8	146°00.9	322°05.7	02.0	328°42.5	25.8	296°20.5	01.4	243°12.3	14.7
9	161°03.4	337°05.3	·· 03.3	343°43.5	·· 25.2	311°22.4	·· 01.6	258°14.5	·· 14.7
10	176°05.9	352°04.9	04.5	358°44.5	24.5	326°24.4	01.8	273°16.8	14.7
11	191°08.3	7°04.5	05.7	13°45.5	23.9	341°26.3	01.9	288°19.0	14.7
12	206°10.8	22°04.1	S00°06.9	28°46.5	N02°23.3	356°28.2	S11°02.1	303°21.3	S22°14.7
13	221°13.2	37°03.8	08.1	43°47.5	22.7	11°30.2	02.3	318°23.5	14.7
14	236°15.7	52°03.4	09.4	58°48.5	22.0	26°32.1	02.5	333°25.8	14.8
15	251°18.2	67°03.0	·· 10.6	73°49.6	·· 21.4	41°34.1	·· 02.7	348°28.0	·· 14.8
16	266°20.6	82°02.6	11.8	88°50.6	20.8	56°36.0	02.9	3°30.3	14.8
17	281°23.1	97°02.2	13.0	103°51.6	20.1	71°38.0	03.1	18°32.5	14.8
18	296°25.6	112°01.8	S00°14.2	118°52.6	N02°19.5	86°39.9	S11°03.3	33°34.8	S22°14.8
19	311°28.0	127°01.4	15.5	133°53.6	18.9	101°41.9	03.5	48°37.0	14.8
20	326°30.5	142°01.0	16.7	148°54.6	18.2	116°43.8	03.7	63°39.3	14.9
21	341°33.0	157°00.6	·· 17.9	163°55.6	·· 17.6	131°45.8	·· 03.8	78°41.5	·· 14.9
22	356°35.4	172°00.2	19.1	178°56.7	17.0	146°47.7	04.0	93°43.8	14.9
23	11°37.9	186°59.8	20.3	193°57.7	16.4	161°49.6	04.2	108°46.1	14.9
Mer.pass.:22:14		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	26°40.4	201°59.4	S00°21.5	208°58.7	N02°15.7	176°51.6	S11°04.4	123°48.3	S22°14.9
1	41°42.8	216°59.1	22.8	223°59.7	15.1	191°53.5	04.6	138°50.6	14.9
2	56°45.3	231°58.7	24.0	239°00.7	14.5	206°55.5	04.8	153°52.8	15.0
3	71°47.7	246°58.3	·· 25.2	254°01.7	·· 13.8	221°57.4	·· 05.0	168°55.1	·· 15.0
4	86°50.2	261°57.9	26.4	269°02.7	13.2	236°59.4	05.2	183°57.3	15.0
5	101°52.7	276°57.5	27.6	284°03.8	12.6	252°01.3	05.4	198°59.6	15.0
6	116°55.1	291°57.1	S00°28.9	299°04.8	N02°11.9	267°03.3	S11°05.5	214°01.8	S22°15.0
7	131°57.6	306°56.7	30.1	314°05.8	11.3	282°05.2	05.7	229°04.1	15.0
8	147°00.1	321°56.3	31.3	329°06.8	10.7	297°07.2	05.9	244°06.3	15.1
9	162°02.5	336°55.9	·· 32.5	344°07.8	·· 10.0	312°09.1	·· 06.1	259°08.6	·· 15.1
10	177°05.0	351°55.5	33.7	359°08.8	09.4	327°11.0	06.3	274°10.8	15.1
11	192°07.5	6°55.1	35.0	14°09.8	08.8	342°13.0	06.5	289°13.1	15.1
12	207°09.9	21°54.7	S00°36.2	29°10.9	N02°08.2	357°14.9	S11°06.7	304°15.3	S22°15.1
13	222°12.4	36°54.3	37.4	44°11.9	07.5	12°16.9	06.9	319°17.6	15.1
14	237°14.9	51°53.9	38.6	59°12.9	06.9	27°18.8	07.1	334°19.8	15.1
15	252°17.3	66°53.6	·· 39.8	74°13.9	·· 06.3	42°20.8	·· 07.2	349°22.1	·· 15.2
16	267°19.8	81°53.2	41.1	89°14.9	05.6	57°22.7	07.4	4°24.3	15.2
17	282°22.2	96°52.8	42.3	104°15.9	05.0	72°24.7	07.6	19°26.6	15.2
18	297°24.7	111°52.4	S00°43.5	119°16.9	N02°04.4	87°26.6	S11°07.8	34°28.8	S22°15.2
19	312°27.2	126°52.0	44.7	134°18.0	03.7	102°28.5	08.0	49°31.1	15.2
20	327°29.6	141°51.6	45.9	149°19.0	03.1	117°30.5	08.2	64°33.3	15.2
21	342°32.1	156°51.2	·· 47.2	164°20.0	·· 02.5	132°32.4	·· 08.4	79°35.6	·· 15.3
22	357°34.6	171°50.8	48.4	179°21.0	01.8	147°34.4	08.6	94°37.8	15.3
23	12°37.0	186°50.4	49.6	194°22.0	01.2	162°36.3	08.8	109°40.1	15.3
Mer.pass.:22:10		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.3 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.6
Schedar	349°36.6	56°38.1
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°08.9
Hamal	327°57.1	23°32.7
Polaris	316°01.2	89°20.1
Acamar	315°15.8	-40°14.0
Menkar	314°11.7	4°09.5
Mirfak	308°35.7	49°55.2
Aldebaran	290°45.8	16°32.5
Rigel	281°09.1	-8°10.9
Capella	280°29.9	46°00.6
Bellatrix	278°28.7	6°21.8
Elnath	278°08.7	28°37.1
Alnilam	275°43.3	-1°11.5
Betelgeuse	270°58.0	7°24.5
Canopus	263°54.7	-52°42.1
Sirius	258°31.1	-16°44.4
Adhara	255°10.2	-28°59.7
Procyon	244°56.7	5°10.7
Pollux	243°24.2	27°58.8
Avior	234°16.9	-59°33.7
Suhail	222°50.4	-43°30.0
Miaplacidus	221°39.3	-69°47.1
Alphard	217°53.4	-8°44.0
Regulus	207°40.6	11°52.9
Dubhe	193°48.8	61°39.2
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.6	-63°11.6
Gacrux	171°58.1	-57°12.5
Alioth	166°18.8	55°51.9
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.7
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.3
Kochab	137°21.3	74°05.2
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.7
Antares	112°23.0	-26°28.1
Atria	107°22.5	-69°03.5
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°03.9	12°33.2
Eltanin	90°45.0	51°29.7
Kaus Aust.	83°40.1	-34°22.4
Vega	80°37.1	38°48.5
Nunki	75°54.8	-26°16.3
Altair	62°05.4	8°55.2
Peacock	53°14.6	-56°40.7
Deneb	49°29.4	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.9	-46°52.6
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.3	28°10.9
Markab	13°35.2	15°18.2

Oct 16 Mon	SHA	Mer.pass
Venus	177°36.2	10:31
Mars	183°27.9	10:07
Jupiter	150°36.1	12:17
Saturn	97°18.0	15:50

Oct 17 Tue	SHA	Mer.pass
Venus	176°27.6	10:32
Mars	182°53.1	10:05
Jupiter	150°23.7	12:14
Saturn	97°13.0	15:46

Oct 18 Wed	SHA	Mer.pass
Venus	175°19.1	10:32
Mars	182°18.3	10:03
Jupiter	150°11.2	12:11
Saturn	97°08.0	15:42

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2998 sec ΔT = TT-UT1 = +68.8842 sec

2017 October 16 to Oct. 18 UT

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°35.7	S08°52.3	225°24.5	10.9'	N10°05.4	-9.8'	57.6'
1	198°35.8	53.2	239°54.4	10.9'	09°55.7	-9.8'	57.6'
2	213°35.9	54.2	254°24.3	11.0'	09°45.8	-9.9'	57.5'
3	228°36.1	·· 55.1	268°54.3	11.0'	09°35.9	-9.9'	57.5'
4	243°36.2	56.0	283°24.3	11.1'	09°26.0	-9.9'	57.5'
5	258°36.3	56.9	297°54.4	11.1'	09°16.0	-10.0'	57.5'
6	273°36.5	S08°57.8	312°24.6	11.2'	N09°06.0	-10.0'	57.5'
7	288°36.6	58.7	326°54.7	11.2'	08°56.0	-10.1'	57.4'
8	303°36.7	08°59.7	341°25.0	11.3'	08°45.9	-10.1'	57.4'
9	318°36.9	09°00.6	355°55.3	11.3'	08°35.7	-10.2'	57.4'
10	333°37.0	01.5	10°25.6	11.4'	08°25.6	-10.2'	57.4'
11	348°37.1	02.4	24°56.0	11.4'	08°15.4	-10.2'	57.4'
12	3°37.3	S09°03.3	39°26.4	11.5'	N08°05.1	-10.3'	57.3'
13	18°37.4	04.3	53°56.9	11.5'	07°54.8	-10.3'	57.3'
14	33°37.5	05.2	68°27.4	11.5'	07°44.5	-10.3'	57.3'
15	48°37.6	·· 06.1	82°58.0	11.6'	07°34.2	-10.4'	57.3'
16	63°37.8	07.0	97°28.6	11.6'	07°23.8	-10.4'	57.3'
17	78°37.9	07.9	111°59.3	11.7'	07°13.4	-10.4'	57.2'
18	93°38.0	S09°08.8	126°30.0	11.7'	N07°02.9	-10.5'	57.2'
19	108°38.2	09.8	141°00.7	11.8'	06°52.4	-10.5'	57.2'
20	123°38.3	10.7	155°31.5	11.8'	06°41.9	-10.5'	57.2'
21	138°38.4	·· 11.6	170°02.4	11.9'	06°31.4	-10.5'	57.2'
22	153°38.5	12.5	184°33.2	11.9'	06°20.8	-10.6'	57.1'
23	168°38.7	13.4	199°04.2	11.9'	06°10.3	-10.6'	57.1'
	SD.=16.0	d=-0.9		S.D.=15.6			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	183°38.8	S09°14.3	213°35.1	12.0'	N05°59.7	-10.6'	57.1'
1	198°38.9	15.2	228°06.1	12.0'	05°49.0	-10.6'	57.1'
2	213°39.1	16.2	242°37.2	12.1'	05°38.4	-10.7'	57.1'
3	228°39.2	·· 17.1	257°08.3	12.1'	05°27.7	-10.7'	57.0'
4	243°39.3	18.0	271°39.4	12.1'	05°17.0	-10.7'	57.0'
5	258°39.4	18.9	286°10.5	12.2'	05°06.3	-10.7'	57.0'
6	273°39.6	S09°19.8	300°41.7	12.2'	N04°55.6	-10.7'	57.0'
7	288°39.7	20.7	315°13.0	12.3'	04°44.8	-10.8'	57.0'
8	303°39.8	21.6	329°44.2	12.3'	04°34.0	-10.8'	56.9'
9	318°39.9	·· 22.5	344°15.5	12.3'	04°23.3	-10.8'	56.9'
10	333°40.1	23.5	358°46.9	12.4'	04°12.5	-10.8'	56.9'
11	348°40.2	24.4	13°18.3	12.4'	04°01.6	-10.8'	56.9'
12	3°40.3	S09°25.3	27°49.7	12.4'	N03°50.8	-10.8'	56.9'
13	18°40.4	26.2	42°21.1	12.5'	03°40.0	-10.8'	56.8'
14	33°40.6	27.1	56°52.6	12.5'	03°29.1	-10.9'	56.8'
15	48°40.7	·· 28.0	71°24.1	12.5'	03°18.3	-10.9'	56.8'
16	63°40.8	28.9	85°55.7	12.6'	03°07.4	-10.9'	56.8'
17	78°40.9	29.8	100°27.2	12.6'	02°56.5	-10.9'	56.8'
18	93°41.0	S09°30.8	114°58.8	12.6'	N02°45.6	-10.9'	56.7'
19	108°41.2	31.7	129°30.5	12.7'	02°34.8	-10.9'	56.7'
20	123°41.3	32.6	144°02.1	12.7'	02°23.9	-10.9'	56.7'
21	138°41.4	·· 33.5	158°33.8	12.7'	02°13.0	-10.9'	56.7'
22	153°41.5	34.4	173°05.6	12.7'	02°02.1	-10.9'	56.7'
23	168°41.7	35.3	187°37.3	12.8'	01°51.2	-10.9'	56.6'
	SD.=16.0	d=-0.9		S.D.=15.5			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°41.8	S09°36.2	202°09.1	12.8'	N01°40.2	-10.9'	56.6'
1	198°41.9	37.1	216°40.9	12.8'	01°29.3	-10.9'	56.6'
2	213°42.0	38.0	231°12.7	12.8'	01°18.4	-10.9'	56.6'
3	228°42.1	·· 38.9	245°44.6	12.9'	01°07.5	-10.9'	56.5'
4	243°42.3	39.8	260°16.5	12.9'	00°56.6	-10.9'	56.5'
5	258°42.4	40.8	274°48.4	12.9'	00°45.7	-10.9'	56.5'
6	273°42.5	S09°41.7	289°20.3	12.9'	N00°34.8	-10.9'	56.5'
7	288°42.6	42.6	303°52.2	13.0'	00°23.9	-10.9'	56.5'
8	303°42.7	43.5	318°24.2	13.0'	00°13.0	-10.9'	56.4'
9	318°42.9	·· 44.4	332°56.2	13.0'	N00°02.1	-10.9'	56.4'
10	333°43.0	45.3	347°28.2	13.0'	S00°08.7	-10.9'	56.4'
11	348°43.1	46.2	2°00.3	13.0'	00°19.6	-10.9'	56.4'
12	3°43.2	S09°47.1	16°32.3	13.1'	S00°30.5	-10.9'	56.4'
13	18°43.3	48.0	31°04.4	13.1'	00°41.3	-10.8'	56.3'
14	33°43.4	48.9	45°36.5	13.1'	00°52.2	-10.8'	56.3'
15	48°43.6	·· 49.8	60°08.6	13.1'	01°03.0	-10.8'	56.3'
16	63°43.7	50.7	74°40.7	13.1'	01°13.8	-10.8'	56.3'
17	78°43.8	51.6	89°12.9	13.2'	01°24.6	-10.8'	56.3'
18	93°43.9	S09°52.5	103°45.1	13.2'	S01°35.4	-10.8'	56.2'
19	108°44.0	53.4	118°17.2	13.2'	01°46.2	-10.8'	56.2'
20	123°44.1	54.3	132°49.4	13.2'	01°56.9	-10.8'	56.2'
21	138°44.3	·· 55.2	147°21.7	13.2'	02°07.7	-10.7'	56.2'
22	153°44.4	56.1	161°53.9	13.2'	02°18.4	-10.7'	56.2'
23	168°44.5	57.1	176°26.1	13.2'	02°29.1	-10.7'	56.1'
	SD.=16.0	d=-0.9		S.D.=15.4			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:05	06:23	07:35	15:54	17:06	18:23
N 70°	05:07	06:18	07:22	16:07	17:11	18:21
68°	05:09	06:14	07:12	16:17	17:15	18:19
66°	05:11	06:10	07:03	16:26	17:19	18:18
64°	05:12	06:07	06:56	16:33	17:22	18:17
62°	05:13	06:05	06:50	16:39	17:25	18:16
60°	05:14	06:02	06:45	16:45	17:27	18:15
N 58°	05:14	06:00	06:40	16:50	17:30	18:15
56°	05:15	05:58	06:36	16:54	17:32	18:15
54°	05:15	05:56	06:32	16:58	17:34	18:15
52°	05:15	05:54	06:28	17:01	17:36	18:15
50°	05:15	05:52	06:25	17:05	17:37	18:15
45°	05:15	05:49	06:18	17:12	17:41	18:15
N 40°	05:14	05:45	06:13	17:17	17:45	18:16
35°	05:13	05:42	06:08	17:22	17:48	18:17
30°	05:11	05:39	06:03	17:27	17:51	18:19
20°	05:08	05:33	05:55	17:35	17:57	18:23
N 10°	05:03	05:27	05:49	17:42	18:03	18:28
0°	04:57	05:21	05:42	17:49	18:10	18:34
S 10°	04:49	05:14	05:35	17:55	18:17	18:42
20°	04:39	05:06	05:28	18:03	18:25	18:52
30°	04:26	04:55	05:20	18:11	18:36	19:05
35°	04:18	04:49	05:15	18:16	18:42	19:13
40°	04:08	04:41	05:09	18:22	18:50	19:24
45°	03:55	04:32	05:03	18:29	18:59	19:36
S 50°	03:39	04:21	04:55	18:37	19:11	19:53
52°	03:31	04:16	04:51	18:40	19:16	20:01
54°	03:23	04:10	04:47	18:45	19:22	20:10
56°	03:12	04:03	04:43	18:49	19:29	20:20
58°	03:00	03:55	04:38	18:54	19:37	20:33
S 60°	02:46	03:47	04:32	19:00	19:46	20:47

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	00:51	02:43	04:31	17:02	16:53	16:44
N 70°	01:08	02:51	04:32	16:52	16:49	16:46
68°	01:21	02:58	04:33	16:44	16:46	16:48
66°	01:31	03:03	04:34	16:37	16:43	16:49
64°	01:40	03:08	04:34	16:31	16:41	16:50
62°	01:47	03:12	04:35	16:26	16:39	16:51
60°	01:54	03:15	04:35	16:21	16:37	16:52
N 58°	01:59	03:18	04:36	16:17	16:36	16:53
56°	02:04	03:21	04:36	16:14	16:34	16:54
54°	02:09	03:23	04:36	16:11	16:33	16:55
52°	02:13	03:25	04:37	16:08	16:32	16:55
50°	02:17	03:27	04:37	16:05	16:31	16:56
45°	02:25	03:32	04:37	15:59	16:29	16:57
N 40°	02:31	03:35	04:38	15:54	16:27	16:58
35°	02:37	03:38	04:38	15:50	16:25	16:59
30°	02:42	03:41	04:39	15:46	16:24	16:59
20°	02:50	03:46	04:39	15:40	16:21	17:01
N 10°	02:58	03:50	04:40	15:34	16:19	17:02
0°	03:05	03:54	04:41	15:29	16:16	17:03
S 10°	03:12	03:58	04:41	15:23	16:14	17:04
20°	03:20	04:02	04:42	15:17	16:12	17:05
30°	03:28	04:06	04:43	15:10	16:09	17:06
35°	03:33	04:09	04:43	15:06	16:07	17:07
40°	03:39	04:12	04:44	15:02	16:05	17:08
45°	03:45	04:16	04:44	14:57	16:03	17:09
S 50°	03:53	04:20	04:45	14:50	16:01	17:10
52°	03:56	04:22	04:45	14:48	15:59	17:10
54°	04:00	04:24	04:46	14:44	15:58	17:11
56°	04:04	04:26	04:46	14:41	15:57	17:11
58°	04:09	04:29	04:46	14:37	15:55	17:12
S 60°	04:15	04:32	04:47	14:32	15:53	17:13

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 26-28 12-2%
16	14:23	14:29	11:46	09:17	21:41	
17	14:35	14:41	11:45	10:05	22:29	
18	14:47	14:53	11:45	10:52	23:15	

October 19, 20, 21 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	27°39.5	201°50.0	S00°50.8	209°23.0	N02°00.6	177°38.3	S11°08.9	124°42.3	S22°15.3
1	42°42.0	216°49.6	52.1	224°24.1	01°59.9	192°40.2	09.1	139°44.6	15.3
2	57°44.4	231°49.2	53.3	239°25.1	59.3	207°42.2	09.3	154°46.8	15.3
3	72°46.9	246°48.8	·· 54.5	254°26.1	·· 58.7	222°44.1	·· 09.5	169°49.1	·· 15.4
4	87°49.3	261°48.4	55.7	269°27.1	58.1	237°46.1	09.7	184°51.3	15.4
5	102°51.8	276°48.0	56.9	284°28.1	57.4	252°48.0	09.9	199°53.6	15.4
6	117°54.3	291°47.6	S00°58.2	299°29.1	N01°56.8	267°49.9	S11°10.1	214°55.8	S22°15.4
7	132°56.7	306°47.2	00°59.4	314°30.1	56.2	282°51.9	10.3	229°58.1	15.4
8	147°59.2	321°46.9	01°00.6	329°31.2	55.5	297°53.8	10.5	245°00.3	15.4
9	163°01.7	336°46.5	·· 01.8	344°32.2	·· 54.9	312°55.8	·· 10.6	260°02.6	·· 15.4
10	178°04.1	351°46.1	03.0	359°33.2	54.3	327°57.7	10.8	275°04.8	15.5
11	193°06.6	6°45.7	04.3	14°34.2	53.6	342°59.7	11.0	290°07.0	15.5
12	208°09.1	21°45.3	S01°05.5	29°35.2	N01°53.0	358°01.6	S11°11.2	305°09.3	S22°15.5
13	223°11.5	36°44.9	06.7	44°36.2	52.4	13°03.5	11.4	320°11.5	15.5
14	238°14.0	51°44.5	07.9	59°37.2	51.7	28°05.5	11.6	335°13.8	15.5
15	253°16.5	66°44.1	·· 09.1	74°38.3	·· 51.1	43°07.4	·· 11.8	350°16.0	·· 15.5
16	268°18.9	81°43.7	10.4	89°39.3	50.5	58°09.4	12.0	5°18.3	15.6
17	283°21.4	96°43.3	11.6	104°40.3	49.9	73°11.3	12.2	20°20.5	15.6
18	298°23.8	111°42.9	S01°12.8	119°41.3	N01°49.2	88°13.3	S11°12.3	35°22.8	S22°15.6
19	313°26.3	126°42.5	14.0	134°42.3	48.6	103°15.2	12.5	50°25.0	15.6
20	328°28.8	141°42.1	15.2	149°43.3	48.0	118°17.2	12.7	65°27.3	15.6
21	343°31.2	156°41.7	·· 16.5	164°44.4	·· 47.3	133°19.1	·· 12.9	80°29.5	·· 15.6
22	358°33.7	171°41.3	17.7	179°45.4	46.7	148°21.0	13.1	95°31.8	15.7
23	13°36.2	186°40.9	18.9	194°46.4	46.1	163°23.0	13.3	110°34.0	15.7
Mer.pass.:22:06		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	28°38.6	201°40.5	S01°20.1	209°47.4	N01°45.4	178°24.9	S11°13.5	125°36.3	S22°15.7
1	43°41.1	216°40.1	21.4	224°48.4	44.8	193°26.9	13.7	140°38.5	15.7
2	58°43.6	231°39.7	22.6	239°49.4	44.2	208°28.8	13.9	155°40.7	15.7
3	73°46.0	246°39.3	·· 23.8	254°50.4	·· 43.5	223°30.8	·· 14.0	170°43.0	·· 15.7
4	88°48.5	261°39.0	25.0	269°51.5	42.9	238°32.7	14.2	185°45.2	15.8
5	103°50.9	276°38.6	26.2	284°52.5	42.3	253°34.7	14.4	200°47.5	15.8
6	118°53.4	291°38.2	S01°27.5	299°53.5	N01°41.6	268°36.6	S11°14.6	215°49.7	S22°15.8
7	133°55.9	306°37.8	28.7	314°54.5	41.0	283°38.5	14.8	230°52.0	15.8
8	148°58.3	321°37.4	29.9	329°55.5	40.4	298°40.5	15.0	245°54.2	15.8
9	164°00.8	336°37.0	·· 31.1	344°56.5	·· 39.8	313°42.4	·· 15.2	260°56.5	·· 15.8
10	179°03.3	351°36.6	32.3	359°57.6	39.1	328°44.4	15.4	275°58.7	15.8
11	194°05.7	6°36.2	33.6	14°58.6	38.5	343°46.3	15.6	291°00.9	15.9
12	209°08.2	21°35.8	S01°34.8	29°59.6	N01°37.9	358°48.3	S11°15.7	306°03.2	S22°15.9
13	224°10.7	36°35.4	36.0	45°00.6	37.2	13°50.2	15.9	321°05.4	15.9
14	239°13.1	51°35.0	37.2	60°01.6	36.6	28°52.1	16.1	336°07.7	15.9
15	254°15.6	66°34.6	·· 38.5	75°02.6	·· 36.0	43°54.1	·· 16.3	351°09.9	·· 15.9
16	269°18.1	81°34.2	39.7	90°03.6	35.3	58°56.0	16.5	6°12.2	15.9
17	284°20.5	96°33.8	40.9	105°04.7	34.7	73°58.0	16.7	21°14.4	16.0
18	299°23.0	111°33.4	S01°42.1	120°05.7	N01°34.1	88°59.9	S11°16.9	36°16.7	S22°16.0
19	314°25.4	126°33.0	43.3	135°06.7	33.4	104°01.9	17.1	51°18.9	16.0
20	329°27.9	141°32.6	44.6	150°07.7	32.8	119°03.8	17.3	66°21.1	16.0
21	344°30.4	156°32.2	·· 45.8	165°08.7	·· 32.2	134°05.7	·· 17.4	81°23.4	·· 16.0
22	359°32.8	171°31.8	47.0	180°09.7	31.5	149°07.7	17.6	96°25.6	16.0
23	14°35.3	186°31.4	48.2	195°10.8	30.9	164°09.6	17.8	111°27.9	16.1
Mer.pass.:22:02		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	29°37.8	201°31.0	S01°49.4	210°11.8	N01°30.3	179°11.6	S11°18.0	126°30.1	S22°16.1
1	44°40.2	216°30.6	50.7	225°12.8	29.6	194°13.5	18.2	141°32.4	16.1
2	59°42.7	231°30.2	51.9	240°13.8	29.0	209°15.5	18.4	156°34.6	16.1
3	74°45.2	246°29.8	·· 53.1	255°14.8	·· 28.4	224°17.4	·· 18.6	171°36.8	·· 16.1
4	89°47.6	261°29.4	54.3	270°15.8	27.8	239°19.3	18.8	186°39.1	16.1
5	104°50.1	276°29.0	55.5	285°16.9	27.1	254°21.3	18.9	201°41.3	16.1
6	119°52.6	291°28.6	S01°56.8	300°17.9	N01°26.5	269°23.2	S11°19.1	216°43.6	S22°16.2
7	134°55.0	306°28.2	58.0	315°18.9	25.9	284°25.2	19.3	231°45.8	16.2
8	149°57.5	321°27.8	01°59.2	330°19.9	25.2	299°27.1	19.5	246°48.1	16.2
9	164°59.9	336°27.4	02°00.4	345°20.9	·· 24.6	314°29.1	·· 19.7	261°50.3	·· 16.2
10	180°02.4	351°27.0	01.7	0°21.9	24.0	329°31.0	19.9	276°52.5	16.2
11	195°04.9	6°26.6	02.9	15°22.9	23.3	344°32.9	20.1	291°54.8	16.2
12	210°07.3	21°26.2	S02°04.1	30°24.0	N01°22.7	359°34.9	S11°20.3	306°57.0	S22°16.3
13	225°09.8	36°25.8	05.3	45°25.0	22.1	14°36.8	20.5	321°59.3	16.3
14	240°12.3	51°25.4	06.5	60°26.0	21.4	29°38.8	20.6	337°01.5	16.3
15	255°14.7	66°25.0	·· 07.8	75°27.0	·· 20.8	44°40.7	·· 20.8	352°03.7	·· 16.3
16	270°17.2	81°24.6	09.0	90°28.0	20.2	59°42.7	21.0	7°06.0	16.3
17	285°19.7	96°24.2	10.2	105°29.0	19.5	74°44.6	21.2	22°08.2	16.3
18	300°22.1	111°23.8	S02°11.4	120°30.1	N01°18.9	89°46.5	S11°21.4	37°10.5	S22°16.4
19	315°24.6	126°23.4	12.6	135°31.1	18.3	104°48.5	21.6	52°12.7	16.4
20	330°27.0	141°23.0	13.9	150°32.1	17.7	119°50.4	21.8	67°14.9	16.4
21	345°29.5	156°22.6	·· 15.1	165°33.1	·· 17.0	134°52.4	·· 22.0	82°17.2	·· 16.4
22	0°32.0	171°22.2	16.3	180°34.1	16.4	149°54.3	22.1	97°19.4	16.4
23	15°34.4	186°21.8	17.5	195°35.1	15.8	164°56.3	22.3	112°21.7	16.4
Mer.pass.:21:58		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.1
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°08.9
Hamal	327°57.1	23°32.7
Polaris	316°00.6	89°20.1
Acamar	315°15.8	-40°14.0
Menkar	314°11.7	4°09.5
Mirfak	308°35.7	49°55.2
Aldebaran	290°45.8	16°32.5
Rigel	281°09.1	-8°10.9
Capella	280°29.8	46°00.6
Bellatrix	278°28.7	6°21.8
Elnath	278°08.7	28°37.1
Alnilam	275°43.2	-1°11.5
Betelgeuse	270°58.0	7°24.5
Canopus	263°54.6	-52°42.2
Sirius	258°31.1	-16°44.4
Adhara	255°10.1	-28°59.7
Procyon	244°56.7	5°10.7
Pollux	243°24.2	27°58.8
Avior	234°16.9	-59°33.7
Suhail	222°50.4	-43°30.0
Miaplacidus	221°39.3	-69°47.1
Alphard	217°53.4	-8°44.0
Regulus	207°40.6	11°52.9
Dubhe	193°48.7	61°39.2
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.6	-63°11.6
Gacrux	171°58.1	-57°12.5
Alioth	166°18.8	55°51.9
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.7
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.4	-60°54.3
Kochab	137°21.4	74°05.2
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.6
Antares	112°23.0	-26°28.0
Atria	107°22.5	-69°03.5
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.2
Eltanin	90°45.1	51°29.6
Kaus Aust.	83°40.1	-34°22.4
Vega	80°37.1	38°48.4
Nunki	75°54.8	-26°16.3
Altair	62°05.4	8°55.2
Peacock	53°14.7	-56°40.7
Deneb	49°29.4	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.9	-46°52.6
Fomalhaut	15°20.5	-29°31.7
Scheat	13°50.3	28°10.9
Markab	13°35.2	15°18.2

Oct 19 Thu	SHA	Mer.pass
Venus	174°10.5	10:33
Mars	181°43.5	10:02
Jupiter	149°58.8	12:08
Saturn	97°02.8	15:39

Oct 20 Fri	SHA	Mer.pass
Venus	173°01.9	10:34
Mars	181°08.8	10:00
Jupiter	149°46.3	12:05
Saturn	96°57.6	15:35

Oct 21 Sat	SHA	Mer.pass
Venus	171°53.3	10:34
Mars	180°34.0	09:59
Jupiter	149°33.8	12:02
Saturn	96°52.3	15:32

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2967 sec ΔT = TT-UT1 = +68.8873 sec

2017 October 19 to Oct. 21 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	183°44.6	S09°58.0	190°58.4	13.3'	S02°39.8	-10.7'	56.1'
1	198°44.7	58.9	205°30.7	13.3'	02°50.5	-10.7'	56.1'
2	213°44.8	09°59.8	220°02.9	13.3'	03°01.1	-10.6'	56.1'
3	228°44.9	10°00.7	234°35.2	13.3'	03°11.7	-10.6'	56.0'
4	243°45.1	01.6	249°07.5	13.3'	03°22.4	-10.6'	56.0'
5	258°45.2	02.5	263°39.9	13.3'	03°32.9	-10.6'	56.0'
6	273°45.3	S10°03.4	278°12.2	13.3'	S03°43.5	-10.5'	56.0'
7	288°45.4	04.3	292°44.5	13.3'	03°54.0	-10.5'	56.0'
8	303°45.5	05.2	307°16.9	13.3'	04°04.6	-10.5'	55.9'
9	318°45.6	·· 06.1	321°49.2	13.4'	04°15.0	-10.5'	55.9'
10	333°45.7	07.0	336°21.6	13.4'	04°25.5	-10.4'	55.9'
11	348°45.8	07.9	350°53.9	13.4'	04°35.9	-10.4'	55.9'
12	3°46.0	S10°08.8	5°26.3	13.4'	S04°46.3	-10.4'	55.9'
13	18°46.1	09.7	19°58.7	13.4'	04°56.7	-10.4'	55.8'
14	33°46.2	10.6	34°31.1	13.4'	05°07.1	-10.3'	55.8'
15	48°46.3	·· 11.5	49°03.5	13.4'	05°17.4	-10.3'	55.8'
16	63°46.4	12.4	63°35.9	13.4'	05°27.7	-10.3'	55.8'
17	78°46.5	13.3	78°08.3	13.4'	05°37.9	-10.2'	55.8'
18	93°46.6	S10°14.2	92°40.7	13.4'	S05°48.1	-10.2'	55.7'
19	108°46.7	15.1	107°13.1	13.4'	05°58.3	-10.2'	55.7'
20	123°46.8	16.0	121°45.5	13.4'	06°08.5	-10.1'	55.7'
21	138°46.9	·· 16.9	136°18.0	13.4'	06°18.6	-10.1'	55.7'
22	153°47.1	17.8	150°50.4	13.4'	06°28.7	-10.1'	55.7'
23	168°47.2	18.7	165°22.8	13.4'	06°38.7	-10.0'	55.6'
	SD.=16.0	d=-0.9	S.D.=15.2				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	183°47.3	S10°19.6	179°55.2	13.4'	S06°48.7	-10.0'	55.6'
1	198°47.4	20.5	194°27.7	13.4'	06°58.7	-10.0'	55.6'
2	213°47.5	21.3	209°00.1	13.4'	07°08.6	-9.9'	55.6'
3	228°47.6	·· 22.2	223°32.5	13.4'	07°18.5	-9.9'	55.6'
4	243°47.7	23.1	238°04.9	13.4'	07°28.4	-9.8'	55.5'
5	258°47.8	24.0	252°37.4	13.4'	07°38.2	-9.8'	55.5'
6	273°47.9	S10°24.9	267°09.8	13.4'	S07°47.9	-9.7'	55.5'
7	288°48.0	25.8	281°42.2	13.4'	07°57.7	-9.7'	55.5'
8	303°48.1	26.7	296°14.6	13.4'	08°07.3	-9.7'	55.5'
9	318°48.2	·· 27.6	310°47.1	13.4'	08°17.0	-9.6'	55.4'
10	333°48.3	28.5	325°19.5	13.4'	08°26.6	-9.6'	55.4'
11	348°48.4	29.4	339°51.9	13.4'	08°36.1	-9.5'	55.4'
12	3°48.5	S10°30.3	354°24.3	13.4'	S08°45.7	-9.5'	55.4'
13	18°48.7	31.2	8°56.7	13.4'	08°55.1	-9.4'	55.4'
14	33°48.8	32.1	23°29.1	13.4'	09°04.5	-9.4'	55.3'
15	48°48.9	·· 33.0	38°01.5	13.4'	09°13.9	-9.3'	55.3'
16	63°49.0	33.9	52°33.9	13.4'	09°23.2	-9.3'	55.3'
17	78°49.1	34.8	67°06.3	13.4'	09°32.5	-9.2'	55.3'
18	93°49.2	S10°35.7	81°38.7	13.4'	S09°41.7	-9.2'	55.3'
19	108°49.3	36.5	96°11.0	13.4'	09°50.9	-9.1'	55.2'
20	123°49.4	37.4	110°43.4	13.4'	10°00.0	-9.1'	55.2'
21	138°49.5	·· 38.3	125°15.8	13.4'	10°09.1	-9.0'	55.2'
22	153°49.6	39.2	139°48.1	13.4'	10°18.1	-9.0'	55.2'
23	168°49.7	40.1	154°20.5	13.3'	10°27.1	-8.9'	55.2'
	SD.=16.1	d=-0.9	S.D.=15.1				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	183°49.8	S10°41.0	168°52.8	13.3'	S10°36.0	-8.9'	55.2'
1	198°49.9	41.9	183°25.2	13.3'	10°44.8	-8.8'	55.1'
2	213°50.0	42.8	197°57.5	13.3'	10°53.7	-8.8'	55.1'
3	228°50.1	·· 43.7	212°29.8	13.3'	11°02.4	-8.7'	55.1'
4	243°50.2	44.6	227°02.1	13.3'	11°11.1	-8.7'	55.1'
5	258°50.3	45.5	241°34.4	13.3'	11°19.7	-8.6'	55.1'
6	273°50.4	S10°46.3	256°06.7	13.3'	S11°28.3	-8.6'	55.0'
7	288°50.5	47.2	270°39.0	13.3'	11°36.9	-8.5'	55.0'
8	303°50.6	48.1	285°11.2	13.3'	11°45.3	-8.4'	55.0'
9	318°50.7	·· 49.0	299°43.5	13.3'	11°53.7	-8.4'	55.0'
10	333°50.8	49.9	314°15.8	13.2'	12°02.1	-8.3'	55.0'
11	348°50.9	50.8	328°48.0	13.2'	12°10.4	-8.3'	55.0'
12	3°51.0	S10°51.7	343°20.2	13.2'	S12°18.6	-8.2'	54.9'
13	18°51.1	52.6	357°52.4	13.2'	12°26.8	-8.1'	54.9'
14	33°51.2	53.4	12°24.7	13.2'	12°34.9	-8.1'	54.9'
15	48°51.3	·· 54.3	26°56.8	13.2'	12°42.9	-8.0'	54.9'
16	63°51.4	55.2	41°29.0	13.2'	12°50.9	-8.0'	54.9'
17	78°51.5	56.1	56°01.2	13.2'	12°58.9	-7.9'	54.9'
18	93°51.6	S10°57.0	70°33.4	13.2'	S13°06.7	-7.8'	54.8'
19	108°51.7	57.9	85°05.5	13.1'	13°14.5	-7.8'	54.8'
20	123°51.7	58.8	99°37.7	13.1'	13°22.2	-7.7'	54.8'
21	138°51.8	10°59.6	114°09.8	13.1'	13°29.9	-7.6'	54.8'
22	153°51.9	11°00.5	128°41.9	13.1'	13°37.5	-7.6'	54.8'
23	168°52.0	01.4	143°14.0	13.1'	13°45.1	-7.5'	54.8'
	SD.=16.1	d=-0.9	S.D.=15.0				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:18	06:36	07:50	15:38	16:51	18:10
N 70°	05:19	06:30	07:35	15:53	16:58	18:09
68°	05:20	06:24	07:23	16:05	17:04	18:08
66°	05:20	06:20	07:13	16:15	17:08	18:08
64°	05:21	06:16	07:05	16:23	17:12	18:07
62°	05:21	06:12	06:58	16:30	17:16	18:07
60°	05:21	06:09	06:52	16:36	17:19	18:07
N 58°	05:21	06:06	06:47	16:42	17:22	18:08
56°	05:21	06:04	06:42	16:47	17:25	18:08
54°	05:20	06:01	06:38	16:51	17:27	18:08
52°	05:20	05:59	06:34	16:55	17:29	18:09
50°	05:20	05:57	06:30	16:59	17:32	18:09
45°	05:18	05:52	06:22	17:07	17:36	18:10
N 40°	05:17	05:48	06:16	17:13	17:41	18:12
35°	05:15	05:45	06:10	17:19	17:44	18:14
30°	05:13	05:41	06:05	17:24	17:48	18:16
20°	05:08	05:34	05:57	17:33	17:55	18:21
N 10°	05:03	05:27	05:49	17:41	18:02	18:27
0°	04:56	05:20	05:41	17:48	18:09	18:34
S 10°	04:48	05:13	05:34	17:56	18:17	18:42
20°	04:37	05:03	05:26	18:04	18:26	18:53
30°	04:23	04:52	05:17	18:13	18:38	19:07
35°	04:14	04:45	05:11	18:19	18:45	19:16
40°	04:03	04:37	05:05	18:25	18:54	19:27
45°	03:50	04:27	04:58	18:33	19:04	19:41
S 50°	03:32	04:15	04:49	18:42	19:16	19:59
52°	03:24	04:09	04:45	18:46	19:22	20:08
54°	03:14	04:02	04:40	18:50	19:29	20:17
56°	03:03	03:55	04:35	18:56	19:36	20:29
58°	02:50	03:46	04:30	19:01	19:45	20:42
S 60°	02:34	03:37	04:24	19:08	19:55	20:58

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	06:16	08:01	09:48	16:35	16:26	16:14
N 70°	06:10	07:48	09:26	16:43	16:40	16:37
68°	06:06	07:38	09:09	16:50	16:52	16:55
66°	06:02	07:29	08:55	16:55	17:02	17:10
64°	05:59	07:22	08:44	17:00	17:10	17:22
62°	05:56	07:16	08:34	17:04	17:17	17:33
60°	05:54	07:11	08:26	17:07	17:23	17:41
N 58°	05:52	07:06	08:19	17:10	17:29	17:49
56°	05:50	07:02	08:12	17:13	17:34	17:56
54°	05:48	06:58	08:07	17:16	17:38	18:02
52°	05:46	06:55	08:02	17:18	17:42	18:08
50°	05:45	06:52	07:57	17:20	17:46	18:13
45°	05:42	06:45	07:47	17:25	17:53	18:24
N 40°	05:39	06:40	07:39	17:28	18:00	18:33
35°	05:37	06:35	07:32	17:32	18:06	18:41
30°	05:35	06:31	07:26	17:35	18:11	18:48
20°	05:32	06:24	07:16	17:40	18:19	19:00
N 10°	05:29	06:18	07:06	17:44	18:27	19:10
0°	05:27	06:12	06:58	17:48	18:34	19:20
S 10°	05:24	06:06	06:49	17:53	18:41	19:30
20°	05:21	06:00	06:40	17:57	18:49	19:40
30°	05:18	05:54	06:30	18:02	18:58	19:52
35°	05:16	05:50	06:24	18:05	19:03	19:59
40°	05:14	05:45	06:17	18:09	19:09	20:07
45°	05:12	05:40	06:09	18:13	19:15	20:17
S 50°	05:09	05:34	06:00	18:17	19:23	20:28
52°	05:08	05:31	05:56	18:19	19:27	20:33
54°	05:07	05:28	05:51	18:22	19:31	20:39
56°	05:05	05:25	05:46	18:24	19:36	20:45
58°	05:03	05:21	05:40	18:27	19:41	20:53
S 60°	05:02	05:17	05:34	18:31	19:47	21:01

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 0-2 0-3%
19	14:58	15:04	11:45	11:38	–:–	
20	15:09	15:14	11:45	12:23	00:00	
21	15:19	15:24	11:45	13:09	00:46	

October 22, 23, 24 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	30°36.9	201°21.4	S02°18.7	210°36.2	N01°15.1	179°58.2	S11°22.5	127°23.9	S22°16.4
1	45°39.4	216°21.0	20.0	225°37.2	14.5	195°00.1	22.7	142°26.1	16.5
2	60°41.8	231°20.6	21.2	240°38.2	13.9	210°02.1	22.9	157°28.4	16.5
3	75°44.3	246°20.2	·· 22.4	255°39.2	·· 13.2	225°04.0	·· 23.1	172°30.6	·· 16.5
4	90°46.8	261°19.8	23.6	270°40.2	12.6	240°06.0	23.3	187°32.9	16.5
5	105°49.2	276°19.4	24.8	285°41.2	12.0	255°07.9	23.5	202°35.1	16.5
6	120°51.7	291°19.0	S02°26.1	300°42.3	N01°11.3	270°09.9	S11°23.7	217°37.3	S22°16.5
7	135°54.2	306°18.6	27.3	315°43.3	10.7	285°11.8	23.8	232°39.6	16.6
8	150°56.6	321°18.2	28.5	330°44.3	10.1	300°13.7	24.0	247°41.8	16.6
9	165°59.1	336°17.8	·· 29.7	345°45.3	·· 09.4	315°15.7	·· 24.2	262°44.1	·· 16.6
10	181°01.5	351°17.4	31.0	0°46.3	08.8	330°17.6	24.4	277°46.3	16.6
11	196°04.0	6°17.0	32.2	15°47.3	08.2	345°19.6	24.6	292°48.5	16.6
12	211°06.5	21°16.6	S02°33.4	30°48.3	N01°07.5	0°21.5	S11°24.8	307°50.8	S22°16.6
13	226°08.9	36°16.2	34.6	45°49.4	06.9	15°23.5	25.0	322°53.0	16.7
14	241°11.4	51°15.8	35.8	60°50.4	06.3	30°25.4	25.2	337°55.2	16.7
15	256°13.9	66°15.4	·· 37.1	75°51.4	·· 05.7	45°27.3	·· 25.3	352°57.5	·· 16.7
16	271°16.3	81°15.0	38.3	90°52.4	05.0	60°29.3	25.5	7°59.7	16.7
17	286°18.8	96°14.6	39.5	105°53.4	04.4	75°31.2	25.7	23°02.0	16.7
18	301°21.3	111°14.2	S02°40.7	120°54.4	N01°03.8	90°33.2	S11°25.9	38°04.2	S22°16.7
19	316°23.7	126°13.8	41.9	135°55.5	03.1	105°35.1	26.1	53°06.4	16.7
20	331°26.2	141°13.4	43.2	150°56.5	02.5	120°37.0	26.3	68°08.7	16.8
21	346°28.7	156°13.0	·· 44.4	165°57.5	·· 01.9	135°39.0	·· 26.5	83°10.9	·· 16.8
22	1°31.1	171°12.6	45.6	180°58.5	01.2	150°40.9	26.7	98°13.1	16.8
23	16°33.6	186°12.2	46.8	195°59.5	00.6	165°42.9	26.8	113°15.4	16.8
Mer.pass.:21:54		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	31°36.0	201°11.8	S02°48.0	211°00.5	N01°00.0	180°44.8	S11°27.0	128°17.6	S22°16.8
1	46°38.5	216°11.4	49.3	226°01.6	00°59.3	195°46.8	27.2	143°19.9	16.8
2	61°41.0	231°11.0	50.5	241°02.6	58.7	210°48.7	27.4	158°22.1	16.9
3	76°43.4	246°10.6	·· 51.7	256°03.6	·· 58.1	225°50.6	·· 27.6	173°24.3	·· 16.9
4	91°45.9	261°10.2	52.9	271°04.6	57.4	240°52.6	27.8	188°26.6	16.9
5	106°48.4	276°09.8	54.1	286°05.6	56.8	255°54.5	28.0	203°28.8	16.9
6	121°50.8	291°09.4	S02°55.4	301°06.6	N00°56.2	270°56.5	S11°28.2	218°31.0	S22°16.9
7	136°53.3	306°09.0	56.6	316°07.7	55.6	285°58.4	28.3	233°33.3	16.9
8	151°55.8	321°08.6	57.8	331°08.7	54.9	301°00.3	28.5	248°35.5	17.0
9	166°58.2	336°08.2	02°59.0	346°09.7	·· 54.3	316°02.3	·· 28.7	263°37.7	·· 17.0
10	182°00.7	351°07.8	03°00.2	1°10.7	53.7	331°04.2	28.9	278°40.0	17.0
11	197°03.1	6°07.4	01.4	16°11.7	53.0	346°06.2	29.1	293°42.2	17.0
12	212°05.6	21°07.0	S03°02.7	31°12.7	N00°52.4	1°08.1	S11°29.3	308°44.4	S22°17.0
13	227°08.1	36°06.6	03.9	46°13.8	51.8	16°10.1	29.5	323°46.7	17.0
14	242°10.5	51°06.1	05.1	61°14.8	51.1	31°12.0	29.7	338°48.9	17.0
15	257°13.0	66°05.7	·· 06.3	76°15.8	·· 50.5	46°13.9	·· 29.8	353°51.2	·· 17.1
16	272°15.5	81°05.3	07.5	91°16.8	49.9	61°15.9	30.0	8°53.4	17.1
17	287°17.9	96°04.9	08.8	106°17.8	49.2	76°17.8	30.2	23°55.6	17.1
18	302°20.4	111°04.5	S03°10.0	121°18.8	N00°48.6	91°19.8	S11°30.4	38°57.9	S22°17.1
19	317°22.9	126°04.1	11.2	136°19.9	48.0	106°21.7	30.6	54°00.1	17.1
20	332°25.3	141°03.7	12.4	151°20.9	47.3	121°23.6	30.8	69°02.3	17.1
21	347°27.8	156°03.3	·· 13.6	166°21.9	·· 46.7	136°25.6	·· 31.0	84°04.6	·· 17.2
22	2°30.3	171°02.9	14.9	181°22.9	46.1	151°27.5	31.2	99°06.8	17.2
23	17°32.7	186°02.5	16.1	196°23.9	45.4	166°29.5	31.3	114°09.0	17.2
Mer.pass.:21:50		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	32°35.2	201°02.1	S03°17.3	211°24.9	N00°44.8	181°31.4	S11°31.5	129°11.3	S22°17.2
1	47°37.6	216°01.7	18.5	226°26.0	44.2	196°33.4	31.7	144°13.5	17.2
2	62°40.1	231°01.3	19.7	241°27.0	43.6	211°35.3	31.9	159°15.7	17.2
3	77°42.6	246°00.9	·· 20.9	256°28.0	·· 42.9	226°37.2	·· 32.1	174°18.0	·· 17.2
4	92°45.0	261°00.5	22.2	271°29.0	42.3	241°39.2	32.3	189°20.2	17.3
5	107°47.5	276°00.1	23.4	286°30.0	41.7	256°41.1	32.5	204°22.4	17.3
6	122°50.0	290°59.6	S03°24.6	301°31.0	N00°41.0	271°43.1	S11°32.7	219°24.7	S22°17.3
7	137°52.4	305°59.2	25.8	316°32.1	40.4	286°45.0	32.8	234°26.9	17.3
8	152°54.9	320°58.8	27.0	331°33.1	39.8	301°46.9	33.0	249°29.1	17.3
9	167°57.4	335°58.4	·· 28.2	346°34.1	·· 39.1	316°48.9	·· 33.2	264°31.4	·· 17.3
10	182°59.8	350°58.0	29.5	1°35.1	38.5	331°50.8	33.4	279°33.6	17.4
11	198°02.3	5°57.6	30.7	16°36.1	37.9	346°52.8	33.6	294°35.8	17.4
12	213°04.8	20°57.2	S03°31.9	31°37.1	N00°37.2	1°54.7	S11°33.8	309°38.1	S22°17.4
13	228°07.2	35°56.8	33.1	46°38.2	36.6	16°56.6	34.0	324°40.3	17.4
14	243°09.7	50°56.4	34.3	61°39.2	36.0	31°58.6	34.2	339°42.5	17.4
15	258°12.1	65°56.0	·· 35.6	76°40.2	·· 35.3	47°00.5	·· 34.3	354°44.7	·· 17.4
16	273°14.6	80°55.6	36.8	91°41.2	34.7	62°02.5	34.5	9°47.0	17.5
17	288°17.1	95°55.2	38.0	106°42.2	34.1	77°04.4	34.7	24°49.2	17.5
18	303°19.5	110°54.7	S03°39.2	121°43.2	N00°33.5	92°06.4	S11°34.9	39°51.4	S22°17.5
19	318°22.0	125°54.3	40.4	136°44.3	32.8	107°08.3	35.1	54°53.7	17.5
20	333°24.5	140°53.9	41.6	151°45.3	32.2	122°10.2	35.3	69°55.9	17.5
21	348°26.9	155°53.5	·· 42.9	166°46.3	·· 31.6	137°12.2	·· 35.5	84°58.1	·· 17.5
22	3°29.4	170°53.1	44.1	181°47.3	30.9	152°14.1	35.6	100°00.4	17.5
23	18°31.9	185°52.7	45.3	196°48.3	30.3	167°16.1	35.8	115°02.6	17.6
Mer.pass.:21:46		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Stars

	SHA	**Dec**
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°08.9
Hamal	327°57.1	23°32.7
Polaris	315°59.9	89°20.2
Acamar	315°15.7	-40°14.1
Menkar	314°11.7	4°09.5
Mirfak	308°35.7	49°55.2
Aldebaran	290°45.8	16°32.5
Rigel	281°09.0	-8°10.9
Capella	280°29.8	46°00.6
Bellatrix	278°28.7	6°21.8
Elnath	278°08.7	28°37.1
Alnilam	275°43.2	-1°11.5
Betelgeuse	270°58.0	7°24.5
Canopus	263°54.6	-52°42.2
Sirius	258°31.0	-16°44.4
Adhara	255°10.1	-28°59.7
Procyon	244°56.7	5°10.7
Pollux	243°24.2	27°58.8
Avior	234°16.8	-59°33.7
Suhail	222°50.4	-43°30.0
Miaplacidus	221°39.2	-69°47.1
Alphard	217°53.3	-8°44.0
Regulus	207°40.6	11°52.8
Dubhe	193°48.7	61°39.2
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.6	-63°11.6
Gacrux	171°58.1	-57°12.5
Alioth	166°18.7	55°51.9
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.7
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.4	-60°54.3
Kochab	137°21.4	74°05.2
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.6
Antares	112°23.0	-26°28.0
Atria	107°22.5	-69°03.5
Sabik	102°09.4	-15°44.5
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.2
Eltanin	90°45.1	51°29.6
Kaus Aust.	83°40.1	-34°22.4
Vega	80°37.1	38°48.4
Nunki	75°54.8	-26°16.3
Altair	62°05.4	8°55.2
Peacock	53°14.7	-56°40.7
Deneb	49°29.4	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.9	-46°52.6
Fomalhaut	15°20.6	-29°31.7
Scheat	13°50.3	28°10.9
Markab	13°35.2	15°18.2

Oct 22 Sun	**SHA**	**Mer.pass**
Venus	170°44.5	10:35
Mars	179°59.3	09:57
Jupiter	149°21.3	11:59
Saturn	96°47.0	15:28

Oct 23 Mon	**SHA**	**Mer.pass**
Venus	169°35.8	10:35
Mars	179°24.5	09:55
Jupiter	149°08.8	11:55
Saturn	96°41.6	15:25

Oct 24 Tue	**SHA**	**Mer.pass**
Venus	168°26.9	10:36
Mars	178°49.8	09:54
Jupiter	148°56.2	11:52
Saturn	96°36.1	15:21

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2936 sec ΔT = TT-UT1 = +68.8904 sec

2017 October 22 to Oct. 24 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°52.1	S11°02.3	157°46.1	13.1′	S13°52.5	-7.4′	54.7′
1	198°52.2	03.2	172°18.1	13.1′	13°59.9	-7.4′	54.7′
2	213°52.3	04.1	186°50.2	13.1′	14°07.3	-7.3′	54.7′
3	228°52.4	·· 04.9	201°22.2	13.0′	14°14.5	-7.2′	54.7′
4	243°52.5	05.8	215°54.3	13.0′	14°21.7	-7.2′	54.7′
5	258°52.6	06.7	230°26.3	13.0′	14°28.9	-7.1′	54.7′
6	273°52.7	S11°07.6	244°58.3	13.0′	S14°35.9	-7.0′	54.7′
7	288°52.8	08.5	259°30.3	13.0′	14°42.9	-7.0′	54.6′
8	303°52.9	09.4	274°02.3	13.0′	14°49.8	-6.9′	54.6′
9	318°53.0	·· 10.2	288°34.2	13.0′	14°56.7	-6.8′	54.6′
10	333°53.1	11.1	303°06.2	12.9′	15°03.5	-6.7′	54.6′
11	348°53.1	12.0	317°38.1	12.9′	15°10.2	-6.7′	54.6′
12	3°53.2	S11°12.9	332°10.0	12.9′	S15°16.8	-6.6′	54.6′
13	18°53.3	13.8	346°41.9	12.9′	15°23.4	-6.5′	54.6′
14	33°53.4	14.6	1°13.8	12.9′	15°29.9	-6.5′	54.5′
15	48°53.5	·· 15.5	15°45.7	12.9′	15°36.3	-6.4′	54.5′
16	63°53.6	16.4	30°17.6	12.9′	15°42.6	-6.3′	54.5′
17	78°53.7	17.3	44°49.4	12.8′	15°48.9	-6.2′	54.5′
18	93°53.8	S11°18.2	59°21.3	12.8′	S15°55.1	-6.2′	54.5′
19	108°53.9	19.0	73°53.1	12.8′	16°01.2	-6.1′	54.5′
20	123°54.0	19.9	88°24.9	12.8′	16°07.3	-6.0′	54.5′
21	138°54.0	·· 20.8	102°56.7	12.8′	16°13.2	-5.9′	54.5′
22	153°54.1	21.7	117°28.5	12.8′	16°19.1	-5.9′	54.4′
23	168°54.2	22.5	132°00.2	12.8′	16°24.9	-5.8′	54.4′
	SD.=16.1	d=-0.9	S.D.=14.9				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°54.3	S11°23.4	146°32.0	12.7′	S16°30.7	-5.7′	54.4′
1	198°54.4	24.3	161°03.7	12.7′	16°36.3	-5.6′	54.4′
2	213°54.5	25.2	175°35.4	12.7′	16°41.9	-5.5′	54.4′
3	228°54.6	·· 26.0	190°07.1	12.7′	16°47.4	-5.5′	54.4′
4	243°54.7	26.9	204°38.8	12.7′	16°52.9	-5.4′	54.4′
5	258°54.7	27.8	219°10.5	12.7′	16°58.2	-5.3′	54.4′
6	273°54.8	S11°28.7	233°42.2	12.7′	S17°03.5	-5.2′	54.4′
7	288°54.9	29.5	248°13.8	12.6′	17°08.7	-5.1′	54.3′
8	303°55.0	30.4	262°45.4	12.6′	17°13.8	-5.1′	54.3′
9	318°55.1	·· 31.3	277°17.1	12.6′	17°18.8	-5.0′	54.3′
10	333°55.2	32.2	291°48.7	12.6′	17°23.8	-4.9′	54.3′
11	348°55.2	33.0	306°20.3	12.6′	17°28.6	-4.8′	54.3′
12	3°55.3	S11°33.9	320°51.8	12.6′	S17°33.4	-4.7′	54.3′
13	18°55.4	34.8	335°23.4	12.6′	17°38.1	-4.7′	54.3′
14	33°55.5	35.7	349°54.9	12.5′	17°42.7	-4.6′	54.3′
15	48°55.6	·· 36.5	4°26.5	12.5′	17°47.3	-4.5′	54.3′
16	63°55.7	37.4	18°58.0	12.5′	17°51.7	-4.4′	54.3′
17	78°55.7	38.3	33°29.5	12.5′	17°56.1	-4.3′	54.3′
18	93°55.8	S11°39.1	48°01.0	12.5′	S18°00.4	-4.3′	54.2′
19	108°55.9	40.0	62°32.5	12.5′	18°04.6	-4.2′	54.2′
20	123°56.0	40.9	77°04.0	12.5′	18°08.7	-4.1′	54.2′
21	138°56.1	·· 41.8	91°35.4	12.5′	18°12.8	-4.0′	54.2′
22	153°56.2	42.6	106°06.9	12.4′	18°16.7	-3.9′	54.2′
23	168°56.2	43.5	120°38.3	12.4′	18°20.6	-3.8′	54.2′
	SD.=16.1	d=-0.9	S.D.=14.8				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	183°56.3	S11°44.4	135°09.7	12.4′	S18°24.4	-3.7′	54.2′
1	198°56.4	45.2	149°41.1	12.4′	18°28.1	-3.7′	54.2′
2	213°56.5	46.1	164°12.5	12.4′	18°31.7	-3.6′	54.2′
3	228°56.6	·· 47.0	178°43.9	12.4′	18°35.3	-3.5′	54.2′
4	243°56.6	47.8	193°15.3	12.4′	18°38.7	-3.4′	54.2′
5	258°56.7	48.7	207°46.7	12.4′	18°42.1	-3.3′	54.2′
6	273°56.8	S11°49.6	222°18.0	12.3′	S18°45.3	-3.2′	54.2′
7	288°56.9	50.4	236°49.4	12.3′	18°48.5	-3.1′	54.2′
8	303°56.9	51.3	251°20.7	12.3′	18°51.6	-3.1′	54.2′
9	318°57.0	·· 52.2	265°52.0	12.3′	18°54.6	-3.0′	54.1′
10	333°57.1	53.0	280°23.3	12.3′	18°57.6	-2.9′	54.1′
11	348°57.2	53.9	294°54.6	12.3′	19°00.4	-2.8′	54.1′
12	3°57.3	S11°54.8	309°25.9	12.3′	S19°03.2	-2.7′	54.1′
13	18°57.3	55.6	323°57.2	12.3′	19°05.8	-2.6′	54.1′
14	33°57.4	56.5	338°28.4	12.3′	19°08.4	-2.5′	54.1′
15	48°57.5	·· 57.4	352°59.7	12.3′	19°10.9	-2.4′	54.1′
16	63°57.6	58.2	7°31.0	12.2′	19°13.3	-2.4′	54.1′
17	78°57.6	11°59.1	22°02.2	12.2′	19°15.6	-2.3′	54.1′
18	93°57.7	S12°00.0	36°33.4	12.2′	S19°17.8	-2.2′	54.1′
19	108°57.8	00.8	51°04.6	12.2′	19°20.0	-2.1′	54.1′
20	123°57.9	01.7	65°35.9	12.2′	19°22.0	-2.0′	54.1′
21	138°57.9	·· 02.6	80°07.1	12.2′	19°24.0	-1.9′	54.1′
22	153°58.0	03.4	94°38.3	12.2′	19°25.9	-1.8′	54.1′
23	168°58.1	04.3	109°09.5	12.2′	19°27.6	-1.7′	54.1′
	SD.=16.1	d=-0.9	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:30	06:50	08:06	15:21	16:37	17:56
N 70°	05:30	06:41	07:49	15:39	16:45	17:57
68°	05:30	06:35	07:35	15:52	16:52	17:57
66°	05:29	06:29	07:24	16:04	16:58	17:58
64°	05:29	06:24	07:14	16:13	17:03	17:58
62°	05:28	06:20	07:07	16:21	17:07	17:59
60°	05:28	06:16	07:00	16:28	17:11	18:00
N 58°	05:27	06:13	06:54	16:34	17:15	18:00
56°	05:26	06:10	06:48	16:40	17:18	18:01
54°	05:26	06:07	06:43	16:44	17:21	18:02
52°	05:25	06:04	06:39	16:49	17:24	18:03
50°	05:24	06:02	06:35	16:53	17:26	18:04
45°	05:22	05:56	06:26	17:02	17:32	18:06
N 40°	05:20	05:51	06:19	17:09	17:37	18:08
35°	05:17	05:47	06:13	17:15	17:41	18:11
30°	05:15	05:43	06:07	17:21	17:45	18:13
20°	05:09	05:35	05:58	17:31	17:53	18:19
N 10°	05:03	05:28	05:49	17:39	18:01	18:26
0°	04:55	05:20	05:41	17:48	18:09	18:33
S 10°	04:46	05:11	05:33	17:56	18:18	18:43
20°	04:35	05:01	05:24	18:05	18:28	18:54
30°	04:19	04:49	05:13	18:16	18:40	19:10
35°	04:10	04:41	05:07	18:22	18:48	19:20
40°	03:58	04:32	05:01	18:29	18:57	19:31
45°	03:44	04:22	04:53	18:37	19:08	19:46
S 50°	03:25	04:08	04:43	18:47	19:22	20:05
52°	03:16	04:02	04:38	18:51	19:28	20:14
54°	03:05	03:55	04:34	18:56	19:35	20:25
56°	02:53	03:47	04:28	19:02	19:44	20:38
58°	02:39	03:38	04:22	19:08	19:53	20:52
S 60°	02:21	03:27	04:15	19:15	20:04	21:10

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	11:41	14:06	▬	15:57	15:09	▬
N 70°	11:04	12:43	14:21	16:35	16:33	16:33
68°	10:38	12:05	13:23	17:01	17:12	17:31
66°	10:18	11:38	12:49	17:22	17:39	18:05
64°	10:03	11:17	12:25	17:38	18:00	18:30
62°	09:50	11:01	12:06	17:52	18:17	18:49
60°	09:39	10:47	11:50	18:03	18:31	19:05
N 58°	09:29	10:35	11:36	18:13	18:43	19:19
56°	09:21	10:25	11:25	18:22	18:53	19:30
54°	09:13	10:16	11:15	18:30	19:02	19:41
52°	09:07	10:08	11:06	18:37	19:11	19:50
50°	09:01	10:01	10:58	18:43	19:18	19:58
45°	08:48	09:46	10:41	18:57	19:34	20:15
N 40°	08:37	09:33	10:27	19:08	19:47	20:29
35°	08:28	09:23	10:15	19:18	19:58	20:41
30°	08:20	09:13	10:05	19:27	20:08	20:52
20°	08:07	08:57	09:47	19:41	20:25	21:10
N 10°	07:55	08:43	09:32	19:54	20:39	21:26
0°	07:44	08:30	09:17	20:06	20:53	21:40
S 10°	07:33	08:17	09:03	20:18	21:07	21:55
20°	07:21	08:04	08:48	20:31	21:21	22:11
30°	07:08	07:48	08:30	20:46	21:38	22:29
35°	07:00	07:39	08:20	20:55	21:48	22:40
40°	06:51	07:28	08:09	21:04	21:59	22:52
45°	06:41	07:16	07:55	21:16	22:13	23:06
S 50°	06:29	07:01	07:39	21:30	22:29	23:23
52°	06:23	06:55	07:31	21:37	22:36	23:31
54°	06:17	06:47	07:22	21:44	22:45	23:40
56°	06:10	06:39	07:12	21:52	22:54	23:51
58°	06:02	06:29	07:01	22:01	23:05	–:–
S 60°	05:54	06:18	06:49	22:12	23:17	–:–

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 3-5 7-20%
22	15:29	15:33	11:44	13:55	01:32	
23	15:37	15:41	11:44	14:42	02:18	
24	15:45	15:49	11:44	15:29	03:05	

October 25, 26, 27 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	33°34.3	200°52.3	S03°46.5	211°49.4	N00°29.7	182°18.0	S11°36.0	130°04.8	S22°17.6
1	48°36.8	215°51.9	47.7	226°50.4	29.0	197°19.9	36.2	145°07.1	17.6
2	63°39.2	230°51.5	48.9	241°51.4	28.4	212°21.9	36.4	160°09.3	17.6
3	78°41.7	245°51.1	·· 50.2	256°52.4	·· 27.8	227°23.8	·· 36.6	175°11.5	·· 17.6
4	93°44.2	260°50.7	51.4	271°53.4	27.1	242°25.8	36.8	190°13.8	17.6
5	108°46.6	275°50.2	52.6	286°54.4	26.5	257°27.7	37.0	205°16.0	17.7
6	123°49.1	290°49.8	S03°53.8	301°55.5	N00°25.9	272°29.6	S11°37.1	220°18.2	S22°17.7
7	138°51.6	305°49.4	55.0	316°56.5	25.2	287°31.6	37.3	235°20.4	17.7
8	153°54.0	320°49.0	56.2	331°57.5	24.6	302°33.5	37.5	250°22.7	17.7
9	168°56.5	335°48.6	·· 57.4	346°58.5	·· 24.0	317°35.5	·· 37.7	265°24.9	·· 17.7
10	183°59.0	350°48.2	58.7	1°59.5	23.4	332°37.4	37.9	280°27.1	17.7
11	199°01.4	5°47.8	03°59.9	17°00.5	22.7	347°39.3	38.1	295°29.4	17.8
12	214°03.9	20°47.4	S04°01.1	32°01.6	N00°22.1	2°41.3	S11°38.3	310°31.6	S22°17.8
13	229°06.4	35°46.9	02.3	47°02.6	21.5	17°43.2	38.4	325°33.8	17.8
14	244°08.8	50°46.5	03.5	62°03.6	20.8	32°45.2	38.6	340°36.0	17.8
15	259°11.3	65°46.1	·· 04.7	77°04.6	·· 20.2	47°47.1	·· 38.8	355°38.3	·· 17.8
16	274°13.7	80°45.7	05.9	92°05.6	19.6	62°49.0	39.0	10°40.5	17.8
17	289°16.2	95°45.3	07.2	107°06.6	18.9	77°51.0	39.2	25°42.7	17.8
18	304°18.7	110°44.9	S04°08.4	122°07.7	N00°18.3	92°52.9	S11°39.4	40°45.0	S22°17.9
19	319°21.1	125°44.5	09.6	137°08.7	17.7	107°54.9	39.6	55°47.2	17.9
20	334°23.6	140°44.1	10.8	152°09.7	17.0	122°56.8	39.8	70°49.4	17.9
21	349°26.1	155°43.6	·· 12.0	167°10.7	·· 16.4	137°58.8	·· 39.9	85°51.6	·· 17.9
22	4°28.5	170°43.2	13.2	182°11.7	15.8	153°00.7	40.1	100°53.9	17.9
23	19°31.0	185°42.8	14.4	197°12.7	15.1	168°02.6	40.3	115°56.1	17.9
Mer.pass.:21:42		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	34°33.5	200°42.4	S04°15.7	212°13.8	N00°14.5	183°04.6	S11°40.5	130°58.3	S22°18.0
1	49°35.9	215°42.0	16.9	227°14.8	13.9	198°06.5	40.7	146°00.6	18.0
2	64°38.4	230°41.6	18.1	242°15.8	13.3	213°08.5	40.9	161°02.8	18.0
3	79°40.9	245°41.2	·· 19.3	257°16.8	·· 12.6	228°10.4	·· 41.1	176°05.0	·· 18.0
4	94°43.3	260°40.7	20.5	272°17.8	12.0	243°12.3	41.2	191°07.2	18.0
5	109°45.8	275°40.3	21.7	287°18.8	11.4	258°14.3	41.4	206°09.5	18.0
6	124°48.2	290°39.9	S04°22.9	302°19.9	N00°10.7	273°16.2	S11°41.6	221°11.7	S22°18.0
7	139°50.7	305°39.5	24.2	317°20.9	10.1	288°18.2	41.8	236°13.9	18.1
8	154°53.2	320°39.1	25.4	332°21.9	09.5	303°20.1	42.0	251°16.2	18.1
9	169°55.6	335°38.7	·· 26.6	347°22.9	·· 08.8	318°22.0	·· 42.2	266°18.4	·· 18.1
10	184°58.1	350°38.3	27.8	2°23.9	08.2	333°24.0	42.4	281°20.6	18.1
11	200°00.6	5°37.8	29.0	17°25.0	07.6	348°25.9	42.5	296°22.8	18.1
12	215°03.0	20°37.4	S04°30.2	32°26.0	N00°06.9	3°27.9	S11°42.7	311°25.1	S22°18.1
13	230°05.5	35°37.0	31.4	47°27.0	06.3	18°29.8	42.9	326°27.3	18.2
14	245°08.0	50°36.6	32.6	62°28.0	05.7	33°31.7	43.1	341°29.5	18.2
15	260°10.4	65°36.2	·· 33.9	77°29.0	·· 05.0	48°33.7	·· 43.3	356°31.7	·· 18.2
16	275°12.9	80°35.8	35.1	92°30.0	04.4	63°35.6	43.5	11°34.0	18.2
17	290°15.4	95°35.3	36.3	107°31.1	03.8	78°37.6	43.7	26°36.2	18.2
18	305°17.8	110°34.9	S04°37.5	122°32.1	N00°03.2	93°39.5	S11°43.8	41°38.4	S22°18.2
19	320°20.3	125°34.5	38.7	137°33.1	02.5	108°41.4	44.0	56°40.6	18.2
20	335°22.7	140°34.1	39.9	152°34.1	01.9	123°43.4	44.2	71°42.9	18.3
21	350°25.2	155°33.7	·· 41.1	167°35.1	·· 01.3	138°45.3	·· 44.4	86°45.1	·· 18.3
22	5°27.7	170°33.2	42.3	182°36.1	00.6	153°47.3	44.6	101°47.3	18.3
23	20°30.1	185°32.8	43.5	197°37.2	00.0	168°49.2	44.8	116°49.5	18.3
Mer.pass.:21:38		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	35°32.6	200°32.4	S04°44.8	212°38.2	S00°00.6	183°51.1	S11°45.0	131°51.8	S22°18.3
1	50°35.1	215°32.0	46.0	227°39.2	01.3	198°53.1	45.2	146°54.0	18.3
2	65°37.5	230°31.6	47.2	242°40.2	01.9	213°55.0	45.3	161°56.2	18.4
3	80°40.0	245°31.2	·· 48.4	257°41.2	·· 02.5	228°57.0	·· 45.5	176°58.4	·· 18.4
4	95°42.5	260°30.7	49.6	272°42.2	03.2	243°58.9	45.7	192°00.7	18.4
5	110°44.9	275°30.3	50.8	287°43.3	03.8	259°00.8	45.9	207°02.9	18.4
6	125°47.4	290°29.9	S04°52.0	302°44.3	S00°04.4	274°02.8	S11°46.1	222°05.1	S22°18.4
7	140°49.8	305°29.5	53.2	317°45.3	05.0	289°04.7	46.3	237°07.3	18.4
8	155°52.3	320°29.1	54.4	332°46.3	05.7	304°06.7	46.5	252°09.6	18.4
9	170°54.8	335°28.6	·· 55.6	347°47.3	·· 06.3	319°08.6	·· 46.6	267°11.8	·· 18.5
10	185°57.2	350°28.2	56.8	2°48.3	06.9	334°10.5	46.8	282°14.0	18.5
11	200°59.7	5°27.8	58.1	17°49.4	07.6	349°12.5	47.0	297°16.2	18.5
12	216°02.2	20°27.4	S04°59.3	32°50.4	S00°08.2	4°14.4	S11°47.2	312°18.5	S22°18.5
13	231°04.6	35°27.0	05°00.5	47°51.4	08.8	19°16.4	47.4	327°20.7	18.5
14	246°07.1	50°26.5	01.7	62°52.4	09.5	34°18.3	47.6	342°22.9	18.5
15	261°09.6	65°26.1	·· 02.9	77°53.4	·· 10.1	49°20.2	·· 47.8	357°25.1	·· 18.6
16	276°12.0	80°25.7	04.1	92°54.5	10.7	64°22.2	47.9	12°27.4	18.6
17	291°14.5	95°25.3	05.3	107°55.5	11.4	79°24.1	48.1	27°29.6	18.6
18	306°17.0	110°24.8	S05°06.5	122°56.5	S00°12.0	94°26.1	S11°48.3	42°31.8	S22°18.6
19	321°19.4	125°24.4	07.7	137°57.5	12.6	109°28.0	48.5	57°34.0	18.6
20	336°21.9	140°24.0	08.9	152°58.5	13.2	124°29.9	48.7	72°36.2	18.6
21	351°24.3	155°23.6	·· 10.1	167°59.5	·· 13.9	139°31.9	·· 48.9	87°38.5	·· 18.6
22	6°26.8	170°23.2	11.3	183°00.6	14.5	154°33.8	49.1	102°40.7	18.7
23	21°29.3	185°22.7	12.6	198°01.6	15.1	169°35.8	49.2	117°42.9	18.7
Mer.pass.:21:34		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Stars

	SHA	**Dec**
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°08.9
Hamal	327°57.1	23°32.7
Polaris	315°59.3	89°20.2
Acamar	315°15.7	-40°14.1
Menkar	314°11.7	4°09.5
Mirfak	308°35.6	49°55.3
Aldebaran	290°45.7	16°32.5
Rigel	281°09.0	-8°10.9
Capella	280°29.8	46°00.6
Bellatrix	278°28.7	6°21.8
Elnath	278°08.7	28°37.1
Alnilam	275°43.2	-1°11.5
Betelgeuse	270°57.9	7°24.5
Canopus	263°54.6	-52°42.2
Sirius	258°31.0	-16°44.4
Adhara	255°10.1	-28°59.7
Procyon	244°56.6	5°10.7
Pollux	243°24.1	27°58.8
Avior	234°16.8	-59°33.7
Suhail	222°50.4	-43°30.0
Miaplacidus	221°39.2	-69°47.1
Alphard	217°53.3	-8°44.0
Regulus	207°40.6	11°52.8
Dubhe	193°48.7	61°39.2
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.6	-63°11.6
Gacrux	171°58.1	-57°12.5
Alioth	166°18.7	55°51.9
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.6
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.7
Rigil Kent.	139°48.3	-60°54.3
Kochab	137°21.4	74°05.2
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.6
Antares	112°23.0	-26°28.0
Atria	107°22.5	-69°03.5
Sabik	102°09.4	-15°44.5
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.2
Eltanin	90°45.1	51°29.6
Kaus Aust.	83°40.1	-34°22.4
Vega	80°37.2	38°48.4
Nunki	75°54.8	-26°16.3
Altair	62°05.4	8°55.2
Peacock	53°14.7	-56°40.7
Deneb	49°29.4	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.9	-46°52.6
Fomalhaut	15°20.6	-29°31.7
Scheat	13°50.3	28°10.9
Markab	13°35.2	15°18.2

Oct 25 Wed	**SHA**	**Mer.pass**
Venus	167°18.0	10:37
Mars	178°15.0	09:52
Jupiter	148°43.7	11:49
Saturn	96°30.5	15:17

Oct 26 Thu	**SHA**	**Mer.pass**
Venus	166°08.9	10:37
Mars	177°40.3	09:50
Jupiter	148°31.1	11:46
Saturn	96°24.9	15:14

Oct 27 Fri	**SHA**	**Mer.pass**
Venus	164°59.8	10:38
Mars	177°05.6	09:49
Jupiter	148°18.5	11:43
Saturn	96°19.2	15:10

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2906 sec ΔT = TT-UT1 = +68.8934 sec

2017 October 25 to Oct. 27 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	183°58.1	S12°05.1	123°40.6	12.2′	S19°29.3	-1.6′	54.1′
1	198°58.2	06.0	138°11.8	12.2′	19°30.9	-1.6′	54.1′
2	213°58.3	06.9	152°43.0	12.2′	19°32.4	-1.5′	54.1′
3	228°58.4	·· 07.7	167°14.1	12.2′	19°33.9	-1.4′	54.1′
4	243°58.4	08.6	181°45.3	12.2′	19°35.2	-1.3′	54.1′
5	258°58.5	09.4	196°16.4	12.1′	19°36.4	-1.2′	54.1′
6	273°58.6	S12°10.3	210°47.6	12.1′	S19°37.6	-1.1′	54.1′
7	288°58.7	11.2	225°18.7	12.1′	19°38.7	-1.0′	54.1′
8	303°58.7	12.0	239°49.9	12.1′	19°39.6	-0.9′	54.1′
9	318°58.8	·· 12.9	254°21.0	12.1′	19°40.5	-0.8′	54.1′
10	333°58.9	13.7	268°52.1	12.1′	19°41.3	-0.7′	54.1′
11	348°58.9	14.6	283°23.2	12.1′	19°42.0	-0.7′	54.1′
12	3°59.0	S12°15.5	297°54.3	12.1′	S19°42.6	-0.6′	54.1′
13	18°59.1	16.3	312°25.4	12.1′	19°43.1	-0.5′	54.1′
14	33°59.1	17.2	326°56.5	12.1′	19°43.6	-0.4′	54.1′
15	48°59.2	·· 18.0	341°27.6	12.1′	19°43.9	-0.3′	54.1′
16	63°59.3	18.9	355°58.7	12.1′	19°44.2	-0.2′	54.1′
17	78°59.3	19.7	10°29.8	12.1′	19°44.3	-0.1′	54.1′
18	93°59.4	S12°20.6	25°00.9	12.1′	S19°44.4	-0.0′	54.1′
19	108°59.5	21.5	39°32.0	12.1′	19°44.4	0.1′	54.1′
20	123°59.5	22.3	54°03.1	12.1′	19°44.2	0.2′	54.2′
21	138°59.6	·· 23.2	68°34.2	12.1′	19°44.0	0.3′	54.2′
22	153°59.7	24.0	83°05.2	12.1′	19°43.7	0.3′	54.2′
23	168°59.7	24.9	97°36.3	12.1′	19°43.3	0.4′	54.2′
	SD.=16.1	d=-0.9	S.D.=14.7				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	183°59.8	S12°25.7	112°07.4	12.1′	S19°42.9	0.5′	54.2′
1	198°59.9	26.6	126°38.5	12.1′	19°42.3	0.6′	54.2′
2	213°59.9	27.4	141°09.5	12.1′	19°41.6	0.7′	54.2′
3	229°00.0	·· 28.3	155°40.6	12.1′	19°40.9	0.8′	54.2′
4	244°00.1	29.1	170°11.7	12.1′	19°40.0	0.9′	54.2′
5	259°00.1	30.0	184°42.7	12.1′	19°39.1	1.0′	54.2′
6	274°00.2	S12°30.9	199°13.8	12.1′	S19°38.1	1.1′	54.2′
7	289°00.3	31.7	213°44.9	12.1′	19°37.0	1.2′	54.2′
8	304°00.3	32.6	228°15.9	12.1′	19°35.8	1.3′	54.2′
9	319°00.4	·· 33.4	242°47.0	12.1′	19°34.5	1.3′	54.2′
10	334°00.5	34.3	257°18.1	12.1′	19°33.1	1.4′	54.2′
11	349°00.5	35.1	271°49.1	12.1′	19°31.6	1.5′	54.3′
12	4°00.6	S12°36.0	286°20.2	12.1′	S19°30.0	1.6′	54.3′
13	19°00.6	36.8	300°51.3	12.1′	19°28.4	1.7′	54.3′
14	34°00.7	37.7	315°22.3	12.1′	19°26.6	1.8′	54.3′
15	49°00.8	·· 38.5	329°53.4	12.1′	19°24.8	1.9′	54.3′
16	64°00.8	39.4	344°24.5	12.1′	19°22.8	2.0′	54.3′
17	79°00.9	40.2	358°55.5	12.1′	19°20.8	2.1′	54.3′
18	94°00.9	S12°41.0	13°26.6	12.1′	S19°18.7	2.2′	54.3′
19	109°01.0	41.9	27°57.7	12.1′	19°16.5	2.2′	54.3′
20	124°01.1	42.7	42°28.8	12.1′	19°14.2	2.3′	54.4′
21	139°01.1	·· 43.6	56°59.9	12.1′	19°11.8	2.4′	54.4′
22	154°01.2	44.4	71°30.9	12.1′	19°09.4	2.5′	54.4′
23	169°01.2	45.3	86°02.0	12.1′	19°06.8	2.6′	54.4′
	SD.=16.1	d=-0.9	S.D.=14.8				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	184°01.3	S12°46.1	100°33.1	12.1′	S19°04.2	2.7′	54.4′
1	199°01.4	47.0	115°04.2	12.1′	19°01.4	2.8′	54.4′
2	214°01.4	47.8	129°35.3	12.1′	18°58.6	2.9′	54.4′
3	229°01.5	·· 48.7	144°06.4	12.1′	18°55.7	3.0′	54.4′
4	244°01.5	49.5	158°37.5	12.1′	18°52.7	3.1′	54.5′
5	259°01.6	50.4	173°08.6	12.1′	18°49.6	3.1′	54.5′
6	274°01.6	S12°51.2	187°39.7	12.1′	S18°46.4	3.2′	54.5′
7	289°01.7	52.0	202°10.8	12.1′	18°43.1	3.3′	54.5′
8	304°01.7	52.9	216°41.9	12.1′	18°39.7	3.4′	54.5′
9	319°01.8	·· 53.7	231°13.1	12.1′	18°36.3	3.5′	54.5′
10	334°01.9	54.6	245°44.2	12.1′	18°32.7	3.6′	54.5′
11	349°01.9	55.4	260°15.3	12.1′	18°29.1	3.7′	54.6′
12	4°02.0	S12°56.3	274°46.4	12.1′	S18°25.4	3.8′	54.6′
13	19°02.0	57.1	289°17.6	12.1′	18°21.6	3.8′	54.6′
14	34°02.1	57.9	303°48.7	12.1′	18°17.7	3.9′	54.6′
15	49°02.1	·· 58.8	318°19.9	12.1′	18°13.7	4.0′	54.6′
16	64°02.2	12°59.6	332°51.0	12.2′	18°09.6	4.1′	54.6′
17	79°02.2	13°00.5	347°22.2	12.2′	18°05.5	4.2′	54.7′
18	94°02.3	S13°01.3	1°53.3	12.2′	S18°01.2	4.3′	54.7′
19	109°02.3	02.1	16°24.5	12.2′	17°56.9	4.4′	54.7′
20	124°02.4	03.0	30°55.7	12.2′	17°52.5	4.5′	54.7′
21	139°02.4	·· 03.8	45°26.8	12.2′	17°48.0	4.5′	54.7′
22	154°02.5	04.7	59°58.0	12.2′	17°43.4	4.6′	54.8′
23	169°02.5	05.5	74°29.2	12.2′	17°38.7	4.7′	54.8′
	SD.=16.1	d=-0.8	S.D.=14.9				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	05:43	07:03	08:22	15:04	16:23	17:43
N 70°	05:41	06:53	08:02	15:24	16:33	17:45
68°	05:40	06:45	07:47	15:40	16:41	17:47
66°	05:38	06:39	07:34	15:52	16:48	17:48
64°	05:37	06:33	07:24	16:03	16:54	17:50
62°	05:36	06:28	07:15	16:12	16:59	17:51
60°	05:34	06:23	07:07	16:20	17:04	17:52
N 58°	05:33	06:19	07:00	16:27	17:08	17:54
56°	05:32	06:16	06:54	16:33	17:11	17:55
54°	05:31	06:12	06:49	16:38	17:15	17:56
52°	05:30	06:09	06:44	16:43	17:18	17:57
50°	05:29	06:06	06:40	16:47	17:21	17:58
45°	05:26	06:00	06:30	16:57	17:27	18:01
N 40°	05:23	05:55	06:22	17:05	17:33	18:04
35°	05:20	05:50	06:16	17:12	17:38	18:07
30°	05:17	05:45	06:09	17:18	17:43	18:11
20°	05:10	05:36	05:59	17:29	17:51	18:17
N 10°	05:03	05:28	05:49	17:38	18:00	18:25
0°	04:55	05:19	05:41	17:47	18:09	18:33
S 10°	04:45	05:10	05:32	17:57	18:18	18:43
20°	04:32	04:59	05:22	18:06	18:29	18:56
30°	04:16	04:46	05:11	18:18	18:43	19:12
35°	04:06	04:38	05:04	18:24	18:51	19:23
40°	03:53	04:28	04:57	18:32	19:01	19:35
45°	03:38	04:16	04:48	18:41	19:12	19:51
S 50°	03:18	04:02	04:37	18:52	19:27	20:12
52°	03:08	03:55	04:32	18:57	19:34	20:22
54°	02:57	03:47	04:27	19:02	19:42	20:33
56°	02:44	03:39	04:21	19:09	19:51	20:47
58°	02:28	03:29	04:14	19:15	20:01	21:03
S 60°	02:08	03:17	04:06	19:23	20:13	21:23

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	▬	▬	▬	▬	▬	▬
N 70°	15:44	16:07	16:09	16:49	18:05	19:43
68°	14:26	15:06	15:27	18:07	19:07	20:24
66°	13:48	14:31	14:59	18:45	19:41	20:52
64°	13:21	14:05	14:37	19:12	20:06	21:13
62°	13:01	13:46	14:20	19:32	20:26	21:30
60°	12:44	13:29	14:06	19:49	20:42	21:44
N 58°	12:30	13:16	13:53	20:03	20:56	21:56
56°	12:18	13:04	13:43	20:15	21:07	22:06
54°	12:08	12:54	13:33	20:26	21:17	22:16
52°	11:58	12:44	13:25	20:35	21:26	22:24
50°	11:50	12:36	13:17	20:43	21:35	22:31
45°	11:32	12:19	13:01	21:01	21:52	22:47
N 40°	11:17	12:04	12:48	21:16	22:06	23:00
35°	11:05	11:52	12:36	21:28	22:18	23:10
30°	10:54	11:42	12:27	21:39	22:28	23:20
20°	10:36	11:24	12:09	21:57	22:46	23:36
N 10°	10:20	11:08	11:55	22:13	23:02	23:50
0°	10:05	10:53	11:41	22:28	23:16	–:–
S 10°	09:50	10:38	11:27	22:43	23:30	–:–
20°	09:34	10:22	11:12	22:59	23:46	–:–
30°	09:16	10:04	10:55	23:17	–:–	00:03
35°	09:05	09:53	10:45	23:28	–:–	00:14
40°	08:53	09:41	10:33	23:40	–:–	00:25
45°	08:39	09:27	10:20	23:55	–:–	00:39
S 50°	08:21	09:10	10:04	–:–	00:12	00:56
52°	08:13	09:01	09:56	–:–	00:21	01:04
54°	08:04	08:52	09:47	–:–	00:30	01:13
56°	07:53	08:42	09:38	–:–	00:40	01:22
58°	07:41	08:30	09:27	00:03	00:52	01:34
S 60°	07:28	08:16	09:14	00:16	01:06	01:47

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 6-8 28-46%
25	15:53	15:56	11:44	16:17	03:53	
26	15:59	16:02	11:44	17:04	04:41	
27	16:05	16:08	11:44	17:52	05:28	

October 28, 29, 30 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	36°31.7	200°22.3	S05°13.8	213°02.6	S00°15.8	184°37.7	S11°49.4	132°45.1	S22°18.7
1	51°34.2	215°21.9	15.0	228°03.6	16.4	199°39.6	49.6	147°47.4	18.7
2	66°36.7	230°21.5	16.2	243°04.6	17.0	214°41.6	49.8	162°49.6	18.7
3	81°39.1	245°21.0	·· 17.4	258°05.6	·· 17.7	229°43.5	·· 50.0	177°51.8	·· 18.7
4	96°41.6	260°20.6	18.6	273°06.7	18.3	244°45.5	50.2	192°54.0	18.8
5	111°44.1	275°20.2	19.8	288°07.7	18.9	259°47.4	50.4	207°56.2	18.8
6	126°46.5	290°19.8	S05°21.0	303°08.7	S00°19.5	274°49.3	S11°50.5	222°58.5	S22°18.8
7	141°49.0	305°19.3	22.2	318°09.7	20.2	289°51.3	50.7	238°00.7	18.8
8	156°51.5	320°18.9	23.4	333°10.7	20.8	304°53.2	50.9	253°02.9	18.8
9	171°53.9	335°18.5	·· 24.6	348°11.7	·· 21.4	319°55.2	·· 51.1	268°05.1	·· 18.8
10	186°56.4	350°18.1	25.8	3°12.8	22.1	334°57.1	51.3	283°07.4	18.9
11	201°58.8	5°17.6	27.0	18°13.8	22.7	349°59.0	51.5	298°09.6	18.9
12	217°01.3	20°17.2	S05°28.2	33°14.8	S00°23.3	5°01.0	S11°51.6	313°11.8	S22°18.9
13	232°03.8	35°16.8	29.4	48°15.8	24.0	20°02.9	51.8	328°14.0	18.9
14	247°06.2	50°16.4	30.6	63°16.8	24.6	35°04.9	52.0	343°16.2	18.9
15	262°08.7	65°15.9	·· 31.8	78°17.9	·· 25.2	50°06.8	·· 52.2	358°18.5	·· 18.9
16	277°11.2	80°15.5	33.0	93°18.9	25.9	65°08.7	52.4	13°20.7	18.9
17	292°13.6	95°15.1	34.3	108°19.9	26.5	80°10.7	52.6	28°22.9	19.0
18	307°16.1	110°14.6	S05°35.5	123°20.9	S00°27.1	95°12.6	S11°52.8	43°25.1	S22°19.0
19	322°18.6	125°14.2	36.7	138°21.9	27.7	110°14.6	52.9	58°27.3	19.0
20	337°21.0	140°13.8	37.9	153°22.9	28.4	125°16.5	53.1	73°29.6	19.0
21	352°23.5	155°13.4	·· 39.1	168°24.0	·· 29.0	140°18.4	·· 53.3	88°31.8	·· 19.0
22	7°25.9	170°12.9	40.3	183°25.0	29.6	155°20.4	53.5	103°34.0	19.0
23	22°28.4	185°12.5	41.5	198°26.0	30.3	170°22.3	53.7	118°36.2	19.0
Mer.pass.:21:30		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	37°30.9	200°12.1	S05°42.7	213°27.0	S00°30.9	185°24.3	S11°53.9	133°38.4	S22°19.1
1	52°33.3	215°11.7	43.9	228°28.0	31.5	200°26.2	54.1	148°40.7	19.1
2	67°35.8	230°11.2	45.1	243°29.0	32.2	215°28.1	54.2	163°42.9	19.1
3	82°38.3	245°10.8	·· 46.3	258°30.1	·· 32.8	230°30.1	·· 54.4	178°45.1	·· 19.1
4	97°40.7	260°10.4	47.5	273°31.1	33.4	245°32.0	54.6	193°47.3	19.1
5	112°43.2	275°09.9	48.7	288°32.1	34.0	260°34.0	54.8	208°49.5	19.1
6	127°45.7	290°09.5	S05°49.9	303°33.1	S00°34.7	275°35.9	S11°55.0	223°51.8	S22°19.2
7	142°48.1	305°09.1	51.1	318°34.1	35.3	290°37.8	55.2	238°54.0	19.2
8	157°50.6	320°08.6	52.3	333°35.2	35.9	305°39.8	55.3	253°56.2	19.2
9	172°53.1	335°08.2	·· 53.5	348°36.2	·· 36.6	320°41.7	·· 55.5	268°58.4	·· 19.2
10	187°55.5	350°07.8	54.7	3°37.2	37.2	335°43.6	55.7	284°00.6	19.2
11	202°58.0	5°07.4	55.9	18°38.2	37.8	350°45.6	55.9	299°02.8	19.2
12	218°00.4	20°06.9	S05°57.1	33°39.2	S00°38.5	5°47.5	S11°56.1	314°05.1	S22°19.2
13	233°02.9	35°06.5	58.3	48°40.2	39.1	20°49.5	56.3	329°07.3	19.3
14	248°05.4	50°06.1	05°59.5	63°41.3	39.7	35°51.4	56.5	344°09.5	19.3
15	263°07.8	65°05.6	06°00.7	78°42.3	·· 40.3	50°53.3	·· 56.6	359°11.7	·· 19.3
16	278°10.3	80°05.2	01.9	93°43.3	41.0	65°55.3	56.8	14°13.9	19.3
17	293°12.8	95°04.8	03.1	108°44.3	41.6	80°57.2	57.0	29°16.2	19.3
18	308°15.2	110°04.3	S06°04.3	123°45.3	S00°42.2	95°59.2	S11°57.2	44°18.4	S22°19.3
19	323°17.7	125°03.9	05.5	138°46.3	42.9	111°01.1	57.4	59°20.6	19.4
20	338°20.2	140°03.5	06.7	153°47.4	43.5	126°03.0	57.6	74°22.8	19.4
21	353°22.6	155°03.0	·· 07.9	168°48.4	·· 44.1	141°05.0	·· 57.7	89°25.0	·· 19.4
22	8°25.1	170°02.6	09.1	183°49.4	44.8	156°06.9	57.9	104°27.2	19.4
23	23°27.6	185°02.2	10.3	198°50.4	45.4	171°08.9	58.1	119°29.5	19.4
Mer.pass.:21:26		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	38°30.0	200°01.7	S06°11.5	213°51.4	S00°46.0	186°10.8	S11°58.3	134°31.7	S22°19.4
1	53°32.5	215°01.3	12.7	228°52.4	46.6	201°12.7	58.5	149°33.9	19.4
2	68°34.9	230°00.9	13.9	243°53.5	47.3	216°14.7	58.7	164°36.1	19.5
3	83°37.4	245°00.4	·· 15.1	258°54.5	·· 47.9	231°16.6	·· 58.9	179°38.3	·· 19.5
4	98°39.9	260°00.0	16.3	273°55.5	48.5	246°18.6	59.0	194°40.5	19.5
5	113°42.3	274°59.5	17.5	288°56.5	49.2	261°20.5	59.2	209°42.8	19.5
6	128°44.8	289°59.1	S06°18.7	303°57.5	S00°49.8	276°22.4	S11°59.4	224°45.0	S22°19.5
7	143°47.3	304°58.7	19.9	318°58.5	50.4	291°24.4	59.6	239°47.2	19.5
8	158°49.7	319°58.2	21.1	333°59.6	51.1	306°26.3	11°59.8	254°49.4	19.6
9	173°52.2	334°57.8	·· 22.3	349°00.6	·· 51.7	321°28.3	12°00.0	269°51.6	·· 19.6
10	188°54.7	349°57.4	23.5	4°01.6	52.3	336°30.2	00.1	284°53.8	19.6
11	203°57.1	4°56.9	24.6	19°02.6	52.9	351°32.1	00.3	299°56.1	19.6
12	218°59.6	19°56.5	S06°25.8	34°03.6	S00°53.6	6°34.1	S12°00.5	314°58.3	S22°19.6
13	234°02.0	34°56.1	27.0	49°04.7	54.2	21°36.0	00.7	330°00.5	19.6
14	249°04.5	49°55.6	28.2	64°05.7	54.8	36°37.9	00.9	345°02.7	19.6
15	264°07.0	64°55.2	·· 29.4	79°06.7	·· 55.5	51°39.9	·· 01.1	0°04.9	·· 19.7
16	279°09.4	79°54.7	30.6	94°07.7	56.1	66°41.8	01.2	15°07.1	19.7
17	294°11.9	94°54.3	31.8	109°08.7	56.7	81°43.8	01.4	30°09.4	19.7
18	309°14.4	109°53.9	S06°33.0	124°09.7	S00°57.3	96°45.7	S12°01.6	45°11.6	S22°19.7
19	324°16.8	124°53.4	34.2	139°10.8	58.0	111°47.6	01.8	60°13.8	19.7
20	339°19.3	139°53.0	35.4	154°11.8	58.6	126°49.6	02.0	75°16.0	19.7
21	354°21.8	154°52.5	·· 36.6	169°12.8	·· 59.2	141°51.5	·· 02.2	90°18.2	·· 19.7
22	9°24.2	169°52.1	37.8	184°13.8	00°59.9	156°53.5	02.4	105°20.4	19.8
23	24°26.7	184°51.7	39.0	199°14.8	01°00.5	171°55.4	02.5	120°22.6	19.8
Mer.pass.:21:22		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°08.9
Hamal	327°57.1	23°32.7
Polaris	315°58.8	89°20.2
Acamar	315°15.7	-40°14.1
Menkar	314°11.7	4°09.5
Mirfak	308°35.6	49°55.3
Aldebaran	290°45.7	16°32.5
Rigel	281°09.0	-8°10.9
Capella	280°29.8	46°00.7
Bellatrix	278°28.6	6°21.8
Elnath	278°08.6	28°37.1
Alnilam	275°43.2	-1°11.5
Betelgeuse	270°57.9	7°24.5
Canopus	263°54.6	-52°42.2
Sirius	258°31.0	-16°44.4
Adhara	255°10.1	-28°59.7
Procyon	244°56.6	5°10.7
Pollux	243°24.1	27°58.8
Avior	234°16.7	-59°33.7
Suhail	222°50.3	-43°30.0
Miaplacidus	221°39.1	-69°47.1
Alphard	217°53.3	-8°44.0
Regulus	207°40.6	11°52.8
Dubhe	193°48.6	61°39.1
Denebola	182°31.0	14°28.5
Gienah	175°49.6	-17°38.2
Acrux	173°06.6	-63°11.6
Gacrux	171°58.1	-57°12.5
Alioth	166°18.7	55°51.9
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.6
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.6
Rigil Kent.	139°48.3	-60°54.3
Kochab	137°21.4	74°05.1
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.6
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.5
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.2
Eltanin	90°45.1	51°29.6
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.2	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.7	-56°40.8
Deneb	49°29.4	45°21.0
Enif	33°44.1	9°57.6
Al Na'ir	27°39.9	-46°52.6
Fomalhaut	15°20.6	-29°31.7
Scheat	13°50.3	28°11.0
Markab	13°35.2	15°18.2

Oct 28 Sat	SHA	Mer.pass
Venus	163°50.6	10:39
Mars	176°30.9	09:47
Jupiter	148°06.0	11:40
Saturn	96°13.4	15:07

Oct 29 Sun	SHA	Mer.pass
Venus	162°41.2	10:39
Mars	175°56.1	09:46
Jupiter	147°53.4	11:37
Saturn	96°07.6	15:03

Oct 30 Mon	SHA	Mer.pass
Venus	161°31.7	10:40
Mars	175°21.4	09:44
Jupiter	147°40.8	11:34
Saturn	96°01.7	15:00

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2875 sec ΔT = TT-UT1 = +68.8965 sec

2017 October 28 to Oct. 30 UT

h

Sat	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	184°02.6	S13°06.3	89°00.4	12.2'	S17°34.0	4.8'	54.8'
1	199°02.6	07.2	103°31.5	12.2'	17°29.1	4.9'	54.8'
2	214°02.7	08.0	118°02.7	12.2'	17°24.2	5.0'	54.8'
3	229°02.7	·· 08.8	132°33.9	12.2'	17°19.2	5.1'	54.9'
4	244°02.8	09.7	147°05.1	12.2'	17°14.1	5.1'	54.9'
5	259°02.8	10.5	161°36.3	12.2'	17°08.9	5.2'	54.9'
6	274°02.9	S13°11.3	176°07.6	12.2'	S17°03.6	5.3'	54.9'
7	289°02.9	12.2	190°38.8	12.2'	16°58.3	5.4'	55.0'
8	304°03.0	13.0	205°10.0	12.2'	16°52.9	5.5'	55.0'
9	319°03.0	·· 13.8	219°41.2	12.2'	16°47.3	5.6'	55.0'
10	334°03.1	14.7	234°12.4	12.2'	16°41.7	5.6'	55.0'
11	349°03.1	15.5	248°43.7	12.2'	16°36.1	5.7'	55.0'
12	4°03.2	S13°16.3	263°14.9	12.2'	S16°30.3	5.8'	55.1'
13	19°03.2	17.2	277°46.1	12.2'	16°24.4	5.9'	55.1'
14	34°03.3	18.0	292°17.4	12.2'	16°18.5	6.0'	55.1'
15	49°03.3	·· 18.8	306°48.6	12.2'	16°12.5	6.1'	55.1'
16	64°03.4	19.7	321°19.9	12.3'	16°06.4	6.1'	55.2'
17	79°03.4	20.5	335°51.1	12.3'	16°00.2	6.2'	55.2'
18	94°03.4	S13°21.3	350°22.4	12.3'	S15°54.0	6.3'	55.2'
19	109°03.5	22.2	4°53.7	12.3'	15°47.6	6.4'	55.2'
20	124°03.5	23.0	19°24.9	12.3'	15°41.2	6.5'	55.3'
21	139°03.6	·· 23.8	33°56.2	12.3'	15°34.7	6.5'	55.3'
22	154°03.6	24.7	48°27.4	12.3'	15°28.1	6.6'	55.3'
23	169°03.7	25.5	62°58.7	12.3'	15°21.5	6.7'	55.3'
	SD.=16.1	d=-0.8	S.D.=15.0				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	184°03.7	S13°26.3	77°30.0	12.3'	S15°14.7	6.8'	55.4'
1	199°03.8	27.1	92°01.3	12.3'	15°07.9	6.9'	55.4'
2	214°03.8	28.0	106°32.5	12.3'	15°01.0	6.9'	55.4'
3	229°03.8	·· 28.8	121°03.8	12.3'	14°54.0	7.0'	55.5'
4	244°03.9	29.6	135°35.1	12.3'	14°47.0	7.1'	55.5'
5	259°03.9	30.5	150°06.4	12.3'	14°39.9	7.2'	55.5'
6	274°04.0	S13°31.3	164°37.7	12.3'	S14°32.7	7.2'	55.5'
7	289°04.0	32.1	179°09.0	12.3'	14°25.4	7.3'	55.6'
8	304°04.0	32.9	193°40.2	12.3'	14°18.0	7.4'	55.6'
9	319°04.1	·· 33.8	208°11.5	12.3'	14°10.6	7.5'	55.6'
10	334°04.1	34.6	222°42.8	12.3'	14°03.1	7.5'	55.6'
11	349°04.2	35.4	237°14.1	12.3'	13°55.5	7.6'	55.7'
12	4°04.2	S13°36.2	251°45.4	12.3'	S13°47.8	7.7'	55.7'
13	19°04.2	37.1	266°16.7	12.3'	13°40.1	7.8'	55.7'
14	34°04.3	37.9	280°47.9	12.3'	13°32.3	7.8'	55.8'
15	49°04.3	·· 38.7	295°19.2	12.3'	13°24.4	7.9'	55.8'
16	64°04.4	39.5	309°50.5	12.3'	13°16.5	8.0'	55.8'
17	79°04.4	40.3	324°21.8	12.3'	13°08.4	8.1'	55.9'
18	94°04.4	S13°41.2	338°53.1	12.3'	S13°00.4	8.1'	55.9'
19	109°04.5	42.0	353°24.3	12.3'	12°52.2	8.2'	55.9'
20	124°04.5	42.8	7°55.6	12.3'	12°43.9	8.3'	56.0'
21	139°04.5	·· 43.6	22°26.9	12.3'	12°35.6	8.3'	56.0'
22	154°04.6	44.5	36°58.1	12.3'	12°27.2	8.4'	56.0'
23	169°04.6	45.3	51°29.4	12.3'	12°18.8	8.5'	56.1'
	SD.=16.1	d=-0.8	S.D.=15.2				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	184°04.6	S13°46.1	66°00.7	12.3'	S12°10.3	8.6'	56.1'
1	199°04.7	46.9	80°31.9	12.2'	12°01.7	8.6'	56.1'
2	214°04.7	47.7	95°03.2	12.2'	11°53.0	8.7'	56.1'
3	229°04.7	·· 48.5	109°34.4	12.2'	11°44.3	8.8'	56.2'
4	244°04.8	49.4	124°05.6	12.2'	11°35.5	8.8'	56.2'
5	259°04.8	50.2	138°36.9	12.2'	11°26.6	8.9'	56.2'
6	274°04.8	S13°51.0	153°08.1	12.2'	S11°17.7	9.0'	56.3'
7	289°04.9	51.8	167°39.3	12.2'	11°08.7	9.0'	56.3'
8	304°04.9	52.6	182°10.5	12.2'	10°59.7	9.1'	56.3'
9	319°04.9	·· 53.5	196°41.7	12.2'	10°50.5	9.2'	56.4'
10	334°05.0	54.3	211°12.9	12.2'	10°41.4	9.2'	56.4'
11	349°05.0	55.1	225°44.1	12.2'	10°32.1	9.3'	56.5'
12	4°05.0	S13°55.9	240°15.3	12.2'	S10°22.8	9.3'	56.5'
13	19°05.1	56.7	254°46.4	12.2'	10°13.4	9.4'	56.5'
14	34°05.1	57.5	269°17.6	12.2'	10°04.0	9.5'	56.6'
15	49°05.1	·· 58.3	283°48.8	12.1'	09°54.5	9.5'	56.6'
16	64°05.2	13°59.2	298°19.9	12.1'	09°44.9	9.6'	56.6'
17	79°05.2	14°00.0	312°51.0	12.1'	09°35.3	9.7'	56.7'
18	94°05.2	S14°00.8	327°22.1	12.1'	S09°25.6	9.7'	56.7'
19	109°05.2	01.6	341°53.2	12.1'	09°15.8	9.8'	56.7'
20	124°05.3	02.4	356°24.3	12.1'	09°06.0	9.8'	56.8'
21	139°05.3	·· 03.2	10°55.4	12.1'	08°56.2	9.9'	56.8'
22	154°05.3	04.0	25°26.5	12.1'	08°46.3	9.9'	56.8'
23	169°05.4	04.8	39°57.5	12.0'	08°36.3	10.0'	56.9'
	SD.=16.1	d=-0.8	S.D.=15.4				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	05:55	07:16	08:39	14:46	16:09	17:31
N 70°	05:52	07:05	08:17	15:09	16:21	17:34
68°	05:49	06:56	07:59	15:27	16:30	17:37
66°	05:47	06:48	07:45	15:41	16:38	17:39
64°	05:45	06:41	07:33	15:53	16:45	17:41
62°	05:43	06:35	07:23	16:03	16:51	17:43
60°	05:41	06:30	07:15	16:12	16:56	17:45
N 58°	05:39	06:26	07:07	16:19	17:01	17:47
56°	05:38	06:22	07:01	16:26	17:05	17:49
54°	05:36	06:18	06:55	16:32	17:09	17:50
52°	05:35	06:14	06:50	16:37	17:12	17:52
50°	05:33	06:11	06:45	16:42	17:16	17:53
45°	05:30	06:04	06:34	16:52	17:23	17:57
N 40°	05:26	05:58	06:26	17:01	17:29	18:01
35°	05:22	05:52	06:18	17:09	17:35	18:05
30°	05:19	05:47	06:12	17:15	17:40	18:08
20°	05:12	05:38	06:00	17:27	17:50	18:16
N 10°	05:03	05:28	05:50	17:37	17:59	18:24
0°	04:54	05:19	05:40	17:47	18:08	18:33
S 10°	04:44	05:09	05:31	17:57	18:19	18:44
20°	04:30	04:57	05:20	18:08	18:31	18:57
30°	04:13	04:43	05:08	18:20	18:45	19:15
35°	04:02	04:34	05:01	18:27	18:54	19:26
40°	03:49	04:24	04:53	18:35	19:04	19:39
45°	03:32	04:11	04:43	18:45	19:17	19:56
S 50°	03:11	03:56	04:32	18:57	19:33	20:18
52°	03:00	03:49	04:26	19:02	19:40	20:29
54°	02:48	03:40	04:20	19:08	19:49	20:41
56°	02:34	03:31	04:14	19:15	19:58	20:56
58°	02:16	03:20	04:06	19:23	20:09	21:14
S 60°	01:54	03:08	03:58	19:31	20:22	21:37

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	16:48	16:29	16:16	20:44	22:42	–:–
N 70°	16:07	16:04	16:01	21:24	23:05	–:–
68°	15:39	15:45	15:49	21:51	23:23	–:–
66°	15:17	15:30	15:39	22:12	23:37	–:–
64°	15:00	15:17	15:30	22:28	23:49	–:–
62°	14:46	15:06	15:23	22:42	23:59	–:–
60°	14:34	14:57	15:16	22:53	–:–	00:08
N 58°	14:24	14:49	15:11	23:03	–:–	00:15
56°	14:15	14:42	15:06	23:12	–:–	00:22
54°	14:07	14:36	15:01	23:19	–:–	00:27
52°	14:00	14:30	14:57	23:26	–:–	00:33
50°	13:53	14:25	14:53	23:32	–:–	00:37
45°	13:39	14:13	14:45	23:46	–:–	00:47
N 40°	13:27	14:04	14:39	23:56	–:–	00:56
35°	13:18	13:56	14:33	–:–	00:06	01:03
30°	13:09	13:49	14:28	–:–	00:14	01:09
20°	12:54	13:37	14:19	–:–	00:28	01:20
N 10°	12:41	13:26	14:11	–:–	00:40	01:30
0°	12:28	13:16	14:03	00:04	00:51	01:39
S 10°	12:16	13:06	13:56	00:17	01:02	01:47
20°	12:03	12:55	13:48	00:31	01:14	01:57
30°	11:48	12:42	13:39	00:47	01:28	02:07
35°	11:39	12:35	13:34	00:56	01:36	02:13
40°	11:29	12:27	13:28	01:07	01:45	02:20
45°	11:17	12:17	13:21	01:19	01:55	02:28
S 50°	11:03	12:06	13:13	01:34	02:08	02:38
52°	10:56	12:00	13:09	01:41	02:14	02:42
54°	10:48	11:54	13:04	01:49	02:20	02:47
56°	10:40	11:48	13:00	01:58	02:27	02:52
58°	10:31	11:40	12:54	02:08	02:35	02:58
S 60°	10:20	11:32	12:48	02:19	02:44	03:05

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 9-11 56-74%
28	16:10	16:13	11:44	18:40	06:16	
29	16:15	16:17	11:44	19:27	07:04	
30	16:19	16:20	11:44	20:15	07:51	

October 31, 01, 02 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	39°29.2	199°51.2	S06°40.2	214°15.8	S01°01.1	186°57.3	S12°02.7	135°24.9	S22°19.8
1	54°31.6	214°50.8	41.4	229°16.9	01.8	201°59.3	02.9	150°27.1	19.8
2	69°34.1	229°50.3	42.6	244°17.9	02.4	217°01.2	03.1	165°29.3	19.8
3	84°36.5	244°49.9	·· 43.7	259°18.9	·· 03.0	232°03.2	·· 03.3	180°31.5	·· 19.8
4	99°39.0	259°49.5	44.9	274°19.9	03.6	247°05.1	03.5	195°33.7	19.9
5	114°41.5	274°49.0	46.1	289°20.9	04.3	262°07.0	03.6	210°35.9	19.9
6	129°43.9	289°48.6	S06°47.3	304°21.9	S01°04.9	277°09.0	S12°03.8	225°38.1	S22°19.9
7	144°46.4	304°48.1	48.5	319°23.0	05.5	292°10.9	04.0	240°40.4	19.9
8	159°48.9	319°47.7	49.7	334°24.0	06.2	307°12.9	04.2	255°42.6	19.9
9	174°51.3	334°47.3	·· 50.9	349°25.0	·· 06.8	322°14.8	·· 04.4	270°44.8	·· 19.9
10	189°53.8	349°46.8	52.1	4°26.0	07.4	337°16.7	04.6	285°47.0	19.9
11	204°56.3	4°46.4	53.3	19°27.0	08.0	352°18.7	04.7	300°49.2	20.0
12	219°58.7	19°45.9	S06°54.5	34°28.0	S01°08.7	7°20.6	S12°04.9	315°51.4	S22°20.0
13	235°01.2	34°45.5	55.7	49°29.1	09.3	22°22.5	05.1	330°53.6	20.0
14	250°03.6	49°45.0	56.8	64°30.1	09.9	37°24.5	05.3	345°55.8	20.0
15	265°06.1	64°44.6	·· 58.0	79°31.1	·· 10.6	52°26.4	·· 05.5	0°58.1	·· 20.0
16	280°08.6	79°44.1	06°59.2	94°32.1	11.2	67°28.4	05.7	16°00.3	20.0
17	295°11.0	94°43.7	07°00.4	109°33.1	11.8	82°30.3	05.8	31°02.5	20.1
18	310°13.5	109°43.3	S07°01.6	124°34.2	S01°12.4	97°32.2	S12°06.0	46°04.7	S22°20.1
19	325°16.0	124°42.8	02.8	139°35.2	13.1	112°34.2	06.2	61°06.9	20.1
20	340°18.4	139°42.4	04.0	154°36.2	13.7	127°36.1	06.4	76°09.1	20.1
21	355°20.9	154°41.9	·· 05.2	169°37.2	·· 14.3	142°38.1	·· 06.6	91°11.3	·· 20.1
22	10°23.4	169°41.5	06.4	184°38.2	15.0	157°40.0	06.8	106°13.5	20.1
23	25°25.8	184°41.0	07.5	199°39.2	15.6	172°41.9	06.9	121°15.8	20.1
Mer.pass.:21:19		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	40°28.3	199°40.6	S07°08.7	214°40.3	S01°16.2	187°43.9	S12°07.1	136°18.0	S22°20.2
1	55°30.8	214°40.1	09.9	229°41.3	16.8	202°45.8	07.3	151°20.2	20.2
2	70°33.2	229°39.7	11.1	244°42.3	17.5	217°47.8	07.5	166°22.4	20.2
3	85°35.7	244°39.2	·· 12.3	259°43.3	·· 18.1	232°49.7	·· 07.7	181°24.6	·· 20.2
4	100°38.1	259°38.8	13.5	274°44.3	18.7	247°51.6	07.9	196°26.8	20.2
5	115°40.6	274°38.3	14.7	289°45.3	19.4	262°53.6	08.0	211°29.0	20.2
6	130°43.1	289°37.9	S07°15.8	304°46.4	S01°20.0	277°55.5	S12°08.2	226°31.2	S22°20.2
7	145°45.5	304°37.4	17.0	319°47.4	20.6	292°57.4	08.4	241°33.4	20.3
8	160°48.0	319°37.0	18.2	334°48.4	21.2	307°59.4	08.6	256°35.7	20.3
9	175°50.5	334°36.5	·· 19.4	349°49.4	·· 21.9	323°01.3	·· 08.8	271°37.9	·· 20.3
10	190°52.9	349°36.1	20.6	4°50.4	22.5	338°03.3	09.0	286°40.1	20.3
11	205°55.4	4°35.7	21.8	19°51.4	23.1	353°05.2	09.1	301°42.3	20.3
12	220°57.9	19°35.2	S07°23.0	34°52.5	S01°23.8	8°07.1	S12°09.3	316°44.5	S22°20.3
13	236°00.3	34°34.8	24.1	49°53.5	24.4	23°09.1	09.5	331°46.7	20.3
14	251°02.8	49°34.3	25.3	64°54.5	25.0	38°11.0	09.7	346°48.9	20.4
15	266°05.3	64°33.8	·· 26.5	79°55.5	·· 25.6	53°13.0	·· 09.9	1°51.1	·· 20.4
16	281°07.7	79°33.4	27.7	94°56.5	26.3	68°14.9	10.1	16°53.3	20.4
17	296°10.2	94°32.9	28.9	109°57.5	26.9	83°16.8	10.2	31°55.6	20.4
18	311°12.6	109°32.5	S07°30.1	124°58.6	S01°27.5	98°18.8	S12°10.4	46°57.8	S22°20.4
19	326°15.1	124°32.0	31.2	139°59.6	28.2	113°20.7	10.6	62°00.0	20.4
20	341°17.6	139°31.6	32.4	155°00.6	28.8	128°22.7	10.8	77°02.2	20.5
21	356°20.0	154°31.1	·· 33.6	170°01.6	·· 29.4	143°24.6	·· 11.0	92°04.4	·· 20.5
22	11°22.5	169°30.7	34.8	185°02.6	30.0	158°26.5	11.2	107°06.6	20.5
23	26°25.0	184°30.2	36.0	200°03.6	30.7	173°28.5	11.3	122°08.8	20.5
Mer.pass.:21:15		v-0.4 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	41°27.4	199°29.8	S07°37.1	215°04.7	S01°31.3	188°30.4	S12°11.5	137°11.0	S22°20.5
1	56°29.9	214°29.3	38.3	230°05.7	31.9	203°32.3	11.7	152°13.2	20.5
2	71°32.4	229°28.9	39.5	245°06.7	32.6	218°34.3	11.9	167°15.4	20.5
3	86°34.8	244°28.4	·· 40.7	260°07.7	·· 33.2	233°36.2	·· 12.1	182°17.6	·· 20.6
4	101°37.3	259°28.0	41.9	275°08.7	33.8	248°38.2	12.2	197°19.9	20.6
5	116°39.7	274°27.5	43.0	290°09.7	34.4	263°40.1	12.4	212°22.1	20.6
6	131°42.2	289°27.1	S07°44.2	305°10.8	S01°35.1	278°42.0	S12°12.6	227°24.3	S22°20.6
7	146°44.7	304°26.6	45.4	320°11.8	35.7	293°44.0	12.8	242°26.5	20.6
8	161°47.1	319°26.1	46.6	335°12.8	36.3	308°45.9	13.0	257°28.7	20.6
9	176°49.6	334°25.7	·· 47.8	350°13.8	·· 36.9	323°47.9	·· 13.2	272°30.9	·· 20.6
10	191°52.1	349°25.2	48.9	5°14.8	37.6	338°49.8	13.3	287°33.1	20.7
11	206°54.5	4°24.8	50.1	20°15.8	38.2	353°51.7	13.5	302°35.3	20.7
12	221°57.0	19°24.3	S07°51.3	35°16.9	S01°38.8	8°53.7	S12°13.7	317°37.5	S22°20.7
13	236°59.5	34°23.9	52.5	50°17.9	39.5	23°55.6	13.9	332°39.7	20.7
14	252°01.9	49°23.4	53.6	65°18.9	40.1	38°57.6	14.1	347°41.9	20.7
15	267°04.4	64°22.9	·· 54.8	80°19.9	·· 40.7	53°59.5	·· 14.3	2°44.1	·· 20.7
16	282°06.9	79°22.5	56.0	95°20.9	41.3	69°01.4	14.4	17°46.4	20.7
17	297°09.3	94°22.0	57.2	110°21.9	42.0	84°03.4	14.6	32°48.6	20.8
18	312°11.8	109°21.6	S07°58.3	125°23.0	S01°42.6	99°05.3	S12°14.8	47°50.8	S22°20.8
19	327°14.2	124°21.1	07°59.5	140°24.0	43.2	114°07.2	15.0	62°53.0	20.8
20	342°16.7	139°20.6	08°00.7	155°25.0	43.9	129°09.2	15.2	77°55.2	20.8
21	357°19.2	154°20.2	·· 01.9	170°26.0	·· 44.5	144°11.1	·· 15.3	92°57.4	·· 20.8
22	12°21.6	169°19.7	03.0	185°27.0	45.1	159°13.1	15.5	107°59.6	20.8
23	27°24.1	184°19.3	04.2	200°28.0	45.7	174°15.0	15.7	123°01.8	20.9
Mer.pass.:21:11		v-0.5 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Stars

	SHA	Dec
Alpheratz	357°40.1	29°11.4
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°09.0
Hamal	327°57.1	23°32.7
Polaris	315°58.6	89°20.2
Acamar	315°15.7	-40°14.1
Menkar	314°11.7	4°09.5
Mirfak	308°35.6	49°55.3
Aldebaran	290°45.7	16°32.5
Rigel	281°09.0	-8°10.9
Capella	280°29.7	46°00.7
Bellatrix	278°28.6	6°21.8
Elnath	278°08.6	28°37.1
Alnilam	275°43.2	-1°11.5
Betelgeuse	270°57.9	7°24.5
Canopus	263°54.5	-52°42.2
Sirius	258°31.0	-16°44.4
Adhara	255°10.1	-28°59.7
Procyon	244°56.6	5°10.7
Pollux	243°24.1	27°58.8
Avior	234°16.7	-59°33.7
Suhail	222°50.3	-43°30.0
Miaplacidus	221°39.1	-69°47.1
Alphard	217°53.3	-8°44.1
Regulus	207°40.5	11°52.8
Dubhe	193°48.6	61°39.1
Denebola	182°30.9	14°28.5
Gienah	175°49.5	-17°38.2
Acrux	173°06.5	-63°11.5
Gacrux	171°58.0	-57°12.5
Alioth	166°18.7	55°51.8
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.6
Hadar	148°44.3	-60°27.3
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.6
Rigil Kent.	139°48.3	-60°54.2
Kochab	137°21.4	74°05.1
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.6
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.5
Sabik	102°09.5	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.2
Eltanin	90°45.1	51°29.6
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.2	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.8	-56°40.8
Deneb	49°29.5	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.0	-46°52.6
Fomalhaut	15°20.6	-29°31.7
Scheat	13°50.3	28°11.0
Markab	13°35.2	15°18.2

Oct 31 Tue	**SHA**	**Mer.pass**
Venus	160°22.1	10:41
Mars	174°46.7	09:42
Jupiter	147°28.2	11:31
Saturn	95°55.7	14:56

Nov 01 Wed	**SHA**	**Mer.pass**
Venus	159°12.3	10:42
Mars	174°12.0	09:41
Jupiter	147°15.6	11:28
Saturn	95°49.7	14:53

Nov 02 Thu	**SHA**	**Mer.pass**
Venus	158°02.4	10:42
Mars	173°37.2	09:39
Jupiter	147°03.0	11:24
Saturn	95°43.6	14:49

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2844 sec ΔT = TT-UT1 = +68.8996 sec

2017 October 31 to Nov. 02 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	184°05.4	S14°05.7	54°28.5	12.0′	S08°26.3	10.1′	56.9′
1	199°05.4	06.5	68°59.6	12.0′	08°16.2	10.1′	56.9′
2	214°05.4	07.3	83°30.6	12.0′	08°06.0	10.2′	57.0′
3	229°05.5	·· 08.1	98°01.6	12.0′	07°55.8	10.2′	57.0′
4	244°05.5	08.9	112°32.5	12.0′	07°45.6	10.3′	57.1′
5	259°05.5	09.7	127°03.5	11.9′	07°35.3	10.3′	57.1′
6	274°05.5	S14°10.5	141°34.4	11.9′	S07°24.9	10.4′	57.1′
7	289°05.6	11.3	156°05.3	11.9′	07°14.5	10.4′	57.2′
8	304°05.6	12.1	170°36.2	11.9′	07°04.1	10.5′	57.2′
9	319°05.6	·· 12.9	185°07.1	11.9′	06°53.6	10.5′	57.2′
10	334°05.6	13.7	199°38.0	11.9′	06°43.0	10.6′	57.3′
11	349°05.7	14.5	214°08.8	11.8′	06°32.4	10.6′	57.3′
12	4°05.7	S14°15.3	228°39.6	11.8′	S06°21.8	10.7′	57.4′
13	19°05.7	16.1	243°10.4	11.8′	06°11.1	10.7′	57.4′
14	34°05.7	17.0	257°41.2	11.8′	06°00.3	10.8′	57.4′
15	49°05.7	·· 17.8	272°12.0	11.7′	05°49.5	10.8′	57.5′
16	64°05.8	18.6	286°42.7	11.7′	05°38.7	10.9′	57.5′
17	79°05.8	19.4	301°13.4	11.7′	05°27.8	10.9′	57.5′
18	94°05.8	S14°20.2	315°44.1	11.7′	S05°16.9	10.9′	57.6′
19	109°05.8	21.0	330°14.7	11.6′	05°05.9	11.0′	57.6′
20	124°05.8	21.8	344°45.4	11.6′	04°54.9	11.0′	57.7′
21	139°05.9	·· 22.6	359°16.0	11.6′	04°43.9	11.1′	57.7′
22	154°05.9	23.4	13°46.5	11.6′	04°32.8	11.1′	57.7′
23	169°05.9	24.2	28°17.1	11.5′	04°21.6	11.1′	57.8′
	SD.=16.1	d=-0.8	S.D.=15.6				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	184°05.9	S14°25.0	42°47.6	11.5′	S04°10.5	11.2′	57.8′
1	199°05.9	25.8	57°18.1	11.5′	03°59.3	11.2′	57.8′
2	214°06.0	26.6	71°48.6	11.4′	03°48.0	11.3′	57.9′
3	229°06.0	·· 27.4	86°19.0	11.4′	03°36.8	11.3′	57.9′
4	244°06.0	28.2	100°49.4	11.4′	03°25.5	11.3′	58.0′
5	259°06.0	29.0	115°19.8	11.4′	03°14.1	11.4′	58.0′
6	274°06.0	S14°29.8	129°50.1	11.3′	S03°02.7	11.4′	58.0′
7	289°06.0	30.6	144°20.4	11.3′	02°51.3	11.4′	58.1′
8	304°06.1	31.4	158°50.7	11.3′	02°39.9	11.5′	58.1′
9	319°06.1	·· 32.2	173°20.9	11.2′	02°28.4	11.5′	58.1′
10	334°06.1	33.0	187°51.2	11.2′	02°16.9	11.5′	58.2′
11	349°06.1	33.8	202°21.3	11.2′	02°05.4	11.5′	58.2′
12	4°06.1	S14°34.6	216°51.5	11.1′	S01°53.9	11.6′	58.2′
13	19°06.1	35.4	231°21.6	11.1′	01°42.3	11.6′	58.3′
14	34°06.2	36.2	245°51.6	11.0′	01°30.7	11.6′	58.3′
15	49°06.2	·· 36.9	260°21.7	11.0′	01°19.1	11.6′	58.4′
16	64°06.2	37.7	274°51.6	11.0′	01°07.4	11.7′	58.4′
17	79°06.2	38.5	289°21.6	10.9′	00°55.7	11.7′	58.4′
18	94°06.2	S14°39.3	303°51.5	10.9′	S00°44.0	11.7′	58.5′
19	109°06.2	40.1	318°21.4	10.9′	00°32.3	11.7′	58.5′
20	124°06.2	40.9	332°51.2	10.8′	00°20.6	11.7′	58.5′
21	139°06.2	·· 41.7	347°21.0	10.8′	S00°08.9	11.8′	58.6′
22	154°06.3	42.5	1°50.7	10.7′	N00°02.9	11.8′	58.6′
23	169°06.3	43.3	16°20.5	10.7′	00°14.7	11.8′	58.7′
	SD.=16.1	d=-0.8	S.D.=15.9				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	184°06.3	S14°44.1	30°50.1	10.6′	N00°26.5	11.8′	58.7′
1	199°06.3	44.9	45°19.7	10.6′	00°38.3	11.8′	58.7′
2	214°06.3	45.7	59°49.3	10.6′	00°50.1	11.8′	58.8′
3	229°06.3	·· 46.4	74°18.8	10.5′	01°01.9	11.8′	58.8′
4	244°06.3	47.2	88°48.3	10.5′	01°13.8	11.8′	58.8′
5	259°06.3	48.0	103°17.8	10.4′	01°25.6	11.9′	58.9′
6	274°06.3	S14°48.8	117°47.2	10.4′	N01°37.5	11.9′	58.9′
7	289°06.3	49.6	132°16.5	10.3′	01°49.3	11.9′	58.9′
8	304°06.3	50.4	146°45.8	10.3′	02°01.2	11.9′	59.0′
9	319°06.4	·· 51.2	161°15.0	10.2′	02°13.1	11.9′	59.0′
10	334°06.4	52.0	175°44.2	10.2′	02°24.9	11.9′	59.0′
11	349°06.4	52.8	190°13.4	10.1′	02°36.8	11.9′	59.1′
12	4°06.4	S14°53.5	204°42.5	10.1′	N02°48.7	11.9′	59.1′
13	19°06.4	54.3	219°11.5	10.0′	03°00.6	11.9′	59.1′
14	34°06.4	55.1	233°40.5	10.0′	03°12.4	11.9′	59.2′
15	49°06.4	·· 55.9	248°09.5	9.9′	03°24.3	11.9′	59.2′
16	64°06.4	56.7	262°38.4	9.9′	03°36.1	11.9′	59.2′
17	79°06.4	57.5	277°07.2	9.8′	03°48.0	11.8′	59.3′
18	94°06.4	S14°58.2	291°36.0	9.8′	N03°59.8	11.8′	59.3′
19	109°06.4	59.0	306°04.8	9.7′	04°11.7	11.8′	59.3′
20	124°06.4	14°59.8	320°33.4	9.7′	04°23.5	11.8′	59.4′
21	139°06.4	15°00.6	335°02.1	9.6′	04°35.3	11.8′	59.4′
22	154°06.4	01.4	349°30.6	9.5′	04°47.1	11.8′	59.4′
23	169°06.4	02.2	3°59.1	9.5′	04°58.9	11.8′	59.5′
	SD.=16.1	d=-0.8	S.D.=16.1				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	06:07	07:30	08:58	14:28	15:56	17:19
N 70°	06:03	07:17	08:31	14:55	16:09	17:23
68°	05:59	07:06	08:11	15:15	16:20	17:27
66°	05:56	06:57	07:56	15:30	16:29	17:30
64°	05:53	06:50	07:43	15:43	16:36	17:33
62°	05:50	06:43	07:32	15:54	16:43	17:36
60°	05:48	06:37	07:23	16:04	16:49	17:38
N 58°	05:46	06:32	07:14	16:12	16:54	17:41
56°	05:43	06:28	07:07	16:19	16:59	17:43
54°	05:41	06:23	07:01	16:26	17:03	17:45
52°	05:39	06:19	06:55	16:31	17:07	17:47
50°	05:38	06:16	06:50	16:37	17:11	17:49
45°	05:33	06:08	06:39	16:48	17:19	17:53
N 40°	05:29	06:01	06:29	16:58	17:26	17:58
35°	05:25	05:55	06:21	17:06	17:32	18:02
30°	05:21	05:49	06:14	17:13	17:38	18:06
20°	05:13	05:39	06:02	17:25	17:48	18:14
N 10°	05:04	05:29	05:51	17:37	17:58	18:23
0°	04:54	05:19	05:40	17:47	18:08	18:33
S 10°	04:42	05:08	05:30	17:58	18:19	18:45
20°	04:28	04:55	05:18	18:09	18:32	18:59
30°	04:10	04:40	05:05	18:22	18:48	19:18
35°	03:58	04:31	04:58	18:30	18:57	19:29
40°	03:44	04:20	04:49	18:39	19:08	19:44
45°	03:27	04:07	04:39	18:49	19:22	20:01
S 50°	03:04	03:50	04:26	19:02	19:38	20:25
52°	02:53	03:42	04:20	19:08	19:46	20:36
54°	02:39	03:33	04:14	19:14	19:56	20:50
56°	02:24	03:23	04:07	19:22	20:06	21:06
58°	02:04	03:11	03:59	19:30	20:18	21:26
S 60°	01:39	02:58	03:50	19:39	20:32	21:52

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	16:06	15:56	15:47	00:34	02:26	04:20
N 70°	15:58	15:55	15:51	00:47	02:31	04:18
68°	15:51	15:53	15:55	00:58	02:36	04:17
66°	15:46	15:52	15:58	01:07	02:40	04:15
64°	15:41	15:51	16:01	01:14	02:43	04:14
62°	15:37	15:50	16:04	01:21	02:45	04:14
60°	15:33	15:49	16:06	01:26	02:48	04:13
N 58°	15:30	15:49	16:08	01:31	02:50	04:12
56°	15:27	15:48	16:09	01:35	02:52	04:12
54°	15:25	15:47	16:11	01:39	02:54	04:11
52°	15:22	15:47	16:12	01:42	02:55	04:11
50°	15:20	15:47	16:13	01:45	02:56	04:10
45°	15:16	15:46	16:16	01:52	02:59	04:09
N 40°	15:12	15:45	16:19	01:58	03:02	04:09
35°	15:08	15:44	16:21	02:03	03:04	04:08
30°	15:05	15:43	16:22	02:07	03:06	04:07
20°	15:00	15:42	16:26	02:14	03:09	04:06
N 10°	14:56	15:41	16:28	02:20	03:12	04:05
0°	14:51	15:40	16:31	02:26	03:15	04:04
S 10°	14:47	15:40	16:34	02:32	03:17	04:03
20°	14:43	15:39	16:37	02:38	03:20	04:02
30°	14:37	15:38	16:40	02:45	03:23	04:01
35°	14:34	15:37	16:42	02:49	03:25	04:01
40°	14:31	15:36	16:44	02:54	03:27	04:00
45°	14:27	15:36	16:47	02:59	03:29	03:59
S 50°	14:22	15:35	16:50	03:05	03:32	03:58
52°	14:20	15:34	16:52	03:08	03:33	03:58
54°	14:18	15:34	16:53	03:11	03:34	03:57
56°	14:15	15:33	16:55	03:15	03:36	03:56
58°	14:12	15:33	16:57	03:19	03:37	03:56
S 60°	14:09	15:32	16:59	03:23	03:39	03:55

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 12-14 83-96%
31	16:22	16:23	11:44	21:03	08:39	
01	16:24	16:25	11:44	21:52	09:28	
02	16:25	16:26	11:44	22:43	10:18	

November 03, 04, 05 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	42°26.6	199°18.8	S08°05.4	215°29.1	S01°46.4	189°16.9	S12°15.9	138°04.0	S22°20.9
1	57°29.0	214°18.3	06.6	230°30.1	47.0	204°18.9	16.1	153°06.2	20.9
2	72°31.5	229°17.9	07.7	245°31.1	47.6	219°20.8	16.3	168°08.4	20.9
3	87°34.0	244°17.4	·· 08.9	260°32.1	·· 48.2	234°22.8	·· 16.4	183°10.6	·· 20.9
4	102°36.4	259°17.0	10.1	275°33.1	48.9	249°24.7	16.6	198°12.8	20.9
5	117°38.9	274°16.5	11.3	290°34.1	49.5	264°26.6	16.8	213°15.0	20.9
6	132°41.3	289°16.0	S08°12.4	305°35.2	S01°50.1	279°28.6	S12°17.0	228°17.2	S22°21.0
7	147°43.8	304°15.6	13.6	320°36.2	50.8	294°30.5	17.2	243°19.5	21.0
8	162°46.3	319°15.1	14.8	335°37.2	51.4	309°32.5	17.3	258°21.7	21.0
9	177°48.7	334°14.6	·· 15.9	350°38.2	·· 52.0	324°34.4	·· 17.5	273°23.9	·· 21.0
10	192°51.2	349°14.2	17.1	5°39.2	52.6	339°36.3	17.7	288°26.1	21.0
11	207°53.7	4°13.7	18.3	20°40.2	53.3	354°38.3	17.9	303°28.3	21.0
12	222°56.1	19°13.3	S08°19.5	35°41.3	S01°53.9	9°40.2	S12°18.1	318°30.5	S22°21.0
13	237°58.6	34°12.8	20.6	50°42.3	54.5	24°42.1	18.3	333°32.7	21.1
14	253°01.1	49°12.3	21.8	65°43.3	55.1	39°44.1	18.4	348°34.9	21.1
15	268°03.5	64°11.9	·· 23.0	80°44.3	·· 55.8	54°46.0	·· 18.6	3°37.1	·· 21.1
16	283°06.0	79°11.4	24.1	95°45.3	56.4	69°48.0	18.8	18°39.3	21.1
17	298°08.5	94°10.9	25.3	110°46.3	57.0	84°49.9	19.0	33°41.5	21.1
18	313°10.9	109°10.5	S08°26.5	125°47.4	S01°57.7	99°51.8	S12°19.2	48°43.7	S22°21.1
19	328°13.4	124°10.0	27.6	140°48.4	58.3	114°53.8	19.3	63°45.9	21.1
20	343°15.8	139°09.5	28.8	155°49.4	58.9	129°55.7	19.5	78°48.1	21.2
21	358°18.3	154°09.1	·· 30.0	170°50.4	01°59.5	144°57.7	·· 19.7	93°50.3	·· 21.2
22	13°20.8	169°08.6	31.1	185°51.4	02°00.2	159°59.6	19.9	108°52.5	21.2
23	28°23.2	184°08.1	32.3	200°52.4	00.8	175°01.5	20.1	123°54.7	21.2
Mer.pass.:21:07		v-0.5 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	43°25.7	199°07.7	S08°33.5	215°53.4	S02°01.4	190°03.5	S12°20.3	138°56.9	S22°21.2
1	58°28.2	214°07.2	34.6	230°54.5	02.0	205°05.4	20.4	153°59.1	21.2
2	73°30.6	229°06.7	35.8	245°55.5	02.7	220°07.4	20.6	169°01.4	21.2
3	88°33.1	244°06.2	·· 37.0	260°56.5	·· 03.3	235°09.3	·· 20.8	184°03.6	·· 21.3
4	103°35.6	259°05.8	38.1	275°57.5	03.9	250°11.2	21.0	199°05.8	21.3
5	118°38.0	274°05.3	39.3	290°58.5	04.5	265°13.2	21.2	214°08.0	21.3
6	133°40.5	289°04.8	S08°40.5	305°59.5	S02°05.2	280°15.1	S12°21.3	229°10.2	S22°21.3
7	148°43.0	304°04.4	41.6	321°00.6	05.8	295°17.0	21.5	244°12.4	21.3
8	163°45.4	319°03.9	42.8	336°01.6	06.4	310°19.0	21.7	259°14.6	21.3
9	178°47.9	334°03.4	·· 44.0	351°02.6	·· 07.1	325°20.9	·· 21.9	274°16.8	·· 21.3
10	193°50.3	349°03.0	45.1	6°03.6	07.7	340°22.9	22.1	289°19.0	21.4
11	208°52.8	4°02.5	46.3	21°04.6	08.3	355°24.8	22.2	304°21.2	21.4
12	223°55.3	19°02.0	S08°47.5	36°05.6	S02°08.9	10°26.7	S12°22.4	319°23.4	S22°21.4
13	238°57.7	34°01.5	48.6	51°06.7	09.6	25°28.7	22.6	334°25.6	21.4
14	254°00.2	49°01.1	49.8	66°07.7	10.2	40°30.6	22.8	349°27.8	21.4
15	269°02.7	64°00.6	·· 50.9	81°08.7	·· 10.8	55°32.6	·· 23.0	4°30.0	·· 21.4
16	284°05.1	79°00.1	52.1	96°09.7	11.4	70°34.5	23.2	19°32.2	21.4
17	299°07.6	93°59.6	53.3	111°10.7	12.1	85°36.4	23.3	34°34.4	21.5
18	314°10.1	108°59.2	S08°54.4	126°11.7	S02°12.7	100°38.4	S12°23.5	49°36.6	S22°21.5
19	329°12.5	123°58.7	55.6	141°12.7	13.3	115°40.3	23.7	64°38.8	21.5
20	344°15.0	138°58.2	56.7	156°13.8	13.9	130°42.3	23.9	79°41.0	21.5
21	359°17.4	153°57.7	·· 57.9	171°14.8	·· 14.6	145°44.2	·· 24.1	94°43.2	·· 21.5
22	14°19.9	168°57.3	08°59.1	186°15.8	15.2	160°46.1	24.2	109°45.4	21.5
23	29°22.4	183°56.8	09°00.2	201°16.8	15.8	175°48.1	24.4	124°47.6	21.5
Mer.pass.:21:03		v-0.5 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.6	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	44°24.8	198°56.3	S09°01.4	216°17.8	S02°16.4	190°50.0	S12°24.6	139°49.8	S22°21.6
1	59°27.3	213°55.8	02.5	231°18.8	17.1	205°51.9	24.8	154°52.0	21.6
2	74°29.8	228°55.4	03.7	246°19.9	17.7	220°53.9	25.0	169°54.2	21.6
3	89°32.2	243°54.9	·· 04.9	261°20.9	·· 18.3	235°55.8	·· 25.1	184°56.4	·· 21.6
4	104°34.7	258°54.4	06.0	276°21.9	18.9	250°57.8	25.3	199°58.6	21.6
5	119°37.2	273°53.9	07.2	291°22.9	19.6	265°59.7	25.5	215°00.8	21.6
6	134°39.6	288°53.4	S09°08.3	306°23.9	S02°20.2	281°01.6	S12°25.7	230°03.0	S22°21.6
7	149°42.1	303°53.0	09.5	321°24.9	20.8	296°03.6	25.9	245°05.2	21.7
8	164°44.6	318°52.5	10.6	336°25.9	21.4	311°05.5	26.0	260°07.4	21.7
9	179°47.0	333°52.0	·· 11.8	351°27.0	·· 22.1	326°07.5	·· 26.2	275°09.6	·· 21.7
10	194°49.5	348°51.5	13.0	6°28.0	22.7	341°09.4	26.4	290°11.8	21.7
11	209°51.9	3°51.0	14.1	21°29.0	23.3	356°11.3	26.6	305°14.0	21.7
12	224°54.4	18°50.6	S09°15.3	36°30.0	S02°24.0	11°13.3	S12°26.8	320°16.2	S22°21.7
13	239°56.9	33°50.1	16.4	51°31.0	24.6	26°15.2	26.9	335°18.4	21.7
14	254°59.3	48°49.6	17.6	66°32.0	25.2	41°17.2	27.1	350°20.6	21.8
15	270°01.8	63°49.1	·· 18.7	81°33.1	·· 25.8	56°19.1	·· 27.3	5°22.8	·· 21.8
16	285°04.3	78°48.6	19.9	96°34.1	26.5	71°21.0	27.5	20°25.0	21.8
17	300°06.7	93°48.2	21.0	111°35.1	27.1	86°23.0	27.7	35°27.2	21.8
18	315°09.2	108°47.7	S09°22.2	126°36.1	S02°27.7	101°24.9	S12°27.8	50°29.4	S22°21.8
19	330°11.7	123°47.2	23.3	141°37.1	28.3	116°26.8	28.0	65°31.6	21.8
20	345°14.1	138°46.7	24.5	156°38.1	29.0	131°28.8	28.2	80°33.8	21.8
21	0°16.6	153°46.2	·· 25.6	171°39.1	·· 29.6	146°30.7	·· 28.4	95°36.0	·· 21.9
22	15°19.1	168°45.7	26.8	186°40.2	30.2	161°32.7	28.6	110°38.2	21.9
23	30°21.5	183°45.3	27.9	201°41.2	30.8	176°34.6	28.7	125°40.4	21.9
Mer.pass.:20:59		v-0.5 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.4
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°09.0
Hamal	327°57.1	23°32.7
Polaris	315°58.2	89°20.2
Acamar	315°15.7	-40°14.1
Menkar	314°11.7	4°09.5
Mirfak	308°35.6	49°55.3
Aldebaran	290°45.7	16°32.5
Rigel	281°09.0	-8°10.9
Capella	280°29.7	46°00.7
Bellatrix	278°28.6	6°21.8
Elnath	278°08.6	28°37.1
Alnilam	275°43.1	-1°11.5
Betelgeuse	270°57.9	7°24.5
Canopus	263°54.5	-52°42.2
Sirius	258°30.9	-16°44.4
Adhara	255°10.0	-28°59.7
Procyon	244°56.6	5°10.7
Pollux	243°24.1	27°58.8
Avior	234°16.7	-59°33.8
Suhail	222°50.3	-43°30.0
Miaplacidus	221°39.0	-69°47.1
Alphard	217°53.3	-8°44.1
Regulus	207°40.5	11°52.8
Dubhe	193°48.6	61°39.1
Denebola	182°30.9	14°28.5
Gienah	175°49.5	-17°38.2
Acrux	173°06.5	-63°11.5
Gacrux	171°58.0	-57°12.4
Alioth	166°18.7	55°51.8
Spica	158°28.5	-11°15.0
Alkaid	152°57.1	49°13.6
Hadar	148°44.3	-60°27.2
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.6
Rigil Kent.	139°48.3	-60°54.2
Kochab	137°21.4	74°05.1
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.6
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.4
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.2
Eltanin	90°45.2	51°29.6
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.2	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.8	-56°40.8
Deneb	49°29.5	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.0	-46°52.6
Fomalhaut	15°20.6	-29°31.7
Scheat	13°50.3	28°11.0
Markab	13°35.2	15°18.2

Nov 03 Fri	SHA	Mer.pass
Venus	156°52.2	10:43
Mars	173°02.5	09:37
Jupiter	146°50.4	11:21
Saturn	95°37.4	14:46

Nov 04 Sat	SHA	Mer.pass
Venus	155°41.9	10:44
Mars	172°27.7	09:36
Jupiter	146°37.8	11:18
Saturn	95°31.2	14:42

Nov 05 Sun	SHA	Mer.pass
Venus	154°31.5	10:45
Mars	171°53.0	09:34
Jupiter	146°25.2	11:15
Saturn	95°25.0	14:39

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2811 sec ΔT = TT-UT1 = +68.9029 sec

2017 November 03 to Nov. 05 UT

h

Fri	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	184°06.4	S15°02.9	18°27.6	9.4′	N05°10.7	11.8′	59.5′
1	199°06.4	03.7	32°56.0	9.4′	05°22.4	11.7′	59.5′
2	214°06.4	04.5	47°24.3	9.3′	05°34.1	11.7′	59.5′
3	229°06.4	·· 05.3	61°52.6	9.3′	05°45.9	11.7′	59.6′
4	244°06.4	06.1	76°20.8	9.2′	05°57.5	11.7′	59.6′
5	259°06.4	06.8	90°49.0	9.1′	06°09.2	11.7′	59.6′
6	274°06.4	S15°07.6	105°17.1	9.1′	N06°20.8	11.6′	59.7′
7	289°06.4	08.4	119°45.2	9.0′	06°32.5	11.6′	59.7′
8	304°06.4	09.2	134°13.1	9.0′	06°44.1	11.6′	59.7′
9	319°06.4	·· 09.9	148°41.1	8.9′	06°55.6	11.5′	59.7′
10	334°06.4	10.7	163°08.9	8.8′	07°07.1	11.5′	59.8′
11	349°06.4	11.5	177°36.7	8.8′	07°18.6	11.5′	59.8′
12	4°06.4	S15°12.3	192°04.5	8.7′	N07°30.1	11.4′	59.8′
13	19°06.4	13.0	206°32.2	8.7′	07°41.5	11.4′	59.9′
14	34°06.4	13.8	220°59.8	8.6′	07°52.9	11.4′	59.9′
15	49°06.4	·· 14.6	235°27.3	8.5′	08°04.3	11.3′	59.9′
16	64°06.4	15.4	249°54.8	8.5′	08°15.6	11.3′	59.9′
17	79°06.4	16.1	264°22.3	8.4′	08°26.9	11.3′	60.0′
18	94°06.4	S15°16.9	278°49.6	8.3′	N08°38.1	11.2′	60.0′
19	109°06.4	17.7	293°16.9	8.3′	08°49.3	11.2′	60.0′
20	124°06.4	18.5	307°44.2	8.2′	09°00.5	11.1′	60.0′
21	139°06.4	·· 19.2	322°11.4	8.1′	09°11.6	11.1′	60.0′
22	154°06.4	20.0	336°38.5	8.1′	09°22.6	11.0′	60.1′
23	169°06.4	20.8	351°05.5	8.0′	09°33.6	11.0′	60.1′
	SD.=16.1	d=-0.8		S.D.=16.3			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.4	S15°21.5	5°32.5	7.9′	N09°44.6	10.9′	60.1′
1	199°06.4	22.3	19°59.4	7.9′	09°55.5	10.9′	60.1′
2	214°06.4	23.1	34°26.3	7.8′	10°06.3	10.8′	60.2′
3	229°06.4	·· 23.9	48°53.1	7.8′	10°17.1	10.8′	60.2′
4	244°06.3	24.6	63°19.8	7.7′	10°27.8	10.7′	60.2′
5	259°06.3	25.4	77°46.4	7.6′	10°38.5	10.6′	60.2′
6	274°06.3	S15°26.2	92°13.0	7.6′	N10°49.1	10.6′	60.2′
7	289°06.3	26.9	106°39.6	7.5′	10°59.7	10.5′	60.3′
8	304°06.3	27.7	121°06.0	7.4′	11°10.1	10.5′	60.3′
9	319°06.3	·· 28.5	135°32.4	7.4′	11°20.6	10.4′	60.3′
10	334°06.3	29.2	149°58.7	7.3′	11°30.9	10.3′	60.3′
11	349°06.3	30.0	164°25.0	7.2′	11°41.2	10.3′	60.3′
12	4°06.3	S15°30.8	178°51.2	7.2′	N11°51.4	10.2′	60.4′
13	19°06.3	31.5	193°17.3	7.1′	12°01.6	10.1′	60.4′
14	34°06.3	32.3	207°43.4	7.0′	12°11.6	10.0′	60.4′
15	49°06.2	·· 33.1	222°09.4	7.0′	12°21.6	10.0′	60.4′
16	64°06.2	33.8	236°35.4	6.9′	12°31.6	9.9′	60.4′
17	79°06.2	34.6	251°01.2	6.8′	12°41.4	9.8′	60.4′
18	94°06.2	S15°35.3	265°27.1	6.8′	N12°51.2	9.7′	60.4′
19	109°06.2	36.1	279°52.8	6.7′	13°00.9	9.6′	60.5′
20	124°06.2	36.9	294°18.5	6.7′	13°10.5	9.6′	60.5′
21	139°06.2	·· 37.6	308°44.1	6.6′	13°20.0	9.5′	60.5′
22	154°06.1	38.4	323°09.7	6.5′	13°29.4	9.4′	60.5′
23	169°06.1	39.1	337°35.2	6.5′	13°38.8	9.3′	60.5′
	SD.=16.1	d=-0.8		S.D.=16.4			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.1	S15°39.9	352°00.6	6.4′	N13°48.1	9.2′	60.5′
1	199°06.1	40.7	6°26.0	6.3′	13°57.2	9.1′	60.5′
2	214°06.1	41.4	20°51.3	6.3′	14°06.3	9.0′	60.5′
3	229°06.1	·· 42.2	35°16.6	6.2′	14°15.3	8.9′	60.6′
4	244°06.1	42.9	49°41.8	6.2′	14°24.2	8.9′	60.6′
5	259°06.0	43.7	64°06.9	6.1′	14°33.0	8.8′	60.6′
6	274°06.0	S15°44.5	78°32.0	6.0′	N14°41.7	8.7′	60.6′
7	289°06.0	45.2	92°57.0	6.0′	14°50.4	8.6′	60.6′
8	304°06.0	46.0	107°21.9	5.9′	14°58.9	8.5′	60.6′
9	319°06.0	·· 46.7	121°46.8	5.9′	15°07.3	8.4′	60.6′
10	334°06.0	47.5	136°11.7	5.8′	15°15.6	8.3′	60.6′
11	349°05.9	48.2	150°36.5	5.8′	15°23.8	8.2′	60.6′
12	4°05.9	S15°49.0	165°01.2	5.7′	N15°31.9	8.1′	60.6′
13	19°05.9	49.7	179°25.9	5.7′	15°39.9	7.9′	60.6′
14	34°05.9	50.5	193°50.5	5.6′	15°47.8	7.8′	60.6′
15	49°05.9	·· 51.3	208°15.1	5.5′	15°55.6	7.7′	60.6′
16	64°05.8	52.0	222°39.6	5.5′	16°03.3	7.6′	60.6′
17	79°05.8	52.8	237°04.1	5.4′	16°10.9	7.5′	60.6′
18	94°05.8	S15°53.5	251°28.5	5.4′	N16°18.3	7.4′	60.7′
19	109°05.8	54.3	265°52.8	5.3′	16°25.7	7.3′	60.7′
20	124°05.7	55.0	280°17.2	5.3′	16°32.9	7.2′	60.7′
21	139°05.7	·· 55.8	294°41.4	5.2′	16°40.0	7.1′	60.7′
22	154°05.7	56.5	309°05.7	5.2′	16°47.0	6.9′	60.7′
23	169°05.7	57.3	323°29.8	5.2′	16°53.9	6.8′	60.7′
	SD.=16.1	d=-0.8		S.D.=16.5			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:19	07:44	09:17	14:08	15:42	17:07
N 70°	06:13	07:29	08:47	14:39	15:57	17:13
68°	06:08	07:17	08:24	15:02	16:09	17:17
66°	06:04	07:07	08:07	15:19	16:19	17:22
64°	06:01	06:58	07:52	15:34	16:28	17:25
62°	05:57	06:51	07:40	15:46	16:35	17:29
60°	05:54	06:44	07:30	15:56	16:42	17:32
N 58°	05:52	06:39	07:21	16:05	16:48	17:35
56°	05:49	06:33	07:14	16:13	16:53	17:37
54°	05:47	06:29	07:07	16:20	16:58	17:40
52°	05:44	06:24	07:00	16:26	17:02	17:42
50°	05:42	06:21	06:55	16:32	17:06	17:44
45°	05:37	06:12	06:43	16:44	17:15	17:50
N 40°	05:32	06:04	06:33	16:54	17:22	17:55
35°	05:28	05:58	06:24	17:03	17:29	17:59
30°	05:23	05:51	06:16	17:11	17:35	18:04
20°	05:14	05:40	06:03	17:24	17:47	18:13
N 10°	05:04	05:29	05:51	17:36	17:58	18:23
0°	04:54	05:19	05:40	17:47	18:08	18:33
S 10°	04:41	05:07	05:29	17:58	18:20	18:46
20°	04:27	04:54	05:17	18:11	18:34	19:01
30°	04:07	04:37	05:03	18:25	18:50	19:21
35°	03:55	04:28	04:55	18:33	19:00	19:33
40°	03:40	04:16	04:45	18:42	19:12	19:48
45°	03:22	04:02	04:34	18:54	19:26	20:07
S 50°	02:57	03:44	04:21	19:07	19:44	20:32
52°	02:45	03:36	04:15	19:13	19:53	20:44
54°	02:31	03:26	04:08	19:20	20:02	20:59
56°	02:13	03:15	04:00	19:28	20:13	21:16
58°	01:52	03:03	03:52	19:37	20:26	21:39
S 60°	01:23	02:48	03:42	19:47	20:42	22:09

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	15:37	15:24	15:06	06:18	08:25	10:44
N 70°	15:48	15:46	15:44	06:09	08:05	10:07
68°	15:58	16:02	16:10	06:01	07:50	09:41
66°	16:06	16:16	16:31	05:55	07:38	09:22
64°	16:13	16:27	16:47	05:49	07:27	09:06
62°	16:19	16:37	17:01	05:45	07:19	08:53
60°	16:24	16:45	17:13	05:41	07:11	08:42
N 58°	16:28	16:53	17:23	05:37	07:05	08:32
56°	16:32	16:59	17:32	05:34	06:59	08:24
54°	16:36	17:05	17:40	05:31	06:54	08:17
52°	16:39	17:10	17:47	05:29	06:49	08:10
50°	16:42	17:15	17:53	05:27	06:45	08:04
45°	16:49	17:26	18:07	05:22	06:36	07:51
N 40°	16:55	17:34	18:19	05:17	06:29	07:41
35°	16:59	17:42	18:29	05:14	06:22	07:32
30°	17:04	17:48	18:37	05:11	06:16	07:24
20°	17:11	18:00	18:52	05:05	06:07	07:10
N 10°	17:18	18:10	19:05	05:00	05:58	06:58
0°	17:24	18:20	19:18	04:56	05:50	06:47
S 10°	17:30	18:29	19:30	04:51	05:42	06:36
20°	17:37	18:40	19:44	04:47	05:34	06:24
30°	17:45	18:52	19:59	04:41	05:24	06:11
35°	17:49	18:59	20:08	04:38	05:18	06:03
40°	17:55	19:06	20:18	04:35	05:12	05:54
45°	18:01	19:16	20:31	04:30	05:05	05:44
S 50°	18:08	19:27	20:45	04:26	04:56	05:31
52°	18:11	19:32	20:52	04:23	04:52	05:25
54°	18:15	19:38	21:00	04:21	04:48	05:19
56°	18:19	19:44	21:08	04:18	04:43	05:12
58°	18:24	19:52	21:18	04:15	04:37	05:04
S 60°	18:29	20:00	21:29	04:12	04:31	04:55

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 15-17 99-97%
03	16:26	16:26	11:44	23:37	11:10	
04	16:26	16:25	11:44	–:–	12:05	
05	16:24	16:24	11:44	00:33	13:02	

November 06, 07, 08 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	45°24.0	198°44.8	S09°29.1	216°42.2	S02°31.5	191°36.5	S12°28.9	140°42.6	S22°21.9
1	60°26.4	213°44.3	30.2	231°43.2	32.1	206°38.5	29.1	155°44.8	21.9
2	75°28.9	228°43.8	31.4	246°44.2	32.7	221°40.4	29.3	170°47.0	21.9
3	90°31.4	243°43.3	·· 32.5	261°45.2	·· 33.3	236°42.4	·· 29.5	185°49.2	·· 21.9
4	105°33.8	258°42.8	33.7	276°46.3	34.0	251°44.3	29.6	200°51.4	22.0
5	120°36.3	273°42.3	34.8	291°47.3	34.6	266°46.2	29.8	215°53.6	22.0
6	135°38.8	288°41.9	S09°36.0	306°48.3	S02°35.2	281°48.2	S12°30.0	230°55.8	S22°22.0
7	150°41.2	303°41.4	37.1	321°49.3	35.8	296°50.1	30.2	245°58.0	22.0
8	165°43.7	318°40.9	38.3	336°50.3	36.5	311°52.1	30.4	261°00.2	22.0
9	180°46.2	333°40.4	·· 39.4	351°51.3	·· 37.1	326°54.0	·· 30.5	276°02.4	·· 22.0
10	195°48.6	348°39.9	40.6	6°52.3	37.7	341°55.9	30.7	291°04.6	22.0
11	210°51.1	3°39.4	41.7	21°53.4	38.3	356°57.9	30.9	306°06.8	22.1
12	225°53.6	18°38.9	S09°42.9	36°54.4	S02°39.0	11°59.8	S12°31.1	321°09.0	S22°22.1
13	240°56.0	33°38.4	44.0	51°55.4	39.6	27°01.8	31.3	336°11.2	22.1
14	255°58.5	48°38.0	45.2	66°56.4	40.2	42°03.7	31.4	351°13.4	22.1
15	271°00.9	63°37.5	·· 46.3	81°57.4	·· 40.8	57°05.6	·· 31.6	6°15.6	·· 22.1
16	286°03.4	78°37.0	47.4	96°58.4	41.5	72°07.6	31.8	21°17.8	22.1
17	301°05.9	93°36.5	48.6	111°59.4	42.1	87°09.5	32.0	36°20.0	22.1
18	316°08.3	108°36.0	S09°49.7	127°00.5	S02°42.7	102°11.4	S12°32.2	51°22.2	S22°22.2
19	331°10.8	123°35.5	50.9	142°01.5	43.3	117°13.4	32.3	66°24.4	22.2
20	346°13.3	138°35.0	52.0	157°02.5	44.0	132°15.3	32.5	81°26.6	22.2
21	1°15.7	153°34.5	·· 53.2	172°03.5	·· 44.6	147°17.3	·· 32.7	96°28.8	·· 22.2
22	16°18.2	168°34.0	54.3	187°04.5	45.2	162°19.2	32.9	111°31.0	22.2
23	31°20.7	183°33.5	55.4	202°05.5	45.8	177°21.1	33.1	126°33.2	22.2
Mer.pass.:20:55		v-0.5 d-1.2 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	46°23.1	198°33.0	S09°56.6	217°06.5	S02°46.4	192°23.1	S12°33.2	141°35.4	S22°22.2
1	61°25.6	213°32.5	57.7	232°07.6	47.1	207°25.0	33.4	156°37.6	22.3
2	76°28.0	228°32.0	09°58.9	247°08.6	47.7	222°27.0	33.6	171°39.8	22.3
3	91°30.5	243°31.6	10°00.0	262°09.6	·· 48.3	237°28.9	·· 33.8	186°42.0	·· 22.3
4	106°33.0	258°31.1	01.2	277°10.6	48.9	252°30.8	34.0	201°44.2	22.3
5	121°35.4	273°30.6	02.3	292°11.6	49.6	267°32.8	34.1	216°46.4	22.3
6	136°37.9	288°30.1	S10°03.4	307°12.6	S02°50.2	282°34.7	S12°34.3	231°48.6	S22°22.3
7	151°40.4	303°29.6	04.6	322°13.6	50.8	297°36.7	34.5	246°50.8	22.3
8	166°42.8	318°29.1	05.7	337°14.7	51.4	312°38.6	34.7	261°53.0	22.4
9	181°45.3	333°28.6	·· 06.8	352°15.7	·· 52.1	327°40.5	·· 34.9	276°55.2	·· 22.4
10	196°47.8	348°28.1	08.0	7°16.7	52.7	342°42.5	35.0	291°57.4	22.4
11	211°50.2	3°27.6	09.1	22°17.7	53.3	357°44.4	35.2	306°59.6	22.4
12	226°52.7	18°27.1	S10°10.3	37°18.7	S02°53.9	12°46.4	S12°35.4	322°01.8	S22°22.4
13	241°55.2	33°26.6	11.4	52°19.7	54.6	27°48.3	35.6	337°04.0	22.4
14	256°57.6	48°26.1	12.5	67°20.7	55.2	42°50.2	35.8	352°06.1	22.4
15	272°00.1	63°25.6	·· 13.7	82°21.8	·· 55.8	57°52.2	·· 35.9	7°08.3	·· 22.5
16	287°02.5	78°25.1	14.8	97°22.8	56.4	72°54.1	36.1	22°10.5	22.5
17	302°05.0	93°24.6	15.9	112°23.8	57.1	87°56.0	36.3	37°12.7	22.5
18	317°07.5	108°24.1	S10°17.1	127°24.8	S02°57.7	102°58.0	S12°36.5	52°14.9	S22°22.5
19	332°09.9	123°23.6	18.2	142°25.8	58.3	117°59.9	36.6	67°17.1	22.5
20	347°12.4	138°23.1	19.3	157°26.8	58.9	133°01.9	36.8	82°19.3	22.5
21	2°14.9	153°22.6	·· 20.5	172°27.8	02°59.5	148°03.8	·· 37.0	97°21.5	·· 22.5
22	17°17.3	168°22.1	21.6	187°28.9	03°00.2	163°05.7	37.2	112°23.7	22.6
23	32°19.8	183°21.6	22.7	202°29.9	00.8	178°07.7	37.4	127°25.9	22.6
Mer.pass.:20:51		v-0.5 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	47°22.3	198°21.1	S10°23.9	217°30.9	S03°01.4	193°09.6	S12°37.5	142°28.1	S22°22.6
1	62°24.7	213°20.6	25.0	232°31.9	02.0	208°11.6	37.7	157°30.3	22.6
2	77°27.2	228°20.1	26.1	247°32.9	02.7	223°13.5	37.9	172°32.5	22.6
3	92°29.7	243°19.6	·· 27.3	262°33.9	·· 03.3	238°15.4	·· 38.1	187°34.7	·· 22.6
4	107°32.1	258°19.1	28.4	277°34.9	03.9	253°17.4	38.3	202°36.9	22.6
5	122°34.6	273°18.6	29.5	292°35.9	04.5	268°19.3	38.4	217°39.1	22.7
6	137°37.0	288°18.1	S10°30.7	307°37.0	S03°05.2	283°21.3	S12°38.6	232°41.3	S22°22.7
7	152°39.5	303°17.5	31.8	322°38.0	05.8	298°23.2	38.8	247°43.5	22.7
8	167°42.0	318°17.0	32.9	337°39.0	06.4	313°25.1	39.0	262°45.7	22.7
9	182°44.4	333°16.5	·· 34.0	352°40.0	·· 07.0	328°27.1	·· 39.2	277°47.9	·· 22.7
10	197°46.9	348°16.0	35.2	7°41.0	07.6	343°29.0	39.3	292°50.0	22.7
11	212°49.4	3°15.5	36.3	22°42.0	08.3	358°31.0	39.5	307°52.2	22.7
12	227°51.8	18°15.0	S10°37.4	37°43.0	S03°08.9	13°32.9	S12°39.7	322°54.4	S22°22.7
13	242°54.3	33°14.5	38.5	52°44.1	09.5	28°34.8	39.9	337°56.6	22.8
14	257°56.8	48°14.0	39.7	67°45.1	10.1	43°36.8	40.0	352°58.8	22.8
15	272°59.2	63°13.5	·· 40.8	82°46.1	·· 10.8	58°38.7	·· 40.2	8°01.0	·· 22.8
16	288°01.7	78°13.0	41.9	97°47.1	11.4	73°40.7	40.4	23°03.2	22.8
17	303°04.2	93°12.5	43.0	112°48.1	12.0	88°42.6	40.6	38°05.4	22.8
18	318°06.6	108°12.0	S10°44.2	127°49.1	S03°12.6	103°44.5	S12°40.8	53°07.6	S22°22.8
19	333°09.1	123°11.5	45.3	142°50.1	13.3	118°46.5	40.9	68°09.8	22.8
20	348°11.5	138°10.9	46.4	157°51.1	13.9	133°48.4	41.1	83°12.0	22.9
21	3°14.0	153°10.4	·· 47.5	172°52.2	·· 14.5	148°50.4	·· 41.3	98°14.2	·· 22.9
22	18°16.5	168°09.9	48.7	187°53.2	15.1	163°52.3	41.5	113°16.4	22.9
23	33°18.9	183°09.4	49.8	202°54.2	15.7	178°54.2	41.6	128°18.6	22.9
Mer.pass.:20:47		v-0.5 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.4
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°09.0
Hamal	327°57.1	23°32.8
Polaris	315°57.8	89°20.2
Acamar	315°15.7	-40°14.1
Menkar	314°11.6	4°09.5
Mirfak	308°35.6	49°55.3
Aldebaran	290°45.7	16°32.5
Rigel	281°08.9	-8°11.0
Capella	280°29.7	46°00.7
Bellatrix	278°28.6	6°21.8
Elnath	278°08.6	28°37.1
Alnilam	275°43.1	-1°11.5
Betelgeuse	270°57.9	7°24.5
Canopus	263°54.5	-52°42.2
Sirius	258°30.9	-16°44.4
Adhara	255°10.0	-28°59.7
Procyon	244°56.5	5°10.7
Pollux	243°24.0	27°58.8
Avior	234°16.6	-59°33.8
Suhail	222°50.2	-43°30.0
Miaplacidus	221°39.0	-69°47.1
Alphard	217°53.2	-8°44.1
Regulus	207°40.5	11°52.8
Dubhe	193°48.6	61°39.1
Denebola	182°30.9	14°28.4
Gienah	175°49.5	-17°38.2
Acrux	173°06.5	-63°11.5
Gacrux	171°58.0	-57°12.4
Alioth	166°18.7	55°51.8
Spica	158°28.4	-11°15.0
Alkaid	152°57.1	49°13.6
Hadar	148°44.3	-60°27.2
Menkent	148°04.5	-36°27.2
Arcturus	145°53.4	19°05.6
Rigil Kent.	139°48.3	-60°54.2
Kochab	137°21.4	74°05.1
Zuben'ubi	137°02.5	-16°06.6
Alphecca	126°08.9	26°39.6
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.4
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.2
Eltanin	90°45.2	51°29.6
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.2	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.8	-56°40.8
Deneb	49°29.5	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.0	-46°52.6
Fomalhaut	15°20.6	-29°31.8
Scheat	13°50.3	28°11.0
Markab	13°35.2	15°18.2

Nov 06 Mon	SHA	Mer.pass
Venus	153°20.8	10:45
Mars	171°18.2	09:33
Jupiter	146°12.6	11:12
Saturn	95°18.7	14:35

Nov 07 Tue	SHA	Mer.pass
Venus	152°09.9	10:46
Mars	170°43.4	09:31
Jupiter	146°00.0	11:09
Saturn	95°12.3	14:32

Nov 08 Wed	SHA	Mer.pass
Venus	150°58.8	10:47
Mars	170°08.6	09:29
Jupiter	145°47.4	11:06
Saturn	95°05.8	14:28

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2776 sec ΔT = TT-UT1 = +68.9064 sec

2017 November 06 to Nov. 08 UT

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	184°05.7	S15°58.0	337°54.0	5.1′	N17°00.6	6.7′	60.7′
1	199°05.6	58.8	352°18.1	5.1′	17°07.3	6.6′	60.7′
2	214°05.6	15°59.5	6°42.1	5.0′	17°13.8	6.5′	60.7′
3	229°05.6	16°00.3	21°06.1	5.0′	17°20.2	6.3′	60.7′
4	244°05.6	01.0	35°30.1	4.9′	17°26.5	6.2′	60.7′
5	259°05.5	01.7	49°54.0	4.9′	17°32.6	6.1′	60.7′
6	274°05.5	S16°02.5	64°17.9	4.9′	N17°38.6	6.0′	60.7′
7	289°05.5	03.2	78°41.7	4.8′	17°44.6	5.8′	60.6′
8	304°05.5	04.0	93°05.6	4.8′	17°50.3	5.7′	60.6′
9	319°05.4	·· 04.7	107°29.3	4.8′	17°56.0	5.6′	60.6′
10	334°05.4	05.5	121°53.1	4.7′	18°01.5	5.5′	60.6′
11	349°05.4	06.2	136°16.8	4.7′	18°06.9	5.3′	60.6′
12	4°05.3	S16°07.0	150°40.5	4.7′	N18°12.1	5.2′	60.6′
13	19°05.3	07.7	165°04.1	4.6′	18°17.3	5.1′	60.6′
14	34°05.3	08.4	179°27.8	4.6′	18°22.3	4.9′	60.6′
15	49°05.3	·· 09.2	193°51.4	4.6′	18°27.1	4.8′	60.6′
16	64°05.2	09.9	208°14.9	4.6′	18°31.9	4.7′	60.6′
17	79°05.2	10.7	222°38.5	4.5′	18°36.5	4.5′	60.6′
18	94°05.2	S16°11.4	237°02.0	4.5′	N18°40.9	4.4′	60.6′
19	109°05.1	12.2	251°25.5	4.5′	18°45.3	4.3′	60.6′
20	124°05.1	12.9	265°49.0	4.5′	18°49.5	4.1′	60.6′
21	139°05.1	·· 13.6	280°12.5	4.5′	18°53.5	4.0′	60.6′
22	154°05.0	14.4	294°36.0	4.4′	18°57.5	3.9′	60.6′
23	169°05.0	15.1	308°59.4	4.4′	19°01.2	3.7′	60.5′
	SD.=16.1	d=-0.7	S.D.=16.5				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	184°05.0	S16°15.8	323°22.8	4.4′	N19°04.9	3.6′	60.5′
1	199°04.9	16.6	337°46.3	4.4′	19°08.4	3.4′	60.5′
2	214°04.9	17.3	352°09.7	4.4′	19°11.8	3.3′	60.5′
3	229°04.9	·· 18.1	6°33.1	4.4′	19°15.0	3.2′	60.5′
4	244°04.8	18.8	20°56.4	4.4′	19°18.1	3.0′	60.5′
5	259°04.8	19.5	35°19.8	4.4′	19°21.0	2.9′	60.5′
6	274°04.8	S16°20.3	49°43.2	4.4′	N19°23.9	2.7′	60.5′
7	289°04.7	21.0	64°06.6	4.4′	19°26.5	2.6′	60.5′
8	304°04.7	21.7	78°30.0	4.4′	19°29.1	2.5′	60.4′
9	319°04.7	·· 22.5	92°53.3	4.4′	19°31.5	2.3′	60.4′
10	334°04.6	23.2	107°16.7	4.4′	19°33.7	2.2′	60.4′
11	349°04.6	23.9	121°40.1	4.4′	19°35.8	2.0′	60.4′
12	4°04.6	S16°24.7	136°03.5	4.4′	N19°37.8	1.9′	60.4′
13	19°04.5	25.4	150°26.9	4.4′	19°39.6	1.8′	60.4′
14	34°04.5	26.1	164°50.3	4.4′	19°41.3	1.6′	60.4′
15	49°04.4	·· 26.9	179°13.7	4.4′	19°42.8	1.5′	60.3′
16	64°04.4	27.6	193°37.1	4.4′	19°44.2	1.3′	60.3′
17	79°04.4	28.3	208°00.6	4.4′	19°45.5	1.2′	60.3′
18	94°04.3	S16°29.0	222°24.0	4.5′	N19°46.6	1.0′	60.3′
19	109°04.3	29.8	236°47.5	4.5′	19°47.6	0.9′	60.3′
20	124°04.3	30.5	251°11.0	4.5′	19°48.4	0.8′	60.3′
21	139°04.2	·· 31.2	265°34.5	4.5′	19°49.1	0.6′	60.2′
22	154°04.2	32.0	279°58.0	4.5′	19°49.7	0.5′	60.2′
23	169°04.1	32.7	294°21.5	4.6′	19°50.1	0.3′	60.2′
	SD.=16.1	d=-0.7	S.D.=16.5				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	184°04.1	S16°33.4	308°45.1	4.6′	N19°50.4	0.2′	60.2′
1	199°04.0	34.1	323°08.7	4.6′	19°50.5	0.1′	60.2′
2	214°04.0	34.9	337°32.3	4.6′	19°50.5	-0.1′	60.1′
3	229°04.0	·· 35.6	351°56.0	4.7′	19°50.4	-0.2′	60.1′
4	244°03.9	36.3	6°19.7	4.7′	19°50.1	-0.4′	60.1′
5	259°03.9	37.0	20°43.4	4.7′	19°49.7	-0.5′	60.1′
6	274°03.8	S16°37.8	35°07.1	4.8′	N19°49.1	-0.6′	60.1′
7	289°03.8	38.5	49°30.9	4.8′	19°48.4	-0.8′	60.0′
8	304°03.7	39.2	63°54.7	4.8′	19°47.6	-0.9′	60.0′
9	319°03.7	·· 39.9	78°18.6	4.9′	19°46.6	-1.0′	60.0′
10	334°03.7	40.6	92°42.5	4.9′	19°45.5	-1.2′	60.0′
11	349°03.6	41.4	107°06.4	5.0′	19°44.2	-1.3′	60.0′
12	4°03.6	S16°42.1	121°30.4	5.0′	N19°42.8	-1.5′	59.9′
13	19°03.5	42.8	135°54.4	5.0′	19°41.3	-1.6′	59.9′
14	34°03.5	43.5	150°18.4	5.1′	19°39.7	-1.7′	59.9′
15	49°03.4	·· 44.2	164°42.5	5.1′	19°37.9	-1.9′	59.9′
16	64°03.4	45.0	179°06.7	5.2′	19°36.0	-2.0′	59.8′
17	79°03.3	45.7	193°30.9	5.2′	19°33.9	-2.1′	59.8′
18	94°03.3	S16°46.4	207°55.1	5.3′	N19°31.7	-2.3′	59.8′
19	109°03.2	47.1	222°19.4	5.3′	19°29.4	-2.4′	59.8′
20	124°03.2	47.8	236°43.8	5.4′	19°27.0	-2.5′	59.8′
21	139°03.1	·· 48.6	251°08.2	5.4′	19°24.4	-2.6′	59.7′
22	154°03.1	49.3	265°32.6	5.5′	19°21.7	-2.8′	59.7′
23	169°03.0	50.0	279°57.1	5.5′	19°18.8	-2.9′	59.7′
	SD.=16.1	d=-0.7	S.D.=16.3				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:30	07:57	09:39	13:47	15:28	16:56
N 70°	06:23	07:41	09:03	14:24	15:46	17:03
68°	06:18	07:27	08:37	14:49	15:59	17:08
66°	06:13	07:16	08:18	15:09	16:10	17:14
64°	06:08	07:06	08:02	15:24	16:20	17:18
62°	06:04	06:58	07:49	15:38	16:28	17:22
60°	06:01	06:51	07:38	15:49	16:35	17:26
N 58°	05:58	06:45	07:28	15:58	16:42	17:29
56°	05:54	06:39	07:20	16:07	16:47	17:32
54°	05:52	06:34	07:13	16:14	16:53	17:35
52°	05:49	06:29	07:06	16:21	16:57	17:38
50°	05:46	06:25	07:00	16:27	17:02	17:40
45°	05:41	06:16	06:47	16:40	17:11	17:46
N 40°	05:35	06:08	06:36	16:51	17:19	17:52
35°	05:30	06:00	06:27	17:00	17:27	17:57
30°	05:25	05:54	06:19	17:08	17:33	18:02
20°	05:15	05:42	06:04	17:23	17:46	18:12
N 10°	05:05	05:30	05:52	17:35	17:57	18:22
0°	04:54	05:19	05:40	17:47	18:09	18:34
S 10°	04:41	05:06	05:28	17:59	18:21	18:47
20°	04:25	04:52	05:15	18:12	18:35	19:03
30°	04:05	04:35	05:01	18:27	18:53	19:23
35°	03:52	04:25	04:52	18:36	19:03	19:36
40°	03:36	04:12	04:42	18:46	19:16	19:52
45°	03:17	03:58	04:30	18:58	19:31	20:12
S 50°	02:51	03:39	04:16	19:12	19:50	20:38
52°	02:37	03:30	04:10	19:19	19:59	20:52
54°	02:22	03:20	04:02	19:26	20:09	21:08
56°	02:03	03:08	03:54	19:35	20:21	21:27
58°	01:39	02:54	03:45	19:44	20:35	21:52
S 60°	01:04	02:38	03:34	19:55	20:52	22:29

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	▭	▭	▭	▭	▭	▭
N 70°	15:44	15:55	17:04	12:12	14:09	15:06
68°	16:26	17:01	18:07	11:30	13:03	14:04
66°	16:55	17:37	18:42	11:02	12:27	13:29
64°	17:17	18:03	19:07	10:40	12:02	13:03
62°	17:35	18:23	19:27	10:23	11:41	12:43
60°	17:50	18:40	19:43	10:08	11:25	12:27
N 58°	18:02	18:54	19:57	09:56	11:11	12:13
56°	18:13	19:06	20:09	09:46	10:59	12:01
54°	18:23	19:16	20:19	09:36	10:49	11:51
52°	18:32	19:25	20:28	09:28	10:40	11:41
50°	18:39	19:34	20:36	09:21	10:31	11:33
45°	18:56	19:52	20:54	09:05	10:14	11:15
N 40°	19:09	20:06	21:08	08:52	09:59	11:01
35°	19:21	20:18	21:20	08:41	09:47	10:48
30°	19:31	20:29	21:31	08:31	09:36	10:38
20°	19:49	20:48	21:49	08:14	09:18	10:19
N 10°	20:04	21:04	22:04	08:00	09:02	10:03
0°	20:18	21:19	22:19	07:46	08:47	09:48
S 10°	20:33	21:34	22:34	07:33	08:32	09:33
20°	20:48	21:51	22:50	07:18	08:16	09:17
30°	21:06	22:09	23:08	07:02	07:58	08:58
35°	21:16	22:20	23:19	06:52	07:47	08:47
40°	21:28	22:33	23:31	06:41	07:35	08:35
45°	21:42	22:48	23:45	06:29	07:21	08:20
S 50°	21:59	23:06	–:–	06:13	07:03	08:02
52°	22:08	23:14	–:–	06:06	06:55	07:53
54°	22:17	23:24	–:–	05:58	06:45	07:44
56°	22:27	23:35	–:–	05:49	06:35	07:33
58°	22:38	23:47	–:–	05:38	06:23	07:20
S 60°	22:52	–:–	00:02	05:27	06:09	07:06

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 18-20 92-76%
06	16:23	16:21	11:44	01:32	14:02	
07	16:20	16:18	11:44	02:33	15:03	
08	16:16	16:14	11:44	03:34	16:04	

November 09, 10, 11 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	48°21.4	198°08.9	S10°50.9	217°55.2	S03°16.4	193°56.2	S12°41.8	143°20.8	S22°22.9
1	63°23.9	213°08.4	52.0	232°56.2	17.0	208°58.1	42.0	158°22.9	22.9
2	78°26.3	228°07.9	53.2	247°57.2	17.6	224°00.0	42.2	173°25.1	22.9
3	93°28.8	243°07.4	·· 54.3	262°58.2	·· 18.2	239°02.0	·· 42.4	188°27.3	·· 23.0
4	108°31.3	258°06.8	55.4	277°59.3	18.9	254°03.9	42.5	203°29.5	23.0
5	123°33.7	273°06.3	56.5	293°00.3	19.5	269°05.9	42.7	218°31.7	23.0
6	138°36.2	288°05.8	S10°57.6	308°01.3	S03°20.1	284°07.8	S12°42.9	233°33.9	S22°23.0
7	153°38.7	303°05.3	58.8	323°02.3	20.7	299°09.7	43.1	248°36.1	23.0
8	168°41.1	318°04.8	10°59.9	338°03.3	21.3	314°11.7	43.2	263°38.3	23.0
9	183°43.6	333°04.3	11°01.0	353°04.3	·· 22.0	329°13.6	·· 43.4	278°40.5	·· 23.0
10	198°46.0	348°03.8	02.1	8°05.3	22.6	344°15.6	43.6	293°42.7	23.1
11	213°48.5	3°03.2	03.2	23°06.3	23.2	359°17.5	43.8	308°44.9	23.1
12	228°51.0	18°02.7	S11°04.3	38°07.4	S03°23.8	14°19.4	S12°44.0	323°47.1	S22°23.1
13	243°53.4	33°02.2	05.5	53°08.4	24.5	29°21.4	44.1	338°49.3	23.1
14	258°55.9	48°01.7	06.6	68°09.4	25.1	44°23.3	44.3	353°51.4	23.1
15	273°58.4	63°01.2	·· 07.7	83°10.4	·· 25.7	59°25.3	·· 44.5	8°53.6	·· 23.1
16	289°00.8	78°00.7	08.8	98°11.4	26.3	74°27.2	44.7	23°55.8	23.1
17	304°03.3	93°00.1	09.9	113°12.4	26.9	89°29.1	44.8	38°58.0	23.1
18	319°05.8	107°59.6	S11°11.0	128°13.4	S03°27.6	104°31.1	S12°45.0	54°00.2	S22°23.2
19	334°08.2	122°59.1	12.1	143°14.4	28.2	119°33.0	45.2	69°02.4	23.2
20	349°10.7	137°58.6	13.3	158°15.5	28.8	134°35.0	45.4	84°04.6	23.2
21	4°13.1	152°58.1	·· 14.4	173°16.5	·· 29.4	149°36.9	·· 45.6	99°06.8	·· 23.2
22	19°15.6	167°57.5	15.5	188°17.5	30.0	164°38.8	45.7	114°09.0	23.2
23	34°18.1	182°57.0	16.6	203°18.5	30.7	179°40.8	45.9	129°11.2	23.2
Mer.pass.:20:43		v-0.5 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	49°20.5	197°56.5	S11°17.7	218°19.5	S03°31.3	194°42.7	S12°46.1	144°13.4	S22°23.2
1	64°23.0	212°56.0	18.8	233°20.5	31.9	209°44.7	46.3	159°15.5	23.3
2	79°25.5	227°55.4	19.9	248°21.5	32.5	224°46.6	46.4	174°17.7	23.3
3	94°27.9	242°54.9	·· 21.0	263°22.5	·· 33.1	239°48.5	·· 46.6	189°19.9	·· 23.3
4	109°30.4	257°54.4	22.1	278°23.5	33.8	254°50.5	46.8	204°22.1	23.3
5	124°32.9	272°53.9	23.3	293°24.6	34.4	269°52.4	47.0	219°24.3	23.3
6	139°35.3	287°53.4	S11°24.4	308°25.6	S03°35.0	284°54.4	S12°47.2	234°26.5	S22°23.3
7	154°37.8	302°52.8	25.5	323°26.6	35.6	299°56.3	47.3	249°28.7	23.3
8	169°40.3	317°52.3	26.6	338°27.6	36.3	314°58.2	47.5	264°30.9	23.4
9	184°42.7	332°51.8	·· 27.7	353°28.6	·· 36.9	330°00.2	·· 47.7	279°33.1	·· 23.4
10	199°45.2	347°51.3	28.8	8°29.6	37.5	345°02.1	47.9	294°35.3	23.4
11	214°47.6	2°50.7	29.9	23°30.6	38.1	0°04.1	48.0	309°37.4	23.4
12	229°50.1	17°50.2	S11°31.0	38°31.6	S03°38.7	15°06.0	S12°48.2	324°39.6	S22°23.4
13	244°52.6	32°49.7	32.1	53°32.7	39.4	30°07.9	48.4	339°41.8	23.4
14	259°55.0	47°49.1	33.2	68°33.7	40.0	45°09.9	48.6	354°44.0	23.4
15	274°57.5	62°48.6	·· 34.3	83°34.7	·· 40.6	60°11.8	·· 48.7	9°46.2	·· 23.4
16	290°00.0	77°48.1	35.4	98°35.7	41.2	75°13.8	48.9	24°48.4	23.5
17	305°02.4	92°47.6	36.5	113°36.7	41.8	90°15.7	49.1	39°50.6	23.5
18	320°04.9	107°47.0	S11°37.6	128°37.7	S03°42.5	105°17.6	S12°49.3	54°52.8	S22°23.5
19	335°07.4	122°46.5	38.7	143°38.7	43.1	120°19.6	49.5	69°55.0	23.5
20	350°09.8	137°46.0	39.8	158°39.7	43.7	135°21.5	49.6	84°57.1	23.5
21	5°12.3	152°45.4	·· 40.9	173°40.7	·· 44.3	150°23.5	·· 49.8	99°59.3	·· 23.5
22	20°14.8	167°44.9	42.0	188°41.8	44.9	165°25.4	50.0	115°01.5	23.5
23	35°17.2	182°44.4	43.1	203°42.8	45.6	180°27.3	50.2	130°03.7	23.6
Mer.pass.:20:39		v-0.5 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	50°19.7	197°43.8	S11°44.2	218°43.8	S03°46.2	195°29.3	S12°50.3	145°05.9	S22°23.6
1	65°22.1	212°43.3	45.3	233°44.8	46.8	210°31.2	50.5	160°08.1	23.6
2	80°24.6	227°42.8	46.4	248°45.8	47.4	225°33.2	50.7	175°10.3	23.6
3	95°27.1	242°42.2	·· 47.5	263°46.8	·· 48.0	240°35.1	·· 50.9	190°12.5	·· 23.6
4	110°29.5	257°41.7	48.6	278°47.8	48.7	255°37.0	51.0	205°14.7	23.6
5	125°32.0	272°41.2	49.7	293°48.8	49.3	270°39.0	51.2	220°16.8	23.6
6	140°34.5	287°40.6	S11°50.8	308°49.8	S03°49.9	285°40.9	S12°51.4	235°19.0	S22°23.6
7	155°36.9	302°40.1	51.9	323°50.9	50.5	300°42.9	51.6	250°21.2	23.7
8	170°39.4	317°39.6	53.0	338°51.9	51.1	315°44.8	51.7	265°23.4	23.7
9	185°41.9	332°39.0	·· 54.1	353°52.9	·· 51.8	330°46.7	·· 51.9	280°25.6	·· 23.7
10	200°44.3	347°38.5	55.2	8°53.9	52.4	345°48.7	52.1	295°27.8	23.7
11	215°46.8	2°38.0	56.3	23°54.9	53.0	0°50.6	52.3	310°30.0	23.7
12	230°49.3	17°37.4	S11°57.4	38°55.9	S03°53.6	15°52.6	S12°52.5	325°32.2	S22°23.7
13	245°51.7	32°36.9	58.5	53°56.9	54.2	30°54.5	52.6	340°34.3	23.7
14	260°54.2	47°36.4	11°59.6	68°57.9	54.9	45°56.4	52.8	355°36.5	23.8
15	275°56.6	62°35.8	12°00.7	83°58.9	·· 55.5	60°58.4	·· 53.0	10°38.7	·· 23.8
16	290°59.1	77°35.3	01.8	99°00.0	56.1	76°00.3	53.2	25°40.9	23.8
17	306°01.6	92°34.7	02.9	114°01.0	56.7	91°02.3	53.3	40°43.1	23.8
18	321°04.0	107°34.2	S12°04.0	129°02.0	S03°57.3	106°04.2	S12°53.5	55°45.3	S22°23.8
19	336°06.5	122°33.7	05.1	144°03.0	58.0	121°06.2	53.7	70°47.5	23.8
20	351°09.0	137°33.1	06.1	159°04.0	58.6	136°08.1	53.9	85°49.7	23.8
21	6°11.4	152°32.6	·· 07.2	174°05.0	·· 59.2	151°10.0	·· 54.0	100°51.8	·· 23.8
22	21°13.9	167°32.0	08.3	189°06.0	03°59.8	166°12.0	54.2	115°54.0	23.9
23	36°16.4	182°31.5	09.4	204°07.0	04°00.4	181°13.9	54.4	130°56.2	23.9
Mer.pass.:20:35		v-0.5 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°09.0
Hamal	327°57.1	23°32.8
Polaris	315°57.5	89°20.3
Acamar	315°15.7	-40°14.1
Menkar	314°11.6	4°09.5
Mirfak	308°35.6	49°55.3
Aldebaran	290°45.7	16°32.5
Rigel	281°08.9	-8°11.0
Capella	280°29.7	46°00.7
Bellatrix	278°28.6	6°21.8
Elnath	278°08.6	28°37.1
Alnilam	275°43.1	-1°11.5
Betelgeuse	270°57.8	7°24.5
Canopus	263°54.4	-52°42.2
Sirius	258°30.9	-16°44.5
Adhara	255°10.0	-28°59.7
Procyon	244°56.5	5°10.7
Pollux	243°24.0	27°58.8
Avior	234°16.6	-59°33.8
Suhail	222°50.2	-43°30.0
Miaplacidus	221°38.9	-69°47.1
Alphard	217°53.2	-8°44.1
Regulus	207°40.5	11°52.8
Dubhe	193°48.5	61°39.1
Denebola	182°30.9	14°28.4
Gienah	175°49.5	-17°38.2
Acrux	173°06.4	-63°11.5
Gacrux	171°58.0	-57°12.4
Alioth	166°18.6	55°51.8
Spica	158°28.4	-11°15.0
Alkaid	152°57.1	49°13.6
Hadar	148°44.2	-60°27.2
Menkent	148°04.4	-36°27.1
Arcturus	145°53.4	19°05.6
Rigil Kent.	139°48.3	-60°54.2
Kochab	137°21.4	74°05.1
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.6
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.4
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.2	51°29.6
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.2	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.8	-56°40.8
Deneb	49°29.5	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.0	-46°52.6
Fomalhaut	15°20.6	-29°31.8
Scheat	13°50.3	28°11.0
Markab	13°35.2	15°18.2

Nov 09 Thu	SHA	Mer.pass
Venus	149°47.5	10:48
Mars	169°33.8	09:28
Jupiter	145°34.8	11:03
Saturn	94°59.4	14:25

Nov 10 Fri	SHA	Mer.pass
Venus	148°35.9	10:49
Mars	168°59.0	09:26
Jupiter	145°22.2	11:00
Saturn	94°52.8	14:21

Nov 11 Sat	SHA	Mer.pass
Venus	147°24.2	10:49
Mars	168°24.1	09:24
Jupiter	145°09.6	10:57
Saturn	94°46.2	14:18

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2741 sec ΔT = TT-UT1 = +68.9099 sec

2017 November 09 to Nov. 11 UT

h — Sun — Moon

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	184°03.0	S16°50.7	294°21.7	5.6'	N19°15.9	-3.0'	59.7'
1	199°02.9	51.4	308°46.3	5.6'	19°12.8	-3.2'	59.6'
2	214°02.9	52.1	323°11.0	5.7'	19°09.5	-3.3'	59.6'
3	229°02.8	·· 52.8	337°35.7	5.8'	19°06.2	-3.4'	59.6'
4	244°02.8	53.6	352°00.5	5.8'	19°02.7	-3.5'	59.6'
5	259°02.7	54.3	6°25.3	5.9'	18°59.1	-3.7'	59.5'
6	274°02.7	S16°55.0	20°50.3	5.9'	N18°55.4	-3.8'	59.5'
7	289°02.6	55.7	35°15.2	6.0'	18°51.6	-3.9'	59.5'
8	304°02.6	56.4	49°40.3	6.1'	18°47.6	-4.0'	59.5'
9	319°02.5	·· 57.1	64°05.4	6.1'	18°43.5	-4.1'	59.4'
10	334°02.5	57.8	78°30.5	6.2'	18°39.3	-4.3'	59.4'
11	349°02.4	58.5	92°55.8	6.3'	18°35.0	-4.4'	59.4'
12	4°02.4	S16°59.2	107°21.1	6.3'	N18°30.6	-4.5'	59.4'
13	19°02.3	16°59.9	121°46.4	6.4'	18°26.0	-4.6'	59.3'
14	34°02.2	17°00.7	136°11.9	6.5'	18°21.4	-4.7'	59.3'
15	49°02.2	·· 01.4	150°37.4	6.5'	18°16.6	-4.8'	59.3'
16	64°02.1	02.1	165°03.0	6.6'	18°11.7	-5.0'	59.2'
17	79°02.1	02.8	179°28.6	6.7'	18°06.7	-5.1'	59.2'
18	94°02.0	S17°03.5	193°54.3	6.7'	N18°01.6	-5.2'	59.2'
19	109°02.0	04.2	208°20.1	6.8'	17°56.4	-5.3'	59.2'
20	124°01.9	04.9	222°46.0	6.9'	17°51.0	-5.4'	59.1'
21	139°01.8	·· 05.6	237°11.9	7.0'	17°45.6	-5.5'	59.1'
22	154°01.8	06.3	251°37.9	7.0'	17°40.0	-5.6'	59.1'
23	169°01.7	07.0	266°03.9	7.1'	17°34.4	-5.7'	59.1'
	SD.=16.1	d=-0.7	S.D.=16.2				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	184°01.7	S17°07.7	280°30.1	7.2'	N17°28.6	-5.8'	59.0'
1	199°01.6	08.4	294°56.3	7.3'	17°22.7	-5.9'	59.0'
2	214°01.5	09.1	309°22.6	7.3'	17°16.8	-6.0'	59.0'
3	229°01.5	·· 09.8	323°49.0	7.4'	17°10.7	-6.1'	58.9'
4	244°01.4	10.5	338°15.4	7.5'	17°04.5	-6.2'	58.9'
5	259°01.4	11.2	352°41.9	7.6'	16°58.2	-6.3'	58.9'
6	274°01.3	S17°11.9	7°08.5	7.6'	N16°51.9	-6.4'	58.9'
7	289°01.2	12.6	21°35.2	7.7'	16°45.4	-6.5'	58.8'
8	304°01.2	13.3	36°01.9	7.8'	16°38.8	-6.6'	58.8'
9	319°01.1	·· 14.0	50°28.7	7.9'	16°32.2	-6.7'	58.8'
10	334°01.1	14.7	64°55.6	7.9'	16°25.4	-6.8'	58.8'
11	349°01.0	15.4	79°22.6	8.0'	16°18.6	-6.9'	58.7'
12	4°00.9	S17°16.1	93°49.6	8.1'	N16°11.6	-7.0'	58.7'
13	19°00.9	16.8	108°16.8	8.2'	16°04.6	-7.1'	58.7'
14	34°00.8	17.5	122°44.0	8.2'	15°57.5	-7.2'	58.6'
15	49°00.7	·· 18.2	137°11.2	8.3'	15°50.3	-7.3'	58.6'
16	64°00.7	18.9	151°38.6	8.4'	15°43.0	-7.3'	58.6'
17	79°00.6	19.6	166°06.0	8.5'	15°35.6	-7.4'	58.6'
18	94°00.5	S17°20.3	180°33.5	8.5'	N15°28.1	-7.5'	58.5'
19	109°00.5	21.0	195°01.1	8.6'	15°20.6	-7.6'	58.5'
20	124°00.4	21.6	209°28.7	8.7'	15°12.9	-7.7'	58.5'
21	139°00.3	·· 22.3	223°56.5	8.8'	15°05.2	-7.8'	58.4'
22	154°00.3	23.0	238°24.3	8.8'	14°57.4	-7.8'	58.4'
23	169°00.2	23.7	252°52.1	8.9'	14°49.5	-7.9'	58.4'
	SD.=16.1	d=-0.7	S.D.=16.0				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	184°00.1	S17°24.4	267°20.1	9.0'	N14°41.6	-8.0'	58.4'
1	199°00.1	25.1	281°48.1	9.1'	14°33.6	-8.1'	58.3'
2	214°00.0	25.8	296°16.2	9.1'	14°25.5	-8.1'	58.3'
3	228°59.9	·· 26.5	310°44.4	9.2'	14°17.3	-8.2'	58.3'
4	243°59.9	27.2	325°12.7	9.3'	14°09.0	-8.3'	58.2'
5	258°59.8	27.9	339°41.0	9.4'	14°00.7	-8.4'	58.2'
6	273°59.7	S17°28.5	354°09.4	9.4'	N13°52.3	-8.4'	58.2'
7	288°59.6	29.2	8°37.9	9.5'	13°43.8	-8.5'	58.2'
8	303°59.6	29.9	23°06.4	9.6'	13°35.3	-8.6'	58.1'
9	318°59.5	·· 30.6	37°35.1	9.7'	13°26.7	-8.6'	58.1'
10	333°59.4	31.3	52°03.7	9.7'	13°18.0	-8.7'	58.1'
11	348°59.4	32.0	66°32.5	9.8'	13°09.3	-8.8'	58.0'
12	3°59.3	S17°32.7	81°01.4	9.9'	N13°00.4	-8.8'	58.0'
13	18°59.2	33.3	95°30.3	9.9'	12°51.6	-8.9'	58.0'
14	33°59.1	34.0	109°59.3	10.0'	12°42.6	-9.0'	58.0'
15	48°59.1	·· 34.7	124°28.3	10.1'	12°33.7	-9.0'	57.9'
16	63°59.0	35.4	138°57.4	10.2'	12°24.6	-9.1'	57.9'
17	78°58.9	36.1	153°26.6	10.2'	12°15.5	-9.1'	57.9'
18	93°58.8	S17°36.8	167°55.9	10.3'	N12°06.3	-9.2'	57.9'
19	108°58.8	37.4	182°25.2	10.4'	11°57.1	-9.3'	57.8'
20	123°58.7	38.1	196°54.6	10.4'	11°47.8	-9.3'	57.8'
21	138°58.6	·· 38.8	211°24.1	10.5'	11°38.5	-9.4'	57.8'
22	153°58.5	39.5	225°53.6	10.6'	11°29.1	-9.4'	57.7'
23	168°58.5	40.2	240°23.2	10.6'	11°19.6	-9.5'	57.7'
	SD.=16.1	d=-0.7	S.D.=15.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:42	08:11	10:04	13:23	15:15	16:45
N 70°	06:33	07:52	09:19	14:07	15:34	16:53
68°	06:27	07:37	08:50	14:36	15:49	17:00
66°	06:21	07:25	08:29	14:58	16:02	17:06
64°	06:16	07:15	08:12	15:15	16:12	17:11
62°	06:11	07:06	07:58	15:29	16:21	17:16
60°	06:07	06:58	07:46	15:41	16:29	17:20
N 58°	06:03	06:51	07:35	15:52	16:36	17:24
56°	06:00	06:45	07:26	16:01	16:42	17:27
54°	05:57	06:39	07:18	16:09	16:48	17:30
52°	05:54	06:34	07:11	16:16	16:53	17:33
50°	05:51	06:30	07:05	16:23	16:57	17:36
45°	05:44	06:20	06:51	16:36	17:08	17:43
N 40°	05:38	06:11	06:39	16:48	17:17	17:49
35°	05:33	06:03	06:30	16:58	17:24	17:55
30°	05:27	05:56	06:21	17:07	17:32	18:00
20°	05:17	05:43	06:06	17:22	17:45	18:11
N 10°	05:06	05:31	05:53	17:35	17:57	18:22
0°	04:54	05:19	05:40	17:47	18:09	18:34
S 10°	04:40	05:06	05:28	18:00	18:22	18:48
20°	04:23	04:51	05:14	18:14	18:37	19:05
30°	04:02	04:33	04:59	18:30	18:55	19:26
35°	03:49	04:22	04:50	18:39	19:07	19:40
40°	03:32	04:09	04:39	18:49	19:20	19:57
45°	03:12	03:53	04:27	19:02	19:35	20:17
S 50°	02:44	03:34	04:12	19:17	19:55	20:45
52°	02:30	03:24	04:04	19:25	20:05	21:00
54°	02:13	03:13	03:57	19:33	20:16	21:17
56°	01:53	03:01	03:48	19:42	20:29	21:38
58°	01:25	02:46	03:38	19:52	20:44	22:07
S 60°	00:41	02:28	03:26	20:04	21:02	22:56

Lat.	Moonrise Thu	Moonrise Fri	Moonrise Sat	Moonset Thu	Moonset Fri	Moonset Sat
N 72°	17:24	20:20	22:26	16:50	15:50	15:33
N 70°	18:59	20:55	22:46	15:14	15:13	15:11
68°	19:39	21:20	23:01	14:34	14:47	14:54
66°	20:06	21:39	23:14	14:06	14:27	14:41
64°	20:27	21:55	23:24	13:44	14:11	14:29
62°	20:44	22:08	23:33	13:27	13:58	14:19
60°	20:58	22:18	23:41	13:13	13:46	14:11
N 58°	21:10	22:28	23:47	13:00	13:36	14:04
56°	21:20	22:36	23:53	12:50	13:28	13:57
54°	21:29	22:43	23:58	12:40	13:20	13:51
52°	21:37	22:50	–:–	12:32	13:13	13:46
50°	21:45	22:56	–:–	12:24	13:06	13:41
45°	22:00	23:08	–:–	12:08	12:53	13:31
N 40°	22:13	23:19	–:–	11:55	12:42	13:22
35°	22:24	23:28	–:–	11:43	12:32	13:14
30°	22:33	23:35	–:–	11:33	12:23	13:08
20°	22:50	23:49	–:–	11:16	12:09	12:56
N 10°	23:04	–:–	00:01	11:01	11:56	12:46
0°	23:17	–:–	00:12	10:47	11:43	12:37
S 10°	23:30	–:–	00:23	10:33	11:31	12:27
20°	23:44	–:–	00:34	10:18	11:18	12:17
30°	–:–	00:01	00:48	10:00	11:03	12:05
35°	–:–	00:10	00:55	09:50	10:54	11:58
40°	–:–	00:21	01:04	09:38	10:44	11:50
45°	–:–	00:33	01:14	09:25	10:32	11:41
S 50°	00:02	00:49	01:26	09:08	10:18	11:30
52°	00:10	00:56	01:32	09:00	10:11	11:24
54°	00:19	01:04	01:38	08:51	10:04	11:19
56°	00:30	01:12	01:45	08:41	09:55	11:12
58°	00:41	01:22	01:53	08:29	09:46	11:05
S 60°	00:55	01:34	02:02	08:16	09:35	10:57

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 21-23 65-43%
09	16:12	16:09	11:44	04:33	17:02	
10	16:07	16:04	11:44	05:30	17:58	
11	16:01	15:57	11:44	06:24	18:50	

November 12, 13, 14 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	51°18.8	197°31.0	S12°10.5	219°08.0	S04°01.0	196°15.9	S12°54.6	145°58.4	S22°23.9
1	66°21.3	212°30.4	11.6	234°09.1	01.7	211°17.8	54.7	161°00.6	23.9
2	81°23.7	227°29.9	12.7	249°10.1	02.3	226°19.7	54.9	176°02.8	23.9
3	96°26.2	242°29.3	·· 13.8	264°11.1	·· 02.9	241°21.7	·· 55.1	191°05.0	·· 23.9
4	111°28.7	257°28.8	14.8	279°12.1	03.5	256°23.6	55.3	206°07.1	23.9
5	126°31.1	272°28.2	15.9	294°13.1	04.1	271°25.6	55.4	221°09.3	24.0
6	141°33.6	287°27.7	S12°17.0	309°14.1	S04°04.8	286°27.5	S12°55.6	236°11.5	S22°24.0
7	156°36.1	302°27.1	18.1	324°15.1	05.4	301°29.4	55.8	251°13.7	24.0
8	171°38.5	317°26.6	19.2	339°16.1	06.0	316°31.4	56.0	266°15.9	24.0
9	186°41.0	332°26.1	·· 20.3	354°17.1	·· 06.6	331°33.3	·· 56.1	281°18.1	·· 24.0
10	201°43.5	347°25.5	21.4	9°18.1	07.2	346°35.3	56.3	296°20.3	24.0
11	216°45.9	2°25.0	22.4	24°19.2	07.9	1°37.2	56.5	311°22.4	24.0
12	231°48.4	17°24.4	S12°23.5	39°20.2	S04°08.5	16°39.1	S12°56.7	326°24.6	S22°24.0
13	246°50.9	32°23.9	24.6	54°21.2	09.1	31°41.1	56.8	341°26.8	24.1
14	261°53.3	47°23.3	25.7	69°22.2	09.7	46°43.0	57.0	356°29.0	24.1
15	276°55.8	62°22.8	·· 26.8	84°23.2	·· 10.3	61°45.0	·· 57.2	11°31.2	·· 24.1
16	291°58.2	77°22.2	27.8	99°24.2	10.9	76°46.9	57.4	26°33.4	24.1
17	307°00.7	92°21.7	28.9	114°25.2	11.6	91°48.8	57.5	41°35.6	24.1
18	322°03.2	107°21.1	S12°30.0	129°26.2	S04°12.2	106°50.8	S12°57.7	56°37.7	S22°24.1
19	337°05.6	122°20.6	31.1	144°27.2	12.8	121°52.7	57.9	71°39.9	24.1
20	352°08.1	137°20.0	32.2	159°28.2	13.4	136°54.7	58.1	86°42.1	24.1
21	7°10.6	152°19.5	·· 33.2	174°29.3	·· 14.0	151°56.6	·· 58.2	101°44.3	·· 24.2
22	22°13.0	167°18.9	34.3	189°30.3	14.6	166°58.6	58.4	116°46.5	24.2
23	37°15.5	182°18.4	35.4	204°31.3	15.3	182°00.5	58.6	131°48.7	24.2
Mer.pass.:20:31		v-0.5 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	52°18.0	197°17.8	S12°36.5	219°32.3	S04°15.9	197°02.4	S12°58.8	146°50.8	S22°24.2
1	67°20.4	212°17.3	37.5	234°33.3	16.5	212°04.4	58.9	161°53.0	24.2
2	82°22.9	227°16.7	38.6	249°34.3	17.1	227°06.3	59.1	176°55.2	24.2
3	97°25.3	242°16.2	·· 39.7	264°35.3	·· 17.7	242°08.3	·· 59.3	191°57.4	·· 24.2
4	112°27.8	257°15.6	40.8	279°36.3	18.4	257°10.2	59.5	206°59.6	24.3
5	127°30.3	272°15.0	41.8	294°37.3	19.0	272°12.1	59.6	222°01.8	24.3
6	142°32.7	287°14.5	S12°42.9	309°38.3	S04°19.6	287°14.1	S12°59.8	237°03.9	S22°24.3
7	157°35.2	302°13.9	44.0	324°39.4	20.2	302°16.0	13°00.0	252°06.1	24.3
8	172°37.7	317°13.4	45.1	339°40.4	20.8	317°18.0	00.2	267°08.3	24.3
9	187°40.1	332°12.8	·· 46.1	354°41.4	·· 21.4	332°19.9	·· 00.3	282°10.5	·· 24.3
10	202°42.6	347°12.3	47.2	9°42.4	22.1	347°21.8	00.5	297°12.7	24.3
11	217°45.1	2°11.7	48.3	24°43.4	22.7	2°23.8	00.7	312°14.9	24.3
12	232°47.5	17°11.1	S12°49.3	39°44.4	S04°23.3	17°25.7	S13°00.9	327°17.1	S22°24.4
13	247°50.0	32°10.6	50.4	54°45.4	23.9	32°27.7	01.0	342°19.2	24.4
14	262°52.5	47°10.0	51.5	69°46.4	24.5	47°29.6	01.2	357°21.4	24.4
15	277°54.9	62°09.5	·· 52.5	84°47.4	·· 25.1	62°31.6	·· 01.4	12°23.6	·· 24.4
16	292°57.4	77°08.9	53.6	99°48.4	25.8	77°33.5	01.6	27°25.8	24.4
17	307°59.8	92°08.4	54.7	114°49.4	26.4	92°35.4	01.7	42°28.0	24.4
18	323°02.3	107°07.8	S12°55.7	129°50.5	S04°27.0	107°37.4	S13°01.9	57°30.1	S22°24.4
19	338°04.8	122°07.2	56.8	144°51.5	27.6	122°39.3	02.1	72°32.3	24.4
20	353°07.2	137°06.7	57.9	159°52.5	28.2	137°41.3	02.3	87°34.5	24.5
21	8°09.7	152°06.1	12°58.9	174°53.5	·· 28.8	152°43.2	·· 02.4	102°36.7	·· 24.5
22	23°12.2	167°05.5	13°00.0	189°54.5	29.5	167°45.1	02.6	117°38.9	24.5
23	38°14.6	182°05.0	01.1	204°55.5	30.1	182°47.1	02.8	132°41.1	24.5
Mer.pass.:20:27		v-0.6 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	53°17.1	197°04.4	S13°02.1	219°56.5	S04°30.7	197°49.0	S13°03.0	147°43.2	S22°24.5
1	68°19.6	212°03.9	03.2	234°57.5	31.3	212°51.0	03.1	162°45.4	24.5
2	83°22.0	227°03.3	04.3	249°58.5	31.9	227°52.9	03.3	177°47.6	24.5
3	98°24.5	242°02.7	·· 05.3	264°59.5	·· 32.5	242°54.9	·· 03.5	192°49.8	·· 24.5
4	113°27.0	257°02.2	06.4	280°00.5	33.2	257°56.8	03.7	207°52.0	24.6
5	128°29.4	272°01.6	07.4	295°01.5	33.8	272°58.7	03.8	222°54.2	24.6
6	143°31.9	287°01.0	S13°08.5	310°02.6	S04°34.4	288°00.7	S13°04.0	237°56.3	S22°24.6
7	158°34.3	302°00.5	09.6	325°03.6	35.0	303°02.6	04.2	252°58.5	24.6
8	173°36.8	316°59.9	10.6	340°04.6	35.6	318°04.6	04.4	268°00.7	24.6
9	188°39.3	331°59.3	·· 11.7	355°05.6	·· 36.2	333°06.5	·· 04.5	283°02.9	·· 24.6
10	203°41.7	346°58.8	12.7	10°06.6	36.8	348°08.4	04.7	298°05.1	24.6
11	218°44.2	1°58.2	13.8	25°07.6	37.5	3°10.4	04.9	313°07.2	24.7
12	233°46.7	16°57.6	S13°14.9	40°08.6	S04°38.1	18°12.3	S13°05.0	328°09.4	S22°24.7
13	248°49.1	31°57.0	15.9	55°09.6	38.7	33°14.3	05.2	343°11.6	24.7
14	263°51.6	46°56.5	17.0	70°10.6	39.3	48°16.2	05.4	358°13.8	24.7
15	278°54.1	61°55.9	·· 18.0	85°11.6	·· 39.9	63°18.2	·· 05.6	13°16.0	·· 24.7
16	293°56.5	76°55.3	19.1	100°12.6	40.5	78°20.1	05.7	28°18.1	24.7
17	308°59.0	91°54.8	20.1	115°13.6	41.2	93°22.0	05.9	43°20.3	24.7
18	324°01.4	106°54.2	S13°21.2	130°14.7	S04°41.8	108°24.0	S13°06.1	58°22.5	S22°24.7
19	339°03.9	121°53.6	22.2	145°15.7	42.4	123°25.9	06.3	73°24.7	24.8
20	354°06.4	136°53.1	23.3	160°16.7	43.0	138°27.9	06.4	88°26.9	24.8
21	9°08.8	151°52.5	·· 24.3	175°17.7	·· 43.6	153°29.8	·· 06.6	103°29.1	·· 24.8
22	24°11.3	166°51.9	25.4	190°18.7	44.2	168°31.7	06.8	118°31.2	24.8
23	39°13.8	181°51.3	26.4	205°19.7	44.8	183°33.7	07.0	133°33.4	24.8
Mer.pass.:20:24		v-0.6 d-1.1 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.5	-42°12.7
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°09.0
Hamal	327°57.1	23°32.8
Polaris	315°57.5	89°20.3
Acamar	315°15.7	-40°14.1
Menkar	314°11.6	4°09.5
Mirfak	308°35.6	49°55.3
Aldebaran	290°45.6	16°32.5
Rigel	281°08.9	-8°11.0
Capella	280°29.6	46°00.7
Bellatrix	278°28.5	6°21.8
Elnath	278°08.5	28°37.1
Alnilam	275°43.1	-1°11.5
Betelgeuse	270°57.8	7°24.5
Canopus	263°54.4	-52°42.2
Sirius	258°30.9	-16°44.5
Adhara	255°10.0	-28°59.7
Procyon	244°56.5	5°10.7
Pollux	243°24.0	27°58.8
Avior	234°16.6	-59°33.8
Suhail	222°50.2	-43°30.0
Miaplacidus	221°38.9	-69°47.1
Alphard	217°53.2	-8°44.1
Regulus	207°40.4	11°52.8
Dubhe	193°48.5	61°39.1
Denebola	182°30.9	14°28.4
Gienah	175°49.5	-17°38.2
Acrux	173°06.4	-63°11.5
Gacrux	171°57.9	-57°12.4
Alioth	166°18.6	55°51.8
Spica	158°28.4	-11°15.0
Alkaid	152°57.1	49°13.5
Hadar	148°44.2	-60°27.2
Menkent	148°04.4	-36°27.1
Arcturus	145°53.4	19°05.6
Rigil Kent.	139°48.3	-60°54.2
Kochab	137°21.4	74°05.0
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.5
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.4
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.2	51°29.6
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.8	-56°40.8
Deneb	49°29.5	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.0	-46°52.6
Fomalhaut	15°20.6	-29°31.8
Scheat	13°50.3	28°11.0
Markab	13°35.2	15°18.2

Nov 12 Sun	**SHA**	**Mer.pass**
Venus	146°12.1	10:50
Mars	167°49.2	09:23
Jupiter	144°57.0	10:54
Saturn	94°39.6	14:14

Nov 13 Mon	**SHA**	**Mer.pass**
Venus	144°59.9	10:51
Mars	167°14.3	09:21
Jupiter	144°44.5	10:50
Saturn	94°32.9	14:11

Nov 14 Tue	**SHA**	**Mer.pass**
Venus	143°47.3	10:52
Mars	166°39.4	09:20
Jupiter	144°31.9	10:47
Saturn	94°26.1	14:07

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2706 sec ΔT = TT-UT1 = +68.9134 sec

2017 November 12 to Nov. 14 UT

h — Sun — Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°58.4	S17°40.8	254°52.9	10.7'	N11°10.1	-9.5'	57.7'
1	198°58.3	41.5	269°22.6	10.8'	11°00.6	-9.6'	57.7'
2	213°58.2	42.2	283°52.4	10.8'	10°51.0	-9.6'	57.6'
3	228°58.1	·· 42.9	298°22.3	10.9'	10°41.3	-9.7'	57.6'
4	243°58.1	43.5	312°52.2	11.0'	10°31.6	-9.7'	57.6'
5	258°58.0	44.2	327°22.2	11.0'	10°21.9	-9.8'	57.5'
6	273°57.9	S17°44.9	341°52.3	11.1'	N10°12.1	-9.8'	57.5'
7	288°57.8	45.6	356°22.4	11.1'	10°02.3	-9.9'	57.5'
8	303°57.7	46.2	10°52.6	11.2'	09°52.4	-9.9'	57.5'
9	318°57.7	·· 46.9	25°22.8	11.3'	09°42.5	-9.9'	57.4'
10	333°57.6	47.6	39°53.1	11.3'	09°32.5	-10.0'	57.4'
11	348°57.5	48.3	54°23.5	11.4'	09°22.5	-10.0'	57.4'
12	3°57.4	S17°48.9	68°53.9	11.4'	N09°12.5	-10.1'	57.4'
13	18°57.3	49.6	83°24.4	11.5'	09°02.4	-10.1'	57.3'
14	33°57.3	50.3	97°54.9	11.6'	08°52.3	-10.1'	57.3'
15	48°57.2	·· 50.9	112°25.5	11.6'	08°42.2	-10.2'	57.3'
16	63°57.1	51.6	126°56.1	11.7'	08°32.0	-10.2'	57.3'
17	78°57.0	52.3	141°26.8	11.7'	08°21.7	-10.2'	57.2'
18	93°56.9	S17°52.9	155°57.6	11.8'	N08°11.5	-10.3'	57.2'
19	108°56.8	53.6	170°28.4	11.8'	08°01.2	-10.3'	57.2'
20	123°56.7	54.3	184°59.3	11.9'	07°50.9	-10.3'	57.2'
21	138°56.7	·· 54.9	199°30.2	11.9'	07°40.5	-10.4'	57.1'
22	153°56.6	55.6	214°01.2	12.0'	07°30.2	-10.4'	57.1'
23	168°56.5	56.3	228°32.2	12.0'	07°19.7	-10.4'	57.1'
	SD.=16.1	d=-0.7		S.D.=15.6			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°56.4	S17°56.9	243°03.3	12.1'	N07°09.3	-10.4'	57.0'
1	198°56.3	57.6	257°34.4	12.1'	06°58.8	-10.5'	57.0'
2	213°56.2	58.3	272°05.6	12.2'	06°48.4	-10.5'	57.0'
3	228°56.1	·· 58.9	286°36.8	12.2'	06°37.8	-10.5'	57.0'
4	243°56.1	17°59.6	301°08.1	12.3'	06°27.3	-10.5'	56.9'
5	258°56.0	18°00.3	315°39.4	12.3'	06°16.7	-10.6'	56.9'
6	273°55.9	S18°00.9	330°10.7	12.4'	N06°06.2	-10.6'	56.9'
7	288°55.8	01.6	344°42.2	12.4'	05°55.6	-10.6'	56.9'
8	303°55.7	02.2	359°13.6	12.5'	05°44.9	-10.6'	56.8'
9	318°55.6	·· 02.9	13°45.1	12.5'	05°34.3	-10.7'	56.8'
10	333°55.5	03.6	28°16.7	12.6'	05°23.6	-10.7'	56.8'
11	348°55.4	04.2	42°48.2	12.6'	05°12.9	-10.7'	56.8'
12	3°55.3	S18°04.9	57°19.9	12.6'	N05°02.2	-10.7'	56.7'
13	18°55.2	05.5	71°51.5	12.7'	04°51.5	-10.7'	56.7'
14	33°55.2	06.2	86°23.2	12.7'	04°40.8	-10.7'	56.7'
15	48°55.1	·· 06.8	100°55.0	12.8'	04°30.1	-10.7'	56.7'
16	63°55.0	07.5	115°26.8	12.8'	04°19.3	-10.8'	56.7'
17	78°54.9	08.2	129°58.6	12.8'	04°08.5	-10.8'	56.6'
18	93°54.8	S18°08.8	144°30.5	12.9'	N03°57.8	-10.8'	56.6'
19	108°54.7	09.5	159°02.4	12.9'	03°47.0	-10.8'	56.6'
20	123°54.6	10.1	173°34.3	13.0'	03°36.2	-10.8'	56.6'
21	138°54.5	·· 10.8	188°06.3	13.0'	03°25.4	-10.8'	56.5'
22	153°54.4	11.4	202°38.3	13.0'	03°14.5	-10.8'	56.5'
23	168°54.3	12.1	217°10.3	13.1'	03°03.7	-10.8'	56.5'
	SD.=16.2	d=-0.7		S.D.=15.5			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	183°54.2	S18°12.7	231°42.4	13.1'	N02°52.9	-10.8'	56.5'
1	198°54.1	13.4	246°14.5	13.1'	02°42.0	-10.8'	56.4'
2	213°54.0	14.0	260°46.6	13.2'	02°31.2	-10.8'	56.4'
3	228°53.9	·· 14.7	275°18.8	13.2'	02°20.3	-10.8'	56.4'
4	243°53.8	15.3	289°51.0	13.2'	02°09.5	-10.9'	56.4'
5	258°53.7	16.0	304°23.2	13.2'	01°58.6	-10.9'	56.3'
6	273°53.6	S18°16.6	318°55.5	13.3'	N01°47.8	-10.9'	56.3'
7	288°53.5	17.3	333°27.8	13.3'	01°36.9	-10.9'	56.3'
8	303°53.4	17.9	348°00.1	13.3'	01°26.1	-10.9'	56.3'
9	318°53.3	·· 18.6	2°32.4	13.4'	01°15.2	-10.9'	56.3'
10	333°53.2	19.2	17°04.8	13.4'	01°04.4	-10.9'	56.2'
11	348°53.1	19.9	31°37.2	13.4'	00°53.5	-10.8'	56.2'
12	3°53.0	S18°20.5	46°09.6	13.4'	N00°42.7	-10.8'	56.2'
13	18°52.9	21.2	60°42.0	13.4'	00°31.8	-10.8'	56.2'
14	33°52.8	21.8	75°14.5	13.5'	00°21.0	-10.8'	56.1'
15	48°52.7	·· 22.5	89°47.0	13.5'	N00°10.2	-10.8'	56.1'
16	63°52.6	23.1	104°19.5	13.5'	S00°00.7	-10.8'	56.1'
17	78°52.5	23.7	118°52.0	13.5'	00°11.5	-10.8'	56.1'
18	93°52.4	S18°24.4	133°24.5	13.6'	S00°22.3	-10.8'	56.1'
19	108°52.3	25.0	147°57.1	13.6'	00°33.1	-10.8'	56.0'
20	123°52.2	25.7	162°29.7	13.6'	00°43.9	-10.8'	56.0'
21	138°52.1	·· 26.3	177°02.3	13.6'	00°54.7	-10.8'	56.0'
22	153°52.0	26.9	191°34.9	13.6'	01°05.4	-10.8'	56.0'
23	168°51.9	27.6	206°07.5	13.6'	01°16.2	-10.8'	55.9'
	SD.=16.2	d=-0.7		S.D.=15.3			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	06:53	08:26	10:35	12:53	15:02	16:35
N 70°	06:43	08:04	09:38	13:50	15:23	16:44
68°	06:36	07:48	09:04	14:23	15:40	16:52
66°	06:29	07:34	08:40	14:48	15:54	16:59
64°	06:23	07:23	08:21	15:06	16:05	17:05
62°	06:18	07:13	08:06	15:22	16:15	17:10
60°	06:13	07:05	07:53	15:35	16:23	17:14
N 58°	06:09	06:57	07:42	15:46	16:31	17:19
56°	06:05	06:51	07:33	15:55	16:37	17:23
54°	06:02	06:45	07:24	16:04	16:43	17:26
52°	05:58	06:39	07:17	16:11	16:49	17:30
50°	05:55	06:34	07:10	16:18	16:54	17:33
45°	05:48	06:23	06:55	16:33	17:05	17:40
N 40°	05:41	06:14	06:43	16:45	17:14	17:47
35°	05:35	06:06	06:33	16:56	17:22	17:53
30°	05:29	05:58	06:23	17:05	17:30	17:59
20°	05:18	05:45	06:08	17:21	17:44	18:10
N 10°	05:06	05:32	05:54	17:35	17:57	18:22
0°	04:54	05:19	05:41	17:48	18:10	18:35
S 10°	04:39	05:05	05:28	18:01	18:23	18:49
20°	04:22	04:50	05:13	18:16	18:39	19:07
30°	04:00	04:31	04:57	18:32	18:58	19:29
35°	03:46	04:19	04:47	18:42	19:10	19:44
40°	03:29	04:06	04:36	18:53	19:23	20:01
45°	03:07	03:49	04:23	19:06	19:40	20:23
S 50°	02:38	03:29	04:07	19:22	20:01	20:52
52°	02:23	03:19	04:00	19:30	20:11	21:08
54°	02:05	03:07	03:51	19:38	20:23	21:26
56°	01:42	02:54	03:42	19:48	20:37	21:50
58°	01:10	02:38	03:31	19:59	20:53	22:24
S 60°	▭	02:19	03:19	20:12	21:13	▭

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	–:–	00:20	02:08	15:21	15:11	15:02
N 70°	–:–	00:31	02:11	15:08	15:05	15:01
68°	–:–	00:39	02:14	14:58	15:00	15:01
66°	–:–	00:46	02:16	14:49	14:56	15:01
64°	–:–	00:52	02:18	14:42	14:52	15:01
62°	–:–	00:57	02:20	14:36	14:49	15:01
60°	–:–	01:02	02:21	14:30	14:47	15:01
N 58°	–:–	01:06	02:23	14:26	14:44	15:01
56°	–:–	01:09	02:24	14:21	14:42	15:01
54°	–:–	01:12	02:25	14:17	14:40	15:01
52°	00:03	01:15	02:26	14:14	14:38	15:01
50°	00:07	01:18	02:27	14:11	14:37	15:01
45°	00:16	01:23	02:29	14:04	14:33	15:01
N 40°	00:24	01:28	02:30	13:58	14:30	15:01
35°	00:31	01:32	02:32	13:53	14:28	15:01
30°	00:36	01:35	02:33	13:48	14:25	15:01
20°	00:46	01:42	02:35	13:40	14:21	15:01
N 10°	00:55	01:47	02:37	13:33	14:18	15:01
0°	01:03	01:52	02:39	13:27	14:14	15:00
S 10°	01:11	01:57	02:40	13:20	14:11	15:00
20°	01:20	02:02	02:42	13:13	14:07	15:00
30°	01:30	02:08	02:44	13:05	14:03	15:00
35°	01:35	02:12	02:46	13:00	14:01	15:00
40°	01:42	02:16	02:47	12:55	13:58	15:00
45°	01:49	02:20	02:49	12:49	13:55	15:00
S 50°	01:58	02:26	02:50	12:41	13:51	14:59
52°	02:02	02:28	02:51	12:37	13:49	14:59
54°	02:07	02:31	02:52	12:34	13:47	14:59
56°	02:12	02:34	02:53	12:29	13:45	14:59
58°	02:17	02:37	02:55	12:25	13:43	14:59
S 60°	02:23	02:41	02:56	12:19	13:40	14:59

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 24-26 33-15%
12	15:54	15:50	11:44	07:15	19:39	
13	15:46	15:41	11:44	08:03	20:27	
14	15:37	15:32	11:44	08:50	21:12	

November 15, 16, 17 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	54°16.2	196°50.8	S13°27.5	220°20.7	S04°45.5	198°35.6	S13°07.1	148°35.6	S22°24.8
1	69°18.7	211°50.2	28.5	235°21.7	46.1	213°37.6	07.3	163°37.8	24.8
2	84°21.2	226°49.6	29.6	250°22.7	46.7	228°39.5	07.5	178°40.0	24.8
3	99°23.6	241°49.0	·· 30.6	265°23.7	·· 47.3	243°41.5	·· 07.6	193°42.1	·· 24.9
4	114°26.1	256°48.5	31.7	280°24.7	47.9	258°43.4	07.8	208°44.3	24.9
5	129°28.6	271°47.9	32.7	295°25.7	48.5	273°45.3	08.0	223°46.5	24.9
6	144°31.0	286°47.3	S13°33.8	310°26.7	S04°49.1	288°47.3	S13°08.2	238°48.7	S22°24.9
7	159°33.5	301°46.7	34.8	325°27.8	49.8	303°49.2	08.3	253°50.9	24.9
8	174°35.9	316°46.1	35.9	340°28.8	50.4	318°51.2	08.5	268°53.0	24.9
9	189°38.4	331°45.6	·· 36.9	355°29.8	·· 51.0	333°53.1	·· 08.7	283°55.2	·· 24.9
10	204°40.9	346°45.0	38.0	10°30.8	51.6	348°55.1	08.9	298°57.4	24.9
11	219°43.3	1°44.4	39.0	25°31.8	52.2	3°57.0	09.0	313°59.6	25.0
12	234°45.8	16°43.8	S13°40.0	40°32.8	S04°52.8	18°58.9	S13°09.2	329°01.8	S22°25.0
13	249°48.3	31°43.2	41.1	55°33.8	53.4	34°00.9	09.4	344°03.9	25.0
14	264°50.7	46°42.7	42.1	70°34.8	54.1	49°02.8	09.6	359°06.1	25.0
15	279°53.2	61°42.1	·· 43.2	85°35.8	·· 54.7	64°04.8	·· 09.7	14°08.3	·· 25.0
16	294°55.7	76°41.5	44.2	100°36.8	55.3	79°06.7	09.9	29°10.5	25.0
17	309°58.1	91°40.9	45.3	115°37.8	55.9	94°08.7	10.1	44°12.6	25.0
18	325°00.6	106°40.3	S13°46.3	130°38.8	S04°56.5	109°10.6	S13°10.2	59°14.8	S22°25.0
19	340°03.0	121°39.8	47.3	145°39.8	57.1	124°12.5	10.4	74°17.0	25.1
20	355°05.5	136°39.2	48.4	160°40.8	57.7	139°14.5	10.6	89°19.2	25.1
21	10°08.0	151°38.6	·· 49.4	175°41.9	·· 58.4	154°16.4	·· 10.8	104°21.4	·· 25.1
22	25°10.4	166°38.0	50.4	190°42.9	59.0	169°18.4	10.9	119°23.5	25.1
23	40°12.9	181°37.4	51.5	205°43.9	59.6	184°20.3	11.1	134°25.7	25.1
Mer.pass.:20:20		v-0.6 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	55°15.4	196°36.8	S13°52.5	220°44.9	S05°00.2	199°22.3	S13°11.3	149°27.9	S22°25.1
1	70°17.8	211°36.2	53.6	235°45.9	00.8	214°24.2	11.4	164°30.1	25.1
2	85°20.3	226°35.7	54.6	250°46.9	01.4	229°26.1	11.6	179°32.3	25.1
3	100°22.8	241°35.1	·· 55.6	265°47.9	·· 02.0	244°28.1	·· 11.8	194°34.4	·· 25.2
4	115°25.2	256°34.5	56.7	280°48.9	02.6	259°30.0	12.0	209°36.6	25.2
5	130°27.7	271°33.9	57.7	295°49.9	03.3	274°32.0	12.1	224°38.8	25.2
6	145°30.2	286°33.3	S13°58.7	310°50.9	S05°03.9	289°33.9	S13°12.3	239°41.0	S22°25.2
7	160°32.6	301°32.7	13°59.8	325°51.9	04.5	304°35.9	12.5	254°43.1	25.2
8	175°35.1	316°32.1	14°00.8	340°52.9	05.1	319°37.8	12.7	269°45.3	25.2
9	190°37.5	331°31.5	·· 01.8	355°53.9	·· 05.7	334°39.7	·· 12.8	284°47.5	·· 25.2
10	205°40.0	346°30.9	02.8	10°54.9	06.3	349°41.7	13.0	299°49.7	25.2
11	220°42.5	1°30.4	03.9	25°55.9	06.9	4°43.6	13.2	314°51.9	25.3
12	235°44.9	16°29.8	S14°04.9	40°57.0	S05°07.5	19°45.6	S13°13.3	329°54.0	S22°25.3
13	250°47.4	31°29.2	05.9	55°58.0	08.2	34°47.5	13.5	344°56.2	25.3
14	265°49.9	46°28.6	07.0	70°59.0	08.8	49°49.5	13.7	359°58.4	25.3
15	280°52.3	61°28.0	·· 08.0	86°00.0	·· 09.4	64°51.4	·· 13.9	15°00.6	·· 25.3
16	295°54.8	76°27.4	09.0	101°01.0	10.0	79°53.3	14.0	30°02.7	25.3
17	310°57.3	91°26.8	10.0	116°02.0	10.6	94°55.3	14.2	45°04.9	25.3
18	325°59.7	106°26.2	S14°11.1	131°03.0	S05°11.2	109°57.2	S13°14.4	60°07.1	S22°25.3
19	341°02.2	121°25.6	12.1	146°04.0	11.8	124°59.2	14.5	75°09.3	25.3
20	356°04.7	136°25.0	13.1	161°05.0	12.4	140°01.1	14.7	90°11.5	25.4
21	11°07.1	151°24.4	·· 14.1	176°06.0	·· 13.1	155°03.1	·· 14.9	105°13.6	·· 25.4
22	26°09.6	166°23.8	15.2	191°07.0	13.7	170°05.0	15.1	120°15.8	25.4
23	41°12.0	181°23.2	16.2	206°08.0	14.3	185°06.9	15.2	135°18.0	25.4
Mer.pass.:20:16		v-0.6 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	56°14.5	196°22.6	S14°17.2	221°09.0	S05°14.9	200°08.9	S13°15.4	150°20.2	S22°25.4
1	71°17.0	211°22.0	18.2	236°10.0	15.5	215°10.8	15.6	165°22.3	25.4
2	86°19.4	226°21.4	19.2	251°11.0	16.1	230°12.8	15.7	180°24.5	25.4
3	101°21.9	241°20.8	·· 20.3	266°12.0	·· 16.7	245°14.7	·· 15.9	195°26.7	·· 25.4
4	116°24.4	256°20.2	21.3	281°13.0	17.3	260°16.7	16.1	210°28.9	25.5
5	131°26.8	271°19.6	22.3	296°14.1	18.0	275°18.6	16.3	225°31.0	25.5
6	146°29.3	286°19.0	S14°23.3	311°15.1	S05°18.6	290°20.6	S13°16.4	240°33.2	S22°25.5
7	161°31.8	301°18.4	24.3	326°16.1	19.2	305°22.5	16.6	255°35.4	25.5
8	176°34.2	316°17.8	25.3	341°17.1	19.8	320°24.4	16.8	270°37.6	25.5
9	191°36.7	331°17.2	·· 26.4	356°18.1	·· 20.4	335°26.4	·· 16.9	285°39.7	·· 25.5
10	206°39.1	346°16.6	27.4	11°19.1	21.0	350°28.3	17.1	300°41.9	25.5
11	221°41.6	1°16.0	28.4	26°20.1	21.6	5°30.3	17.3	315°44.1	25.5
12	236°44.1	16°15.4	S14°29.4	41°21.1	S05°22.2	20°32.2	S13°17.5	330°46.3	S22°25.6
13	251°46.5	31°14.8	30.4	56°22.1	22.8	35°34.2	17.6	345°48.4	25.6
14	266°49.0	46°14.2	31.4	71°23.1	23.5	50°36.1	17.8	0°50.6	25.6
15	281°51.5	61°13.6	·· 32.4	86°24.1	·· 24.1	65°38.0	·· 18.0	15°52.8	·· 25.6
16	296°53.9	76°13.0	33.5	101°25.1	24.7	80°40.0	18.1	30°55.0	25.6
17	311°56.4	91°12.4	34.5	116°26.1	25.3	95°41.9	18.3	45°57.1	25.6
18	326°58.9	106°11.8	S14°35.5	131°27.1	S05°25.9	110°43.9	S13°18.5	60°59.3	S22°25.6
19	342°01.3	121°11.2	36.5	146°28.1	26.5	125°45.8	18.7	76°01.5	25.6
20	357°03.8	136°10.6	37.5	161°29.1	27.1	140°47.8	18.8	91°03.7	25.7
21	12°06.3	151°10.0	·· 38.5	176°30.1	·· 27.7	155°49.7	·· 19.0	106°05.8	·· 25.7
22	27°08.7	166°09.4	39.5	191°31.1	28.3	170°51.7	19.2	121°08.0	25.7
23	42°11.2	181°08.8	40.5	206°32.1	28.9	185°53.6	19.3	136°10.2	25.7
Mer.pass.:20:12		v-0.6 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.5	-42°12.8
Schedar	349°36.6	56°38.2
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°09.0
Hamal	327°57.1	23°32.8
Polaris	315°57.6	89°20.3
Acamar	315°15.7	-40°14.2
Menkar	314°11.6	4°09.5
Mirfak	308°35.5	49°55.3
Aldebaran	290°45.6	16°32.5
Rigel	281°08.9	-8°11.0
Capella	280°29.6	46°00.7
Bellatrix	278°28.5	6°21.8
Elnath	278°08.5	28°37.1
Alnilam	275°43.1	-1°11.6
Betelgeuse	270°57.8	7°24.5
Canopus	263°54.4	-52°42.3
Sirius	258°30.9	-16°44.5
Adhara	255°09.9	-28°59.7
Procyon	244°56.5	5°10.7
Pollux	243°24.0	27°58.8
Avior	234°16.5	-59°33.8
Suhail	222°50.2	-43°30.1
Miaplacidus	221°38.8	-69°47.1
Alphard	217°53.2	-8°44.1
Regulus	207°40.4	11°52.8
Dubhe	193°48.4	61°39.1
Denebola	182°30.8	14°28.4
Gienah	175°49.5	-17°38.2
Acrux	173°06.4	-63°11.5
Gacrux	171°57.9	-57°12.4
Alioth	166°18.6	55°51.7
Spica	158°28.4	-11°15.0
Alkaid	152°57.1	49°13.5
Hadar	148°44.2	-60°27.2
Menkent	148°04.4	-36°27.1
Arcturus	145°53.4	19°05.6
Rigil Kent.	139°48.3	-60°54.2
Kochab	137°21.4	74°05.0
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.5
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.4
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.2	51°29.6
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.9	-56°40.7
Deneb	49°29.6	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.0	-46°52.6
Fomalhaut	15°20.6	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Nov 15 Wed	**SHA**	**Mer.pass**
Venus	142°34.5	10:53
Mars	166°04.5	09:18
Jupiter	144°19.4	10:44
Saturn	94°19.4	14:04

Nov 16 Thu	**SHA**	**Mer.pass**
Venus	141°21.5	10:54
Mars	165°29.5	09:16
Jupiter	144°06.9	10:41
Saturn	94°12.5	14:00

Nov 17 Fri	**SHA**	**Mer.pass**
Venus	140°08.1	10:55
Mars	164°54.5	09:15
Jupiter	143°54.4	10:38
Saturn	94°05.6	13:57

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2671 sec ΔT = TT-UT1 = +68.9169 sec

2017 November 15 to Nov. 17 UT

h — Sun — Moon

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°51.8	S18°28.2	220°40.2	13.7'	S01°26.9	-10.7'	55.9'
1	198°51.7	28.9	235°12.8	13.7'	01°37.7	-10.7'	55.9'
2	213°51.6	29.5	249°45.5	13.7'	01°48.4	-10.7'	55.9'
3	228°51.5	·· 30.1	264°18.2	13.7'	01°59.1	-10.7'	55.9'
4	243°51.4	30.8	278°50.9	13.7'	02°09.8	-10.7'	55.8'
5	258°51.3	31.4	293°23.6	13.7'	02°20.5	-10.7'	55.8'
6	273°51.2	S18°32.0	307°56.4	13.7'	S02°31.1	-10.6'	55.8'
7	288°51.1	32.7	322°29.1	13.7'	02°41.8	-10.6'	55.8'
8	303°51.0	33.3	337°01.9	13.8'	02°52.4	-10.6'	55.8'
9	318°50.9	·· 33.9	351°34.6	13.8'	03°03.0	-10.6'	55.7'
10	333°50.8	34.6	6°07.4	13.8'	03°13.6	-10.6'	55.7'
11	348°50.6	35.2	20°40.2	13.8'	03°24.1	-10.5'	55.7'
12	3°50.5	S18°35.8	35°13.0	13.8'	S03°34.7	-10.5'	55.7'
13	18°50.4	36.5	49°45.8	13.8'	03°45.2	-10.5'	55.7'
14	33°50.3	37.1	64°18.6	13.8'	03°55.7	-10.5'	55.6'
15	48°50.2	·· 37.7	78°51.4	13.8'	04°06.1	-10.5'	55.6'
16	63°50.1	38.4	93°24.2	13.8'	04°16.6	-10.4'	55.6'
17	78°50.0	39.0	107°57.0	13.8'	04°27.0	-10.4'	55.6'
18	93°49.9	S18°39.6	122°29.8	13.8'	S04°37.4	-10.4'	55.6'
19	108°49.8	40.2	137°02.6	13.8'	04°47.8	-10.4'	55.5'
20	123°49.6	40.9	151°35.5	13.8'	04°58.1	-10.3'	55.5'
21	138°49.5	·· 41.5	166°08.3	13.8'	05°08.4	-10.3'	55.5'
22	153°49.4	42.1	180°41.1	13.8'	05°18.7	-10.3'	55.5'
23	168°49.3	42.7	195°14.0	13.8'	05°28.9	-10.2'	55.5'
	SD.=16.2	d=-0.6		S.D.=15.2			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	183°49.2	S18°43.4	209°46.8	13.8'	S05°39.2	-10.2'	55.5'
1	198°49.1	44.0	224°19.7	13.8'	05°49.4	-10.2'	55.4'
2	213°49.0	44.6	238°52.5	13.8'	05°59.5	-10.1'	55.4'
3	228°48.9	·· 45.2	253°25.3	13.8'	06°09.7	-10.1'	55.4'
4	243°48.7	45.9	267°58.2	13.8'	06°19.7	-10.1'	55.4'
5	258°48.6	46.5	282°31.0	13.8'	06°29.8	-10.0'	55.4'
6	273°48.5	S18°47.1	297°03.8	13.8'	S06°39.8	-10.0'	55.3'
7	288°48.4	47.7	311°36.7	13.8'	06°49.8	-10.0'	55.3'
8	303°48.3	48.4	326°09.5	13.8'	06°59.8	-9.9'	55.3'
9	318°48.2	·· 49.0	340°42.3	13.8'	07°09.7	-9.9'	55.3'
10	333°48.0	49.6	355°15.1	13.8'	07°19.6	-9.9'	55.3'
11	348°47.9	50.2	9°47.9	13.8'	07°29.5	-9.8'	55.3'
12	3°47.8	S18°50.8	24°20.8	13.8'	S07°39.3	-9.8'	55.2'
13	18°47.7	51.4	38°53.6	13.8'	07°49.0	-9.8'	55.2'
14	33°47.6	52.1	53°26.3	13.8'	07°58.8	-9.7'	55.2'
15	48°47.5	·· 52.7	67°59.1	13.8'	08°08.5	-9.7'	55.2'
16	63°47.3	53.3	82°31.9	13.8'	08°18.1	-9.6'	55.2'
17	78°47.2	53.9	97°04.7	13.8'	08°27.7	-9.6'	55.2'
18	93°47.1	S18°54.5	111°37.5	13.8'	S08°37.3	-9.5'	55.1'
19	108°47.0	55.1	126°10.2	13.8'	08°46.8	-9.5'	55.1'
20	123°46.9	55.8	140°43.0	13.7'	08°56.3	-9.5'	55.1'
21	138°46.7	·· 56.4	155°15.7	13.7'	09°05.7	-9.4'	55.1'
22	153°46.6	57.0	169°48.4	13.7'	09°15.1	-9.4'	55.1'
23	168°46.5	57.6	184°21.2	13.7'	09°24.5	-9.3'	55.1'
	SD.=16.2	d=-0.6		S.D.=15.1			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	183°46.4	S18°58.2	198°53.9	13.7'	S09°33.8	-9.3'	55.0'
1	198°46.2	58.8	213°26.6	13.7'	09°43.0	-9.2'	55.0'
2	213°46.1	18°59.4	227°59.3	13.7'	09°52.2	-9.2'	55.0'
3	228°46.0	19°00.0	242°31.9	13.7'	10°01.4	-9.1'	55.0'
4	243°45.9	00.6	257°04.6	13.7'	10°10.5	-9.1'	55.0'
5	258°45.8	01.2	271°37.2	13.6'	10°19.5	-9.0'	55.0'
6	273°45.6	S19°01.9	286°09.9	13.6'	S10°28.5	-9.0'	54.9'
7	288°45.5	02.5	300°42.5	13.6'	10°37.5	-8.9'	54.9'
8	303°45.4	03.1	315°15.1	13.6'	10°46.4	-8.9'	54.9'
9	318°45.3	·· 03.7	329°47.7	13.6'	10°55.3	-8.8'	54.9'
10	333°45.1	04.3	344°20.3	13.6'	11°04.1	-8.8'	54.9'
11	348°45.0	04.9	358°52.9	13.6'	11°12.8	-8.7'	54.9'
12	3°44.9	S19°05.5	13°25.4	13.5'	S11°21.5	-8.7'	54.8'
13	18°44.7	06.1	27°58.0	13.5'	11°30.2	-8.6'	54.8'
14	33°44.6	06.7	42°30.5	13.5'	11°38.8	-8.6'	54.8'
15	48°44.5	·· 07.3	57°03.0	13.5'	11°47.3	-8.5'	54.8'
16	63°44.4	07.9	71°35.5	13.5'	11°55.8	-8.4'	54.8'
17	78°44.2	08.5	86°08.0	13.5'	12°04.2	-8.4'	54.8'
18	93°44.1	S19°09.1	100°40.5	13.5'	S12°12.5	-8.3'	54.8'
19	108°44.0	09.7	115°12.9	13.4'	12°20.8	-8.3'	54.7'
20	123°43.8	10.3	129°45.3	13.4'	12°29.1	-8.2'	54.7'
21	138°43.7	·· 10.9	144°17.7	13.4'	12°37.3	-8.2'	54.7'
22	153°43.6	11.5	158°50.1	13.4'	12°45.4	-8.1'	54.7'
23	168°43.5	12.1	173°22.5	13.4'	12°53.5	-8.0'	54.7'
	SD.=16.2	d=-0.6		S.D.=14.9			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:04	08:40	▬	▬	14:49	16:25
N 70°	06:53	08:16	09:57	13:31	15:13	16:36
68°	06:44	07:58	09:18	14:10	15:31	16:44
66°	06:37	07:43	08:51	14:37	15:46	16:52
64°	06:30	07:31	08:31	14:58	15:58	16:59
62°	06:24	07:20	08:15	15:14	16:08	17:04
60°	06:19	07:11	08:01	15:28	16:18	17:10
N 58°	06:15	07:03	07:49	15:40	16:26	17:14
56°	06:10	06:56	07:39	15:50	16:33	17:19
54°	06:06	06:50	07:30	15:59	16:39	17:22
52°	06:03	06:44	07:22	16:07	16:45	17:26
50°	05:59	06:39	07:15	16:15	16:50	17:30
45°	05:52	06:27	06:59	16:30	17:02	17:38
N 40°	05:44	06:17	06:46	16:43	17:12	17:45
35°	05:38	06:09	06:35	16:54	17:21	17:51
30°	05:32	06:01	06:26	17:03	17:29	17:58
20°	05:20	05:46	06:09	17:20	17:43	18:10
N 10°	05:07	05:33	05:55	17:35	17:57	18:22
0°	04:54	05:19	05:41	17:48	18:10	18:36
S 10°	04:39	05:05	05:27	18:02	18:25	18:51
20°	04:21	04:49	05:13	18:17	18:41	19:09
30°	03:58	04:29	04:55	18:35	19:01	19:32
35°	03:43	04:17	04:45	18:45	19:13	19:47
40°	03:25	04:03	04:34	18:57	19:27	20:05
45°	03:03	03:46	04:20	19:10	19:45	20:28
S 50°	02:32	03:24	04:03	19:27	20:07	21:00
52°	02:16	03:13	03:55	19:35	20:18	21:16
54°	01:56	03:01	03:46	19:44	20:30	21:36
56°	01:30	02:47	03:36	19:55	20:45	22:03
58°	00:52	02:30	03:25	20:06	21:02	22:44
S 60°	▭	02:09	03:12	20:20	21:23	▭

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	03:52	05:36	07:21	14:52	14:42	14:31
N 70°	03:49	05:26	07:03	14:58	14:54	14:50
68°	03:46	05:18	06:48	15:03	15:04	15:06
66°	03:44	05:11	06:37	15:06	15:12	15:19
64°	03:42	05:05	06:27	15:10	15:19	15:30
62°	03:41	05:00	06:19	15:13	15:25	15:39
60°	03:39	04:56	06:11	15:15	15:30	15:47
N 58°	03:38	04:52	06:05	15:18	15:35	15:54
56°	03:37	04:49	06:00	15:20	15:39	16:00
54°	03:36	04:46	05:55	15:21	15:43	16:05
52°	03:35	04:43	05:50	15:23	15:46	16:10
50°	03:34	04:41	05:46	15:25	15:49	16:15
45°	03:33	04:36	05:38	15:28	15:56	16:25
N 40°	03:31	04:31	05:30	15:31	16:01	16:33
35°	03:30	04:27	05:24	15:33	16:06	16:40
30°	03:29	04:24	05:19	15:35	16:10	16:46
20°	03:27	04:18	05:09	15:39	16:18	16:57
N 10°	03:25	04:13	05:01	15:42	16:24	17:07
0°	03:24	04:09	04:54	15:46	16:30	17:16
S 10°	03:22	04:04	04:46	15:49	16:37	17:24
20°	03:21	03:59	04:38	15:52	16:43	17:34
30°	03:19	03:54	04:29	15:56	16:51	17:45
35°	03:18	03:51	04:24	15:58	16:55	17:51
40°	03:17	03:47	04:18	16:00	17:00	17:59
45°	03:16	03:43	04:11	16:03	17:06	18:07
S 50°	03:14	03:38	04:03	16:06	17:12	18:17
52°	03:14	03:36	03:59	16:08	17:16	18:22
54°	03:13	03:33	03:55	16:10	17:19	18:27
56°	03:12	03:31	03:51	16:12	17:23	18:33
58°	03:11	03:28	03:46	16:14	17:27	18:39
S 60°	03:10	03:24	03:40	16:16	17:32	18:47

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 27-29 9-1%
15	15:27	15:22	11:45	09:35	21:57	
16	15:17	15:11	11:45	10:20	22:42	
17	15:05	14:59	11:45	11:05	23:27	

November 18, 19, 20 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	57°13.6	196°08.1	S14°41.5	221°33.2	S05°29.6	200°55.5	S13°19.5	151°12.4	S22°25.7
1	72°16.1	211°07.5	42.5	236°34.2	30.2	215°57.5	19.7	166°14.5	25.7
2	87°18.6	226°06.9	43.5	251°35.2	30.8	230°59.4	19.9	181°16.7	25.7
3	102°21.0	241°06.3	·· 44.5	266°36.2	·· 31.4	246°01.4	·· 20.0	196°18.9	·· 25.7
4	117°23.5	256°05.7	45.5	281°37.2	32.0	261°03.3	20.2	211°21.1	25.7
5	132°26.0	271°05.1	46.5	296°38.2	32.6	276°05.3	20.4	226°23.2	25.8
6	147°28.4	286°04.5	S14°47.5	311°39.2	S05°33.2	291°07.2	S13°20.5	241°25.4	S22°25.8
7	162°30.9	301°03.9	48.6	326°40.2	33.8	306°09.2	20.7	256°27.6	25.8
8	177°33.4	316°03.3	49.6	341°41.2	34.4	321°11.1	20.9	271°29.8	25.8
9	192°35.8	331°02.6	·· 50.6	356°42.2	·· 35.0	336°13.0	·· 21.0	286°31.9	·· 25.8
10	207°38.3	346°02.0	51.6	11°43.2	35.7	351°15.0	21.2	301°34.1	25.8
11	222°40.8	1°01.4	52.6	26°44.2	36.3	6°16.9	21.4	316°36.3	25.8
12	237°43.2	16°00.8	S14°53.6	41°45.2	S05°36.9	21°18.9	S13°21.6	331°38.5	S22°25.8
13	252°45.7	31°00.2	54.5	56°46.2	37.5	36°20.8	21.7	346°40.6	25.9
14	267°48.1	45°59.6	55.5	71°47.2	38.1	51°22.8	21.9	1°42.8	25.9
15	282°50.6	60°59.0	·· 56.5	86°48.2	·· 38.7	66°24.7	·· 22.1	16°45.0	·· 25.9
16	297°53.1	75°58.3	57.5	101°49.2	39.3	81°26.7	22.2	31°47.2	25.9
17	312°55.5	90°57.7	58.5	116°50.2	39.9	96°28.6	22.4	46°49.3	25.9
18	327°58.0	105°57.1	S14°59.5	131°51.2	S05°40.5	111°30.5	S13°22.6	61°51.5	S22°25.9
19	343°00.5	120°56.5	15°00.5	146°52.2	41.1	126°32.5	22.7	76°53.7	25.9
20	358°02.9	135°55.9	01.5	161°53.2	41.7	141°34.4	22.9	91°55.9	25.9
21	13°05.4	150°55.2	·· 02.5	176°54.2	·· 42.4	156°36.4	·· 23.1	106°58.0	·· 25.9
22	28°07.9	165°54.6	03.5	191°55.2	43.0	171°38.3	23.3	122°00.2	26.0
23	43°10.3	180°54.0	04.5	206°56.2	43.6	186°40.3	23.4	137°02.4	26.0
Mer.pass.:20:08		v-0.6 d-1.0 m-3.8		v1.0 d-0.6 m1.8		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	58°12.8	195°53.4	S15°05.5	221°57.3	S05°44.2	201°42.2	S13°23.6	152°04.5	S22°26.0
1	73°15.2	210°52.8	06.5	236°58.3	44.8	216°44.2	23.8	167°06.7	26.0
2	88°17.7	225°52.1	07.5	251°59.3	45.4	231°46.1	23.9	182°08.9	26.0
3	103°20.2	240°51.5	·· 08.5	267°00.3	·· 46.0	246°48.1	·· 24.1	197°11.1	·· 26.0
4	118°22.6	255°50.9	09.4	282°01.3	46.6	261°50.0	24.3	212°13.2	26.0
5	133°25.1	270°50.3	10.4	297°02.3	47.2	276°51.9	24.4	227°15.4	26.0
6	148°27.6	285°49.7	S15°11.4	312°03.3	S05°47.8	291°53.9	S13°24.6	242°17.6	S22°26.1
7	163°30.0	300°49.0	12.4	327°04.3	48.4	306°55.8	24.8	257°19.8	26.1
8	178°32.5	315°48.4	13.4	342°05.3	49.0	321°57.8	25.0	272°21.9	26.1
9	193°35.0	330°47.8	·· 14.4	357°06.3	·· 49.6	336°59.7	·· 25.1	287°24.1	·· 26.1
10	208°37.4	345°47.2	15.4	12°07.3	50.3	352°01.7	25.3	302°26.3	26.1
11	223°39.9	0°46.5	16.3	27°08.3	50.9	7°03.6	25.5	317°28.4	26.1
12	238°42.4	15°45.9	S15°17.3	42°09.3	S05°51.5	22°05.6	S13°25.6	332°30.6	S22°26.1
13	253°44.8	30°45.3	18.3	57°10.3	52.1	37°07.5	25.8	347°32.8	26.1
14	268°47.3	45°44.6	19.3	72°11.3	52.7	52°09.5	26.0	2°35.0	26.1
15	283°49.7	60°44.0	·· 20.3	87°12.3	·· 53.3	67°11.4	·· 26.1	17°37.1	·· 26.2
16	298°52.2	75°43.4	21.2	102°13.3	53.9	82°13.3	26.3	32°39.3	26.2
17	313°54.7	90°42.8	22.2	117°14.3	54.5	97°15.3	26.5	47°41.5	26.2
18	328°57.1	105°42.1	S15°23.2	132°15.3	S05°55.1	112°17.2	S13°26.6	62°43.6	S22°26.2
19	343°59.6	120°41.5	24.2	147°16.3	55.7	127°19.2	26.8	77°45.8	26.2
20	359°02.1	135°40.9	25.2	162°17.3	56.3	142°21.1	27.0	92°48.0	26.2
21	14°04.5	150°40.2	·· 26.1	177°18.3	·· 56.9	157°23.1	·· 27.2	107°50.2	·· 26.2
22	29°07.0	165°39.6	27.1	192°19.3	57.5	172°25.0	27.3	122°52.3	26.2
23	44°09.5	180°39.0	28.1	207°20.3	58.2	187°27.0	27.5	137°54.5	26.2
Mer.pass.:20:04		v-0.6 d-1.0 m-3.8		v1.0 d-0.6 m1.7		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	59°11.9	195°38.3	S15°29.1	222°21.3	S05°58.8	202°28.9	S13°27.7	152°56.7	S22°26.3
1	74°14.4	210°37.7	30.0	237°22.3	05°59.4	217°30.9	27.8	167°58.8	26.3
2	89°16.9	225°37.1	31.0	252°23.3	06°00.0	232°32.8	28.0	183°01.0	26.3
3	104°19.3	240°36.4	·· 32.0	267°24.3	·· 00.6	247°34.8	·· 28.2	198°03.2	·· 26.3
4	119°21.8	255°35.8	32.9	282°25.3	01.2	262°36.7	28.3	213°05.4	26.3
5	134°24.2	270°35.2	33.9	297°26.3	01.8	277°38.6	28.5	228°07.5	26.3
6	149°26.7	285°34.5	S15°34.9	312°27.3	S06°02.4	292°40.6	S13°28.7	243°09.7	S22°26.3
7	164°29.2	300°33.9	35.9	327°28.3	03.0	307°42.5	28.8	258°11.9	26.3
8	179°31.6	315°33.3	36.8	342°29.3	03.6	322°44.5	29.0	273°14.0	26.4
9	194°34.1	330°32.6	·· 37.8	357°30.3	·· 04.2	337°46.4	·· 29.2	288°16.2	·· 26.4
10	209°36.6	345°32.0	38.8	12°31.4	04.8	352°48.4	29.3	303°18.4	26.4
11	224°39.0	0°31.3	39.7	27°32.4	05.4	7°50.3	29.5	318°20.6	26.4
12	239°41.5	15°30.7	S15°40.7	42°33.4	S06°06.0	22°52.3	S13°29.7	333°22.7	S22°26.4
13	254°44.0	30°30.1	41.7	57°34.4	06.6	37°54.2	29.9	348°24.9	26.4
14	269°46.4	45°29.4	42.6	72°35.4	07.2	52°56.2	30.0	3°27.1	26.4
15	284°48.9	60°28.8	·· 43.6	87°36.4	·· 07.8	67°58.1	·· 30.2	18°29.2	·· 26.4
16	299°51.4	75°28.1	44.6	102°37.4	08.5	83°00.1	30.4	33°31.4	26.4
17	314°53.8	90°27.5	45.5	117°38.4	09.1	98°02.0	30.5	48°33.6	26.5
18	329°56.3	105°26.9	S15°46.5	132°39.4	S06°09.7	113°03.9	S13°30.7	63°35.8	S22°26.5
19	344°58.7	120°26.2	47.4	147°40.4	10.3	128°05.9	30.9	78°37.9	26.5
20	0°01.2	135°25.6	48.4	162°41.4	10.9	143°07.8	31.0	93°40.1	26.5
21	15°03.7	150°24.9	·· 49.4	177°42.4	·· 11.5	158°09.8	·· 31.2	108°42.3	·· 26.5
22	30°06.1	165°24.3	50.3	192°43.4	12.1	173°11.7	31.4	123°44.4	26.5
23	45°08.6	180°23.7	51.3	207°44.4	12.7	188°13.7	31.5	138°46.6	26.5
Mer.pass.:20:00		v-0.6 d-1.0 m-3.8		v1.0 d-0.6 m1.7		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.6	-42°12.8
Schedar	349°36.6	56°38.3
Diphda	348°52.7	-17°53.4
Achernar	335°24.1	-57°09.0
Hamal	327°57.1	23°32.8
Polaris	315°57.5	89°20.3
Acamar	315°15.7	-40°14.2
Menkar	314°11.6	4°09.5
Mirfak	308°35.5	49°55.3
Aldebaran	290°45.6	16°32.5
Rigel	281°08.9	-8°11.0
Capella	280°29.6	46°00.7
Bellatrix	278°28.5	6°21.8
Elnath	278°08.5	28°37.1
Alnilam	275°43.1	-1°11.6
Betelgeuse	270°57.8	7°24.5
Canopus	263°54.4	-52°42.3
Sirius	258°30.8	-16°44.5
Adhara	255°09.9	-28°59.8
Procyon	244°56.5	5°10.6
Pollux	243°23.9	27°58.8
Avior	234°16.5	-59°33.8
Suhail	222°50.1	-43°30.1
Miaplacidus	221°38.8	-69°47.1
Alphard	217°53.1	-8°44.1
Regulus	207°40.4	11°52.8
Dubhe	193°48.4	61°39.1
Denebola	182°30.8	14°28.4
Gienah	175°49.4	-17°38.2
Acrux	173°06.3	-63°11.5
Gacrux	171°57.9	-57°12.4
Alioth	166°18.6	55°51.7
Spica	158°28.4	-11°15.0
Alkaid	152°57.1	49°13.5
Hadar	148°44.2	-60°27.2
Menkent	148°04.4	-36°27.1
Arcturus	145°53.4	19°05.6
Rigil Kent.	139°48.3	-60°54.2
Kochab	137°21.4	74°05.0
Zuben'ubi	137°02.5	-16°06.7
Alphecca	126°08.9	26°39.5
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.4
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.2	51°29.5
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.9	-56°40.7
Deneb	49°29.6	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.1	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Nov 18 Sat	SHA	Mer.pass
Venus	138°54.5	10:56
Mars	164°19.5	09:13
Jupiter	143°41.9	10:35
Saturn	93°58.7	13:53

Nov 19 Sun	SHA	Mer.pass
Venus	137°40.6	10:57
Mars	163°44.5	09:12
Jupiter	143°29.4	10:32
Saturn	93°51.8	13:50

Nov 20 Mon	SHA	Mer.pass
Venus	136°26.4	10:58
Mars	163°09.4	09:10
Jupiter	143°17.0	10:29
Saturn	93°44.8	13:46

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2636 sec ΔT = TT-UT1 = +68.9204 sec

2017 November 18 to Nov. 20 UT

h

Sun

Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°43.3	S19°12.7	187°54.9	13.4'	S13°01.5	-8.0'	54.7'
1	198°43.2	13.3	202°27.2	13.3'	13°09.4	-7.9'	54.7'
2	213°43.1	13.9	216°59.6	13.3'	13°17.3	-7.9'	54.6'
3	228°42.9	·· 14.5	231°31.9	13.3'	13°25.1	-7.8'	54.6'
4	243°42.8	15.1	246°04.2	13.3'	13°32.9	-7.7'	54.6'
5	258°42.7	15.7	260°36.4	13.3'	13°40.6	-7.7'	54.6'
6	273°42.5	S19°16.3	275°08.7	13.2'	S13°48.2	-7.6'	54.6'
7	288°42.4	16.8	289°40.9	13.2'	13°55.8	-7.5'	54.6'
8	303°42.3	17.4	304°13.1	13.2'	14°03.3	-7.5'	54.6'
9	318°42.1	·· 18.0	318°45.3	13.2'	14°10.7	-7.4'	54.6'
10	333°42.0	18.6	333°17.5	13.2'	14°18.1	-7.3'	54.5'
11	348°41.9	19.2	347°49.7	13.2'	14°25.4	-7.3'	54.5'
12	3°41.7	S19°19.8	2°21.8	13.1'	S14°32.6	-7.2'	54.5'
13	18°41.6	20.4	16°53.9	13.1'	14°39.8	-7.1'	54.5'
14	33°41.5	21.0	31°26.0	13.1'	14°46.9	-7.1'	54.5'
15	48°41.3	·· 21.6	45°58.1	13.1'	14°53.9	-7.0'	54.5'
16	63°41.2	22.2	60°30.2	13.1'	15°00.9	-6.9'	54.5'
17	78°41.0	22.7	75°02.2	13.0'	15°07.7	-6.9'	54.5'
18	93°40.9	S19°23.3	89°34.3	13.0'	S15°14.6	-6.8'	54.4'
19	108°40.8	23.9	104°06.3	13.0'	15°21.3	-6.7'	54.4'
20	123°40.6	24.5	118°38.3	13.0'	15°28.0	-6.6'	54.4'
21	138°40.5	·· 25.1	133°10.2	13.0'	15°34.6	-6.6'	54.4'
22	153°40.4	25.7	147°42.2	12.9'	15°41.1	-6.5'	54.4'
23	168°40.2	26.2	162°14.1	12.9'	15°47.6	-6.4'	54.4'
	SD.=16.2	d=-0.6	S.D.=14.9				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°40.1	S19°26.8	176°46.0	12.9'	S15°54.0	-6.3'	54.4'
1	198°39.9	27.4	191°17.9	12.9'	16°00.3	-6.3'	54.4'
2	213°39.8	28.0	205°49.8	12.9'	16°06.5	-6.2'	54.4'
3	228°39.7	·· 28.6	220°21.6	12.8'	16°12.7	-6.1'	54.3'
4	243°39.5	29.2	234°53.5	12.8'	16°18.8	-6.1'	54.3'
5	258°39.4	29.7	249°25.3	12.8'	16°24.8	-6.0'	54.3'
6	273°39.2	S19°30.3	263°57.1	12.8'	S16°30.7	-5.9'	54.3'
7	288°39.1	30.9	278°28.8	12.8'	16°36.6	-5.8'	54.3'
8	303°39.0	31.5	293°00.6	12.7'	16°42.4	-5.7'	54.3'
9	318°38.8	·· 32.0	307°32.3	12.7'	16°48.1	-5.7'	54.3'
10	333°38.7	32.6	322°04.1	12.7'	16°53.7	-5.6'	54.3'
11	348°38.5	33.2	336°35.8	12.7'	16°59.3	-5.5'	54.3'
12	3°38.4	S19°33.8	351°07.5	12.7'	S17°04.7	-5.4'	54.3'
13	18°38.2	34.3	5°39.1	12.7'	17°10.1	-5.4'	54.2'
14	33°38.1	34.9	20°10.8	12.6'	17°15.4	-5.3'	54.2'
15	48°37.9	·· 35.5	34°42.4	12.6'	17°20.7	-5.2'	54.2'
16	63°37.8	36.1	49°14.0	12.6'	17°25.8	-5.1'	54.2'
17	78°37.7	36.6	63°45.6	12.6'	17°30.9	-5.0'	54.2'
18	93°37.5	S19°37.2	78°17.2	12.6'	S17°35.9	-5.0'	54.2'
19	108°37.4	37.8	92°48.7	12.6'	17°40.8	-4.9'	54.2'
20	123°37.2	38.4	107°20.3	12.5'	17°45.6	-4.8'	54.2'
21	138°37.1	·· 38.9	121°51.8	12.5'	17°50.4	-4.7'	54.2'
22	153°36.9	39.5	136°23.3	12.5'	17°55.0	-4.6'	54.2'
23	168°36.8	40.1	150°54.8	12.5'	17°59.6	-4.5'	54.2'
	SD.=16.2	d=-0.6	S.D.=14.8				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	183°36.6	S19°40.6	165°26.3	12.5'	S18°04.1	-4.5'	54.2'
1	198°36.5	41.2	179°57.8	12.5'	18°08.5	-4.4'	54.1'
2	213°36.3	41.8	194°29.2	12.4'	18°12.9	-4.3'	54.1'
3	228°36.2	·· 42.3	209°00.6	12.4'	18°17.1	-4.2'	54.1'
4	243°36.0	42.9	223°32.1	12.4'	18°21.3	-4.1'	54.1'
5	258°35.9	43.5	238°03.5	12.4'	18°25.3	-4.0'	54.1'
6	273°35.7	S19°44.0	252°34.8	12.4'	S18°29.3	-3.9'	54.1'
7	288°35.6	44.6	267°06.2	12.4'	18°33.2	-3.9'	54.1'
8	303°35.4	45.1	281°37.6	12.4'	18°37.1	-3.8'	54.1'
9	318°35.3	·· 45.7	296°08.9	12.3'	18°40.8	-3.7'	54.1'
10	333°35.1	46.3	310°40.2	12.3'	18°44.4	-3.6'	54.1'
11	348°35.0	46.8	325°11.6	12.3'	18°48.0	-3.5'	54.1'
12	3°34.8	S19°47.4	339°42.9	12.3'	S18°51.5	-3.4'	54.1'
13	18°34.7	47.9	354°14.2	12.3'	18°54.9	-3.3'	54.1'
14	33°34.5	48.5	8°45.4	12.3'	18°58.2	-3.3'	54.1'
15	48°34.4	·· 49.1	23°16.7	12.3'	19°01.4	-3.2'	54.1'
16	63°34.2	49.6	37°48.0	12.3'	19°04.5	-3.1'	54.1'
17	78°34.1	50.2	52°19.2	12.2'	19°07.6	-3.0'	54.0'
18	93°33.9	S19°50.7	66°50.4	12.2'	S19°10.5	-2.9'	54.0'
19	108°33.8	51.3	81°21.7	12.2'	19°13.4	-2.8'	54.0'
20	123°33.6	51.8	95°52.9	12.2'	19°16.1	-2.7'	54.0'
21	138°33.4	·· 52.4	110°24.1	12.2'	19°18.8	-2.6'	54.0'
22	153°33.3	53.0	124°55.3	12.2'	19°21.4	-2.6'	54.0'
23	168°33.1	53.5	139°26.5	12.2'	19°23.9	-2.5'	54.0'
	SD.=16.2	d=-0.6	S.D.=14.7				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:14	08:54	▬	▬	14:36	16:16
N 70°	07:02	08:28	10:19	13:11	15:02	16:28
68°	06:52	08:08	09:33	13:57	15:22	16:37
66°	06:44	07:52	09:03	14:27	15:38	16:46
64°	06:37	07:39	08:41	14:50	15:52	16:53
62°	06:31	07:27	08:23	15:07	16:03	16:59
60°	06:25	07:18	08:08	15:22	16:12	17:05
N 58°	06:20	07:09	07:56	15:35	16:21	17:10
56°	06:15	07:02	07:45	15:45	16:28	17:15
54°	06:11	06:55	07:35	15:55	16:35	17:19
52°	06:07	06:49	07:27	16:03	16:41	17:23
50°	06:04	06:43	07:19	16:11	16:47	17:27
45°	05:55	06:31	07:03	16:27	16:59	17:35
N 40°	05:48	06:20	06:50	16:41	17:10	17:43
35°	05:41	06:11	06:38	16:52	17:19	17:50
30°	05:34	06:03	06:28	17:02	17:28	17:57
20°	05:21	05:48	06:11	17:19	17:43	18:10
N 10°	05:08	05:34	05:56	17:35	17:57	18:23
0°	04:54	05:20	05:42	17:49	18:11	18:37
S 10°	04:39	05:05	05:27	18:04	18:26	18:52
20°	04:20	04:48	05:12	18:19	18:43	19:11
30°	03:56	04:28	04:54	18:37	19:04	19:35
35°	03:41	04:15	04:43	18:48	19:16	19:51
40°	03:22	04:01	04:31	19:00	19:31	20:09
45°	02:58	03:43	04:17	19:14	19:49	20:34
S 50°	02:26	03:20	03:59	19:32	20:12	21:07
52°	02:09	03:08	03:51	19:41	20:24	21:24
54°	01:47	02:55	03:42	19:50	20:37	21:46
56°	01:19	02:40	03:31	20:01	20:52	22:16
58°	00:30	02:22	03:19	20:13	21:11	23:11
S 60°	▭	01:59	03:05	20:27	21:34	▭

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	09:12	11:19	▬	14:15	13:44	▬
N 70°	08:41	10:21	12:04	14:47	14:43	14:38
68°	08:19	09:47	11:11	15:10	15:17	15:31
66°	08:01	09:23	10:39	15:28	15:42	16:04
64°	07:47	09:04	10:15	15:43	16:02	16:28
62°	07:35	08:49	09:57	15:56	16:18	16:47
60°	07:25	08:36	09:41	16:07	16:31	17:02
N 58°	07:16	08:25	09:28	16:16	16:42	17:15
56°	07:09	08:15	09:17	16:24	16:52	17:27
54°	07:02	08:07	09:07	16:31	17:01	17:37
52°	06:56	07:59	08:59	16:38	17:09	17:46
50°	06:50	07:52	08:51	16:44	17:16	17:54
45°	06:38	07:38	08:34	16:56	17:32	18:11
N 40°	06:29	07:26	08:20	17:07	17:44	18:25
35°	06:20	07:15	08:09	17:16	17:55	18:37
30°	06:13	07:06	07:59	17:24	18:04	18:47
20°	06:00	06:51	07:41	17:38	18:21	19:05
N 10°	05:49	06:38	07:26	17:50	18:35	19:21
0°	05:39	06:25	07:12	18:01	18:48	19:35
S 10°	05:29	06:13	06:58	18:13	19:01	19:50
20°	05:18	06:00	06:43	18:25	19:16	20:05
30°	05:06	05:45	06:26	18:39	19:32	20:23
35°	04:59	05:36	06:16	18:47	19:41	20:34
40°	04:51	05:26	06:05	18:56	19:52	20:46
45°	04:41	05:15	05:52	19:07	20:05	21:00
S 50°	04:30	05:01	05:36	19:20	20:21	21:17
52°	04:25	04:54	05:28	19:26	20:28	21:25
54°	04:19	04:47	05:20	19:33	20:36	21:34
56°	04:13	04:39	05:10	19:41	20:45	21:45
58°	04:06	04:30	05:00	19:49	20:56	21:56
S 60°	03:58	04:20	04:47	19:59	21:07	22:10

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 0-2 0-4%
18	14:53	14:47	11:45	11:50	–:–	
19	14:40	14:34	11:45	12:37	00:13	
20	14:27	14:19	11:46	13:24	01:00	

November 21, 22, 23 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	60°11.1	195°23.0	S15°52.2	222°45.4	S06°13.3	203°15.6	S13°31.7	153°48.8	S22°26.5
1	75°13.5	210°22.4	53.2	237°46.4	13.9	218°17.6	31.9	168°50.9	26.5
2	90°16.0	225°21.7	54.2	252°47.4	14.5	233°19.5	32.0	183°53.1	26.6
3	105°18.5	240°21.1	·· 55.1	267°48.4	·· 15.1	248°21.5	·· 32.2	198°55.3	·· 26.6
4	120°20.9	255°20.4	56.1	282°49.4	15.7	263°23.4	32.4	213°57.4	26.6
5	135°23.4	270°19.8	57.0	297°50.4	16.3	278°25.4	32.5	228°59.6	26.6
6	150°25.9	285°19.1	S15°58.0	312°51.4	S06°16.9	293°27.3	S13°32.7	244°01.8	S22°26.6
7	165°28.3	300°18.5	58.9	327°52.4	17.5	308°29.3	32.9	259°04.0	26.6
8	180°30.8	315°17.8	15°59.9	342°53.4	18.1	323°31.2	33.0	274°06.1	26.6
9	195°33.2	330°17.2	16°00.8	357°54.4	·· 18.7	338°33.2	·· 33.2	289°08.3	·· 26.6
10	210°35.7	345°16.5	01.8	12°55.4	19.3	353°35.1	33.4	304°10.5	26.6
11	225°38.2	0°15.9	02.7	27°56.4	19.9	8°37.1	33.5	319°12.6	26.7
12	240°40.6	15°15.2	S16°03.7	42°57.4	S06°20.5	23°39.0	S13°33.7	334°14.8	S22°26.7
13	255°43.1	30°14.6	04.6	57°58.4	21.2	38°40.9	33.9	349°17.0	26.7
14	270°45.6	45°13.9	05.6	72°59.4	21.8	53°42.9	34.0	4°19.1	26.7
15	285°48.0	60°13.3	·· 06.5	88°00.4	·· 22.4	68°44.8	·· 34.2	19°21.3	·· 26.7
16	300°50.5	75°12.6	07.5	103°01.4	23.0	83°46.8	34.4	34°23.5	26.7
17	315°53.0	90°12.0	08.4	118°02.4	23.6	98°48.7	34.5	49°25.6	26.7
18	330°55.4	105°11.3	S16°09.4	133°03.4	S06°24.2	113°50.7	S13°34.7	64°27.8	S22°26.7
19	345°57.9	120°10.7	10.3	148°04.4	24.8	128°52.6	34.9	79°30.0	26.7
20	1°00.3	135°10.0	11.2	163°05.4	25.4	143°54.6	35.1	94°32.1	26.8
21	16°02.8	150°09.3	·· 12.2	178°06.4	·· 26.0	158°56.5	·· 35.2	109°34.3	·· 26.8
22	31°05.3	165°08.7	13.1	193°07.4	26.6	173°58.5	35.4	124°36.5	26.8
23	46°07.7	180°08.0	14.1	208°08.4	27.2	189°00.4	35.6	139°38.7	26.8
Mer.pass.:19:56		v-0.6 d-1.0 m-3.8		v1.0 d-0.6 m1.7		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	61°10.2	195°07.4	S16°15.0	223°09.4	S06°27.8	204°02.4	S13°35.7	154°40.8	S22°26.8
1	76°12.7	210°06.7	15.9	238°10.4	28.4	219°04.3	35.9	169°43.0	26.8
2	91°15.1	225°06.1	16.9	253°11.4	29.0	234°06.3	36.1	184°45.2	26.8
3	106°17.6	240°05.4	·· 17.8	268°12.4	·· 29.6	249°08.2	·· 36.2	199°47.3	·· 26.8
4	121°20.1	255°04.7	18.8	283°13.4	30.2	264°10.2	36.4	214°49.5	26.8
5	136°22.5	270°04.1	19.7	298°14.4	30.8	279°12.1	36.6	229°51.7	26.9
6	151°25.0	285°03.4	S16°20.6	313°15.4	S06°31.4	294°14.1	S13°36.7	244°53.8	S22°26.9
7	166°27.5	300°02.8	21.6	328°16.4	32.0	309°16.0	36.9	259°56.0	26.9
8	181°29.9	315°02.1	22.5	343°17.4	32.6	324°18.0	37.1	274°58.2	26.9
9	196°32.4	330°01.4	·· 23.4	358°18.4	·· 33.2	339°19.9	·· 37.2	290°00.3	·· 26.9
10	211°34.8	345°00.8	24.4	13°19.4	33.8	354°21.9	37.4	305°02.5	26.9
11	226°37.3	0°00.1	25.3	28°20.4	34.4	9°23.8	37.6	320°04.7	26.9
12	241°39.8	14°59.5	S16°26.2	43°21.4	S06°35.0	24°25.8	S13°37.7	335°06.8	S22°26.9
13	256°42.2	29°58.8	27.2	58°22.4	35.6	39°27.7	37.9	350°09.0	26.9
14	271°44.7	44°58.1	28.1	73°23.4	36.2	54°29.6	38.1	5°11.2	27.0
15	286°47.2	59°57.5	·· 29.0	88°24.4	·· 36.8	69°31.6	·· 38.2	20°13.3	·· 27.0
16	301°49.6	74°56.8	30.0	103°25.4	37.4	84°33.5	38.4	35°15.5	27.0
17	316°52.1	89°56.1	30.9	118°26.4	38.0	99°35.5	38.6	50°17.7	27.0
18	331°54.6	104°55.5	S16°31.8	133°27.4	S06°38.6	114°37.4	S13°38.7	65°19.8	S22°27.0
19	346°57.0	119°54.8	32.7	148°28.4	39.2	129°39.4	38.9	80°22.0	27.0
20	1°59.5	134°54.1	33.7	163°29.4	39.8	144°41.3	39.0	95°24.2	27.0
21	17°02.0	149°53.5	·· 34.6	178°30.4	·· 40.4	159°43.3	·· 39.2	110°26.3	·· 27.0
22	32°04.4	164°52.8	35.5	193°31.4	41.0	174°45.2	39.4	125°28.5	27.0
23	47°06.9	179°52.1	36.4	208°32.4	41.6	189°47.2	39.5	140°30.7	27.1
Mer.pass.:19:52		v-0.7 d-0.9 m-3.8		v1.0 d-0.6 m1.7		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	62°09.3	194°51.5	S16°37.4	223°33.4	S06°42.2	204°49.1	S13°39.7	155°32.8	S22°27.1
1	77°11.8	209°50.8	38.3	238°34.4	42.8	219°51.1	39.9	170°35.0	27.1
2	92°14.3	224°50.1	39.2	253°35.4	43.4	234°53.0	40.0	185°37.2	27.1
3	107°16.7	239°49.5	·· 40.1	268°36.4	·· 44.0	249°55.0	·· 40.2	200°39.3	·· 27.1
4	122°19.2	254°48.8	41.0	283°37.4	44.6	264°56.9	40.4	215°41.5	27.1
5	137°21.7	269°48.1	42.0	298°38.4	45.2	279°58.9	40.5	230°43.7	27.1
6	152°24.1	284°47.4	S16°42.9	313°39.4	S06°45.8	295°00.8	S13°40.7	245°45.8	S22°27.1
7	167°26.6	299°46.8	43.8	328°40.4	46.4	310°02.8	40.9	260°48.0	27.1
8	182°29.1	314°46.1	44.7	343°41.4	47.0	325°04.7	41.0	275°50.2	27.1
9	197°31.5	329°45.4	·· 45.6	358°42.4	·· 47.6	340°06.7	·· 41.2	290°52.3	·· 27.2
10	212°34.0	344°44.7	46.5	13°43.4	48.2	355°08.6	41.4	305°54.5	27.2
11	227°36.5	359°44.1	47.5	28°44.4	48.8	10°10.6	41.5	320°56.7	27.2
12	242°38.9	14°43.4	S16°48.4	43°45.4	S06°49.4	25°12.5	S13°41.7	335°58.8	S22°27.2
13	257°41.4	29°42.7	49.3	58°46.4	50.0	40°14.5	41.9	351°01.0	27.2
14	272°43.8	44°42.0	50.2	73°47.4	50.6	55°16.4	42.0	6°03.2	27.2
15	287°46.3	59°41.4	·· 51.1	88°48.4	·· 51.2	70°18.4	·· 42.2	21°05.3	·· 27.2
16	302°48.8	74°40.7	52.0	103°49.4	51.8	85°20.3	42.4	36°07.5	27.2
17	317°51.2	89°40.0	52.9	118°50.4	52.4	100°22.3	42.5	51°09.7	27.2
18	332°53.7	104°39.3	S16°53.8	133°51.4	S06°53.0	115°24.2	S13°42.7	66°11.8	S22°27.3
19	347°56.2	119°38.6	54.7	148°52.4	53.6	130°26.2	42.9	81°14.0	27.3
20	2°58.6	134°38.0	55.6	163°53.4	54.2	145°28.1	43.0	96°16.2	27.3
21	18°01.1	149°37.3	·· 56.6	178°54.4	·· 54.8	160°30.1	·· 43.2	111°18.3	·· 27.3
22	33°03.6	164°36.6	57.5	193°55.4	55.4	175°32.0	43.4	126°20.5	27.3
23	48°06.0	179°35.9	58.4	208°56.4	56.0	190°34.0	43.5	141°22.7	27.3
Mer.pass.:19:48		v-0.7 d-0.9 m-3.8		v1.0 d-0.6 m1.7		v1.9 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.6	-42°12.8
Schedar	349°36.7	56°38.3
Diphda	348°52.7	-17°53.4
Achernar	335°24.2	-57°09.0
Hamal	327°57.1	23°32.8
Polaris	315°57.5	89°20.3
Acamar	315°15.7	-40°14.2
Menkar	314°11.6	4°09.5
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.9	-8°11.0
Capella	280°29.6	46°00.7
Bellatrix	278°28.5	6°21.8
Elnath	278°08.5	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.8	7°24.5
Canopus	263°54.4	-52°42.3
Sirius	258°30.8	-16°44.5
Adhara	255°09.9	-28°59.8
Procyon	244°56.4	5°10.6
Pollux	243°23.9	27°58.8
Avior	234°16.5	-59°33.8
Suhail	222°50.1	-43°30.1
Miaplacidus	221°38.7	-69°47.2
Alphard	217°53.1	-8°44.1
Regulus	207°40.4	11°52.8
Dubhe	193°48.4	61°39.0
Denebola	182°30.8	14°28.4
Gienah	175°49.4	-17°38.2
Acrux	173°06.3	-63°11.5
Gacrux	171°57.8	-57°12.4
Alioth	166°18.6	55°51.7
Spica	158°28.4	-11°15.0
Alkaid	152°57.0	49°13.5
Hadar	148°44.1	-60°27.2
Menkent	148°04.4	-36°27.1
Arcturus	145°53.4	19°05.5
Rigil Kent.	139°48.2	-60°54.2
Kochab	137°21.4	74°05.0
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.9	26°39.5
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.4
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.2	51°29.5
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.4
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.9	-56°40.7
Deneb	49°29.6	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.1	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Nov 21 Tue	SHA	Mer.pass
Venus	135°11.9	10:59
Mars	162°34.3	09:08
Jupiter	143°04.6	10:26
Saturn	93°37.7	13:43

Nov 22 Wed	SHA	Mer.pass
Venus	133°57.2	11:00
Mars	161°59.2	09:07
Jupiter	142°52.2	10:22
Saturn	93°30.6	13:39

Nov 23 Thu	SHA	Mer.pass
Venus	132°42.1	11:01
Mars	161°24.0	09:05
Jupiter	142°39.8	10:19
Saturn	93°23.5	13:36

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2601 sec ΔT = TT-UT1 = +68.9239 sec

2017 November 21 to Nov. 23 UT

h — Sun — Moon

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	183°33.0	S19°54.1	153°57.6	12.2'	S19°26.4	-2.4'	54.0'
1	198°32.8	54.6	168°28.8	12.2'	19°28.7	-2.3'	54.0'
2	213°32.7	55.2	183°00.0	12.2'	19°30.9	-2.2'	54.0'
3	228°32.5	·· 55.7	197°31.1	12.1'	19°33.1	-2.1'	54.0'
4	243°32.3	56.3	212°02.3	12.1'	19°35.1	-2.0'	54.0'
5	258°32.2	56.8	226°33.4	12.1'	19°37.1	-1.9'	54.0'
6	273°32.0	S19°57.4	241°04.5	12.1'	S19°39.0	-1.8'	54.0'
7	288°31.9	57.9	255°35.6	12.1'	19°40.8	-1.7'	54.0'
8	303°31.7	58.5	270°06.8	12.1'	19°42.5	-1.7'	54.0'
9	318°31.6	·· 59.0	284°37.9	12.1'	19°44.1	-1.6'	54.0'
10	333°31.4	19°59.6	299°09.0	12.1'	19°45.6	-1.5'	54.0'
11	348°31.2	20°00.1	313°40.1	12.1'	19°47.0	-1.4'	54.0'
12	3°31.1	S20°00.6	328°11.2	12.1'	S19°48.4	-1.3'	54.0'
13	18°30.9	01.2	342°42.3	12.1'	19°49.6	-1.2'	54.0'
14	33°30.7	01.7	357°13.3	12.1'	19°50.8	-1.1'	54.0'
15	48°30.6	·· 02.3	11°44.4	12.1'	19°51.8	-1.0'	54.0'
16	63°30.4	02.8	26°15.5	12.1'	19°52.8	-0.9'	54.0'
17	78°30.3	03.4	40°46.6	12.1'	19°53.7	-0.8'	54.0'
18	93°30.1	S20°03.9	55°17.7	12.1'	S19°54.5	-0.7'	54.0'
19	108°29.9	04.4	69°48.7	12.1'	19°55.1	-0.7'	54.0'
20	123°29.8	05.0	84°19.8	12.1'	19°55.8	-0.6'	54.0'
21	138°29.6	·· 05.5	98°50.9	12.1'	19°56.3	-0.5'	54.0'
22	153°29.4	06.1	113°22.0	12.1'	19°56.7	-0.4'	54.0'
23	168°29.3	06.6	127°53.0	12.1'	19°57.0	-0.3'	54.0'
	SD.=16.2	d=-0.6	S.D.=14.7				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°29.1	S20°07.1	142°24.1	12.1'	S19°57.3	-0.2'	54.0'
1	198°29.0	07.7	156°55.2	12.1'	19°57.4	-0.1'	54.0'
2	213°28.8	08.2	171°26.2	12.1'	19°57.5	-0.0'	54.0'
3	228°28.6	·· 08.7	185°57.3	12.1'	19°57.4	0.1'	54.0'
4	243°28.5	09.3	200°28.4	12.1'	19°57.3	0.2'	54.0'
5	258°28.3	09.8	214°59.5	12.1'	19°57.1	0.3'	54.0'
6	273°28.1	S20°10.4	229°30.5	12.1'	S19°56.8	0.4'	54.0'
7	288°28.0	10.9	244°01.6	12.1'	19°56.4	0.4'	54.0'
8	303°27.8	11.4	258°32.7	12.1'	19°55.9	0.5'	54.0'
9	318°27.6	·· 11.9	273°03.8	12.1'	19°55.3	0.6'	54.0'
10	333°27.5	12.5	287°34.9	12.1'	19°54.6	0.7'	54.0'
11	348°27.3	13.0	302°06.0	12.1'	19°53.8	0.8'	54.0'
12	3°27.1	S20°13.5	316°37.1	12.1'	S19°53.0	0.9'	54.0'
13	18°26.9	14.1	331°08.2	12.1'	19°52.0	1.0'	54.0'
14	33°26.8	14.6	345°39.3	12.1'	19°51.0	1.1'	54.0'
15	48°26.6	·· 15.1	0°10.4	12.1'	19°49.9	1.2'	54.0'
16	63°26.4	15.7	14°41.5	12.1'	19°48.6	1.3'	54.0'
17	78°26.3	16.2	29°12.6	12.1'	19°47.3	1.4'	54.0'
18	93°26.1	S20°16.7	43°43.8	12.1'	S19°45.9	1.5'	54.0'
19	108°25.9	17.2	58°14.9	12.1'	19°44.4	1.5'	54.0'
20	123°25.8	17.8	72°46.0	12.1'	19°42.8	1.6'	54.0'
21	138°25.6	·· 18.3	87°17.2	12.2'	19°41.1	1.7'	54.1'
22	153°25.4	18.8	101°48.3	12.2'	19°39.4	1.8'	54.1'
23	168°25.2	19.3	116°19.5	12.2'	19°37.5	1.9'	54.1'
	SD.=16.2	d=-0.5	S.D.=14.7				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	183°25.1	S20°19.8	130°50.7	12.2'	S19°35.6	2.0'	54.1'
1	198°24.9	20.4	145°21.9	12.2'	19°33.5	2.1'	54.1'
2	213°24.7	20.9	159°53.0	12.2'	19°31.4	2.2'	54.1'
3	228°24.6	·· 21.4	174°24.2	12.2'	19°29.2	2.3'	54.1'
4	243°24.4	21.9	188°55.4	12.2'	19°26.9	2.4'	54.1'
5	258°24.2	22.4	203°26.7	12.2'	19°24.5	2.4'	54.1'
6	273°24.0	S20°23.0	217°57.9	12.2'	S19°22.0	2.5'	54.1'
7	288°23.9	23.5	232°29.1	12.2'	19°19.4	2.6'	54.1'
8	303°23.7	24.0	247°00.4	12.3'	19°16.8	2.7'	54.1'
9	318°23.5	·· 24.5	261°31.6	12.3'	19°14.0	2.8'	54.1'
10	333°23.3	25.0	276°02.9	12.3'	19°11.2	2.9'	54.1'
11	348°23.1	25.5	290°34.2	12.3'	19°08.2	3.0'	54.2'
12	3°23.0	S20°26.1	305°05.5	12.3'	S19°05.2	3.1'	54.2'
13	18°22.8	26.6	319°36.8	12.3'	19°02.1	3.1'	54.2'
14	33°22.6	27.1	334°08.1	12.3'	18°58.9	3.2'	54.2'
15	48°22.4	·· 27.6	348°39.4	12.3'	18°55.6	3.3'	54.2'
16	63°22.3	28.1	3°10.7	12.3'	18°52.3	3.4'	54.2'
17	78°22.1	28.6	17°42.1	12.3'	18°48.8	3.5'	54.2'
18	93°21.9	S20°29.1	32°13.4	12.4'	S18°45.3	3.6'	54.2'
19	108°21.7	29.6	46°44.8	12.4'	18°41.7	3.7'	54.2'
20	123°21.5	30.1	61°16.2	12.4'	18°37.9	3.8'	54.3'
21	138°21.4	·· 30.7	75°47.5	12.4'	18°34.1	3.8'	54.3'
22	153°21.2	31.2	90°19.0	12.4'	18°30.3	3.9'	54.3'
23	168°21.0	31.7	104°50.4	12.4'	18°26.3	4.0'	54.3'
	SD.=16.2	d=-0.5	S.D.=14.8				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:24	09:08	▬	▬	14:23	16:07
N 70°	07:11	08:39	10:47	12:45	14:52	16:20
68°	07:00	08:17	09:48	13:44	15:14	16:31
66°	06:51	08:00	09:14	14:17	15:31	16:40
64°	06:44	07:46	08:50	14:42	15:46	16:48
62°	06:37	07:34	08:31	15:01	15:57	16:55
60°	06:31	07:24	08:15	15:16	16:08	17:01
N 58°	06:25	07:15	08:02	15:30	16:17	17:06
56°	06:20	07:07	07:51	15:41	16:25	17:11
54°	06:16	07:00	07:41	15:51	16:32	17:16
52°	06:12	06:53	07:32	16:00	16:38	17:20
50°	06:08	06:48	07:24	16:08	16:44	17:24
45°	05:59	06:35	07:07	16:25	16:57	17:33
N 40°	05:51	06:24	06:53	16:39	17:08	17:42
35°	05:43	06:14	06:41	16:51	17:18	17:49
30°	05:36	06:05	06:31	17:01	17:27	17:56
20°	05:23	05:50	06:13	17:19	17:43	18:10
N 10°	05:09	05:35	05:57	17:35	17:57	18:23
0°	04:55	05:21	05:43	17:50	18:12	18:37
S 10°	04:39	05:05	05:28	18:05	18:27	18:54
20°	04:19	04:48	05:12	18:21	18:45	19:13
30°	03:55	04:26	04:53	18:40	19:06	19:38
35°	03:39	04:14	04:42	18:51	19:19	19:54
40°	03:19	03:58	04:29	19:03	19:35	20:14
45°	02:55	03:40	04:15	19:19	19:54	20:39
S 50°	02:20	03:16	03:56	19:37	20:18	21:13
52°	02:02	03:04	03:47	19:46	20:30	21:32
54°	01:39	02:50	03:38	19:56	20:44	21:56
56°	01:06	02:34	03:27	20:07	21:00	22:30
58°	▭	02:15	03:14	20:20	21:20	▭
S 60°	▭	01:50	02:59	20:35	21:45	▭

Lat.	Moonrise Tue	Moonrise Wed	Moonrise Thu	Moonset Tue	Moonset Wed	Moonset Thu
N 72°	▬	▬	▬	▬	▬	▬
N 70°	13:51	14:38	14:30	14:31	15:23	17:09
68°	12:23	13:12	13:39	15:59	16:49	18:01
66°	11:44	12:33	13:06	16:37	17:27	18:32
64°	11:17	12:06	12:42	17:04	17:54	18:56
62°	10:57	11:46	12:24	17:25	18:14	19:15
60°	10:40	11:29	12:08	17:42	18:31	19:30
N 58°	10:26	11:14	11:55	17:56	18:45	19:43
56°	10:13	11:02	11:43	18:08	18:58	19:54
54°	10:03	10:52	11:33	18:19	19:08	20:04
52°	09:53	10:42	11:25	18:29	19:18	20:12
50°	09:45	10:34	11:17	18:37	19:26	20:20
45°	09:27	10:16	10:59	18:55	19:44	20:37
N 40°	09:12	10:01	10:46	19:10	19:58	20:50
35°	09:00	09:49	10:34	19:22	20:11	21:02
30°	08:49	09:38	10:23	19:33	20:21	21:12
20°	08:31	09:19	10:05	19:52	20:40	21:29
N 10°	08:15	09:03	09:50	20:08	20:56	21:44
0°	08:00	08:48	09:35	20:23	21:11	21:58
S 10°	07:45	08:33	09:21	20:38	21:26	22:12
20°	07:29	08:16	09:05	20:54	21:42	22:27
30°	07:11	07:58	08:47	21:13	22:00	22:44
35°	07:00	07:47	08:37	21:24	22:11	22:54
40°	06:48	07:35	08:25	21:36	22:23	23:05
45°	06:34	07:20	08:11	21:51	22:37	23:18
S 50°	06:16	07:02	07:54	22:09	22:54	23:35
52°	06:08	06:54	07:46	22:17	23:03	23:42
54°	05:59	06:44	07:37	22:27	23:12	23:50
56°	05:48	06:34	07:27	22:37	23:22	–:–
58°	05:36	06:22	07:15	22:49	23:34	–:–
S 60°	05:23	06:07	07:01	23:03	23:48	–:–

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 3-5 8-21%
21	14:12	14:04	11:46	14:11	01:48	
22	13:56	13:48	11:46	14:59	02:35	
23	13:40	13:32	11:46	15:47	03:23	

November 24, 25, 26 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	63°08.5	194°35.2	S16°59.3	223°57.4	S06°56.6	205°35.9	S13°43.7	156°24.8	S22°27.3
1	78°10.9	209°34.6	17°00.2	238°58.3	57.2	220°37.9	43.8	171°27.0	27.3
2	93°13.4	224°33.9	01.1	253°59.3	57.8	235°39.8	44.0	186°29.1	27.3
3	108°15.9	239°33.2	·· 02.0	269°00.3	·· 58.4	250°41.8	·· 44.2	201°31.3	·· 27.3
4	123°18.3	254°32.5	02.9	284°01.3	59.0	265°43.7	44.3	216°33.5	27.4
5	138°20.8	269°31.8	03.8	299°02.3	06°59.6	280°45.7	44.5	231°35.6	27.4
6	153°23.3	284°31.1	S17°04.7	314°03.3	S07°00.2	295°47.6	S13°44.7	246°37.8	S22°27.4
7	168°25.7	299°30.5	05.6	329°04.3	00.8	310°49.6	44.8	261°40.0	27.4
8	183°28.2	314°29.8	06.5	344°05.3	01.4	325°51.5	45.0	276°42.1	27.4
9	198°30.7	329°29.1	·· 07.4	359°06.3	·· 02.0	340°53.5	·· 45.2	291°44.3	·· 27.4
10	213°33.1	344°28.4	08.3	14°07.3	02.6	355°55.4	45.3	306°46.5	27.4
11	228°35.6	359°27.7	09.2	29°08.3	03.2	10°57.4	45.5	321°48.6	27.4
12	243°38.1	14°27.0	S17°10.1	44°09.3	S07°03.8	25°59.3	S13°45.7	336°50.8	S22°27.4
13	258°40.5	29°26.3	10.9	59°10.3	04.4	41°01.3	45.8	351°53.0	27.5
14	273°43.0	44°25.6	11.8	74°11.3	05.0	56°03.2	46.0	6°55.1	27.5
15	288°45.4	59°25.0	·· 12.7	89°12.3	·· 05.6	71°05.2	·· 46.2	21°57.3	·· 27.5
16	303°47.9	74°24.3	13.6	104°13.3	06.2	86°07.1	46.3	36°59.5	27.5
17	318°50.4	89°23.6	14.5	119°14.3	06.8	101°09.1	46.5	52°01.6	27.5
18	333°52.8	104°22.9	S17°15.4	134°15.3	S07°07.4	116°11.0	S13°46.6	67°03.8	S22°27.5
19	348°55.3	119°22.2	16.3	149°16.3	08.0	131°13.0	46.8	82°05.9	27.5
20	3°57.8	134°21.5	17.2	164°17.3	08.6	146°14.9	47.0	97°08.1	27.5
21	19°00.2	149°20.8	·· 18.1	179°18.3	·· 09.2	161°16.9	·· 47.1	112°10.3	·· 27.5
22	34°02.7	164°20.1	19.0	194°19.3	09.8	176°18.9	47.3	127°12.4	27.5
23	49°05.2	179°19.4	19.8	209°20.3	10.4	191°20.8	47.5	142°14.6	27.6
Mer.pass.:19:44		v-0.7 d-0.9 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	64°07.6	194°18.7	S17°20.7	224°21.3	S07°11.0	206°22.8	S13°47.6	157°16.8	S22°27.6
1	79°10.1	209°18.0	21.6	239°22.3	11.6	221°24.7	47.8	172°18.9	27.6
2	94°12.6	224°17.3	22.5	254°23.3	12.2	236°26.7	48.0	187°21.1	27.6
3	109°15.0	239°16.6	·· 23.4	269°24.3	·· 12.8	251°28.6	·· 48.1	202°23.3	·· 27.6
4	124°17.5	254°16.0	24.3	284°25.3	13.4	266°30.6	48.3	217°25.4	27.6
5	139°19.9	269°15.3	25.1	299°26.3	14.0	281°32.5	48.4	232°27.6	27.6
6	154°22.4	284°14.6	S17°26.0	314°27.3	S07°14.6	296°34.5	S13°48.6	247°29.7	S22°27.6
7	169°24.9	299°13.9	26.9	329°28.3	15.2	311°36.4	48.8	262°31.9	27.6
8	184°27.3	314°13.2	27.8	344°29.3	15.8	326°38.4	48.9	277°34.1	27.7
9	199°29.8	329°12.5	·· 28.7	359°30.2	·· 16.4	341°40.3	·· 49.1	292°36.2	·· 27.7
10	214°32.3	344°11.8	29.5	14°31.2	16.9	356°42.3	49.3	307°38.4	27.7
11	229°34.7	359°11.1	30.4	29°32.2	17.5	11°44.2	49.4	322°40.6	27.7
12	244°37.2	14°10.4	S17°31.3	44°33.2	S07°18.1	26°46.2	S13°49.6	337°42.7	S22°27.7
13	259°39.7	29°09.7	32.2	59°34.2	18.7	41°48.1	49.8	352°44.9	27.7
14	274°42.1	44°09.0	33.0	74°35.2	19.3	56°50.1	49.9	7°47.0	27.7
15	289°44.6	59°08.3	·· 33.9	89°36.2	·· 19.9	71°52.0	·· 50.1	22°49.2	·· 27.7
16	304°47.1	74°07.6	34.8	104°37.2	20.5	86°54.0	50.2	37°51.4	27.7
17	319°49.5	89°06.9	35.6	119°38.2	21.1	101°55.9	50.4	52°53.5	27.7
18	334°52.0	104°06.2	S17°36.5	134°39.2	S07°21.7	116°57.9	S13°50.6	67°55.7	S22°27.8
19	349°54.4	119°05.4	37.4	149°40.2	22.3	131°59.8	50.7	82°57.9	27.8
20	4°56.9	134°04.7	38.3	164°41.2	22.9	147°01.8	50.9	98°00.0	27.8
21	19°59.4	149°04.0	·· 39.1	179°42.2	·· 23.5	162°03.8	·· 51.1	113°02.2	·· 27.8
22	35°01.8	164°03.3	40.0	194°43.2	24.1	177°05.7	51.2	128°04.3	27.8
23	50°04.3	179°02.6	40.9	209°44.2	24.7	192°07.7	51.4	143°06.5	27.8
Mer.pass.:19:40		v-0.7 d-0.9 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.5		v2.2 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	65°06.8	194°01.9	S17°41.7	224°45.2	S07°25.3	207°09.6	S13°51.5	158°08.7	S22°27.8
1	80°09.2	209°01.2	42.6	239°46.2	25.9	222°11.6	51.7	173°10.8	27.8
2	95°11.7	224°00.5	43.5	254°47.2	26.5	237°13.5	51.9	188°13.0	27.8
3	110°14.2	238°59.8	·· 44.3	269°48.2	·· 27.1	252°15.5	·· 52.0	203°15.2	·· 27.8
4	125°16.6	253°59.1	45.2	284°49.2	27.7	267°17.4	52.2	218°17.3	27.9
5	140°19.1	268°58.4	46.0	299°50.2	28.3	282°19.4	52.4	233°19.5	27.9
6	155°21.5	283°57.7	S17°46.9	314°51.2	S07°28.8	297°21.3	S13°52.5	248°21.6	S22°27.9
7	170°24.0	298°57.0	47.8	329°52.1	29.4	312°23.3	52.7	263°23.8	27.9
8	185°26.5	313°56.3	48.6	344°53.1	30.0	327°25.2	52.9	278°26.0	27.9
9	200°28.9	328°55.5	·· 49.5	359°54.1	·· 30.6	342°27.2	·· 53.0	293°28.1	·· 27.9
10	215°31.4	343°54.8	50.3	14°55.1	31.2	357°29.1	53.2	308°30.3	27.9
11	230°33.9	358°54.1	51.2	29°56.1	31.8	12°31.1	53.3	323°32.5	27.9
12	245°36.3	13°53.4	S17°52.0	44°57.1	S07°32.4	27°33.0	S13°53.5	338°34.6	S22°27.9
13	260°38.8	28°52.7	52.9	59°58.1	33.0	42°35.0	53.7	353°36.8	27.9
14	275°41.3	43°52.0	53.8	74°59.1	33.6	57°37.0	53.8	8°38.9	28.0
15	290°43.7	58°51.3	·· 54.6	90°00.1	·· 34.2	72°38.9	·· 54.0	23°41.1	·· 28.0
16	305°46.2	73°50.5	55.5	105°01.1	34.8	87°40.9	54.1	38°43.3	28.0
17	320°48.7	88°49.8	56.3	120°02.1	35.4	102°42.8	54.3	53°45.4	28.0
18	335°51.1	103°49.1	S17°57.2	135°03.1	S07°36.0	117°44.8	S13°54.5	68°47.6	S22°28.0
19	350°53.6	118°48.4	58.0	150°04.1	36.6	132°46.7	54.6	83°49.7	28.0
20	5°56.0	133°47.7	58.9	165°05.1	37.2	147°48.7	54.8	98°51.9	28.0
21	20°58.5	148°47.0	17°59.7	180°06.1	·· 37.7	162°50.6	·· 55.0	113°54.1	·· 28.0
22	36°01.0	163°46.2	18°00.6	195°07.1	38.3	177°52.6	55.1	128°56.2	28.0
23	51°03.4	178°45.5	01.4	210°08.1	38.9	192°54.5	55.3	143°58.4	28.0
Mer.pass.:19:36		v-0.7 d-0.9 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.6	-42°12.8
Schedar	349°36.7	56°38.3
Diphda	348°52.7	-17°53.5
Achernar	335°24.2	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	315°57.7	89°20.4
Acamar	315°15.7	-40°14.2
Menkar	314°11.6	4°09.5
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.9	-8°11.0
Capella	280°29.6	46°00.7
Bellatrix	278°28.5	6°21.8
Elnath	278°08.5	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.8	7°24.5
Canopus	263°54.3	-52°42.3
Sirius	258°30.8	-16°44.5
Adhara	255°09.9	-28°59.8
Procyon	244°56.4	5°10.6
Pollux	243°23.9	27°58.8
Avior	234°16.4	-59°33.8
Suhail	222°50.1	-43°30.1
Miaplacidus	221°38.7	-69°47.2
Alphard	217°53.1	-8°44.1
Regulus	207°40.3	11°52.8
Dubhe	193°48.3	61°39.0
Denebola	182°30.8	14°28.4
Gienah	175°49.4	-17°38.2
Acrux	173°06.3	-63°11.5
Gacrux	171°57.8	-57°12.4
Alioth	166°18.5	55°51.7
Spica	158°28.3	-11°15.0
Alkaid	152°57.0	49°13.5
Hadar	148°44.1	-60°27.2
Menkent	148°04.4	-36°27.1
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°48.2	-60°54.2
Kochab	137°21.4	74°05.0
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.9	26°39.5
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.4
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.3	51°29.5
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.3
Nunki	75°54.9	-26°16.3
Altair	62°05.5	8°55.2
Peacock	53°14.9	-56°40.7
Deneb	49°29.6	45°21.0
Enif	33°44.2	9°57.6
Al Na'ir	27°40.1	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Nov 24 Fri	SHA	Mer.pass
Venus	131°26.8	11:02
Mars	160°48.9	09:04
Jupiter	142°27.4	10:16
Saturn	93°16.3	13:32

Nov 25 Sat	SHA	Mer.pass
Venus	130°11.1	11:03
Mars	160°13.7	09:02
Jupiter	142°15.1	10:13
Saturn	93°09.1	13:29

Nov 26 Sun	SHA	Mer.pass
Venus	128°55.2	11:04
Mars	159°38.4	09:00
Jupiter	142°02.8	10:10
Saturn	93°01.9	13:25

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2566 sec ΔT = TT-UT1 = +68.9274 sec

2017 November 24 to Nov. 26 UT

h — Sun — Moon

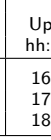
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	183°20.8	S20°32.2	119°21.8	12.4'	S18°22.2	4.1'	54.3'
1	198°20.6	32.7	133°53.2	12.4'	18°18.1	4.2'	54.3'
2	213°20.5	33.2	148°24.7	12.5'	18°13.9	4.3'	54.3'
3	228°20.3	·· 33.7	162°56.2	12.5'	18°09.5	4.4'	54.3'
4	243°20.1	34.2	177°27.6	12.5'	18°05.2	4.4'	54.4'
5	258°19.9	34.7	191°59.1	12.5'	18°00.7	4.5'	54.4'
6	273°19.7	S20°35.2	206°30.6	12.5'	S17°56.1	4.6'	54.4'
7	288°19.6	35.7	221°02.1	12.5'	17°51.5	4.7'	54.4'
8	303°19.4	36.2	235°33.7	12.5'	17°46.7	4.8'	54.4'
9	318°19.2	·· 36.7	250°05.2	12.5'	17°41.9	4.9'	54.4'
10	333°19.0	37.2	264°36.8	12.6'	17°37.0	4.9'	54.4'
11	348°18.8	37.7	279°08.3	12.6'	17°32.0	5.0'	54.5'
12	3°18.6	S20°38.2	293°39.9	12.6'	S17°27.0	5.1'	54.5'
13	18°18.5	38.7	308°11.5	12.6'	17°21.8	5.2'	54.5'
14	33°18.3	39.2	322°43.1	12.6'	17°16.6	5.3'	54.5'
15	48°18.1	·· 39.7	337°14.7	12.6'	17°11.3	5.3'	54.5'
16	63°17.9	40.2	351°46.4	12.6'	17°05.9	5.4'	54.5'
17	78°17.7	40.7	6°18.0	12.7'	17°00.5	5.5'	54.6'
18	93°17.5	S20°41.2	20°49.7	12.7'	S16°54.9	5.6'	54.6'
19	108°17.3	41.7	35°21.3	12.7'	16°49.3	5.7'	54.6'
20	123°17.2	42.2	49°53.0	12.7'	16°43.6	5.7'	54.6'
21	138°17.0	·· 42.7	64°24.7	12.7'	16°37.8	5.8'	54.6'
22	153°16.8	43.1	78°56.4	12.7'	16°31.9	5.9'	54.6'
23	168°16.6	43.6	93°28.2	12.7'	16°26.0	6.0'	54.7'
	SD.=16.2	d=-0.5		S.D.=14.8			

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°16.4	S20°44.1	107°59.9	12.7'	S16°20.0	6.1'	54.7'
1	198°16.2	44.6	122°31.6	12.7'	16°13.9	6.1'	54.7'
2	213°16.0	45.1	137°03.4	12.8'	16°07.7	6.2'	54.7'
3	228°15.8	·· 45.6	151°35.1	12.8'	16°01.4	6.3'	54.7'
4	243°15.6	46.1	166°06.9	12.8'	15°55.1	6.4'	54.8'
5	258°15.5	46.6	180°38.7	12.8'	15°48.7	6.4'	54.8'
6	273°15.3	S20°47.1	195°10.5	12.8'	S15°42.2	6.5'	54.8'
7	288°15.1	47.5	209°42.3	12.8'	15°35.7	6.6'	54.8'
8	303°14.9	48.0	224°14.1	12.8'	15°29.0	6.7'	54.8'
9	318°14.7	·· 48.5	238°46.0	12.8'	15°22.3	6.7'	54.9'
10	333°14.5	49.0	253°17.8	12.8'	15°15.5	6.8'	54.9'
11	348°14.3	49.5	267°49.7	12.9'	15°08.7	6.9'	54.9'
12	3°14.1	S20°50.0	282°21.5	12.9'	S15°01.7	7.0'	54.9'
13	18°13.9	50.4	296°53.4	12.9'	14°54.7	7.0'	55.0'
14	33°13.7	50.9	311°25.3	12.9'	14°47.7	7.1'	55.0'
15	48°13.5	·· 51.4	325°57.2	12.9'	14°40.5	7.2'	55.0'
16	63°13.3	51.9	340°29.1	12.9'	14°33.3	7.3'	55.0'
17	78°13.2	52.4	355°01.0	12.9'	14°26.0	7.3'	55.1'
18	93°13.0	S20°52.8	9°32.9	12.9'	S14°18.6	7.4'	55.1'
19	108°12.8	53.3	24°04.8	12.9'	14°11.2	7.5'	55.1'
20	123°12.6	53.8	38°36.7	12.9'	14°03.7	7.5'	55.1'
21	138°12.4	·· 54.3	53°08.7	12.9'	13°56.1	7.6'	55.1'
22	153°12.2	54.7	67°40.6	12.9'	13°48.4	7.7'	55.2'
23	168°12.0	55.2	82°12.5	13.0'	13°40.7	7.8'	55.2'
	SD.=16.2	d=-0.5		S.D.=15.0			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	183°11.8	S20°55.7	96°44.5	13.0'	S13°32.9	7.8'	55.2'
1	198°11.6	56.2	111°16.5	13.0'	13°25.1	7.9'	55.3'
2	213°11.4	56.6	125°48.4	13.0'	13°17.1	8.0'	55.3'
3	228°11.2	·· 57.1	140°20.4	13.0'	13°09.2	8.0'	55.3'
4	243°11.0	57.6	154°52.4	13.0'	13°01.1	8.1'	55.3'
5	258°10.8	58.0	169°24.3	13.0'	12°53.0	8.2'	55.4'
6	273°10.6	S20°58.5	183°56.3	13.0'	S12°44.8	8.2'	55.4'
7	288°10.4	59.0	198°28.3	13.0'	12°36.5	8.3'	55.4'
8	303°10.2	59.5	213°00.3	13.0'	12°28.2	8.4'	55.4'
9	318°10.0	20°59.9	227°32.3	13.0'	12°19.8	8.4'	55.5'
10	333°09.8	21°00.4	242°04.3	13.0'	12°11.3	8.5'	55.5'
11	348°09.6	00.9	256°36.3	13.0'	12°02.8	8.6'	55.5'
12	3°09.4	S21°01.3	271°08.3	13.0'	S11°54.2	8.6'	55.6'
13	18°09.2	01.8	285°40.2	13.0'	11°45.6	8.7'	55.6'
14	33°09.0	02.3	300°12.2	13.0'	11°36.9	8.7'	55.6'
15	48°08.8	·· 02.7	314°44.2	13.0'	11°28.1	8.8'	55.6'
16	63°08.6	03.2	329°16.2	13.0'	11°19.3	8.9'	55.7'
17	78°08.4	03.6	343°48.2	13.0'	11°10.4	8.9'	55.7'
18	93°08.2	S21°04.1	358°20.2	13.0'	S11°01.4	9.0'	55.7'
19	108°08.0	04.6	12°52.2	13.0'	10°52.4	9.0'	55.8'
20	123°07.8	05.0	27°24.2	13.0'	10°43.3	9.1'	55.8'
21	138°07.6	·· 05.5	41°56.2	13.0'	10°34.2	9.2'	55.8'
22	153°07.4	05.9	56°28.1	13.0'	10°25.0	9.2'	55.9'
23	168°07.2	06.4	71°00.1	13.0'	10°15.7	9.3'	55.9'
	SD.=16.2	d=-0.5		S.D.=15.1			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:34	09:23	▬	▬	14:11	15:59
N 70°	07:20	08:50	11:42	11:51	14:43	16:14
68°	07:08	08:27	10:03	13:30	15:07	16:25
66°	06:58	08:08	09:26	14:08	15:25	16:35
64°	06:50	07:53	08:59	14:34	15:40	16:43
62°	06:43	07:41	08:39	14:55	15:53	16:51
60°	06:36	07:30	08:22	15:11	16:04	16:57
N 58°	06:30	07:21	08:08	15:25	16:13	17:03
56°	06:25	07:12	07:56	15:37	16:21	17:09
54°	06:20	07:05	07:46	15:48	16:29	17:13
52°	06:16	06:58	07:37	15:57	16:36	17:18
50°	06:11	06:52	07:28	16:05	16:42	17:22
45°	06:02	06:38	07:11	16:23	16:56	17:32
N 40°	05:53	06:27	06:56	16:37	17:07	17:40
35°	05:46	06:17	06:44	16:50	17:17	17:48
30°	05:38	06:08	06:33	17:00	17:26	17:56
20°	05:24	05:51	06:15	17:19	17:43	18:10
N 10°	05:10	05:36	05:59	17:35	17:58	18:24
0°	04:56	05:21	05:43	17:51	18:13	18:39
S 10°	04:39	05:05	05:28	18:06	18:29	18:55
20°	04:19	04:47	05:11	18:23	18:47	19:15
30°	03:53	04:25	04:52	18:42	19:09	19:41
35°	03:37	04:12	04:41	18:54	19:22	19:58
40°	03:17	03:56	04:28	19:07	19:38	20:18
45°	02:51	03:37	04:12	19:22	19:58	20:44
S 50°	02:15	03:12	03:53	19:42	20:23	21:20
52°	01:56	03:00	03:44	19:51	20:36	21:40
54°	01:31	02:45	03:34	20:01	20:50	22:06
56°	00:53	02:28	03:22	20:13	21:07	22:46
58°	▭	02:08	03:09	20:26	21:29	▭
S 60°	▭	01:41	02:53	20:43	21:56	▭

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	15:23	14:53	14:38	17:55	20:02	21:54
N 70°	14:26	14:22	14:18	18:51	20:32	22:12
68°	13:52	13:59	14:03	19:25	20:54	22:26
66°	13:27	13:41	13:50	19:49	21:11	22:38
64°	13:08	13:26	13:40	20:08	21:25	22:47
62°	12:52	13:14	13:31	20:23	21:37	22:55
60°	12:39	13:03	13:23	20:36	21:47	23:02
N 58°	12:28	12:54	13:16	20:47	21:56	23:08
56°	12:18	12:46	13:10	20:56	22:03	23:14
54°	12:09	12:39	13:05	21:05	22:10	23:18
52°	12:01	12:32	13:00	21:12	22:16	23:23
50°	11:54	12:26	12:55	21:19	22:21	23:27
45°	11:39	12:14	12:46	21:34	22:33	23:35
N 40°	11:26	12:03	12:38	21:45	22:43	23:42
35°	11:15	11:54	12:31	21:56	22:51	23:48
30°	11:06	11:46	12:25	22:04	22:58	23:53
20°	10:50	11:33	12:14	22:20	23:11	–:–
N 10°	10:36	11:21	12:05	22:33	23:22	–:–
0°	10:23	11:09	11:56	22:45	23:32	–:–
S 10°	10:09	10:58	11:47	22:58	23:42	–:–
20°	09:55	10:46	11:38	23:11	23:53	–:–
30°	09:39	10:32	11:27	23:26	–:–	00:05
35°	09:30	10:24	11:21	23:34	–:–	00:12
40°	09:19	10:15	11:13	23:44	–:–	00:20
45°	09:06	10:04	11:05	23:55	–:–	00:29
S 50°	08:51	09:51	10:55	–:–	00:09	00:40
52°	08:43	09:45	10:50	–:–	00:16	00:45
54°	08:35	09:38	10:45	–:–	00:23	00:51
56°	08:26	09:31	10:40	00:00	00:31	00:57
58°	08:16	09:22	10:33	00:10	00:40	01:04
S 60°	08:04	09:13	10:26	00:23	00:50	01:12

Day	Sun Eqn.of Time 00^h mm:ss	Sun Eqn.of Time 12^h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 6-8 29-48%
24	13:23	13:15	11:47	16:34	04:10	
25	13:06	12:56	11:47	17:21	04:57	
26	12:47	12:38	11:47	18:07	05:44	

November 27, 28, 29 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	66°05.9	193°44.8	S18°02.2	225°09.0	S07°39.5	207°56.5	S13°55.4	159°00.6	S22°28.0
1	81°08.4	208°44.1	03.1	240°10.0	40.1	222°58.4	55.6	174°02.7	28.1
2	96°10.8	223°43.4	03.9	255°11.0	40.7	238°00.4	55.8	189°04.9	28.1
3	111°13.3	238°42.7	·· 04.8	270°12.0	·· 41.3	253°02.4	·· 55.9	204°07.0	·· 28.1
4	126°15.8	253°41.9	05.6	285°13.0	41.9	268°04.3	56.1	219°09.2	28.1
5	141°18.2	268°41.2	06.5	300°14.0	42.5	283°06.3	56.3	234°11.4	28.1
6	156°20.7	283°40.5	S18°07.3	315°15.0	S07°43.1	298°08.2	S13°56.4	249°13.5	S22°28.1
7	171°23.2	298°39.8	08.1	330°16.0	43.7	313°10.2	56.6	264°15.7	28.1
8	186°25.6	313°39.0	09.0	345°17.0	44.3	328°12.1	56.7	279°17.8	28.1
9	201°28.1	328°38.3	·· 09.8	0°18.0	·· 44.9	343°14.1	·· 56.9	294°20.0	·· 28.1
10	216°30.5	343°37.6	10.7	15°19.0	45.4	358°16.0	57.1	309°22.2	28.1
11	231°33.0	358°36.9	11.5	30°20.0	46.0	13°18.0	57.2	324°24.3	28.2
12	246°35.5	13°36.1	S18°12.3	45°21.0	S07°46.6	28°19.9	S13°57.4	339°26.5	S22°28.2
13	261°37.9	28°35.4	13.2	60°22.0	47.2	43°21.9	57.5	354°28.6	28.2
14	276°40.4	43°34.7	14.0	75°23.0	47.8	58°23.9	57.7	9°30.8	28.2
15	291°42.9	58°34.0	·· 14.8	90°23.9	·· 48.4	73°25.8	·· 57.9	24°33.0	·· 28.2
16	306°45.3	73°33.2	15.7	105°24.9	49.0	88°27.8	58.0	39°35.1	28.2
17	321°47.8	88°32.5	16.5	120°25.9	49.6	103°29.7	58.2	54°37.3	28.2
18	336°50.3	103°31.8	S18°17.3	135°26.9	S07°50.2	118°31.7	S13°58.3	69°39.4	S22°28.2
19	351°52.7	118°31.1	18.1	150°27.9	50.8	133°33.6	58.5	84°41.6	28.2
20	6°55.2	133°30.3	19.0	165°28.9	51.4	148°35.6	58.7	99°43.8	28.2
21	21°57.6	148°29.6	·· 19.8	180°29.9	·· 51.9	163°37.5	·· 58.8	114°45.9	·· 28.3
22	37°00.1	163°28.9	20.6	195°30.9	52.5	178°39.5	59.0	129°48.1	28.3
23	52°02.6	178°28.1	21.5	210°31.9	53.1	193°41.5	59.2	144°50.2	28.3
Mer.pass.:19:32		v-0.7 d-0.8 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	67°05.0	193°27.4	S18°22.3	225°32.9	S07°53.7	208°43.4	S13°59.3	159°52.4	S22°28.3
1	82°07.5	208°26.7	23.1	240°33.9	54.3	223°45.4	59.5	174°54.6	28.3
2	97°10.0	223°25.9	23.9	255°34.9	54.9	238°47.3	59.6	189°56.7	28.3
3	112°12.4	238°25.2	·· 24.8	270°35.9	·· 55.5	253°49.3	13°59.8	204°58.9	·· 28.3
4	127°14.9	253°24.5	25.6	285°36.9	56.1	268°51.2	14°00.0	220°01.0	28.3
5	142°17.4	268°23.7	26.4	300°37.8	56.7	283°53.2	00.1	235°03.2	28.3
6	157°19.8	283°23.0	S18°27.2	315°38.8	S07°57.3	298°55.1	S14°00.3	250°05.4	S22°28.3
7	172°22.3	298°22.3	28.0	330°39.8	57.8	313°57.1	00.4	265°07.5	28.3
8	187°24.8	313°21.5	28.9	345°40.8	58.4	328°59.1	00.6	280°09.7	28.4
9	202°27.2	328°20.8	·· 29.7	0°41.8	·· 59.0	344°01.0	·· 00.8	295°11.8	·· 28.4
10	217°29.7	343°20.1	30.5	15°42.8	07°59.6	359°03.0	00.9	310°14.0	28.4
11	232°32.1	358°19.3	31.3	30°43.8	08°00.2	14°04.9	01.1	325°16.2	28.4
12	247°34.6	13°18.6	S18°32.1	45°44.8	S08°00.8	29°06.9	S14°01.2	340°18.3	S22°28.4
13	262°37.1	28°17.8	32.9	60°45.8	01.4	44°08.8	01.4	355°20.5	28.4
14	277°39.5	43°17.1	33.7	75°46.8	02.0	59°10.8	01.6	10°22.6	28.4
15	292°42.0	58°16.4	·· 34.6	90°47.8	·· 02.6	74°12.8	·· 01.7	25°24.8	·· 28.4
16	307°44.5	73°15.6	35.4	105°48.8	03.1	89°14.7	01.9	40°27.0	28.4
17	322°46.9	88°14.9	36.2	120°49.7	03.7	104°16.7	02.0	55°29.1	28.4
18	337°49.4	103°14.1	S18°37.0	135°50.7	S08°04.3	119°18.6	S14°02.2	70°31.3	S22°28.4
19	352°51.9	118°13.4	37.8	150°51.7	04.9	134°20.6	02.4	85°33.4	28.5
20	7°54.3	133°12.7	38.6	165°52.7	05.5	149°22.5	02.5	100°35.6	28.5
21	22°56.8	148°11.9	·· 39.4	180°53.7	·· 06.1	164°24.5	·· 02.7	115°37.7	·· 28.5
22	37°59.2	163°11.2	40.2	195°54.7	06.7	179°26.4	02.8	130°39.9	28.5
23	53°01.7	178°10.4	41.0	210°55.7	07.3	194°28.4	03.0	145°42.1	28.5
Mer.pass.:19:28		v-0.7 d-0.8 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	68°04.2	193°09.7	S18°41.8	225°56.7	S08°07.9	209°30.4	S14°03.2	160°44.2	S22°28.5
1	83°06.6	208°08.9	42.6	240°57.7	08.4	224°32.3	03.3	175°46.4	28.5
2	98°09.1	223°08.2	43.4	255°58.7	09.0	239°34.3	03.5	190°48.5	28.5
3	113°11.6	238°07.5	·· 44.2	270°59.7	·· 09.6	254°36.2	·· 03.6	205°50.7	·· 28.5
4	128°14.0	253°06.7	45.0	286°00.6	10.2	269°38.2	03.8	220°52.9	28.5
5	143°16.5	268°06.0	45.8	301°01.6	10.8	284°40.1	04.0	235°55.0	28.5
6	158°19.0	283°05.2	S18°46.6	316°02.6	S08°11.4	299°42.1	S14°04.1	250°57.2	S22°28.6
7	173°21.4	298°04.5	47.4	331°03.6	12.0	314°44.1	04.3	265°59.3	28.6
8	188°23.9	313°03.7	48.2	346°04.6	12.6	329°46.0	04.4	281°01.5	28.6
9	203°26.4	328°03.0	·· 49.0	1°05.6	·· 13.1	344°48.0	·· 04.6	296°03.6	·· 28.6
10	218°28.8	343°02.2	49.8	16°06.6	13.7	359°49.9	04.8	311°05.8	28.6
11	233°31.3	358°01.5	50.6	31°07.6	14.3	14°51.9	04.9	326°08.0	28.6
12	248°33.7	13°00.7	S18°51.4	46°08.6	S08°14.9	29°53.9	S14°05.1	341°10.1	S22°28.6
13	263°36.2	28°00.0	52.2	61°09.6	15.5	44°55.8	05.2	356°12.3	28.6
14	278°38.7	42°59.2	53.0	76°10.5	16.1	59°57.8	05.4	11°14.4	28.6
15	293°41.1	57°58.5	·· 53.8	91°11.5	·· 16.7	74°59.7	·· 05.5	26°16.6	·· 28.6
16	308°43.6	72°57.7	54.6	106°12.5	17.2	90°01.7	05.7	41°18.8	28.6
17	323°46.1	87°57.0	55.3	121°13.5	17.8	105°03.6	05.9	56°20.9	28.7
18	338°48.5	102°56.2	S18°56.1	136°14.5	S08°18.4	120°05.6	S14°06.0	71°23.1	S22°28.7
19	353°51.0	117°55.5	56.9	151°15.5	19.0	135°07.6	06.2	86°25.2	28.7
20	8°53.5	132°54.7	57.7	166°16.5	19.6	150°09.5	06.3	101°27.4	28.7
21	23°55.9	147°54.0	·· 58.5	181°17.5	·· 20.2	165°11.5	·· 06.5	116°29.5	·· 28.7
22	38°58.4	162°53.2	18°59.3	196°18.5	20.8	180°13.4	06.7	131°31.7	28.7
23	54°00.9	177°52.4	19°00.1	211°19.5	21.3	195°15.4	06.8	146°33.9	28.7
Mer.pass.:19:25		v-0.7 d-0.8 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.6	-42°12.8
Schedar	349°36.7	56°38.3
Diphda	348°52.7	-17°53.5
Achernar	335°24.2	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	315°58.1	89°20.4
Acamar	315°15.7	-40°14.2
Menkar	314°11.6	4°09.5
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.9	-8°11.0
Capella	280°29.5	46°00.7
Bellatrix	278°28.5	6°21.8
Elnath	278°08.5	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.8	7°24.5
Canopus	263°54.3	-52°42.3
Sirius	258°30.8	-16°44.5
Adhara	255°09.9	-28°59.8
Procyon	244°56.4	5°10.6
Pollux	243°23.9	27°58.8
Avior	234°16.4	-59°33.8
Suhail	222°50.0	-43°30.1
Miaplacidus	221°38.6	-69°47.2
Alphard	217°53.1	-8°44.1
Regulus	207°40.3	11°52.7
Dubhe	193°48.3	61°39.0
Denebola	182°30.8	14°28.4
Gienah	175°49.4	-17°38.2
Acrux	173°06.2	-63°11.5
Gacrux	171°57.8	-57°12.4
Alioth	166°18.5	55°51.7
Spica	158°28.3	-11°15.0
Alkaid	152°57.0	49°13.5
Hadar	148°44.1	-60°27.2
Menkent	148°04.4	-36°27.1
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°48.2	-60°54.2
Kochab	137°21.4	74°04.9
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.9	26°39.5
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.3
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.3	51°29.5
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.3
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.2
Peacock	53°14.9	-56°40.7
Deneb	49°29.6	45°21.0
Enif	33°44.3	9°57.6
Al Na'ir	27°40.1	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Nov 27 Mon	SHA	Mer.pass
Venus	127°38.9	11:06
Mars	159°03.1	08:59
Jupiter	141°50.6	10:07
Saturn	92°54.7	13:22

Nov 28 Tue	SHA	Mer.pass
Venus	126°22.4	11:07
Mars	158°27.8	08:57
Jupiter	141°38.4	10:04
Saturn	92°47.4	13:19

Nov 29 Wed	SHA	Mer.pass
Venus	125°05.5	11:08
Mars	157°52.5	08:56
Jupiter	141°26.2	10:01
Saturn	92°40.0	13:15

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2532 sec ΔT = TT-UT1 = +68.9308 sec

2017 November 27 to Nov. 29 UT

h	Sun		Moon				
Mon	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	183°07.0	S21°06.9	85°32.1	13.0′	S10°06.4	9.3′	55.9′
1	198°06.8	07.3	100°04.0	13.0′	09°57.0	9.4′	56.0′
2	213°06.6	07.8	114°36.0	12.9′	09°47.6	9.5′	56.0′
3	228°06.4	·· 08.2	129°07.9	12.9′	09°38.1	9.5′	56.0′
4	243°06.2	08.7	143°39.9	12.9′	09°28.6	9.6′	56.1′
5	258°06.0	09.1	158°11.8	12.9′	09°19.0	9.6′	56.1′
6	273°05.8	S21°09.6	172°43.7	12.9′	S09°09.3	9.7′	56.1′
7	288°05.6	10.0	187°15.6	12.9′	08°59.6	9.7′	56.2′
8	303°05.4	10.5	201°47.5	12.9′	08°49.8	9.8′	56.2′
9	318°05.2	·· 10.9	216°19.4	12.9′	08°40.0	9.8′	56.2′
10	333°04.9	11.4	230°51.3	12.9′	08°30.1	9.9′	56.3′
11	348°04.7	11.8	245°23.2	12.9′	08°20.2	9.9′	56.3′
12	3°04.5	S21°12.3	259°55.0	12.8′	S08°10.3	10.0′	56.3′
13	18°04.3	12.7	274°26.9	12.8′	08°00.2	10.0′	56.4′
14	33°04.1	13.2	288°58.7	12.8′	07°50.2	10.1′	56.4′
15	48°03.9	·· 13.6	303°30.5	12.8′	07°40.0	10.1′	56.4′
16	63°03.7	14.1	318°02.3	12.8′	07°29.9	10.2′	56.5′
17	78°03.5	14.5	332°34.1	12.8′	07°19.6	10.2′	56.5′
18	93°03.3	S21°15.0	347°05.9	12.8′	S07°09.4	10.3′	56.5′
19	108°03.1	15.4	1°37.6	12.7′	06°59.1	10.3′	56.6′
20	123°02.9	15.9	16°09.3	12.7′	06°48.7	10.4′	56.6′
21	138°02.7	·· 16.3	30°41.1	12.7′	06°38.3	10.4′	56.6′
22	153°02.4	16.7	45°12.7	12.7′	06°27.8	10.5′	56.7′
23	168°02.2	17.2	59°44.4	12.7′	06°17.3	10.5′	56.7′
	SD.=16.2	d=-0.5	S.D.=15.4				

Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	183°02.0	S21°17.6	74°16.1	12.6′	S06°06.8	10.6′	56.8′
1	198°01.8	18.1	88°47.7	12.6′	05°56.2	10.6′	56.8′
2	213°01.6	18.5	103°19.3	12.6′	05°45.6	10.7′	56.8′
3	228°01.4	·· 19.0	117°50.9	12.6′	05°34.9	10.7′	56.9′
4	243°01.2	19.4	132°22.5	12.6′	05°24.2	10.7′	56.9′
5	258°01.0	19.8	146°54.0	12.5′	05°13.4	10.8′	56.9′
6	273°00.8	S21°20.3	161°25.5	12.5′	S05°02.6	10.8′	57.0′
7	288°00.5	20.7	175°57.0	12.5′	04°51.8	10.9′	57.0′
8	303°00.3	21.1	190°28.5	12.4′	04°40.9	10.9′	57.1′
9	318°00.1	·· 21.6	204°59.9	12.4′	04°30.0	10.9′	57.1′
10	332°59.9	22.0	219°31.3	12.4′	04°19.0	11.0′	57.1′
11	347°59.7	22.4	234°02.7	12.4′	04°08.1	11.0′	57.2′
12	2°59.5	S21°22.9	248°34.0	12.3′	S03°57.0	11.0′	57.2′
13	17°59.3	23.3	263°05.3	12.3′	03°46.0	11.1′	57.3′
14	32°59.0	23.7	277°36.6	12.3′	03°34.9	11.1′	57.3′
15	47°58.8	·· 24.2	292°07.9	12.2′	03°23.7	11.1′	57.3′
16	62°58.6	24.6	306°39.1	12.2′	03°12.6	11.2′	57.4′
17	77°58.4	25.0	321°10.3	12.2′	03°01.4	11.2′	57.4′
18	92°58.2	S21°25.4	335°41.4	12.1′	S02°50.2	11.2′	57.5′
19	107°58.0	25.9	350°12.6	12.1′	02°38.9	11.3′	57.5′
20	122°57.8	26.3	4°43.6	12.1′	02°27.6	11.3′	57.5′
21	137°57.5	·· 26.7	19°14.7	12.0′	02°16.3	11.3′	57.6′
22	152°57.3	27.2	33°45.7	12.0′	02°05.0	11.4′	57.6′
23	167°57.1	27.6	48°16.7	11.9′	01°53.6	11.4′	57.7′
	SD.=16.2	d=-0.4	S.D.=15.6				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	182°56.9	S21°28.0	62°47.6	11.9′	S01°42.2	11.4′	57.7′
1	197°56.7	28.4	77°18.5	11.9′	01°30.8	11.4′	57.7′
2	212°56.4	28.8	91°49.3	11.8′	01°19.3	11.5′	57.8′
3	227°56.2	·· 29.3	106°20.1	11.8′	01°07.9	11.5′	57.8′
4	242°56.0	29.7	120°50.9	11.7′	00°56.4	11.5′	57.9′
5	257°55.8	30.1	135°21.6	11.7′	00°44.9	11.5′	57.9′
6	272°55.6	S21°30.5	149°52.3	11.7′	S00°33.3	11.5′	57.9′
7	287°55.4	30.9	164°22.9	11.6′	00°21.8	11.6′	58.0′
8	302°55.1	31.4	178°53.5	11.6′	S00°10.2	11.6′	58.0′
9	317°54.9	·· 31.8	193°24.1	11.5′	N00°01.4	11.6′	58.1′
10	332°54.7	32.2	207°54.6	11.5′	00°13.0	11.6′	58.1′
11	347°54.5	32.6	222°25.0	11.4′	00°24.6	11.6′	58.1′
12	2°54.2	S21°33.0	236°55.4	11.4′	N00°36.3	11.6′	58.2′
13	17°54.0	33.4	251°25.7	11.3′	00°47.9	11.7′	58.2′
14	32°53.8	33.9	265°56.0	11.3′	00°59.6	11.7′	58.3′
15	47°53.6	·· 34.3	280°26.3	11.2′	01°11.3	11.7′	58.3′
16	62°53.4	34.7	294°56.5	11.2′	01°23.0	11.7′	58.3′
17	77°53.1	35.1	309°26.6	11.1′	01°34.7	11.7′	58.4′
18	92°52.9	S21°35.5	323°56.7	11.1′	N01°46.4	11.7′	58.4′
19	107°52.7	35.9	338°26.7	11.0′	01°58.1	11.7′	58.5′
20	122°52.5	36.3	352°56.7	10.9′	02°09.8	11.7′	58.5′
21	137°52.2	·· 36.7	7°26.6	10.9′	02°21.6	11.7′	58.6′
22	152°52.0	37.1	21°56.5	10.8′	02°33.3	11.7′	58.6′
23	167°51.8	37.6	36°26.3	10.8′	02°45.0	11.7′	58.6′
	SD.=16.2	d=-0.4	S.D.=15.9				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:43	09:37	▬	▬	13:58	15:52
N 70°	07:28	09:01	▬	▬	14:34	16:08
68°	07:15	08:36	10:20	13:16	15:00	16:20
66°	07:05	08:16	09:37	13:59	15:19	16:31
64°	06:56	08:00	09:08	14:27	15:35	16:40
62°	06:48	07:47	08:46	14:49	15:49	16:47
60°	06:41	07:36	08:29	15:07	16:00	16:54
N 58°	06:35	07:26	08:14	15:21	16:10	17:00
56°	06:29	07:17	08:02	15:34	16:19	17:06
54°	06:24	07:09	07:51	15:45	16:26	17:11
52°	06:20	07:02	07:41	15:54	16:34	17:16
50°	06:15	06:56	07:33	16:03	16:40	17:21
45°	06:05	06:42	07:15	16:21	16:54	17:31
N 40°	05:56	06:30	07:00	16:36	17:06	17:39
35°	05:48	06:19	06:47	16:49	17:16	17:48
30°	05:41	06:10	06:36	17:00	17:26	17:55
20°	05:26	05:53	06:17	17:19	17:43	18:10
N 10°	05:12	05:38	06:00	17:36	17:58	18:24
0°	04:56	05:22	05:44	17:52	18:14	18:40
S 10°	04:39	05:06	05:28	18:08	18:30	18:57
20°	04:19	04:47	05:11	18:25	18:49	19:18
30°	03:52	04:25	04:52	18:45	19:12	19:44
35°	03:36	04:11	04:40	18:57	19:25	20:01
40°	03:15	03:55	04:26	19:10	19:42	20:22
45°	02:48	03:35	04:10	19:26	20:02	20:49
S 50°	02:11	03:09	03:51	19:46	20:28	21:27
52°	01:50	02:56	03:41	19:56	20:41	21:48
54°	01:22	02:41	03:31	20:06	20:56	22:16
56°	00:37	02:23	03:19	20:19	21:14	23:05
58°	▭	02:01	03:05	20:33	21:37	▭
S 60°	▭	01:31	02:48	20:50	22:08	▭

Lat.	**Moonrise** Mon	Tue	Wed	**Moonset** Mon	Tue	Wed
N 72°	14:26	14:16	14:06	23:43	–:–	01:33
N 70°	14:14	14:11	14:07	23:53	–:–	01:35
68°	14:05	14:07	14:08	–:–	00:00	01:37
66°	13:57	14:03	14:09	–:–	00:06	01:38
64°	13:51	14:00	14:09	–:–	00:12	01:39
62°	13:45	13:58	14:10	–:–	00:16	01:41
60°	13:40	13:55	14:11	–:–	00:20	01:41
N 58°	13:36	13:53	14:11	–:–	00:24	01:42
56°	13:32	13:52	14:12	–:–	00:27	01:43
54°	13:28	13:50	14:12	–:–	00:30	01:44
52°	13:25	13:49	14:12	–:–	00:32	01:44
50°	13:22	13:47	14:13	–:–	00:34	01:45
45°	13:16	13:44	14:13	–:–	00:39	01:46
N 40°	13:10	13:42	14:14	–:–	00:43	01:47
35°	13:06	13:40	14:15	–:–	00:47	01:48
30°	13:01	13:38	14:15	–:–	00:50	01:49
20°	12:54	13:35	14:16	00:03	00:55	01:50
N 10°	12:48	13:32	14:17	00:11	01:00	01:51
0°	12:42	13:29	14:17	00:18	01:04	01:52
S 10°	12:36	13:26	14:18	00:25	01:09	01:53
20°	12:30	13:24	14:19	00:33	01:13	01:54
30°	12:23	13:20	14:20	00:42	01:18	01:55
35°	12:19	13:18	14:21	00:47	01:21	01:56
40°	12:14	13:16	14:21	00:53	01:25	01:56
45°	12:08	13:14	14:22	00:59	01:29	01:57
S 50°	12:02	13:11	14:23	01:07	01:33	01:58
52°	11:59	13:10	14:23	01:11	01:35	01:59
54°	11:55	13:08	14:24	01:15	01:37	01:59
56°	11:52	13:06	14:24	01:19	01:40	02:00
58°	11:47	13:05	14:25	01:24	01:43	02:00
S 60°	11:43	13:03	14:26	01:30	01:46	02:01

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 9-11 58-78%
27	12:28	12:18	11:48	18:53	06:30	
28	12:08	11:58	11:48	19:40	07:17	
29	11:48	11:37	11:48	20:29	08:05	

November 30, 01, 02 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	69°03.3	192°51.7	S19°00.8	226°20.4	S08°21.9	210°17.3	S14°07.0	161°36.0	S22°28.7
1	84°05.8	207°50.9	01.6	241°21.4	22.5	225°19.3	07.1	176°38.2	28.7
2	99°08.2	222°50.2	02.4	256°22.4	23.1	240°21.3	07.3	191°40.3	28.7
3	114°10.7	237°49.4	·· 03.2	271°23.4	·· 23.7	255°23.2	·· 07.4	206°42.5	·· 28.7
4	129°13.2	252°48.7	04.0	286°24.4	24.3	270°25.2	07.6	221°44.6	28.8
5	144°15.6	267°47.9	04.7	301°25.4	24.9	285°27.1	07.8	236°46.8	28.8
6	159°18.1	282°47.1	S19°05.5	316°26.4	S08°25.4	300°29.1	S14°07.9	251°49.0	S22°28.8
7	174°20.6	297°46.4	06.3	331°27.4	26.0	315°31.1	08.1	266°51.1	28.8
8	189°23.0	312°45.6	07.1	346°28.4	26.6	330°33.0	08.2	281°53.3	28.8
9	204°25.5	327°44.9	·· 07.8	1°29.3	·· 27.2	345°35.0	·· 08.4	296°55.4	·· 28.8
10	219°28.0	342°44.1	08.6	16°30.3	27.8	0°36.9	08.6	311°57.6	28.8
11	234°30.4	357°43.3	09.4	31°31.3	28.4	15°38.9	08.7	326°59.7	28.8
12	249°32.9	12°42.6	S19°10.2	46°32.3	S08°28.9	30°40.9	S14°08.9	342°01.9	S22°28.8
13	264°35.3	27°41.8	10.9	61°33.3	29.5	45°42.8	09.0	357°04.1	28.8
14	279°37.8	42°41.0	11.7	76°34.3	30.1	60°44.8	09.2	12°06.2	28.8
15	294°40.3	57°40.3	·· 12.5	91°35.3	·· 30.7	75°46.7	·· 09.3	27°08.4	·· 28.9
16	309°42.7	72°39.5	13.2	106°36.3	31.3	90°48.7	09.5	42°10.5	28.9
17	324°45.2	87°38.8	14.0	121°37.3	31.9	105°50.7	09.7	57°12.7	28.9
18	339°47.7	102°38.0	S19°14.8	136°38.2	S08°32.5	120°52.6	S14°09.8	72°14.8	S22°28.9
19	354°50.1	117°37.2	15.5	151°39.2	33.0	135°54.6	10.0	87°17.0	28.9
20	9°52.6	132°36.5	16.3	166°40.2	33.6	150°56.5	10.1	102°19.1	28.9
21	24°55.1	147°35.7	·· 17.0	181°41.2	·· 34.2	165°58.5	·· 10.3	117°21.3	·· 28.9
22	39°57.5	162°34.9	17.8	196°42.2	34.8	181°00.5	10.4	132°23.5	28.9
23	55°00.0	177°34.2	18.6	211°43.2	35.4	196°02.4	10.6	147°25.6	28.9
Mer.pass.:19:21		v-0.8 d-0.8 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	70°02.5	192°33.4	S19°19.3	226°44.2	S08°36.0	211°04.4	S14°10.8	162°27.8	S22°28.9
1	85°04.9	207°32.6	20.1	241°45.2	36.5	226°06.3	10.9	177°29.9	28.9
2	100°07.4	222°31.8	20.8	256°46.1	37.1	241°08.3	11.1	192°32.1	28.9
3	115°09.8	237°31.1	·· 21.6	271°47.1	·· 37.7	256°10.3	·· 11.2	207°34.2	·· 29.0
4	130°12.3	252°30.3	22.4	286°48.1	38.3	271°12.2	11.4	222°36.4	29.0
5	145°14.8	267°29.5	23.1	301°49.1	38.9	286°14.2	11.5	237°38.6	29.0
6	160°17.2	282°28.8	S19°23.9	316°50.1	S08°39.4	301°16.1	S14°11.7	252°40.7	S22°29.0
7	175°19.7	297°28.0	24.6	331°51.1	40.0	316°18.1	11.9	267°42.9	29.0
8	190°22.2	312°27.2	25.4	346°52.1	40.6	331°20.1	12.0	282°45.0	29.0
9	205°24.6	327°26.4	·· 26.1	1°53.1	·· 41.2	346°22.0	·· 12.2	297°47.2	·· 29.0
10	220°27.1	342°25.7	26.9	16°54.0	41.8	1°24.0	12.3	312°49.3	29.0
11	235°29.6	357°24.9	27.6	31°55.0	42.4	16°25.9	12.5	327°51.5	29.0
12	250°32.0	12°24.1	S19°28.4	46°56.0	S08°42.9	31°27.9	S14°12.6	342°53.6	S22°29.0
13	265°34.5	27°23.4	29.1	61°57.0	43.5	46°29.9	12.8	357°55.8	29.0
14	280°37.0	42°22.6	29.9	76°58.0	44.1	61°31.8	13.0	12°58.0	29.1
15	295°39.4	57°21.8	·· 30.6	91°59.0	·· 44.7	76°33.8	·· 13.1	28°00.1	·· 29.1
16	310°41.9	72°21.0	31.4	107°00.0	45.3	91°35.7	13.3	43°02.3	29.1
17	325°44.3	87°20.2	32.1	122°00.9	45.8	106°37.7	13.4	58°04.4	29.1
18	340°46.8	102°19.5	S19°32.8	137°01.9	S08°46.4	121°39.7	S14°13.6	73°06.6	S22°29.1
19	355°49.3	117°18.7	33.6	152°02.9	47.0	136°41.6	13.7	88°08.7	29.1
20	10°51.7	132°17.9	34.3	167°03.9	47.6	151°43.6	13.9	103°10.9	29.1
21	25°54.2	147°17.1	·· 35.1	182°04.9	·· 48.2	166°45.6	·· 14.1	118°13.0	·· 29.1
22	40°56.7	162°16.4	35.8	197°05.9	48.8	181°47.5	14.2	133°15.2	29.1
23	55°59.1	177°15.6	36.6	212°06.9	49.3	196°49.5	14.4	148°17.4	29.1
Mer.pass.:19:17		v-0.8 d-0.8 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	71°01.6	192°14.8	S19°37.3	227°07.9	S08°49.9	211°51.4	S14°14.5	163°19.5	S22°29.1
1	86°04.1	207°14.0	38.0	242°08.8	50.5	226°53.4	14.7	178°21.7	29.1
2	101°06.5	222°13.2	38.8	257°09.8	51.1	241°55.4	14.8	193°23.8	29.2
3	116°09.0	237°12.4	·· 39.5	272°10.8	·· 51.7	256°57.3	·· 15.0	208°26.0	·· 29.2
4	131°11.4	252°11.7	40.2	287°11.8	52.2	271°59.3	15.1	223°28.1	29.2
5	146°13.9	267°10.9	41.0	302°12.8	52.8	287°01.2	15.3	238°30.3	29.2
6	161°16.4	282°10.1	S19°41.7	317°13.8	S08°53.4	302°03.2	S14°15.5	253°32.4	S22°29.2
7	176°18.8	297°09.3	42.4	332°14.8	54.0	317°05.2	15.6	268°34.6	29.2
8	191°21.3	312°08.5	43.2	347°15.7	54.6	332°07.1	15.8	283°36.8	29.2
9	206°23.8	327°07.7	·· 43.9	2°16.7	·· 55.1	347°09.1	·· 15.9	298°38.9	·· 29.2
10	221°26.2	342°07.0	44.6	17°17.7	55.7	2°11.1	16.1	313°41.1	29.2
11	236°28.7	357°06.2	45.3	32°18.7	56.3	17°13.0	16.2	328°43.2	29.2
12	251°31.2	12°05.4	S19°46.1	47°19.7	S08°56.9	32°15.0	S14°16.4	343°45.4	S22°29.2
13	266°33.6	27°04.6	46.8	62°20.7	57.4	47°16.9	16.6	358°47.5	29.2
14	281°36.1	42°03.8	47.5	77°21.6	58.0	62°18.9	16.7	13°49.7	29.2
15	296°38.6	57°03.0	·· 48.2	92°22.6	·· 58.6	77°20.9	·· 16.9	28°51.8	·· 29.3
16	311°41.0	72°02.2	49.0	107°23.6	59.2	92°22.8	17.0	43°54.0	29.3
17	326°43.5	87°01.4	49.7	122°24.6	08°59.8	107°24.8	17.2	58°56.1	29.3
18	341°45.9	102°00.7	S19°50.4	137°25.6	S09°00.3	122°26.8	S14°17.3	73°58.3	S22°29.3
19	356°48.4	116°59.9	51.1	152°26.6	00.9	137°28.7	17.5	89°00.5	29.3
20	11°50.9	131°59.1	51.8	167°27.6	01.5	152°30.7	17.6	104°02.6	29.3
21	26°53.3	146°58.3	·· 52.5	182°28.5	·· 02.1	167°32.6	·· 17.8	119°04.8	·· 29.3
22	41°55.8	161°57.5	53.3	197°29.5	02.7	182°34.6	17.9	134°06.9	29.3
23	56°58.3	176°56.7	54.0	212°30.5	03.2	197°36.6	18.1	149°09.1	29.3
Mer.pass.:19:13		v-0.8 d-0.7 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.6	-42°12.8
Schedar	349°36.7	56°38.3
Diphda	348°52.7	-17°53.5
Achernar	335°24.2	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	315°58.5	89°20.4
Acamar	315°15.7	-40°14.2
Menkar	314°11.6	4°09.5
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.8	-8°11.0
Capella	280°29.5	46°00.7
Bellatrix	278°28.5	6°21.8
Elnath	278°08.5	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.7	7°24.5
Canopus	263°54.3	-52°42.3
Sirius	258°30.8	-16°44.5
Adhara	255°09.8	-28°59.8
Procyon	244°56.4	5°10.6
Pollux	243°23.8	27°58.7
Avior	234°16.4	-59°33.8
Suhail	222°50.0	-43°30.1
Miaplacidus	221°38.6	-69°47.2
Alphard	217°53.0	-8°44.1
Regulus	207°40.3	11°52.7
Dubhe	193°48.2	61°39.0
Denebola	182°30.7	14°28.4
Gienah	175°49.3	-17°38.2
Acrux	173°06.2	-63°11.5
Gacrux	171°57.8	-57°12.4
Alioth	166°18.5	55°51.7
Spica	158°28.3	-11°15.0
Alkaid	152°57.0	49°13.4
Hadar	148°44.1	-60°27.2
Menkent	148°04.3	-36°27.1
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°48.2	-60°54.1
Kochab	137°21.3	74°04.9
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.9	26°39.5
Antares	112°23.0	-26°28.0
Atria	107°22.6	-69°03.3
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.3	51°29.5
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.3
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.2
Peacock	53°15.0	-56°40.7
Deneb	49°29.7	45°21.0
Enif	33°44.3	9°57.6
Al Na'ir	27°40.1	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Nov 30 Thu	SHA	Mer.pass
Venus	123°48.4	11:09
Mars	157°17.1	08:54
Jupiter	141°14.0	09:58
Saturn	92°32.7	13:12

Dec 01 Fri	SHA	Mer.pass
Venus	122°30.9	11:10
Mars	156°41.7	08:52
Jupiter	141°01.9	09:54
Saturn	92°25.3	13:08

Dec 02 Sat	SHA	Mer.pass
Venus	121°13.2	11:12
Mars	156°06.3	08:51
Jupiter	140°49.8	09:51
Saturn	92°17.9	13:05

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2497 sec ΔT = TT-UT1 = +68.9343 sec

2017 November 30 to Dec. 02 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	182°51.6	S21°38.0	50°56.0	10.7'	N02°56.8	11.7'	58.7'
1	197°51.4	38.4	65°25.7	10.7'	03°08.5	11.7'	58.7'
2	212°51.1	38.8	79°55.4	10.6'	03°20.3	11.7'	58.8'
3	227°50.9	·· 39.2	94°24.9	10.5'	03°32.0	11.7'	58.8'
4	242°50.7	39.6	108°54.4	10.5'	03°43.8	11.7'	58.8'
5	257°50.4	40.0	123°23.9	10.4'	03°55.5	11.7'	58.9'
6	272°50.2	S21°40.4	137°53.2	10.3'	N04°07.2	11.7'	58.9'
7	287°50.0	40.8	152°22.6	10.3'	04°19.0	11.7'	59.0'
8	302°49.8	41.2	166°51.8	10.2'	04°30.7	11.7'	59.0'
9	317°49.5	·· 41.6	181°21.0	10.2'	04°42.4	11.7'	59.0'
10	332°49.3	42.0	195°50.1	10.1'	04°54.1	11.7'	59.1'
11	347°49.1	42.4	210°19.2	10.0'	05°05.8	11.7'	59.1'
12	2°48.9	S21°42.8	224°48.2	10.0'	N05°17.5	11.7'	59.2'
13	17°48.6	43.2	239°17.1	9.9'	05°29.1	11.7'	59.2'
14	32°48.4	43.6	253°45.9	9.8'	05°40.8	11.6'	59.2'
15	47°48.2	·· 44.0	268°14.7	9.7'	05°52.4	11.6'	59.3'
16	62°47.9	44.4	282°43.4	9.7'	06°04.1	11.6'	59.3'
17	77°47.7	44.8	297°12.0	9.6'	06°15.7	11.6'	59.4'
18	92°47.5	S21°45.2	311°40.6	9.5'	N06°27.2	11.6'	59.4'
19	107°47.3	45.6	326°09.1	9.5'	06°38.8	11.6'	59.4'
20	122°47.0	45.9	340°37.5	9.4'	06°50.3	11.5'	59.5'
21	137°46.8	·· 46.3	355°05.9	9.3'	07°01.9	11.5'	59.5'
22	152°46.6	46.7	9°34.1	9.2'	07°13.4	11.5'	59.5'
23	167°46.3	47.1	24°02.3	9.2'	07°24.8	11.4'	59.6'
	SD.=16.2	d=-0.4	S.D.=16.1				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	182°46.1	S21°47.5	38°30.5	9.1'	N07°36.3	11.4'	59.6'
1	197°45.9	47.9	52°58.5	9.0'	07°47.7	11.4'	59.7'
2	212°45.6	48.3	67°26.5	8.9'	07°59.0	11.4'	59.7'
3	227°45.4	·· 48.7	81°54.4	8.9'	08°10.4	11.3'	59.7'
4	242°45.2	49.1	96°22.2	8.8'	08°21.7	11.3'	59.8'
5	257°44.9	49.4	110°49.9	8.7'	08°33.0	11.3'	59.8'
6	272°44.7	S21°49.8	125°17.6	8.6'	N08°44.2	11.2'	59.8'
7	287°44.5	50.2	139°45.2	8.5'	08°55.4	11.2'	59.9'
8	302°44.2	50.6	154°12.7	8.5'	09°06.5	11.1'	59.9'
9	317°44.0	·· 51.0	168°40.1	8.4'	09°17.7	11.1'	59.9'
10	332°43.8	51.4	183°07.4	8.3'	09°28.7	11.0'	60.0'
11	347°43.5	51.7	197°34.7	8.2'	09°39.8	11.0'	60.0'
12	2°43.3	S21°52.1	212°01.9	8.1'	N09°50.7	11.0'	60.0'
13	17°43.1	52.5	226°29.0	8.1'	10°01.7	10.9'	60.1'
14	32°42.8	52.9	240°56.0	8.0'	10°12.6	10.9'	60.1'
15	47°42.6	·· 53.3	255°22.9	7.9'	10°23.4	10.8'	60.1'
16	62°42.4	53.6	269°49.8	7.8'	10°34.2	10.8'	60.2'
17	77°42.1	54.0	284°16.6	7.7'	10°44.9	10.7'	60.2'
18	92°41.9	S21°54.4	298°43.3	7.6'	N10°55.6	10.6'	60.2'
19	107°41.7	54.8	313°09.9	7.6'	11°06.2	10.6'	60.3'
20	122°41.4	55.1	327°36.4	7.5'	11°16.7	10.5'	60.3'
21	137°41.2	·· 55.5	342°02.8	7.4'	11°27.2	10.5'	60.3'
22	152°41.0	55.9	356°29.2	7.3'	11°37.7	10.4'	60.4'
23	167°40.7	56.3	10°55.5	7.2'	11°48.0	10.3'	60.4'
	SD.=16.2	d=-0.4	S.D.=16.4				

Sat	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	182°40.5	S21°56.6	25°21.7	7.1'	N11°58.3	10.3'	60.4'
1	197°40.2	57.0	39°47.8	7.1'	12°08.6	10.2'	60.5'
2	212°40.0	57.4	54°13.8	7.0'	12°18.7	10.1'	60.5'
3	227°39.8	·· 57.8	68°39.7	6.9'	12°28.8	10.1'	60.5'
4	242°39.5	58.1	83°05.6	6.8'	12°38.9	10.0'	60.5'
5	257°39.3	58.5	97°31.4	6.7'	12°48.8	9.9'	60.6'
6	272°39.0	S21°58.9	111°57.0	6.6'	N12°58.7	9.8'	60.6'
7	287°38.8	59.2	126°22.7	6.6'	13°08.5	9.8'	60.6'
8	302°38.6	21°59.6	140°48.2	6.5'	13°18.2	9.7'	60.7'
9	317°38.3	22°00.0	155°13.6	6.4'	13°27.9	9.6'	60.7'
10	332°38.1	00.3	169°39.0	6.3'	13°37.4	9.5'	60.7'
11	347°37.8	00.7	184°04.2	6.2'	13°46.9	9.4'	60.7'
12	2°37.6	S22°01.0	198°29.4	6.2'	N13°56.3	9.4'	60.8'
13	17°37.4	01.4	212°54.6	6.1'	14°05.6	9.3'	60.8'
14	32°37.1	01.8	227°19.6	6.0'	14°14.8	9.2'	60.8'
15	47°36.9	·· 02.1	241°44.5	5.9'	14°24.0	9.1'	60.8'
16	62°36.6	02.5	256°09.4	5.8'	14°33.0	9.0'	60.9'
17	77°36.4	02.9	270°34.2	5.7'	14°42.0	8.9'	60.9'
18	92°36.2	S22°03.2	284°58.9	5.7'	N14°50.8	8.8'	60.9'
19	107°35.9	03.6	299°23.5	5.6'	14°59.6	8.7'	60.9'
20	122°35.7	03.9	313°48.1	5.5'	15°08.2	8.6'	60.9'
21	137°35.4	·· 04.3	328°12.5	5.4'	15°16.8	8.5'	61.0'
22	152°35.2	04.6	342°36.9	5.4'	15°25.3	8.4'	61.0'
23	167°34.9	05.0	357°01.3	5.3'	15°33.6	8.3'	61.0'
	SD.=16.2	d=-0.4	S.D.=16.6				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	07:51	09:51	▬	▬	13:47	15:46
N 70°	07:35	09:11	▬	▬	14:26	16:02
68°	07:22	08:44	10:37	13:01	14:53	16:16
66°	07:11	08:23	09:47	13:50	15:14	16:27
64°	07:01	08:07	09:16	14:21	15:31	16:36
62°	06:53	07:53	08:54	14:44	15:45	16:44
60°	06:46	07:41	08:35	15:03	15:57	16:52
N 58°	06:40	07:31	08:20	15:18	16:07	16:58
56°	06:34	07:22	08:07	15:31	16:16	17:04
54°	06:28	07:13	07:56	15:42	16:24	17:10
52°	06:23	07:06	07:46	15:52	16:32	17:15
50°	06:19	06:59	07:37	16:01	16:38	17:19
45°	06:08	06:45	07:18	16:20	16:53	17:30
N 40°	05:59	06:33	07:03	16:35	17:05	17:39
35°	05:51	06:22	06:50	16:48	17:16	17:47
30°	05:43	06:12	06:38	17:00	17:26	17:55
20°	05:28	05:55	06:19	17:19	17:43	18:10
N 10°	05:13	05:39	06:02	17:37	17:59	18:25
0°	04:57	05:23	05:45	17:53	18:15	18:41
S 10°	04:40	05:06	05:29	18:09	18:32	18:59
20°	04:19	04:47	05:12	18:27	18:51	19:20
30°	03:52	04:24	04:51	18:47	19:14	19:47
35°	03:35	04:10	04:39	18:59	19:28	20:04
40°	03:13	03:54	04:25	19:13	19:45	20:26
45°	02:46	03:33	04:09	19:30	20:06	20:53
S 50°	02:07	03:06	03:49	19:50	20:33	21:33
52°	01:44	02:53	03:39	20:00	20:46	21:56
54°	01:14	02:37	03:28	20:11	21:02	22:27
56°	00:16	02:19	03:15	20:24	21:21	23:35
58°	▭	01:55	03:01	20:39	21:45	▭
S 60°	▭	01:22	02:43	20:56	22:19	▭

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	13:56	13:44	13:29	03:26	05:27	07:38
N 70°	14:03	14:00	13:57	03:21	05:13	07:13
68°	14:10	14:12	14:17	03:17	05:02	06:53
66°	14:15	14:23	14:34	03:14	04:54	06:38
64°	14:19	14:31	14:48	03:11	04:46	06:25
62°	14:23	14:39	14:59	03:08	04:40	06:14
60°	14:27	14:46	15:09	03:06	04:34	06:05
N 58°	14:30	14:51	15:18	03:04	04:29	05:57
56°	14:33	14:57	15:25	03:02	04:25	05:50
54°	14:35	15:01	15:32	03:01	04:21	05:44
52°	14:37	15:05	15:38	03:00	04:18	05:39
50°	14:39	15:09	15:44	02:58	04:15	05:33
45°	14:44	15:18	15:56	02:55	04:08	05:23
N 40°	14:48	15:25	16:06	02:53	04:02	05:14
35°	14:51	15:31	16:15	02:51	03:57	05:06
30°	14:54	15:36	16:22	02:49	03:53	04:59
20°	14:59	15:45	16:36	02:46	03:46	04:48
N 10°	15:04	15:54	16:47	02:44	03:39	04:38
0°	15:08	16:01	16:58	02:41	03:33	04:28
S 10°	15:12	16:09	17:09	02:39	03:27	04:19
20°	15:17	16:18	17:21	02:36	03:20	04:08
30°	15:22	16:27	17:35	02:33	03:13	03:57
35°	15:25	16:33	17:43	02:31	03:09	03:50
40°	15:29	16:39	17:52	02:29	03:04	03:43
45°	15:33	16:47	18:03	02:27	02:58	03:34
S 50°	15:38	16:56	18:16	02:24	02:52	03:24
52°	15:40	17:00	18:22	02:23	02:49	03:19
54°	15:43	17:05	18:29	02:21	02:45	03:13
56°	15:46	17:10	18:36	02:20	02:42	03:08
58°	15:49	17:16	18:45	02:18	02:38	03:01
S 60°	15:52	17:22	18:54	02:16	02:33	02:54

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 12-14 86-98%
30	11:26	11:15	11:49	21:20	08:54	
01	11:04	10:53	11:49	22:15	09:47	
02	10:42	10:30	11:49	23:12	10:43	

December 03, 04, 05 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	72°00.7	191°55.9	S19°54.7	227°31.5	S09°03.8	212°38.5	S14°18.3	164°11.2	S22°29.3
1	87°03.2	206°55.1	55.4	242°32.5	04.4	227°40.5	18.4	179°13.4	29.3
2	102°05.7	221°54.3	56.1	257°33.5	05.0	242°42.5	18.6	194°15.5	29.3
3	117°08.1	236°53.5	·· 56.8	272°34.4	·· 05.5	257°44.4	·· 18.7	209°17.7	·· 29.4
4	132°10.6	251°52.7	57.5	287°35.4	06.1	272°46.4	18.9	224°19.8	29.4
5	147°13.1	266°51.9	58.3	302°36.4	06.7	287°48.4	19.0	239°22.0	29.4
6	162°15.5	281°51.1	S19°59.0	317°37.4	S09°07.3	302°50.3	S14°19.2	254°24.1	S22°29.4
7	177°18.0	296°50.3	19°59.7	332°38.4	07.9	317°52.3	19.3	269°26.3	29.4
8	192°20.4	311°49.5	20°00.4	347°39.4	08.4	332°54.2	19.5	284°28.5	29.4
9	207°22.9	326°48.7	·· 01.1	2°40.3	·· 09.0	347°56.2	·· 19.7	299°30.6	·· 29.4
10	222°25.4	341°47.9	01.8	17°41.3	09.6	2°58.2	19.8	314°32.8	29.4
11	237°27.8	356°47.1	02.5	32°42.3	10.2	18°00.1	20.0	329°34.9	29.4
12	252°30.3	11°46.4	S20°03.2	47°43.3	S09°10.7	33°02.1	S14°20.1	344°37.1	S22°29.4
13	267°32.8	26°45.6	03.9	62°44.3	11.3	48°04.1	20.3	359°39.2	29.4
14	282°35.2	41°44.8	04.6	77°45.3	11.9	63°06.0	20.4	14°41.4	29.4
15	297°37.7	56°44.0	·· 05.3	92°46.3	·· 12.5	78°08.0	·· 20.6	29°43.5	·· 29.4
16	312°40.2	71°43.2	06.0	107°47.2	13.0	93°10.0	20.7	44°45.7	29.5
17	327°42.6	86°42.3	06.7	122°48.2	13.6	108°11.9	20.9	59°47.8	29.5
18	342°45.1	101°41.5	S20°07.4	137°49.2	S09°14.2	123°13.9	S14°21.0	74°50.0	S22°29.5
19	357°47.6	116°40.7	08.1	152°50.2	14.8	138°15.9	21.2	89°52.1	29.5
20	12°50.0	131°39.9	08.8	167°51.2	15.3	153°17.8	21.4	104°54.3	29.5
21	27°52.5	146°39.1	·· 09.5	182°52.1	·· 15.9	168°19.8	·· 21.5	119°56.5	·· 29.5
22	42°54.9	161°38.3	10.2	197°53.1	16.5	183°21.7	21.7	134°58.6	29.5
23	57°57.4	176°37.5	10.9	212°54.1	17.1	198°23.7	21.8	150°00.8	29.5
Mer.pass.:19:09		v-0.8 d-0.7 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	72°59.9	191°36.7	S20°11.5	227°55.1	S09°17.7	213°25.7	S14°22.0	165°02.9	S22°29.5
1	88°02.3	206°35.9	12.2	242°56.1	18.2	228°27.6	22.1	180°05.1	29.5
2	103°04.8	221°35.1	12.9	257°57.1	18.8	243°29.6	22.3	195°07.2	29.5
3	118°07.3	236°34.3	·· 13.6	272°58.0	·· 19.4	258°31.6	·· 22.4	210°09.4	·· 29.5
4	133°09.7	251°33.5	14.3	287°59.0	20.0	273°33.5	22.6	225°11.5	29.6
5	148°12.2	266°32.7	15.0	303°00.0	20.5	288°35.5	22.7	240°13.7	29.6
6	163°14.7	281°31.9	S20°15.7	318°01.0	S09°21.1	303°37.5	S14°22.9	255°15.8	S22°29.6
7	178°17.1	296°31.1	16.3	333°02.0	21.7	318°39.4	23.0	270°18.0	29.6
8	193°19.6	311°30.3	17.0	348°03.0	22.3	333°41.4	23.2	285°20.1	29.6
9	208°22.1	326°29.5	·· 17.7	3°03.9	·· 22.8	348°43.4	·· 23.4	300°22.3	·· 29.6
10	223°24.5	341°28.7	18.4	18°04.9	23.4	3°45.3	23.5	315°24.4	29.6
11	238°27.0	356°27.8	19.1	33°05.9	24.0	18°47.3	23.7	330°26.6	29.6
12	253°29.4	11°27.0	S20°19.7	48°06.9	S09°24.5	33°49.3	S14°23.8	345°28.7	S22°29.6
13	268°31.9	26°26.2	20.4	63°07.9	25.1	48°51.2	24.0	0°30.9	29.6
14	283°34.4	41°25.4	21.1	78°08.8	25.7	63°53.2	24.1	15°33.1	29.6
15	298°36.8	56°24.6	·· 21.8	93°09.8	·· 26.3	78°55.2	·· 24.3	30°35.2	·· 29.6
16	313°39.3	71°23.8	22.5	108°10.8	26.8	93°57.1	24.4	45°37.4	29.6
17	328°41.8	86°23.0	23.1	123°11.8	27.4	108°59.1	24.6	60°39.5	29.6
18	343°44.2	101°22.2	S20°23.8	138°12.8	S09°28.0	124°01.1	S14°24.7	75°41.7	S22°29.7
19	358°46.7	116°21.3	24.5	153°13.7	28.6	139°03.0	24.9	90°43.8	29.7
20	13°49.2	131°20.5	25.1	168°14.7	29.1	154°05.0	25.0	105°46.0	29.7
21	28°51.6	146°19.7	·· 25.8	183°15.7	·· 29.7	169°07.0	·· 25.2	120°48.1	·· 29.7
22	43°54.1	161°18.9	26.5	198°16.7	30.3	184°08.9	25.3	135°50.3	29.7
23	58°56.6	176°18.1	27.1	213°17.7	30.9	199°10.9	25.5	150°52.4	29.7
Mer.pass.:19:05		v-0.8 d-0.7 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	73°59.0	191°17.3	S20°27.8	228°18.7	S09°31.4	214°12.9	S14°25.6	165°54.6	S22°29.7
1	89°01.5	206°16.4	28.5	243°19.6	32.0	229°14.8	25.8	180°56.7	29.7
2	104°03.9	221°15.6	29.1	258°20.6	32.6	244°16.8	26.0	195°58.9	29.7
3	119°06.4	236°14.8	·· 29.8	273°21.6	·· 33.1	259°18.8	·· 26.1	211°01.0	·· 29.7
4	134°08.9	251°14.0	30.5	288°22.6	33.7	274°20.7	26.3	226°03.2	29.7
5	149°11.3	266°13.2	31.1	303°23.6	34.3	289°22.7	26.4	241°05.3	29.7
6	164°13.8	281°12.4	S20°31.8	318°24.5	S09°34.9	304°24.7	S14°26.6	256°07.5	S22°29.7
7	179°16.3	296°11.5	32.5	333°25.5	35.4	319°26.6	26.7	271°09.6	29.8
8	194°18.7	311°10.7	33.1	348°26.5	36.0	334°28.6	26.9	286°11.8	29.8
9	209°21.2	326°09.9	·· 33.8	3°27.5	·· 36.6	349°30.6	·· 27.0	301°13.9	·· 29.8
10	224°23.7	341°09.1	34.4	18°28.5	37.1	4°32.5	27.2	316°16.1	29.8
11	239°26.1	356°08.3	35.1	33°29.4	37.7	19°34.5	27.3	331°18.3	29.8
12	254°28.6	11°07.4	S20°35.7	48°30.4	S09°38.3	34°36.5	S14°27.5	346°20.4	S22°29.8
13	269°31.0	26°06.6	36.4	63°31.4	38.9	49°38.4	27.6	1°22.6	29.8
14	284°33.5	41°05.8	37.0	78°32.4	39.4	64°40.4	27.8	16°24.7	29.8
15	299°36.0	56°05.0	·· 37.7	93°33.4	·· 40.0	79°42.4	·· 27.9	31°26.9	·· 29.8
16	314°38.4	71°04.1	38.3	108°34.3	40.6	94°44.3	28.1	46°29.0	29.8
17	329°40.9	86°03.3	39.0	123°35.3	41.1	109°46.3	28.2	61°31.2	29.8
18	344°43.4	101°02.5	S20°39.6	138°36.3	S09°41.7	124°48.3	S14°28.4	76°33.3	S22°29.8
19	359°45.8	116°01.7	40.3	153°37.3	42.3	139°50.3	28.5	91°35.5	29.8
20	14°48.3	131°00.8	40.9	168°38.3	42.9	154°52.2	28.7	106°37.6	29.8
21	29°50.8	146°00.0	·· 41.6	183°39.2	·· 43.4	169°54.2	·· 28.8	121°39.8	·· 29.9
22	44°53.2	160°59.2	42.2	198°40.2	44.0	184°56.2	29.0	136°41.9	29.9
23	59°55.7	175°58.4	42.9	213°41.2	44.6	199°58.1	29.1	151°44.1	29.9
Mer.pass.:19:01		v-0.8 d-0.7 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.6	-42°12.8
Schedar	349°36.7	56°38.3
Diphda	348°52.7	-17°53.5
Achernar	335°24.2	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	315°58.7	89°20.4
Acamar	315°15.7	-40°14.2
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.8	-8°11.0
Capella	280°29.5	46°00.7
Bellatrix	278°28.5	6°21.8
Elnath	278°08.4	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.7	7°24.4
Canopus	263°54.3	-52°42.4
Sirius	258°30.8	-16°44.5
Adhara	255°09.8	-28°59.8
Procyon	244°56.4	5°10.6
Pollux	243°23.8	27°58.7
Avior	234°16.3	-59°33.9
Suhail	222°50.0	-43°30.1
Miaplacidus	221°38.5	-69°47.2
Alphard	217°53.0	-8°44.1
Regulus	207°40.3	11°52.7
Dubhe	193°48.2	61°39.0
Denebola	182°30.7	14°28.3
Gienah	175°49.3	-17°38.3
Acrux	173°06.1	-63°11.5
Gacrux	171°57.7	-57°12.4
Alioth	166°18.4	55°51.7
Spica	158°28.3	-11°15.0
Alkaid	152°57.0	49°13.4
Hadar	148°44.0	-60°27.2
Menkent	148°04.3	-36°27.1
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°48.1	-60°54.1
Kochab	137°21.3	74°04.9
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.8	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.6	-69°03.3
Sabik	102°09.5	-15°44.6
Shaula	96°18.3	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.3	51°29.5
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.3
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.2
Peacock	53°15.0	-56°40.7
Deneb	49°29.7	45°21.0
Enif	33°44.3	9°57.6
Al Na'ir	27°40.1	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Dec 03 Sun	**SHA**	**Mer.pass**
Venus	119°55.2	11:13
Mars	155°30.8	08:49
Jupiter	140°37.8	09:48
Saturn	92°10.5	13:01

Dec 04 Mon	**SHA**	**Mer.pass**
Venus	118°36.9	11:14
Mars	154°55.2	08:48
Jupiter	140°25.8	09:45
Saturn	92°03.0	12:58

Dec 05 Tue	**SHA**	**Mer.pass**
Venus	117°18.3	11:15
Mars	154°19.6	08:46
Jupiter	140°13.9	09:42
Saturn	91°55.6	12:55

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2464 sec ΔT = TT-UT1 = +68.9376 sec

2017 December 03 to Dec. 05 UT

h

Sun	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	182°34.7	S22°05.4	11°25.5	5.2′	N15°41.9	8.2′	61.0′
1	197°34.4	05.7	25°49.7	5.1′	15°50.0	8.1′	61.0′
2	212°34.2	06.1	40°13.8	5.1′	15°58.1	8.0′	61.1′
3	227°34.0	·· 06.4	54°37.8	5.0′	16°06.0	7.9′	61.1′
4	242°33.7	06.8	69°01.7	4.9′	16°13.8	7.8′	61.1′
5	257°33.5	07.1	83°25.6	4.8′	16°21.5	7.7′	61.1′
6	272°33.2	S22°07.5	97°49.4	4.8′	N16°29.1	7.5′	61.1′
7	287°33.0	07.8	112°13.1	4.7′	16°36.6	7.4′	61.1′
8	302°32.7	08.2	126°36.8	4.6′	16°44.0	7.3′	61.1′
9	317°32.5	·· 08.5	141°00.4	4.6′	16°51.2	7.2′	61.2′
10	332°32.2	08.9	155°23.9	4.5′	16°58.4	7.1′	61.2′
11	347°32.0	09.2	169°47.4	4.4′	17°05.4	7.0′	61.2′
12	2°31.7	S22°09.5	184°10.8	4.4′	N17°12.3	6.8′	61.2′
13	17°31.5	09.9	198°34.1	4.3′	17°19.0	6.7′	61.2′
14	32°31.3	10.2	212°57.4	4.2′	17°25.7	6.6′	61.2′
15	47°31.0	·· 10.6	227°20.6	4.2′	17°32.2	6.5′	61.2′
16	62°30.8	10.9	241°43.7	4.1′	17°38.6	6.3′	61.2′
17	77°30.5	11.3	256°06.8	4.1′	17°44.9	6.2′	61.3′
18	92°30.3	S22°11.6	270°29.8	4.0′	N17°51.0	6.1′	61.3′
19	107°30.0	11.9	284°52.8	4.0′	17°57.0	5.9′	61.3′
20	122°29.8	12.3	299°15.7	3.9′	18°02.9	5.8′	61.3′
21	137°29.5	·· 12.6	313°38.6	3.8′	18°08.6	5.7′	61.3′
22	152°29.3	13.0	328°01.4	3.8′	18°14.3	5.5′	61.3′
23	167°29.0	13.3	342°24.2	3.7′	18°19.7	5.4′	61.3′
	SD.=16.2	d=-0.4		S.D.=16.7			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°28.8	S22°13.6	356°46.9	3.7′	N18°25.1	5.3′	61.3′
1	197°28.5	14.0	11°09.6	3.7′	18°30.3	5.1′	61.3′
2	212°28.3	14.3	25°32.2	3.6′	18°35.3	5.0′	61.3′
3	227°28.0	·· 14.6	39°54.8	3.6′	18°40.3	4.9′	61.3′
4	242°27.8	15.0	54°17.4	3.5′	18°45.1	4.7′	61.3′
5	257°27.5	15.3	68°39.9	3.5′	18°49.7	4.6′	61.3′
6	272°27.3	S22°15.6	83°02.3	3.4′	N18°54.2	4.4′	61.3′
7	287°27.0	16.0	97°24.8	3.4′	18°58.6	4.3′	61.3′
8	302°26.8	16.3	111°47.1	3.4′	19°02.8	4.2′	61.3′
9	317°26.5	·· 16.6	126°09.5	3.3′	19°06.9	4.0′	61.3′
10	332°26.2	17.0	140°31.8	3.3′	19°10.8	3.9′	61.3′
11	347°26.0	17.3	154°54.1	3.3′	19°14.6	3.7′	61.3′
12	2°25.7	S22°17.6	169°16.4	3.3′	N19°18.2	3.6′	61.3′
13	17°25.5	17.9	183°38.7	3.2′	19°21.7	3.4′	61.3′
14	32°25.2	18.3	198°00.9	3.2′	19°25.1	3.3′	61.3′
15	47°25.0	·· 18.6	212°23.1	3.2′	19°28.3	3.1′	61.3′
16	62°24.7	18.9	226°45.3	3.2′	19°31.3	3.0′	61.3′
17	77°24.5	19.2	241°07.4	3.2′	19°34.3	2.8′	61.3′
18	92°24.2	S22°19.6	255°29.6	3.1′	N19°37.0	2.7′	61.3′
19	107°24.0	19.9	269°51.7	3.1′	19°39.6	2.5′	61.3′
20	122°23.7	20.2	284°13.8	3.1′	19°42.1	2.4′	61.3′
21	137°23.5	·· 20.5	298°35.9	3.1′	19°44.4	2.2′	61.3′
22	152°23.2	20.8	312°58.0	3.1′	19°46.5	2.1′	61.3′
23	167°22.9	21.2	327°20.1	3.1′	19°48.5	1.9′	61.3′
	SD.=16.2	d=-0.3		S.D.=16.7			

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	182°22.7	S22°21.5	341°42.2	3.1′	N19°50.4	1.8′	61.3′
1	197°22.4	21.8	356°04.3	3.1′	19°52.1	1.6′	61.3′
2	212°22.2	22.1	10°26.4	3.1′	19°53.6	1.5′	61.2′
3	227°21.9	·· 22.4	24°48.5	3.1′	19°55.0	1.3′	61.2′
4	242°21.7	22.8	39°10.6	3.1′	19°56.3	1.2′	61.2′
5	257°21.4	23.1	53°32.7	3.1′	19°57.4	1.0′	61.2′
6	272°21.1	S22°23.4	67°54.8	3.1′	N19°58.3	0.9′	61.2′
7	287°20.9	23.7	82°17.0	3.1′	19°59.1	0.7′	61.2′
8	302°20.6	24.0	96°39.1	3.1′	19°59.7	0.6′	61.2′
9	317°20.4	·· 24.3	111°01.3	3.2′	20°00.2	0.4′	61.2′
10	332°20.1	24.6	125°23.4	3.2′	20°00.5	0.3′	61.1′
11	347°19.8	24.9	139°45.6	3.2′	20°00.7	0.1′	61.1′
12	2°19.6	S22°25.2	154°07.8	3.2′	N20°00.8	-0.0′	61.1′
13	17°19.3	25.6	168°30.1	3.2′	20°00.6	-0.2′	61.1′
14	32°19.1	25.9	182°52.3	3.3′	20°00.4	-0.3′	61.1′
15	47°18.8	·· 26.2	197°14.6	3.3′	19°59.9	-0.5′	61.1′
16	62°18.6	26.5	211°36.9	3.3′	19°59.4	-0.6′	61.1′
17	77°18.3	26.8	225°59.2	3.4′	19°58.6	-0.8′	61.0′
18	92°18.0	S22°27.1	240°21.6	3.4′	N19°57.8	-0.9′	61.0′
19	107°17.8	27.4	254°44.0	3.4′	19°56.8	-1.1′	61.0′
20	122°17.5	27.7	269°06.5	3.5′	19°55.6	-1.2′	61.0′
21	137°17.2	·· 28.0	283°29.0	3.5′	19°54.3	-1.4′	61.0′
22	152°17.0	28.3	297°51.5	3.5′	19°52.8	-1.5′	60.9′
23	167°16.7	28.6	312°14.0	3.6′	19°51.2	-1.7′	60.9′
	SD.=16.2	d=-0.3		S.D.=16.7			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	07:59	10:05	▬	▬	13:35	15:41
N 70°	07:42	09:21	▬	▬	14:19	15:58
68°	07:28	08:52	10:56	12:44	14:48	16:12
66°	07:16	08:30	09:58	13:42	15:10	16:24
64°	07:07	08:13	09:24	14:16	15:27	16:34
62°	06:58	07:58	09:00	14:40	15:42	16:42
60°	06:50	07:46	08:41	14:59	15:54	16:50
N 58°	06:44	07:35	08:25	15:15	16:05	16:56
56°	06:38	07:26	08:12	15:28	16:14	17:03
54°	06:32	07:17	08:00	15:40	16:23	17:08
52°	06:27	07:10	07:50	15:50	16:30	17:13
50°	06:22	07:03	07:41	16:00	16:37	17:18
45°	06:11	06:48	07:21	16:19	16:52	17:29
N 40°	06:02	06:35	07:06	16:35	17:05	17:39
35°	05:53	06:24	06:52	16:48	17:16	17:47
30°	05:45	06:15	06:41	17:00	17:26	17:56
20°	05:30	05:57	06:21	17:20	17:44	18:11
N 10°	05:14	05:40	06:03	17:37	18:00	18:26
0°	04:58	05:24	05:47	17:54	18:16	18:42
S 10°	04:40	05:07	05:30	18:11	18:34	19:00
20°	04:19	04:48	05:12	18:29	18:53	19:22
30°	03:51	04:24	04:51	18:50	19:17	19:50
35°	03:34	04:10	04:39	19:02	19:31	20:07
40°	03:12	03:53	04:25	19:16	19:48	20:29
45°	02:44	03:32	04:08	19:33	20:10	20:58
S 50°	02:03	03:04	03:47	19:54	20:37	21:39
52°	01:40	02:50	03:37	20:04	20:51	22:03
54°	01:07	02:34	03:26	20:16	21:08	22:36
56°	▭	02:14	03:13	20:29	21:27	▭
58°	▭	01:50	02:57	20:44	21:53	▭
S 60°	▭	01:14	02:39	21:03	22:29	▭

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	12:59	▭	▭	10:13	▭	▭
N 70°	13:54	13:54	14:20	09:19	11:30	13:16
68°	14:28	14:50	15:40	08:46	10:34	11:56
66°	14:52	15:24	16:18	08:23	10:01	11:18
64°	15:11	15:49	16:45	08:04	09:36	10:51
62°	15:27	16:08	17:06	07:49	09:17	10:31
60°	15:41	16:24	17:23	07:36	09:01	10:14
N 58°	15:52	16:38	17:37	07:25	08:48	09:59
56°	16:02	16:49	17:49	07:16	08:36	09:47
54°	16:11	17:00	18:00	07:07	08:26	09:36
52°	16:19	17:09	18:09	07:00	08:17	09:27
50°	16:26	17:17	18:18	06:53	08:09	09:18
45°	16:41	17:35	18:36	06:38	07:52	09:00
N 40°	16:54	17:49	18:51	06:27	07:38	08:45
35°	17:05	18:01	19:03	06:16	07:26	08:33
30°	17:14	18:12	19:14	06:08	07:16	08:22
20°	17:31	18:30	19:33	05:52	06:58	08:03
N 10°	17:45	18:46	19:49	05:39	06:43	07:47
0°	17:59	19:01	20:04	05:27	06:28	07:31
S 10°	18:12	19:16	20:20	05:14	06:14	07:16
20°	18:27	19:33	20:36	05:01	05:58	07:00
30°	18:44	19:51	20:55	04:46	05:41	06:41
35°	18:54	20:02	21:06	04:37	05:30	06:30
40°	19:05	20:15	21:19	04:27	05:19	06:17
45°	19:18	20:29	21:33	04:16	05:05	06:02
S 50°	19:34	20:48	21:52	04:02	04:48	05:44
52°	19:42	20:56	22:00	03:55	04:40	05:35
54°	19:50	21:06	22:10	03:48	04:31	05:25
56°	20:00	21:17	22:21	03:40	04:21	05:15
58°	20:11	21:29	22:33	03:31	04:10	05:02
S 60°	20:23	21:43	22:47	03:20	03:57	04:48

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 15-17 100-95%
03	10:19	10:07	11:50	–:–	11:43	◯
04	09:55	09:43	11:50	00:13	12:45	
05	09:31	09:18	11:51	01:16	13:48	

December 06, 07, 08 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	74°58.2	190°57.5	S20°43.5	228°42.2	S09°45.1	215°00.1	S14°29.3	166°46.2	S22°29.9
1	90°00.6	205°56.7	44.1	243°43.1	45.7	230°02.1	29.5	181°48.4	29.9
2	105°03.1	220°55.9	44.8	258°44.1	46.3	245°04.0	29.6	196°50.5	29.9
3	120°05.5	235°55.0	·· 45.4	273°45.1	·· 46.8	260°06.0	·· 29.8	211°52.7	·· 29.9
4	135°08.0	250°54.2	46.1	288°46.1	47.4	275°08.0	29.9	226°54.8	29.9
5	150°10.5	265°53.4	46.7	303°47.1	48.0	290°09.9	30.1	241°57.0	29.9
6	165°12.9	280°52.5	S20°47.3	318°48.0	S09°48.6	305°11.9	S14°30.2	256°59.1	S22°29.9
7	180°15.4	295°51.7	48.0	333°49.0	49.1	320°13.9	30.4	272°01.3	29.9
8	195°17.9	310°50.9	48.6	348°50.0	49.7	335°15.8	30.5	287°03.4	29.9
9	210°20.3	325°50.0	·· 49.2	3°51.0	·· 50.3	350°17.8	·· 30.7	302°05.6	·· 29.9
10	225°22.8	340°49.2	49.9	18°52.0	50.8	5°19.8	30.8	317°07.7	29.9
11	240°25.3	355°48.4	50.5	33°52.9	51.4	20°21.8	31.0	332°09.9	30.0
12	255°27.7	10°47.5	S20°51.1	48°53.9	S09°52.0	35°23.7	S14°31.1	347°12.0	S22°30.0
13	270°30.2	25°46.7	51.8	63°54.9	52.5	50°25.7	31.3	2°14.2	30.0
14	285°32.7	40°45.9	52.4	78°55.9	53.1	65°27.7	31.4	17°16.3	30.0
15	300°35.1	55°45.0	·· 53.0	93°56.8	·· 53.7	80°29.6	·· 31.6	32°18.5	·· 30.0
16	315°37.6	70°44.2	53.6	108°57.8	54.2	95°31.6	31.7	47°20.6	30.0
17	330°40.0	85°43.4	54.3	123°58.8	54.8	110°33.6	31.9	62°22.8	30.0
18	345°42.5	100°42.5	S20°54.9	138°59.8	S09°55.4	125°35.5	S14°32.0	77°24.9	S22°30.0
19	0°45.0	115°41.7	55.5	154°00.8	55.9	140°37.5	32.2	92°27.1	30.0
20	15°47.4	130°40.9	56.1	169°01.7	56.5	155°39.5	32.3	107°29.2	30.0
21	30°49.9	145°40.0	·· 56.7	184°02.7	·· 57.1	170°41.5	·· 32.5	122°31.4	·· 30.0
22	45°52.4	160°39.2	57.4	199°03.7	57.6	185°43.4	32.6	137°33.5	30.0
23	60°54.8	175°38.3	58.0	214°04.7	58.2	200°45.4	32.8	152°35.7	30.0
Mer.pass.:18:57		v-0.8 d-0.6 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	75°57.3	190°37.5	S20°58.6	229°05.6	S09°58.8	215°47.4	S14°32.9	167°37.8	S22°30.0
1	90°59.8	205°36.7	59.2	244°06.6	59.3	230°49.3	33.1	182°40.0	30.1
2	106°02.2	220°35.8	20°59.8	259°07.6	09°59.9	245°51.3	33.2	197°42.1	30.1
3	121°04.7	235°35.0	21°00.4	274°08.6	10°00.5	260°53.3	·· 33.4	212°44.3	·· 30.1
4	136°07.2	250°34.1	01.1	289°09.5	01.0	275°55.3	33.5	227°46.4	30.1
5	151°09.6	265°33.3	01.7	304°10.5	01.6	290°57.2	33.7	242°48.6	30.1
6	166°12.1	280°32.5	S21°02.3	319°11.5	S10°02.2	305°59.2	S14°33.8	257°50.7	S22°30.1
7	181°14.5	295°31.6	02.9	334°12.5	02.7	321°01.2	34.0	272°52.9	30.1
8	196°17.0	310°30.8	03.5	349°13.4	03.3	336°03.1	34.1	287°55.1	30.1
9	211°19.5	325°29.9	·· 04.1	4°14.4	·· 03.9	351°05.1	·· 34.3	302°57.2	·· 30.1
10	226°21.9	340°29.1	04.7	19°15.4	04.4	6°07.1	34.4	317°59.4	30.1
11	241°24.4	355°28.2	05.3	34°16.4	05.0	21°09.1	34.6	333°01.5	30.1
12	256°26.9	10°27.4	S21°05.9	49°17.4	S10°05.6	36°11.0	S14°34.7	348°03.7	S22°30.1
13	271°29.3	25°26.5	06.5	64°18.3	06.1	51°13.0	34.9	3°05.8	30.1
14	286°31.8	40°25.7	07.1	79°19.3	06.7	66°15.0	35.0	18°08.0	30.1
15	301°34.3	55°24.9	·· 07.7	94°20.3	·· 07.3	81°16.9	·· 35.2	33°10.1	·· 30.1
16	316°36.7	70°24.0	08.3	109°21.3	07.8	96°18.9	35.3	48°12.3	30.2
17	331°39.2	85°23.2	08.9	124°22.2	08.4	111°20.9	35.5	63°14.4	30.2
18	346°41.7	100°22.3	S21°09.5	139°23.2	S10°09.0	126°22.9	S14°35.6	78°16.6	S22°30.2
19	1°44.1	115°21.5	10.1	154°24.2	09.5	141°24.8	35.8	93°18.7	30.2
20	16°46.6	130°20.6	10.7	169°25.2	10.1	156°26.8	35.9	108°20.9	30.2
21	31°49.0	145°19.8	·· 11.3	184°26.1	·· 10.7	171°28.8	·· 36.1	123°23.0	·· 30.2
22	46°51.5	160°18.9	11.9	199°27.1	11.2	186°30.7	36.2	138°25.2	30.2
23	61°54.0	175°18.1	12.5	214°28.1	11.8	201°32.7	36.4	153°27.3	30.2
Mer.pass.:18:53		v-0.8 d-0.6 m-3.8		v1.0 d-0.6 m1.7		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

Fri	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	76°56.4	190°17.2	S21°13.1	229°29.1	S10°12.4	216°34.7	S14°36.5	168°29.5	S22°30.2
1	91°58.9	205°16.4	13.7	244°30.0	12.9	231°36.7	36.7	183°31.6	30.2
2	107°01.4	220°15.5	14.3	259°31.0	13.5	246°38.6	36.8	198°33.8	30.2
3	122°03.8	235°14.7	·· 14.9	274°32.0	·· 14.1	261°40.6	·· 37.0	213°35.9	·· 30.2
4	137°06.3	250°13.8	15.4	289°33.0	14.6	276°42.6	37.1	228°38.1	30.2
5	152°08.8	265°13.0	16.0	304°33.9	15.2	291°44.6	37.3	243°40.2	30.2
6	167°11.2	280°12.1	S21°16.6	319°34.9	S10°15.7	306°46.5	S14°37.4	258°42.3	S22°30.2
7	182°13.7	295°11.2	17.2	334°35.9	16.3	321°48.5	37.6	273°44.5	30.3
8	197°16.1	310°10.4	17.8	349°36.9	16.9	336°50.5	37.7	288°46.6	30.3
9	212°18.6	325°09.5	·· 18.4	4°37.8	·· 17.4	351°52.4	·· 37.9	303°48.8	·· 30.3
10	227°21.1	340°08.7	18.9	19°38.8	18.0	6°54.4	38.0	318°50.9	30.3
11	242°23.5	355°07.8	19.5	34°39.8	18.6	21°56.4	38.2	333°53.1	30.3
12	257°26.0	10°07.0	S21°20.1	49°40.8	S10°19.1	36°58.4	S14°38.3	348°55.2	S22°30.3
13	272°28.5	25°06.1	20.7	64°41.7	19.7	52°00.3	38.4	3°57.4	30.3
14	287°30.9	40°05.3	21.3	79°42.7	20.2	67°02.3	38.6	18°59.5	30.3
15	302°33.4	55°04.4	·· 21.8	94°43.7	·· 20.8	82°04.3	·· 38.7	34°01.7	·· 30.3
16	317°35.9	70°03.5	22.4	109°44.6	21.4	97°06.3	38.9	49°03.8	30.3
17	332°38.3	85°02.7	23.0	124°45.6	21.9	112°08.2	39.0	64°06.0	30.3
18	347°40.8	100°01.8	S21°23.6	139°46.6	S10°22.5	127°10.2	S14°39.2	79°08.1	S22°30.3
19	2°43.3	115°01.0	24.1	154°47.6	23.1	142°12.2	39.3	94°10.3	30.3
20	17°45.7	130°00.1	24.7	169°48.5	23.6	157°14.2	39.5	109°12.4	30.3
21	32°48.2	144°59.2	·· 25.3	184°49.5	·· 24.2	172°16.1	·· 39.6	124°14.6	·· 30.3
22	47°50.6	159°58.4	25.8	199°50.5	24.7	187°18.1	39.8	139°16.7	30.4
23	62°53.1	174°57.5	26.4	214°51.5	25.3	202°20.1	39.9	154°18.9	30.4
Mer.pass.:18:49		v-0.9 d-0.6 m-3.8		v1.0 d-0.6 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.2	29°11.5
Ankaa	353°12.6	-42°12.8
Schedar	349°36.7	56°38.3
Diphda	348°52.7	-17°53.5
Achernar	335°24.2	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	315°59.1	89°20.4
Acamar	315°15.7	-40°14.2
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.8	-8°11.0
Capella	280°29.5	46°00.7
Bellatrix	278°28.4	6°21.8
Elnath	278°08.4	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.7	7°24.4
Canopus	263°54.3	-52°42.4
Sirius	258°30.7	-16°44.6
Adhara	255°09.8	-28°59.8
Procyon	244°56.3	5°10.6
Pollux	243°23.8	27°58.7
Avior	234°16.3	-59°33.9
Suhail	222°50.0	-43°30.1
Miaplacidus	221°38.5	-69°47.2
Alphard	217°53.0	-8°44.2
Regulus	207°40.2	11°52.7
Dubhe	193°48.1	61°39.0
Denebola	182°30.7	14°28.3
Gienah	175°49.3	-17°38.3
Acrux	173°06.1	-63°11.5
Gacrux	171°57.7	-57°12.4
Alioth	166°18.4	55°51.6
Spica	158°28.3	-11°15.1
Alkaid	152°56.9	49°13.4
Hadar	148°44.0	-60°27.2
Menkent	148°04.3	-36°27.1
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°48.1	-60°54.1
Kochab	137°21.3	74°04.9
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.8	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.6	-69°03.3
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.3	51°29.4
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.3
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.7
Deneb	49°29.7	45°21.0
Enif	33°44.3	9°57.6
Al Na'ir	27°40.1	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Dec 06 Wed	**SHA**	**Mer.pass**
Venus	115°59.4	11:17
Mars	153°44.0	08:45
Jupiter	140°01.9	09:39
Saturn	91°48.1	12:51

Dec 07 Thu	**SHA**	**Mer.pass**
Venus	114°40.2	11:18
Mars	153°08.3	08:43
Jupiter	139°50.1	09:36
Saturn	91°40.5	12:48

Dec 08 Fri	**SHA**	**Mer.pass**
Venus	113°20.8	11:19
Mars	152°32.6	08:41
Jupiter	139°38.3	09:32
Saturn	91°33.0	12:44

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2433 sec ΔT = TT-UT1 = +68.9407 sec

2017 December 06 to Dec. 08 UT

h

Wed	Sun GHA	Sun Dec	Moon GHA	Moon ν	Moon Dec	Moon d	Moon HP
0	182°16.5	S22°28.9	326°36.6	3.6′	N19°49.4	-1.8′	60.9′
1	197°16.2	29.2	340°59.3	3.7′	19°47.5	-2.0′	60.9′
2	212°15.9	29.5	355°22.0	3.7′	19°45.5	-2.1′	60.9′
3	227°15.7	·· 29.8	9°44.7	3.8′	19°43.3	-2.3′	60.8′
4	242°15.4	30.1	24°07.5	3.8′	19°41.0	-2.4′	60.8′
5	257°15.2	30.4	38°30.4	3.9′	19°38.5	-2.5′	60.8′
6	272°14.9	S22°30.7	52°53.3	3.9′	N19°35.9	-2.7′	60.8′
7	287°14.6	31.0	67°16.3	4.0′	19°33.1	-2.8′	60.7′
8	302°14.4	31.3	81°39.3	4.0′	19°30.2	-3.0′	60.7′
9	317°14.1	·· 31.6	96°02.3	4.1′	19°27.2	-3.1′	60.7′
10	332°13.8	31.9	110°25.5	4.2′	19°24.0	-3.2′	60.7′
11	347°13.6	32.2	124°48.7	4.2′	19°20.7	-3.4′	60.6′
12	2°13.3	S22°32.5	139°11.9	4.3′	N19°17.2	-3.5′	60.6′
13	17°13.0	32.7	153°35.3	4.4′	19°13.6	-3.7′	60.6′
14	32°12.8	33.0	167°58.6	4.4′	19°09.9	-3.8′	60.6′
15	47°12.5	·· 33.3	182°22.1	4.5′	19°06.0	-3.9′	60.5′
16	62°12.2	33.6	196°45.6	4.6′	19°02.1	-4.1′	60.5′
17	77°12.0	33.9	211°09.2	4.6′	18°57.9	-4.2′	60.5′
18	92°11.7	S22°34.2	225°32.9	4.7′	N18°53.7	-4.3′	60.5′
19	107°11.4	34.5	239°56.6	4.8′	18°49.3	-4.4′	60.4′
20	122°11.2	34.8	254°20.4	4.8′	18°44.8	-4.6′	60.4′
21	137°10.9	·· 35.0	268°44.3	4.9′	18°40.2	-4.7′	60.4′
22	152°10.6	35.3	283°08.3	5.0′	18°35.4	-4.8′	60.3′
23	167°10.4	35.6	297°32.3	5.1′	18°30.5	-4.9′	60.3′
	SD.=16.2	d=-0.3	S.D.=16.5				

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	182°10.1	S22°35.9	311°56.4	5.2′	N18°25.5	-5.1′	60.3′
1	197°09.8	36.2	326°20.6	5.2′	18°20.4	-5.2′	60.3′
2	212°09.6	36.4	340°44.9	5.3′	18°15.1	-5.3′	60.2′
3	227°09.3	·· 36.7	355°09.2	5.4′	18°09.7	-5.4′	60.2′
4	242°09.0	37.0	9°33.7	5.5′	18°04.3	-5.5′	60.2′
5	257°08.8	37.3	23°58.2	5.6′	17°58.6	-5.7′	60.1′
6	272°08.5	S22°37.6	38°22.8	5.6′	N17°52.9	-5.8′	60.1′
7	287°08.2	37.8	52°47.5	5.7′	17°47.1	-5.9′	60.1′
8	302°08.0	38.1	67°12.2	5.8′	17°41.1	-6.0′	60.0′
9	317°07.7	·· 38.4	81°37.1	5.9′	17°35.1	-6.1′	60.0′
10	332°07.4	38.7	96°02.0	6.0′	17°28.9	-6.2′	60.0′
11	347°07.2	38.9	110°27.1	6.1′	17°22.6	-6.3′	59.9′
12	2°06.9	S22°39.2	124°52.2	6.2′	N17°16.2	-6.4′	59.9′
13	17°06.6	39.5	139°17.4	6.2′	17°09.7	-6.6′	59.9′
14	32°06.3	39.8	153°42.6	6.3′	17°03.1	-6.7′	59.8′
15	47°06.1	·· 40.0	168°08.0	6.4′	16°56.4	-6.8′	59.8′
16	62°05.8	40.3	182°33.5	6.5′	16°49.6	-6.9′	59.8′
17	77°05.5	40.6	196°59.0	6.6′	16°42.7	-7.0′	59.7′
18	92°05.3	S22°40.8	211°24.7	6.7′	N16°35.6	-7.1′	59.7′
19	107°05.0	41.1	225°50.4	6.8′	16°28.5	-7.2′	59.7′
20	122°04.7	41.4	240°16.2	6.9′	16°21.3	-7.3′	59.6′
21	137°04.4	·· 41.6	254°42.1	7.0′	16°14.0	-7.4′	59.6′
22	152°04.2	41.9	269°08.1	7.0′	16°06.6	-7.4′	59.6′
23	167°03.9	42.2	283°34.2	7.1′	15°59.1	-7.5′	59.5′
	SD.=16.2	d=-0.3	S.D.=16.3				

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	182°03.6	S22°42.4	298°00.4	7.2′	N15°51.5	-7.6′	59.5′
1	197°03.4	42.7	312°26.7	7.3′	15°43.8	-7.7′	59.5′
2	212°03.1	43.0	326°53.0	7.4′	15°36.1	-7.8′	59.4′
3	227°02.8	·· 43.2	341°19.5	7.5′	15°28.2	-7.9′	59.4′
4	242°02.5	43.5	355°46.0	7.6′	15°20.3	-8.0′	59.4′
5	257°02.3	43.7	10°12.7	7.7′	15°12.2	-8.1′	59.3′
6	272°02.0	S22°44.0	24°39.4	7.8′	N15°04.1	-8.2′	59.3′
7	287°01.7	44.3	39°06.2	7.9′	14°55.9	-8.2′	59.2′
8	302°01.4	44.5	53°33.1	8.0′	14°47.7	-8.3′	59.2′
9	317°01.2	·· 44.8	68°00.1	8.0′	14°39.3	-8.4′	59.2′
10	332°00.9	45.0	82°27.2	8.1′	14°30.9	-8.5′	59.1′
11	347°00.6	45.3	96°54.4	8.2′	14°22.4	-8.5′	59.1′
12	2°00.3	S22°45.5	111°21.7	8.3′	N14°13.8	-8.6′	59.1′
13	17°00.1	45.8	125°49.1	8.4′	14°05.1	-8.7′	59.0′
14	31°59.8	46.0	140°16.5	8.5′	13°56.4	-8.8′	59.0′
15	46°59.5	·· 46.3	154°44.1	8.6′	13°47.6	-8.8′	59.0′
16	61°59.2	46.5	169°11.7	8.7′	13°38.7	-8.9′	58.9′
17	76°59.0	46.8	183°39.4	8.8′	13°29.8	-9.0′	58.9′
18	91°58.7	S22°47.0	198°07.2	8.9′	N13°20.8	-9.0′	58.8′
19	106°58.4	47.3	212°35.1	8.9′	13°11.7	-9.1′	58.8′
20	121°58.1	47.5	227°03.1	9.0′	13°02.5	-9.2′	58.8′
21	136°57.9	·· 47.8	241°31.2	9.1′	12°53.3	-9.2′	58.7′
22	151°57.6	48.0	255°59.3	9.2′	12°44.1	-9.3′	58.7′
23	166°57.3	48.3	270°27.6	9.3′	12°34.7	-9.4′	58.7′
	SD.=16.2	d=-0.3	S.D.=16.1				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:06	10:18	▬	▬	13:25	15:36
N 70°	07:48	09:30	▬	▬	14:13	15:55
68°	07:34	08:59	11:20	12:22	14:44	16:09
66°	07:21	08:36	10:07	13:36	15:07	16:21
64°	07:11	08:18	09:32	14:11	15:25	16:31
62°	07:02	08:03	09:06	14:37	15:40	16:40
60°	06:54	07:50	08:46	14:57	15:52	16:48
N 58°	06:47	07:39	08:30	15:13	16:03	16:55
56°	06:41	07:30	08:16	15:27	16:13	17:02
54°	06:35	07:21	08:04	15:39	16:22	17:07
52°	06:30	07:13	07:54	15:49	16:29	17:13
50°	06:25	07:06	07:44	15:59	16:37	17:18
45°	06:14	06:51	07:24	16:18	16:52	17:29
N 40°	06:04	06:38	07:08	16:35	17:05	17:39
35°	05:55	06:27	06:55	16:48	17:16	17:48
30°	05:47	06:17	06:43	17:00	17:26	17:56
20°	05:31	05:59	06:22	17:21	17:44	18:12
N 10°	05:16	05:42	06:05	17:38	18:01	18:27
0°	04:59	05:25	05:48	17:55	18:18	18:44
S 10°	04:41	05:08	05:31	18:12	18:35	19:02
20°	04:19	04:48	05:13	18:31	18:55	19:24
30°	03:51	04:24	04:51	18:52	19:19	19:52
35°	03:33	04:10	04:39	19:04	19:34	20:10
40°	03:11	03:52	04:24	19:19	19:51	20:32
45°	02:42	03:31	04:07	19:36	20:13	21:02
S 50°	02:00	03:02	03:46	19:58	20:41	21:44
52°	01:35	02:48	03:35	20:08	20:56	22:09
54°	01:00	02:31	03:24	20:20	21:13	22:46
56°	▭	02:11	03:10	20:33	21:33	▭
58°	▭	01:45	02:55	20:49	22:00	▭
S 60°	▭	01:06	02:36	21:08	22:40	▭

Lat.	Moonrise Wed	Moonrise Thu	Moonrise Fri	Moonset Wed	Moonset Thu	Moonset Fri
N 72°	▭	17:30	19:52	▭	14:21	13:55
N 70°	16:15	18:19	20:17	13:32	13:31	13:29
68°	17:06	18:50	20:36	12:40	13:00	13:08
66°	17:38	19:13	20:51	12:08	12:36	12:52
64°	18:02	19:31	21:04	11:44	12:17	12:39
62°	18:21	19:46	21:14	11:25	12:02	12:27
60°	18:36	19:58	21:23	11:09	11:49	12:18
N 58°	18:49	20:09	21:31	10:56	11:38	12:09
56°	19:00	20:18	21:38	10:44	11:28	12:02
54°	19:10	20:26	21:44	10:34	11:20	11:55
52°	19:19	20:33	21:49	10:25	11:12	11:49
50°	19:27	20:40	21:54	10:17	11:05	11:44
45°	19:44	20:54	22:05	10:00	10:50	11:32
N 40°	19:57	21:06	22:14	09:46	10:37	11:22
35°	20:09	21:16	22:21	09:33	10:27	11:13
30°	20:19	21:24	22:28	09:23	10:18	11:06
20°	20:37	21:39	22:39	09:05	10:02	10:53
N 10°	20:52	21:52	22:49	08:49	09:47	10:41
0°	21:06	22:04	22:59	08:34	09:34	10:31
S 10°	21:20	22:16	23:08	08:19	09:21	10:20
20°	21:35	22:29	23:18	08:03	09:07	10:08
30°	21:53	22:44	23:29	07:45	08:50	09:55
35°	22:03	22:53	23:36	07:34	08:41	09:47
40°	22:14	23:02	23:43	07:22	08:30	09:38
45°	22:28	23:14	23:52	07:07	08:17	09:28
S 50°	22:45	23:27	–:–	06:49	08:01	09:15
52°	22:52	23:34	–:–	06:41	07:53	09:09
54°	23:01	23:41	–:–	06:31	07:45	09:03
56°	23:11	23:49	–:–	06:20	07:36	08:55
58°	23:22	23:57	–:–	06:08	07:25	08:47
S 60°	23:34	–:–	00:07	05:54	07:13	08:38

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 18-20 88-70%
06	09:06	08:53	11:51	02:19	14:50	
07	08:40	08:28	11:52	03:20	15:49	
08	08:15	08:01	11:52	04:18	16:45	

December 09, 10, 11 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	77°55.6	189°56.7	S21°27.0	229°52.4	S10°25.9	217°22.1	S14°40.1	169°21.0	S22°30.4
1	92°58.0	204°55.8	27.5	244°53.4	26.4	232°24.0	40.2	184°23.2	30.4
2	108°00.5	219°54.9	28.1	259°54.4	27.0	247°26.0	40.4	199°25.3	30.4
3	123°03.0	234°54.1	·· 28.7	274°55.4	·· 27.5	262°28.0	·· 40.5	214°27.5	·· 30.4
4	138°05.4	249°53.2	29.2	289°56.3	28.1	277°30.0	40.7	229°29.6	30.4
5	153°07.9	264°52.4	29.8	304°57.3	28.7	292°31.9	40.8	244°31.8	30.4
6	168°10.4	279°51.5	S21°30.3	319°58.3	S10°29.2	307°33.9	S14°41.0	259°33.9	S22°30.4
7	183°12.8	294°50.6	30.9	334°59.2	29.8	322°35.9	41.1	274°36.1	30.4
8	198°15.3	309°49.8	31.5	350°00.2	30.4	337°37.9	41.3	289°38.2	30.4
9	213°17.8	324°48.9	·· 32.0	5°01.2	·· 30.9	352°39.8	·· 41.4	304°40.4	·· 30.4
10	228°20.2	339°48.0	32.6	20°02.2	31.5	7°41.8	41.6	319°42.5	30.4
11	243°22.7	354°47.2	33.1	35°03.1	32.0	22°43.8	41.7	334°44.7	30.4
12	258°25.1	9°46.3	S21°33.7	50°04.1	S10°32.6	37°45.8	S14°41.9	349°46.8	S22°30.4
13	273°27.6	24°45.4	34.2	65°05.1	33.2	52°47.7	42.0	4°49.0	30.4
14	288°30.1	39°44.6	34.8	80°06.0	33.7	67°49.7	42.1	19°51.1	30.5
15	303°32.5	54°43.7	·· 35.3	95°07.0	·· 34.3	82°51.7	·· 42.3	34°53.3	·· 30.5
16	318°35.0	69°42.8	35.9	110°08.0	34.8	97°53.7	42.4	49°55.4	30.5
17	333°37.5	84°42.0	36.4	125°09.0	35.4	112°55.6	42.6	64°57.6	30.5
18	348°39.9	99°41.1	S21°37.0	140°09.9	S10°35.9	127°57.6	S14°42.7	79°59.7	S22°30.5
19	3°42.4	114°40.2	37.5	155°10.9	36.5	142°59.6	42.9	95°01.9	30.5
20	18°44.9	129°39.3	38.0	170°11.9	37.1	158°01.6	43.0	110°04.0	30.5
21	33°47.3	144°38.5	·· 38.6	185°12.8	·· 37.6	173°03.5	·· 43.2	125°06.2	·· 30.5
22	48°49.8	159°37.6	39.1	200°13.8	38.2	188°05.5	43.3	140°08.3	30.5
23	63°52.3	174°36.7	39.7	215°14.8	38.7	203°07.5	43.5	155°10.5	30.5
Mer.pass.:18:45		v-0.9 d-0.6 m-3.8		v1.0 d-0.6 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	78°54.7	189°35.9	S21°40.2	230°15.8	S10°39.3	218°09.5	S14°43.6	170°12.6	S22°30.5
1	93°57.2	204°35.0	40.8	245°16.7	39.9	233°11.5	43.8	185°14.8	30.5
2	108°59.6	219°34.1	41.3	260°17.7	40.4	248°13.4	43.9	200°16.9	30.5
3	124°02.1	234°33.2	·· 41.8	275°18.7	·· 41.0	263°15.4	·· 44.1	215°19.1	·· 30.5
4	139°04.6	249°32.4	42.4	290°19.6	41.5	278°17.4	44.2	230°21.2	30.5
5	154°07.0	264°31.5	42.9	305°20.6	42.1	293°19.4	44.3	245°23.3	30.5
6	169°09.5	279°30.6	S21°43.4	320°21.6	S10°42.6	308°21.3	S14°44.5	260°25.5	S22°30.5
7	184°12.0	294°29.7	44.0	335°22.6	43.2	323°23.3	44.6	275°27.6	30.6
8	199°14.4	309°28.9	44.5	350°23.5	43.8	338°25.3	44.8	290°29.8	30.6
9	214°16.9	324°28.0	·· 45.0	5°24.5	·· 44.3	353°27.3	·· 44.9	305°31.9	·· 30.6
10	229°19.4	339°27.1	45.5	20°25.5	44.9	8°29.2	45.1	320°34.1	30.6
11	244°21.8	354°26.2	46.1	35°26.4	45.4	23°31.2	45.2	335°36.2	30.6
12	259°24.3	9°25.4	S21°46.6	50°27.4	S10°46.0	38°33.2	S14°45.4	350°38.4	S22°30.6
13	274°26.7	24°24.5	47.1	65°28.4	46.5	53°35.2	45.5	5°40.5	30.6
14	289°29.2	39°23.6	47.6	80°29.3	47.1	68°37.2	45.7	20°42.7	30.6
15	304°31.7	54°22.7	·· 48.2	95°30.3	·· 47.7	83°39.1	·· 45.8	35°44.8	·· 30.6
16	319°34.1	69°21.9	48.7	110°31.3	48.2	98°41.1	46.0	50°47.0	30.6
17	334°36.6	84°21.0	49.2	125°32.3	48.8	113°43.1	46.1	65°49.1	30.6
18	349°39.1	99°20.1	S21°49.7	140°33.2	S10°49.3	128°45.1	S14°46.2	80°51.3	S22°30.6
19	4°41.5	114°19.2	50.3	155°34.2	49.9	143°47.1	46.4	95°53.4	30.6
20	19°44.0	129°18.3	50.8	170°35.2	50.4	158°49.0	46.5	110°55.6	30.6
21	34°46.5	144°17.5	·· 51.3	185°36.1	·· 51.0	173°51.0	·· 46.7	125°57.7	·· 30.6
22	49°48.9	159°16.6	51.8	200°37.1	51.6	188°53.0	46.8	140°59.9	30.6
23	64°51.4	174°15.7	52.3	215°38.1	52.1	203°55.0	47.0	156°02.0	30.6
Mer.pass.:18:41		v-0.9 d-0.5 m-3.8		v1.0 d-0.6 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	79°53.9	189°14.8	S21°52.8	230°39.0	S10°52.7	218°56.9	S14°47.1	171°04.2	S22°30.7
1	94°56.3	204°13.9	53.3	245°40.0	53.2	233°58.9	47.3	186°06.3	30.7
2	109°58.8	219°13.0	53.8	260°41.0	53.8	249°00.9	47.4	201°08.5	30.7
3	125°01.2	234°12.2	·· 54.4	275°42.0	·· 54.3	264°02.9	·· 47.6	216°10.6	·· 30.7
4	140°03.7	249°11.3	54.9	290°42.9	54.9	279°04.9	47.7	231°12.8	30.7
5	155°06.2	264°10.4	55.4	305°43.9	55.4	294°06.8	47.8	246°14.9	30.7
6	170°08.6	279°09.5	S21°55.9	320°44.9	S10°56.0	309°08.8	S14°48.0	261°17.0	S22°30.7
7	185°11.1	294°08.6	56.4	335°45.8	56.5	324°10.8	48.1	276°19.2	30.7
8	200°13.6	309°07.7	56.9	350°46.8	57.1	339°12.8	48.3	291°21.3	30.7
9	215°16.0	324°06.8	·· 57.4	5°47.8	·· 57.7	354°14.8	·· 48.4	306°23.5	·· 30.7
10	230°18.5	339°06.0	57.9	20°48.7	58.2	9°16.7	48.6	321°25.6	30.7
11	245°21.0	354°05.1	58.4	35°49.7	58.8	24°18.7	48.7	336°27.8	30.7
12	260°23.4	9°04.2	S21°58.9	50°50.7	S10°59.3	39°20.7	S14°48.9	351°29.9	S22°30.7
13	275°25.9	24°03.3	59.4	65°51.6	10°59.9	54°22.7	49.0	6°32.1	30.7
14	290°28.3	39°02.4	21°59.9	80°52.6	11°00.4	69°24.7	49.1	21°34.2	30.7
15	305°30.8	54°01.5	22°00.4	95°53.6	·· 01.0	84°26.6	·· 49.3	36°36.4	·· 30.7
16	320°33.3	69°00.6	00.9	110°54.5	01.5	99°28.6	49.4	51°38.5	30.7
17	335°35.7	83°59.7	01.4	125°55.5	02.1	114°30.6	49.6	66°40.7	30.7
18	350°38.2	98°58.9	S22°01.9	140°56.5	S11°02.6	129°32.6	S14°49.7	81°42.8	S22°30.8
19	5°40.7	113°58.0	02.4	155°57.4	03.2	144°34.6	49.9	96°45.0	30.8
20	20°43.1	128°57.1	02.8	170°58.4	03.7	159°36.5	50.0	111°47.1	30.8
21	35°45.6	143°56.2	·· 03.3	185°59.4	·· 04.3	174°38.5	·· 50.2	126°49.3	·· 30.8
22	50°48.1	158°55.3	03.8	201°00.3	04.8	189°40.5	50.3	141°51.4	30.8
23	65°50.5	173°54.4	04.3	216°01.3	05.4	204°42.5	50.4	156°53.6	30.8
Mer.pass.:18:37		v-0.9 d-0.5 m-3.8		v1.0 d-0.6 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Stars

	SHA	**Dec**
Alpheratz	357°40.3	29°11.5
Ankaa	353°12.6	-42°12.8
Schedar	349°36.8	56°38.3
Diphda	348°52.7	-17°53.5
Achernar	335°24.2	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	315°59.7	89°20.4
Acamar	315°15.7	-40°14.3
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.8	-8°11.0
Capella	280°29.5	46°00.7
Bellatrix	278°28.4	6°21.8
Elnath	278°08.4	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.7	7°24.4
Canopus	263°54.3	-52°42.4
Sirius	258°30.7	-16°44.6
Adhara	255°09.8	-28°59.9
Procyon	244°56.3	5°10.6
Pollux	243°23.8	27°58.7
Avior	234°16.3	-59°33.9
Suhail	222°49.9	-43°30.1
Miaplacidus	221°38.4	-69°47.2
Alphard	217°53.0	-8°44.2
Regulus	207°40.2	11°52.7
Dubhe	193°48.1	61°39.0
Denebola	182°30.7	14°28.3
Gienah	175°49.3	-17°38.3
Acrux	173°06.0	-63°11.5
Gacrux	171°57.6	-57°12.4
Alioth	166°18.4	55°51.6
Spica	158°28.2	-11°15.1
Alkaid	152°56.9	49°13.4
Hadar	148°44.0	-60°27.1
Menkent	148°04.3	-36°27.1
Arcturus	145°53.3	19°05.5
Rigil Kent.	139°48.1	-60°54.1
Kochab	137°21.3	74°04.9
Zuben'ubi	137°02.4	-16°06.7
Alphecca	126°08.8	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.6	-69°03.3
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.1
Eltanin	90°45.3	51°29.4
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.3
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.7
Deneb	49°29.7	45°21.0
Enif	33°44.3	9°57.6
Al Na'ir	27°40.2	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.4	28°11.0
Markab	13°35.3	15°18.2

Dec 09 Sat	**SHA**	**Mer.pass**
Venus	112°01.1	11:21
Mars	151°56.9	08:40
Jupiter	139°26.5	09:29
Saturn	91°25.5	12:41

Dec 10 Sun	**SHA**	**Mer.pass**
Venus	110°41.1	11:22
Mars	151°21.0	08:38
Jupiter	139°14.8	09:26
Saturn	91°17.9	12:37

Dec 11 Mon	**SHA**	**Mer.pass**
Venus	109°21.0	11:24
Mars	150°45.2	08:37
Jupiter	139°03.1	09:23
Saturn	91°10.3	12:34

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2402 sec ΔT = TT-UT1 = +68.9438 sec

2017 December 09 to Dec. 11 UT

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	181°57.0	S22°48.5	284°55.9	9.4'	N12°25.3	-9.4'	58.6'
1	196°56.7	48.8	299°24.3	9.5'	12°15.9	-9.5'	58.6'
2	211°56.5	49.0	313°52.8	9.5'	12°06.4	-9.5'	58.6'
3	226°56.2	·· 49.3	328°21.4	9.6'	11°56.8	-9.6'	58.5'
4	241°55.9	49.5	342°50.1	9.7'	11°47.2	-9.6'	58.5'
5	256°55.6	49.7	357°18.8	9.8'	11°37.5	-9.7'	58.4'
6	271°55.4	S22°50.0	11°47.7	9.9'	N11°27.8	-9.7'	58.4'
7	286°55.1	50.2	26°16.6	10.0'	11°18.0	-9.8'	58.4'
8	301°54.8	50.5	40°45.6	10.0'	11°08.2	-9.8'	58.3'
9	316°54.5	·· 50.7	55°14.7	10.1'	10°58.3	-9.9'	58.3'
10	331°54.2	50.9	69°43.9	10.2'	10°48.4	-9.9'	58.3'
11	346°54.0	51.2	84°13.1	10.3'	10°38.4	-10.0'	58.2'
12	1°53.7	S22°51.4	98°42.4	10.4'	N10°28.4	-10.0'	58.2'
13	16°53.4	51.6	113°11.8	10.4'	10°18.4	-10.1'	58.1'
14	31°53.1	51.9	127°41.3	10.5'	10°08.3	-10.1'	58.1'
15	46°52.8	·· 52.1	142°10.8	10.6'	09°58.1	-10.2'	58.1'
16	61°52.6	52.3	156°40.5	10.7'	09°48.0	-10.2'	58.0'
17	76°52.3	52.6	171°10.2	10.7'	09°37.7	-10.2'	58.0'
18	91°52.0	S22°52.8	185°40.0	10.8'	N09°27.5	-10.3'	58.0'
19	106°51.7	53.0	200°09.8	10.9'	09°17.2	-10.3'	57.9'
20	121°51.4	53.3	214°39.8	11.0'	09°06.8	-10.3'	57.9'
21	136°51.1	·· 53.5	229°09.8	11.0'	08°56.5	-10.4'	57.9'
22	151°50.9	53.7	243°39.8	11.1'	08°46.1	-10.4'	57.8'
23	166°50.6	53.9	258°10.0	11.2'	08°35.6	-10.4'	57.8'
	SD.=16.2	d=-0.2		S.D.=15.9			

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°50.3	S22°54.2	272°40.2	11.2'	N08°25.2	-10.5'	57.7'
1	196°50.0	54.4	287°10.5	11.3'	08°14.7	-10.5'	57.7'
2	211°49.7	54.6	301°40.8	11.4'	08°04.2	-10.5'	57.7'
3	226°49.5	·· 54.8	316°11.2	11.5'	07°53.6	-10.6'	57.6'
4	241°49.2	55.1	330°41.7	11.5'	07°43.0	-10.6'	57.6'
5	256°48.9	55.3	345°12.3	11.6'	07°32.4	-10.6'	57.6'
6	271°48.6	S22°55.5	359°42.9	11.7'	N07°21.8	-10.6'	57.5'
7	286°48.3	55.7	14°13.6	11.7'	07°11.1	-10.7'	57.5'
8	301°48.0	56.0	28°44.3	11.8'	07°00.5	-10.7'	57.5'
9	316°47.7	·· 56.2	43°15.1	11.8'	06°49.8	-10.7'	57.4'
10	331°47.5	56.4	57°46.0	11.9'	06°39.0	-10.7'	57.4'
11	346°47.2	56.6	72°17.0	12.0'	06°28.3	-10.8'	57.4'
12	1°46.9	S22°56.8	86°47.9	12.0'	N06°17.5	-10.8'	57.3'
13	16°46.6	57.0	101°19.0	12.1'	06°06.7	-10.8'	57.3'
14	31°46.3	57.3	115°50.1	12.1'	05°55.9	-10.8'	57.3'
15	46°46.0	·· 57.5	130°21.3	12.2'	05°45.1	-10.8'	57.2'
16	61°45.8	57.7	144°52.5	12.3'	05°34.3	-10.8'	57.2'
17	76°45.5	57.9	159°23.8	12.3'	05°23.4	-10.9'	57.2'
18	91°45.2	S22°58.1	173°55.1	12.4'	N05°12.6	-10.9'	57.1'
19	106°44.9	58.3	188°26.5	12.4'	05°01.7	-10.9'	57.1'
20	121°44.6	58.5	202°58.0	12.5'	04°50.8	-10.9'	57.1'
21	136°44.3	·· 58.7	217°29.5	12.5'	04°39.9	-10.9'	57.0'
22	151°44.0	58.9	232°01.0	12.6'	04°29.0	-10.9'	57.0'
23	166°43.8	59.2	246°32.6	12.6'	04°18.1	-10.9'	57.0'
	SD.=16.2	d=-0.2		S.D.=15.6			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°43.5	S22°59.4	261°04.2	12.7'	N04°07.2	-10.9'	56.9'
1	196°43.2	59.6	275°35.9	12.7'	03°56.3	-10.9'	56.9'
2	211°42.9	22°59.8	290°07.7	12.8'	03°45.3	-10.9'	56.9'
3	226°42.6	23°00.0	304°39.5	12.8'	03°34.4	-10.9'	56.8'
4	241°42.3	00.2	319°11.3	12.9'	03°23.4	-11.0'	56.8'
5	256°42.0	00.4	333°43.2	12.9'	03°12.5	-11.0'	56.8'
6	271°41.7	S23°00.6	348°15.1	12.9'	N03°01.5	-11.0'	56.7'
7	286°41.5	00.8	2°47.1	13.0'	02°50.6	-11.0'	56.7'
8	301°41.2	01.0	17°19.1	13.0'	02°39.6	-11.0'	56.7'
9	316°40.9	·· 01.2	31°51.2	13.1'	02°28.6	-11.0'	56.6'
10	331°40.6	01.4	46°23.3	13.1'	02°17.7	-11.0'	56.6'
11	346°40.3	01.6	60°55.4	13.2'	02°06.7	-11.0'	56.6'
12	1°40.0	S23°01.8	75°27.6	13.2'	N01°55.8	-11.0'	56.5'
13	16°39.7	02.0	89°59.8	13.2'	01°44.8	-11.0'	56.5'
14	31°39.4	02.2	104°32.0	13.3'	01°33.8	-11.0'	56.5'
15	46°39.1	·· 02.4	119°04.3	13.3'	01°22.9	-10.9'	56.5'
16	61°38.9	02.6	133°36.6	13.3'	01°12.0	-10.9'	56.4'
17	76°38.6	02.8	148°09.0	13.4'	01°01.0	-10.9'	56.4'
18	91°38.3	S23°03.0	162°41.4	13.4'	N00°50.1	-10.9'	56.4'
19	106°38.0	03.2	177°13.8	13.4'	00°39.2	-10.9'	56.3'
20	121°37.7	03.3	191°46.3	13.5'	00°28.2	-10.9'	56.3'
21	136°37.4	·· 03.5	206°18.8	13.5'	00°17.3	-10.9'	56.3'
22	151°37.1	03.7	220°51.3	13.5'	N00°06.4	-10.9'	56.2'
23	166°36.8	03.9	235°23.8	13.6'	00°04.5	-10.9'	56.2'
	SD.=16.2	d=-0.2		S.D.=15.4			

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:12	10:30	▬	▬	13:15	15:33
N 70°	07:53	09:38	▬	▬	14:08	15:52
68°	07:38	09:05	▬	▬	14:40	16:07
66°	07:26	08:42	10:16	13:30	15:04	16:19
64°	07:15	08:23	09:38	14:08	15:23	16:30
62°	07:06	08:07	09:11	14:34	15:38	16:39
60°	06:58	07:54	08:51	14:55	15:51	16:47
N 58°	06:51	07:43	08:34	15:11	16:02	16:55
56°	06:44	07:33	08:20	15:26	16:12	17:01
54°	06:38	07:24	08:08	15:38	16:21	17:07
52°	06:33	07:16	07:57	15:49	16:29	17:12
50°	06:28	07:09	07:47	15:58	16:36	17:18
45°	06:17	06:54	07:27	16:18	16:52	17:29
N 40°	06:07	06:41	07:11	16:35	17:05	17:39
35°	05:57	06:29	06:57	16:49	17:17	17:48
30°	05:49	06:19	06:45	17:01	17:27	17:57
20°	05:33	06:00	06:24	17:21	17:45	18:13
N 10°	05:17	05:43	06:06	17:40	18:02	18:29
0°	05:01	05:27	05:49	17:57	18:19	18:45
S 10°	04:42	05:09	05:32	18:14	18:37	19:04
20°	04:20	04:49	05:13	18:32	18:57	19:26
30°	03:51	04:25	04:52	18:54	19:21	19:54
35°	03:33	04:10	04:39	19:07	19:36	20:13
40°	03:11	03:52	04:25	19:21	19:54	20:35
45°	02:41	03:30	04:07	19:39	20:16	21:05
S 50°	01:58	03:01	03:45	20:01	20:45	21:49
52°	01:32	02:47	03:35	20:12	21:00	22:15
54°	00:53	02:30	03:23	20:24	21:17	22:55
56°	▭	02:09	03:09	20:37	21:38	▭
58°	▭	01:41	02:53	20:53	22:06	▭
S 60°	▭	00:59	02:34	21:13	22:49	▭

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	21:53	23:45	–:–	13:41	13:30	13:20
N 70°	22:07	23:51	–:–	13:25	13:22	13:18
68°	22:18	23:56	–:–	13:13	13:15	13:16
66°	22:27	–:–	00:00	13:02	13:09	13:15
64°	22:35	–:–	00:03	12:53	13:04	13:13
62°	22:41	–:–	00:06	12:46	13:00	13:12
60°	22:47	–:–	00:08	12:39	12:56	13:11
N 58°	22:52	–:–	00:11	12:33	12:53	13:10
56°	22:56	–:–	00:13	12:28	12:50	13:10
54°	23:00	–:–	00:14	12:24	12:48	13:09
52°	23:04	–:–	00:16	12:19	12:45	13:08
50°	23:07	–:–	00:18	12:16	12:43	13:08
45°	23:14	–:–	00:21	12:07	12:38	13:06
N 40°	23:20	–:–	00:23	12:00	12:34	13:05
35°	23:25	–:–	00:26	11:54	12:31	13:04
30°	23:29	–:–	00:28	11:49	12:28	13:04
20°	23:37	–:–	00:31	11:39	12:22	13:02
N 10°	23:43	–:–	00:34	11:31	12:17	13:01
0°	23:50	–:–	00:37	11:23	12:13	13:00
S 10°	23:56	–:–	00:40	11:16	12:08	12:58
20°	–:–	00:02	00:43	11:07	12:03	12:57
30°	–:–	00:10	00:47	10:57	11:58	12:55
35°	–:–	00:14	00:49	10:52	11:54	12:54
40°	–:–	00:19	00:51	10:45	11:50	12:53
45°	–:–	00:25	00:54	10:38	11:46	12:52
S 50°	00:02	00:31	00:57	10:29	11:41	12:51
52°	00:07	00:34	00:59	10:25	11:38	12:50
54°	00:12	00:38	01:00	10:20	11:36	12:49
56°	00:18	00:42	01:02	10:15	11:33	12:48
58°	00:24	00:46	01:04	10:09	11:30	12:47
S 60°	00:32	00:50	01:06	10:03	11:26	12:46

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 21-23 59-38%
09	07:48	07:35	11:52	05:11	17:37	
10	07:21	07:08	11:53	06:01	18:25	
11	06:54	06:40	11:53	06:49	19:11	

December 12, 13, 14 UT (Tue., Wed., Thu.)

	Aries	Venus		Mars		Jupiter		Saturn	
Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	80°53.0	188°53.5	S22°04.8	231°02.3	S11°06.0	219°44.5	S14°50.6	171°55.7	S22°30.8
1	95°55.5	203°52.6	05.3	246°03.2	06.5	234°46.5	50.7	186°57.8	30.8
2	110°57.9	218°51.7	05.8	261°04.2	07.1	249°48.4	50.9	202°00.0	30.8
3	126°00.4	233°50.8	·· 06.2	276°05.2	·· 07.6	264°50.4	·· 51.0	217°02.1	·· 30.8
4	141°02.8	248°49.9	06.7	291°06.1	08.2	279°52.4	51.2	232°04.3	30.8
5	156°05.3	263°49.1	07.2	306°07.1	08.7	294°54.4	51.3	247°06.4	30.8
6	171°07.8	278°48.2	S22°07.7	321°08.1	S11°09.3	309°56.4	S14°51.5	262°08.6	S22°30.8
7	186°10.2	293°47.3	08.2	336°09.0	09.8	324°58.3	51.6	277°10.7	30.8
8	201°12.7	308°46.4	08.6	351°10.0	10.4	340°00.3	51.7	292°12.9	30.8
9	216°15.2	323°45.5	·· 09.1	6°11.0	·· 10.9	355°02.3	·· 51.9	307°15.0	·· 30.8
10	231°17.6	338°44.6	09.6	21°11.9	11.5	10°04.3	52.0	322°17.2	30.8
11	246°20.1	353°43.7	10.1	36°12.9	12.0	25°06.3	52.2	337°19.3	30.8
12	261°22.6	8°42.8	S22°10.5	51°13.9	S11°12.6	40°08.3	S14°52.3	352°21.5	S22°30.8
13	276°25.0	23°41.9	11.0	66°14.8	13.1	55°10.2	52.5	7°23.6	30.9
14	291°27.5	38°41.0	11.5	81°15.8	13.7	70°12.2	52.6	22°25.8	30.9
15	306°30.0	53°40.1	·· 11.9	96°16.8	·· 14.2	85°14.2	·· 52.7	37°27.9	·· 30.9
16	321°32.4	68°39.2	12.4	111°17.7	14.8	100°16.2	52.9	52°30.1	30.9
17	336°34.9	83°38.3	12.9	126°18.7	15.3	115°18.2	53.0	67°32.2	30.9
18	351°37.3	98°37.4	S22°13.3	141°19.7	S11°15.9	130°20.2	S14°53.2	82°34.3	S22°30.9
19	6°39.8	113°36.5	13.8	156°20.6	16.4	145°22.1	53.3	97°36.5	30.9
20	21°42.3	128°35.6	14.3	171°21.6	17.0	160°24.1	53.5	112°38.6	30.9
21	36°44.7	143°34.7	·· 14.7	186°22.6	·· 17.5	175°26.1	·· 53.6	127°40.8	·· 30.9
22	51°47.2	158°33.8	15.2	201°23.5	18.1	190°28.1	53.7	142°42.9	30.9
23	66°49.7	173°32.9	15.6	216°24.5	18.6	205°30.1	53.9	157°45.1	30.9
Mer.pass.:18:33		v-0.9 d-0.5 m-3.8		v1.0 d-0.6 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Wed	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	81°52.1	188°32.0	S22°16.1	231°25.5	S11°19.2	220°32.1	S14°54.0	172°47.2	S22°30.9
1	96°54.6	203°31.1	16.6	246°26.4	19.7	235°34.0	54.2	187°49.4	30.9
2	111°57.1	218°30.2	17.0	261°27.4	20.3	250°36.0	54.3	202°51.5	30.9
3	126°59.5	233°29.3	·· 17.5	276°28.4	·· 20.8	265°38.0	·· 54.5	217°53.7	·· 30.9
4	142°02.0	248°28.4	17.9	291°29.3	21.4	280°40.0	54.6	232°55.8	30.9
5	157°04.4	263°27.5	18.4	306°30.3	21.9	295°42.0	54.7	247°58.0	30.9
6	172°06.9	278°26.6	S22°18.8	321°31.3	S11°22.5	310°44.0	S14°54.9	263°00.1	S22°30.9
7	187°09.4	293°25.7	19.3	336°32.2	23.0	325°45.9	55.0	278°02.3	30.9
8	202°11.8	308°24.8	19.7	351°33.2	23.6	340°47.9	55.2	293°04.4	30.9
9	217°14.3	323°23.9	·· 20.2	6°34.1	·· 24.1	355°49.9	·· 55.3	308°06.5	·· 31.0
10	232°16.8	338°23.0	20.6	21°35.1	24.6	10°51.9	55.5	323°08.7	31.0
11	247°19.2	353°22.1	21.1	36°36.1	25.2	25°53.9	55.6	338°10.8	31.0
12	262°21.7	8°21.2	S22°21.5	51°37.0	S11°25.7	40°55.9	S14°55.7	353°13.0	S22°31.0
13	277°24.2	23°20.3	22.0	66°38.0	26.3	55°57.8	55.9	8°15.1	31.0
14	292°26.6	38°19.3	22.4	81°39.0	26.8	70°59.8	56.0	23°17.3	31.0
15	307°29.1	53°18.4	·· 22.8	96°39.9	·· 27.4	86°01.8	·· 56.2	38°19.4	·· 31.0
16	322°31.6	68°17.5	23.3	111°40.9	27.9	101°03.8	56.3	53°21.6	31.0
17	337°34.0	83°16.6	23.7	126°41.9	28.5	116°05.8	56.4	68°23.7	31.0
18	352°36.5	98°15.7	S22°24.2	141°42.8	S11°29.0	131°07.8	S14°56.6	83°25.9	S22°31.0
19	7°38.9	113°14.8	24.6	156°43.8	29.6	146°09.8	56.7	98°28.0	31.0
20	22°41.4	128°13.9	25.0	171°44.7	30.1	161°11.7	56.9	113°30.2	31.0
21	37°43.9	143°13.0	·· 25.5	186°45.7	·· 30.7	176°13.7	·· 57.0	128°32.3	·· 31.0
22	52°46.3	158°12.1	25.9	201°46.7	31.2	191°15.7	57.2	143°34.4	31.0
23	67°48.8	173°11.2	26.3	216°47.6	31.8	206°17.7	57.3	158°36.6	31.0
Mer.pass.:18:29		v-0.9 d-0.5 m-3.8		v1.0 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Thu	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	82°51.3	188°10.3	S22°26.8	231°48.6	S11°32.3	221°19.7	S14°57.4	173°38.7	S22°31.0
1	97°53.7	203°09.4	27.2	246°49.6	32.8	236°21.7	57.6	188°40.9	31.0
2	112°56.2	218°08.4	27.6	261°50.5	33.4	251°23.7	57.7	203°43.0	31.0
3	127°58.7	233°07.5	·· 28.0	276°51.5	·· 33.9	266°25.6	·· 57.9	218°45.2	·· 31.0
4	143°01.1	248°06.6	28.5	291°52.5	34.5	281°27.6	58.0	233°47.3	31.0
5	158°03.6	263°05.7	28.9	306°53.4	35.0	296°29.6	58.1	248°49.5	31.0
6	173°06.1	278°04.8	S22°29.3	321°54.4	S11°35.6	311°31.6	S14°58.3	263°51.6	S22°31.1
7	188°08.5	293°03.9	29.7	336°55.3	36.1	326°33.6	58.4	278°53.8	31.1
8	203°11.0	308°03.0	30.2	351°56.3	36.7	341°35.6	58.6	293°55.9	31.1
9	218°13.4	323°02.1	·· 30.6	6°57.3	·· 37.2	356°37.6	·· 58.7	308°58.1	·· 31.1
10	233°15.9	338°01.1	31.0	21°58.2	37.8	11°39.6	58.9	324°00.2	31.1
11	248°18.4	353°00.2	31.4	36°59.2	38.3	26°41.5	59.0	339°02.3	31.1
12	263°20.8	7°59.3	S22°31.8	52°00.1	S11°38.8	41°43.5	S14°59.1	354°04.5	S22°31.1
13	278°23.3	22°58.4	32.2	67°01.1	39.4	56°45.5	59.3	9°06.6	31.1
14	293°25.8	37°57.5	32.7	82°02.1	39.9	71°47.5	59.4	24°08.8	31.1
15	308°28.2	52°56.6	·· 33.1	97°03.0	·· 40.5	86°49.5	·· 59.6	39°10.9	·· 31.1
16	323°30.7	67°55.7	33.5	112°04.0	41.0	101°51.5	59.7	54°13.1	31.1
17	338°33.2	82°54.7	33.9	127°05.0	41.6	116°53.5	14°59.8	69°15.2	31.1
18	353°35.6	97°53.8	S22°34.3	142°05.9	S11°42.1	131°55.5	S15°00.0	84°17.4	S22°31.1
19	8°38.1	112°52.9	34.7	157°06.9	42.6	146°57.4	00.1	99°19.5	31.1
20	23°40.5	127°52.0	35.1	172°07.8	43.2	161°59.4	00.3	114°21.7	31.1
21	38°43.0	142°51.1	·· 35.5	187°08.8	·· 43.7	177°01.4	·· 00.4	129°23.8	·· 31.1
22	53°45.5	157°50.2	35.9	202°09.8	44.3	192°03.4	00.5	144°26.0	31.1
23	68°47.9	172°49.2	36.3	217°10.7	44.8	207°05.4	00.7	159°28.1	31.1
Mer.pass.:18:26		v-0.9 d-0.4 m-3.8		v1.0 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.5
Ankaa	353°12.7	-42°12.8
Schedar	349°36.8	56°38.3
Diphda	348°52.8	-17°53.5
Achernar	335°24.3	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	316°00.5	89°20.5
Acamar	315°15.7	-40°14.3
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.8	-8°11.0
Capella	280°29.5	46°00.8
Bellatrix	278°28.4	6°21.8
Elnath	278°08.4	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.7	7°24.4
Canopus	263°54.2	-52°42.4
Sirius	258°30.7	-16°44.6
Adhara	255°09.8	-28°59.9
Procyon	244°56.3	5°10.6
Pollux	243°23.8	27°58.7
Avior	234°16.2	-59°33.9
Suhail	222°49.9	-43°30.2
Miaplacidus	221°38.4	-69°47.2
Alphard	217°52.9	-8°44.2
Regulus	207°40.2	11°52.7
Dubhe	193°48.1	61°39.0
Denebola	182°30.6	14°28.3
Gienah	175°49.2	-17°38.3
Acrux	173°06.0	-63°11.5
Gacrux	171°57.6	-57°12.4
Alioth	166°18.3	55°51.6
Spica	158°28.2	-11°15.1
Alkaid	152°56.9	49°13.4
Hadar	148°43.9	-60°27.1
Menkent	148°04.2	-36°27.1
Arcturus	145°53.2	19°05.4
Rigil Kent.	139°48.0	-60°54.1
Kochab	137°21.2	74°04.9
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.8	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.5	-69°03.3
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.0
Eltanin	90°45.3	51°29.4
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.3
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.7
Deneb	49°29.7	45°20.9
Enif	33°44.3	9°57.6
Al Na'ir	27°40.2	-46°52.6
Fomalhaut	15°20.7	-29°31.8
Scheat	13°50.5	28°11.0
Markab	13°35.3	15°18.2

Dec 12 Tue	**SHA**	**Mer.pass**
Venus	108°00.5	11:25
Mars	150°09.3	08:35
Jupiter	138°51.5	09:20
Saturn	91°02.7	12:30

Dec 13 Wed	**SHA**	**Mer.pass**
Venus	106°39.9	11:27
Mars	149°33.3	08:34
Jupiter	138°39.9	09:17
Saturn	90°55.1	12:27

Dec 14 Thu	**SHA**	**Mer.pass**
Venus	105°19.0	11:28
Mars	148°57.3	08:32
Jupiter	138°28.4	09:13
Saturn	90°47.5	12:24

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2371 sec ΔT = TT-UT1 = +68.9469 sec

2017 December 12 to Dec. 14 UT

h	Sun		Moon				
Tue	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	181°36.5	S23°04.1	249°56.4	13.6′	S00°15.3	-10.9′	56.2′
1	196°36.2	04.3	264°29.0	13.6′	00°26.2	-10.9′	56.2′
2	211°35.9	04.5	279°01.6	13.6′	00°37.1	-10.8′	56.1′
3	226°35.7	·· 04.7	293°34.3	13.7′	00°47.9	-10.8′	56.1′
4	241°35.4	04.9	308°07.0	13.7′	00°58.7	-10.8′	56.1′
5	256°35.1	05.0	322°39.7	13.7′	01°09.5	-10.8′	56.0′
6	271°34.8	S23°05.2	337°12.4	13.7′	S01°20.3	-10.8′	56.0′
7	286°34.5	05.4	351°45.2	13.8′	01°31.1	-10.8′	56.0′
8	301°34.2	05.6	6°18.0	13.8′	01°41.9	-10.8′	56.0′
9	316°33.9	·· 05.8	20°50.8	13.8′	01°52.6	-10.7′	55.9′
10	331°33.6	05.9	35°23.6	13.8′	02°03.4	-10.7′	55.9′
11	346°33.3	06.1	49°56.4	13.8′	02°14.1	-10.7′	55.9′
12	1°33.0	S23°06.3	64°29.3	13.9′	S02°24.8	-10.7′	55.9′
13	16°32.7	06.5	79°02.1	13.9′	02°35.5	-10.7′	55.8′
14	31°32.4	06.7	93°35.0	13.9′	02°46.1	-10.6′	55.8′
15	46°32.1	·· 06.8	108°07.9	13.9′	02°56.7	-10.6′	55.8′
16	61°31.9	07.0	122°40.9	13.9′	03°07.4	-10.6′	55.8′
17	76°31.6	07.2	137°13.8	13.9′	03°17.9	-10.6′	55.7′
18	91°31.3	S23°07.4	151°46.8	14.0′	S03°28.5	-10.6′	55.7′
19	106°31.0	07.5	166°19.7	14.0′	03°39.1	-10.5′	55.7′
20	121°30.7	07.7	180°52.7	14.0′	03°49.6	-10.5′	55.7′
21	136°30.4	·· 07.9	195°25.7	14.0′	04°00.1	-10.5′	55.6′
22	151°30.1	08.1	209°58.7	14.0′	04°10.5	-10.5′	55.6′
23	166°29.8	08.2	224°31.7	14.0′	04°21.0	-10.4′	55.6′
	SD.=16.2	d=-0.2	S.D.=15.2				

Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	181°29.5	S23°08.4	239°04.7	14.0′	S04°31.4	-10.4′	55.6′
1	196°29.2	08.6	253°37.8	14.0′	04°41.8	-10.4′	55.5′
2	211°28.9	08.7	268°10.8	14.0′	04°52.1	-10.3′	55.5′
3	226°28.6	·· 08.9	282°43.9	14.1′	05°02.4	-10.3′	55.5′
4	241°28.3	09.1	297°16.9	14.1′	05°12.7	-10.3′	55.5′
5	256°28.0	09.2	311°50.0	14.1′	05°23.0	-10.3′	55.4′
6	271°27.7	S23°09.4	326°23.0	14.1′	S05°33.3	-10.2′	55.4′
7	286°27.4	09.6	340°56.1	14.1′	05°43.5	-10.2′	55.4′
8	301°27.1	09.7	355°29.2	14.1′	05°53.6	-10.2′	55.4′
9	316°26.8	·· 09.9	10°02.3	14.1′	06°03.8	-10.1′	55.3′
10	331°26.5	10.0	24°35.3	14.1′	06°13.9	-10.1′	55.3′
11	346°26.3	10.2	39°08.4	14.1′	06°23.9	-10.1′	55.3′
12	1°26.0	S23°10.4	53°41.5	14.1′	S06°34.0	-10.0′	55.3′
13	16°25.7	10.5	68°14.6	14.1′	06°44.0	-10.0′	55.3′
14	31°25.4	10.7	82°47.7	14.1′	06°54.0	-9.9′	55.2′
15	46°25.1	·· 10.8	97°20.8	14.1′	07°03.9	-9.9′	55.2′
16	61°24.8	11.0	111°53.9	14.1′	07°13.8	-9.9′	55.2′
17	76°24.5	11.1	126°26.9	14.1′	07°23.6	-9.8′	55.2′
18	91°24.2	S23°11.3	141°00.0	14.1′	S07°33.5	-9.8′	55.2′
19	106°23.9	11.5	155°33.1	14.1′	07°43.2	-9.8′	55.1′
20	121°23.6	11.6	170°06.2	14.1′	07°53.0	-9.7′	55.1′
21	136°23.3	·· 11.8	184°39.2	14.1′	08°02.7	-9.7′	55.1′
22	151°23.0	11.9	199°12.3	14.1′	08°12.3	-9.6′	55.1′
23	166°22.7	12.1	213°45.4	14.1′	08°21.9	-9.6′	55.1′
	SD.=16.2	d=-0.2	S.D.=15.1				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	181°22.4	S23°12.2	228°18.4	14.0′	S08°31.5	-9.6′	55.0′
1	196°22.1	12.4	242°51.5	14.0′	08°41.1	-9.5′	55.0′
2	211°21.8	12.5	257°24.5	14.0′	08°50.5	-9.5′	55.0′
3	226°21.5	·· 12.7	271°57.5	14.0′	09°00.0	-9.4′	55.0′
4	241°21.2	12.8	286°30.5	14.0′	09°09.4	-9.4′	55.0′
5	256°20.9	13.0	301°03.6	14.0′	09°18.7	-9.3′	54.9′
6	271°20.6	S23°13.1	315°36.6	14.0′	S09°28.1	-9.3′	54.9′
7	286°20.3	13.2	330°09.6	14.0′	09°37.3	-9.2′	54.9′
8	301°20.0	13.4	344°42.6	14.0′	09°46.5	-9.2′	54.9′
9	316°19.7	·· 13.5	359°15.5	14.0′	09°55.7	-9.1′	54.9′
10	331°19.4	13.7	13°48.5	14.0′	10°04.8	-9.1′	54.9′
11	346°19.1	13.8	28°21.4	13.9′	10°13.9	-9.1′	54.8′
12	1°18.8	S23°14.0	42°54.4	13.9′	S10°22.9	-9.0′	54.8′
13	16°18.5	14.1	57°27.3	13.9′	10°31.9	-9.0′	54.8′
14	31°18.2	14.2	72°00.2	13.9′	10°40.8	-8.9′	54.8′
15	46°17.9	·· 14.4	86°33.1	13.9′	10°49.7	-8.9′	54.8′
16	61°17.6	14.5	101°06.0	13.9′	10°58.5	-8.8′	54.8′
17	76°17.3	14.6	115°38.9	13.9′	11°07.3	-8.7′	54.7′
18	91°17.0	S23°14.8	130°11.7	13.9′	S11°16.0	-8.7′	54.7′
19	106°16.7	14.9	144°44.6	13.8′	11°24.7	-8.6′	54.7′
20	121°16.4	15.1	159°17.4	13.8′	11°33.3	-8.6′	54.7′
21	136°16.1	·· 15.2	173°50.2	13.8′	11°41.9	-8.5′	54.7′
22	151°15.8	15.3	188°23.0	13.8′	11°50.4	-8.5′	54.7′
23	166°15.5	15.4	202°55.8	13.8′	11°58.8	-8.4′	54.6′
	SD.=16.2	d=-0.1	S.D.=14.9				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:17	10:41	▬	▬	13:07	15:31
N 70°	07:58	09:44	▬	▬	14:04	15:50
68°	07:43	09:11	▬	▬	14:38	16:06
66°	07:30	08:46	10:23	13:25	15:02	16:19
64°	07:19	08:27	09:43	14:05	15:21	16:29
62°	07:10	08:11	09:16	14:32	15:37	16:39
60°	07:01	07:58	08:55	14:53	15:51	16:47
N 58°	06:54	07:46	08:38	15:11	16:02	16:54
56°	06:47	07:36	08:23	15:25	16:12	17:01
54°	06:41	07:27	08:11	15:37	16:21	17:07
52°	06:36	07:19	08:00	15:48	16:29	17:13
50°	06:31	07:12	07:50	15:58	16:36	17:18
45°	06:19	06:56	07:30	16:19	16:52	17:29
N 40°	06:09	06:43	07:13	16:35	17:06	17:40
35°	06:00	06:31	06:59	16:49	17:17	17:49
30°	05:51	06:21	06:47	17:01	17:28	17:58
20°	05:35	06:02	06:26	17:22	17:46	18:14
N 10°	05:19	05:45	06:08	17:41	18:04	18:30
0°	05:02	05:28	05:51	17:58	18:21	18:47
S 10°	04:43	05:10	05:33	18:15	18:38	19:05
20°	04:21	04:50	05:14	18:34	18:59	19:28
30°	03:52	04:25	04:53	18:56	19:23	19:57
35°	03:34	04:10	04:40	19:09	19:39	20:15
40°	03:11	03:52	04:25	19:24	19:57	20:38
45°	02:41	03:30	04:07	19:42	20:19	21:08
S 50°	01:56	03:01	03:45	20:04	20:48	21:53
52°	01:30	02:46	03:34	20:15	21:03	22:20
54°	00:48	02:28	03:22	20:27	21:21	23:03
56°	▭	02:07	03:08	20:41	21:42	▭
58°	▭	01:38	02:52	20:57	22:11	▭
S 60°	▭	00:53	02:32	21:17	22:58	▭

Lat.	**Moonrise** Tue	Wed	Thu	**Moonset** Tue	Wed	Thu
N 72°	01:31	03:14	04:58	13:10	13:00	12:49
N 70°	01:30	03:07	04:43	13:14	13:10	13:06
68°	01:29	03:01	04:31	13:17	13:18	13:19
66°	01:29	02:56	04:21	13:20	13:25	13:31
64°	01:28	02:51	04:13	13:22	13:30	13:40
62°	01:28	02:48	04:06	13:24	13:35	13:48
60°	01:27	02:44	04:00	13:25	13:39	13:55
N 58°	01:27	02:41	03:54	13:27	13:43	14:01
56°	01:27	02:39	03:50	13:28	13:47	14:06
54°	01:26	02:37	03:45	13:29	13:50	14:11
52°	01:26	02:35	03:41	13:30	13:52	14:16
50°	01:26	02:33	03:38	13:31	13:55	14:20
45°	01:26	02:29	03:30	13:33	14:00	14:28
N 40°	01:25	02:25	03:24	13:35	14:05	14:36
35°	01:25	02:22	03:19	13:37	14:09	14:42
30°	01:25	02:20	03:14	13:38	14:13	14:48
20°	01:24	02:15	03:06	13:41	14:19	14:57
N 10°	01:24	02:12	02:59	13:43	14:24	15:06
0°	01:23	02:08	02:52	13:45	14:29	15:14
S 10°	01:23	02:04	02:46	13:47	14:34	15:22
20°	01:22	02:01	02:39	13:49	14:40	15:30
30°	01:22	01:56	02:31	13:51	14:46	15:40
35°	01:22	01:54	02:26	13:53	14:50	15:46
40°	01:22	01:51	02:21	13:54	14:54	15:52
45°	01:21	01:48	02:15	13:56	14:58	16:00
S 50°	01:21	01:44	02:08	13:58	15:04	16:09
52°	01:21	01:43	02:05	13:59	15:07	16:13
54°	01:21	01:41	02:02	14:00	15:10	16:18
56°	01:21	01:39	01:58	14:01	15:13	16:23
58°	01:20	01:36	01:53	14:03	15:16	16:29
S 60°	01:20	01:34	01:49	14:04	15:20	16:35

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 24-26 28-13%
12	06:26	06:12	11:54	07:34	19:56	
13	05:58	05:44	11:54	08:19	20:41	
14	05:30	05:15	11:55	09:03	21:25	

December 15, 16, 17 UT (Fri., Sat., Sun.)

	Aries	Venus		Mars		Jupiter		Saturn	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	83°50.4	187°48.3	S22°36.7	232°11.7	S11°45.4	222°07.4	S15°00.8	174°30.2	S22°31.1
1	98°52.9	202°47.4	37.1	247°12.6	45.9	237°09.4	01.0	189°32.4	31.1
2	113°55.3	217°46.5	37.5	262°13.6	46.4	252°11.4	01.1	204°34.5	31.1
3	128°57.8	232°45.6	·· 37.9	277°14.6	·· 47.0	267°13.3	·· 01.2	219°36.7	·· 31.1
4	144°00.3	247°44.6	38.3	292°15.5	47.5	282°15.3	01.4	234°38.8	31.2
5	159°02.7	262°43.7	38.7	307°16.5	48.1	297°17.3	01.5	249°41.0	31.2
6	174°05.2	277°42.8	S22°39.1	322°17.5	S11°48.6	312°19.3	S15°01.7	264°43.1	S22°31.2
7	189°07.7	292°41.9	39.5	337°18.4	49.2	327°21.3	01.8	279°45.3	31.2
8	204°10.1	307°41.0	39.9	352°19.4	49.7	342°23.3	01.9	294°47.4	31.2
9	219°12.6	322°40.0	·· 40.3	7°20.3	·· 50.2	357°25.3	·· 02.1	309°49.6	·· 31.2
10	234°15.0	337°39.1	40.7	22°21.3	50.8	12°27.3	02.2	324°51.7	31.2
11	249°17.5	352°38.2	41.1	37°22.3	51.3	27°29.3	02.4	339°53.8	31.2
12	264°20.0	7°37.3	S22°41.5	52°23.2	S11°51.9	42°31.3	S15°02.5	354°56.0	S22°31.2
13	279°22.4	22°36.4	41.8	67°24.2	52.4	57°33.2	02.6	9°58.1	31.2
14	294°24.9	37°35.4	42.2	82°25.1	52.9	72°35.2	02.8	25°00.3	31.2
15	309°27.4	52°34.5	·· 42.6	97°26.1	·· 53.5	87°37.2	·· 02.9	40°02.4	·· 31.2
16	324°29.8	67°33.6	43.0	112°27.1	54.0	102°39.2	03.1	55°04.6	31.2
17	339°32.3	82°32.7	43.4	127°28.0	54.6	117°41.2	03.2	70°06.7	31.2
18	354°34.8	97°31.7	S22°43.8	142°29.0	S11°55.1	132°43.2	S15°03.3	85°08.9	S22°31.2
19	9°37.2	112°30.8	44.1	157°29.9	55.6	147°45.2	03.5	100°11.0	31.2
20	24°39.7	127°29.9	44.5	172°30.9	56.2	162°47.2	03.6	115°13.2	31.2
21	39°42.2	142°29.0	·· 44.9	187°31.9	·· 56.7	177°49.2	·· 03.7	130°15.3	·· 31.2
22	54°44.6	157°28.0	45.3	202°32.8	57.3	192°51.2	03.9	145°17.4	31.2
23	69°47.1	172°27.1	45.7	217°33.8	57.8	207°53.1	04.0	160°19.6	31.2
Mer.pass.:18:22		v-0.9 d-0.4 m-3.8		v1.0 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	84°49.5	187°26.2	S22°46.0	232°34.7	S11°58.3	222°55.1	S15°04.2	175°21.7	S22°31.2
1	99°52.0	202°25.3	46.4	247°35.7	58.9	237°57.1	04.3	190°23.9	31.2
2	114°54.5	217°24.3	46.8	262°36.6	59.4	252°59.1	04.4	205°26.0	31.2
3	129°56.9	232°23.4	·· 47.1	277°37.6	11°59.9	268°01.1	·· 04.6	220°28.2	·· 31.3
4	144°59.4	247°22.5	47.5	292°38.6	12°00.5	283°03.1	04.7	235°30.3	31.3
5	160°01.9	262°21.6	47.9	307°39.5	01.0	298°05.1	04.9	250°32.5	31.3
6	175°04.3	277°20.6	S22°48.2	322°40.5	S12°01.6	313°07.1	S15°05.0	265°34.6	S22°31.3
7	190°06.8	292°19.7	48.6	337°41.4	02.1	328°09.1	05.1	280°36.8	31.3
8	205°09.3	307°18.8	49.0	352°42.4	02.6	343°11.1	05.3	295°38.9	31.3
9	220°11.7	322°17.8	·· 49.3	7°43.4	·· 03.2	358°13.1	·· 05.4	310°41.0	·· 31.3
10	235°14.2	337°16.9	49.7	22°44.3	03.7	13°15.1	05.6	325°43.2	31.3
11	250°16.7	352°16.0	50.1	37°45.3	04.3	28°17.0	05.7	340°45.3	31.3
12	265°19.1	7°15.0	S22°50.4	52°46.2	S12°04.8	43°19.0	S15°05.8	355°47.5	S22°31.3
13	280°21.6	22°14.1	50.8	67°47.2	05.3	58°21.0	06.0	10°49.6	31.3
14	295°24.0	37°13.2	51.1	82°48.1	05.9	73°23.0	06.1	25°51.8	31.3
15	310°26.5	52°12.3	·· 51.5	97°49.1	·· 06.4	88°25.0	·· 06.2	40°53.9	·· 31.3
16	325°29.0	67°11.3	51.8	112°50.1	06.9	103°27.0	06.4	55°56.1	31.3
17	340°31.4	82°10.4	52.2	127°51.0	07.5	118°29.0	06.5	70°58.2	31.3
18	355°33.9	97°09.5	S22°52.5	142°52.0	S12°08.0	133°31.0	S15°06.7	86°00.4	S22°31.3
19	10°36.4	112°08.5	52.9	157°52.9	08.5	148°33.0	06.8	101°02.5	31.3
20	25°38.8	127°07.6	53.2	172°53.9	09.1	163°35.0	06.9	116°04.6	31.3
21	40°41.3	142°06.7	·· 53.6	187°54.8	·· 09.6	178°37.0	·· 07.1	131°06.8	·· 31.3
22	55°43.8	157°05.7	53.9	202°55.8	10.2	193°39.0	07.2	146°08.9	31.3
23	70°46.2	172°04.8	54.3	217°56.8	10.7	208°41.0	07.3	161°11.1	31.3
Mer.pass.:18:18		v-0.9 d-0.4 m-3.8		v1.0 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	85°48.7	187°03.9	S22°54.6	232°57.7	S12°11.2	223°43.0	S15°07.5	176°13.2	S22°31.3
1	100°51.1	202°02.9	55.0	247°58.7	11.8	238°44.9	07.6	191°15.4	31.3
2	115°53.6	217°02.0	55.3	262°59.6	12.3	253°46.9	07.8	206°17.5	31.3
3	130°56.1	232°01.1	·· 55.7	278°00.6	·· 12.8	268°48.9	·· 07.9	221°19.7	·· 31.3
4	145°58.5	247°00.1	56.0	293°01.5	13.4	283°50.9	08.0	236°21.8	31.3
5	161°01.0	261°59.2	56.3	308°02.5	13.9	298°52.9	08.2	251°23.9	31.4
6	176°03.5	276°58.3	S22°56.7	323°03.5	S12°14.4	313°54.9	S15°08.3	266°26.1	S22°31.4
7	191°05.9	291°57.3	57.0	338°04.4	15.0	328°56.9	08.4	281°28.2	31.4
8	206°08.4	306°56.4	57.4	353°05.4	15.5	343°58.9	08.6	296°30.4	31.4
9	221°10.9	321°55.5	·· 57.7	8°06.3	·· 16.0	359°00.9	·· 08.7	311°32.5	·· 31.4
10	236°13.3	336°54.5	58.0	23°07.3	16.6	14°02.9	08.9	326°34.7	31.4
11	251°15.8	351°53.6	58.3	38°08.2	17.1	29°04.9	09.0	341°36.8	31.4
12	266°18.3	6°52.6	S22°58.7	53°09.2	S12°17.6	44°06.9	S15°09.1	356°39.0	S22°31.4
13	281°20.7	21°51.7	59.0	68°10.2	18.2	59°08.9	09.3	11°41.1	31.4
14	296°23.2	36°50.8	59.3	83°11.1	18.7	74°10.9	09.4	26°43.3	31.4
15	311°25.6	51°49.8	22°59.7	98°12.1	·· 19.2	89°12.9	·· 09.5	41°45.4	·· 31.4
16	326°28.1	66°48.9	23°00.0	113°13.0	19.8	104°14.9	09.7	56°47.5	31.4
17	341°30.6	81°48.0	00.3	128°14.0	20.3	119°16.9	09.8	71°49.7	31.4
18	356°33.0	96°47.0	S23°00.6	143°14.9	S12°20.8	134°18.9	S15°09.9	86°51.8	S22°31.4
19	11°35.5	111°46.1	01.0	158°15.9	21.4	149°20.9	10.1	101°54.0	31.4
20	26°38.0	126°45.1	01.3	173°16.8	21.9	164°22.9	10.2	116°56.1	31.4
21	41°40.4	141°44.2	·· 01.6	188°17.8	·· 22.4	179°24.8	·· 10.4	131°58.3	·· 31.4
22	56°42.9	156°43.3	01.9	203°18.8	23.0	194°26.8	10.5	147°00.4	31.4
23	71°45.4	171°42.3	02.2	218°19.7	23.5	209°28.8	10.6	162°02.6	31.4
Mer.pass.:18:14		v-0.9 d-0.3 m-3.8		v1.0 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.5
Ankaa	353°12.7	-42°12.8
Schedar	349°36.8	56°38.3
Diphda	348°52.8	-17°53.5
Achernar	335°24.3	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	316°01.1	89°20.5
Acamar	315°15.7	-40°14.3
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.6	16°32.5
Rigel	281°08.8	-8°11.1
Capella	280°29.5	46°00.8
Bellatrix	278°28.4	6°21.8
Elnath	278°08.4	28°37.1
Alnilam	275°43.0	-1°11.6
Betelgeuse	270°57.7	7°24.4
Canopus	263°54.2	-52°42.4
Sirius	258°30.7	-16°44.6
Adhara	255°09.8	-28°59.9
Procyon	244°56.3	5°10.6
Pollux	243°23.7	27°58.7
Avior	234°16.2	-59°33.9
Suhail	222°49.9	-43°30.2
Miaplacidus	221°38.3	-69°47.2
Alphard	217°52.9	-8°44.2
Regulus	207°40.2	11°52.7
Dubhe	193°48.0	61°39.0
Denebola	182°30.6	14°28.3
Gienah	175°49.2	-17°38.3
Acrux	173°06.0	-63°11.5
Gacrux	171°57.6	-57°12.4
Alioth	166°18.3	55°51.6
Spica	158°28.2	-11°15.1
Alkaid	152°56.9	49°13.4
Hadar	148°43.9	-60°27.1
Menkent	148°04.2	-36°27.1
Arcturus	145°53.2	19°05.4
Rigil Kent.	139°48.0	-60°54.1
Kochab	137°21.2	74°04.8
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.8	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.5	-69°03.3
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.0
Eltanin	90°45.3	51°29.4
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.2
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.7
Deneb	49°29.7	45°20.9
Enif	33°44.3	9°57.5
Al Na'ir	27°40.2	-46°52.6
Fomalhaut	15°20.8	-29°31.8
Scheat	13°50.5	28°11.0
Markab	13°35.4	15°18.2

Dec 15 Fri	SHA	Mer.pass
Venus	103°57.9	11:29
Mars	148°21.3	08:31
Jupiter	138°17.0	09:10
Saturn	90°39.8	12:20

Dec 16 Sat	SHA	Mer.pass
Venus	102°36.6	11:31
Mars	147°45.2	08:29
Jupiter	138°05.6	09:07
Saturn	90°32.2	12:17

Dec 17 Sun	SHA	Mer.pass
Venus	101°15.2	11:32
Mars	147°09.0	08:28
Jupiter	137°54.3	09:04
Saturn	90°24.5	12:13

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2340 sec ΔT = TT-UT1 = +68.9500 sec

2017 December 15 to Dec. 17 UT

h — Sun — Moon

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	181°15.2	S23°15.6	217°28.6	13.8'	S12°07.2	-8.4'	54.6'
1	196°14.9	15.7	232°01.3	13.7'	12°15.6	-8.3'	54.6'
2	211°14.6	15.8	246°34.0	13.7'	12°23.9	-8.3'	54.6'
3	226°14.3	·· 16.0	261°06.7	13.7'	12°32.1	-8.2'	54.6'
4	241°14.0	16.1	275°39.4	13.7'	12°40.3	-8.1'	54.6'
5	256°13.7	16.2	290°12.1	13.7'	12°48.4	-8.1'	54.6'
6	271°13.4	S23°16.3	304°44.8	13.6'	S12°56.4	-8.0'	54.5'
7	286°13.1	16.5	319°17.4	13.6'	13°04.4	-8.0'	54.5'
8	301°12.8	16.6	333°50.0	13.6'	13°12.3	-7.9'	54.5'
9	316°12.5	·· 16.7	348°22.6	13.6'	13°20.2	-7.8'	54.5'
10	331°12.2	16.8	2°55.2	13.6'	13°28.0	-7.8'	54.5'
11	346°11.9	17.0	17°27.7	13.5'	13°35.8	-7.7'	54.5'
12	1°11.6	S23°17.1	32°00.3	13.5'	S13°43.4	-7.7'	54.5'
13	16°11.3	17.2	46°32.8	13.5'	13°51.1	-7.6'	54.4'
14	31°11.0	17.3	61°05.3	13.5'	13°58.6	-7.5'	54.4'
15	46°10.7	·· 17.4	75°37.7	13.5'	14°06.1	-7.5'	54.4'
16	61°10.4	17.6	90°10.2	13.4'	14°13.6	-7.4'	54.4'
17	76°10.1	17.7	104°42.6	13.4'	14°20.9	-7.3'	54.4'
18	91°09.8	S23°17.8	119°15.0	13.4'	S14°28.2	-7.3'	54.4'
19	106°09.5	17.9	133°47.4	13.4'	14°35.5	-7.2'	54.4'
20	121°09.2	18.0	148°19.8	13.4'	14°42.6	-7.1'	54.4'
21	136°08.9	·· 18.1	162°52.1	13.3'	14°49.7	-7.1'	54.4'
22	151°08.5	18.3	177°24.4	13.3'	14°56.8	-7.0'	54.3'
23	166°08.2	18.4	191°56.7	13.3'	15°03.7	-6.9'	54.3'
	SD.=16.2	d=-0.1	S.D.=14.8				

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	181°07.9	S23°18.5	206°29.0	13.3'	S15°10.6	-6.9'	54.3'
1	196°07.6	18.6	221°01.2	13.2'	15°17.4	-6.8'	54.3'
2	211°07.3	18.7	235°33.5	13.2'	15°24.2	-6.7'	54.3'
3	226°07.0	·· 18.8	250°05.7	13.2'	15°30.9	-6.7'	54.3'
4	241°06.7	18.9	264°37.9	13.2'	15°37.5	-6.6'	54.3'
5	256°06.4	19.0	279°10.0	13.1'	15°44.1	-6.5'	54.3'
6	271°06.1	S23°19.1	293°42.1	13.1'	S15°50.5	-6.4'	54.3'
7	286°05.8	19.2	308°14.3	13.1'	15°56.9	-6.4'	54.2'
8	301°05.5	19.3	322°46.3	13.1'	16°03.3	-6.3'	54.2'
9	316°05.2	·· 19.4	337°18.4	13.1'	16°09.5	-6.2'	54.2'
10	331°04.9	19.6	351°50.5	13.0'	16°15.7	-6.1'	54.2'
11	346°04.6	19.7	6°22.5	13.0'	16°21.8	-6.1'	54.2'
12	1°04.3	S23°19.8	20°54.5	13.0'	S16°27.9	-6.0'	54.2'
13	16°04.0	19.9	35°26.4	13.0'	16°33.8	-5.9'	54.2'
14	31°03.7	20.0	49°58.4	12.9'	16°39.7	-5.8'	54.2'
15	46°03.4	·· 20.1	64°30.3	12.9'	16°45.5	-5.8'	54.2'
16	61°03.1	20.2	79°02.2	12.9'	16°51.3	-5.7'	54.2'
17	76°02.8	20.3	93°34.1	12.9'	16°56.9	-5.6'	54.2'
18	91°02.5	S23°20.4	108°06.0	12.8'	S17°02.5	-5.5'	54.1'
19	106°02.2	20.4	122°37.8	12.8'	17°08.0	-5.5'	54.1'
20	121°01.8	20.5	137°09.6	12.8'	17°13.4	-5.4'	54.1'
21	136°01.5	·· 20.6	151°41.4	12.8'	17°18.8	-5.3'	54.1'
22	151°01.2	20.7	166°13.2	12.8'	17°24.0	-5.2'	54.1'
23	166°00.9	20.8	180°44.9	12.7'	17°29.2	-5.2'	54.1'
	SD.=16.2	d=-0.1	S.D.=14.8				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	181°00.6	S23°20.9	195°16.7	12.7'	S17°34.4	-5.1'	54.1'
1	196°00.3	21.0	209°48.4	12.7'	17°39.4	-5.0'	54.1'
2	211°00.0	21.1	224°20.1	12.7'	17°44.3	-4.9'	54.1'
3	225°59.7	·· 21.2	238°51.7	12.7'	17°49.2	-4.8'	54.1'
4	240°59.4	21.3	253°23.4	12.6'	17°54.0	-4.7'	54.1'
5	255°59.1	21.4	267°55.0	12.6'	17°58.7	-4.7'	54.1'
6	270°58.8	S23°21.5	282°26.6	12.6'	S18°03.3	-4.6'	54.1'
7	285°58.5	21.5	296°58.2	12.6'	18°07.9	-4.5'	54.1'
8	300°58.2	21.6	311°29.7	12.5'	18°12.3	-4.4'	54.0'
9	315°57.9	·· 21.7	326°01.2	12.5'	18°16.7	-4.3'	54.0'
10	330°57.6	21.8	340°32.8	12.5'	18°21.0	-4.3'	54.0'
11	345°57.3	21.9	355°04.3	12.5'	18°25.2	-4.2'	54.0'
12	0°56.9	S23°22.0	9°35.7	12.5'	S18°29.3	-4.1'	54.0'
13	15°56.6	22.0	24°07.2	12.4'	18°33.4	-4.0'	54.0'
14	30°56.3	22.1	38°38.6	12.4'	18°37.3	-3.9'	54.0'
15	45°56.0	·· 22.2	53°10.1	12.4'	18°41.2	-3.8'	54.0'
16	60°55.7	22.3	67°41.5	12.4'	18°45.0	-3.7'	54.0'
17	75°55.4	22.4	82°12.8	12.4'	18°48.7	-3.7'	54.0'
18	90°55.1	S23°22.4	96°44.2	12.4'	S18°52.3	-3.6'	54.0'
19	105°54.8	22.5	111°15.6	12.3'	18°55.8	-3.5'	54.0'
20	120°54.5	22.6	125°46.9	12.3'	18°59.3	-3.4'	54.0'
21	135°54.2	·· 22.7	140°18.2	12.3'	19°02.6	-3.3'	54.0'
22	150°53.9	22.7	154°49.5	12.3'	19°05.9	-3.2'	54.0'
23	165°53.6	22.8	169°20.8	12.3'	19°09.1	-3.1'	54.0'
	SD.=16.2	d=-0.1	S.D.=14.7				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:22	10:50	▬	▬	13:01	15:30
N 70°	08:02	09:49	▬	▬	14:02	15:50
68°	07:46	09:15	▬	▬	14:37	16:05
66°	07:33	08:50	10:29	13:22	15:02	16:18
64°	07:22	08:30	09:48	14:04	15:21	16:29
62°	07:12	08:14	09:20	14:32	15:37	16:39
60°	07:04	08:01	08:58	14:53	15:51	16:47
N 58°	06:57	07:49	08:41	15:10	16:02	16:55
56°	06:50	07:39	08:26	15:25	16:12	17:01
54°	06:44	07:30	08:14	15:38	16:21	17:08
52°	06:38	07:22	08:03	15:49	16:30	17:13
50°	06:33	07:14	07:53	15:59	16:37	17:19
45°	06:21	06:58	07:32	16:19	16:53	17:30
N 40°	06:11	06:45	07:15	16:36	17:07	17:41
35°	06:01	06:33	07:01	16:50	17:18	17:50
30°	05:53	06:23	06:49	17:02	17:29	17:59
20°	05:36	06:04	06:28	17:24	17:48	18:15
N 10°	05:20	05:47	06:09	17:42	18:05	18:31
0°	05:03	05:29	05:52	17:59	18:22	18:48
S 10°	04:44	05:11	05:34	18:17	18:40	19:07
20°	04:22	04:51	05:16	18:36	19:00	19:30
30°	03:53	04:26	04:54	18:58	19:25	19:59
35°	03:34	04:11	04:41	19:11	19:41	20:17
40°	03:11	03:53	04:26	19:26	19:59	20:40
45°	02:41	03:30	04:08	19:44	20:21	21:11
S 50°	01:56	03:01	03:45	20:06	20:51	21:56
52°	01:28	02:46	03:34	20:17	21:06	22:24
54°	00:44	02:28	03:22	20:29	21:24	23:09
56°	▭	02:06	03:08	20:44	21:46	▭
58°	▭	01:37	02:51	21:00	22:15	▭
S 60°	▭	00:48	02:31	21:21	23:05	▭

Lat.	Moonrise Fri	Moonrise Sat	Moonrise Sun	Moonset Fri	Moonset Sat	Moonset Sun
N 72°	06:46	08:45	▬	12:35	12:11	▬
N 70°	06:20	08:00	09:42	13:02	12:57	12:52
68°	06:01	07:30	08:57	13:22	13:27	13:37
66°	05:46	07:08	08:27	13:38	13:50	14:07
64°	05:33	06:51	08:05	13:52	14:08	14:30
62°	05:22	06:37	07:47	14:03	14:22	14:48
60°	05:13	06:25	07:33	14:13	14:35	15:03
N 58°	05:06	06:15	07:20	14:21	14:46	15:16
56°	04:59	06:06	07:09	14:29	14:55	15:27
54°	04:52	05:58	07:00	14:35	15:03	15:37
52°	04:47	05:51	06:52	14:41	15:11	15:45
50°	04:42	05:44	06:44	14:47	15:18	15:53
45°	04:31	05:31	06:28	14:59	15:32	16:10
N 40°	04:22	05:19	06:15	15:08	15:44	16:23
35°	04:15	05:10	06:04	15:17	15:54	16:35
30°	04:08	05:01	05:54	15:24	16:03	16:45
20°	03:56	04:47	05:37	15:37	16:19	17:02
N 10°	03:46	04:34	05:23	15:48	16:32	17:18
0°	03:37	04:23	05:09	15:59	16:45	17:32
S 10°	03:28	04:11	04:55	16:09	16:58	17:46
20°	03:18	03:58	04:41	16:21	17:11	18:01
30°	03:07	03:44	04:25	16:34	17:27	18:19
35°	03:00	03:36	04:15	16:41	17:36	18:29
40°	02:53	03:27	04:04	16:50	17:46	18:41
45°	02:44	03:16	03:51	17:00	17:58	18:54
S 50°	02:34	03:03	03:36	17:12	18:13	19:11
52°	02:30	02:57	03:29	17:18	18:20	19:19
54°	02:24	02:50	03:21	17:24	18:28	19:28
56°	02:19	02:43	03:12	17:31	18:37	19:38
58°	02:12	02:34	03:02	17:39	18:46	19:49
S 60°	02:05	02:25	02:50	17:48	18:58	20:02

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 27-29 7-1%
15	05:01	04:46	11:55	09:48	22:11	
16	04:32	04:17	11:56	10:34	22:57	
17	04:02	03:48	11:56	11:20	23:44	

December 18, 19, 20 UT (Mon., Tue., Wed.)

	Aries	Venus		Mars		Jupiter		Saturn	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	86°47.8	186°41.4	S23°02.6	233°20.7	S12°24.0	224°30.8	S15°10.8	177°04.7	S22°31.4
1	101°50.3	201°40.4	02.9	248°21.6	24.6	239°32.8	10.9	192°06.8	31.4
2	116°52.8	216°39.5	03.2	263°22.6	25.1	254°34.8	11.0	207°09.0	31.4
3	131°55.2	231°38.6	·· 03.5	278°23.5	·· 25.6	269°36.8	·· 11.2	222°11.1	·· 31.4
4	146°57.7	246°37.6	03.8	293°24.5	26.2	284°38.8	11.3	237°13.3	31.4
5	162°00.1	261°36.7	04.1	308°25.4	26.7	299°40.8	11.4	252°15.4	31.4
6	177°02.6	276°35.7	S23°04.4	323°26.4	S12°27.2	314°42.8	S15°11.6	267°17.6	S22°31.4
7	192°05.1	291°34.8	04.7	338°27.3	27.8	329°44.8	11.7	282°19.7	31.4
8	207°07.5	306°33.9	05.0	353°28.3	28.3	344°46.8	11.8	297°21.9	31.4
9	222°10.0	321°32.9	·· 05.3	8°29.3	·· 28.8	359°48.8	·· 12.0	312°24.0	·· 31.5
10	237°12.5	336°32.0	05.6	23°30.2	29.3	14°50.8	12.1	327°26.1	31.5
11	252°14.9	351°31.0	05.9	38°31.2	29.9	29°52.8	12.3	342°28.3	31.5
12	267°17.4	6°30.1	S23°06.2	53°32.1	S12°30.4	44°54.8	S15°12.4	357°30.4	S22°31.5
13	282°19.9	21°29.1	06.5	68°33.1	30.9	59°56.8	12.5	12°32.6	31.5
14	297°22.3	36°28.2	06.8	83°34.0	31.5	74°58.8	12.7	27°34.7	31.5
15	312°24.8	51°27.3	·· 07.1	98°35.0	·· 32.0	90°00.8	·· 12.8	42°36.9	·· 31.5
16	327°27.3	66°26.3	07.4	113°35.9	32.5	105°02.8	12.9	57°39.0	31.5
17	342°29.7	81°25.4	07.7	128°36.9	33.1	120°04.8	13.1	72°41.2	31.5
18	357°32.2	96°24.4	S23°08.0	143°37.8	S12°33.6	135°06.8	S15°13.2	87°43.3	S22°31.5
19	12°34.6	111°23.5	08.3	158°38.8	34.1	150°08.8	13.3	102°45.5	31.5
20	27°37.1	126°22.5	08.6	173°39.7	34.6	165°10.8	13.5	117°47.6	31.5
21	42°39.6	141°21.6	·· 08.9	188°40.7	·· 35.2	180°12.8	·· 13.6	132°49.7	·· 31.5
22	57°42.0	156°20.6	09.2	203°41.7	35.7	195°14.8	13.7	147°51.9	31.5
23	72°44.5	171°19.7	09.5	218°42.6	36.2	210°16.8	13.9	162°54.0	31.5
Mer.pass.:18:10		v-0.9 d-0.3 m-3.8		v1.0 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	87°47.0	186°18.7	S23°09.8	233°43.6	S12°36.8	225°18.8	S15°14.0	177°56.2	S22°31.5
1	102°49.4	201°17.8	10.1	248°44.5	37.3	240°20.8	14.1	192°58.3	31.5
2	117°51.9	216°16.8	10.3	263°45.5	37.8	255°22.8	14.3	208°00.5	31.5
3	132°54.4	231°15.9	·· 10.6	278°46.4	·· 38.3	270°24.8	·· 14.4	223°02.6	·· 31.5
4	147°56.8	246°15.0	10.9	293°47.4	38.9	285°26.8	14.5	238°04.8	31.5
5	162°59.3	261°14.0	11.2	308°48.3	39.4	300°28.8	14.7	253°06.9	31.5
6	178°01.8	276°13.1	S23°11.5	323°49.3	S12°39.9	315°30.8	S15°14.8	268°09.0	S22°31.5
7	193°04.2	291°12.1	11.7	338°50.2	40.5	330°32.8	15.0	283°11.2	31.5
8	208°06.7	306°11.2	12.0	353°51.2	41.0	345°34.8	15.1	298°13.3	31.5
9	223°09.1	321°10.2	·· 12.3	8°52.1	·· 41.5	0°36.8	·· 15.2	313°15.5	·· 31.5
10	238°11.6	336°09.3	12.6	23°53.1	42.0	15°38.8	15.4	328°17.6	31.5
11	253°14.1	351°08.3	12.8	38°54.0	42.6	30°40.8	15.5	343°19.8	31.5
12	268°16.5	6°07.4	S23°13.1	53°55.0	S12°43.1	45°42.8	S15°15.6	358°21.9	S22°31.5
13	283°19.0	21°06.4	13.4	68°55.9	43.6	60°44.8	15.8	13°24.1	31.5
14	298°21.5	36°05.5	13.6	83°56.9	44.1	75°46.8	15.9	28°26.2	31.5
15	313°23.9	51°04.5	·· 13.9	98°57.8	·· 44.7	90°48.8	·· 16.0	43°28.3	·· 31.5
16	328°26.4	66°03.6	14.2	113°58.8	45.2	105°50.8	16.2	58°30.5	31.5
17	343°28.9	81°02.6	14.5	128°59.8	45.7	120°52.8	16.3	73°32.6	31.6
18	358°31.3	96°01.7	S23°14.7	144°00.7	S12°46.2	135°54.8	S15°16.4	88°34.8	S22°31.6
19	13°33.8	111°00.7	15.0	159°01.7	46.8	150°56.8	16.6	103°36.9	31.6
20	28°36.2	125°59.8	15.2	174°02.6	47.3	165°58.8	16.7	118°39.1	31.6
21	43°38.7	140°58.8	·· 15.5	189°03.6	·· 47.8	181°00.8	·· 16.8	133°41.2	·· 31.6
22	58°41.2	155°57.9	15.8	204°04.5	48.3	196°02.8	17.0	148°43.4	31.6
23	73°43.6	170°56.9	16.0	219°05.5	48.9	211°04.8	17.1	163°45.5	31.6
Mer.pass.:18:06		v-0.9 d-0.3 m-3.8		v1.0 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	88°46.1	185°56.0	S23°16.3	234°06.4	S12°49.4	226°06.8	S15°17.2	178°47.6	S22°31.6
1	103°48.6	200°55.0	16.5	249°07.4	49.9	241°08.8	17.4	193°49.8	31.6
2	118°51.0	215°54.1	16.8	264°08.3	50.4	256°10.8	17.5	208°51.9	31.6
3	133°53.5	230°53.1	·· 17.0	279°09.3	·· 51.0	271°12.8	·· 17.6	223°54.1	·· 31.6
4	148°56.0	245°52.2	17.3	294°10.2	51.5	286°14.8	17.8	238°56.2	31.6
5	163°58.4	260°51.2	17.5	309°11.2	52.0	301°16.8	17.9	253°58.4	31.6
6	179°00.9	275°50.2	S23°17.8	324°12.1	S12°52.5	316°18.8	S15°18.0	269°00.5	S22°31.6
7	194°03.4	290°49.3	18.0	339°13.1	53.1	331°20.8	18.2	284°02.7	31.6
8	209°05.8	305°48.3	18.3	354°14.0	53.6	346°22.8	18.3	299°04.8	31.6
9	224°08.3	320°47.4	·· 18.5	9°15.0	·· 54.1	1°24.8	·· 18.4	314°06.9	·· 31.6
10	239°10.7	335°46.4	18.8	24°15.9	54.6	16°26.8	18.6	329°09.1	31.6
11	254°13.2	350°45.5	19.0	39°16.9	55.2	31°28.8	18.7	344°11.2	31.6
12	269°15.7	5°44.5	S23°19.3	54°17.8	S12°55.7	46°30.8	S15°18.8	359°13.4	S22°31.6
13	284°18.1	20°43.6	19.5	69°18.8	56.2	61°32.8	19.0	14°15.5	31.6
14	299°20.6	35°42.6	19.7	84°19.7	56.7	76°34.8	19.1	29°17.7	31.6
15	314°23.1	50°41.7	·· 20.0	99°20.7	·· 57.3	91°36.8	·· 19.2	44°19.8	·· 31.6
16	329°25.5	65°40.7	20.2	114°21.6	57.8	106°38.9	19.3	59°22.0	31.6
17	344°28.0	80°39.7	20.5	129°22.6	58.3	121°40.9	19.5	74°24.1	31.6
18	359°30.5	95°38.8	S23°20.7	144°23.5	S12°58.8	136°42.9	S15°19.6	89°26.2	S22°31.6
19	14°32.9	110°37.8	20.9	159°24.5	59.3	151°44.9	19.7	104°28.4	31.6
20	29°35.4	125°36.9	21.2	174°25.4	12°59.9	166°46.9	19.9	119°30.5	31.6
21	44°37.9	140°35.9	·· 21.4	189°26.4	13°00.4	181°48.9	·· 20.0	134°32.7	·· 31.6
22	59°40.3	155°35.0	21.6	204°27.3	00.9	196°50.9	20.1	149°34.8	31.6
23	74°42.8	170°34.0	21.8	219°28.3	01.4	211°52.9	20.3	164°37.0	31.6
Mer.pass.:18:02		v-1.0 d-0.3 m-3.8		v1.0 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.5
Ankaa	353°12.7	-42°12.8
Schedar	349°36.8	56°38.3
Diphda	348°52.8	-17°53.5
Achernar	335°24.3	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	316°01.7	89°20.5
Acamar	315°15.7	-40°14.3
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.5	16°32.5
Rigel	281°08.8	-8°11.1
Capella	280°29.5	46°00.8
Bellatrix	278°28.4	6°21.7
Elnath	278°08.4	28°37.1
Alnilam	275°42.9	-1°11.6
Betelgeuse	270°57.7	7°24.4
Canopus	263°54.2	-52°42.4
Sirius	258°30.7	-16°44.6
Adhara	255°09.8	-28°59.9
Procyon	244°56.3	5°10.6
Pollux	243°23.7	27°58.7
Avior	234°16.2	-59°33.9
Suhail	222°49.9	-43°30.2
Miaplacidus	221°38.3	-69°47.3
Alphard	217°52.9	-8°44.2
Regulus	207°40.2	11°52.7
Dubhe	193°48.0	61°39.0
Denebola	182°30.6	14°28.3
Gienah	175°49.2	-17°38.3
Acrux	173°05.9	-63°11.5
Gacrux	171°57.5	-57°12.4
Alioth	166°18.3	55°51.6
Spica	158°28.2	-11°15.1
Alkaid	152°56.8	49°13.3
Hadar	148°43.8	-60°27.1
Menkent	148°04.2	-36°27.1
Arcturus	145°53.2	19°05.4
Rigil Kent.	139°48.0	-60°54.1
Kochab	137°21.1	74°04.8
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.8	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.5	-69°03.3
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.0
Eltanin	90°45.3	51°29.4
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.2
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.7
Deneb	49°29.7	45°20.9
Enif	33°44.3	9°57.5
Al Na'ir	27°40.2	-46°52.6
Fomalhaut	15°20.8	-29°31.8
Scheat	13°50.5	28°10.9
Markab	13°35.4	15°18.2

Dec 18 Mon	SHA	Mer.pass
Venus	99°53.6	11:34
Mars	146°32.8	08:26
Jupiter	137°43.0	09:01
Saturn	90°16.9	12:10

Dec 19 Tue	SHA	Mer.pass
Venus	98°31.8	11:35
Mars	145°56.6	08:25
Jupiter	137°31.8	08:58
Saturn	90°09.2	12:07

Dec 20 Wed	SHA	Mer.pass
Venus	97°09.9	11:37
Mars	145°20.3	08:23
Jupiter	137°20.7	08:54
Saturn	90°01.5	12:03

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2309 sec ΔT = TT-UT1 = +68.9531 sec

2017 December 18 to Dec. 20 UT

h — Sun — Moon

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°53.3	S23°22.9	183°52.1	12.3'	S19°12.2	-3.0'	54.0'
1	195°52.9	23.0	198°23.3	12.2'	19°15.2	-3.0'	54.0'
2	210°52.6	23.0	212°54.6	12.2'	19°18.1	-2.9'	54.0'
3	225°52.3	·· 23.1	227°25.8	12.2'	19°20.9	-2.8'	54.0'
4	240°52.0	23.2	241°57.0	12.2'	19°23.7	-2.7'	54.0'
5	255°51.7	23.2	256°28.2	12.2'	19°26.3	-2.6'	54.0'
6	270°51.4	S23°23.3	270°59.4	12.2'	S19°28.9	-2.5'	53.9'
7	285°51.1	23.4	285°30.5	12.2'	19°31.4	-2.4'	53.9'
8	300°50.8	23.4	300°01.7	12.2'	19°33.7	-2.3'	53.9'
9	315°50.5	·· 23.5	314°32.8	12.1'	19°36.0	-2.2'	53.9'
10	330°50.2	23.6	329°04.0	12.1'	19°38.2	-2.2'	53.9'
11	345°49.9	23.6	343°35.1	12.1'	19°40.4	-2.1'	53.9'
12	0°49.6	S23°23.7	358°06.2	12.1'	S19°42.4	-2.0'	53.9'
13	15°49.2	23.8	12°37.3	12.1'	19°44.3	-1.9'	53.9'
14	30°48.9	23.8	27°08.4	12.1'	19°46.1	-1.8'	53.9'
15	45°48.6	·· 23.9	41°39.5	12.1'	19°47.9	-1.7'	53.9'
16	60°48.3	23.9	56°10.6	12.1'	19°49.6	-1.6'	53.9'
17	75°48.0	24.0	70°41.6	12.1'	19°51.1	-1.5'	53.9'
18	90°47.7	S23°24.1	85°12.7	12.1'	S19°52.6	-1.4'	53.9'
19	105°47.4	24.1	99°43.7	12.0'	19°54.0	-1.3'	53.9'
20	120°47.1	24.2	114°14.8	12.0'	19°55.3	-1.2'	53.9'
21	135°46.8	·· 24.2	128°45.8	12.0'	19°56.5	-1.2'	53.9'
22	150°46.5	24.3	143°16.8	12.0'	19°57.6	-1.1'	53.9'
23	165°46.2	24.3	157°47.8	12.0'	19°58.6	-1.0'	53.9'
	SD.=16.2	d=-0.1	S.D.=14.7				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°45.8	S23°24.4	172°18.9	12.0'	S19°59.5	-0.9'	53.9'
1	195°45.5	24.4	186°49.9	12.0'	20°00.4	-0.8'	53.9'
2	210°45.2	24.5	201°20.9	12.0'	20°01.1	-0.7'	53.9'
3	225°44.9	·· 24.5	215°51.9	12.0'	20°01.8	-0.6'	53.9'
4	240°44.6	24.6	230°22.9	12.0'	20°02.3	-0.5'	53.9'
5	255°44.3	24.6	244°53.9	12.0'	20°02.8	-0.4'	53.9'
6	270°44.0	S23°24.7	259°24.9	12.0'	S20°03.2	-0.3'	53.9'
7	285°43.7	24.7	273°55.9	12.0'	20°03.4	-0.2'	53.9'
8	300°43.4	24.8	288°26.9	12.0'	20°03.6	-0.1'	53.9'
9	315°43.1	·· 24.8	302°57.9	12.0'	20°03.7	-0.0'	53.9'
10	330°42.8	24.9	317°28.8	12.0'	20°03.7	0.0'	53.9'
11	345°42.4	24.9	331°59.8	12.0'	20°03.6	0.1'	53.9'
12	0°42.1	S23°25.0	346°30.8	12.0'	S20°03.4	0.2'	53.9'
13	15°41.8	25.0	1°01.8	12.0'	20°03.2	0.3'	53.9'
14	30°41.5	25.0	15°32.8	12.0'	20°02.8	0.4'	53.9'
15	45°41.2	·· 25.1	30°03.8	12.0'	20°02.3	0.5'	53.9'
16	60°40.9	25.1	44°34.8	12.0'	20°01.8	0.6'	53.9'
17	75°40.6	25.2	59°05.8	12.0'	20°01.1	0.7'	53.9'
18	90°40.3	S23°25.2	73°36.8	12.0'	S20°00.4	0.8'	53.9'
19	105°40.0	25.2	88°07.8	12.0'	19°59.6	0.9'	53.9'
20	120°39.7	25.3	102°38.8	12.0'	19°58.7	1.0'	53.9'
21	135°39.3	·· 25.3	117°09.9	12.0'	19°57.6	1.1'	53.9'
22	150°39.0	25.3	131°40.9	12.0'	19°56.5	1.2'	54.0'
23	165°38.7	25.4	146°11.9	12.0'	19°55.3	1.2'	54.0'
	SD.=16.2	d=-0.1	S.D.=14.7				

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°38.4	S23°25.4	160°42.9	12.0'	S19°54.1	1.3'	54.0'
1	195°38.1	25.4	175°14.0	12.0'	19°52.7	1.4'	54.0'
2	210°37.8	25.5	189°45.0	12.1'	19°51.2	1.5'	54.0'
3	225°37.5	·· 25.5	204°16.1	12.1'	19°49.6	1.6'	54.0'
4	240°37.2	25.5	218°47.1	12.1'	19°48.0	1.7'	54.0'
5	255°36.9	25.6	233°18.2	12.1'	19°46.2	1.8'	54.0'
6	270°36.5	S23°25.6	247°49.3	12.1'	S19°44.4	1.9'	54.0'
7	285°36.2	25.6	262°20.4	12.1'	19°42.5	2.0'	54.0'
8	300°35.9	25.7	276°51.5	12.1'	19°40.4	2.1'	54.0'
9	315°35.6	·· 25.7	291°22.6	12.1'	19°38.3	2.2'	54.0'
10	330°35.3	25.7	305°53.7	12.1'	19°36.1	2.2'	54.0'
11	345°35.0	25.7	320°24.8	12.1'	19°33.8	2.3'	54.0'
12	0°34.7	S23°25.8	334°56.0	12.1'	S19°31.5	2.4'	54.0'
13	15°34.4	25.8	349°27.1	12.2'	19°29.0	2.5'	54.0'
14	30°34.1	25.8	3°58.3	12.2'	19°26.4	2.6'	54.0'
15	45°33.7	·· 25.8	18°29.5	12.2'	19°23.8	2.7'	54.0'
16	60°33.4	25.8	33°00.6	12.2'	19°21.0	2.8'	54.0'
17	75°33.1	25.9	47°31.8	12.2'	19°18.2	2.9'	54.0'
18	90°32.8	S23°25.9	62°03.1	12.2'	S19°15.3	3.0'	54.0'
19	105°32.5	25.9	76°34.3	12.2'	19°12.3	3.0'	54.1'
20	120°32.2	25.9	91°05.5	12.2'	19°09.2	3.1'	54.1'
21	135°31.9	·· 25.9	105°36.8	12.3'	19°06.0	3.2'	54.1'
22	150°31.6	25.9	120°08.0	12.3'	19°02.8	3.3'	54.1'
23	165°31.3	26.0	134°39.3	12.3'	18°59.4	3.4'	54.1'
	SD.=16.2	d=-0.0	S.D.=14.7				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:24	10:56	▬	▬	12:59	15:30
N 70°	08:04	09:53	▬	▬	14:01	15:50
68°	07:48	09:18	▬	▬	14:37	16:06
66°	07:35	08:52	10:33	13:21	15:02	16:19
64°	07:24	08:33	09:51	14:04	15:22	16:30
62°	07:15	08:17	09:22	14:32	15:38	16:40
60°	07:06	08:03	09:01	14:54	15:51	16:48
N 58°	06:59	07:51	08:43	15:11	16:03	16:56
56°	06:52	07:41	08:29	15:26	16:13	17:02
54°	06:46	07:32	08:16	15:39	16:22	17:09
52°	06:40	07:24	08:05	15:50	16:31	17:14
50°	06:35	07:16	07:55	16:00	16:38	17:20
45°	06:23	07:00	07:34	16:20	16:54	17:31
N 40°	06:13	06:47	07:17	16:37	17:08	17:42
35°	06:03	06:35	07:03	16:51	17:19	17:51
30°	05:54	06:24	06:51	17:04	17:30	18:00
20°	05:38	06:05	06:29	17:25	17:49	18:16
N 10°	05:22	05:48	06:11	17:43	18:06	18:33
0°	05:05	05:31	05:53	18:01	18:23	18:50
S 10°	04:46	05:13	05:36	18:19	18:42	19:09
20°	04:23	04:52	05:17	18:38	19:02	19:31
30°	03:54	04:27	04:55	19:00	19:27	20:00
35°	03:35	04:12	04:42	19:13	19:42	20:19
40°	03:12	03:54	04:27	19:28	20:01	20:42
45°	02:42	03:31	04:09	19:46	20:23	21:13
S 50°	01:56	03:02	03:46	20:08	20:53	21:59
52°	01:28	02:46	03:35	20:19	21:08	22:27
54°	00:41	02:28	03:23	20:32	21:26	23:13
56°	▭	02:06	03:09	20:46	21:48	▭
58°	▭	01:36	02:52	21:03	22:18	▭
S 60°	▭	00:46	02:31	21:23	23:09	▭

Lat.	Moonrise Mon	Moonrise Tue	Moonrise Wed	Moonset Mon	Moonset Tue	Moonset Wed
N 72°	▬	▬	▬	▬	▬	▬
N 70°	11:31	▬	12:53	12:42	▬	14:39
68°	10:15	11:13	11:48	13:58	14:39	15:44
66°	09:37	10:33	11:12	14:35	15:19	16:19
64°	09:11	10:05	10:46	15:02	15:46	16:44
62°	08:51	09:44	10:26	15:22	16:08	17:04
60°	08:34	09:27	10:10	15:39	16:25	17:20
N 58°	08:20	09:12	09:56	15:53	16:39	17:34
56°	08:08	09:00	09:44	16:05	16:52	17:46
54°	07:58	08:49	09:34	16:16	17:03	17:56
52°	07:48	08:40	09:25	16:25	17:12	18:05
50°	07:40	08:31	09:16	16:34	17:21	18:13
45°	07:22	08:13	08:59	16:52	17:39	18:31
N 40°	07:08	07:58	08:44	17:06	17:54	18:45
35°	06:56	07:45	08:32	17:19	18:06	18:57
30°	06:45	07:35	08:21	17:30	18:17	19:07
20°	06:27	07:16	08:03	17:48	18:36	19:25
N 10°	06:11	06:59	07:47	18:04	18:52	19:41
0°	05:56	06:44	07:32	18:19	19:07	19:55
S 10°	05:42	06:29	07:17	18:35	19:23	20:10
20°	05:26	06:13	07:01	18:51	19:39	20:25
30°	05:08	05:54	06:43	19:09	19:57	20:43
35°	04:57	05:43	06:32	19:20	20:08	20:53
40°	04:45	05:31	06:20	19:32	20:21	21:05
45°	04:31	05:16	06:05	19:47	20:35	21:19
S 50°	04:14	04:58	05:48	20:05	20:53	21:35
52°	04:06	04:49	05:39	20:13	21:02	21:43
54°	03:57	04:40	05:30	20:23	21:11	21:52
56°	03:47	04:29	05:19	20:33	21:22	22:02
58°	03:35	04:17	05:07	20:46	21:34	22:13
S 60°	03:22	04:03	04:53	21:00	21:48	22:26

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 0-2 0-4%
18	03:33	03:18	11:57	12:08	–:–	
19	03:03	02:49	11:57	12:56	00:32	
20	02:34	02:19	11:58	13:44	01:20	

December 21, 22, 23 UT (Thu., Fri., Sat.)

	Aries	Venus		Mars		Jupiter		Saturn	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	89°45.2	185°33.1	S23°22.1	234°29.2	S13°01.9	226°54.9	S15°20.4	179°39.1	S22°31.6
1	104°47.7	200°32.1	22.3	249°30.2	02.5	241°56.9	20.5	194°41.3	31.6
2	119°50.2	215°31.1	22.5	264°31.1	03.0	256°58.9	20.7	209°43.4	31.6
3	134°52.6	230°30.2	·· 22.7	279°32.1	·· 03.5	272°00.9	·· 20.8	224°45.5	·· 31.6
4	149°55.1	245°29.2	23.0	294°33.0	04.0	287°02.9	20.9	239°47.7	31.6
5	164°57.6	260°28.3	23.2	309°34.0	04.6	302°04.9	21.1	254°49.8	31.6
6	180°00.0	275°27.3	S23°23.4	324°34.9	S13°05.1	317°06.9	S15°21.2	269°52.0	S22°31.6
7	195°02.5	290°26.4	23.6	339°35.8	05.6	332°08.9	21.3	284°54.1	31.7
8	210°05.0	305°25.4	23.8	354°36.8	06.1	347°10.9	21.5	299°56.3	31.7
9	225°07.4	320°24.4	·· 24.1	9°37.7	·· 06.6	2°12.9	·· 21.6	314°58.4	·· 31.7
10	240°09.9	335°23.5	24.3	24°38.7	07.2	17°14.9	21.7	330°00.6	31.7
11	255°12.4	350°22.5	24.5	39°39.6	07.7	32°17.0	21.9	345°02.7	31.7
12	270°14.8	5°21.6	S23°24.7	54°40.6	S13°08.2	47°19.0	S15°22.0	0°04.8	S22°31.7
13	285°17.3	20°20.6	24.9	69°41.5	08.7	62°21.0	22.1	15°07.0	31.7
14	300°19.7	35°19.6	25.1	84°42.5	09.2	77°23.0	22.2	30°09.1	31.7
15	315°22.2	50°18.7	·· 25.3	99°43.4	·· 09.7	92°25.0	·· 22.4	45°11.3	·· 31.7
16	330°24.7	65°17.7	25.5	114°44.4	10.3	107°27.0	22.5	60°13.4	31.7
17	345°27.1	80°16.8	25.7	129°45.3	10.8	122°29.0	22.6	75°15.6	31.7
18	0°29.6	95°15.8	S23°26.0	144°46.3	S13°11.3	137°31.0	S15°22.8	90°17.7	S22°31.7
19	15°32.1	110°14.8	26.2	159°47.2	11.8	152°33.0	22.9	105°19.9	31.7
20	30°34.5	125°13.9	26.4	174°48.2	12.3	167°35.0	23.0	120°22.0	31.7
21	45°37.0	140°12.9	·· 26.6	189°49.1	·· 12.9	182°37.0	·· 23.2	135°24.1	·· 31.7
22	60°39.5	155°12.0	26.8	204°50.1	13.4	197°39.0	23.3	150°26.3	31.7
23	75°41.9	170°11.0	27.0	219°51.0	13.9	212°41.0	23.4	165°28.4	31.7
Mer.pass.:17:58		v-1.0 d-0.2 m-3.8		v0.9 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	90°44.4	185°10.0	S23°27.2	234°52.0	S13°14.4	227°43.0	S15°23.6	180°30.6	S22°31.7
1	105°46.9	200°09.1	27.4	249°52.9	14.9	242°45.1	23.7	195°32.7	31.7
2	120°49.3	215°08.1	27.5	264°53.9	15.4	257°47.1	23.8	210°34.9	31.7
3	135°51.8	230°07.2	·· 27.7	279°54.8	·· 16.0	272°49.1	·· 23.9	225°37.0	·· 31.7
4	150°54.2	245°06.2	27.9	294°55.7	16.5	287°51.1	24.1	240°39.2	31.7
5	165°56.7	260°05.2	28.1	309°56.7	17.0	302°53.1	24.2	255°41.3	31.7
6	180°59.2	275°04.3	S23°28.3	324°57.6	S13°17.5	317°55.1	S15°24.3	270°43.5	S22°31.7
7	196°01.6	290°03.3	28.5	339°58.6	18.0	332°57.1	24.5	285°45.6	31.7
8	211°04.1	305°02.3	28.7	354°59.5	18.5	347°59.1	24.6	300°47.7	31.7
9	226°06.6	320°01.4	·· 28.9	10°00.5	·· 19.1	3°01.1	·· 24.7	315°49.9	·· 31.7
10	241°09.0	335°00.4	29.1	25°01.4	19.6	18°03.1	24.9	330°52.0	31.7
11	256°11.5	349°59.5	29.2	40°02.4	20.1	33°05.1	25.0	345°54.2	31.7
12	271°14.0	4°58.5	S23°29.4	55°03.3	S13°20.6	48°07.2	S15°25.1	0°56.3	S22°31.7
13	286°16.4	19°57.5	29.6	70°04.3	21.1	63°09.2	25.2	15°58.5	31.7
14	301°18.9	34°56.6	29.8	85°05.2	21.6	78°11.2	25.4	31°00.6	31.7
15	316°21.3	49°55.6	·· 30.0	100°06.2	·· 22.1	93°13.2	·· 25.5	46°02.8	·· 31.7
16	331°23.8	64°54.6	30.1	115°07.1	22.7	108°15.2	25.6	61°04.9	31.7
17	346°26.3	79°53.7	30.3	130°08.0	23.2	123°17.2	25.8	76°07.0	31.7
18	1°28.7	94°52.7	S23°30.5	145°09.0	S13°23.7	138°19.2	S15°25.9	91°09.2	S22°31.7
19	16°31.2	109°51.7	30.7	160°09.9	24.2	153°21.2	26.0	106°11.3	31.7
20	31°33.7	124°50.8	30.8	175°10.9	24.7	168°23.2	26.1	121°13.5	31.7
21	46°36.1	139°49.8	·· 31.0	190°11.8	·· 25.2	183°25.2	·· 26.3	136°15.6	·· 31.7
22	61°38.6	154°48.9	31.2	205°12.8	25.7	198°27.3	26.4	151°17.8	31.7
23	76°41.1	169°47.9	31.3	220°13.7	26.3	213°29.3	26.5	166°19.9	31.7
Mer.pass.:17:54		v-1.0 d-0.2 m-3.8		v0.9 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	91°43.5	184°46.9	S23°31.5	235°14.7	S13°26.8	228°31.3	S15°26.7	181°22.1	S22°31.7
1	106°46.0	199°46.0	31.7	250°15.6	27.3	243°33.3	26.8	196°24.2	31.7
2	121°48.5	214°45.0	31.8	265°16.5	27.8	258°35.3	26.9	211°26.3	31.7
3	136°50.9	229°44.0	·· 32.0	280°17.5	·· 28.3	273°37.3	·· 27.1	226°28.5	·· 31.8
4	151°53.4	244°43.1	32.2	295°18.4	28.8	288°39.3	27.2	241°30.6	31.8
5	166°55.8	259°42.1	32.3	310°19.4	29.3	303°41.3	27.3	256°32.8	31.8
6	181°58.3	274°41.1	S23°32.5	325°20.3	S13°29.9	318°43.3	S15°27.4	271°34.9	S22°31.8
7	197°00.8	289°40.2	32.7	340°21.3	30.4	333°45.4	27.6	286°37.1	31.8
8	212°03.2	304°39.2	32.8	355°22.2	30.9	348°47.4	27.7	301°39.2	31.8
9	227°05.7	319°38.2	·· 33.0	10°23.2	·· 31.4	3°49.4	·· 27.8	316°41.4	·· 31.8
10	242°08.2	334°37.3	33.1	25°24.1	31.9	18°51.4	28.0	331°43.5	31.8
11	257°10.6	349°36.3	33.3	40°25.0	32.4	33°53.4	28.1	346°45.6	31.8
12	272°13.1	4°35.3	S23°33.4	55°26.0	S13°32.9	48°55.4	S15°28.2	1°47.8	S22°31.8
13	287°15.6	19°34.4	33.6	70°26.9	33.4	63°57.4	28.3	16°49.9	31.8
14	302°18.0	34°33.4	33.7	85°27.9	33.9	78°59.5	28.5	31°52.1	31.8
15	317°20.5	49°32.4	·· 33.9	100°28.8	·· 34.5	94°01.5	·· 28.6	46°54.2	·· 31.8
16	332°23.0	64°31.5	34.0	115°29.8	35.0	109°03.5	28.7	61°56.4	31.8
17	347°25.4	79°30.5	34.2	130°30.7	35.5	124°05.5	28.8	76°58.5	31.8
18	2°27.9	94°29.5	S23°34.3	145°31.7	S13°36.0	139°07.5	S15°29.0	92°00.7	S22°31.8
19	17°30.3	109°28.6	34.5	160°32.6	36.5	154°09.5	29.1	107°02.8	31.8
20	32°32.8	124°27.6	34.6	175°33.5	37.0	169°11.5	29.2	122°04.9	31.8
21	47°35.3	139°26.6	·· 34.7	190°34.5	·· 37.5	184°13.5	·· 29.4	137°07.1	·· 31.8
22	62°37.7	154°25.7	34.9	205°35.4	38.0	199°15.6	29.5	152°09.2	31.8
23	77°40.2	169°24.7	35.0	220°36.4	38.5	214°17.6	29.6	167°11.4	31.8
Mer.pass.:17:50		v-1.0 d-0.2 m-3.8		v0.9 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.5
Ankaa	353°12.7	-42°12.8
Schedar	349°36.8	56°38.3
Diphda	348°52.8	-17°53.5
Achernar	335°24.3	-57°09.1
Hamal	327°57.1	23°32.8
Polaris	316°02.6	89°20.5
Acamar	315°15.8	-40°14.3
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.4
Aldebaran	290°45.5	16°32.5
Rigel	281°08.8	-8°11.1
Capella	280°29.4	46°00.8
Bellatrix	278°28.4	6°21.7
Elnath	278°08.4	28°37.2
Alnilam	275°42.9	-1°11.6
Betelgeuse	270°57.7	7°24.4
Canopus	263°54.2	-52°42.5
Sirius	258°30.7	-16°44.6
Adhara	255°09.7	-28°59.9
Procyon	244°56.2	5°10.6
Pollux	243°23.7	27°58.7
Avior	234°16.2	-59°33.9
Suhail	222°49.8	-43°30.2
Miaplacidus	221°38.3	-69°47.3
Alphard	217°52.9	-8°44.2
Regulus	207°40.1	11°52.7
Dubhe	193°47.9	61°39.0
Denebola	182°30.6	14°28.3
Gienah	175°49.2	-17°38.3
Acrux	173°05.9	-63°11.5
Gacrux	171°57.5	-57°12.4
Alioth	166°18.2	55°51.6
Spica	158°28.2	-11°15.1
Alkaid	152°56.8	49°13.3
Hadar	148°43.8	-60°27.1
Menkent	148°04.2	-36°27.1
Arcturus	145°53.2	19°05.4
Rigil Kent.	139°47.9	-60°54.1
Kochab	137°21.1	74°04.8
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.8	26°39.4
Antares	112°22.9	-26°28.0
Atria	107°22.5	-69°03.2
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.0
Eltanin	90°45.3	51°29.4
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.2
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.7
Deneb	49°29.7	45°20.9
Enif	33°44.3	9°57.5
Al Na'ir	27°40.2	-46°52.6
Fomalhaut	15°20.8	-29°31.8
Scheat	13°50.5	28°10.9
Markab	13°35.4	15°18.2

Dec 21 Thu	SHA	Mer.pass
Venus	95°47.8	11:39
Mars	144°44.0	08:22
Jupiter	137°09.6	08:51
Saturn	89°53.9	12:00

Dec 22 Fri	SHA	Mer.pass
Venus	94°25.7	11:40
Mars	144°07.6	08:20
Jupiter	136°58.7	08:48
Saturn	89°46.2	11:56

Dec 23 Sat	SHA	Mer.pass
Venus	93°03.4	11:42
Mars	143°31.1	08:18
Jupiter	136°47.8	08:45
Saturn	89°38.5	11:53

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2278 sec ΔT = TT-UT1 = +68.9562 sec

2017 December 21 to Dec. 23 UT

h	Sun		Moon				
Thu	**GHA**	**Dec**	**GHA**	**ν**	**Dec**	**d**	**HP**
0	180°30.9	S23°26.0	149°10.6	12.3'	S18°55.9	3.5'	54.1'
1	195°30.6	26.0	163°41.9	12.3'	18°52.4	3.6'	54.1'
2	210°30.3	26.0	178°13.3	12.3'	18°48.8	3.7'	54.1'
3	225°30.0	·· 26.0	192°44.6	12.4'	18°45.1	3.7'	54.1'
4	240°29.7	26.0	207°16.0	12.4'	18°41.3	3.8'	54.1'
5	255°29.4	26.0	221°47.4	12.4'	18°37.4	3.9'	54.1'
6	270°29.1	S23°26.0	236°18.7	12.4'	S18°33.5	4.0'	54.1'
7	285°28.8	26.0	250°50.2	12.4'	18°29.4	4.1'	54.1'
8	300°28.5	26.1	265°21.6	12.4'	18°25.3	4.2'	54.2'
9	315°28.1	·· 26.1	279°53.0	12.5'	18°21.1	4.3'	54.2'
10	330°27.8	26.1	294°24.5	12.5'	18°16.8	4.3'	54.2'
11	345°27.5	26.1	308°56.0	12.5'	18°12.4	4.4'	54.2'
12	0°27.2	S23°26.1	323°27.5	12.5'	S18°07.9	4.5'	54.2'
13	15°26.9	26.1	337°59.0	12.5'	18°03.4	4.6'	54.2'
14	30°26.6	26.1	352°30.5	12.5'	17°58.7	4.7'	54.2'
15	45°26.3	·· 26.1	7°02.1	12.6'	17°54.0	4.8'	54.2'
16	60°26.0	26.1	21°33.7	12.6'	17°49.2	4.8'	54.2'
17	75°25.7	26.1	36°05.2	12.6'	17°44.3	4.9'	54.2'
18	90°25.3	S23°26.1	50°36.9	12.6'	S17°39.3	5.0'	54.3'
19	105°25.0	26.1	65°08.5	12.6'	17°34.3	5.1'	54.3'
20	120°24.7	26.1	79°40.1	12.7'	17°29.2	5.2'	54.3'
21	135°24.4	·· 26.1	94°11.8	12.7'	17°24.0	5.2'	54.3'
22	150°24.1	26.1	108°43.5	12.7'	17°18.7	5.3'	54.3'
23	165°23.8	26.1	123°15.2	12.7'	17°13.3	5.4'	54.3'
	SD.=16.2	d=-0.0	S.D.=14.8				

Fri	**GHA**	**Dec**	**GHA**	**ν**	**Dec**	**d**	**HP**
0	180°23.5	S23°26.1	137°46.9	12.7'	S17°07.9	5.5'	54.3'
1	195°23.2	26.1	152°18.6	12.8'	17°02.3	5.6'	54.3'
2	210°22.9	26.1	166°50.4	12.8'	16°56.7	5.6'	54.4'
3	225°22.5	·· 26.0	181°22.2	12.8'	16°51.0	5.7'	54.4'
4	240°22.2	26.0	195°54.0	12.8'	16°45.3	5.8'	54.4'
5	255°21.9	26.0	210°25.8	12.8'	16°39.4	5.9'	54.4'
6	270°21.6	S23°26.0	224°57.6	12.8'	S16°33.5	6.0'	54.4'
7	285°21.3	26.0	239°29.5	12.9'	16°27.5	6.0'	54.4'
8	300°21.0	26.0	254°01.4	12.9'	16°21.5	6.1'	54.4'
9	315°20.7	·· 26.0	268°33.3	12.9'	16°15.3	6.2'	54.4'
10	330°20.4	26.0	283°05.2	12.9'	16°09.1	6.3'	54.5'
11	345°20.0	25.9	297°37.1	12.9'	16°02.8	6.3'	54.5'
12	0°19.7	S23°25.9	312°09.1	13.0'	S15°56.4	6.4'	54.5'
13	15°19.4	25.9	326°41.0	13.0'	15°50.0	6.5'	54.5'
14	30°19.1	25.9	341°13.0	13.0'	15°43.5	6.6'	54.5'
15	45°18.8	·· 25.9	355°45.0	13.0'	15°36.9	6.6'	54.5'
16	60°18.5	25.9	10°17.0	13.0'	15°30.2	6.7'	54.5'
17	75°18.2	25.8	24°49.1	13.1'	15°23.5	6.8'	54.6'
18	90°17.9	S23°25.8	39°21.1	13.1'	S15°16.7	6.8'	54.6'
19	105°17.6	25.8	53°53.2	13.1'	15°09.8	6.9'	54.6'
20	120°17.2	25.8	68°25.3	13.1'	15°02.9	7.0'	54.6'
21	135°16.9	·· 25.8	82°57.4	13.1'	14°55.8	7.1'	54.6'
22	150°16.6	25.7	97°29.6	13.1'	14°48.7	7.1'	54.6'
23	165°16.3	25.7	112°01.7	13.2'	14°41.6	7.2'	54.7'
	SD.=16.2	d=0.0	S.D.=14.9				

Sat	**GHA**	**Dec**	**GHA**	**ν**	**Dec**	**d**	**HP**
0	180°16.0	S23°25.7	126°33.9	13.2'	S14°34.4	7.3'	54.7'
1	195°15.7	25.7	141°06.1	13.2'	14°27.1	7.3'	54.7'
2	210°15.4	25.6	155°38.3	13.2'	14°19.7	7.4'	54.7'
3	225°15.1	·· 25.6	170°10.5	13.2'	14°12.3	7.5'	54.7'
4	240°14.8	25.6	184°42.7	13.2'	14°04.8	7.5'	54.8'
5	255°14.4	25.5	199°15.0	13.3'	13°57.2	7.6'	54.8'
6	270°14.1	S23°25.5	213°47.2	13.3'	S13°49.6	7.7'	54.8'
7	285°13.8	25.5	228°19.5	13.3'	13°41.8	7.7'	54.8'
8	300°13.5	25.5	242°51.8	13.3'	13°34.1	7.8'	54.8'
9	315°13.2	·· 25.4	257°24.1	13.3'	13°26.3	7.9'	54.8'
10	330°12.9	25.4	271°56.4	13.3'	13°18.4	7.9'	54.9'
11	345°12.6	25.4	286°28.7	13.3'	13°10.4	8.0'	54.9'
12	0°12.3	S23°25.3	301°01.1	13.4'	S13°02.4	8.1'	54.9'
13	15°12.0	25.3	315°33.4	13.4'	12°54.3	8.1'	54.9'
14	30°11.6	25.2	330°05.8	13.4'	12°46.1	8.2'	54.9'
15	45°11.3	·· 25.2	344°38.2	13.4'	12°37.9	8.2'	55.0'
16	60°11.0	25.2	359°10.6	13.4'	12°29.7	8.3'	55.0'
17	75°10.7	25.1	13°43.0	13.4'	12°21.3	8.4'	55.0'
18	90°10.4	S23°25.1	28°15.4	13.4'	S12°12.9	8.4'	55.0'
19	105°10.1	25.0	42°47.9	13.4'	12°04.5	8.5'	55.1'
20	120°09.8	25.0	57°20.3	13.4'	11°56.0	8.5'	55.1'
21	135°09.5	·· 25.0	71°52.7	13.5'	11°47.4	8.6'	55.1'
22	150°09.2	24.9	86°25.2	13.5'	11°38.8	8.7'	55.1'
23	165°08.8	24.9	100°57.7	13.5'	11°30.1	8.7'	55.1'
	SD.=16.2	d=0.0	S.D.=15.0				

Lat.	**Twilight** Naut.	Civil	**Sunrise**	**Sunset**	**Twilight** Civil	Naut.
N 72°	08:26	10:58	▬	▬	12:59	15:31
N 70°	08:06	09:55	▬	▬	14:02	15:51
68°	07:50	09:20	▬	▬	14:38	16:07
66°	07:37	08:54	10:35	13:22	15:03	16:20
64°	07:26	08:34	09:53	14:05	15:23	16:31
62°	07:16	08:18	09:24	14:33	15:39	16:41
60°	07:08	08:05	09:02	14:55	15:53	16:50
N 58°	07:00	07:53	08:45	15:12	16:04	16:57
56°	06:54	07:43	08:30	15:27	16:15	17:04
54°	06:47	07:34	08:17	15:40	16:24	17:10
52°	06:42	07:25	08:06	15:51	16:32	17:16
50°	06:36	07:18	07:56	16:01	16:39	17:21
45°	06:25	07:02	07:36	16:22	16:56	17:33
N 40°	06:14	06:48	07:19	16:39	17:09	17:43
35°	06:05	06:36	07:05	16:53	17:21	17:53
30°	05:56	06:26	06:52	17:05	17:32	18:01
20°	05:39	06:07	06:31	17:26	17:50	18:18
N 10°	05:23	05:50	06:12	17:45	18:08	18:34
0°	05:06	05:32	05:55	18:02	18:25	18:51
S 10°	04:47	05:14	05:37	18:20	18:43	19:10
20°	04:25	04:54	05:18	18:39	19:04	19:33
30°	03:55	04:29	04:56	19:01	19:29	20:02
35°	03:37	04:13	04:43	19:14	19:44	20:21
40°	03:13	03:55	04:28	19:29	20:02	20:44
45°	02:43	03:33	04:10	19:47	20:25	21:15
S 50°	01:57	03:03	03:47	20:10	20:55	22:00
52°	01:29	02:48	03:37	20:21	21:10	22:28
54°	00:42	02:30	03:24	20:33	21:28	23:15
56°	▭	02:07	03:10	20:47	21:50	▭
58°	▭	01:37	02:53	21:04	22:20	▭
S 60°	▭	00:46	02:33	21:25	23:11	▭

Lat.	**Moonrise** Thu	Fri	Sat	**Moonset** Thu	Fri	Sat
N 72°	▬	13:19	12:59	▬	17:29	19:24
N 70°	12:45	12:40	12:35	16:25	18:07	19:46
68°	12:04	12:13	12:17	17:05	18:33	20:03
66°	11:37	11:52	12:02	17:32	18:53	20:17
64°	11:15	11:36	11:50	17:53	19:09	20:28
62°	10:58	11:22	11:40	18:10	19:22	20:38
60°	10:44	11:10	11:31	18:24	19:33	20:46
N 58°	10:32	11:00	11:23	18:36	19:43	20:53
56°	10:21	10:51	11:16	18:46	19:51	21:00
54°	10:12	10:43	11:10	18:55	19:59	21:05
52°	10:03	10:36	11:05	19:03	20:05	21:10
50°	09:56	10:30	11:00	19:11	20:11	21:15
45°	09:40	10:16	10:49	19:26	20:24	21:25
N 40°	09:26	10:05	10:39	19:39	20:35	21:33
35°	09:15	09:55	10:32	19:49	20:44	21:40
30°	09:05	09:46	10:25	19:59	20:52	21:46
20°	08:48	09:31	10:13	20:15	21:06	21:57
N 10°	08:33	09:19	10:02	20:29	21:18	22:06
0°	08:20	09:06	09:52	20:42	21:29	22:14
S 10°	08:06	08:54	09:43	20:55	21:40	22:23
20°	07:51	08:41	09:32	21:09	21:51	22:32
30°	07:34	08:26	09:20	21:25	22:05	22:42
35°	07:24	08:18	09:13	21:34	22:13	22:48
40°	07:12	08:08	09:05	21:45	22:21	22:55
45°	06:59	07:56	08:55	21:57	22:31	23:03
S 50°	06:43	07:42	08:44	22:12	22:44	23:12
52°	06:35	07:35	08:39	22:19	22:49	23:16
54°	06:26	07:28	08:33	22:27	22:56	23:21
56°	06:17	07:20	08:27	22:35	23:03	23:26
58°	06:06	07:10	08:19	22:45	23:10	23:32
S 60°	05:53	07:00	08:11	22:56	23:19	23:38

Day	**Sun** Eqn.of Time 00^h mm:ss	12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 3-5 9-23%
21	02:04	01:49	11:58	14:31	02:07	
22	01:34	01:19	11:59	15:18	02:54	
23	01:04	00:49	11:59	16:03	03:41	

December 24, 25, 26 UT (Sun., Mon., Tue.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	92°42.7	184°23.7	S23°35.2	235°37.3	S13°39.0	229°19.6	S15°29.7	182°13.5	S22°31.8
1	107°45.1	199°22.8	35.3	250°38.3	39.6	244°21.6	29.9	197°15.7	31.8
2	122°47.6	214°21.8	35.4	265°39.2	40.1	259°23.6	30.0	212°17.8	31.8
3	137°50.1	229°20.8	·· 35.6	280°40.1	·· 40.6	274°25.6	·· 30.1	227°20.0	·· 31.8
4	152°52.5	244°19.9	35.7	295°41.1	41.1	289°27.6	30.3	242°22.1	31.8
5	167°55.0	259°18.9	35.8	310°42.0	41.6	304°29.7	30.4	257°24.2	31.8
6	182°57.4	274°17.9	S23°35.9	325°43.0	S13°42.1	319°31.7	S15°30.5	272°26.4	S22°31.8
7	197°59.9	289°16.9	36.1	340°43.9	42.6	334°33.7	30.6	287°28.5	31.8
8	213°02.4	304°16.0	36.2	355°44.8	43.1	349°35.7	30.8	302°30.7	31.8
9	228°04.8	319°15.0	·· 36.3	10°45.8	·· 43.6	4°37.7	·· 30.9	317°32.8	·· 31.8
10	243°07.3	334°14.0	36.5	25°46.7	44.1	19°39.7	31.0	332°35.0	31.8
11	258°09.8	349°13.1	36.6	40°47.7	44.6	34°41.8	31.1	347°37.1	31.8
12	273°12.2	4°12.1	S23°36.7	55°48.6	S13°45.1	49°43.8	S15°31.3	2°39.3	S22°31.8
13	288°14.7	19°11.1	36.8	70°49.6	45.7	64°45.8	31.4	17°41.4	31.8
14	303°17.2	34°10.2	36.9	85°50.5	46.2	79°47.8	31.5	32°43.5	31.8
15	318°19.6	49°09.2	·· 37.1	100°51.4	·· 46.7	94°49.8	·· 31.6	47°45.7	·· 31.8
16	333°22.1	64°08.2	37.2	115°52.4	47.2	109°51.8	31.8	62°47.8	31.8
17	348°24.6	79°07.3	37.3	130°53.3	47.7	124°53.9	31.9	77°50.0	31.8
18	3°27.0	94°06.3	S23°37.4	145°54.3	S13°48.2	139°55.9	S15°32.0	92°52.1	S22°31.8
19	18°29.5	109°05.3	37.5	160°55.2	48.7	154°57.9	32.2	107°54.3	31.8
20	33°31.9	124°04.3	37.6	175°56.1	49.2	169°59.9	32.3	122°56.4	31.8
21	48°34.4	139°03.4	·· 37.7	190°57.1	·· 49.7	185°01.9	·· 32.4	137°58.6	·· 31.8
22	63°36.9	154°02.4	37.8	205°58.0	50.2	200°03.9	32.5	153°00.7	31.8
23	78°39.3	169°01.4	38.0	220°59.0	50.7	215°06.0	32.7	168°02.8	31.8
Mer.pass.:17:46		v-1.0 d-0.1 m-3.8		v0.9 d-0.5 m1.6		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	93°41.8	184°00.5	S23°38.1	235°59.9	S13°51.2	230°08.0	S15°32.8	183°05.0	S22°31.8
1	108°44.3	198°59.5	38.2	251°00.9	51.7	245°10.0	32.9	198°07.1	31.8
2	123°46.7	213°58.5	38.3	266°01.8	52.2	260°12.0	33.0	213°09.3	31.8
3	138°49.2	228°57.6	·· 38.4	281°02.7	·· 52.7	275°14.0	·· 33.2	228°11.4	·· 31.8
4	153°51.7	243°56.6	38.5	296°03.7	53.2	290°16.0	33.3	243°13.6	31.8
5	168°54.1	258°55.6	38.6	311°04.6	53.8	305°18.1	33.4	258°15.7	31.8
6	183°56.6	273°54.6	S23°38.7	326°05.6	S13°54.3	320°20.1	S15°33.5	273°17.9	S22°31.8
7	198°59.1	288°53.7	38.8	341°06.5	54.8	335°22.1	33.7	288°20.0	31.8
8	214°01.5	303°52.7	38.9	356°07.4	55.3	350°24.1	33.8	303°22.1	31.8
9	229°04.0	318°51.7	·· 39.0	11°08.4	·· 55.8	5°26.1	·· 33.9	318°24.3	·· 31.8
10	244°06.4	333°50.8	39.1	26°09.3	56.3	20°28.2	34.0	333°26.4	31.8
11	259°08.9	348°49.8	39.1	41°10.3	56.8	35°30.2	34.2	348°28.6	31.8
12	274°11.4	3°48.8	S23°39.2	56°11.2	S13°57.3	50°32.2	S15°34.3	3°30.7	S22°31.8
13	289°13.8	18°47.8	39.3	71°12.1	57.8	65°34.2	34.4	18°32.9	31.8
14	304°16.3	33°46.9	39.4	86°13.1	58.3	80°36.2	34.5	33°35.0	31.8
15	319°18.8	48°45.9	·· 39.5	101°14.0	·· 58.8	95°38.3	·· 34.7	48°37.2	·· 31.8
16	334°21.2	63°44.9	39.6	116°15.0	59.3	110°40.3	34.8	63°39.3	31.8
17	349°23.7	78°44.0	39.7	131°15.9	13°59.8	125°42.3	34.9	78°41.5	31.8
18	4°26.2	93°43.0	S23°39.8	146°16.8	S14°00.3	140°44.3	S15°35.0	93°43.6	S22°31.8
19	19°28.6	108°42.0	39.8	161°17.8	00.8	155°46.3	35.2	108°45.7	31.8
20	34°31.1	123°41.0	39.9	176°18.7	01.3	170°48.4	35.3	123°47.9	31.8
21	49°33.5	138°40.1	·· 40.0	191°19.6	·· 01.8	185°50.4	·· 35.4	138°50.0	·· 31.9
22	64°36.0	153°39.1	40.1	206°20.6	02.3	200°52.4	35.5	153°52.2	31.9
23	79°38.5	168°38.1	40.2	221°21.5	02.8	215°54.4	35.7	168°54.3	31.9
Mer.pass.:17:42		v-1.0 d-0.1 m-3.8		v0.9 d-0.5 m1.5		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Tue	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	94°40.9	183°37.2	S23°40.2	236°22.5	S14°03.3	230°56.4	S15°35.8	183°56.5	S22°31.9
1	109°43.4	198°36.2	40.3	251°23.4	03.8	245°58.5	35.9	198°58.6	31.9
2	124°45.9	213°35.2	40.4	266°24.3	04.3	261°00.5	36.0	214°00.8	31.9
3	139°48.3	228°34.2	·· 40.5	281°25.3	·· 04.8	276°02.5	·· 36.2	229°02.9	·· 31.9
4	154°50.8	243°33.3	40.5	296°26.2	05.3	291°04.5	36.3	244°05.0	31.9
5	169°53.3	258°32.3	40.6	311°27.2	05.8	306°06.5	36.4	259°07.2	31.9
6	184°55.7	273°31.3	S23°40.7	326°28.1	S14°06.3	321°08.6	S15°36.5	274°09.3	S22°31.9
7	199°58.2	288°30.3	40.7	341°29.0	06.8	336°10.6	36.7	289°11.5	31.9
8	215°00.7	303°29.4	40.8	356°30.0	07.3	351°12.6	36.8	304°13.6	31.9
9	230°03.1	318°28.4	·· 40.9	11°30.9	·· 07.8	6°14.6	·· 36.9	319°15.8	·· 31.9
10	245°05.6	333°27.4	40.9	26°31.8	08.3	21°16.7	37.0	334°17.9	31.9
11	260°08.0	348°26.5	41.0	41°32.8	08.8	36°18.7	37.2	349°20.1	31.9
12	275°10.5	3°25.5	S23°41.0	56°33.7	S14°09.3	51°20.7	S15°37.3	4°22.2	S22°31.9
13	290°13.0	18°24.5	41.1	71°34.7	09.8	66°22.7	37.4	19°24.4	31.9
14	305°15.4	33°23.5	41.2	86°35.6	10.3	81°24.7	37.5	34°26.5	31.9
15	320°17.9	48°22.6	·· 41.2	101°36.5	·· 10.8	96°26.8	·· 37.6	49°28.6	·· 31.9
16	335°20.4	63°21.6	41.3	116°37.5	11.3	111°28.8	37.8	64°30.8	31.9
17	350°22.8	78°20.6	41.3	131°38.4	11.8	126°30.8	37.9	79°32.9	31.9
18	5°25.3	93°19.6	S23°41.4	146°39.3	S14°12.3	141°32.8	S15°38.0	94°35.1	S22°31.9
19	20°27.8	108°18.7	41.4	161°40.3	12.8	156°34.9	38.1	109°37.2	31.9
20	35°30.2	123°17.7	41.5	176°41.2	13.3	171°36.9	38.3	124°39.4	31.9
21	50°32.7	138°16.7	·· 41.5	191°42.2	·· 13.8	186°38.9	·· 38.4	139°41.5	·· 31.9
22	65°35.2	153°15.8	41.6	206°43.1	14.3	201°40.9	38.5	154°43.7	31.9
23	80°37.6	168°14.8	41.6	221°44.0	14.8	216°43.0	38.6	169°45.8	31.9
Mer.pass.:17:38		v-1.0 d-0.1 m-3.8		v0.9 d-0.5 m1.5		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.5
Ankaa	353°12.7	-42°12.8
Schedar	349°36.9	56°38.3
Diphda	348°52.8	-17°53.5
Achernar	335°24.4	-57°09.2
Hamal	327°57.1	23°32.8
Polaris	316°03.6	89°20.5
Acamar	315°15.8	-40°14.3
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.5
Aldebaran	290°45.5	16°32.5
Rigel	281°08.8	-8°11.1
Capella	280°29.4	46°00.8
Bellatrix	278°28.4	6°21.7
Elnath	278°08.4	28°37.2
Alnilam	275°42.9	-1°11.6
Betelgeuse	270°57.7	7°24.4
Canopus	263°54.2	-52°42.5
Sirius	258°30.7	-16°44.6
Adhara	255°09.7	-28°59.9
Procyon	244°56.2	5°10.6
Pollux	243°23.7	27°58.7
Avior	234°16.1	-59°34.0
Suhail	222°49.8	-43°30.2
Miaplacidus	221°38.2	-69°47.3
Alphard	217°52.9	-8°44.2
Regulus	207°40.1	11°52.7
Dubhe	193°47.9	61°39.0
Denebola	182°30.5	14°28.3
Gienah	175°49.1	-17°38.3
Acrux	173°05.8	-63°11.5
Gacrux	171°57.4	-57°12.4
Alioth	166°18.2	55°51.6
Spica	158°28.1	-11°15.1
Alkaid	152°56.8	49°13.3
Hadar	148°43.8	-60°27.1
Menkent	148°04.1	-36°27.2
Arcturus	145°53.2	19°05.4
Rigil Kent.	139°47.9	-60°54.1
Kochab	137°21.0	74°04.8
Zuben'ubi	137°02.3	-16°06.7
Alphecca	126°08.7	26°39.3
Antares	112°22.8	-26°28.0
Atria	107°22.4	-69°03.2
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.0
Eltanin	90°45.3	51°29.3
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.2
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.7
Deneb	49°29.8	45°20.9
Enif	33°44.3	9°57.5
Al Na'ir	27°40.2	-46°52.6
Fomalhaut	15°20.8	-29°31.8
Scheat	13°50.5	28°10.9
Markab	13°35.4	15°18.2

Dec 24 Sun	**SHA**	**Mer.pass**
Venus	91°41.1	11:43
Mars	142°54.6	08:17
Jupiter	136°36.9	08:42
Saturn	89°30.9	11:49

Dec 25 Mon	**SHA**	**Mer.pass**
Venus	90°18.7	11:45
Mars	142°18.1	08:15
Jupiter	136°26.2	08:38
Saturn	89°23.2	11:46

Dec 26 Tue	**SHA**	**Mer.pass**
Venus	88°56.2	11:46
Mars	141°41.5	08:14
Jupiter	136°15.5	08:35
Saturn	89°15.5	11:43

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2247 sec ΔT = TT-UT1 = +68.9593 sec

2017 December 24 to Dec. 26 UT

h Sun Moon

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°08.5	S23°24.8	115°30.2	13.5'	S11°21.3	8.8'	55.2'
1	195°08.2	24.8	130°02.6	13.5'	11°12.5	8.8'	55.2'
2	210°07.9	24.7	144°35.1	13.5'	11°03.7	8.9'	55.2'
3	225°07.6	·· 24.7	159°07.6	13.5'	10°54.7	8.9'	55.2'
4	240°07.3	24.6	173°40.1	13.5'	10°45.8	9.0'	55.3'
5	255°07.0	24.6	188°12.7	13.5'	10°36.7	9.1'	55.3'
6	270°06.7	S23°24.5	202°45.2	13.5'	S10°27.7	9.1'	55.3'
7	285°06.4	24.5	217°17.7	13.5'	10°18.5	9.2'	55.3'
8	300°06.0	24.4	231°50.2	13.5'	10°09.3	9.2'	55.4'
9	315°05.7	·· 24.4	246°22.8	13.5'	10°00.1	9.3'	55.4'
10	330°05.4	24.3	260°55.3	13.5'	09°50.8	9.3'	55.4'
11	345°05.1	24.3	275°27.8	13.5'	09°41.5	9.4'	55.4'
12	0°04.8	S23°24.2	290°00.4	13.5'	S09°32.1	9.4'	55.5'
13	15°04.5	24.2	304°32.9	13.5'	09°22.6	9.5'	55.5'
14	30°04.2	24.1	319°05.4	13.5'	09°13.1	9.5'	55.5'
15	45°03.9	·· 24.1	333°38.0	13.5'	09°03.6	9.6'	55.5'
16	60°03.6	24.0	348°10.5	13.5'	08°54.0	9.6'	55.6'
17	75°03.2	23.9	2°43.1	13.5'	08°44.3	9.7'	55.6'
18	90°02.9	S23°23.9	17°15.6	13.5'	S08°34.6	9.7'	55.6'
19	105°02.6	23.8	31°48.2	13.5'	08°24.9	9.8'	55.6'
20	120°02.3	23.8	46°20.7	13.5'	08°15.1	9.8'	55.7'
21	135°02.0	·· 23.7	60°53.2	13.5'	08°05.3	9.9'	55.7'
22	150°01.7	23.6	75°25.7	13.5'	07°55.4	9.9'	55.7'
23	165°01.4	23.6	89°58.3	13.5'	07°45.5	9.9'	55.8'
	SD.=16.2	d=0.0	S.D.=15.1				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°01.1	S23°23.5	104°30.8	13.5'	S07°35.5	10.0'	55.8'
1	195°00.8	23.4	119°03.3	13.5'	07°25.5	10.0'	55.8'
2	210°00.5	23.4	133°35.8	13.5'	07°15.5	10.1'	55.8'
3	225°00.1	·· 23.3	148°08.3	13.5'	07°05.4	10.1'	55.9'
4	239°59.8	23.2	162°40.8	13.5'	06°55.2	10.2'	55.9'
5	254°59.5	23.2	177°13.3	13.5'	06°45.1	10.2'	55.9'
6	269°59.2	S23°23.1	191°45.7	13.5'	S06°34.8	10.2'	56.0'
7	284°58.9	23.0	206°18.2	13.5'	06°24.6	10.3'	56.0'
8	299°58.6	23.0	220°50.7	13.4'	06°14.3	10.3'	56.0'
9	314°58.3	·· 22.9	235°23.1	13.4'	06°03.9	10.4'	56.0'
10	329°58.0	22.8	249°55.5	13.4'	05°53.6	10.4'	56.1'
11	344°57.7	22.7	264°27.9	13.4'	05°43.1	10.4'	56.1'
12	359°57.4	S23°22.7	279°00.3	13.4'	S05°32.7	10.5'	56.1'
13	14°57.0	22.6	293°32.7	13.4'	05°22.2	10.5'	56.2'
14	29°56.7	22.5	308°05.1	13.4'	05°11.7	10.5'	56.2'
15	44°56.4	·· 22.4	322°37.4	13.3'	05°01.1	10.6'	56.2'
16	59°56.1	22.4	337°09.8	13.3'	04°50.5	10.6'	56.3'
17	74°55.8	22.3	351°42.1	13.3'	04°39.9	10.6'	56.3'
18	89°55.5	S23°22.2	6°14.4	13.3'	S04°29.2	10.7'	56.3'
19	104°55.2	22.1	20°46.7	13.3'	04°18.5	10.7'	56.4'
20	119°54.9	22.0	35°18.9	13.2'	04°07.8	10.7'	56.4'
21	134°54.6	·· 22.0	49°51.2	13.2'	03°57.1	10.8'	56.4'
22	149°54.3	21.9	64°23.4	13.2'	03°46.3	10.8'	56.5'
23	164°54.0	21.8	78°55.6	13.2'	03°35.5	10.8'	56.5'
	SD.=16.3	d=0.1	S.D.=15.3				

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°53.6	S23°21.7	93°27.8	13.2'	S03°24.6	10.9'	56.5'
1	194°53.3	21.6	107°59.9	13.1'	03°13.7	10.9'	56.6'
2	209°53.0	21.5	122°32.0	13.1'	03°02.8	10.9'	56.6'
3	224°52.7	·· 21.5	137°04.1	13.1'	02°51.9	10.9'	56.6'
4	239°52.4	21.4	151°36.2	13.1'	02°40.9	11.0'	56.7'
5	254°52.1	21.3	166°08.2	13.0'	02°30.0	11.0'	56.7'
6	269°51.8	S23°21.2	180°40.3	13.0'	S02°18.9	11.0'	56.7'
7	284°51.5	21.1	195°12.2	13.0'	02°07.9	11.0'	56.8'
8	299°51.2	21.0	209°44.2	12.9'	01°56.9	11.1'	56.8'
9	314°50.9	·· 20.9	224°16.1	12.9'	01°45.8	11.1'	56.8'
10	329°50.6	20.8	238°48.0	12.9'	01°34.7	11.1'	56.9'
11	344°50.2	20.7	253°19.9	12.8'	01°23.6	11.1'	56.9'
12	359°49.9	S23°20.6	267°51.7	12.8'	S01°12.4	11.2'	56.9'
13	14°49.6	20.6	282°23.5	12.8'	01°01.2	11.2'	57.0'
14	29°49.3	20.5	296°55.2	12.7'	00°50.1	11.2'	57.0'
15	44°49.0	·· 20.4	311°26.9	12.7'	00°38.9	11.2'	57.1'
16	59°48.7	20.3	325°58.6	12.7'	00°27.6	11.2'	57.1'
17	74°48.4	20.2	340°30.3	12.6'	00°16.4	11.2'	57.1'
18	89°48.1	S23°20.1	355°01.9	12.6'	S00°05.2	11.3'	57.2'
19	104°47.8	20.0	9°33.4	12.5'	N00°06.1	11.3'	57.2'
20	119°47.5	19.9	24°05.0	12.5'	00°17.4	11.3'	57.2'
21	134°47.2	·· 19.8	38°36.4	12.5'	00°28.7	11.3'	57.3'
22	149°46.9	19.7	53°07.9	12.4'	00°40.0	11.3'	57.3'
23	164°46.6	19.6	67°39.3	12.4'	00°51.3	11.3'	57.3'
	SD.=16.3	d=0.1	S.D.=15.5				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:27	10:57	▬	▬	13:04	15:34
N 70°	08:07	09:55	▬	▬	14:05	15:54
68°	07:51	09:20	▬	▬	14:40	16:09
66°	07:38	08:55	10:35	13:25	15:05	16:22
64°	07:27	08:35	09:53	14:07	15:25	16:34
62°	07:17	08:19	09:25	14:36	15:41	16:43
60°	07:09	08:06	09:03	14:57	15:55	16:52
N 58°	07:01	07:54	08:46	15:15	16:06	16:59
56°	06:55	07:44	08:31	15:29	16:17	17:06
54°	06:49	07:35	08:19	15:42	16:26	17:12
52°	06:43	07:27	08:07	15:53	16:34	17:18
50°	06:38	07:19	07:58	16:03	16:41	17:23
45°	06:26	07:03	07:37	16:24	16:57	17:35
N 40°	06:15	06:50	07:20	16:40	17:11	17:45
35°	06:06	06:38	07:06	16:54	17:23	17:54
30°	05:57	06:27	06:54	17:07	17:33	18:03
20°	05:41	06:08	06:32	17:28	17:52	18:20
N 10°	05:25	05:51	06:14	17:47	18:09	18:36
0°	05:08	05:34	05:56	18:04	18:26	18:53
S 10°	04:49	05:16	05:39	18:21	18:45	19:12
20°	04:26	04:55	05:20	18:40	19:05	19:34
30°	03:57	04:30	04:58	19:02	19:30	20:03
35°	03:38	04:15	04:45	19:15	19:45	20:22
40°	03:15	03:57	04:30	19:30	20:03	20:45
45°	02:45	03:34	04:12	19:48	20:26	21:16
S 50°	01:59	03:05	03:49	20:11	20:56	22:01
52°	01:31	02:50	03:38	20:22	21:11	22:29
54°	00:45	02:32	03:26	20:34	21:28	23:14
56°	▭	02:09	03:12	20:48	21:51	▭
58°	▭	01:40	02:55	21:05	22:20	▭
S 60°	▭	00:49	02:35	21:25	23:10	▭

Lat.	Moonrise Sun	Moonrise Mon	Moonrise Tue	Moonset Sun	Moonset Mon	Moonset Tue
N 72°	12:46	12:35	12:25	21:12	22:58	–:–
N 70°	12:31	12:27	12:23	21:25	23:03	–:–
68°	12:19	12:21	12:22	21:35	23:08	–:–
66°	12:10	12:16	12:21	21:43	23:11	–:–
64°	12:02	12:11	12:20	21:50	23:14	–:–
62°	11:55	12:07	12:19	21:56	23:17	–:–
60°	11:48	12:04	12:18	22:02	23:19	–:–
N 58°	11:43	12:01	12:17	22:06	23:21	–:–
56°	11:38	11:58	12:17	22:10	23:23	–:–
54°	11:34	11:55	12:16	22:14	23:25	–:–
52°	11:30	11:53	12:16	22:17	23:26	–:–
50°	11:26	11:51	12:15	22:20	23:28	–:–
45°	11:18	11:47	12:14	22:27	23:31	–:–
N 40°	11:12	11:43	12:14	22:32	23:33	–:–
35°	11:06	11:40	12:13	22:37	23:35	–:–
30°	11:01	11:37	12:12	22:41	23:37	–:–
20°	10:53	11:32	12:11	22:48	23:40	–:–
N 10°	10:45	11:27	12:10	22:54	23:43	–:–
0°	10:38	11:23	12:09	23:00	23:45	–:–
S 10°	10:31	11:19	12:08	23:05	23:48	–:–
20°	10:23	11:15	12:08	23:11	23:50	–:–
30°	10:14	11:10	12:07	23:18	23:53	–:–
35°	10:09	11:07	12:06	23:22	23:55	–:–
40°	10:04	11:04	12:05	23:26	23:57	–:–
45°	09:57	11:00	12:05	23:31	23:59	–:–
S 50°	09:49	10:55	12:04	23:37	–:–	00:02
52°	09:45	10:53	12:03	23:40	–:–	00:03
54°	09:41	10:51	12:03	23:43	–:–	00:04
56°	09:36	10:48	12:02	23:47	–:–	00:06
58°	09:31	10:45	12:02	23:50	–:–	00:07
S 60°	09:25	10:42	12:01	23:54	–:–	00:09

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 6-8 31-51%
24	00:34	00:19	12:00	16:49	04:26	
25	00:04	00:11	12:00	17:34	05:11	
26	00:25	00:40	12:01	18:21	05:57	

December 27, 28, 29 UT (Wed., Thu., Fri.)

	Aries	Venus		Mars		Jupiter		Saturn	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	95°40.1	183°13.8	S23°41.7	236°45.0	S14°15.3	231°45.0	S15°38.8	184°47.9	S22°31.9
1	110°42.5	198°12.8	41.7	251°45.9	15.8	246°47.0	38.9	199°50.1	31.9
2	125°45.0	213°11.9	41.8	266°46.8	16.3	261°49.0	39.0	214°52.2	31.9
3	140°47.5	228°10.9	·· 41.8	281°47.8	·· 16.8	276°51.1	·· 39.1	229°54.4	·· 31.9
4	155°49.9	243°09.9	41.8	296°48.7	17.3	291°53.1	39.2	244°56.5	31.9
5	170°52.4	258°08.9	41.9	311°49.6	17.8	306°55.1	39.4	259°58.7	31.9
6	185°54.9	273°08.0	S23°41.9	326°50.6	S14°18.3	321°57.1	S15°39.5	275°00.8	S22°31.9
7	200°57.3	288°07.0	42.0	341°51.5	18.8	336°59.2	39.6	290°03.0	31.9
8	215°59.8	303°06.0	42.0	356°52.5	19.3	352°01.2	39.7	305°05.1	31.9
9	231°02.3	318°05.0	·· 42.0	11°53.4	·· 19.8	7°03.2	·· 39.9	320°07.3	·· 31.9
10	246°04.7	333°04.1	42.1	26°54.3	20.3	22°05.2	40.0	335°09.4	31.9
11	261°07.2	348°03.1	42.1	41°55.3	20.8	37°07.3	40.1	350°11.5	31.9
12	276°09.6	3°02.1	S23°42.1	56°56.2	S14°21.2	52°09.3	S15°40.2	5°13.7	S22°31.9
13	291°12.1	18°01.2	42.2	71°57.1	21.7	67°11.3	40.4	20°15.8	31.9
14	306°14.6	33°00.2	42.2	86°58.1	22.2	82°13.3	40.5	35°18.0	31.9
15	321°17.0	47°59.2	·· 42.2	101°59.0	·· 22.7	97°15.4	·· 40.6	50°20.1	·· 31.9
16	336°19.5	62°58.2	42.2	116°59.9	23.2	112°17.4	40.7	65°22.3	31.9
17	351°22.0	77°57.3	42.3	132°00.9	23.7	127°19.4	40.8	80°24.4	31.9
18	6°24.4	92°56.3	S23°42.3	147°01.8	S14°24.2	142°21.4	S15°41.0	95°26.6	S22°31.9
19	21°26.9	107°55.3	42.3	162°02.7	24.7	157°23.5	41.1	110°28.7	31.9
20	36°29.4	122°54.3	42.3	177°03.7	25.2	172°25.5	41.2	125°30.9	31.9
21	51°31.8	137°53.4	·· 42.3	192°04.6	·· 25.7	187°27.5	·· 41.3	140°33.0	·· 31.9
22	66°34.3	152°52.4	42.4	207°05.5	26.2	202°29.6	41.4	155°35.1	31.9
23	81°36.8	167°51.4	42.4	222°06.5	26.7	217°31.6	41.6	170°37.3	31.9
Mer.pass.:17:34		v-1.0 d-0.0 m-3.8		v0.9 d-0.5 m1.5		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	96°39.2	182°50.4	S23°42.4	237°07.4	S14°27.2	232°33.6	S15°41.7	185°39.4	S22°31.9
1	111°41.7	197°49.5	42.4	252°08.3	27.7	247°35.6	41.8	200°41.6	31.9
2	126°44.1	212°48.5	42.4	267°09.3	28.2	262°37.7	41.9	215°43.7	31.9
3	141°46.6	227°47.5	·· 42.4	282°10.2	·· 28.7	277°39.7	·· 42.1	230°45.9	·· 31.9
4	156°49.1	242°46.6	42.4	297°11.2	29.2	292°41.7	42.2	245°48.0	31.9
5	171°51.5	257°45.6	42.4	312°12.1	29.6	307°43.7	42.3	260°50.2	31.9
6	186°54.0	272°44.6	S23°42.4	327°13.0	S14°30.1	322°45.8	S15°42.4	275°52.3	S22°31.9
7	201°56.5	287°43.6	42.5	342°14.0	30.6	337°47.8	42.5	290°54.5	31.9
8	216°58.9	302°42.7	42.5	357°14.9	31.1	352°49.8	42.7	305°56.6	31.9
9	232°01.4	317°41.7	·· 42.5	12°15.8	·· 31.6	7°51.9	·· 42.8	320°58.7	·· 31.9
10	247°03.9	332°40.7	42.5	27°16.8	32.1	22°53.9	42.9	336°00.9	31.9
11	262°06.3	347°39.7	42.5	42°17.7	32.6	37°55.9	43.0	351°03.0	31.9
12	277°08.8	2°38.8	S23°42.5	57°18.6	S14°33.1	52°58.0	S15°43.1	6°05.2	S22°31.9
13	292°11.3	17°37.8	42.5	72°19.6	33.6	68°00.0	43.3	21°07.3	31.9
14	307°13.7	32°36.8	42.5	87°20.5	34.1	83°02.0	43.4	36°09.5	31.9
15	322°16.2	47°35.8	·· 42.5	102°21.4	·· 34.6	98°04.0	·· 43.5	51°11.6	·· 31.9
16	337°18.6	62°34.9	42.4	117°22.4	35.0	113°06.1	43.6	66°13.8	31.9
17	352°21.1	77°33.9	42.4	132°23.3	35.5	128°08.1	43.7	81°15.9	31.9
18	7°23.6	92°32.9	S23°42.4	147°24.2	S14°36.0	143°10.1	S15°43.9	96°18.1	S22°31.9
19	22°26.0	107°31.9	42.4	162°25.2	36.5	158°12.2	44.0	111°20.2	31.9
20	37°28.5	122°31.0	42.4	177°26.1	37.0	173°14.2	44.1	126°22.3	31.9
21	52°31.0	137°30.0	·· 42.4	192°27.0	·· 37.5	188°16.2	·· 44.2	141°24.5	·· 31.9
22	67°33.4	152°29.0	42.4	207°27.9	38.0	203°18.3	44.3	156°26.6	31.9
23	82°35.9	167°28.1	42.4	222°28.9	38.5	218°20.3	44.5	171°28.8	31.9
Mer.pass.:17:31		v-1.0 d-0.0 m-3.8		v0.9 d-0.5 m1.5		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	97°38.4	182°27.1	S23°42.4	237°29.8	S14°39.0	233°22.3	S15°44.6	186°30.9	S22°31.9
1	112°40.8	197°26.1	42.3	252°30.7	39.5	248°24.3	44.7	201°33.1	31.9
2	127°43.3	212°25.1	42.3	267°31.7	39.9	263°26.4	44.8	216°35.2	31.9
3	142°45.7	227°24.2	·· 42.3	282°32.6	·· 40.4	278°28.4	·· 44.9	231°37.4	·· 31.9
4	157°48.2	242°23.2	42.3	297°33.5	40.9	293°30.4	45.1	246°39.5	31.9
5	172°50.7	257°22.2	42.3	312°34.5	41.4	308°32.5	45.2	261°41.7	31.9
6	187°53.1	272°21.2	S23°42.2	327°35.4	S14°41.9	323°34.5	S15°45.3	276°43.8	S22°31.9
7	202°55.6	287°20.3	42.2	342°36.3	42.4	338°36.5	45.4	291°46.0	31.9
8	217°58.1	302°19.3	42.2	357°37.3	42.9	353°38.6	45.5	306°48.1	31.9
9	233°00.5	317°18.3	·· 42.2	12°38.2	·· 43.4	8°40.6	·· 45.7	321°50.2	·· 31.9
10	248°03.0	332°17.3	42.1	27°39.1	43.8	23°42.6	45.8	336°52.4	31.9
11	263°05.5	347°16.4	42.1	42°40.1	44.3	38°44.7	45.9	351°54.5	31.9
12	278°07.9	2°15.4	S23°42.1	57°41.0	S14°44.8	53°46.7	S15°46.0	6°56.7	S22°31.9
13	293°10.4	17°14.4	42.0	72°41.9	45.3	68°48.7	46.1	21°58.8	31.9
14	308°12.9	32°13.5	42.0	87°42.9	45.8	83°50.8	46.3	37°01.0	31.9
15	323°15.3	47°12.5	·· 42.0	102°43.8	·· 46.3	98°52.8	·· 46.4	52°03.1	·· 31.9
16	338°17.8	62°11.5	41.9	117°44.7	46.8	113°54.8	46.5	67°05.3	31.9
17	353°20.2	77°10.5	41.9	132°45.6	47.3	128°56.9	46.6	82°07.4	31.9
18	8°22.7	92°09.6	S23°41.9	147°46.6	S14°47.7	143°58.9	S15°46.7	97°09.6	S22°31.9
19	23°25.2	107°08.6	41.8	162°47.5	48.2	159°00.9	46.9	112°11.7	31.9
20	38°27.6	122°07.6	41.8	177°48.4	48.7	174°03.0	47.0	127°13.9	31.9
21	53°30.1	137°06.6	·· 41.7	192°49.4	·· 49.2	189°05.0	·· 47.1	142°16.0	·· 31.9
22	68°32.6	152°05.7	41.7	207°50.3	49.7	204°07.0	47.2	157°18.1	31.9
23	83°35.0	167°04.7	41.6	222°51.2	50.2	219°09.1	47.3	172°20.3	31.9
Mer.pass.:17:27		v-1.0 d0.0 m-3.8		v0.9 d-0.5 m1.5		v2.0 d-0.1 m-1.6		v2.1 d-0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.5
Ankaa	353°12.7	-42°12.8
Schedar	349°36.9	56°38.3
Diphda	348°52.8	-17°53.5
Achernar	335°24.4	-57°09.2
Hamal	327°57.1	23°32.8
Polaris	316°04.7	89°20.5
Acamar	315°15.8	-40°14.3
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.5
Aldebaran	290°45.5	16°32.5
Rigel	281°08.8	-8°11.1
Capella	280°29.4	46°00.8
Bellatrix	278°28.4	6°21.7
Elnath	278°08.4	28°37.2
Alnilam	275°42.9	-1°11.7
Betelgeuse	270°57.6	7°24.4
Canopus	263°54.2	-52°42.5
Sirius	258°30.7	-16°44.6
Adhara	255°09.7	-28°59.9
Procyon	244°56.2	5°10.6
Pollux	243°23.7	27°58.7
Avior	234°16.1	-59°34.0
Suhail	222°49.8	-43°30.2
Miaplacidus	221°38.2	-69°47.3
Alphard	217°52.8	-8°44.2
Regulus	207°40.1	11°52.7
Dubhe	193°47.8	61°39.0
Denebola	182°30.5	14°28.3
Gienah	175°49.1	-17°38.3
Acrux	173°05.8	-63°11.5
Gacrux	171°57.4	-57°12.4
Alioth	166°18.2	55°51.6
Spica	158°28.1	-11°15.1
Alkaid	152°56.7	49°13.3
Hadar	148°43.7	-60°27.1
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.4
Rigil Kent.	139°47.9	-60°54.1
Kochab	137°21.0	74°04.8
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.7	26°39.3
Antares	112°22.8	-26°28.0
Atria	107°22.4	-69°03.2
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.8
Rasalhague	96°04.0	12°33.0
Eltanin	90°45.3	51°29.3
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.2
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.7
Deneb	49°29.8	45°20.9
Enif	33°44.3	9°57.5
Al Na'ir	27°40.2	-46°52.6
Fomalhaut	15°20.8	-29°31.8
Scheat	13°50.5	28°10.9
Markab	13°35.4	15°18.2

Dec 27 Wed	SHA	Mer.pass
Venus	87°33.7	11:48
Mars	141°04.9	08:12
Jupiter	136°04.9	08:32
Saturn	89°07.9	11:39

Dec 28 Thu	SHA	Mer.pass
Venus	86°11.2	11:49
Mars	140°28.2	08:11
Jupiter	135°54.4	08:29
Saturn	89°00.2	11:36

Dec 29 Fri	SHA	Mer.pass
Venus	84°48.7	11:51
Mars	139°51.5	08:10
Jupiter	135°44.0	08:25
Saturn	88°52.6	11:32

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2216 sec ΔT = TT-UT1 = +68.9624 sec

2017 December 27 to Dec. 29 UT

h	Sun		Moon				
Wed	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	179°46.2	S23°19.5	82°10.6	12.3'	N01°02.6	11.3'	57.4'
1	194°45.9	19.4	96°41.9	12.3'	01°14.0	11.3'	57.4'
2	209°45.6	19.2	111°13.2	12.2'	01°25.3	11.4'	57.5'
3	224°45.3	·· 19.1	125°44.4	12.2'	01°36.7	11.4'	57.5'
4	239°45.0	19.0	140°15.6	12.1'	01°48.0	11.4'	57.5'
5	254°44.7	18.9	154°46.7	12.1'	01°59.4	11.4'	57.6'
6	269°44.4	S23°18.8	169°17.8	12.0'	N02°10.8	11.4'	57.6'
7	284°44.1	18.7	183°48.8	12.0'	02°22.2	11.4'	57.7'
8	299°43.8	18.6	198°19.7	11.9'	02°33.6	11.4'	57.7'
9	314°43.5	·· 18.5	212°50.6	11.9'	02°44.9	11.4'	57.7'
10	329°43.2	18.4	227°21.5	11.8'	02°56.3	11.4'	57.8'
11	344°42.9	18.3	241°52.3	11.8'	03°07.7	11.4'	57.8'
12	359°42.6	S23°18.1	256°23.1	11.7'	N03°19.1	11.4'	57.8'
13	14°42.3	18.0	270°53.7	11.7'	03°30.5	11.4'	57.9'
14	29°42.0	17.9	285°24.4	11.6'	03°41.9	11.4'	57.9'
15	44°41.6	·· 17.8	299°55.0	11.5'	03°53.3	11.4'	58.0'
16	59°41.3	17.7	314°25.5	11.5'	04°04.6	11.4'	58.0'
17	74°41.0	17.6	328°55.9	11.4'	04°16.0	11.4'	58.0'
18	89°40.7	S23°17.5	343°26.3	11.4'	N04°27.4	11.4'	58.1'
19	104°40.4	17.3	357°56.7	11.3'	04°38.8	11.4'	58.1'
20	119°40.1	17.2	12°26.9	11.2'	04°50.1	11.3'	58.2'
21	134°39.8	·· 17.1	26°57.1	11.2'	05°01.4	11.3'	58.2'
22	149°39.5	17.0	41°27.3	11.1'	05°12.8	11.3'	58.2'
23	164°39.2	16.8	55°57.4	11.0'	05°24.1	11.3'	58.3'
	SD.=16.3	d=0.1	S.D.=15.8				

Thu	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	179°38.9	S23°16.7	70°27.4	11.0'	N05°35.4	11.3'	58.3'
1	194°38.6	16.6	84°57.3	10.9'	05°46.7	11.3'	58.4'
2	209°38.3	16.5	99°27.2	10.8'	05°58.0	11.3'	58.4'
3	224°38.0	·· 16.4	113°57.0	10.8'	06°09.3	11.3'	58.4'
4	239°37.7	16.2	128°26.8	10.7'	06°20.5	11.2'	58.5'
5	254°37.4	16.1	142°56.4	10.6'	06°31.7	11.2'	58.5'
6	269°37.1	S23°16.0	157°26.0	10.6'	N06°42.9	11.2'	58.6'
7	284°36.8	15.8	171°55.6	10.5'	06°54.1	11.2'	58.6'
8	299°36.5	15.7	186°25.0	10.4'	07°05.3	11.2'	58.6'
9	314°36.1	·· 15.6	200°54.4	10.3'	07°16.4	11.1'	58.7'
10	329°35.8	15.4	215°23.7	10.3'	07°27.6	11.1'	58.7'
11	344°35.5	15.3	229°53.0	10.2'	07°38.7	11.1'	58.8'
12	359°35.2	S23°15.2	244°22.1	10.1'	N07°49.7	11.1'	58.8'
13	14°34.9	15.1	258°51.2	10.0'	08°00.8	11.0'	58.8'
14	29°34.6	14.9	273°20.2	10.0'	08°11.8	11.0'	58.9'
15	44°34.3	·· 14.8	287°49.1	9.9'	08°22.8	11.0'	58.9'
16	59°34.0	14.6	302°18.0	9.8'	08°33.7	10.9'	59.0'
17	74°33.7	14.5	316°46.8	9.7'	08°44.6	10.9'	59.0'
18	89°33.4	S23°14.4	331°15.4	9.6'	N08°55.5	10.9'	59.0'
19	104°33.1	14.2	345°44.0	9.6'	09°06.3	10.8'	59.1'
20	119°32.8	14.1	0°12.6	9.5'	09°17.2	10.8'	59.1'
21	134°32.5	·· 14.0	14°41.0	9.4'	09°27.9	10.8'	59.2'
22	149°32.2	13.8	29°09.4	9.3'	09°38.7	10.7'	59.2'
23	164°31.9	13.7	43°37.7	9.2'	09°49.3	10.7'	59.2'
	SD.=16.3	d=0.1	S.D.=16.0				

Fri	**GHA**	**Dec**	**GHA**	ν	**Dec**	**d**	**HP**
0	179°31.6	S23°13.5	58°05.9	9.2'	N10°00.0	10.6'	59.3'
1	194°31.3	13.4	72°34.0	9.1'	10°10.6	10.6'	59.3'
2	209°31.0	13.2	87°02.0	9.0'	10°21.2	10.5'	59.3'
3	224°30.7	·· 13.1	101°29.9	8.9'	10°31.7	10.5'	59.4'
4	239°30.4	12.9	115°57.8	8.8'	10°42.1	10.4'	59.4'
5	254°30.1	12.8	130°25.5	8.7'	10°52.6	10.4'	59.5'
6	269°29.8	S23°12.7	144°53.2	8.6'	N11°02.9	10.3'	59.5'
7	284°29.5	12.5	159°20.8	8.5'	11°13.2	10.3'	59.5'
8	299°29.2	12.4	173°48.3	8.5'	11°23.5	10.2'	59.6'
9	314°28.9	·· 12.2	188°15.7	8.4'	11°33.7	10.2'	59.6'
10	329°28.6	12.1	202°43.0	8.3'	11°43.8	10.1'	59.7'
11	344°28.3	11.9	217°10.3	8.2'	11°53.9	10.1'	59.7'
12	359°28.0	S23°11.8	231°37.4	8.1'	N12°04.0	10.0'	59.7'
13	14°27.7	11.6	246°04.5	8.0'	12°13.9	9.9'	59.8'
14	29°27.4	11.4	260°31.4	7.9'	12°23.8	9.9'	59.8'
15	44°27.1	·· 11.3	274°58.3	7.8'	12°33.7	9.8'	59.8'
16	59°26.7	11.1	289°25.1	7.7'	12°43.4	9.7'	59.9'
17	74°26.4	11.0	303°51.8	7.6'	12°53.2	9.7'	59.9'
18	89°26.1	S23°10.8	318°18.4	7.6'	N13°02.8	9.6'	59.9'
19	104°25.8	10.7	332°44.9	7.5'	13°12.4	9.5'	60.0'
20	119°25.5	10.5	347°11.3	7.4'	13°21.9	9.5'	60.0'
21	134°25.2	·· 10.3	1°37.6	7.3'	13°31.3	9.4'	60.0'
22	149°24.9	10.2	16°03.8	7.2'	13°40.6	9.3'	60.1'
23	164°24.6	10.0	30°30.0	7.1'	13°49.9	9.2'	60.1'
	SD.=16.3	d=0.1	S.D.=16.3				

Lat.	**Twilight** Naut.	**Twilight** Civil	**Sunrise**	**Sunset**	**Twilight** Civil	**Twilight** Naut.
N 72°	08:26	10:52	▬	▬	13:11	15:37
N 70°	08:07	09:54	▬	▬	14:10	15:57
68°	07:51	09:20	▬	▬	14:44	16:12
66°	07:38	08:55	10:33	13:30	15:09	16:25
64°	07:27	08:35	09:52	14:11	15:28	16:36
62°	07:18	08:20	09:25	14:39	15:44	16:46
60°	07:09	08:06	09:03	15:00	15:57	16:54
N 58°	07:02	07:55	08:46	15:17	16:09	17:01
56°	06:55	07:44	08:32	15:32	16:19	17:08
54°	06:49	07:35	08:19	15:44	16:28	17:14
52°	06:44	07:27	08:08	15:55	16:36	17:20
50°	06:38	07:20	07:58	16:05	16:43	17:25
45°	06:27	07:04	07:38	16:26	16:59	17:37
N 40°	06:17	06:51	07:21	16:42	17:13	17:47
35°	06:07	06:39	07:07	16:56	17:24	17:56
30°	05:59	06:28	06:55	17:09	17:35	18:05
20°	05:42	06:10	06:34	17:30	17:54	18:21
N 10°	05:26	05:52	06:15	17:48	18:11	18:37
0°	05:09	05:35	05:58	18:05	18:28	18:54
S 10°	04:50	05:17	05:40	18:23	18:46	19:13
20°	04:28	04:57	05:22	18:42	19:06	19:35
30°	03:59	04:32	05:00	19:04	19:31	20:04
35°	03:40	04:17	04:47	19:16	19:46	20:23
40°	03:17	03:59	04:32	19:31	20:04	20:46
45°	02:47	03:37	04:14	19:49	20:26	21:16
S 50°	02:02	03:07	03:52	20:12	20:56	22:01
52°	01:35	02:52	03:41	20:22	21:11	22:28
54°	00:51	02:34	03:29	20:34	21:28	23:11
56°	▭	02:12	03:14	20:48	21:50	▭
58°	▭	01:43	02:58	21:05	22:19	▭
S 60°	▭	00:55	02:38	21:25	23:06	▭

Lat.	**Moonrise** Wed	Thu	Fri	**Moonset** Wed	Thu	Fri
N 72°	12:15	12:04	11:52	00:46	02:38	04:39
N 70°	12:19	12:16	12:12	00:44	02:29	04:21
68°	12:23	12:25	12:28	00:43	02:22	04:06
66°	12:26	12:32	12:41	00:42	02:16	03:55
64°	12:29	12:39	12:52	00:41	02:11	03:45
62°	12:31	12:44	13:01	00:40	02:07	03:37
60°	12:33	12:49	13:09	00:40	02:03	03:30
N 58°	12:35	12:54	13:16	00:39	02:00	03:23
56°	12:36	12:57	13:22	00:39	01:57	03:18
54°	12:38	13:01	13:28	00:38	01:54	03:13
52°	12:39	13:04	13:33	00:38	01:52	03:08
50°	12:40	13:07	13:38	00:37	01:49	03:04
45°	12:43	13:13	13:48	00:36	01:45	02:56
N 40°	12:45	13:19	13:56	00:36	01:41	02:49
35°	12:47	13:23	14:03	00:35	01:37	02:42
30°	12:49	13:27	14:10	00:34	01:34	02:37
20°	12:52	13:35	14:21	00:33	01:29	02:28
N 10°	12:54	13:41	14:31	00:33	01:25	02:19
0°	12:57	13:47	14:40	00:32	01:20	02:12
S 10°	12:59	13:53	14:49	00:31	01:16	02:04
20°	13:02	13:59	14:59	00:30	01:11	01:56
30°	13:05	14:07	15:11	00:29	01:06	01:47
35°	13:07	14:11	15:18	00:28	01:03	01:41
40°	13:09	14:16	15:25	00:28	01:00	01:35
45°	13:12	14:22	15:34	00:27	00:56	01:28
S 50°	13:15	14:29	15:45	00:26	00:51	01:20
52°	13:16	14:32	15:50	00:26	00:49	01:16
54°	13:18	14:35	15:56	00:25	00:47	01:12
56°	13:19	14:39	16:02	00:25	00:44	01:07
58°	13:21	14:43	16:09	00:24	00:42	01:02
S 60°	13:23	14:48	16:17	00:23	00:38	00:56

Day	**Sun** Eqn.of Time 00^h mm:ss	Eqn.of Time 12^h mm:ss	Mer. Pass hh:mm	**Moon** Mer.Pass. Upper hh:mm	Lower hh:mm	Age 9-11 62-82%
27	00:55	01:10	12:01	19:09	06:44	
28	01:24	01:39	12:02	19:59	07:33	
29	01:54	02:08	12:02	20:53	08:26	

December 30, 31, 01 UT (Sat., Sun., Mon.)

	Aries	Venus		Mars		Jupiter		Saturn	
Sat	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	98°37.5	182°03.7	S23°41.6	237°52.2	S14°50.7	234°11.1	S15°47.4	187°22.4	S22°31.9
1	113°40.0	197°02.8	41.5	252°53.1	51.1	249°13.1	47.6	202°24.6	31.9
2	128°42.4	212°01.8	41.5	267°54.0	51.6	264°15.2	47.7	217°26.7	31.9
3	143°44.9	227°00.8	·· 41.4	282°54.9	·· 52.1	279°17.2	·· 47.8	232°28.9	·· 31.9
4	158°47.4	241°59.8	41.4	297°55.9	52.6	294°19.3	47.9	247°31.0	31.9
5	173°49.8	256°58.9	41.3	312°56.8	53.1	309°21.3	48.0	262°33.2	31.9
6	188°52.3	271°57.9	S23°41.3	327°57.7	S14°53.6	324°23.3	S15°48.2	277°35.3	S22°31.9
7	203°54.7	286°56.9	41.2	342°58.7	54.0	339°25.4	48.3	292°37.5	31.9
8	218°57.2	301°56.0	41.2	357°59.6	54.5	354°27.4	48.4	307°39.6	31.9
9	233°59.7	316°55.0	·· 41.1	13°00.5	·· 55.0	9°29.4	·· 48.5	322°41.8	·· 31.9
10	249°02.1	331°54.0	41.1	28°01.5	55.5	24°31.5	48.6	337°43.9	31.9
11	264°04.6	346°53.0	41.0	43°02.4	56.0	39°33.5	48.7	352°46.0	31.9
12	279°07.1	1°52.1	S23°40.9	58°03.3	S14°56.5	54°35.5	S15°48.9	7°48.2	S22°31.9
13	294°09.5	16°51.1	40.9	73°04.2	56.9	69°37.6	49.0	22°50.3	31.9
14	309°12.0	31°50.1	40.8	88°05.2	57.4	84°39.6	49.1	37°52.5	31.9
15	324°14.5	46°49.1	·· 40.7	103°06.1	·· 57.9	99°41.7	·· 49.2	52°54.6	·· 31.9
16	339°16.9	61°48.2	40.7	118°07.0	58.4	114°43.7	49.3	67°56.8	31.9
17	354°19.4	76°47.2	40.6	133°08.0	58.9	129°45.7	49.5	82°58.9	31.9
18	9°21.9	91°46.2	S23°40.5	148°08.9	S14°59.3	144°47.8	S15°49.6	98°01.1	S22°31.9
19	24°24.3	106°45.3	40.5	163°09.8	14°59.8	159°49.8	49.7	113°03.2	31.9
20	39°26.8	121°44.3	40.4	178°10.7	15°00.3	174°51.8	49.8	128°05.4	31.9
21	54°29.2	136°43.3	·· 40.3	193°11.7	·· 00.8	189°53.9	·· 49.9	143°07.5	·· 31.9
22	69°31.7	151°42.3	40.2	208°12.6	01.3	204°55.9	50.0	158°09.7	31.9
23	84°34.2	166°41.4	40.2	223°13.5	01.8	219°58.0	50.2	173°11.8	31.9
Mer.pass.:17:23		v-1.0 d0.0 m-3.8		v0.9 d-0.5 m1.5		v2.0 d-0.1 m-1.6		v2.1 d0.0 m0.5	

Sun	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	99°36.6	181°40.4	S23°40.1	238°14.5	S15°02.2	235°00.0	S15°50.3	188°14.0	S22°31.9
1	114°39.1	196°39.4	40.0	253°15.4	02.7	250°02.0	50.4	203°16.1	31.9
2	129°41.6	211°38.5	39.9	268°16.3	03.2	265°04.1	50.5	218°18.2	31.9
3	144°44.0	226°37.5	·· 39.9	283°17.2	·· 03.7	280°06.1	·· 50.6	233°20.4	·· 31.9
4	159°46.5	241°36.5	39.8	298°18.2	04.2	295°08.1	50.7	248°22.5	31.9
5	174°49.0	256°35.6	39.7	313°19.1	04.6	310°10.2	50.9	263°24.7	31.9
6	189°51.4	271°34.6	S23°39.6	328°20.0	S15°05.1	325°12.2	S15°51.0	278°26.8	S22°31.9
7	204°53.9	286°33.6	39.5	343°20.9	05.6	340°14.3	51.1	293°29.0	31.9
8	219°56.3	301°32.6	39.4	358°21.9	06.1	355°16.3	51.2	308°31.1	31.9
9	234°58.8	316°31.7	·· 39.3	13°22.8	·· 06.6	10°18.3	·· 51.3	323°33.3	·· 31.9
10	250°01.3	331°30.7	39.2	28°23.7	07.0	25°20.4	51.4	338°35.4	31.9
11	265°03.7	346°29.7	39.2	43°24.7	07.5	40°22.4	51.6	353°37.6	31.9
12	280°06.2	1°28.8	S23°39.1	58°25.6	S15°08.0	55°24.5	S15°51.7	8°39.7	S22°31.9
13	295°08.7	16°27.8	39.0	73°26.5	08.5	70°26.5	51.8	23°41.9	31.9
14	310°11.1	31°26.8	38.9	88°27.4	08.9	85°28.5	51.9	38°44.0	31.9
15	325°13.6	46°25.9	·· 38.8	103°28.4	·· 09.4	100°30.6	·· 52.0	53°46.2	·· 31.9
16	340°16.1	61°24.9	38.7	118°29.3	09.9	115°32.6	52.1	68°48.3	31.9
17	355°18.5	76°23.9	38.6	133°30.2	10.4	130°34.7	52.3	83°50.4	31.9
18	10°21.0	91°22.9	S23°38.5	148°31.1	S15°10.9	145°36.7	S15°52.4	98°52.6	S22°31.9
19	25°23.5	106°22.0	38.4	163°32.1	11.3	160°38.8	52.5	113°54.7	31.9
20	40°25.9	121°21.0	38.3	178°33.0	11.8	175°40.8	52.6	128°56.9	31.9
21	55°28.4	136°20.0	·· 38.2	193°33.9	·· 12.3	190°42.8	·· 52.7	143°59.0	·· 31.9
22	70°30.8	151°19.1	38.1	208°34.8	12.8	205°44.9	52.8	159°01.2	31.9
23	85°33.3	166°18.1	38.0	223°35.8	13.2	220°46.9	52.9	174°03.3	31.9
Mer.pass.:17:19		v-1.0 d0.1 m-3.8		v0.9 d-0.5 m1.5		v2.0 d-0.1 m-1.6		v2.1 d0.0 m0.5	

Mon	**GHA**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**	**GHA**	**Dec**
0	100°35.8	181°17.1	S23°37.9	238°36.7	S15°13.7	235°49.0	S15°53.1	189°05.5	S22°31.9
1	115°38.2	196°16.2	37.7	253°37.6	14.2	250°51.0	53.2	204°07.6	31.9
2	130°40.7	211°15.2	37.6	268°38.5	14.7	265°53.0	53.3	219°09.8	31.9
3	145°43.2	226°14.2	·· 37.5	283°39.5	·· 15.1	280°55.1	·· 53.4	234°11.9	·· 31.9
4	160°45.6	241°13.3	37.4	298°40.4	15.6	295°57.1	53.5	249°14.1	31.9
5	175°48.1	256°12.3	37.3	313°41.3	16.1	310°59.2	53.6	264°16.2	31.9
6	190°50.6	271°11.3	S23°37.2	328°42.2	S15°16.6	326°01.2	S15°53.8	279°18.4	S22°31.9
7	205°53.0	286°10.4	37.1	343°43.2	17.0	341°03.3	53.9	294°20.5	31.9
8	220°55.5	301°09.4	36.9	358°44.1	17.5	356°05.3	54.0	309°22.7	31.9
9	235°58.0	316°08.4	·· 36.8	13°45.0	·· 18.0	11°07.4	·· 54.1	324°24.8	·· 31.9
10	251°00.4	331°07.4	36.7	28°45.9	18.5	26°09.4	54.2	339°27.0	31.9
11	266°02.9	346°06.5	36.6	43°46.9	18.9	41°11.4	54.3	354°29.1	31.8
12	281°05.3	1°05.5	S23°36.5	58°47.8	S15°19.4	56°13.5	S15°54.4	9°31.2	S22°31.8
13	296°07.8	16°04.5	36.3	73°48.7	19.9	71°15.5	54.6	24°33.4	31.8
14	311°10.3	31°03.6	36.2	88°49.6	20.4	86°17.6	54.7	39°35.5	31.8
15	326°12.7	46°02.6	·· 36.1	103°50.6	·· 20.8	101°19.6	·· 54.8	54°37.7	·· 31.8
16	341°15.2	61°01.6	36.0	118°51.5	21.3	116°21.7	54.9	69°39.8	31.8
17	356°17.7	76°00.7	35.8	133°52.4	21.8	131°23.7	55.0	84°42.0	31.8
18	11°20.1	90°59.7	S23°35.7	148°53.3	S15°22.3	146°25.8	S15°55.1	99°44.1	S22°31.8
19	26°22.6	105°58.7	35.6	163°54.3	22.7	161°27.8	55.2	114°46.3	31.8
20	41°25.1	120°57.8	35.4	178°55.2	23.2	176°29.8	55.4	129°48.4	31.8
21	56°27.5	135°56.8	·· 35.3	193°56.1	·· 23.7	191°31.9	·· 55.5	144°50.6	·· 31.8
22	71°30.0	150°55.8	35.2	208°57.0	24.1	206°33.9	55.6	159°52.7	31.8
23	86°32.5	165°54.9	35.0	223°58.0	24.6	221°36.0	55.7	174°54.9	31.8
Mer.pass.:17:15		v-1.0 d0.1 m-3.8		v0.9 d-0.5 m1.5		v2.0 d-0.1 m-1.7		v2.1 d0.0 m0.5	

Stars

	SHA	Dec
Alpheratz	357°40.3	29°11.4
Ankaa	353°12.7	-42°12.8
Schedar	349°36.9	56°38.3
Diphda	348°52.8	-17°53.5
Achernar	335°24.4	-57°09.2
Hamal	327°57.1	23°32.8
Polaris	316°05.5	89°20.5
Acamar	315°15.8	-40°14.3
Menkar	314°11.6	4°09.4
Mirfak	308°35.5	49°55.5
Aldebaran	290°45.5	16°32.5
Rigel	281°08.8	-8°11.1
Capella	280°29.4	46°00.8
Bellatrix	278°28.4	6°21.7
Elnath	278°08.4	28°37.2
Alnilam	275°42.9	-1°11.7
Betelgeuse	270°57.6	7°24.4
Canopus	263°54.2	-52°42.5
Sirius	258°30.7	-16°44.6
Adhara	255°09.7	-29°00.0
Procyon	244°56.2	5°10.5
Pollux	243°23.6	27°58.7
Avior	234°16.1	-59°34.0
Suhail	222°49.8	-43°30.3
Miaplacidus	221°38.2	-69°47.3
Alphard	217°52.8	-8°44.2
Regulus	207°40.1	11°52.6
Dubhe	193°47.8	61°39.0
Denebola	182°30.5	14°28.2
Gienah	175°49.1	-17°38.3
Acrux	173°05.7	-63°11.5
Gacrux	171°57.4	-57°12.5
Alioth	166°18.1	55°51.5
Spica	158°28.1	-11°15.1
Alkaid	152°56.7	49°13.3
Hadar	148°43.7	-60°27.1
Menkent	148°04.1	-36°27.2
Arcturus	145°53.1	19°05.4
Rigil Kent.	139°47.8	-60°54.1
Kochab	137°20.9	74°04.8
Zuben'ubi	137°02.2	-16°06.7
Alphecca	126°08.7	26°39.3
Antares	112°22.8	-26°28.0
Atria	107°22.4	-69°03.2
Sabik	102°09.4	-15°44.6
Shaula	96°18.2	-37°06.7
Rasalhague	96°03.9	12°33.0
Eltanin	90°45.3	51°29.3
Kaus Aust.	83°40.2	-34°22.4
Vega	80°37.3	38°48.2
Nunki	75°54.9	-26°16.3
Altair	62°05.6	8°55.1
Peacock	53°15.0	-56°40.6
Deneb	49°29.8	45°20.9
Enif	33°44.3	9°57.5
Al Na'ir	27°40.3	-46°52.6
Fomalhaut	15°20.8	-29°31.8
Scheat	13°50.5	28°10.9
Markab	13°35.4	15°18.2

Dec 30 Sat	**SHA**	**Mer.pass**
Venus	83°26.2	11:53
Mars	139°14.7	08:08
Jupiter	135°33.6	08:22
Saturn	88°44.9	11:29

Dec 31 Sun	**SHA**	**Mer.pass**
Venus	82°03.8	11:54
Mars	138°37.8	08:07
Jupiter	135°23.4	08:19
Saturn	88°37.3	11:25

Jan 01 Mon	**SHA**	**Mer.pass**
Venus	80°41.4	11:56
Mars	138°00.9	08:05
Jupiter	135°13.2	08:16
Saturn	88°29.7	11:22

Horizontal parallax	
Venus:	0.1
Mars:	0.1

DUT1 = UT1-UTC = +0.2185 sec ΔT = TT-UT1 = +68.9655 sec

2017 December 30 to Jan. 01 UT

h — Sun — Moon

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°24.3	S23°09.9	44°56.0	7.0'	N13°59.1	9.2'	60.2'
1	194°24.0	09.7	59°22.0	6.9'	14°08.2	9.1'	60.2'
2	209°23.7	09.5	73°47.8	6.8'	14°17.3	9.0'	60.2'
3	224°23.4	·· 09.4	88°13.6	6.7'	14°26.2	8.9'	60.3'
4	239°23.1	09.2	102°39.3	6.6'	14°35.1	8.8'	60.3'
5	254°22.8	09.0	117°04.9	6.5'	14°43.9	8.7'	60.3'
6	269°22.5	S23°08.9	131°30.3	6.4'	N14°52.6	8.7'	60.4'
7	284°22.2	08.7	145°55.7	6.4'	15°01.2	8.6'	60.4'
8	299°21.9	08.5	160°21.0	6.3'	15°09.7	8.5'	60.4'
9	314°21.6	·· 08.4	174°46.3	6.2'	15°18.1	8.4'	60.4'
10	329°21.3	08.2	189°11.4	6.1'	15°26.4	8.3'	60.5'
11	344°21.0	08.0	203°36.4	6.0'	15°34.7	8.2'	60.5'
12	359°20.7	S23°07.9	218°01.4	5.9'	N15°42.8	8.1'	60.5'
13	14°20.4	07.7	232°26.2	5.8'	15°50.9	8.0'	60.6'
14	29°20.1	07.5	246°51.0	5.7'	15°58.8	7.9'	60.6'
15	44°19.8	·· 07.3	261°15.7	5.6'	16°06.6	7.8'	60.6'
16	59°19.5	07.2	275°40.3	5.5'	16°14.4	7.7'	60.7'
17	74°19.2	07.0	290°04.8	5.5'	16°22.0	7.6'	60.7'
18	89°18.9	S23°06.8	304°29.2	5.4'	N16°29.5	7.5'	60.7'
19	104°18.6	06.6	318°53.5	5.3'	16°37.0	7.4'	60.7'
20	119°18.4	06.5	333°17.7	5.2'	16°44.3	7.3'	60.8'
21	134°18.1	·· 06.3	347°41.9	5.1'	16°51.5	7.1'	60.8'
22	149°17.8	06.1	2°06.0	5.0'	16°58.6	7.0'	60.8'
23	164°17.5	05.9	16°29.9	4.9'	17°05.5	6.9'	60.8'
	SD.=16.3	d=0.2	S.D.=16.5				

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°17.2	S23°05.7	30°53.8	4.9'	N17°12.4	6.8'	60.9'
1	194°16.9	05.6	45°17.7	4.8'	17°19.1	6.7'	60.9'
2	209°16.6	05.4	59°41.4	4.7'	17°25.8	6.6'	60.9'
3	224°16.3	·· 05.2	74°05.1	4.6'	17°32.3	6.4'	60.9'
4	239°16.0	05.0	88°28.7	4.5'	17°38.7	6.3'	61.0'
5	254°15.7	04.8	102°52.2	4.5'	17°44.9	6.2'	61.0'
6	269°15.4	S23°04.6	117°15.6	4.4'	N17°51.1	6.1'	61.0'
7	284°15.1	04.4	131°38.9	4.3'	17°57.1	6.0'	61.0'
8	299°14.8	04.3	146°02.2	4.2'	18°03.0	5.8'	61.1'
9	314°14.5	·· 04.1	160°25.4	4.2'	18°08.8	5.7'	61.1'
10	329°14.2	03.9	174°48.6	4.1'	18°14.4	5.6'	61.1'
11	344°13.9	03.7	189°11.6	4.0'	18°19.9	5.4'	61.1'
12	359°13.6	S23°03.5	203°34.6	4.0'	N18°25.3	5.3'	61.1'
13	14°13.3	03.3	217°57.5	3.9'	18°30.5	5.2'	61.2'
14	29°13.0	03.1	232°20.4	3.8'	18°35.6	5.0'	61.2'
15	44°12.7	·· 02.9	246°43.2	3.8'	18°40.6	4.9'	61.2'
16	59°12.4	02.7	261°05.9	3.7'	18°45.5	4.8'	61.2'
17	74°12.1	02.5	275°28.6	3.6'	18°50.2	4.6'	61.2'
18	89°11.8	S23°02.3	289°51.2	3.6'	N18°54.7	4.5'	61.3'
19	104°11.5	02.1	304°13.7	3.5'	18°59.2	4.4'	61.3'
20	119°11.2	01.9	318°36.2	3.5'	19°03.4	4.2'	61.3'
21	134°10.9	·· 01.7	332°58.7	3.4'	19°07.6	4.1'	61.3'
22	149°10.6	01.5	347°21.1	3.4'	19°11.6	3.9'	61.3'
23	164°10.3	01.3	1°43.4	3.3'	19°15.5	3.8'	61.3'
	SD.=16.3	d=0.2	S.D.=16.7				

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°10.1	S23°01.1	16°05.7	3.3'	N19°19.2	3.6'	61.3'
1	194°09.8	00.9	30°27.9	3.2'	19°22.7	3.5'	61.4'
2	209°09.5	00.7	44°50.1	3.2'	19°26.2	3.4'	61.4'
3	224°09.2	·· 00.5	59°12.2	3.1'	19°29.5	3.2'	61.4'
4	239°08.9	00.3	73°34.3	3.1'	19°32.6	3.1'	61.4'
5	254°08.6	23°00.1	87°56.4	3.0'	19°35.6	2.9'	61.4'
6	269°08.3	S22°59.9	102°18.4	3.0'	N19°38.4	2.8'	61.4'
7	284°08.0	59.7	116°40.4	3.0'	19°41.1	2.6'	61.4'
8	299°07.7	59.5	131°02.3	2.9'	19°43.6	2.5'	61.4'
9	314°07.4	·· 59.3	145°24.2	2.9'	19°46.0	2.3'	61.4'
10	329°07.1	59.1	159°46.1	2.9'	19°48.2	2.2'	61.4'
11	344°06.8	58.9	174°08.0	2.8'	19°50.3	2.0'	61.4'
12	359°06.5	S22°58.7	188°29.8	2.8'	N19°52.3	1.9'	61.5'
13	14°06.2	58.5	202°51.6	2.8'	19°54.0	1.7'	61.5'
14	29°05.9	58.3	217°13.4	2.8'	19°55.7	1.5'	61.5'
15	44°05.6	·· 58.0	231°35.1	2.7'	19°57.1	1.4'	61.5'
16	59°05.4	57.8	245°56.9	2.7'	19°58.4	1.2'	61.5'
17	74°05.1	57.6	260°18.6	2.7'	19°59.6	1.1'	61.5'
18	89°04.8	S22°57.4	274°40.3	2.7'	N20°00.6	0.9'	61.5'
19	104°04.5	57.2	289°02.0	2.7'	20°01.5	0.8'	61.5'
20	119°04.2	57.0	303°23.7	2.7'	20°02.2	0.6'	61.5'
21	134°03.9	·· 56.8	317°45.4	2.7'	20°02.7	0.5'	61.5'
22	149°03.6	56.5	332°07.1	2.7'	20°03.1	0.3'	61.5'
23	164°03.3	56.3	346°28.7	2.7'	20°03.3	0.2'	61.5'
	SD.=16.3	d=0.2	S.D.=16.7				

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Sunset	Twilight Civil	Twilight Naut.
N 72°	08:25	10:45	▬	▬	13:21	15:42
N 70°	08:06	09:51	▬	▬	14:16	16:01
68°	07:50	09:18	▬	▬	14:49	16:16
66°	07:38	08:54	10:29	13:37	15:13	16:29
64°	07:27	08:35	09:50	14:16	15:32	16:40
62°	07:18	08:19	09:23	14:43	15:47	16:49
60°	07:09	08:06	09:03	15:04	16:01	16:57
N 58°	07:02	07:54	08:46	15:21	16:12	17:04
56°	06:56	07:44	08:31	15:35	16:22	17:11
54°	06:50	07:36	08:19	15:47	16:31	17:17
52°	06:44	07:28	08:08	15:58	16:39	17:22
50°	06:39	07:20	07:59	16:08	16:46	17:27
45°	06:27	07:05	07:38	16:28	17:02	17:39
N 40°	06:17	06:51	07:22	16:45	17:15	17:49
35°	06:08	06:40	07:08	16:59	17:27	17:58
30°	06:00	06:29	06:56	17:11	17:37	18:07
20°	05:43	06:11	06:35	17:31	17:55	18:23
N 10°	05:27	05:54	06:17	17:50	18:12	18:39
0°	05:11	05:37	05:59	18:07	18:29	18:55
S 10°	04:52	05:19	05:42	18:24	18:47	19:14
20°	04:30	04:59	05:23	18:43	19:07	19:36
30°	04:01	04:34	05:02	19:04	19:32	20:05
35°	03:43	04:19	04:49	19:17	19:47	20:23
40°	03:20	04:01	04:34	19:32	20:05	20:46
45°	02:50	03:39	04:16	19:50	20:27	21:16
S 50°	02:06	03:10	03:54	20:12	20:56	22:00
52°	01:39	02:55	03:44	20:22	21:10	22:26
54°	00:58	02:38	03:32	20:34	21:28	23:06
56°	▭	02:16	03:18	20:48	21:49	▭
58°	▭	01:48	03:01	21:04	22:17	▭
S 60°	▭	01:03	02:41	21:24	23:01	▭

Lat.	Moonrise Sat	Moonrise Sun	Moonrise Mon	Moonset Sat	Moonset Sun	Moonset Mon
N 72°	11:33	▭	▭	06:55	▭	▭
N 70°	12:09	12:06	12:08	06:20	08:28	10:38
68°	12:34	12:48	13:19	05:56	07:47	09:27
66°	12:54	13:16	13:56	05:37	07:19	08:50
64°	13:10	13:38	14:22	05:22	06:58	08:24
62°	13:23	13:56	14:43	05:09	06:41	08:04
60°	13:35	14:10	15:00	04:58	06:26	07:47
N 58°	13:45	14:23	15:14	04:49	06:14	07:33
56°	13:53	14:33	15:26	04:41	06:04	07:21
54°	14:01	14:43	15:37	04:34	05:55	07:10
52°	14:08	14:52	15:46	04:27	05:46	07:01
50°	14:14	14:59	15:55	04:22	05:39	06:53
45°	14:28	15:16	16:13	04:09	05:23	06:35
N 40°	14:39	15:29	16:27	03:59	05:10	06:20
35°	14:49	15:41	16:40	03:50	04:59	06:08
30°	14:57	15:51	16:51	03:42	04:50	05:57
20°	15:12	16:08	17:10	03:29	04:33	05:39
N 10°	15:25	16:24	17:26	03:18	04:19	05:23
0°	15:37	16:38	17:41	03:07	04:06	05:08
S 10°	15:49	16:52	17:57	02:56	03:52	04:53
20°	16:03	17:08	18:13	02:44	03:38	04:37
30°	16:18	17:26	18:32	02:31	03:22	04:18
35°	16:26	17:36	18:43	02:24	03:12	04:07
40°	16:37	17:48	18:56	02:15	03:01	03:55
45°	16:48	18:02	19:11	02:05	02:49	03:41
S 50°	17:03	18:19	19:29	01:53	02:33	03:23
52°	17:10	18:27	19:38	01:47	02:26	03:15
54°	17:17	18:36	19:48	01:41	02:18	03:05
56°	17:26	18:47	19:59	01:34	02:09	02:55
58°	17:35	18:58	20:11	01:27	01:59	02:43
S 60°	17:46	19:12	20:26	01:18	01:47	02:29

Day	Sun Eqn.of Time 00h mm:ss	Sun Eqn.of Time 12h mm:ss	Sun Mer. Pass hh:mm	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Moon Age 12-14 90-99%
30	02:23	02:37	12:03	21:51	09:22	
31	02:51	03:06	12:03	22:53	10:22	
01	03:20	03:34	12:04	23:56	11:25	

Increments and Corrections

m 0	Sun Plan.	Aries	Moon	v and d corr		
0	0°00.0	0°00.0	0°00.0	0.0 - 0.0	6.0 - 0.1	12.0 - 0.1
1	0°00.3	0°00.3	0°00.2	0.1 - 0.0	6.1 - 0.1	12.1 - 0.1
2	0°00.5	0°00.5	0°00.5	0.2 - 0.0	6.2 - 0.1	12.2 - 0.1
3	0°00.8	0°00.8	0°00.7	0.3 - 0.0	6.3 - 0.1	12.3 - 0.1
4	0°01.0	0°01.0	0°01.0	0.4 - 0.0	6.4 - 0.1	12.4 - 0.1
5	0°01.3	0°01.3	0°01.2	0.5 - 0.0	6.5 - 0.1	12.5 - 0.1
6	0°01.5	0°01.5	0°01.4	0.6 - 0.0	6.6 - 0.1	12.6 - 0.1
7	0°01.8	0°01.8	0°01.7	0.7 - 0.0	6.7 - 0.1	12.7 - 0.1
8	0°02.0	0°02.0	0°01.9	0.8 - 0.0	6.8 - 0.1	12.8 - 0.1
9	0°02.3	0°02.3	0°02.1	0.9 - 0.0	6.9 - 0.1	12.9 - 0.1
10	0°02.5	0°02.5	0°02.4	1.0 - 0.0	7.0 - 0.1	13.0 - 0.1
11	0°02.8	0°02.8	0°02.6	1.1 - 0.0	7.1 - 0.1	13.1 - 0.1
12	0°03.0	0°03.0	0°02.9	1.2 - 0.0	7.2 - 0.1	13.2 - 0.1
13	0°03.3	0°03.3	0°03.1	1.3 - 0.0	7.3 - 0.1	13.3 - 0.1
14	0°03.5	0°03.5	0°03.3	1.4 - 0.0	7.4 - 0.1	13.4 - 0.1
15	0°03.8	0°03.8	0°03.6	1.5 - 0.0	7.5 - 0.1	13.5 - 0.1
16	0°04.0	0°04.0	0°03.8	1.6 - 0.0	7.6 - 0.1	13.6 - 0.1
17	0°04.3	0°04.3	0°04.1	1.7 - 0.0	7.7 - 0.1	13.7 - 0.1
18	0°04.5	0°04.5	0°04.3	1.8 - 0.0	7.8 - 0.1	13.8 - 0.1
19	0°04.8	0°04.8	0°04.5	1.9 - 0.0	7.9 - 0.1	13.9 - 0.1
20	0°05.0	0°05.0	0°04.8	2.0 - 0.0	8.0 - 0.1	14.0 - 0.1
21	0°05.3	0°05.3	0°05.0	2.1 - 0.0	8.1 - 0.1	14.1 - 0.1
22	0°05.5	0°05.5	0°05.2	2.2 - 0.0	8.2 - 0.1	14.2 - 0.1
23	0°05.8	0°05.8	0°05.5	2.3 - 0.0	8.3 - 0.1	14.3 - 0.1
24	0°06.0	0°06.0	0°05.7	2.4 - 0.0	8.4 - 0.1	14.4 - 0.1
25	0°06.3	0°06.3	0°06.0	2.5 - 0.0	8.5 - 0.1	14.5 - 0.1
26	0°06.5	0°06.5	0°06.2	2.6 - 0.0	8.6 - 0.1	14.6 - 0.1
27	0°06.8	0°06.8	0°06.4	2.7 - 0.0	8.7 - 0.1	14.7 - 0.1
28	0°07.0	0°07.0	0°06.7	2.8 - 0.0	8.8 - 0.1	14.8 - 0.1
29	0°07.3	0°07.3	0°06.9	2.9 - 0.0	8.9 - 0.1	14.9 - 0.1
30	0°07.5	0°07.5	0°07.2	3.0 - 0.0	9.0 - 0.1	15.0 - 0.1
31	0°07.8	0°07.8	0°07.4	3.1 - 0.0	9.1 - 0.1	15.1 - 0.1
32	0°08.0	0°08.0	0°07.6	3.2 - 0.0	9.2 - 0.1	15.2 - 0.1
33	0°08.3	0°08.3	0°07.9	3.3 - 0.0	9.3 - 0.1	15.3 - 0.1
34	0°08.5	0°08.5	0°08.1	3.4 - 0.0	9.4 - 0.1	15.4 - 0.1
35	0°08.8	0°08.8	0°08.4	3.5 - 0.0	9.5 - 0.1	15.5 - 0.1
36	0°09.0	0°09.0	0°08.6	3.6 - 0.0	9.6 - 0.1	15.6 - 0.1
37	0°09.3	0°09.3	0°08.8	3.7 - 0.0	9.7 - 0.1	15.7 - 0.1
38	0°09.5	0°09.5	0°09.1	3.8 - 0.0	9.8 - 0.1	15.8 - 0.1
39	0°09.8	0°09.8	0°09.3	3.9 - 0.0	9.9 - 0.1	15.9 - 0.1
40	0°10.0	0°10.0	0°09.5	4.0 - 0.0	10.0 - 0.1	16.0 - 0.1
41	0°10.3	0°10.3	0°09.8	4.1 - 0.0	10.1 - 0.1	16.1 - 0.1
42	0°10.5	0°10.5	0°10.0	4.2 - 0.0	10.2 - 0.1	16.2 - 0.1
43	0°10.8	0°10.8	0°10.3	4.3 - 0.0	10.3 - 0.1	16.3 - 0.1
44	0°11.0	0°11.0	0°10.5	4.4 - 0.0	10.4 - 0.1	16.4 - 0.1
45	0°11.3	0°11.3	0°10.7	4.5 - 0.0	10.5 - 0.1	16.5 - 0.1
46	0°11.5	0°11.5	0°11.0	4.6 - 0.0	10.6 - 0.1	16.6 - 0.1
47	0°11.8	0°11.8	0°11.2	4.7 - 0.0	10.7 - 0.1	16.7 - 0.1
48	0°12.0	0°12.0	0°11.5	4.8 - 0.0	10.8 - 0.1	16.8 - 0.1
49	0°12.3	0°12.3	0°11.7	4.9 - 0.0	10.9 - 0.1	16.9 - 0.1
50	0°12.5	0°12.5	0°11.9	5.0 - 0.0	11.0 - 0.1	17.0 - 0.1
51	0°12.8	0°12.8	0°12.2	5.1 - 0.0	11.1 - 0.1	17.1 - 0.1
52	0°13.0	0°13.0	0°12.4	5.2 - 0.0	11.2 - 0.1	17.2 - 0.1
53	0°13.3	0°13.3	0°12.6	5.3 - 0.0	11.3 - 0.1	17.3 - 0.1
54	0°13.5	0°13.5	0°12.9	5.4 - 0.0	11.4 - 0.1	17.4 - 0.1
55	0°13.8	0°13.8	0°13.1	5.5 - 0.0	11.5 - 0.1	17.5 - 0.1
56	0°14.0	0°14.0	0°13.4	5.6 - 0.0	11.6 - 0.1	17.6 - 0.1
57	0°14.2	0°14.3	0°13.6	5.7 - 0.0	11.7 - 0.1	17.7 - 0.1
58	0°14.5	0°14.5	0°13.8	5.8 - 0.0	11.8 - 0.1	17.8 - 0.1
59	0°14.7	0°14.8	0°14.1	5.9 - 0.0	11.9 - 0.1	17.9 - 0.1

m 1	Sun Plan.	Aries	Moon	v and d corr		
0	0°15.0	0°15.0	0°14.3	0.0 - 0.0	6.0 - 0.2	12.0 - 0.3
1	0°15.3	0°15.3	0°14.6	0.1 - 0.0	6.1 - 0.2	12.1 - 0.3
2	0°15.5	0°15.5	0°14.8	0.2 - 0.0	6.2 - 0.2	12.2 - 0.3
3	0°15.8	0°15.8	0°15.0	0.3 - 0.0	6.3 - 0.2	12.3 - 0.3
4	0°16.0	0°16.0	0°15.3	0.4 - 0.0	6.4 - 0.2	12.4 - 0.3
5	0°16.3	0°16.3	0°15.5	0.5 - 0.0	6.5 - 0.2	12.5 - 0.3
6	0°16.5	0°16.5	0°15.7	0.6 - 0.0	6.6 - 0.2	12.6 - 0.3
7	0°16.8	0°16.8	0°16.0	0.7 - 0.0	6.7 - 0.2	12.7 - 0.3
8	0°17.0	0°17.0	0°16.2	0.8 - 0.0	6.8 - 0.2	12.8 - 0.3
9	0°17.3	0°17.3	0°16.5	0.9 - 0.0	6.9 - 0.2	12.9 - 0.3
10	0°17.5	0°17.5	0°16.7	1.0 - 0.0	7.0 - 0.2	13.0 - 0.3
11	0°17.8	0°17.8	0°16.9	1.1 - 0.0	7.1 - 0.2	13.1 - 0.3
12	0°18.0	0°18.0	0°17.2	1.2 - 0.0	7.2 - 0.2	13.2 - 0.3
13	0°18.3	0°18.3	0°17.4	1.3 - 0.0	7.3 - 0.2	13.3 - 0.3
14	0°18.5	0°18.6	0°17.7	1.4 - 0.0	7.4 - 0.2	13.4 - 0.3
15	0°18.8	0°18.8	0°17.9	1.5 - 0.0	7.5 - 0.2	13.5 - 0.3
16	0°19.0	0°19.1	0°18.1	1.6 - 0.0	7.6 - 0.2	13.6 - 0.3
17	0°19.3	0°19.3	0°18.4	1.7 - 0.0	7.7 - 0.2	13.7 - 0.3
18	0°19.5	0°19.6	0°18.6	1.8 - 0.0	7.8 - 0.2	13.8 - 0.3
19	0°19.8	0°19.8	0°18.9	1.9 - 0.0	7.9 - 0.2	13.9 - 0.3
20	0°20.0	0°20.1	0°19.1	2.0 - 0.1	8.0 - 0.2	14.0 - 0.4
21	0°20.3	0°20.3	0°19.3	2.1 - 0.1	8.1 - 0.2	14.1 - 0.4
22	0°20.5	0°20.6	0°19.6	2.2 - 0.1	8.2 - 0.2	14.2 - 0.4
23	0°20.8	0°20.8	0°19.8	2.3 - 0.1	8.3 - 0.2	14.3 - 0.4
24	0°21.0	0°21.1	0°20.0	2.4 - 0.1	8.4 - 0.2	14.4 - 0.4
25	0°21.3	0°21.3	0°20.3	2.5 - 0.1	8.5 - 0.2	14.5 - 0.4
26	0°21.5	0°21.6	0°20.5	2.6 - 0.1	8.6 - 0.2	14.6 - 0.4
27	0°21.8	0°21.8	0°20.8	2.7 - 0.1	8.7 - 0.2	14.7 - 0.4
28	0°22.0	0°22.1	0°21.0	2.8 - 0.1	8.8 - 0.2	14.8 - 0.4
29	0°22.3	0°22.3	0°21.2	2.9 - 0.1	8.9 - 0.2	14.9 - 0.4
30	0°22.5	0°22.6	0°21.5	3.0 - 0.1	9.0 - 0.2	15.0 - 0.4
31	0°22.8	0°22.8	0°21.7	3.1 - 0.1	9.1 - 0.2	15.1 - 0.4
32	0°23.0	0°23.1	0°22.0	3.2 - 0.1	9.2 - 0.2	15.2 - 0.4
33	0°23.3	0°23.3	0°22.2	3.3 - 0.1	9.3 - 0.2	15.3 - 0.4
34	0°23.5	0°23.6	0°22.4	3.4 - 0.1	9.4 - 0.2	15.4 - 0.4
35	0°23.8	0°23.8	0°22.7	3.5 - 0.1	9.5 - 0.2	15.5 - 0.4
36	0°24.0	0°24.1	0°22.9	3.6 - 0.1	9.6 - 0.2	15.6 - 0.4
37	0°24.3	0°24.3	0°23.1	3.7 - 0.1	9.7 - 0.2	15.7 - 0.4
38	0°24.5	0°24.6	0°23.4	3.8 - 0.1	9.8 - 0.2	15.8 - 0.4
39	0°24.8	0°24.8	0°23.6	3.9 - 0.1	9.9 - 0.2	15.9 - 0.4
40	0°25.0	0°25.1	0°23.9	4.0 - 0.1	10.0 - 0.3	16.0 - 0.4
41	0°25.3	0°25.3	0°24.1	4.1 - 0.1	10.1 - 0.3	16.1 - 0.4
42	0°25.5	0°25.6	0°24.3	4.2 - 0.1	10.2 - 0.3	16.2 - 0.4
43	0°25.8	0°25.8	0°24.6	4.3 - 0.1	10.3 - 0.3	16.3 - 0.4
44	0°26.0	0°26.1	0°24.8	4.4 - 0.1	10.4 - 0.3	16.4 - 0.4
45	0°26.3	0°26.3	0°25.1	4.5 - 0.1	10.5 - 0.3	16.5 - 0.4
46	0°26.5	0°26.6	0°25.3	4.6 - 0.1	10.6 - 0.3	16.6 - 0.4
47	0°26.8	0°26.8	0°25.5	4.7 - 0.1	10.7 - 0.3	16.7 - 0.4
48	0°27.0	0°27.1	0°25.8	4.8 - 0.1	10.8 - 0.3	16.8 - 0.4
49	0°27.3	0°27.3	0°26.0	4.9 - 0.1	10.9 - 0.3	16.9 - 0.4
50	0°27.5	0°27.6	0°26.2	5.0 - 0.1	11.0 - 0.3	17.0 - 0.4
51	0°27.8	0°27.8	0°26.5	5.1 - 0.1	11.1 - 0.3	17.1 - 0.4
52	0°28.0	0°28.1	0°26.7	5.2 - 0.1	11.2 - 0.3	17.2 - 0.4
53	0°28.3	0°28.3	0°27.0	5.3 - 0.1	11.3 - 0.3	17.3 - 0.4
54	0°28.5	0°28.6	0°27.2	5.4 - 0.1	11.4 - 0.3	17.4 - 0.4
55	0°28.7	0°28.8	0°27.4	5.5 - 0.1	11.5 - 0.3	17.5 - 0.4
56	0°29.0	0°29.1	0°27.7	5.6 - 0.1	11.6 - 0.3	17.6 - 0.4
57	0°29.3	0°29.3	0°27.9	5.7 - 0.1	11.7 - 0.3	17.7 - 0.4
58	0°29.5	0°29.6	0°28.2	5.8 - 0.1	11.8 - 0.3	17.8 - 0.4
59	0°29.7	0°29.8	0°28.4	5.9 - 0.1	11.9 - 0.3	17.9 - 0.4

m 2	Sun Plan.	Aries	Moon	v and d corr		
0	0°30.0	0°30.1	0°28.6	0.0 - 0.0	6.0 - 0.3	12.0 - 0.5
1	0°30.3	0°30.3	0°28.9	0.1 - 0.0	6.1 - 0.3	12.1 - 0.5
2	0°30.5	0°30.6	0°29.1	0.2 - 0.0	6.2 - 0.3	12.2 - 0.5
3	0°30.7	0°30.8	0°29.3	0.3 - 0.0	6.3 - 0.3	12.3 - 0.5
4	0°31.0	0°31.1	0°29.6	0.4 - 0.0	6.4 - 0.3	12.4 - 0.5
5	0°31.3	0°31.3	0°29.8	0.5 - 0.0	6.5 - 0.3	12.5 - 0.5
6	0°31.5	0°31.6	0°30.1	0.6 - 0.0	6.6 - 0.3	12.6 - 0.5
7	0°31.8	0°31.8	0°30.3	0.7 - 0.0	6.7 - 0.3	12.7 - 0.5
8	0°32.0	0°32.1	0°30.5	0.8 - 0.0	6.8 - 0.3	12.8 - 0.5
9	0°32.3	0°32.3	0°30.8	0.9 - 0.0	6.9 - 0.3	12.9 - 0.5
10	0°32.5	0°32.6	0°31.0	1.0 - 0.0	7.0 - 0.3	13.0 - 0.5
11	0°32.8	0°32.8	0°31.3	1.1 - 0.0	7.1 - 0.3	13.1 - 0.5
12	0°33.0	0°33.1	0°31.5	1.2 - 0.1	7.2 - 0.3	13.2 - 0.5
13	0°33.3	0°33.3	0°31.7	1.3 - 0.1	7.3 - 0.3	13.3 - 0.6
14	0°33.5	0°33.6	0°32.0	1.4 - 0.1	7.4 - 0.3	13.4 - 0.6
15	0°33.8	0°33.8	0°32.2	1.5 - 0.1	7.5 - 0.3	13.5 - 0.6
16	0°34.0	0°34.1	0°32.5	1.6 - 0.1	7.6 - 0.3	13.6 - 0.6
17	0°34.3	0°34.3	0°32.7	1.7 - 0.1	7.7 - 0.3	13.7 - 0.6
18	0°34.5	0°34.6	0°32.9	1.8 - 0.1	7.8 - 0.3	13.8 - 0.6
19	0°34.8	0°34.8	0°33.2	1.9 - 0.1	7.9 - 0.3	13.9 - 0.6
20	0°35.0	0°35.1	0°33.4	2.0 - 0.1	8.0 - 0.3	14.0 - 0.6
21	0°35.3	0°35.3	0°33.6	2.1 - 0.1	8.1 - 0.3	14.1 - 0.6
22	0°35.5	0°35.6	0°33.9	2.2 - 0.1	8.2 - 0.3	14.2 - 0.6
23	0°35.8	0°35.8	0°34.1	2.3 - 0.1	8.3 - 0.3	14.3 - 0.6
24	0°36.0	0°36.1	0°34.4	2.4 - 0.1	8.4 - 0.3	14.4 - 0.6
25	0°36.3	0°36.3	0°34.6	2.5 - 0.1	8.5 - 0.4	14.5 - 0.6
26	0°36.5	0°36.6	0°34.8	2.6 - 0.1	8.6 - 0.4	14.6 - 0.6
27	0°36.8	0°36.9	0°35.1	2.7 - 0.1	8.7 - 0.4	14.7 - 0.6
28	0°37.0	0°37.1	0°35.3	2.8 - 0.1	8.8 - 0.4	14.8 - 0.6
29	0°37.3	0°37.4	0°35.6	2.9 - 0.1	8.9 - 0.4	14.9 - 0.6
30	0°37.5	0°37.6	0°35.8	3.0 - 0.1	9.0 - 0.4	15.0 - 0.6
31	0°37.8	0°37.9	0°36.0	3.1 - 0.1	9.1 - 0.4	15.1 - 0.6
32	0°38.0	0°38.1	0°36.3	3.2 - 0.1	9.2 - 0.4	15.2 - 0.6
33	0°38.3	0°38.4	0°36.5	3.3 - 0.1	9.3 - 0.4	15.3 - 0.6
34	0°38.5	0°38.6	0°36.7	3.4 - 0.1	9.4 - 0.4	15.4 - 0.6
35	0°38.8	0°38.9	0°37.0	3.5 - 0.1	9.5 - 0.4	15.5 - 0.6
36	0°39.0	0°39.1	0°37.2	3.6 - 0.1	9.6 - 0.4	15.6 - 0.6
37	0°39.3	0°39.4	0°37.5	3.7 - 0.2	9.7 - 0.4	15.7 - 0.7
38	0°39.5	0°39.6	0°37.7	3.8 - 0.2	9.8 - 0.4	15.8 - 0.7
39	0°39.8	0°39.9	0°37.9	3.9 - 0.2	9.9 - 0.4	15.9 - 0.7
40	0°40.0	0°40.1	0°38.2	4.0 - 0.2	10.0 - 0.4	16.0 - 0.7
41	0°40.3	0°40.4	0°38.4	4.1 - 0.2	10.1 - 0.4	16.1 - 0.7
42	0°40.5	0°40.6	0°38.7	4.2 - 0.2	10.2 - 0.4	16.2 - 0.7
43	0°40.8	0°40.9	0°38.9	4.3 - 0.2	10.3 - 0.4	16.3 - 0.7
44	0°41.0	0°41.1	0°39.1	4.4 - 0.2	10.4 - 0.4	16.4 - 0.7
45	0°41.3	0°41.4	0°39.4	4.5 - 0.2	10.5 - 0.4	16.5 - 0.7
46	0°41.5	0°41.6	0°39.6	4.6 - 0.2	10.6 - 0.4	16.6 - 0.7
47	0°41.8	0°41.9	0°39.8	4.7 - 0.2	10.7 - 0.4	16.7 - 0.7
48	0°42.0	0°42.1	0°40.1	4.8 - 0.2	10.8 - 0.5	16.8 - 0.7
49	0°42.3	0°42.4	0°40.3	4.9 - 0.2	10.9 - 0.5	16.9 - 0.7
50	0°42.5	0°42.6	0°40.6	5.0 - 0.2	11.0 - 0.5	17.0 - 0.7
51	0°42.8	0°42.9	0°40.8	5.1 - 0.2	11.1 - 0.5	17.1 - 0.7
52	0°43.0	0°43.1	0°41.0	5.2 - 0.2	11.2 - 0.5	17.2 - 0.7
53	0°43.3	0°43.4	0°41.3	5.3 - 0.2	11.3 - 0.5	17.3 - 0.7
54	0°43.5	0°43.6	0°41.5	5.4 - 0.2	11.4 - 0.5	17.4 - 0.7
55	0°43.8	0°43.9	0°41.8	5.5 - 0.2	11.5 - 0.5	17.5 - 0.7
56	0°44.0	0°44.1	0°42.0	5.6 - 0.2	11.6 - 0.5	17.6 - 0.7
57	0°44.3	0°44.4	0°42.2	5.7 - 0.2	11.7 - 0.5	17.7 - 0.7
58	0°44.5	0°44.6	0°42.5	5.8 - 0.2	11.8 - 0.5	17.8 - 0.7
59	0°44.8	0°44.9	0°42.7	5.9 - 0.2	11.9 - 0.5	17.9 - 0.7

Increments and Corrections

m 3	Sun Plan.	Aries	Moon	v and d corr		
0	0°45.0	0°45.1	0°43.0	0.0 - 0.0	6.0 - 0.3	12.0 - 0.7
1	0°45.3	0°45.4	0°43.2	0.1 - 0.0	6.1 - 0.4	12.1 - 0.7
2	0°45.5	0°45.6	0°43.4	0.2 - 0.0	6.2 - 0.4	12.2 - 0.7
3	0°45.8	0°45.9	0°43.7	0.3 - 0.0	6.3 - 0.4	12.3 - 0.7
4	0°46.0	0°46.1	0°43.9	0.4 - 0.0	6.4 - 0.4	12.4 - 0.7
5	0°46.3	0°46.4	0°44.1	0.5 - 0.0	6.5 - 0.4	12.5 - 0.7
6	0°46.5	0°46.6	0°44.4	0.6 - 0.0	6.6 - 0.4	12.6 - 0.7
7	0°46.8	0°46.9	0°44.6	0.7 - 0.0	6.7 - 0.4	12.7 - 0.7
8	0°47.0	0°47.1	0°44.9	0.8 - 0.0	6.8 - 0.4	12.8 - 0.7
9	0°47.3	0°47.4	0°45.1	0.9 - 0.1	6.9 - 0.4	12.9 - 0.8
10	0°47.5	0°47.6	0°45.3	1.0 - 0.1	7.0 - 0.4	13.0 - 0.8
11	0°47.8	0°47.9	0°45.6	1.1 - 0.1	7.1 - 0.4	13.1 - 0.8
12	0°48.0	0°48.1	0°45.8	1.2 - 0.1	7.2 - 0.4	13.2 - 0.8
13	0°48.3	0°48.4	0°46.1	1.3 - 0.1	7.3 - 0.4	13.3 - 0.8
14	0°48.5	0°48.6	0°46.3	1.4 - 0.1	7.4 - 0.4	13.4 - 0.8
15	0°48.8	0°48.9	0°46.5	1.5 - 0.1	7.5 - 0.4	13.5 - 0.8
16	0°49.0	0°49.1	0°46.8	1.6 - 0.1	7.6 - 0.4	13.6 - 0.8
17	0°49.3	0°49.4	0°47.0	1.7 - 0.1	7.7 - 0.4	13.7 - 0.8
18	0°49.5	0°49.6	0°47.2	1.8 - 0.1	7.8 - 0.5	13.8 - 0.8
19	0°49.8	0°49.9	0°47.5	1.9 - 0.1	7.9 - 0.5	13.9 - 0.8
20	0°50.0	0°50.1	0°47.7	2.0 - 0.1	8.0 - 0.5	14.0 - 0.8
21	0°50.3	0°50.4	0°48.0	2.1 - 0.1	8.1 - 0.5	14.1 - 0.8
22	0°50.5	0°50.6	0°48.2	2.2 - 0.1	8.2 - 0.5	14.2 - 0.8
23	0°50.8	0°50.9	0°48.4	2.3 - 0.1	8.3 - 0.5	14.3 - 0.8
24	0°51.0	0°51.1	0°48.7	2.4 - 0.1	8.4 - 0.5	14.4 - 0.8
25	0°51.3	0°51.4	0°48.9	2.5 - 0.1	8.5 - 0.5	14.5 - 0.8
26	0°51.5	0°51.6	0°49.2	2.6 - 0.2	8.6 - 0.5	14.6 - 0.9
27	0°51.8	0°51.9	0°49.4	2.7 - 0.2	8.7 - 0.5	14.7 - 0.9
28	0°52.0	0°52.1	0°49.6	2.8 - 0.2	8.8 - 0.5	14.8 - 0.9
29	0°52.3	0°52.4	0°49.9	2.9 - 0.2	8.9 - 0.5	14.9 - 0.9
30	0°52.5	0°52.6	0°50.1	3.0 - 0.2	9.0 - 0.5	15.0 - 0.9
31	0°52.8	0°52.9	0°50.3	3.1 - 0.2	9.1 - 0.5	15.1 - 0.9
32	0°53.0	0°53.1	0°50.6	3.2 - 0.2	9.2 - 0.5	15.2 - 0.9
33	0°53.3	0°53.4	0°50.8	3.3 - 0.2	9.3 - 0.5	15.3 - 0.9
34	0°53.5	0°53.6	0°51.1	3.4 - 0.2	9.4 - 0.5	15.4 - 0.9
35	0°53.8	0°53.9	0°51.3	3.5 - 0.2	9.5 - 0.6	15.5 - 0.9
36	0°54.0	0°54.1	0°51.5	3.6 - 0.2	9.6 - 0.6	15.6 - 0.9
37	0°54.3	0°54.4	0°51.8	3.7 - 0.2	9.7 - 0.6	15.7 - 0.9
38	0°54.5	0°54.6	0°52.0	3.8 - 0.2	9.8 - 0.6	15.8 - 0.9
39	0°54.8	0°54.9	0°52.3	3.9 - 0.2	9.9 - 0.6	15.9 - 0.9
40	0°55.0	0°55.2	0°52.5	4.0 - 0.2	10.0 - 0.6	16.0 - 0.9
41	0°55.3	0°55.4	0°52.7	4.1 - 0.2	10.1 - 0.6	16.1 - 0.9
42	0°55.5	0°55.7	0°53.0	4.2 - 0.2	10.2 - 0.6	16.2 - 0.9
43	0°55.8	0°55.9	0°53.2	4.3 - 0.3	10.3 - 0.6	16.3 - 1.0
44	0°56.0	0°56.2	0°53.4	4.4 - 0.3	10.4 - 0.6	16.4 - 1.0
45	0°56.3	0°56.4	0°53.7	4.5 - 0.3	10.5 - 0.6	16.5 - 1.0
46	0°56.5	0°56.7	0°53.9	4.6 - 0.3	10.6 - 0.6	16.6 - 1.0
47	0°56.8	0°56.9	0°54.2	4.7 - 0.3	10.7 - 0.6	16.7 - 1.0
48	0°57.0	0°57.2	0°54.4	4.8 - 0.3	10.8 - 0.6	16.8 - 1.0
49	0°57.3	0°57.4	0°54.6	4.9 - 0.3	10.9 - 0.6	16.9 - 1.0
50	0°57.5	0°57.7	0°54.9	5.0 - 0.3	11.0 - 0.6	17.0 - 1.0
51	0°57.7	0°57.9	0°55.1	5.1 - 0.3	11.1 - 0.6	17.1 - 1.0
52	0°58.0	0°58.2	0°55.4	5.2 - 0.3	11.2 - 0.7	17.2 - 1.0
53	0°58.3	0°58.4	0°55.6	5.3 - 0.3	11.3 - 0.7	17.3 - 1.0
54	0°58.5	0°58.7	0°55.8	5.4 - 0.3	11.4 - 0.7	17.4 - 1.0
55	0°58.8	0°58.9	0°56.1	5.5 - 0.3	11.5 - 0.7	17.5 - 1.0
56	0°59.0	0°59.2	0°56.3	5.6 - 0.3	11.6 - 0.7	17.6 - 1.0
57	0°59.3	0°59.4	0°56.6	5.7 - 0.3	11.7 - 0.7	17.7 - 1.0
58	0°59.5	0°59.7	0°56.8	5.8 - 0.3	11.8 - 0.7	17.8 - 1.0
59	0°59.8	0°59.9	0°57.0	5.9 - 0.3	11.9 - 0.7	17.9 - 1.0

m 4	Sun Plan.	Aries	Moon	v and d corr		
0	1°00.0	1°00.2	0°57.3	0.0 - 0.0	6.0 - 0.4	12.0 - 0.9
1	1°00.2	1°00.4	0°57.5	0.1 - 0.0	6.1 - 0.5	12.1 - 0.9
2	1°00.5	1°00.7	0°57.7	0.2 - 0.0	6.2 - 0.5	12.2 - 0.9
3	1°00.7	1°00.9	0°58.0	0.3 - 0.0	6.3 - 0.5	12.3 - 0.9
4	1°01.0	1°01.2	0°58.2	0.4 - 0.0	6.4 - 0.5	12.4 - 0.9
5	1°01.2	1°01.4	0°58.5	0.5 - 0.0	6.5 - 0.5	12.5 - 0.9
6	1°01.5	1°01.7	0°58.7	0.6 - 0.0	6.6 - 0.5	12.6 - 0.9
7	1°01.7	1°01.9	0°58.9	0.7 - 0.1	6.7 - 0.5	12.7 - 1.0
8	1°02.0	1°02.2	0°59.2	0.8 - 0.1	6.8 - 0.5	12.8 - 1.0
9	1°02.3	1°02.4	0°59.4	0.9 - 0.1	6.9 - 0.5	12.9 - 1.0
10	1°02.5	1°02.7	0°59.7	1.0 - 0.1	7.0 - 0.5	13.0 - 1.0
11	1°02.8	1°02.9	0°59.9	1.1 - 0.1	7.1 - 0.5	13.1 - 1.0
12	1°03.0	1°03.2	1°00.1	1.2 - 0.1	7.2 - 0.5	13.2 - 1.0
13	1°03.3	1°03.4	1°00.4	1.3 - 0.1	7.3 - 0.5	13.3 - 1.0
14	1°03.5	1°03.7	1°00.6	1.4 - 0.1	7.4 - 0.6	13.4 - 1.0
15	1°03.8	1°03.9	1°00.8	1.5 - 0.1	7.5 - 0.6	13.5 - 1.0
16	1°04.0	1°04.2	1°01.1	1.6 - 0.1	7.6 - 0.6	13.6 - 1.0
17	1°04.2	1°04.4	1°01.3	1.7 - 0.1	7.7 - 0.6	13.7 - 1.0
18	1°04.5	1°04.7	1°01.6	1.8 - 0.1	7.8 - 0.6	13.8 - 1.0
19	1°04.7	1°04.9	1°01.8	1.9 - 0.1	7.9 - 0.6	13.9 - 1.0
20	1°05.0	1°05.2	1°02.0	2.0 - 0.1	8.0 - 0.6	14.0 - 1.1
21	1°05.2	1°05.4	1°02.3	2.1 - 0.2	8.1 - 0.6	14.1 - 1.1
22	1°05.5	1°05.7	1°02.5	2.2 - 0.2	8.2 - 0.6	14.2 - 1.1
23	1°05.8	1°05.9	1°02.8	2.3 - 0.2	8.3 - 0.6	14.3 - 1.1
24	1°06.0	1°06.2	1°03.0	2.4 - 0.2	8.4 - 0.6	14.4 - 1.1
25	1°06.3	1°06.4	1°03.2	2.5 - 0.2	8.5 - 0.6	14.5 - 1.1
26	1°06.5	1°06.7	1°03.5	2.6 - 0.2	8.6 - 0.6	14.6 - 1.1
27	1°06.8	1°06.9	1°03.7	2.7 - 0.2	8.7 - 0.7	14.7 - 1.1
28	1°07.0	1°07.2	1°03.9	2.8 - 0.2	8.8 - 0.7	14.8 - 1.1
29	1°07.3	1°07.4	1°04.2	2.9 - 0.2	8.9 - 0.7	14.9 - 1.1
30	1°07.5	1°07.7	1°04.4	3.0 - 0.2	9.0 - 0.7	15.0 - 1.1
31	1°07.7	1°07.9	1°04.7	3.1 - 0.2	9.1 - 0.7	15.1 - 1.1
32	1°08.0	1°08.2	1°04.9	3.2 - 0.2	9.2 - 0.7	15.2 - 1.1
33	1°08.2	1°08.4	1°05.1	3.3 - 0.2	9.3 - 0.7	15.3 - 1.1
34	1°08.5	1°08.7	1°05.4	3.4 - 0.3	9.4 - 0.7	15.4 - 1.2
35	1°08.7	1°08.9	1°05.6	3.5 - 0.3	9.5 - 0.7	15.5 - 1.2
36	1°09.0	1°09.2	1°05.9	3.6 - 0.3	9.6 - 0.7	15.6 - 1.2
37	1°09.3	1°09.4	1°06.1	3.7 - 0.3	9.7 - 0.7	15.7 - 1.2
38	1°09.5	1°09.7	1°06.3	3.8 - 0.3	9.8 - 0.7	15.8 - 1.2
39	1°09.8	1°09.9	1°06.6	3.9 - 0.3	9.9 - 0.7	15.9 - 1.2
40	1°10.0	1°10.2	1°06.8	4.0 - 0.3	10.0 - 0.8	16.0 - 1.2
41	1°10.3	1°10.4	1°07.0	4.1 - 0.3	10.1 - 0.8	16.1 - 1.2
42	1°10.5	1°10.7	1°07.3	4.2 - 0.3	10.2 - 0.8	16.2 - 1.2
43	1°10.8	1°10.9	1°07.5	4.3 - 0.3	10.3 - 0.8	16.3 - 1.2
44	1°11.0	1°11.2	1°07.8	4.4 - 0.3	10.4 - 0.8	16.4 - 1.2
45	1°11.3	1°11.4	1°08.0	4.5 - 0.3	10.5 - 0.8	16.5 - 1.2
46	1°11.5	1°11.7	1°08.2	4.6 - 0.3	10.6 - 0.8	16.6 - 1.2
47	1°11.7	1°11.9	1°08.5	4.7 - 0.4	10.7 - 0.8	16.7 - 1.3
48	1°12.0	1°12.2	1°08.7	4.8 - 0.4	10.8 - 0.8	16.8 - 1.3
49	1°12.2	1°12.4	1°09.0	4.9 - 0.4	10.9 - 0.8	16.9 - 1.3
50	1°12.5	1°12.7	1°09.2	5.0 - 0.4	11.0 - 0.8	17.0 - 1.3
51	1°12.7	1°12.9	1°09.4	5.1 - 0.4	11.1 - 0.8	17.1 - 1.3
52	1°13.0	1°13.2	1°09.7	5.2 - 0.4	11.2 - 0.8	17.2 - 1.3
53	1°13.2	1°13.5	1°09.9	5.3 - 0.4	11.3 - 0.8	17.3 - 1.3
54	1°13.5	1°13.7	1°10.2	5.4 - 0.4	11.4 - 0.9	17.4 - 1.3
55	1°13.8	1°14.0	1°10.4	5.5 - 0.4	11.5 - 0.9	17.5 - 1.3
56	1°14.0	1°14.2	1°10.6	5.6 - 0.4	11.6 - 0.9	17.6 - 1.3
57	1°14.3	1°14.5	1°10.9	5.7 - 0.4	11.7 - 0.9	17.7 - 1.3
58	1°14.5	1°14.7	1°11.1	5.8 - 0.4	11.8 - 0.9	17.8 - 1.3
59	1°14.8	1°15.0	1°11.3	5.9 - 0.4	11.9 - 0.9	17.9 - 1.3

m 5	Sun Plan.	Aries	Moon	v and d corr		
0	1°15.0	1°15.2	1°11.6	0.0 - 0.0	6.0 - 0.5	12.0 - 1.1
1	1°15.3	1°15.5	1°11.8	0.1 - 0.0	6.1 - 0.6	12.1 - 1.1
2	1°15.5	1°15.7	1°12.1	0.2 - 0.0	6.2 - 0.6	12.2 - 1.1
3	1°15.7	1°16.0	1°12.3	0.3 - 0.0	6.3 - 0.6	12.3 - 1.1
4	1°16.0	1°16.2	1°12.5	0.4 - 0.0	6.4 - 0.6	12.4 - 1.1
5	1°16.2	1°16.5	1°12.8	0.5 - 0.0	6.5 - 0.6	12.5 - 1.1
6	1°16.5	1°16.7	1°13.0	0.6 - 0.1	6.6 - 0.6	12.6 - 1.2
7	1°16.7	1°17.0	1°13.3	0.7 - 0.1	6.7 - 0.6	12.7 - 1.2
8	1°17.0	1°17.2	1°13.5	0.8 - 0.1	6.8 - 0.6	12.8 - 1.2
9	1°17.3	1°17.5	1°13.7	0.9 - 0.1	6.9 - 0.6	12.9 - 1.2
10	1°17.5	1°17.7	1°14.0	1.0 - 0.1	7.0 - 0.6	13.0 - 1.2
11	1°17.8	1°18.0	1°14.2	1.1 - 0.1	7.1 - 0.7	13.1 - 1.2
12	1°18.0	1°18.2	1°14.4	1.2 - 0.1	7.2 - 0.7	13.2 - 1.2
13	1°18.3	1°18.5	1°14.7	1.3 - 0.1	7.3 - 0.7	13.3 - 1.2
14	1°18.5	1°18.7	1°14.9	1.4 - 0.1	7.4 - 0.7	13.4 - 1.2
15	1°18.8	1°19.0	1°15.2	1.5 - 0.1	7.5 - 0.7	13.5 - 1.2
16	1°19.0	1°19.2	1°15.4	1.6 - 0.1	7.6 - 0.7	13.6 - 1.2
17	1°19.3	1°19.5	1°15.6	1.7 - 0.2	7.7 - 0.7	13.7 - 1.3
18	1°19.5	1°19.7	1°15.9	1.8 - 0.2	7.8 - 0.7	13.8 - 1.3
19	1°19.7	1°20.0	1°16.1	1.9 - 0.2	7.9 - 0.7	13.9 - 1.3
20	1°20.0	1°20.2	1°16.4	2.0 - 0.2	8.0 - 0.7	14.0 - 1.3
21	1°20.2	1°20.5	1°16.6	2.1 - 0.2	8.1 - 0.7	14.1 - 1.3
22	1°20.5	1°20.7	1°16.8	2.2 - 0.2	8.2 - 0.8	14.2 - 1.3
23	1°20.8	1°21.0	1°17.1	2.3 - 0.2	8.3 - 0.8	14.3 - 1.3
24	1°21.0	1°21.2	1°17.3	2.4 - 0.2	8.4 - 0.8	14.4 - 1.3
25	1°21.3	1°21.5	1°17.5	2.5 - 0.2	8.5 - 0.8	14.5 - 1.3
26	1°21.5	1°21.7	1°17.8	2.6 - 0.2	8.6 - 0.8	14.6 - 1.3
27	1°21.8	1°22.0	1°18.0	2.7 - 0.2	8.7 - 0.8	14.7 - 1.3
28	1°22.0	1°22.2	1°18.3	2.8 - 0.3	8.8 - 0.8	14.8 - 1.4
29	1°22.3	1°22.5	1°18.5	2.9 - 0.3	8.9 - 0.8	14.9 - 1.4
30	1°22.5	1°22.7	1°18.7	3.0 - 0.3	9.0 - 0.8	15.0 - 1.4
31	1°22.8	1°23.0	1°19.0	3.1 - 0.3	9.1 - 0.8	15.1 - 1.4
32	1°23.0	1°23.2	1°19.2	3.2 - 0.3	9.2 - 0.8	15.2 - 1.4
33	1°23.2	1°23.5	1°19.5	3.3 - 0.3	9.3 - 0.9	15.3 - 1.4
34	1°23.5	1°23.7	1°19.7	3.4 - 0.3	9.4 - 0.9	15.4 - 1.4
35	1°23.7	1°24.0	1°19.9	3.5 - 0.3	9.5 - 0.9	15.5 - 1.4
36	1°24.0	1°24.2	1°20.2	3.6 - 0.3	9.6 - 0.9	15.6 - 1.4
37	1°24.3	1°24.5	1°20.4	3.7 - 0.3	9.7 - 0.9	15.7 - 1.4
38	1°24.5	1°24.7	1°20.7	3.8 - 0.3	9.8 - 0.9	15.8 - 1.4
39	1°24.8	1°25.0	1°20.9	3.9 - 0.4	9.9 - 0.9	15.9 - 1.5
40	1°25.0	1°25.2	1°21.1	4.0 - 0.4	10.0 - 0.9	16.0 - 1.5
41	1°25.3	1°25.5	1°21.4	4.1 - 0.4	10.1 - 0.9	16.1 - 1.5
42	1°25.5	1°25.7	1°21.6	4.2 - 0.4	10.2 - 0.9	16.2 - 1.5
43	1°25.8	1°26.0	1°21.8	4.3 - 0.4	10.3 - 0.9	16.3 - 1.5
44	1°26.0	1°26.2	1°22.1	4.4 - 0.4	10.4 - 1.0	16.4 - 1.5
45	1°26.3	1°26.5	1°22.3	4.5 - 0.4	10.5 - 1.0	16.5 - 1.5
46	1°26.5	1°26.7	1°22.6	4.6 - 0.4	10.6 - 1.0	16.6 - 1.5
47	1°26.8	1°27.0	1°22.8	4.7 - 0.4	10.7 - 1.0	16.7 - 1.5
48	1°27.0	1°27.2	1°23.0	4.8 - 0.4	10.8 - 1.0	16.8 - 1.5
49	1°27.2	1°27.5	1°23.3	4.9 - 0.4	10.9 - 1.0	16.9 - 1.5
50	1°27.5	1°27.7	1°23.5	5.0 - 0.5	11.0 - 1.0	17.0 - 1.6
51	1°27.7	1°28.0	1°23.8	5.1 - 0.5	11.1 - 1.0	17.1 - 1.6
52	1°28.0	1°28.2	1°24.0	5.2 - 0.5	11.2 - 1.0	17.2 - 1.6
53	1°28.2	1°28.5	1°24.2	5.3 - 0.5	11.3 - 1.0	17.3 - 1.6
54	1°28.5	1°28.7	1°24.5	5.4 - 0.5	11.4 - 1.0	17.4 - 1.6
55	1°28.8	1°29.0	1°24.7	5.5 - 0.5	11.5 - 1.1	17.5 - 1.6
56	1°29.0	1°29.2	1°24.9	5.6 - 0.5	11.6 - 1.1	17.6 - 1.6
57	1°29.3	1°29.5	1°25.2	5.7 - 0.5	11.7 - 1.1	17.7 - 1.6
58	1°29.5	1°29.7	1°25.4	5.8 - 0.5	11.8 - 1.1	17.8 - 1.6
59	1°29.8	1°30.0	1°25.7	5.9 - 0.5	11.9 - 1.1	17.9 - 1.6

Increments and Corrections

m 6	Sun Plan.	Aries	Moon	v and d corr		
0	1°30.0	1°30.2	1°25.9	0.0 - 0.0	6.0 - 0.7	12.0 - 1.3
1	1°30.3	1°30.5	1°26.1	0.1 - 0.0	6.1 - 0.7	12.1 - 1.3
2	1°30.5	1°30.7	1°26.4	0.2 - 0.0	6.2 - 0.7	12.2 - 1.3
3	1°30.7	1°31.0	1°26.6	0.3 - 0.0	6.3 - 0.7	12.3 - 1.3
4	1°31.0	1°31.2	1°26.9	0.4 - 0.0	6.4 - 0.7	12.4 - 1.3
5	1°31.2	1°31.5	1°27.1	0.5 - 0.1	6.5 - 0.7	12.5 - 1.4
6	1°31.5	1°31.8	1°27.3	0.6 - 0.1	6.6 - 0.7	12.6 - 1.4
7	1°31.7	1°32.0	1°27.6	0.7 - 0.1	6.7 - 0.7	12.7 - 1.4
8	1°32.0	1°32.3	1°27.8	0.8 - 0.1	6.8 - 0.7	12.8 - 1.4
9	1°32.3	1°32.5	1°28.0	0.9 - 0.1	6.9 - 0.7	12.9 - 1.4
10	1°32.5	1°32.8	1°28.3	1.0 - 0.1	7.0 - 0.8	13.0 - 1.4
11	1°32.8	1°33.0	1°28.5	1.1 - 0.1	7.1 - 0.8	13.1 - 1.4
12	1°33.0	1°33.3	1°28.8	1.2 - 0.1	7.2 - 0.8	13.2 - 1.4
13	1°33.3	1°33.5	1°29.0	1.3 - 0.1	7.3 - 0.8	13.3 - 1.4
14	1°33.5	1°33.8	1°29.2	1.4 - 0.2	7.4 - 0.8	13.4 - 1.5
15	1°33.8	1°34.0	1°29.5	1.5 - 0.2	7.5 - 0.8	13.5 - 1.5
16	1°34.0	1°34.3	1°29.7	1.6 - 0.2	7.6 - 0.8	13.6 - 1.5
17	1°34.3	1°34.5	1°30.0	1.7 - 0.2	7.7 - 0.8	13.7 - 1.5
18	1°34.5	1°34.8	1°30.2	1.8 - 0.2	7.8 - 0.8	13.8 - 1.5
19	1°34.8	1°35.0	1°30.4	1.9 - 0.2	7.9 - 0.9	13.9 - 1.5
20	1°35.0	1°35.3	1°30.7	2.0 - 0.2	8.0 - 0.9	14.0 - 1.5
21	1°35.2	1°35.5	1°30.9	2.1 - 0.2	8.1 - 0.9	14.1 - 1.5
22	1°35.5	1°35.8	1°31.1	2.2 - 0.2	8.2 - 0.9	14.2 - 1.5
23	1°35.8	1°36.0	1°31.4	2.3 - 0.2	8.3 - 0.9	14.3 - 1.5
24	1°36.0	1°36.3	1°31.6	2.4 - 0.3	8.4 - 0.9	14.4 - 1.6
25	1°36.3	1°36.5	1°31.9	2.5 - 0.3	8.5 - 0.9	14.5 - 1.6
26	1°36.5	1°36.8	1°32.1	2.6 - 0.3	8.6 - 0.9	14.6 - 1.6
27	1°36.8	1°37.0	1°32.3	2.7 - 0.3	8.7 - 0.9	14.7 - 1.6
28	1°37.0	1°37.3	1°32.6	2.8 - 0.3	8.8 - 1.0	14.8 - 1.6
29	1°37.3	1°37.5	1°32.8	2.9 - 0.3	8.9 - 1.0	14.9 - 1.6
30	1°37.5	1°37.8	1°33.1	3.0 - 0.3	9.0 - 1.0	15.0 - 1.6
31	1°37.8	1°38.0	1°33.3	3.1 - 0.3	9.1 - 1.0	15.1 - 1.6
32	1°38.0	1°38.3	1°33.5	3.2 - 0.3	9.2 - 1.0	15.2 - 1.6
33	1°38.3	1°38.5	1°33.8	3.3 - 0.4	9.3 - 1.0	15.3 - 1.7
34	1°38.5	1°38.8	1°34.0	3.4 - 0.4	9.4 - 1.0	15.4 - 1.7
35	1°38.7	1°39.0	1°34.3	3.5 - 0.4	9.5 - 1.0	15.5 - 1.7
36	1°39.0	1°39.3	1°34.5	3.6 - 0.4	9.6 - 1.0	15.6 - 1.7
37	1°39.3	1°39.5	1°34.7	3.7 - 0.4	9.7 - 1.1	15.7 - 1.7
38	1°39.5	1°39.8	1°35.0	3.8 - 0.4	9.8 - 1.1	15.8 - 1.7
39	1°39.8	1°40.0	1°35.2	3.9 - 0.4	9.9 - 1.1	15.9 - 1.7
40	1°40.0	1°40.3	1°35.4	4.0 - 0.4	10.0 - 1.1	16.0 - 1.7
41	1°40.3	1°40.5	1°35.7	4.1 - 0.4	10.1 - 1.1	16.1 - 1.7
42	1°40.5	1°40.8	1°35.9	4.2 - 0.5	10.2 - 1.1	16.2 - 1.8
43	1°40.8	1°41.0	1°36.2	4.3 - 0.5	10.3 - 1.1	16.3 - 1.8
44	1°41.0	1°41.3	1°36.4	4.4 - 0.5	10.4 - 1.1	16.4 - 1.8
45	1°41.3	1°41.5	1°36.6	4.5 - 0.5	10.5 - 1.1	16.5 - 1.8
46	1°41.5	1°41.8	1°36.9	4.6 - 0.5	10.6 - 1.1	16.6 - 1.8
47	1°41.8	1°42.0	1°37.1	4.7 - 0.5	10.7 - 1.2	16.7 - 1.8
48	1°42.0	1°42.3	1°37.4	4.8 - 0.5	10.8 - 1.2	16.8 - 1.8
49	1°42.3	1°42.5	1°37.6	4.9 - 0.5	10.9 - 1.2	16.9 - 1.8
50	1°42.5	1°42.8	1°37.8	5.0 - 0.5	11.0 - 1.2	17.0 - 1.8
51	1°42.7	1°43.0	1°38.1	5.1 - 0.6	11.1 - 1.2	17.1 - 1.9
52	1°43.0	1°43.3	1°38.3	5.2 - 0.6	11.2 - 1.2	17.2 - 1.9
53	1°43.2	1°43.5	1°38.5	5.3 - 0.6	11.3 - 1.2	17.3 - 1.9
54	1°43.5	1°43.8	1°38.8	5.4 - 0.6	11.4 - 1.2	17.4 - 1.9
55	1°43.8	1°44.0	1°39.0	5.5 - 0.6	11.5 - 1.2	17.5 - 1.9
56	1°44.0	1°44.3	1°39.3	5.6 - 0.6	11.6 - 1.3	17.6 - 1.9
57	1°44.3	1°44.5	1°39.5	5.7 - 0.6	11.7 - 1.3	17.7 - 1.9
58	1°44.5	1°44.8	1°39.7	5.8 - 0.6	11.8 - 1.3	17.8 - 1.9
59	1°44.8	1°45.0	1°40.0	5.9 - 0.6	11.9 - 1.3	17.9 - 1.9

m 7	Sun Plan.	Aries	Moon	v and d corr		
0	1°45.0	1°45.3	1°40.2	0.0 - 0.0	6.0 - 0.8	12.0 - 1.5
1	1°45.3	1°45.5	1°40.5	0.1 - 0.0	6.1 - 0.8	12.1 - 1.5
2	1°45.5	1°45.8	1°40.7	0.2 - 0.0	6.2 - 0.8	12.2 - 1.5
3	1°45.8	1°46.0	1°40.9	0.3 - 0.0	6.3 - 0.8	12.3 - 1.5
4	1°46.0	1°46.3	1°41.2	0.4 - 0.1	6.4 - 0.8	12.4 - 1.6
5	1°46.2	1°46.5	1°41.4	0.5 - 0.1	6.5 - 0.8	12.5 - 1.6
6	1°46.5	1°46.8	1°41.6	0.6 - 0.1	6.6 - 0.8	12.6 - 1.6
7	1°46.7	1°47.0	1°41.9	0.7 - 0.1	6.7 - 0.8	12.7 - 1.6
8	1°47.0	1°47.3	1°42.1	0.8 - 0.1	6.8 - 0.8	12.8 - 1.6
9	1°47.3	1°47.5	1°42.4	0.9 - 0.1	6.9 - 0.9	12.9 - 1.6
10	1°47.5	1°47.8	1°42.6	1.0 - 0.1	7.0 - 0.9	13.0 - 1.6
11	1°47.8	1°48.0	1°42.8	1.1 - 0.1	7.1 - 0.9	13.1 - 1.6
12	1°48.0	1°48.3	1°43.1	1.2 - 0.2	7.2 - 0.9	13.2 - 1.6
13	1°48.3	1°48.5	1°43.3	1.3 - 0.2	7.3 - 0.9	13.3 - 1.7
14	1°48.5	1°48.8	1°43.6	1.4 - 0.2	7.4 - 0.9	13.4 - 1.7
15	1°48.8	1°49.0	1°43.8	1.5 - 0.2	7.5 - 0.9	13.5 - 1.7
16	1°49.0	1°49.3	1°44.0	1.6 - 0.2	7.6 - 0.9	13.6 - 1.7
17	1°49.3	1°49.5	1°44.3	1.7 - 0.2	7.7 - 1.0	13.7 - 1.7
18	1°49.5	1°49.8	1°44.5	1.8 - 0.2	7.8 - 1.0	13.8 - 1.7
19	1°49.8	1°50.0	1°44.8	1.9 - 0.2	7.9 - 1.0	13.9 - 1.7
20	1°50.0	1°50.3	1°45.0	2.0 - 0.3	8.0 - 1.0	14.0 - 1.8
21	1°50.2	1°50.6	1°45.2	2.1 - 0.3	8.1 - 1.0	14.1 - 1.8
22	1°50.5	1°50.8	1°45.5	2.2 - 0.3	8.2 - 1.0	14.2 - 1.8
23	1°50.8	1°51.1	1°45.7	2.3 - 0.3	8.3 - 1.0	14.3 - 1.8
24	1°51.0	1°51.3	1°45.9	2.4 - 0.3	8.4 - 1.1	14.4 - 1.8
25	1°51.3	1°51.6	1°46.2	2.5 - 0.3	8.5 - 1.1	14.5 - 1.8
26	1°51.5	1°51.8	1°46.4	2.6 - 0.3	8.6 - 1.1	14.6 - 1.8
27	1°51.8	1°52.1	1°46.7	2.7 - 0.3	8.7 - 1.1	14.7 - 1.8
28	1°52.0	1°52.3	1°46.9	2.8 - 0.4	8.8 - 1.1	14.8 - 1.9
29	1°52.3	1°52.6	1°47.1	2.9 - 0.4	8.9 - 1.1	14.9 - 1.9
30	1°52.5	1°52.8	1°47.4	3.0 - 0.4	9.0 - 1.1	15.0 - 1.9
31	1°52.7	1°53.1	1°47.6	3.1 - 0.4	9.1 - 1.1	15.1 - 1.9
32	1°53.0	1°53.3	1°47.9	3.2 - 0.4	9.2 - 1.1	15.2 - 1.9
33	1°53.3	1°53.6	1°48.1	3.3 - 0.4	9.3 - 1.2	15.3 - 1.9
34	1°53.5	1°53.8	1°48.3	3.4 - 0.4	9.4 - 1.2	15.4 - 1.9
35	1°53.7	1°54.1	1°48.6	3.5 - 0.4	9.5 - 1.2	15.5 - 1.9
36	1°54.0	1°54.3	1°48.8	3.6 - 0.5	9.6 - 1.2	15.6 - 1.9
37	1°54.2	1°54.6	1°49.0	3.7 - 0.5	9.7 - 1.2	15.7 - 2.0
38	1°54.5	1°54.8	1°49.3	3.8 - 0.5	9.8 - 1.2	15.8 - 2.0
39	1°54.8	1°55.1	1°49.5	3.9 - 0.5	9.9 - 1.2	15.9 - 2.0
40	1°55.0	1°55.3	1°49.8	4.0 - 0.5	10.0 - 1.3	16.0 - 2.0
41	1°55.3	1°55.6	1°50.0	4.1 - 0.5	10.1 - 1.3	16.1 - 2.0
42	1°55.5	1°55.8	1°50.2	4.2 - 0.5	10.2 - 1.3	16.2 - 2.0
43	1°55.8	1°56.1	1°50.5	4.3 - 0.5	10.3 - 1.3	16.3 - 2.0
44	1°56.0	1°56.3	1°50.7	4.4 - 0.6	10.4 - 1.3	16.4 - 2.0
45	1°56.3	1°56.6	1°51.0	4.5 - 0.6	10.5 - 1.3	16.5 - 2.1
46	1°56.5	1°56.8	1°51.2	4.6 - 0.6	10.6 - 1.3	16.6 - 2.1
47	1°56.7	1°57.1	1°51.4	4.7 - 0.6	10.7 - 1.3	16.7 - 2.1
48	1°57.0	1°57.3	1°51.7	4.8 - 0.6	10.8 - 1.4	16.8 - 2.1
49	1°57.3	1°57.6	1°51.9	4.9 - 0.6	10.9 - 1.4	16.9 - 2.1
50	1°57.5	1°57.8	1°52.1	5.0 - 0.6	11.0 - 1.4	17.0 - 2.1
51	1°57.7	1°58.1	1°52.4	5.1 - 0.6	11.1 - 1.4	17.1 - 2.1
52	1°58.0	1°58.3	1°52.6	5.2 - 0.7	11.2 - 1.4	17.2 - 2.1
53	1°58.2	1°58.6	1°52.9	5.3 - 0.7	11.3 - 1.4	17.3 - 2.2
54	1°58.5	1°58.8	1°53.1	5.4 - 0.7	11.4 - 1.4	17.4 - 2.2
55	1°58.8	1°59.1	1°53.3	5.5 - 0.7	11.5 - 1.4	17.5 - 2.2
56	1°59.0	1°59.3	1°53.6	5.6 - 0.7	11.6 - 1.5	17.6 - 2.2
57	1°59.3	1°59.6	1°53.8	5.7 - 0.7	11.7 - 1.5	17.7 - 2.2
58	1°59.5	1°59.8	1°54.1	5.8 - 0.7	11.8 - 1.5	17.8 - 2.2
59	1°59.8	2°00.1	1°54.3	5.9 - 0.7	11.9 - 1.5	17.9 - 2.2

m 8	Sun Plan.	Aries	Moon	v and d corr		
0	2°00.0	2°00.3	1°54.5	0.0 - 0.0	6.0 - 0.8	12.0 - 1.7
1	2°00.3	2°00.6	1°54.8	0.1 - 0.0	6.1 - 0.9	12.1 - 1.7
2	2°00.5	2°00.8	1°55.0	0.2 - 0.0	6.2 - 0.9	12.2 - 1.7
3	2°00.8	2°01.1	1°55.2	0.3 - 0.0	6.3 - 0.9	12.3 - 1.7
4	2°01.0	2°01.3	1°55.5	0.4 - 0.1	6.4 - 0.9	12.4 - 1.8
5	2°01.3	2°01.6	1°55.7	0.5 - 0.1	6.5 - 0.9	12.5 - 1.8
6	2°01.5	2°01.8	1°56.0	0.6 - 0.1	6.6 - 0.9	12.6 - 1.8
7	2°01.8	2°02.1	1°56.2	0.7 - 0.1	6.7 - 0.9	12.7 - 1.8
8	2°02.0	2°02.3	1°56.4	0.8 - 0.1	6.8 - 1.0	12.8 - 1.8
9	2°02.3	2°02.6	1°56.7	0.9 - 0.1	6.9 - 1.0	12.9 - 1.8
10	2°02.5	2°02.8	1°56.9	1.0 - 0.1	7.0 - 1.0	13.0 - 1.8
11	2°02.8	2°03.1	1°57.2	1.1 - 0.2	7.1 - 1.0	13.1 - 1.9
12	2°03.0	2°03.3	1°57.4	1.2 - 0.2	7.2 - 1.0	13.2 - 1.9
13	2°03.3	2°03.6	1°57.6	1.3 - 0.2	7.3 - 1.0	13.3 - 1.9
14	2°03.5	2°03.8	1°57.9	1.4 - 0.2	7.4 - 1.0	13.4 - 1.9
15	2°03.8	2°04.1	1°58.1	1.5 - 0.2	7.5 - 1.1	13.5 - 1.9
16	2°04.0	2°04.3	1°58.4	1.6 - 0.2	7.6 - 1.1	13.6 - 1.9
17	2°04.2	2°04.6	1°58.6	1.7 - 0.2	7.7 - 1.1	13.7 - 1.9
18	2°04.5	2°04.8	1°58.8	1.8 - 0.3	7.8 - 1.1	13.8 - 2.0
19	2°04.7	2°05.1	1°59.1	1.9 - 0.3	7.9 - 1.1	13.9 - 2.0
20	2°05.0	2°05.3	1°59.3	2.0 - 0.3	8.0 - 1.1	14.0 - 2.0
21	2°05.2	2°05.6	1°59.5	2.1 - 0.3	8.1 - 1.1	14.1 - 2.0
22	2°05.5	2°05.8	1°59.8	2.2 - 0.3	8.2 - 1.2	14.2 - 2.0
23	2°05.7	2°06.1	2°00.0	2.3 - 0.3	8.3 - 1.2	14.3 - 2.0
24	2°06.0	2°06.3	2°00.3	2.4 - 0.3	8.4 - 1.2	14.4 - 2.0
25	2°06.2	2°06.6	2°00.5	2.5 - 0.4	8.5 - 1.2	14.5 - 2.1
26	2°06.5	2°06.8	2°00.7	2.6 - 0.4	8.6 - 1.2	14.6 - 2.1
27	2°06.7	2°07.1	2°01.0	2.7 - 0.4	8.7 - 1.2	14.7 - 2.1
28	2°07.0	2°07.3	2°01.2	2.8 - 0.4	8.8 - 1.2	14.8 - 2.1
29	2°07.2	2°07.6	2°01.5	2.9 - 0.4	8.9 - 1.3	14.9 - 2.1
30	2°07.5	2°07.8	2°01.7	3.0 - 0.4	9.0 - 1.3	15.0 - 2.1
31	2°07.8	2°08.1	2°01.9	3.1 - 0.4	9.1 - 1.3	15.1 - 2.1
32	2°08.0	2°08.3	2°02.2	3.2 - 0.5	9.2 - 1.3	15.2 - 2.2
33	2°08.3	2°08.6	2°02.4	3.3 - 0.5	9.3 - 1.3	15.3 - 2.2
34	2°08.5	2°08.9	2°02.6	3.4 - 0.5	9.4 - 1.3	15.4 - 2.2
35	2°08.8	2°09.1	2°02.9	3.5 - 0.5	9.5 - 1.3	15.5 - 2.2
36	2°09.0	2°09.4	2°03.1	3.6 - 0.5	9.6 - 1.4	15.6 - 2.2
37	2°09.3	2°09.6	2°03.4	3.7 - 0.5	9.7 - 1.4	15.7 - 2.2
38	2°09.5	2°09.9	2°03.6	3.8 - 0.5	9.8 - 1.4	15.8 - 2.2
39	2°09.8	2°10.1	2°03.8	3.9 - 0.6	9.9 - 1.4	15.9 - 2.3
40	2°10.0	2°10.4	2°04.1	4.0 - 0.6	10.0 - 1.4	16.0 - 2.3
41	2°10.3	2°10.6	2°04.3	4.1 - 0.6	10.1 - 1.4	16.1 - 2.3
42	2°10.5	2°10.9	2°04.6	4.2 - 0.6	10.2 - 1.4	16.2 - 2.3
43	2°10.8	2°11.1	2°04.8	4.3 - 0.6	10.3 - 1.5	16.3 - 2.3
44	2°11.0	2°11.4	2°05.0	4.4 - 0.6	10.4 - 1.5	16.4 - 2.3
45	2°11.3	2°11.6	2°05.3	4.5 - 0.6	10.5 - 1.5	16.5 - 2.3
46	2°11.5	2°11.9	2°05.5	4.6 - 0.7	10.6 - 1.5	16.6 - 2.4
47	2°11.7	2°12.1	2°05.7	4.7 - 0.7	10.7 - 1.5	16.7 - 2.4
48	2°12.0	2°12.4	2°06.0	4.8 - 0.7	10.8 - 1.5	16.8 - 2.4
49	2°12.2	2°12.6	2°06.2	4.9 - 0.7	10.9 - 1.5	16.9 - 2.4
50	2°12.5	2°12.9	2°06.5	5.0 - 0.7	11.0 - 1.6	17.0 - 2.4
51	2°12.7	2°13.1	2°06.7	5.1 - 0.7	11.1 - 1.6	17.1 - 2.4
52	2°13.0	2°13.4	2°06.9	5.2 - 0.7	11.2 - 1.6	17.2 - 2.4
53	2°13.2	2°13.6	2°07.2	5.3 - 0.8	11.3 - 1.6	17.3 - 2.5
54	2°13.5	2°13.9	2°07.4	5.4 - 0.8	11.4 - 1.6	17.4 - 2.5
55	2°13.7	2°14.1	2°07.7	5.5 - 0.8	11.5 - 1.6	17.5 - 2.5
56	2°14.0	2°14.4	2°07.9	5.6 - 0.8	11.6 - 1.6	17.6 - 2.5
57	2°14.2	2°14.6	2°08.1	5.7 - 0.8	11.7 - 1.7	17.7 - 2.5
58	2°14.5	2°14.9	2°08.4	5.8 - 0.8	11.8 - 1.7	17.8 - 2.5
59	2°14.7	2°15.1	2°08.6	5.9 - 0.8	11.9 - 1.7	17.9 - 2.5

Increments and Corrections

m 9	Sun Plan.	Aries	Moon	v and d corr		
0	2°15.0	2°15.4	2°08.8	0.0 - 0.0	6.0 - 0.9	12.0 - 1.9
1	2°15.3	2°15.6	2°09.1	0.1 - 0.0	6.1 - 1.0	12.1 - 1.9
2	2°15.5	2°15.9	2°09.3	0.2 - 0.0	6.2 - 1.0	12.2 - 1.9
3	2°15.8	2°16.1	2°09.6	0.3 - 0.0	6.3 - 1.0	12.3 - 1.9
4	2°16.0	2°16.4	2°09.8	0.4 - 0.1	6.4 - 1.0	12.4 - 2.0
5	2°16.3	2°16.6	2°10.0	0.5 - 0.1	6.5 - 1.0	12.5 - 2.0
6	2°16.5	2°16.9	2°10.3	0.6 - 0.1	6.6 - 1.0	12.6 - 2.0
7	2°16.8	2°17.1	2°10.5	0.7 - 0.1	6.7 - 1.1	12.7 - 2.0
8	2°17.0	2°17.4	2°10.8	0.8 - 0.1	6.8 - 1.1	12.8 - 2.0
9	2°17.3	2°17.6	2°11.0	0.9 - 0.1	6.9 - 1.1	12.9 - 2.0
10	2°17.5	2°17.9	2°11.2	1.0 - 0.2	7.0 - 1.1	13.0 - 2.1
11	2°17.8	2°18.1	2°11.5	1.1 - 0.2	7.1 - 1.1	13.1 - 2.1
12	2°18.0	2°18.4	2°11.7	1.2 - 0.2	7.2 - 1.1	13.2 - 2.1
13	2°18.3	2°18.6	2°12.0	1.3 - 0.2	7.3 - 1.2	13.3 - 2.1
14	2°18.5	2°18.9	2°12.2	1.4 - 0.2	7.4 - 1.2	13.4 - 2.1
15	2°18.8	2°19.1	2°12.4	1.5 - 0.2	7.5 - 1.2	13.5 - 2.1
16	2°19.0	2°19.4	2°12.7	1.6 - 0.3	7.6 - 1.2	13.6 - 2.2
17	2°19.3	2°19.6	2°12.9	1.7 - 0.3	7.7 - 1.2	13.7 - 2.2
18	2°19.5	2°19.9	2°13.1	1.8 - 0.3	7.8 - 1.2	13.8 - 2.2
19	2°19.7	2°20.1	2°13.4	1.9 - 0.3	7.9 - 1.3	13.9 - 2.2
20	2°20.0	2°20.4	2°13.6	2.0 - 0.3	8.0 - 1.3	14.0 - 2.2
21	2°20.2	2°20.6	2°13.9	2.1 - 0.3	8.1 - 1.3	14.1 - 2.2
22	2°20.5	2°20.9	2°14.1	2.2 - 0.3	8.2 - 1.3	14.2 - 2.2
23	2°20.7	2°21.1	2°14.3	2.3 - 0.4	8.3 - 1.3	14.3 - 2.3
24	2°21.0	2°21.4	2°14.6	2.4 - 0.4	8.4 - 1.3	14.4 - 2.3
25	2°21.2	2°21.6	2°14.8	2.5 - 0.4	8.5 - 1.3	14.5 - 2.3
26	2°21.5	2°21.9	2°15.1	2.6 - 0.4	8.6 - 1.4	14.6 - 2.3
27	2°21.7	2°22.1	2°15.3	2.7 - 0.4	8.7 - 1.4	14.7 - 2.3
28	2°22.0	2°22.4	2°15.5	2.8 - 0.4	8.8 - 1.4	14.8 - 2.3
29	2°22.2	2°22.6	2°15.8	2.9 - 0.5	8.9 - 1.4	14.9 - 2.4
30	2°22.5	2°22.9	2°16.0	3.0 - 0.5	9.0 - 1.4	15.0 - 2.4
31	2°22.8	2°23.1	2°16.2	3.1 - 0.5	9.1 - 1.4	15.1 - 2.4
32	2°23.0	2°23.4	2°16.5	3.2 - 0.5	9.2 - 1.5	15.2 - 2.4
33	2°23.3	2°23.6	2°16.7	3.3 - 0.5	9.3 - 1.5	15.3 - 2.4
34	2°23.5	2°23.9	2°17.0	3.4 - 0.5	9.4 - 1.5	15.4 - 2.4
35	2°23.8	2°24.1	2°17.2	3.5 - 0.6	9.5 - 1.5	15.5 - 2.5
36	2°24.0	2°24.4	2°17.4	3.6 - 0.6	9.6 - 1.5	15.6 - 2.5
37	2°24.3	2°24.6	2°17.7	3.7 - 0.6	9.7 - 1.5	15.7 - 2.5
38	2°24.5	2°24.9	2°17.9	3.8 - 0.6	9.8 - 1.6	15.8 - 2.5
39	2°24.8	2°25.1	2°18.2	3.9 - 0.6	9.9 - 1.6	15.9 - 2.5
40	2°25.0	2°25.4	2°18.4	4.0 - 0.6	10.0 - 1.6	16.0 - 2.5
41	2°25.3	2°25.6	2°18.6	4.1 - 0.6	10.1 - 1.6	16.1 - 2.5
42	2°25.5	2°25.9	2°18.9	4.2 - 0.7	10.2 - 1.6	16.2 - 2.6
43	2°25.8	2°26.1	2°19.1	4.3 - 0.7	10.3 - 1.6	16.3 - 2.6
44	2°26.0	2°26.4	2°19.3	4.4 - 0.7	10.4 - 1.6	16.4 - 2.6
45	2°26.3	2°26.6	2°19.6	4.5 - 0.7	10.5 - 1.7	16.5 - 2.6
46	2°26.5	2°26.9	2°19.8	4.6 - 0.7	10.6 - 1.7	16.6 - 2.6
47	2°26.8	2°27.2	2°20.1	4.7 - 0.7	10.7 - 1.7	16.7 - 2.6
48	2°27.0	2°27.4	2°20.3	4.8 - 0.8	10.8 - 1.7	16.8 - 2.7
49	2°27.2	2°27.7	2°20.5	4.9 - 0.8	10.9 - 1.7	16.9 - 2.7
50	2°27.5	2°27.9	2°20.8	5.0 - 0.8	11.0 - 1.7	17.0 - 2.7
51	2°27.7	2°28.2	2°21.0	5.1 - 0.8	11.1 - 1.8	17.1 - 2.7
52	2°28.0	2°28.4	2°21.3	5.2 - 0.8	11.2 - 1.8	17.2 - 2.7
53	2°28.2	2°28.7	2°21.5	5.3 - 0.8	11.3 - 1.8	17.3 - 2.7
54	2°28.5	2°28.9	2°21.7	5.4 - 0.9	11.4 - 1.8	17.4 - 2.8
55	2°28.7	2°29.2	2°22.0	5.5 - 0.9	11.5 - 1.8	17.5 - 2.8
56	2°29.0	2°29.4	2°22.2	5.6 - 0.9	11.6 - 1.8	17.6 - 2.8
57	2°29.2	2°29.7	2°22.5	5.7 - 0.9	11.7 - 1.9	17.7 - 2.8
58	2°29.5	2°29.9	2°22.7	5.8 - 0.9	11.8 - 1.9	17.8 - 2.8
59	2°29.7	2°30.2	2°22.9	5.9 - 0.9	11.9 - 1.9	17.9 - 2.8

m 10	Sun Plan.	Aries	Moon	v and d corr		
0	2°30.0	2°30.4	2°23.2	0.0 - 0.0	6.0 - 1.0	12.0 - 2.1
1	2°30.3	2°30.7	2°23.4	0.1 - 0.0	6.1 - 1.1	12.1 - 2.1
2	2°30.5	2°30.9	2°23.6	0.2 - 0.0	6.2 - 1.1	12.2 - 2.1
3	2°30.8	2°31.2	2°23.9	0.3 - 0.1	6.3 - 1.1	12.3 - 2.2
4	2°31.0	2°31.4	2°24.1	0.4 - 0.1	6.4 - 1.1	12.4 - 2.2
5	2°31.3	2°31.7	2°24.4	0.5 - 0.1	6.5 - 1.1	12.5 - 2.2
6	2°31.5	2°31.9	2°24.6	0.6 - 0.1	6.6 - 1.2	12.6 - 2.2
7	2°31.8	2°32.2	2°24.8	0.7 - 0.1	6.7 - 1.2	12.7 - 2.2
8	2°32.0	2°32.4	2°25.1	0.8 - 0.1	6.8 - 1.2	12.8 - 2.2
9	2°32.3	2°32.7	2°25.3	0.9 - 0.2	6.9 - 1.2	12.9 - 2.3
10	2°32.5	2°32.9	2°25.6	1.0 - 0.2	7.0 - 1.2	13.0 - 2.3
11	2°32.8	2°33.2	2°25.8	1.1 - 0.2	7.1 - 1.2	13.1 - 2.3
12	2°33.0	2°33.4	2°26.0	1.2 - 0.2	7.2 - 1.3	13.2 - 2.3
13	2°33.3	2°33.7	2°26.3	1.3 - 0.2	7.3 - 1.3	13.3 - 2.3
14	2°33.5	2°33.9	2°26.5	1.4 - 0.2	7.4 - 1.3	13.4 - 2.3
15	2°33.8	2°34.2	2°26.7	1.5 - 0.3	7.5 - 1.3	13.5 - 2.4
16	2°34.0	2°34.4	2°27.0	1.6 - 0.3	7.6 - 1.3	13.6 - 2.4
17	2°34.3	2°34.7	2°27.2	1.7 - 0.3	7.7 - 1.3	13.7 - 2.4
18	2°34.5	2°34.9	2°27.5	1.8 - 0.3	7.8 - 1.4	13.8 - 2.4
19	2°34.8	2°35.2	2°27.7	1.9 - 0.3	7.9 - 1.4	13.9 - 2.4
20	2°35.0	2°35.4	2°27.9	2.0 - 0.3	8.0 - 1.4	14.0 - 2.4
21	2°35.2	2°35.7	2°28.2	2.1 - 0.4	8.1 - 1.4	14.1 - 2.5
22	2°35.5	2°35.9	2°28.4	2.2 - 0.4	8.2 - 1.4	14.2 - 2.5
23	2°35.7	2°36.2	2°28.7	2.3 - 0.4	8.3 - 1.5	14.3 - 2.5
24	2°36.0	2°36.4	2°28.9	2.4 - 0.4	8.4 - 1.5	14.4 - 2.5
25	2°36.2	2°36.7	2°29.1	2.5 - 0.4	8.5 - 1.5	14.5 - 2.5
26	2°36.5	2°36.9	2°29.4	2.6 - 0.5	8.6 - 1.5	14.6 - 2.6
27	2°36.7	2°37.2	2°29.6	2.7 - 0.5	8.7 - 1.5	14.7 - 2.6
28	2°37.0	2°37.4	2°29.8	2.8 - 0.5	8.8 - 1.5	14.8 - 2.6
29	2°37.2	2°37.7	2°30.1	2.9 - 0.5	8.9 - 1.6	14.9 - 2.6
30	2°37.5	2°37.9	2°30.3	3.0 - 0.5	9.0 - 1.6	15.0 - 2.6
31	2°37.8	2°38.2	2°30.6	3.1 - 0.5	9.1 - 1.6	15.1 - 2.6
32	2°38.0	2°38.4	2°30.8	3.2 - 0.6	9.2 - 1.6	15.2 - 2.7
33	2°38.3	2°38.7	2°31.0	3.3 - 0.6	9.3 - 1.6	15.3 - 2.7
34	2°38.5	2°38.9	2°31.3	3.4 - 0.6	9.4 - 1.6	15.4 - 2.7
35	2°38.8	2°39.2	2°31.5	3.5 - 0.6	9.5 - 1.7	15.5 - 2.7
36	2°39.0	2°39.4	2°31.8	3.6 - 0.6	9.6 - 1.7	15.6 - 2.7
37	2°39.3	2°39.7	2°32.0	3.7 - 0.6	9.7 - 1.7	15.7 - 2.7
38	2°39.5	2°39.9	2°32.2	3.8 - 0.7	9.8 - 1.7	15.8 - 2.8
39	2°39.8	2°40.2	2°32.5	3.9 - 0.7	9.9 - 1.7	15.9 - 2.8
40	2°40.0	2°40.4	2°32.7	4.0 - 0.7	10.0 - 1.8	16.0 - 2.8
41	2°40.3	2°40.7	2°32.9	4.1 - 0.7	10.1 - 1.8	16.1 - 2.8
42	2°40.5	2°40.9	2°33.2	4.2 - 0.7	10.2 - 1.8	16.2 - 2.8
43	2°40.8	2°41.2	2°33.4	4.3 - 0.8	10.3 - 1.8	16.3 - 2.9
44	2°41.0	2°41.4	2°33.7	4.4 - 0.8	10.4 - 1.8	16.4 - 2.9
45	2°41.3	2°41.7	2°33.9	4.5 - 0.8	10.5 - 1.8	16.5 - 2.9
46	2°41.5	2°41.9	2°34.1	4.6 - 0.8	10.6 - 1.9	16.6 - 2.9
47	2°41.8	2°42.2	2°34.4	4.7 - 0.8	10.7 - 1.9	16.7 - 2.9
48	2°42.0	2°42.4	2°34.6	4.8 - 0.8	10.8 - 1.9	16.8 - 2.9
49	2°42.3	2°42.7	2°34.9	4.9 - 0.9	10.9 - 1.9	16.9 - 3.0
50	2°42.5	2°42.9	2°35.1	5.0 - 0.9	11.0 - 1.9	17.0 - 3.0
51	2°42.7	2°43.2	2°35.3	5.1 - 0.9	11.1 - 1.9	17.1 - 3.0
52	2°43.0	2°43.4	2°35.6	5.2 - 0.9	11.2 - 2.0	17.2 - 3.0
53	2°43.2	2°43.7	2°35.8	5.3 - 0.9	11.3 - 2.0	17.3 - 3.0
54	2°43.5	2°43.9	2°36.1	5.4 - 0.9	11.4 - 2.0	17.4 - 3.0
55	2°43.7	2°44.2	2°36.3	5.5 - 1.0	11.5 - 2.0	17.5 - 3.1
56	2°44.0	2°44.4	2°36.5	5.6 - 1.0	11.6 - 2.0	17.6 - 3.1
57	2°44.2	2°44.7	2°36.8	5.7 - 1.0	11.7 - 2.0	17.7 - 3.1
58	2°44.5	2°44.9	2°37.0	5.8 - 1.0	11.8 - 2.1	17.8 - 3.1
59	2°44.7	2°45.2	2°37.2	5.9 - 1.0	11.9 - 2.1	17.9 - 3.1

m 11	Sun Plan.	Aries	Moon	v and d corr		
0	2°45.0	2°45.5	2°37.5	0.0 - 0.0	6.0 - 1.2	12.0 - 2.3
1	2°45.3	2°45.7	2°37.7	0.1 - 0.0	6.1 - 1.2	12.1 - 2.3
2	2°45.5	2°46.0	2°38.0	0.2 - 0.0	6.2 - 1.2	12.2 - 2.3
3	2°45.8	2°46.2	2°38.2	0.3 - 0.1	6.3 - 1.2	12.3 - 2.4
4	2°46.0	2°46.5	2°38.4	0.4 - 0.1	6.4 - 1.2	12.4 - 2.4
5	2°46.3	2°46.7	2°38.7	0.5 - 0.1	6.5 - 1.2	12.5 - 2.4
6	2°46.5	2°47.0	2°38.9	0.6 - 0.1	6.6 - 1.3	12.6 - 2.4
7	2°46.8	2°47.2	2°39.2	0.7 - 0.1	6.7 - 1.3	12.7 - 2.4
8	2°47.0	2°47.5	2°39.4	0.8 - 0.2	6.8 - 1.3	12.8 - 2.5
9	2°47.3	2°47.7	2°39.6	0.9 - 0.2	6.9 - 1.3	12.9 - 2.5
10	2°47.5	2°48.0	2°39.9	1.0 - 0.2	7.0 - 1.3	13.0 - 2.5
11	2°47.8	2°48.2	2°40.1	1.1 - 0.2	7.1 - 1.4	13.1 - 2.5
12	2°48.0	2°48.5	2°40.3	1.2 - 0.2	7.2 - 1.4	13.2 - 2.5
13	2°48.3	2°48.7	2°40.6	1.3 - 0.2	7.3 - 1.4	13.3 - 2.5
14	2°48.5	2°49.0	2°40.8	1.4 - 0.3	7.4 - 1.4	13.4 - 2.6
15	2°48.8	2°49.2	2°41.1	1.5 - 0.3	7.5 - 1.4	13.5 - 2.6
16	2°49.0	2°49.5	2°41.3	1.6 - 0.3	7.6 - 1.5	13.6 - 2.6
17	2°49.3	2°49.7	2°41.5	1.7 - 0.3	7.7 - 1.5	13.7 - 2.6
18	2°49.5	2°50.0	2°41.8	1.8 - 0.3	7.8 - 1.5	13.8 - 2.6
19	2°49.8	2°50.2	2°42.0	1.9 - 0.4	7.9 - 1.5	13.9 - 2.7
20	2°50.0	2°50.5	2°42.3	2.0 - 0.4	8.0 - 1.5	14.0 - 2.7
21	2°50.2	2°50.7	2°42.5	2.1 - 0.4	8.1 - 1.6	14.1 - 2.7
22	2°50.5	2°51.0	2°42.7	2.2 - 0.4	8.2 - 1.6	14.2 - 2.7
23	2°50.7	2°51.2	2°43.0	2.3 - 0.4	8.3 - 1.6	14.3 - 2.7
24	2°51.0	2°51.5	2°43.2	2.4 - 0.5	8.4 - 1.6	14.4 - 2.8
25	2°51.2	2°51.7	2°43.4	2.5 - 0.5	8.5 - 1.6	14.5 - 2.8
26	2°51.5	2°52.0	2°43.7	2.6 - 0.5	8.6 - 1.6	14.6 - 2.8
27	2°51.7	2°52.2	2°43.9	2.7 - 0.5	8.7 - 1.7	14.7 - 2.8
28	2°52.0	2°52.5	2°44.2	2.8 - 0.5	8.8 - 1.7	14.8 - 2.8
29	2°52.2	2°52.7	2°44.4	2.9 - 0.6	8.9 - 1.7	14.9 - 2.9
30	2°52.5	2°53.0	2°44.6	3.0 - 0.6	9.0 - 1.7	15.0 - 2.9
31	2°52.8	2°53.2	2°44.9	3.1 - 0.6	9.1 - 1.7	15.1 - 2.9
32	2°53.0	2°53.5	2°45.1	3.2 - 0.6	9.2 - 1.8	15.2 - 2.9
33	2°53.3	2°53.7	2°45.4	3.3 - 0.6	9.3 - 1.8	15.3 - 2.9
34	2°53.5	2°54.0	2°45.6	3.4 - 0.7	9.4 - 1.8	15.4 - 3.0
35	2°53.8	2°54.2	2°45.8	3.5 - 0.7	9.5 - 1.8	15.5 - 3.0
36	2°54.0	2°54.5	2°46.1	3.6 - 0.7	9.6 - 1.8	15.6 - 3.0
37	2°54.3	2°54.7	2°46.3	3.7 - 0.7	9.7 - 1.9	15.7 - 3.0
38	2°54.5	2°55.0	2°46.6	3.8 - 0.7	9.8 - 1.9	15.8 - 3.0
39	2°54.8	2°55.2	2°46.8	3.9 - 0.7	9.9 - 1.9	15.9 - 3.0
40	2°55.0	2°55.5	2°47.0	4.0 - 0.8	10.0 - 1.9	16.0 - 3.1
41	2°55.3	2°55.7	2°47.3	4.1 - 0.8	10.1 - 1.9	16.1 - 3.1
42	2°55.5	2°56.0	2°47.5	4.2 - 0.8	10.2 - 2.0	16.2 - 3.1
43	2°55.8	2°56.2	2°47.7	4.3 - 0.8	10.3 - 2.0	16.3 - 3.1
44	2°56.0	2°56.5	2°48.0	4.4 - 0.8	10.4 - 2.0	16.4 - 3.1
45	2°56.3	2°56.7	2°48.2	4.5 - 0.9	10.5 - 2.0	16.5 - 3.2
46	2°56.5	2°57.0	2°48.5	4.6 - 0.9	10.6 - 2.0	16.6 - 3.2
47	2°56.8	2°57.2	2°48.7	4.7 - 0.9	10.7 - 2.1	16.7 - 3.2
48	2°57.0	2°57.5	2°48.9	4.8 - 0.9	10.8 - 2.1	16.8 - 3.2
49	2°57.3	2°57.7	2°49.2	4.9 - 0.9	10.9 - 2.1	16.9 - 3.2
50	2°57.5	2°58.0	2°49.4	5.0 - 1.0	11.0 - 2.1	17.0 - 3.3
51	2°57.7	2°58.2	2°49.7	5.1 - 1.0	11.1 - 2.1	17.1 - 3.3
52	2°58.0	2°58.5	2°49.9	5.2 - 1.0	11.2 - 2.1	17.2 - 3.3
53	2°58.2	2°58.7	2°50.1	5.3 - 1.0	11.3 - 2.2	17.3 - 3.3
54	2°58.5	2°59.0	2°50.4	5.4 - 1.0	11.4 - 2.2	17.4 - 3.3
55	2°58.7	2°59.2	2°50.6	5.5 - 1.1	11.5 - 2.2	17.5 - 3.4
56	2°59.0	2°59.5	2°50.8	5.6 - 1.1	11.6 - 2.2	17.6 - 3.4
57	2°59.2	2°59.7	2°51.1	5.7 - 1.1	11.7 - 2.2	17.7 - 3.4
58	2°59.5	3°00.0	2°51.3	5.8 - 1.1	11.8 - 2.3	17.8 - 3.4
59	2°59.7	3°00.2	2°51.6	5.9 - 1.1	11.9 - 2.3	17.9 - 3.4

Increments and Corrections

m 12	Sun Plan.	Aries	Moon	v and d corr		
0	3°00.0	3°00.5	2°51.8	0.0 - 0.0	6.0 - 1.3	12.0 - 2.5
1	3°00.3	3°00.7	2°52.0	0.1 - 0.0	6.1 - 1.3	12.1 - 2.5
2	3°00.5	3°01.0	2°52.3	0.2 - 0.0	6.2 - 1.3	12.2 - 2.5
3	3°00.8	3°01.2	2°52.5	0.3 - 0.1	6.3 - 1.3	12.3 - 2.6
4	3°01.0	3°01.5	2°52.8	0.4 - 0.1	6.4 - 1.3	12.4 - 2.6
5	3°01.3	3°01.7	2°53.0	0.5 - 0.1	6.5 - 1.4	12.5 - 2.6
6	3°01.5	3°02.0	2°53.2	0.6 - 0.1	6.6 - 1.4	12.6 - 2.6
7	3°01.8	3°02.2	2°53.5	0.7 - 0.1	6.7 - 1.4	12.7 - 2.6
8	3°02.0	3°02.5	2°53.7	0.8 - 0.2	6.8 - 1.4	12.8 - 2.7
9	3°02.3	3°02.7	2°53.9	0.9 - 0.2	6.9 - 1.4	12.9 - 2.7
10	3°02.5	3°03.0	2°54.2	1.0 - 0.2	7.0 - 1.5	13.0 - 2.7
11	3°02.8	3°03.2	2°54.4	1.1 - 0.2	7.1 - 1.5	13.1 - 2.7
12	3°03.0	3°03.5	2°54.7	1.2 - 0.3	7.2 - 1.5	13.2 - 2.8
13	3°03.3	3°03.8	2°54.9	1.3 - 0.3	7.3 - 1.5	13.3 - 2.8
14	3°03.5	3°04.0	2°55.1	1.4 - 0.3	7.4 - 1.5	13.4 - 2.8
15	3°03.8	3°04.3	2°55.4	1.5 - 0.3	7.5 - 1.6	13.5 - 2.8
16	3°04.0	3°04.5	2°55.6	1.6 - 0.3	7.6 - 1.6	13.6 - 2.8
17	3°04.2	3°04.8	2°55.9	1.7 - 0.4	7.7 - 1.6	13.7 - 2.9
18	3°04.5	3°05.0	2°56.1	1.8 - 0.4	7.8 - 1.6	13.8 - 2.9
19	3°04.7	3°05.3	2°56.3	1.9 - 0.4	7.9 - 1.6	13.9 - 2.9
20	3°05.0	3°05.5	2°56.6	2.0 - 0.4	8.0 - 1.7	14.0 - 2.9
21	3°05.2	3°05.8	2°56.8	2.1 - 0.4	8.1 - 1.7	14.1 - 2.9
22	3°05.5	3°06.0	2°57.0	2.2 - 0.5	8.2 - 1.7	14.2 - 3.0
23	3°05.7	3°06.3	2°57.3	2.3 - 0.5	8.3 - 1.7	14.3 - 3.0
24	3°06.0	3°06.5	2°57.5	2.4 - 0.5	8.4 - 1.8	14.4 - 3.0
25	3°06.2	3°06.8	2°57.8	2.5 - 0.5	8.5 - 1.8	14.5 - 3.0
26	3°06.5	3°07.0	2°58.0	2.6 - 0.5	8.6 - 1.8	14.6 - 3.0
27	3°06.7	3°07.3	2°58.2	2.7 - 0.6	8.7 - 1.8	14.7 - 3.1
28	3°07.0	3°07.5	2°58.5	2.8 - 0.6	8.8 - 1.8	14.8 - 3.1
29	3°07.2	3°07.8	2°58.7	2.9 - 0.6	8.9 - 1.9	14.9 - 3.1
30	3°07.5	3°08.0	2°59.0	3.0 - 0.6	9.0 - 1.9	15.0 - 3.1
31	3°07.8	3°08.3	2°59.2	3.1 - 0.6	9.1 - 1.9	15.1 - 3.1
32	3°08.0	3°08.5	2°59.4	3.2 - 0.7	9.2 - 1.9	15.2 - 3.2
33	3°08.3	3°08.8	2°59.7	3.3 - 0.7	9.3 - 1.9	15.3 - 3.2
34	3°08.5	3°09.0	2°59.9	3.4 - 0.7	9.4 - 2.0	15.4 - 3.2
35	3°08.8	3°09.3	3°00.2	3.5 - 0.7	9.5 - 2.0	15.5 - 3.2
36	3°09.0	3°09.5	3°00.4	3.6 - 0.8	9.6 - 2.0	15.6 - 3.3
37	3°09.3	3°09.8	3°00.6	3.7 - 0.8	9.7 - 2.0	15.7 - 3.3
38	3°09.5	3°10.0	3°00.9	3.8 - 0.8	9.8 - 2.0	15.8 - 3.3
39	3°09.8	3°10.3	3°01.1	3.9 - 0.8	9.9 - 2.1	15.9 - 3.3
40	3°10.0	3°10.5	3°01.3	4.0 - 0.8	10.0 - 2.1	16.0 - 3.3
41	3°10.3	3°10.8	3°01.6	4.1 - 0.9	10.1 - 2.1	16.1 - 3.4
42	3°10.5	3°11.0	3°01.8	4.2 - 0.9	10.2 - 2.1	16.2 - 3.4
43	3°10.8	3°11.3	3°02.1	4.3 - 0.9	10.3 - 2.1	16.3 - 3.4
44	3°11.0	3°11.5	3°02.3	4.4 - 0.9	10.4 - 2.2	16.4 - 3.4
45	3°11.3	3°11.8	3°02.5	4.5 - 0.9	10.5 - 2.2	16.5 - 3.4
46	3°11.5	3°12.0	3°02.8	4.6 - 1.0	10.6 - 2.2	16.6 - 3.5
47	3°11.7	3°12.3	3°03.0	4.7 - 1.0	10.7 - 2.2	16.7 - 3.5
48	3°12.0	3°12.5	3°03.3	4.8 - 1.0	10.8 - 2.3	16.8 - 3.5
49	3°12.2	3°12.8	3°03.5	4.9 - 1.0	10.9 - 2.3	16.9 - 3.5
50	3°12.5	3°13.0	3°03.7	5.0 - 1.0	11.0 - 2.3	17.0 - 3.5
51	3°12.7	3°13.3	3°04.0	5.1 - 1.1	11.1 - 2.3	17.1 - 3.6
52	3°13.0	3°13.5	3°04.2	5.2 - 1.1	11.2 - 2.3	17.2 - 3.6
53	3°13.2	3°13.8	3°04.4	5.3 - 1.1	11.3 - 2.4	17.3 - 3.6
54	3°13.5	3°14.0	3°04.7	5.4 - 1.1	11.4 - 2.4	17.4 - 3.6
55	3°13.7	3°14.3	3°04.9	5.5 - 1.1	11.5 - 2.4	17.5 - 3.6
56	3°14.0	3°14.5	3°05.2	5.6 - 1.2	11.6 - 2.4	17.6 - 3.7
57	3°14.2	3°14.8	3°05.4	5.7 - 1.2	11.7 - 2.4	17.7 - 3.7
58	3°14.5	3°15.0	3°05.6	5.8 - 1.2	11.8 - 2.5	17.8 - 3.7
59	3°14.7	3°15.3	3°05.9	5.9 - 1.2	11.9 - 2.5	17.9 - 3.7

m 13	Sun Plan.	Aries	Moon	v and d corr		
0	3°15.0	3°15.5	3°06.1	0.0 - 0.0	6.0 - 1.4	12.0 - 2.7
1	3°15.3	3°15.8	3°06.4	0.1 - 0.0	6.1 - 1.4	12.1 - 2.7
2	3°15.5	3°16.0	3°06.6	0.2 - 0.0	6.2 - 1.4	12.2 - 2.7
3	3°15.8	3°16.3	3°06.8	0.3 - 0.1	6.3 - 1.4	12.3 - 2.8
4	3°16.0	3°16.5	3°07.1	0.4 - 0.1	6.4 - 1.4	12.4 - 2.8
5	3°16.3	3°16.8	3°07.3	0.5 - 0.1	6.5 - 1.5	12.5 - 2.8
6	3°16.5	3°17.0	3°07.5	0.6 - 0.1	6.6 - 1.5	12.6 - 2.8
7	3°16.8	3°17.3	3°07.8	0.7 - 0.2	6.7 - 1.5	12.7 - 2.9
8	3°17.0	3°17.5	3°08.0	0.8 - 0.2	6.8 - 1.5	12.8 - 2.9
9	3°17.3	3°17.8	3°08.3	0.9 - 0.2	6.9 - 1.6	12.9 - 2.9
10	3°17.5	3°18.0	3°08.5	1.0 - 0.2	7.0 - 1.6	13.0 - 2.9
11	3°17.8	3°18.3	3°08.7	1.1 - 0.2	7.1 - 1.6	13.1 - 2.9
12	3°18.0	3°18.5	3°09.0	1.2 - 0.3	7.2 - 1.6	13.2 - 3.0
13	3°18.3	3°18.8	3°09.2	1.3 - 0.3	7.3 - 1.6	13.3 - 3.0
14	3°18.5	3°19.0	3°09.5	1.4 - 0.3	7.4 - 1.7	13.4 - 3.0
15	3°18.8	3°19.3	3°09.7	1.5 - 0.3	7.5 - 1.7	13.5 - 3.0
16	3°19.0	3°19.5	3°09.9	1.6 - 0.4	7.6 - 1.7	13.6 - 3.1
17	3°19.3	3°19.8	3°10.2	1.7 - 0.4	7.7 - 1.7	13.7 - 3.1
18	3°19.5	3°20.0	3°10.4	1.8 - 0.4	7.8 - 1.8	13.8 - 3.1
19	3°19.7	3°20.3	3°10.7	1.9 - 0.4	7.9 - 1.8	13.9 - 3.1
20	3°20.0	3°20.5	3°10.9	2.0 - 0.5	8.0 - 1.8	14.0 - 3.1
21	3°20.2	3°20.8	3°11.1	2.1 - 0.5	8.1 - 1.8	14.1 - 3.2
22	3°20.5	3°21.0	3°11.4	2.2 - 0.5	8.2 - 1.8	14.2 - 3.2
23	3°20.7	3°21.3	3°11.6	2.3 - 0.5	8.3 - 1.9	14.3 - 3.2
24	3°21.0	3°21.5	3°11.8	2.4 - 0.5	8.4 - 1.9	14.4 - 3.2
25	3°21.2	3°21.8	3°12.1	2.5 - 0.6	8.5 - 1.9	14.5 - 3.3
26	3°21.5	3°22.1	3°12.3	2.6 - 0.6	8.6 - 1.9	14.6 - 3.3
27	3°21.7	3°22.3	3°12.6	2.7 - 0.6	8.7 - 2.0	14.7 - 3.3
28	3°22.0	3°22.6	3°12.8	2.8 - 0.6	8.8 - 2.0	14.8 - 3.3
29	3°22.2	3°22.8	3°13.0	2.9 - 0.7	8.9 - 2.0	14.9 - 3.4
30	3°22.5	3°23.1	3°13.3	3.0 - 0.7	9.0 - 2.0	15.0 - 3.4
31	3°22.8	3°23.3	3°13.5	3.1 - 0.7	9.1 - 2.0	15.1 - 3.4
32	3°23.0	3°23.6	3°13.8	3.2 - 0.7	9.2 - 2.1	15.2 - 3.4
33	3°23.3	3°23.8	3°14.0	3.3 - 0.7	9.3 - 2.1	15.3 - 3.4
34	3°23.5	3°24.1	3°14.2	3.4 - 0.8	9.4 - 2.1	15.4 - 3.5
35	3°23.8	3°24.3	3°14.5	3.5 - 0.8	9.5 - 2.1	15.5 - 3.5
36	3°24.0	3°24.6	3°14.7	3.6 - 0.8	9.6 - 2.2	15.6 - 3.5
37	3°24.3	3°24.8	3°14.9	3.7 - 0.8	9.7 - 2.2	15.7 - 3.5
38	3°24.5	3°25.1	3°15.2	3.8 - 0.9	9.8 - 2.2	15.8 - 3.6
39	3°24.8	3°25.3	3°15.4	3.9 - 0.9	9.9 - 2.2	15.9 - 3.6
40	3°25.0	3°25.6	3°15.7	4.0 - 0.9	10.0 - 2.3	16.0 - 3.6
41	3°25.3	3°25.8	3°15.9	4.1 - 0.9	10.1 - 2.3	16.1 - 3.6
42	3°25.5	3°26.1	3°16.1	4.2 - 0.9	10.2 - 2.3	16.2 - 3.6
43	3°25.8	3°26.3	3°16.4	4.3 - 1.0	10.3 - 2.3	16.3 - 3.7
44	3°26.0	3°26.6	3°16.6	4.4 - 1.0	10.4 - 2.3	16.4 - 3.7
45	3°26.3	3°26.8	3°16.9	4.5 - 1.0	10.5 - 2.4	16.5 - 3.7
46	3°26.5	3°27.1	3°17.1	4.6 - 1.0	10.6 - 2.4	16.6 - 3.7
47	3°26.8	3°27.3	3°17.3	4.7 - 1.1	10.7 - 2.4	16.7 - 3.8
48	3°27.0	3°27.6	3°17.6	4.8 - 1.1	10.8 - 2.4	16.8 - 3.8
49	3°27.2	3°27.8	3°17.8	4.9 - 1.1	10.9 - 2.5	16.9 - 3.8
50	3°27.5	3°28.1	3°18.0	5.0 - 1.1	11.0 - 2.5	17.0 - 3.8
51	3°27.7	3°28.3	3°18.3	5.1 - 1.1	11.1 - 2.5	17.1 - 3.8
52	3°28.0	3°28.6	3°18.5	5.2 - 1.2	11.2 - 2.5	17.2 - 3.9
53	3°28.2	3°28.8	3°18.8	5.3 - 1.2	11.3 - 2.5	17.3 - 3.9
54	3°28.5	3°29.1	3°19.0	5.4 - 1.2	11.4 - 2.6	17.4 - 3.9
55	3°28.7	3°29.3	3°19.2	5.5 - 1.2	11.5 - 2.6	17.5 - 3.9
56	3°29.0	3°29.6	3°19.5	5.6 - 1.3	11.6 - 2.6	17.6 - 4.0
57	3°29.2	3°29.8	3°19.7	5.7 - 1.3	11.7 - 2.6	17.7 - 4.0
58	3°29.5	3°30.1	3°20.0	5.8 - 1.3	11.8 - 2.7	17.8 - 4.0
59	3°29.7	3°30.3	3°20.2	5.9 - 1.3	11.9 - 2.7	17.9 - 4.0

m 14	Sun Plan.	Aries	Moon	v and d corr		
0	3°30.0	3°30.6	3°20.4	0.0 - 0.0	6.0 - 1.4	12.0 - 2.9
1	3°30.3	3°30.8	3°20.7	0.1 - 0.0	6.1 - 1.5	12.1 - 2.9
2	3°30.5	3°31.1	3°20.9	0.2 - 0.0	6.2 - 1.5	12.2 - 2.9
3	3°30.8	3°31.3	3°21.1	0.3 - 0.1	6.3 - 1.5	12.3 - 3.0
4	3°31.0	3°31.6	3°21.4	0.4 - 0.1	6.4 - 1.5	12.4 - 3.0
5	3°31.3	3°31.8	3°21.6	0.5 - 0.1	6.5 - 1.6	12.5 - 3.0
6	3°31.5	3°32.1	3°21.9	0.6 - 0.1	6.6 - 1.6	12.6 - 3.0
7	3°31.8	3°32.3	3°22.1	0.7 - 0.2	6.7 - 1.6	12.7 - 3.1
8	3°32.0	3°32.6	3°22.3	0.8 - 0.2	6.8 - 1.6	12.8 - 3.1
9	3°32.3	3°32.8	3°22.6	0.9 - 0.2	6.9 - 1.7	12.9 - 3.1
10	3°32.5	3°33.1	3°22.8	1.0 - 0.2	7.0 - 1.7	13.0 - 3.1
11	3°32.8	3°33.3	3°23.1	1.1 - 0.3	7.1 - 1.7	13.1 - 3.2
12	3°33.0	3°33.6	3°23.3	1.2 - 0.3	7.2 - 1.7	13.2 - 3.2
13	3°33.3	3°33.8	3°23.5	1.3 - 0.3	7.3 - 1.8	13.3 - 3.2
14	3°33.5	3°34.1	3°23.8	1.4 - 0.3	7.4 - 1.8	13.4 - 3.2
15	3°33.8	3°34.3	3°24.0	1.5 - 0.4	7.5 - 1.8	13.5 - 3.3
16	3°34.0	3°34.6	3°24.3	1.6 - 0.4	7.6 - 1.8	13.6 - 3.3
17	3°34.3	3°34.8	3°24.5	1.7 - 0.4	7.7 - 1.9	13.7 - 3.3
18	3°34.5	3°35.1	3°24.7	1.8 - 0.4	7.8 - 1.9	13.8 - 3.3
19	3°34.8	3°35.3	3°25.0	1.9 - 0.5	7.9 - 1.9	13.9 - 3.4
20	3°35.0	3°35.6	3°25.2	2.0 - 0.5	8.0 - 1.9	14.0 - 3.4
21	3°35.2	3°35.8	3°25.4	2.1 - 0.5	8.1 - 2.0	14.1 - 3.4
22	3°35.5	3°36.1	3°25.7	2.2 - 0.5	8.2 - 2.0	14.2 - 3.4
23	3°35.7	3°36.3	3°25.9	2.3 - 0.6	8.3 - 2.0	14.3 - 3.5
24	3°36.0	3°36.6	3°26.2	2.4 - 0.6	8.4 - 2.0	14.4 - 3.5
25	3°36.2	3°36.8	3°26.4	2.5 - 0.6	8.5 - 2.1	14.5 - 3.5
26	3°36.5	3°37.1	3°26.6	2.6 - 0.6	8.6 - 2.1	14.6 - 3.5
27	3°36.7	3°37.3	3°26.9	2.7 - 0.7	8.7 - 2.1	14.7 - 3.6
28	3°37.0	3°37.6	3°27.1	2.8 - 0.7	8.8 - 2.1	14.8 - 3.6
29	3°37.2	3°37.8	3°27.4	2.9 - 0.7	8.9 - 2.2	14.9 - 3.6
30	3°37.5	3°38.1	3°27.6	3.0 - 0.7	9.0 - 2.2	15.0 - 3.6
31	3°37.8	3°38.3	3°27.8	3.1 - 0.7	9.1 - 2.2	15.1 - 3.6
32	3°38.0	3°38.6	3°28.1	3.2 - 0.8	9.2 - 2.2	15.2 - 3.7
33	3°38.3	3°38.8	3°28.3	3.3 - 0.8	9.3 - 2.2	15.3 - 3.7
34	3°38.5	3°39.1	3°28.5	3.4 - 0.8	9.4 - 2.3	15.4 - 3.7
35	3°38.8	3°39.3	3°28.8	3.5 - 0.8	9.5 - 2.3	15.5 - 3.7
36	3°39.0	3°39.6	3°29.0	3.6 - 0.9	9.6 - 2.3	15.6 - 3.8
37	3°39.3	3°39.8	3°29.3	3.7 - 0.9	9.7 - 2.3	15.7 - 3.8
38	3°39.5	3°40.1	3°29.5	3.8 - 0.9	9.8 - 2.4	15.8 - 3.8
39	3°39.8	3°40.4	3°29.7	3.9 - 0.9	9.9 - 2.4	15.9 - 3.8
40	3°40.0	3°40.6	3°30.0	4.0 - 1.0	10.0 - 2.4	16.0 - 3.9
41	3°40.3	3°40.9	3°30.2	4.1 - 1.0	10.1 - 2.4	16.1 - 3.9
42	3°40.5	3°41.1	3°30.5	4.2 - 1.0	10.2 - 2.5	16.2 - 3.9
43	3°40.8	3°41.4	3°30.7	4.3 - 1.0	10.3 - 2.5	16.3 - 3.9
44	3°41.0	3°41.6	3°30.9	4.4 - 1.1	10.4 - 2.5	16.4 - 4.0
45	3°41.3	3°41.9	3°31.2	4.5 - 1.1	10.5 - 2.5	16.5 - 4.0
46	3°41.5	3°42.1	3°31.4	4.6 - 1.1	10.6 - 2.6	16.6 - 4.0
47	3°41.8	3°42.4	3°31.6	4.7 - 1.1	10.7 - 2.6	16.7 - 4.0
48	3°42.0	3°42.6	3°31.9	4.8 - 1.2	10.8 - 2.6	16.8 - 4.1
49	3°42.3	3°42.9	3°32.1	4.9 - 1.2	10.9 - 2.6	16.9 - 4.1
50	3°42.5	3°43.1	3°32.4	5.0 - 1.2	11.0 - 2.7	17.0 - 4.1
51	3°42.7	3°43.4	3°32.6	5.1 - 1.2	11.1 - 2.7	17.1 - 4.1
52	3°43.0	3°43.6	3°32.8	5.2 - 1.3	11.2 - 2.7	17.2 - 4.2
53	3°43.2	3°43.9	3°33.1	5.3 - 1.3	11.3 - 2.7	17.3 - 4.2
54	3°43.5	3°44.1	3°33.3	5.4 - 1.3	11.4 - 2.8	17.4 - 4.2
55	3°43.7	3°44.4	3°33.6	5.5 - 1.3	11.5 - 2.8	17.5 - 4.2
56	3°44.0	3°44.6	3°33.8	5.6 - 1.4	11.6 - 2.8	17.6 - 4.3
57	3°44.2	3°44.9	3°34.0	5.7 - 1.4	11.7 - 2.8	17.7 - 4.3
58	3°44.5	3°45.1	3°34.3	5.8 - 1.4	11.8 - 2.9	17.8 - 4.3
59	3°44.7	3°45.4	3°34.5	5.9 - 1.4	11.9 - 2.9	17.9 - 4.3

Increments and Corrections

m 15	Sun Plan.	Aries	Moon	v and d corr		
0	3°45.0	3°45.6	3°34.8	0.0 - 0.0	6.0 - 1.6	12.0 - 3.1
1	3°45.2	3°45.9	3°35.0	0.1 - 0.0	6.1 - 1.6	12.1 - 3.1
2	3°45.5	3°46.1	3°35.2	0.2 - 0.1	6.2 - 1.6	12.2 - 3.2
3	3°45.8	3°46.4	3°35.5	0.3 - 0.1	6.3 - 1.6	12.3 - 3.2
4	3°46.0	3°46.6	3°35.7	0.4 - 0.1	6.4 - 1.7	12.4 - 3.2
5	3°46.2	3°46.9	3°35.9	0.5 - 0.1	6.5 - 1.7	12.5 - 3.2
6	3°46.5	3°47.1	3°36.2	0.6 - 0.2	6.6 - 1.7	12.6 - 3.3
7	3°46.8	3°47.4	3°36.4	0.7 - 0.2	6.7 - 1.7	12.7 - 3.3
8	3°47.0	3°47.6	3°36.7	0.8 - 0.2	6.8 - 1.8	12.8 - 3.3
9	3°47.3	3°47.9	3°36.9	0.9 - 0.2	6.9 - 1.8	12.9 - 3.3
10	3°47.5	3°48.1	3°37.1	1.0 - 0.3	7.0 - 1.8	13.0 - 3.4
11	3°47.7	3°48.4	3°37.4	1.1 - 0.3	7.1 - 1.8	13.1 - 3.4
12	3°48.0	3°48.6	3°37.6	1.2 - 0.3	7.2 - 1.9	13.2 - 3.4
13	3°48.3	3°48.9	3°37.9	1.3 - 0.3	7.3 - 1.9	13.3 - 3.4
14	3°48.5	3°49.1	3°38.1	1.4 - 0.4	7.4 - 1.9	13.4 - 3.5
15	3°48.8	3°49.4	3°38.3	1.5 - 0.4	7.5 - 1.9	13.5 - 3.5
16	3°49.0	3°49.6	3°38.6	1.6 - 0.4	7.6 - 2.0	13.6 - 3.5
17	3°49.3	3°49.9	3°38.8	1.7 - 0.4	7.7 - 2.0	13.7 - 3.5
18	3°49.5	3°50.1	3°39.0	1.8 - 0.5	7.8 - 2.0	13.8 - 3.6
19	3°49.8	3°50.4	3°39.3	1.9 - 0.5	7.9 - 2.0	13.9 - 3.6
20	3°50.0	3°50.6	3°39.5	2.0 - 0.5	8.0 - 2.1	14.0 - 3.6
21	3°50.2	3°50.9	3°39.8	2.1 - 0.5	8.1 - 2.1	14.1 - 3.6
22	3°50.5	3°51.1	3°40.0	2.2 - 0.6	8.2 - 2.1	14.2 - 3.7
23	3°50.7	3°51.4	3°40.2	2.3 - 0.6	8.3 - 2.1	14.3 - 3.7
24	3°51.0	3°51.6	3°40.5	2.4 - 0.6	8.4 - 2.2	14.4 - 3.7
25	3°51.2	3°51.9	3°40.7	2.5 - 0.6	8.5 - 2.2	14.5 - 3.7
26	3°51.5	3°52.1	3°41.0	2.6 - 0.7	8.6 - 2.2	14.6 - 3.8
27	3°51.8	3°52.4	3°41.2	2.7 - 0.7	8.7 - 2.2	14.7 - 3.8
28	3°52.0	3°52.6	3°41.4	2.8 - 0.7	8.8 - 2.3	14.8 - 3.8
29	3°52.2	3°52.9	3°41.7	2.9 - 0.7	8.9 - 2.3	14.9 - 3.8
30	3°52.5	3°53.1	3°41.9	3.0 - 0.8	9.0 - 2.3	15.0 - 3.9
31	3°52.8	3°53.4	3°42.1	3.1 - 0.8	9.1 - 2.4	15.1 - 3.9
32	3°53.0	3°53.6	3°42.4	3.2 - 0.8	9.2 - 2.4	15.2 - 3.9
33	3°53.2	3°53.9	3°42.6	3.3 - 0.9	9.3 - 2.4	15.3 - 4.0
34	3°53.5	3°54.1	3°42.9	3.4 - 0.9	9.4 - 2.4	15.4 - 4.0
35	3°53.8	3°54.4	3°43.1	3.5 - 0.9	9.5 - 2.5	15.5 - 4.0
36	3°54.0	3°54.6	3°43.3	3.6 - 0.9	9.6 - 2.5	15.6 - 4.0
37	3°54.3	3°54.9	3°43.6	3.7 - 1.0	9.7 - 2.5	15.7 - 4.1
38	3°54.5	3°55.1	3°43.8	3.8 - 1.0	9.8 - 2.5	15.8 - 4.1
39	3°54.8	3°55.4	3°44.1	3.9 - 1.0	9.9 - 2.6	15.9 - 4.1
40	3°55.0	3°55.6	3°44.3	4.0 - 1.0	10.0 - 2.6	16.0 - 4.1
41	3°55.3	3°55.9	3°44.5	4.1 - 1.1	10.1 - 2.6	16.1 - 4.2
42	3°55.5	3°56.1	3°44.8	4.2 - 1.1	10.2 - 2.6	16.2 - 4.2
43	3°55.7	3°56.4	3°45.0	4.3 - 1.1	10.3 - 2.7	16.3 - 4.2
44	3°56.0	3°56.6	3°45.2	4.4 - 1.1	10.4 - 2.7	16.4 - 4.2
45	3°56.3	3°56.9	3°45.5	4.5 - 1.2	10.5 - 2.7	16.5 - 4.3
46	3°56.5	3°57.1	3°45.7	4.6 - 1.2	10.6 - 2.7	16.6 - 4.3
47	3°56.8	3°57.4	3°46.0	4.7 - 1.2	10.7 - 2.8	16.7 - 4.3
48	3°57.0	3°57.6	3°46.2	4.8 - 1.2	10.8 - 2.8	16.8 - 4.3
49	3°57.3	3°57.9	3°46.4	4.9 - 1.3	10.9 - 2.8	16.9 - 4.4
50	3°57.5	3°58.1	3°46.7	5.0 - 1.3	11.0 - 2.8	17.0 - 4.4
51	3°57.7	3°58.4	3°46.9	5.1 - 1.3	11.1 - 2.9	17.1 - 4.4
52	3°58.0	3°58.7	3°47.2	5.2 - 1.3	11.2 - 2.9	17.2 - 4.4
53	3°58.2	3°58.9	3°47.4	5.3 - 1.4	11.3 - 2.9	17.3 - 4.5
54	3°58.5	3°59.2	3°47.6	5.4 - 1.4	11.4 - 2.9	17.4 - 4.5
55	3°58.7	3°59.4	3°47.9	5.5 - 1.4	11.5 - 3.0	17.5 - 4.5
56	3°59.0	3°59.7	3°48.1	5.6 - 1.4	11.6 - 3.0	17.6 - 4.5
57	3°59.2	3°59.9	3°48.4	5.7 - 1.5	11.7 - 3.0	17.7 - 4.6
58	3°59.5	4°00.2	3°48.6	5.8 - 1.5	11.8 - 3.0	17.8 - 4.6
59	3°59.8	4°00.4	3°48.8	5.9 - 1.5	11.9 - 3.1	17.9 - 4.6

m 16	Sun Plan.	Aries	Moon	v and d corr		
0	4°00.0	4°00.7	3°49.1	0.0 - 0.0	6.0 - 1.7	12.0 - 3.3
1	4°00.2	4°00.9	3°49.3	0.1 - 0.0	6.1 - 1.7	12.1 - 3.3
2	4°00.5	4°01.2	3°49.5	0.2 - 0.1	6.2 - 1.7	12.2 - 3.4
3	4°00.8	4°01.4	3°49.8	0.3 - 0.1	6.3 - 1.7	12.3 - 3.4
4	4°01.0	4°01.7	3°50.0	0.4 - 0.1	6.4 - 1.8	12.4 - 3.4
5	4°01.2	4°01.9	3°50.3	0.5 - 0.1	6.5 - 1.8	12.5 - 3.4
6	4°01.5	4°02.2	3°50.5	0.6 - 0.2	6.6 - 1.8	12.6 - 3.5
7	4°01.8	4°02.4	3°50.7	0.7 - 0.2	6.7 - 1.8	12.7 - 3.5
8	4°02.0	4°02.7	3°51.0	0.8 - 0.2	6.8 - 1.9	12.8 - 3.5
9	4°02.2	4°02.9	3°51.2	0.9 - 0.2	6.9 - 1.9	12.9 - 3.5
10	4°02.5	4°03.2	3°51.5	1.0 - 0.3	7.0 - 1.9	13.0 - 3.6
11	4°02.8	4°03.4	3°51.7	1.1 - 0.3	7.1 - 2.0	13.1 - 3.6
12	4°03.0	4°03.7	3°51.9	1.2 - 0.3	7.2 - 2.0	13.2 - 3.6
13	4°03.2	4°03.9	3°52.2	1.3 - 0.4	7.3 - 2.0	13.3 - 3.7
14	4°03.5	4°04.2	3°52.4	1.4 - 0.4	7.4 - 2.0	13.4 - 3.7
15	4°03.8	4°04.4	3°52.6	1.5 - 0.4	7.5 - 2.1	13.5 - 3.7
16	4°04.0	4°04.7	3°52.9	1.6 - 0.4	7.6 - 2.1	13.6 - 3.7
17	4°04.3	4°04.9	3°53.1	1.7 - 0.5	7.7 - 2.1	13.7 - 3.8
18	4°04.5	4°05.2	3°53.4	1.8 - 0.5	7.8 - 2.1	13.8 - 3.8
19	4°04.7	4°05.4	3°53.6	1.9 - 0.5	7.9 - 2.2	13.9 - 3.8
20	4°05.0	4°05.7	3°53.8	2.0 - 0.6	8.0 - 2.2	14.0 - 3.9
21	4°05.3	4°05.9	3°54.1	2.1 - 0.6	8.1 - 2.2	14.1 - 3.9
22	4°05.5	4°06.2	3°54.3	2.2 - 0.6	8.2 - 2.3	14.2 - 3.9
23	4°05.7	4°06.4	3°54.6	2.3 - 0.6	8.3 - 2.3	14.3 - 3.9
24	4°06.0	4°06.7	3°54.8	2.4 - 0.7	8.4 - 2.3	14.4 - 4.0
25	4°06.3	4°06.9	3°55.0	2.5 - 0.7	8.5 - 2.3	14.5 - 4.0
26	4°06.5	4°07.2	3°55.3	2.6 - 0.7	8.6 - 2.4	14.6 - 4.0
27	4°06.7	4°07.4	3°55.5	2.7 - 0.7	8.7 - 2.4	14.7 - 4.0
28	4°07.0	4°07.7	3°55.7	2.8 - 0.8	8.8 - 2.4	14.8 - 4.1
29	4°07.3	4°07.9	3°56.0	2.9 - 0.8	8.9 - 2.4	14.9 - 4.1
30	4°07.5	4°08.2	3°56.2	3.0 - 0.8	9.0 - 2.5	15.0 - 4.1
31	4°07.7	4°08.4	3°56.5	3.1 - 0.9	9.1 - 2.5	15.1 - 4.2
32	4°08.0	4°08.7	3°56.7	3.2 - 0.9	9.2 - 2.5	15.2 - 4.2
33	4°08.3	4°08.9	3°56.9	3.3 - 0.9	9.3 - 2.6	15.3 - 4.2
34	4°08.5	4°09.2	3°57.2	3.4 - 0.9	9.4 - 2.6	15.4 - 4.2
35	4°08.7	4°09.4	3°57.4	3.5 - 1.0	9.5 - 2.6	15.5 - 4.3
36	4°09.0	4°09.7	3°57.7	3.6 - 1.0	9.6 - 2.6	15.6 - 4.3
37	4°09.3	4°09.9	3°57.9	3.7 - 1.0	9.7 - 2.7	15.7 - 4.3
38	4°09.5	4°10.2	3°58.1	3.8 - 1.0	9.8 - 2.7	15.8 - 4.3
39	4°09.7	4°10.4	3°58.4	3.9 - 1.1	9.9 - 2.7	15.9 - 4.4
40	4°10.0	4°10.7	3°58.6	4.0 - 1.1	10.0 - 2.8	16.0 - 4.4
41	4°10.3	4°10.9	3°58.8	4.1 - 1.1	10.1 - 2.8	16.1 - 4.4
42	4°10.5	4°11.2	3°59.1	4.2 - 1.2	10.2 - 2.8	16.2 - 4.5
43	4°10.7	4°11.4	3°59.3	4.3 - 1.2	10.3 - 2.8	16.3 - 4.5
44	4°11.0	4°11.7	3°59.6	4.4 - 1.2	10.4 - 2.9	16.4 - 4.5
45	4°11.3	4°11.9	3°59.8	4.5 - 1.2	10.5 - 2.9	16.5 - 4.5
46	4°11.5	4°12.2	4°00.0	4.6 - 1.3	10.6 - 2.9	16.6 - 4.6
47	4°11.8	4°12.4	4°00.3	4.7 - 1.3	10.7 - 2.9	16.7 - 4.6
48	4°12.0	4°12.7	4°00.5	4.8 - 1.3	10.8 - 3.0	16.8 - 4.6
49	4°12.2	4°12.9	4°00.8	4.9 - 1.3	10.9 - 3.0	16.9 - 4.6
50	4°12.5	4°13.2	4°01.0	5.0 - 1.4	11.0 - 3.0	17.0 - 4.7
51	4°12.8	4°13.4	4°01.2	5.1 - 1.4	11.1 - 3.1	17.1 - 4.7
52	4°13.0	4°13.7	4°01.5	5.2 - 1.4	11.2 - 3.1	17.2 - 4.7
53	4°13.2	4°13.9	4°01.7	5.3 - 1.5	11.3 - 3.1	17.3 - 4.8
54	4°13.5	4°14.2	4°02.0	5.4 - 1.5	11.4 - 3.1	17.4 - 4.8
55	4°13.8	4°14.4	4°02.2	5.5 - 1.5	11.5 - 3.2	17.5 - 4.8
56	4°14.0	4°14.7	4°02.4	5.6 - 1.5	11.6 - 3.2	17.6 - 4.8
57	4°14.2	4°14.9	4°02.7	5.7 - 1.6	11.7 - 3.2	17.7 - 4.9
58	4°14.5	4°15.2	4°02.9	5.8 - 1.6	11.8 - 3.2	17.8 - 4.9
59	4°14.8	4°15.4	4°03.1	5.9 - 1.6	11.9 - 3.3	17.9 - 4.9

m 17	Sun Plan.	Aries	Moon	v and d corr		
0	4°15.0	4°15.7	4°03.4	0.0 - 0.0	6.0 - 1.8	12.0 - 3.5
1	4°15.2	4°15.9	4°03.6	0.1 - 0.0	6.1 - 1.8	12.1 - 3.5
2	4°15.5	4°16.2	4°03.9	0.2 - 0.1	6.2 - 1.8	12.2 - 3.6
3	4°15.8	4°16.4	4°04.1	0.3 - 0.1	6.3 - 1.8	12.3 - 3.6
4	4°16.0	4°16.7	4°04.3	0.4 - 0.1	6.4 - 1.9	12.4 - 3.6
5	4°16.2	4°17.0	4°04.6	0.5 - 0.1	6.5 - 1.9	12.5 - 3.6
6	4°16.5	4°17.2	4°04.8	0.6 - 0.2	6.6 - 1.9	12.6 - 3.7
7	4°16.8	4°17.5	4°05.1	0.7 - 0.2	6.7 - 2.0	12.7 - 3.7
8	4°17.0	4°17.7	4°05.3	0.8 - 0.2	6.8 - 2.0	12.8 - 3.7
9	4°17.2	4°18.0	4°05.5	0.9 - 0.3	6.9 - 2.0	12.9 - 3.8
10	4°17.5	4°18.2	4°05.8	1.0 - 0.3	7.0 - 2.0	13.0 - 3.8
11	4°17.8	4°18.5	4°06.0	1.1 - 0.3	7.1 - 2.1	13.1 - 3.8
12	4°18.0	4°18.7	4°06.2	1.2 - 0.4	7.2 - 2.1	13.2 - 3.9
13	4°18.2	4°19.0	4°06.5	1.3 - 0.4	7.3 - 2.1	13.3 - 3.9
14	4°18.5	4°19.2	4°06.7	1.4 - 0.4	7.4 - 2.2	13.4 - 3.9
15	4°18.8	4°19.5	4°07.0	1.5 - 0.4	7.5 - 2.2	13.5 - 3.9
16	4°19.0	4°19.7	4°07.2	1.6 - 0.5	7.6 - 2.2	13.6 - 4.0
17	4°19.3	4°20.0	4°07.4	1.7 - 0.5	7.7 - 2.2	13.7 - 4.0
18	4°19.5	4°20.2	4°07.7	1.8 - 0.5	7.8 - 2.3	13.8 - 4.0
19	4°19.7	4°20.5	4°07.9	1.9 - 0.6	7.9 - 2.3	13.9 - 4.1
20	4°20.0	4°20.7	4°08.2	2.0 - 0.6	8.0 - 2.3	14.0 - 4.1
21	4°20.3	4°21.0	4°08.4	2.1 - 0.6	8.1 - 2.4	14.1 - 4.1
22	4°20.5	4°21.2	4°08.6	2.2 - 0.6	8.2 - 2.4	14.2 - 4.1
23	4°20.7	4°21.5	4°08.9	2.3 - 0.7	8.3 - 2.4	14.3 - 4.2
24	4°21.0	4°21.7	4°09.1	2.4 - 0.7	8.4 - 2.5	14.4 - 4.2
25	4°21.3	4°22.0	4°09.3	2.5 - 0.7	8.5 - 2.5	14.5 - 4.2
26	4°21.5	4°22.2	4°09.6	2.6 - 0.8	8.6 - 2.5	14.6 - 4.3
27	4°21.7	4°22.5	4°09.8	2.7 - 0.8	8.7 - 2.5	14.7 - 4.3
28	4°22.0	4°22.7	4°10.1	2.8 - 0.8	8.8 - 2.6	14.8 - 4.3
29	4°22.3	4°23.0	4°10.3	2.9 - 0.8	8.9 - 2.6	14.9 - 4.3
30	4°22.5	4°23.2	4°10.5	3.0 - 0.9	9.0 - 2.6	15.0 - 4.4
31	4°22.7	4°23.5	4°10.8	3.1 - 0.9	9.1 - 2.7	15.1 - 4.4
32	4°23.0	4°23.7	4°11.0	3.2 - 0.9	9.2 - 2.7	15.2 - 4.4
33	4°23.3	4°24.0	4°11.3	3.3 - 1.0	9.3 - 2.7	15.3 - 4.5
34	4°23.5	4°24.2	4°11.5	3.4 - 1.0	9.4 - 2.7	15.4 - 4.5
35	4°23.7	4°24.5	4°11.7	3.5 - 1.0	9.5 - 2.8	15.5 - 4.5
36	4°24.0	4°24.7	4°12.0	3.6 - 1.1	9.6 - 2.8	15.6 - 4.5
37	4°24.3	4°25.0	4°12.2	3.7 - 1.1	9.7 - 2.8	15.7 - 4.6
38	4°24.5	4°25.2	4°12.5	3.8 - 1.1	9.8 - 2.9	15.8 - 4.6
39	4°24.7	4°25.5	4°12.7	3.9 - 1.1	9.9 - 2.9	15.9 - 4.6
40	4°25.0	4°25.7	4°12.9	4.0 - 1.2	10.0 - 2.9	16.0 - 4.7
41	4°25.3	4°26.0	4°13.2	4.1 - 1.2	10.1 - 2.9	16.1 - 4.7
42	4°25.5	4°26.2	4°13.4	4.2 - 1.2	10.2 - 3.0	16.2 - 4.7
43	4°25.7	4°26.5	4°13.6	4.3 - 1.3	10.3 - 3.0	16.3 - 4.8
44	4°26.0	4°26.7	4°13.9	4.4 - 1.3	10.4 - 3.0	16.4 - 4.8
45	4°26.3	4°27.0	4°14.1	4.5 - 1.3	10.5 - 3.1	16.5 - 4.8
46	4°26.5	4°27.2	4°14.4	4.6 - 1.3	10.6 - 3.1	16.6 - 4.8
47	4°26.8	4°27.5	4°14.6	4.7 - 1.4	10.7 - 3.1	16.7 - 4.9
48	4°27.0	4°27.7	4°14.8	4.8 - 1.4	10.8 - 3.2	16.8 - 4.9
49	4°27.2	4°28.0	4°15.1	4.9 - 1.4	10.9 - 3.2	16.9 - 4.9
50	4°27.5	4°28.2	4°15.3	5.0 - 1.5	11.0 - 3.2	17.0 - 5.0
51	4°27.8	4°28.5	4°15.6	5.1 - 1.5	11.1 - 3.2	17.1 - 5.0
52	4°28.0	4°28.7	4°15.8	5.2 - 1.5	11.2 - 3.3	17.2 - 5.0
53	4°28.2	4°29.0	4°16.0	5.3 - 1.5	11.3 - 3.3	17.3 - 5.0
54	4°28.5	4°29.2	4°16.3	5.4 - 1.6	11.4 - 3.3	17.4 - 5.1
55	4°28.8	4°29.5	4°16.5	5.5 - 1.6	11.5 - 3.4	17.5 - 5.1
56	4°29.0	4°29.7	4°16.7	5.6 - 1.6	11.6 - 3.4	17.6 - 5.1
57	4°29.2	4°30.0	4°17.0	5.7 - 1.7	11.7 - 3.4	17.7 - 5.2
58	4°29.5	4°30.2	4°17.2	5.8 - 1.7	11.8 - 3.4	17.8 - 5.2
59	4°29.8	4°30.5	4°17.5	5.9 - 1.7	11.9 - 3.5	17.9 - 5.2

Increments and Corrections

m	Sun	Aries	Moon	v and d corr		
18	Plan.					
0	4°30.0	4°30.7	4°17.7	0.0 - 0.0	6.0 - 1.9	12.0 - 3.7
1	4°30.2	4°31.0	4°17.9	0.1 - 0.0	6.1 - 1.9	12.1 - 3.7
2	4°30.5	4°31.2	4°18.2	0.2 - 0.1	6.2 - 1.9	12.2 - 3.8
3	4°30.8	4°31.5	4°18.4	0.3 - 0.1	6.3 - 1.9	12.3 - 3.8
4	4°31.0	4°31.7	4°18.7	0.4 - 0.1	6.4 - 2.0	12.4 - 3.8
5	4°31.2	4°32.0	4°18.9	0.5 - 0.2	6.5 - 2.0	12.5 - 3.9
6	4°31.5	4°32.2	4°19.1	0.6 - 0.2	6.6 - 2.0	12.6 - 3.9
7	4°31.8	4°32.5	4°19.4	0.7 - 0.2	6.7 - 2.1	12.7 - 3.9
8	4°32.0	4°32.7	4°19.6	0.8 - 0.2	6.8 - 2.1	12.8 - 3.9
9	4°32.2	4°33.0	4°19.8	0.9 - 0.3	6.9 - 2.1	12.9 - 4.0
10	4°32.5	4°33.2	4°20.1	1.0 - 0.3	7.0 - 2.2	13.0 - 4.0
11	4°32.8	4°33.5	4°20.3	1.1 - 0.3	7.1 - 2.2	13.1 - 4.0
12	4°33.0	4°33.7	4°20.6	1.2 - 0.4	7.2 - 2.2	13.2 - 4.1
13	4°33.2	4°34.0	4°20.8	1.3 - 0.4	7.3 - 2.3	13.3 - 4.1
14	4°33.5	4°34.2	4°21.0	1.4 - 0.4	7.4 - 2.3	13.4 - 4.1
15	4°33.8	4°34.5	4°21.3	1.5 - 0.5	7.5 - 2.3	13.5 - 4.2
16	4°34.0	4°34.7	4°21.5	1.6 - 0.5	7.6 - 2.3	13.6 - 4.2
17	4°34.3	4°35.0	4°21.8	1.7 - 0.5	7.7 - 2.4	13.7 - 4.2
18	4°34.5	4°35.3	4°22.0	1.8 - 0.6	7.8 - 2.4	13.8 - 4.3
19	4°34.8	4°35.5	4°22.2	1.9 - 0.6	7.9 - 2.4	13.9 - 4.3
20	4°35.0	4°35.8	4°22.5	2.0 - 0.6	8.0 - 2.5	14.0 - 4.3
21	4°35.3	4°36.0	4°22.7	2.1 - 0.6	8.1 - 2.5	14.1 - 4.3
22	4°35.5	4°36.3	4°22.9	2.2 - 0.7	8.2 - 2.5	14.2 - 4.4
23	4°35.7	4°36.5	4°23.2	2.3 - 0.7	8.3 - 2.6	14.3 - 4.4
24	4°36.0	4°36.8	4°23.4	2.4 - 0.7	8.4 - 2.6	14.4 - 4.4
25	4°36.3	4°37.0	4°23.7	2.5 - 0.8	8.5 - 2.6	14.5 - 4.5
26	4°36.5	4°37.3	4°23.9	2.6 - 0.8	8.6 - 2.7	14.6 - 4.5
27	4°36.7	4°37.5	4°24.1	2.7 - 0.8	8.7 - 2.7	14.7 - 4.5
28	4°37.0	4°37.8	4°24.4	2.8 - 0.9	8.8 - 2.7	14.8 - 4.6
29	4°37.3	4°38.0	4°24.6	2.9 - 0.9	8.9 - 2.7	14.9 - 4.6
30	4°37.5	4°38.3	4°24.9	3.0 - 0.9	9.0 - 2.8	15.0 - 4.6
31	4°37.7	4°38.5	4°25.1	3.1 - 1.0	9.1 - 2.8	15.1 - 4.7
32	4°38.0	4°38.8	4°25.3	3.2 - 1.0	9.2 - 2.8	15.2 - 4.7
33	4°38.3	4°39.0	4°25.6	3.3 - 1.0	9.3 - 2.9	15.3 - 4.7
34	4°38.5	4°39.3	4°25.8	3.4 - 1.0	9.4 - 2.9	15.4 - 4.7
35	4°38.7	4°39.5	4°26.1	3.5 - 1.1	9.5 - 2.9	15.5 - 4.8
36	4°39.0	4°39.8	4°26.3	3.6 - 1.1	9.6 - 3.0	15.6 - 4.8
37	4°39.3	4°40.0	4°26.5	3.7 - 1.1	9.7 - 3.0	15.7 - 4.8
38	4°39.5	4°40.3	4°26.8	3.8 - 1.2	9.8 - 3.0	15.8 - 4.9
39	4°39.7	4°40.5	4°27.0	3.9 - 1.2	9.9 - 3.1	15.9 - 4.9
40	4°40.0	4°40.8	4°27.2	4.0 - 1.2	10.0 - 3.1	16.0 - 4.9
41	4°40.3	4°41.0	4°27.5	4.1 - 1.3	10.1 - 3.1	16.1 - 5.0
42	4°40.5	4°41.3	4°27.7	4.2 - 1.3	10.2 - 3.1	16.2 - 5.0
43	4°40.7	4°41.5	4°28.0	4.3 - 1.3	10.3 - 3.2	16.3 - 5.0
44	4°41.0	4°41.8	4°28.2	4.4 - 1.4	10.4 - 3.2	16.4 - 5.1
45	4°41.3	4°42.0	4°28.4	4.5 - 1.4	10.5 - 3.2	16.5 - 5.1
46	4°41.5	4°42.3	4°28.7	4.6 - 1.4	10.6 - 3.3	16.6 - 5.1
47	4°41.8	4°42.5	4°28.9	4.7 - 1.4	10.7 - 3.3	16.7 - 5.1
48	4°42.0	4°42.8	4°29.2	4.8 - 1.5	10.8 - 3.3	16.8 - 5.2
49	4°42.3	4°43.0	4°29.4	4.9 - 1.5	10.9 - 3.4	16.9 - 5.2
50	4°42.5	4°43.3	4°29.6	5.0 - 1.5	11.0 - 3.4	17.0 - 5.2
51	4°42.8	4°43.5	4°29.9	5.1 - 1.6	11.1 - 3.4	17.1 - 5.3
52	4°43.0	4°43.8	4°30.1	5.2 - 1.6	11.2 - 3.5	17.2 - 5.3
53	4°43.2	4°44.0	4°30.3	5.3 - 1.6	11.3 - 3.5	17.3 - 5.3
54	4°43.5	4°44.3	4°30.6	5.4 - 1.7	11.4 - 3.5	17.4 - 5.4
55	4°43.8	4°44.5	4°30.8	5.5 - 1.7	11.5 - 3.5	17.5 - 5.4
56	4°44.0	4°44.8	4°31.1	5.6 - 1.7	11.6 - 3.6	17.6 - 5.4
57	4°44.2	4°45.0	4°31.3	5.7 - 1.8	11.7 - 3.6	17.7 - 5.5
58	4°44.5	4°45.3	4°31.5	5.8 - 1.8	11.8 - 3.6	17.8 - 5.5
59	4°44.8	4°45.5	4°31.8	5.9 - 1.8	11.9 - 3.7	17.9 - 5.5

m	Sun	Aries	Moon	v and d corr		
19	Plan.					
0	4°45.0	4°45.8	4°32.0	0.0 - 0.0	6.0 - 2.0	12.0 - 3.9
1	4°45.2	4°46.0	4°32.3	0.1 - 0.0	6.1 - 2.0	12.1 - 3.9
2	4°45.5	4°46.3	4°32.5	0.2 - 0.1	6.2 - 2.0	12.2 - 4.0
3	4°45.8	4°46.5	4°32.7	0.3 - 0.1	6.3 - 2.0	12.3 - 4.0
4	4°46.0	4°46.8	4°33.0	0.4 - 0.1	6.4 - 2.1	12.4 - 4.0
5	4°46.2	4°47.0	4°33.2	0.5 - 0.2	6.5 - 2.1	12.5 - 4.1
6	4°46.5	4°47.3	4°33.4	0.6 - 0.2	6.6 - 2.1	12.6 - 4.1
7	4°46.8	4°47.5	4°33.7	0.7 - 0.2	6.7 - 2.2	12.7 - 4.1
8	4°47.0	4°47.8	4°33.9	0.8 - 0.3	6.8 - 2.2	12.8 - 4.2
9	4°47.2	4°48.0	4°34.2	0.9 - 0.3	6.9 - 2.2	12.9 - 4.2
10	4°47.5	4°48.3	4°34.4	1.0 - 0.3	7.0 - 2.3	13.0 - 4.2
11	4°47.8	4°48.5	4°34.6	1.1 - 0.4	7.1 - 2.3	13.1 - 4.3
12	4°48.0	4°48.8	4°34.9	1.2 - 0.4	7.2 - 2.3	13.2 - 4.3
13	4°48.2	4°49.0	4°35.1	1.3 - 0.4	7.3 - 2.4	13.3 - 4.3
14	4°48.5	4°49.3	4°35.4	1.4 - 0.5	7.4 - 2.4	13.4 - 4.4
15	4°48.8	4°49.5	4°35.6	1.5 - 0.5	7.5 - 2.4	13.5 - 4.4
16	4°49.0	4°49.8	4°35.8	1.6 - 0.5	7.6 - 2.5	13.6 - 4.4
17	4°49.3	4°50.0	4°36.1	1.7 - 0.6	7.7 - 2.5	13.7 - 4.5
18	4°49.5	4°50.3	4°36.3	1.8 - 0.6	7.8 - 2.5	13.8 - 4.5
19	4°49.8	4°50.5	4°36.6	1.9 - 0.6	7.9 - 2.6	13.9 - 4.5
20	4°50.0	4°50.8	4°36.8	2.0 - 0.7	8.0 - 2.6	14.0 - 4.5
21	4°50.3	4°51.0	4°37.0	2.1 - 0.7	8.1 - 2.6	14.1 - 4.6
22	4°50.5	4°51.3	4°37.3	2.2 - 0.7	8.2 - 2.7	14.2 - 4.6
23	4°50.7	4°51.5	4°37.5	2.3 - 0.7	8.3 - 2.7	14.3 - 4.6
24	4°51.0	4°51.8	4°37.7	2.4 - 0.8	8.4 - 2.7	14.4 - 4.7
25	4°51.3	4°52.0	4°38.0	2.5 - 0.8	8.5 - 2.8	14.5 - 4.7
26	4°51.5	4°52.3	4°38.2	2.6 - 0.8	8.6 - 2.8	14.6 - 4.7
27	4°51.7	4°52.5	4°38.5	2.7 - 0.9	8.7 - 2.8	14.7 - 4.8
28	4°52.0	4°52.8	4°38.7	2.8 - 0.9	8.8 - 2.9	14.8 - 4.8
29	4°52.3	4°53.0	4°38.9	2.9 - 0.9	8.9 - 2.9	14.9 - 4.8
30	4°52.5	4°53.3	4°39.2	3.0 - 1.0	9.0 - 2.9	15.0 - 4.9
31	4°52.7	4°53.6	4°39.4	3.1 - 1.0	9.1 - 3.0	15.1 - 4.9
32	4°53.0	4°53.8	4°39.7	3.2 - 1.0	9.2 - 3.0	15.2 - 4.9
33	4°53.3	4°54.1	4°39.9	3.3 - 1.1	9.3 - 3.0	15.3 - 5.0
34	4°53.5	4°54.3	4°40.1	3.4 - 1.1	9.4 - 3.1	15.4 - 5.0
35	4°53.7	4°54.6	4°40.4	3.5 - 1.1	9.5 - 3.1	15.5 - 5.0
36	4°54.0	4°54.8	4°40.6	3.6 - 1.2	9.6 - 3.1	15.6 - 5.1
37	4°54.3	4°55.1	4°40.8	3.7 - 1.2	9.7 - 3.2	15.7 - 5.1
38	4°54.5	4°55.3	4°41.1	3.8 - 1.2	9.8 - 3.2	15.8 - 5.1
39	4°54.7	4°55.6	4°41.3	3.9 - 1.3	9.9 - 3.2	15.9 - 5.2
40	4°55.0	4°55.8	4°41.6	4.0 - 1.3	10.0 - 3.3	16.0 - 5.2
41	4°55.3	4°56.1	4°41.8	4.1 - 1.3	10.1 - 3.3	16.1 - 5.2
42	4°55.5	4°56.3	4°42.0	4.2 - 1.4	10.2 - 3.3	16.2 - 5.3
43	4°55.7	4°56.6	4°42.3	4.3 - 1.4	10.3 - 3.3	16.3 - 5.3
44	4°56.0	4°56.8	4°42.5	4.4 - 1.4	10.4 - 3.4	16.4 - 5.3
45	4°56.3	4°57.1	4°42.8	4.5 - 1.5	10.5 - 3.4	16.5 - 5.4
46	4°56.5	4°57.3	4°43.0	4.6 - 1.5	10.6 - 3.4	16.6 - 5.4
47	4°56.8	4°57.6	4°43.2	4.7 - 1.5	10.7 - 3.5	16.7 - 5.4
48	4°57.0	4°57.8	4°43.5	4.8 - 1.6	10.8 - 3.5	16.8 - 5.5
49	4°57.3	4°58.1	4°43.7	4.9 - 1.6	10.9 - 3.5	16.9 - 5.5
50	4°57.5	4°58.3	4°43.9	5.0 - 1.6	11.0 - 3.6	17.0 - 5.5
51	4°57.8	4°58.6	4°44.2	5.1 - 1.7	11.1 - 3.6	17.1 - 5.6
52	4°58.0	4°58.8	4°44.4	5.2 - 1.7	11.2 - 3.6	17.2 - 5.6
53	4°58.2	4°59.1	4°44.7	5.3 - 1.7	11.3 - 3.7	17.3 - 5.6
54	4°58.5	4°59.3	4°44.9	5.4 - 1.8	11.4 - 3.7	17.4 - 5.7
55	4°58.8	4°59.6	4°45.1	5.5 - 1.8	11.5 - 3.7	17.5 - 5.7
56	4°59.0	4°59.8	4°45.4	5.6 - 1.8	11.6 - 3.8	17.6 - 5.7
57	4°59.2	5°00.1	4°45.6	5.7 - 1.9	11.7 - 3.8	17.7 - 5.8
58	4°59.5	5°00.3	4°45.9	5.8 - 1.9	11.8 - 3.8	17.8 - 5.8
59	4°59.8	5°00.6	4°46.1	5.9 - 1.9	11.9 - 3.9	17.9 - 5.8

m	Sun	Aries	Moon	v and d corr		
20	Plan.					
0	5°00.0	5°00.8	4°46.3	0.0 - 0.0	6.0 - 2.0	12.0 - 4.1
1	5°00.2	5°01.1	4°46.6	0.1 - 0.0	6.1 - 2.1	12.1 - 4.1
2	5°00.5	5°01.3	4°46.8	0.2 - 0.1	6.2 - 2.1	12.2 - 4.2
3	5°00.8	5°01.6	4°47.0	0.3 - 0.1	6.3 - 2.2	12.3 - 4.2
4	5°01.0	5°01.8	4°47.3	0.4 - 0.1	6.4 - 2.2	12.4 - 4.2
5	5°01.2	5°02.1	4°47.5	0.5 - 0.2	6.5 - 2.2	12.5 - 4.3
6	5°01.5	5°02.3	4°47.8	0.6 - 0.2	6.6 - 2.3	12.6 - 4.3
7	5°01.8	5°02.6	4°48.0	0.7 - 0.2	6.7 - 2.3	12.7 - 4.3
8	5°02.0	5°02.8	4°48.2	0.8 - 0.3	6.8 - 2.3	12.8 - 4.4
9	5°02.2	5°03.1	4°48.5	0.9 - 0.3	6.9 - 2.4	12.9 - 4.4
10	5°02.5	5°03.3	4°48.7	1.0 - 0.3	7.0 - 2.4	13.0 - 4.4
11	5°02.8	5°03.6	4°49.0	1.1 - 0.4	7.1 - 2.4	13.1 - 4.5
12	5°03.0	5°03.8	4°49.2	1.2 - 0.4	7.2 - 2.5	13.2 - 4.5
13	5°03.2	5°04.1	4°49.4	1.3 - 0.4	7.3 - 2.5	13.3 - 4.5
14	5°03.5	5°04.3	4°49.7	1.4 - 0.5	7.4 - 2.5	13.4 - 4.6
15	5°03.8	5°04.6	4°49.9	1.5 - 0.5	7.5 - 2.6	13.5 - 4.6
16	5°04.0	5°04.8	4°50.2	1.6 - 0.5	7.6 - 2.6	13.6 - 4.6
17	5°04.3	5°05.1	4°50.4	1.7 - 0.6	7.7 - 2.6	13.7 - 4.7
18	5°04.5	5°05.3	4°50.6	1.8 - 0.6	7.8 - 2.7	13.8 - 4.7
19	5°04.7	5°05.6	4°50.9	1.9 - 0.6	7.9 - 2.7	13.9 - 4.7
20	5°05.0	5°05.8	4°51.1	2.0 - 0.7	8.0 - 2.7	14.0 - 4.8
21	5°05.3	5°06.1	4°51.3	2.1 - 0.7	8.1 - 2.8	14.1 - 4.8
22	5°05.5	5°06.3	4°51.6	2.2 - 0.8	8.2 - 2.8	14.2 - 4.9
23	5°05.7	5°06.6	4°51.8	2.3 - 0.8	8.3 - 2.8	14.3 - 4.9
24	5°06.0	5°06.8	4°52.1	2.4 - 0.8	8.4 - 2.9	14.4 - 4.9
25	5°06.3	5°07.1	4°52.3	2.5 - 0.9	8.5 - 2.9	14.5 - 5.0
26	5°06.5	5°07.3	4°52.5	2.6 - 0.9	8.6 - 2.9	14.6 - 5.0
27	5°06.7	5°07.6	4°52.8	2.7 - 0.9	8.7 - 3.0	14.7 - 5.0
28	5°07.0	5°07.8	4°53.0	2.8 - 1.0	8.8 - 3.0	14.8 - 5.1
29	5°07.3	5°08.1	4°53.3	2.9 - 1.0	8.9 - 3.0	14.9 - 5.1
30	5°07.5	5°08.3	4°53.5	3.0 - 1.0	9.0 - 3.1	15.0 - 5.1
31	5°07.7	5°08.6	4°53.7	3.1 - 1.1	9.1 - 3.1	15.1 - 5.2
32	5°08.0	5°08.8	4°54.0	3.2 - 1.1	9.2 - 3.1	15.2 - 5.2
33	5°08.3	5°09.1	4°54.2	3.3 - 1.1	9.3 - 3.2	15.3 - 5.2
34	5°08.5	5°09.3	4°54.4	3.4 - 1.2	9.4 - 3.2	15.4 - 5.3
35	5°08.7	5°09.6	4°54.7	3.5 - 1.2	9.5 - 3.2	15.5 - 5.3
36	5°09.0	5°09.8	4°54.9	3.6 - 1.2	9.6 - 3.3	15.6 - 5.3
37	5°09.3	5°10.1	4°55.2	3.7 - 1.3	9.7 - 3.3	15.7 - 5.4
38	5°09.5	5°10.3	4°55.4	3.8 - 1.3	9.8 - 3.3	15.8 - 5.4
39	5°09.7	5°10.6	4°55.6	3.9 - 1.3	9.9 - 3.4	15.9 - 5.4
40	5°10.0	5°10.8	4°55.9	4.0 - 1.4	10.0 - 3.4	16.0 - 5.5
41	5°10.3	5°11.1	4°56.1	4.1 - 1.4	10.1 - 3.5	16.1 - 5.5
42	5°10.5	5°11.3	4°56.4	4.2 - 1.4	10.2 - 3.5	16.2 - 5.5
43	5°10.7	5°11.6	4°56.6	4.3 - 1.5	10.3 - 3.5	16.3 - 5.6
44	5°11.0	5°11.9	4°56.8	4.4 - 1.5	10.4 - 3.6	16.4 - 5.6
45	5°11.3	5°12.1	4°57.1	4.5 - 1.5	10.5 - 3.6	16.5 - 5.6
46	5°11.5	5°12.4	4°57.3	4.6 - 1.6	10.6 - 3.6	16.6 - 5.7
47	5°11.8	5°12.6	4°57.5	4.7 - 1.6	10.7 - 3.7	16.7 - 5.7
48	5°12.0	5°12.9	4°57.8	4.8 - 1.6	10.8 - 3.7	16.8 - 5.7
49	5°12.2	5°13.1	4°58.0	4.9 - 1.7	10.9 - 3.7	16.9 - 5.8
50	5°12.5	5°13.4	4°58.3	5.0 - 1.7	11.0 - 3.8	17.0 - 5.8
51	5°12.8	5°13.6	4°58.5	5.1 - 1.7	11.1 - 3.8	17.1 - 5.8
52	5°13.0	5°13.9	4°58.7	5.2 - 1.8	11.2 - 3.8	17.2 - 5.9
53	5°13.2	5°14.1	4°59.0	5.3 - 1.8	11.3 - 3.9	17.3 - 5.9
54	5°13.5	5°14.4	4°59.2	5.4 - 1.8	11.4 - 3.9	17.4 - 5.9
55	5°13.8	5°14.6	4°59.5	5.5 - 1.9	11.5 - 3.9	17.5 - 6.0
56	5°14.0	5°14.9	4°59.7	5.6 - 1.9	11.6 - 4.0	17.6 - 6.0
57	5°14.2	5°15.1	4°59.9	5.7 - 1.9	11.7 - 4.0	17.7 - 6.0
58	5°14.5	5°15.4	5°00.2	5.8 - 2.0	11.8 - 4.0	17.8 - 6.1
59	5°14.8	5°15.6	5°00.4	5.9 - 2.0	11.9 - 4.1	17.9 - 6.1

Increments and Corrections

m 21	Sun Plan.	Aries	Moon	v and d corr		
0	5°15.0	5°15.9	5°00.6	0.0 - 0.0	6.0 - 2.1	12.0 - 4.3
1	5°15.2	5°16.1	5°00.9	0.1 - 0.0	6.1 - 2.2	12.1 - 4.3
2	5°15.5	5°16.4	5°01.1	0.2 - 0.1	6.2 - 2.2	12.2 - 4.4
3	5°15.8	5°16.6	5°01.4	0.3 - 0.1	6.3 - 2.3	12.3 - 4.4
4	5°16.0	5°16.9	5°01.6	0.4 - 0.1	6.4 - 2.3	12.4 - 4.4
5	5°16.2	5°17.1	5°01.8	0.5 - 0.2	6.5 - 2.3	12.5 - 4.5
6	5°16.5	5°17.4	5°02.1	0.6 - 0.2	6.6 - 2.4	12.6 - 4.5
7	5°16.8	5°17.6	5°02.3	0.7 - 0.3	6.7 - 2.4	12.7 - 4.6
8	5°17.0	5°17.9	5°02.6	0.8 - 0.3	6.8 - 2.4	12.8 - 4.6
9	5°17.2	5°18.1	5°02.8	0.9 - 0.3	6.9 - 2.5	12.9 - 4.6
10	5°17.5	5°18.4	5°03.0	1.0 - 0.4	7.0 - 2.5	13.0 - 4.7
11	5°17.8	5°18.6	5°03.3	1.1 - 0.4	7.1 - 2.5	13.1 - 4.7
12	5°18.0	5°18.9	5°03.5	1.2 - 0.4	7.2 - 2.6	13.2 - 4.7
13	5°18.2	5°19.1	5°03.8	1.3 - 0.5	7.3 - 2.6	13.3 - 4.8
14	5°18.5	5°19.4	5°04.0	1.4 - 0.5	7.4 - 2.7	13.4 - 4.8
15	5°18.8	5°19.6	5°04.2	1.5 - 0.5	7.5 - 2.7	13.5 - 4.8
16	5°19.0	5°19.9	5°04.5	1.6 - 0.6	7.6 - 2.7	13.6 - 4.9
17	5°19.3	5°20.1	5°04.7	1.7 - 0.6	7.7 - 2.8	13.7 - 4.9
18	5°19.5	5°20.4	5°04.9	1.8 - 0.6	7.8 - 2.8	13.8 - 4.9
19	5°19.7	5°20.6	5°05.2	1.9 - 0.7	7.9 - 2.8	13.9 - 5.0
20	5°20.0	5°20.9	5°05.4	2.0 - 0.7	8.0 - 2.9	14.0 - 5.0
21	5°20.3	5°21.1	5°05.7	2.1 - 0.8	8.1 - 2.9	14.1 - 5.1
22	5°20.5	5°21.4	5°05.9	2.2 - 0.8	8.2 - 2.9	14.2 - 5.1
23	5°20.7	5°21.6	5°06.1	2.3 - 0.8	8.3 - 3.0	14.3 - 5.1
24	5°21.0	5°21.9	5°06.4	2.4 - 0.9	8.4 - 3.0	14.4 - 5.2
25	5°21.3	5°22.1	5°06.6	2.5 - 0.9	8.5 - 3.0	14.5 - 5.2
26	5°21.5	5°22.4	5°06.9	2.6 - 0.9	8.6 - 3.1	14.6 - 5.2
27	5°21.7	5°22.6	5°07.1	2.7 - 1.0	8.7 - 3.1	14.7 - 5.3
28	5°22.0	5°22.9	5°07.3	2.8 - 1.0	8.8 - 3.2	14.8 - 5.3
29	5°22.3	5°23.1	5°07.6	2.9 - 1.0	8.9 - 3.2	14.9 - 5.3
30	5°22.5	5°23.4	5°07.8	3.0 - 1.1	9.0 - 3.2	15.0 - 5.4
31	5°22.7	5°23.6	5°08.0	3.1 - 1.1	9.1 - 3.3	15.1 - 5.4
32	5°23.0	5°23.9	5°08.3	3.2 - 1.1	9.2 - 3.3	15.2 - 5.4
33	5°23.3	5°24.1	5°08.5	3.3 - 1.2	9.3 - 3.3	15.3 - 5.5
34	5°23.5	5°24.4	5°08.8	3.4 - 1.2	9.4 - 3.4	15.4 - 5.5
35	5°23.7	5°24.6	5°09.0	3.5 - 1.3	9.5 - 3.4	15.5 - 5.6
36	5°24.0	5°24.9	5°09.2	3.6 - 1.3	9.6 - 3.4	15.6 - 5.6
37	5°24.3	5°25.1	5°09.5	3.7 - 1.3	9.7 - 3.5	15.7 - 5.6
38	5°24.5	5°25.4	5°09.7	3.8 - 1.4	9.8 - 3.5	15.8 - 5.7
39	5°24.7	5°25.6	5°10.0	3.9 - 1.4	9.9 - 3.5	15.9 - 5.7
40	5°25.0	5°25.9	5°10.2	4.0 - 1.4	10.0 - 3.6	16.0 - 5.7
41	5°25.3	5°26.1	5°10.4	4.1 - 1.5	10.1 - 3.6	16.1 - 5.8
42	5°25.5	5°26.4	5°10.7	4.2 - 1.5	10.2 - 3.7	16.2 - 5.8
43	5°25.7	5°26.6	5°10.9	4.3 - 1.5	10.3 - 3.7	16.3 - 5.8
44	5°26.0	5°26.9	5°11.1	4.4 - 1.6	10.4 - 3.7	16.4 - 5.9
45	5°26.3	5°27.1	5°11.4	4.5 - 1.6	10.5 - 3.8	16.5 - 5.9
46	5°26.5	5°27.4	5°11.6	4.6 - 1.6	10.6 - 3.8	16.6 - 5.9
47	5°26.8	5°27.6	5°11.9	4.7 - 1.7	10.7 - 3.8	16.7 - 6.0
48	5°27.0	5°27.9	5°12.1	4.8 - 1.7	10.8 - 3.9	16.8 - 6.0
49	5°27.2	5°28.1	5°12.3	4.9 - 1.8	10.9 - 3.9	16.9 - 6.1
50	5°27.5	5°28.4	5°12.6	5.0 - 1.8	11.0 - 3.9	17.0 - 6.1
51	5°27.8	5°28.6	5°12.8	5.1 - 1.8	11.1 - 4.0	17.1 - 6.1
52	5°28.0	5°28.9	5°13.1	5.2 - 1.9	11.2 - 4.0	17.2 - 6.2
53	5°28.2	5°29.1	5°13.3	5.3 - 1.9	11.3 - 4.0	17.3 - 6.2
54	5°28.5	5°29.4	5°13.5	5.4 - 1.9	11.4 - 4.1	17.4 - 6.2
55	5°28.8	5°29.6	5°13.8	5.5 - 2.0	11.5 - 4.1	17.5 - 6.3
56	5°29.0	5°29.9	5°14.0	5.6 - 2.0	11.6 - 4.2	17.6 - 6.3
57	5°29.2	5°30.1	5°14.3	5.7 - 2.0	11.7 - 4.2	17.7 - 6.3
58	5°29.5	5°30.4	5°14.5	5.8 - 2.1	11.8 - 4.2	17.8 - 6.4
59	5°29.8	5°30.7	5°14.7	5.9 - 2.1	11.9 - 4.3	17.9 - 6.4

m 22	Sun Plan.	Aries	Moon	v and d corr		
0	5°30.0	5°30.9	5°15.0	0.0 - 0.0	6.0 - 2.3	12.0 - 4.5
1	5°30.2	5°31.2	5°15.2	0.1 - 0.0	6.1 - 2.3	12.1 - 4.5
2	5°30.5	5°31.4	5°15.4	0.2 - 0.1	6.2 - 2.3	12.2 - 4.6
3	5°30.8	5°31.7	5°15.7	0.3 - 0.1	6.3 - 2.4	12.3 - 4.6
4	5°31.0	5°31.9	5°15.9	0.4 - 0.2	6.4 - 2.4	12.4 - 4.7
5	5°31.2	5°32.2	5°16.2	0.5 - 0.2	6.5 - 2.4	12.5 - 4.7
6	5°31.5	5°32.4	5°16.4	0.6 - 0.2	6.6 - 2.5	12.6 - 4.7
7	5°31.8	5°32.7	5°16.6	0.7 - 0.3	6.7 - 2.5	12.7 - 4.8
8	5°32.0	5°32.9	5°16.9	0.8 - 0.3	6.8 - 2.5	12.8 - 4.8
9	5°32.2	5°33.2	5°17.1	0.9 - 0.3	6.9 - 2.6	12.9 - 4.8
10	5°32.5	5°33.4	5°17.4	1.0 - 0.4	7.0 - 2.6	13.0 - 4.9
11	5°32.8	5°33.7	5°17.6	1.1 - 0.4	7.1 - 2.7	13.1 - 4.9
12	5°33.0	5°33.9	5°17.8	1.2 - 0.5	7.2 - 2.7	13.2 - 4.9
13	5°33.2	5°34.2	5°18.1	1.3 - 0.5	7.3 - 2.7	13.3 - 5.0
14	5°33.5	5°34.4	5°18.3	1.4 - 0.5	7.4 - 2.8	13.4 - 5.0
15	5°33.8	5°34.7	5°18.5	1.5 - 0.6	7.5 - 2.8	13.5 - 5.1
16	5°34.0	5°34.9	5°18.8	1.6 - 0.6	7.6 - 2.8	13.6 - 5.1
17	5°34.3	5°35.2	5°19.0	1.7 - 0.6	7.7 - 2.9	13.7 - 5.1
18	5°34.5	5°35.4	5°19.3	1.8 - 0.7	7.8 - 2.9	13.8 - 5.2
19	5°34.8	5°35.7	5°19.5	1.9 - 0.7	7.9 - 3.0	13.9 - 5.2
20	5°35.0	5°35.9	5°19.7	2.0 - 0.8	8.0 - 3.0	14.0 - 5.3
21	5°35.3	5°36.2	5°20.0	2.1 - 0.8	8.1 - 3.0	14.1 - 5.3
22	5°35.5	5°36.4	5°20.2	2.2 - 0.8	8.2 - 3.1	14.2 - 5.3
23	5°35.7	5°36.7	5°20.5	2.3 - 0.9	8.3 - 3.1	14.3 - 5.4
24	5°36.0	5°36.9	5°20.7	2.4 - 0.9	8.4 - 3.2	14.4 - 5.4
25	5°36.3	5°37.2	5°20.9	2.5 - 0.9	8.5 - 3.2	14.5 - 5.4
26	5°36.5	5°37.4	5°21.2	2.6 - 1.0	8.6 - 3.2	14.6 - 5.5
27	5°36.7	5°37.7	5°21.4	2.7 - 1.0	8.7 - 3.3	14.7 - 5.5
28	5°37.0	5°37.9	5°21.6	2.8 - 1.1	8.8 - 3.3	14.8 - 5.6
29	5°37.3	5°38.2	5°21.9	2.9 - 1.1	8.9 - 3.3	14.9 - 5.6
30	5°37.5	5°38.4	5°22.1	3.0 - 1.1	9.0 - 3.4	15.0 - 5.6
31	5°37.7	5°38.7	5°22.4	3.1 - 1.2	9.1 - 3.4	15.1 - 5.7
32	5°38.0	5°38.9	5°22.6	3.2 - 1.2	9.2 - 3.4	15.2 - 5.7
33	5°38.3	5°39.2	5°22.8	3.3 - 1.2	9.3 - 3.5	15.3 - 5.7
34	5°38.5	5°39.4	5°23.1	3.4 - 1.3	9.4 - 3.5	15.4 - 5.8
35	5°38.7	5°39.7	5°23.3	3.5 - 1.3	9.5 - 3.6	15.5 - 5.8
36	5°39.0	5°39.9	5°23.6	3.6 - 1.4	9.6 - 3.6	15.6 - 5.8
37	5°39.3	5°40.2	5°23.8	3.7 - 1.4	9.7 - 3.6	15.7 - 5.9
38	5°39.5	5°40.4	5°24.0	3.8 - 1.4	9.8 - 3.7	15.8 - 5.9
39	5°39.7	5°40.7	5°24.3	3.9 - 1.5	9.9 - 3.7	15.9 - 6.0
40	5°40.0	5°40.9	5°24.5	4.0 - 1.5	10.0 - 3.8	16.0 - 6.0
41	5°40.3	5°41.2	5°24.7	4.1 - 1.5	10.1 - 3.8	16.1 - 6.0
42	5°40.5	5°41.4	5°25.0	4.2 - 1.6	10.2 - 3.8	16.2 - 6.1
43	5°40.7	5°41.7	5°25.2	4.3 - 1.6	10.3 - 3.9	16.3 - 6.1
44	5°41.0	5°41.9	5°25.5	4.4 - 1.7	10.4 - 3.9	16.4 - 6.1
45	5°41.3	5°42.2	5°25.7	4.5 - 1.7	10.5 - 3.9	16.5 - 6.2
46	5°41.5	5°42.4	5°25.9	4.6 - 1.7	10.6 - 4.0	16.6 - 6.2
47	5°41.8	5°42.7	5°26.2	4.7 - 1.8	10.7 - 4.0	16.7 - 6.3
48	5°42.0	5°42.9	5°26.4	4.8 - 1.8	10.8 - 4.1	16.8 - 6.3
49	5°42.3	5°43.2	5°26.7	4.9 - 1.8	10.9 - 4.1	16.9 - 6.3
50	5°42.5	5°43.4	5°26.9	5.0 - 1.9	11.0 - 4.1	17.0 - 6.4
51	5°42.8	5°43.7	5°27.1	5.1 - 1.9	11.1 - 4.2	17.1 - 6.4
52	5°43.0	5°43.9	5°27.4	5.2 - 2.0	11.2 - 4.2	17.2 - 6.4
53	5°43.2	5°44.2	5°27.6	5.3 - 2.0	11.3 - 4.2	17.3 - 6.5
54	5°43.5	5°44.4	5°27.9	5.4 - 2.0	11.4 - 4.3	17.4 - 6.5
55	5°43.8	5°44.7	5°28.1	5.5 - 2.1	11.5 - 4.3	17.5 - 6.6
56	5°44.0	5°44.9	5°28.3	5.6 - 2.1	11.6 - 4.4	17.6 - 6.6
57	5°44.2	5°45.2	5°28.6	5.7 - 2.1	11.7 - 4.4	17.7 - 6.6
58	5°44.5	5°45.4	5°28.8	5.8 - 2.2	11.8 - 4.4	17.8 - 6.7
59	5°44.8	5°45.7	5°29.0	5.9 - 2.2	11.9 - 4.5	17.9 - 6.7

m 23	Sun Plan.	Aries	Moon	v and d corr		
0	5°45.0	5°45.9	5°29.3	0.0 - 0.0	6.0 - 2.4	12.0 - 4.7
1	5°45.2	5°46.2	5°29.5	0.1 - 0.0	6.1 - 2.4	12.1 - 4.7
2	5°45.5	5°46.4	5°29.8	0.2 - 0.1	6.2 - 2.4	12.2 - 4.8
3	5°45.8	5°46.7	5°30.0	0.3 - 0.1	6.3 - 2.5	12.3 - 4.8
4	5°46.0	5°46.9	5°30.2	0.4 - 0.2	6.4 - 2.5	12.4 - 4.9
5	5°46.2	5°47.2	5°30.5	0.5 - 0.2	6.5 - 2.5	12.5 - 4.9
6	5°46.5	5°47.4	5°30.7	0.6 - 0.2	6.6 - 2.6	12.6 - 4.9
7	5°46.8	5°47.7	5°31.0	0.7 - 0.3	6.7 - 2.6	12.7 - 5.0
8	5°47.0	5°47.9	5°31.2	0.8 - 0.3	6.8 - 2.7	12.8 - 5.0
9	5°47.2	5°48.2	5°31.4	0.9 - 0.4	6.9 - 2.7	12.9 - 5.1
10	5°47.5	5°48.4	5°31.7	1.0 - 0.4	7.0 - 2.7	13.0 - 5.1
11	5°47.8	5°48.7	5°31.9	1.1 - 0.4	7.1 - 2.8	13.1 - 5.1
12	5°48.0	5°49.0	5°32.1	1.2 - 0.5	7.2 - 2.8	13.2 - 5.2
13	5°48.2	5°49.2	5°32.4	1.3 - 0.5	7.3 - 2.9	13.3 - 5.2
14	5°48.5	5°49.5	5°32.6	1.4 - 0.5	7.4 - 2.9	13.4 - 5.2
15	5°48.8	5°49.7	5°32.9	1.5 - 0.6	7.5 - 2.9	13.5 - 5.3
16	5°49.0	5°50.0	5°33.1	1.6 - 0.6	7.6 - 3.0	13.6 - 5.3
17	5°49.3	5°50.2	5°33.3	1.7 - 0.7	7.7 - 3.0	13.7 - 5.4
18	5°49.5	5°50.5	5°33.6	1.8 - 0.7	7.8 - 3.1	13.8 - 5.4
19	5°49.8	5°50.7	5°33.8	1.9 - 0.7	7.9 - 3.1	13.9 - 5.4
20	5°50.0	5°51.0	5°34.1	2.0 - 0.8	8.0 - 3.1	14.0 - 5.5
21	5°50.3	5°51.2	5°34.3	2.1 - 0.8	8.1 - 3.2	14.1 - 5.5
22	5°50.5	5°51.5	5°34.5	2.2 - 0.9	8.2 - 3.2	14.2 - 5.6
23	5°50.7	5°51.7	5°34.8	2.3 - 0.9	8.3 - 3.3	14.3 - 5.6
24	5°51.0	5°52.0	5°35.0	2.4 - 0.9	8.4 - 3.3	14.4 - 5.6
25	5°51.3	5°52.2	5°35.2	2.5 - 1.0	8.5 - 3.3	14.5 - 5.7
26	5°51.5	5°52.5	5°35.5	2.6 - 1.0	8.6 - 3.4	14.6 - 5.7
27	5°51.7	5°52.7	5°35.7	2.7 - 1.1	8.7 - 3.4	14.7 - 5.8
28	5°52.0	5°53.0	5°36.0	2.8 - 1.1	8.8 - 3.4	14.8 - 5.8
29	5°52.3	5°53.2	5°36.2	2.9 - 1.1	8.9 - 3.5	14.9 - 5.8
30	5°52.5	5°53.5	5°36.4	3.0 - 1.2	9.0 - 3.5	15.0 - 5.9
31	5°52.7	5°53.7	5°36.7	3.1 - 1.2	9.1 - 3.6	15.1 - 5.9
32	5°53.0	5°54.0	5°36.9	3.2 - 1.3	9.2 - 3.6	15.2 - 6.0
33	5°53.3	5°54.2	5°37.2	3.3 - 1.3	9.3 - 3.6	15.3 - 6.0
34	5°53.5	5°54.5	5°37.4	3.4 - 1.3	9.4 - 3.7	15.4 - 6.0
35	5°53.7	5°54.7	5°37.6	3.5 - 1.4	9.5 - 3.7	15.5 - 6.1
36	5°54.0	5°55.0	5°37.9	3.6 - 1.4	9.6 - 3.8	15.6 - 6.1
37	5°54.3	5°55.2	5°38.1	3.7 - 1.4	9.7 - 3.8	15.7 - 6.1
38	5°54.5	5°55.5	5°38.4	3.8 - 1.5	9.8 - 3.8	15.8 - 6.2
39	5°54.7	5°55.7	5°38.6	3.9 - 1.5	9.9 - 3.9	15.9 - 6.2
40	5°55.0	5°56.0	5°38.8	4.0 - 1.6	10.0 - 3.9	16.0 - 6.3
41	5°55.3	5°56.2	5°39.1	4.1 - 1.6	10.1 - 4.0	16.1 - 6.3
42	5°55.5	5°56.5	5°39.3	4.2 - 1.6	10.2 - 4.0	16.2 - 6.3
43	5°55.7	5°56.7	5°39.5	4.3 - 1.7	10.3 - 4.0	16.3 - 6.4
44	5°56.0	5°57.0	5°39.8	4.4 - 1.7	10.4 - 4.1	16.4 - 6.4
45	5°56.3	5°57.2	5°40.0	4.5 - 1.8	10.5 - 4.1	16.5 - 6.5
46	5°56.5	5°57.5	5°40.3	4.6 - 1.8	10.6 - 4.2	16.6 - 6.5
47	5°56.8	5°57.7	5°40.5	4.7 - 1.8	10.7 - 4.2	16.7 - 6.5
48	5°57.0	5°58.0	5°40.7	4.8 - 1.9	10.8 - 4.2	16.8 - 6.6
49	5°57.3	5°58.2	5°41.0	4.9 - 1.9	10.9 - 4.3	16.9 - 6.6
50	5°57.5	5°58.5	5°41.2	5.0 - 2.0	11.0 - 4.3	17.0 - 6.7
51	5°57.8	5°58.7	5°41.5	5.1 - 2.0	11.1 - 4.3	17.1 - 6.7
52	5°58.0	5°59.0	5°41.7	5.2 - 2.0	11.2 - 4.4	17.2 - 6.7
53	5°58.2	5°59.2	5°41.9	5.3 - 2.1	11.3 - 4.4	17.3 - 6.8
54	5°58.5	5°59.5	5°42.2	5.4 - 2.1	11.4 - 4.5	17.4 - 6.8
55	5°58.8	5°59.7	5°42.4	5.5 - 2.2	11.5 - 4.5	17.5 - 6.9
56	5°59.0	6°00.0	5°42.6	5.6 - 2.2	11.6 - 4.5	17.6 - 6.9
57	5°59.2	6°00.2	5°42.9	5.7 - 2.2	11.7 - 4.6	17.7 - 6.9
58	5°59.5	6°00.5	5°43.1	5.8 - 2.3	11.8 - 4.6	17.8 - 7.0
59	5°59.8	6°00.7	5°43.4	5.9 - 2.3	11.9 - 4.7	17.9 - 7.0

Increments and Corrections

m 24	Sun Plan.	Aries	Moon	v and d corr		
0	6°00.0	6°01.0	5°43.6	0.0 - 0.0	6.0 - 2.5	12.0 - 4.9
1	6°00.2	6°01.2	5°43.8	0.1 - 0.0	6.1 - 2.5	12.1 - 4.9
2	6°00.5	6°01.5	5°44.1	0.2 - 0.1	6.2 - 2.5	12.2 - 5.0
3	6°00.8	6°01.7	5°44.3	0.3 - 0.1	6.3 - 2.6	12.3 - 5.0
4	6°01.0	6°02.0	5°44.6	0.4 - 0.2	6.4 - 2.6	12.4 - 5.1
5	6°01.2	6°02.2	5°44.8	0.5 - 0.2	6.5 - 2.7	12.5 - 5.1
6	6°01.5	6°02.5	5°45.0	0.6 - 0.2	6.6 - 2.7	12.6 - 5.1
7	6°01.8	6°02.7	5°45.3	0.7 - 0.3	6.7 - 2.7	12.7 - 5.2
8	6°02.0	6°03.0	5°45.5	0.8 - 0.3	6.8 - 2.8	12.8 - 5.2
9	6°02.2	6°03.2	5°45.7	0.9 - 0.4	6.9 - 2.8	12.9 - 5.3
10	6°02.5	6°03.5	5°46.0	1.0 - 0.4	7.0 - 2.9	13.0 - 5.3
11	6°02.8	6°03.7	5°46.2	1.1 - 0.4	7.1 - 2.9	13.1 - 5.3
12	6°03.0	6°04.0	5°46.5	1.2 - 0.5	7.2 - 2.9	13.2 - 5.4
13	6°03.2	6°04.2	5°46.7	1.3 - 0.5	7.3 - 3.0	13.3 - 5.4
14	6°03.5	6°04.5	5°46.9	1.4 - 0.6	7.4 - 3.0	13.4 - 5.5
15	6°03.8	6°04.7	5°47.2	1.5 - 0.6	7.5 - 3.1	13.5 - 5.5
16	6°04.0	6°05.0	5°47.4	1.6 - 0.7	7.6 - 3.1	13.6 - 5.6
17	6°04.3	6°05.2	5°47.7	1.7 - 0.7	7.7 - 3.1	13.7 - 5.6
18	6°04.5	6°05.5	5°47.9	1.8 - 0.7	7.8 - 3.2	13.8 - 5.6
19	6°04.7	6°05.7	5°48.1	1.9 - 0.8	7.9 - 3.2	13.9 - 5.7
20	6°05.0	6°06.0	5°48.4	2.0 - 0.8	8.0 - 3.3	14.0 - 5.7
21	6°05.3	6°06.2	5°48.6	2.1 - 0.9	8.1 - 3.3	14.1 - 5.8
22	6°05.5	6°06.5	5°48.8	2.2 - 0.9	8.2 - 3.3	14.2 - 5.8
23	6°05.7	6°06.7	5°49.1	2.3 - 0.9	8.3 - 3.4	14.3 - 5.8
24	6°06.0	6°07.0	5°49.3	2.4 - 1.0	8.4 - 3.4	14.4 - 5.9
25	6°06.3	6°07.3	5°49.6	2.5 - 1.0	8.5 - 3.5	14.5 - 5.9
26	6°06.5	6°07.5	5°49.8	2.6 - 1.1	8.6 - 3.5	14.6 - 6.0
27	6°06.7	6°07.8	5°50.0	2.7 - 1.1	8.7 - 3.6	14.7 - 6.0
28	6°07.0	6°08.0	5°50.3	2.8 - 1.1	8.8 - 3.6	14.8 - 6.0
29	6°07.3	6°08.3	5°50.5	2.9 - 1.2	8.9 - 3.6	14.9 - 6.1
30	6°07.5	6°08.5	5°50.8	3.0 - 1.2	9.0 - 3.7	15.0 - 6.1
31	6°07.7	6°08.8	5°51.0	3.1 - 1.3	9.1 - 3.7	15.1 - 6.2
32	6°08.0	6°09.0	5°51.2	3.2 - 1.3	9.2 - 3.8	15.2 - 6.2
33	6°08.3	6°09.3	5°51.5	3.3 - 1.3	9.3 - 3.8	15.3 - 6.2
34	6°08.5	6°09.5	5°51.7	3.4 - 1.4	9.4 - 3.8	15.4 - 6.3
35	6°08.7	6°09.8	5°52.0	3.5 - 1.4	9.5 - 3.9	15.5 - 6.3
36	6°09.0	6°10.0	5°52.2	3.6 - 1.5	9.6 - 3.9	15.6 - 6.4
37	6°09.3	6°10.3	5°52.4	3.7 - 1.5	9.7 - 4.0	15.7 - 6.4
38	6°09.5	6°10.5	5°52.7	3.8 - 1.6	9.8 - 4.0	15.8 - 6.5
39	6°09.7	6°10.8	5°52.9	3.9 - 1.6	9.9 - 4.0	15.9 - 6.5
40	6°10.0	6°11.0	5°53.1	4.0 - 1.6	10.0 - 4.1	16.0 - 6.5
41	6°10.3	6°11.3	5°53.4	4.1 - 1.7	10.1 - 4.1	16.1 - 6.6
42	6°10.5	6°11.5	5°53.6	4.2 - 1.7	10.2 - 4.2	16.2 - 6.6
43	6°10.7	6°11.8	5°53.9	4.3 - 1.8	10.3 - 4.2	16.3 - 6.7
44	6°11.0	6°12.0	5°54.1	4.4 - 1.8	10.4 - 4.2	16.4 - 6.7
45	6°11.3	6°12.3	5°54.3	4.5 - 1.8	10.5 - 4.3	16.5 - 6.7
46	6°11.5	6°12.5	5°54.6	4.6 - 1.9	10.6 - 4.3	16.6 - 6.8
47	6°11.8	6°12.8	5°54.8	4.7 - 1.9	10.7 - 4.4	16.7 - 6.8
48	6°12.0	6°13.0	5°55.1	4.8 - 2.0	10.8 - 4.4	16.8 - 6.9
49	6°12.2	6°13.3	5°55.3	4.9 - 2.0	10.9 - 4.5	16.9 - 6.9
50	6°12.5	6°13.5	5°55.5	5.0 - 2.0	11.0 - 4.5	17.0 - 6.9
51	6°12.8	6°13.8	5°55.8	5.1 - 2.1	11.1 - 4.5	17.1 - 7.0
52	6°13.0	6°14.0	5°56.0	5.2 - 2.1	11.2 - 4.6	17.2 - 7.0
53	6°13.2	6°14.3	5°56.2	5.3 - 2.2	11.3 - 4.6	17.3 - 7.1
54	6°13.5	6°14.5	5°56.5	5.4 - 2.2	11.4 - 4.7	17.4 - 7.1
55	6°13.8	6°14.8	5°56.7	5.5 - 2.2	11.5 - 4.7	17.5 - 7.1
56	6°14.0	6°15.0	5°57.0	5.6 - 2.3	11.6 - 4.7	17.6 - 7.2
57	6°14.2	6°15.3	5°57.2	5.7 - 2.3	11.7 - 4.8	17.7 - 7.2
58	6°14.5	6°15.5	5°57.4	5.8 - 2.4	11.8 - 4.8	17.8 - 7.3
59	6°14.8	6°15.8	5°57.7	5.9 - 2.4	11.9 - 4.9	17.9 - 7.3

m 25	Sun Plan.	Aries	Moon	v and d corr		
0	6°15.0	6°16.0	5°57.9	0.0 - 0.0	6.0 - 2.5	12.0 - 5.1
1	6°15.2	6°16.3	5°58.2	0.1 - 0.0	6.1 - 2.6	12.1 - 5.1
2	6°15.5	6°16.5	5°58.4	0.2 - 0.1	6.2 - 2.6	12.2 - 5.2
3	6°15.8	6°16.8	5°58.6	0.3 - 0.1	6.3 - 2.7	12.3 - 5.2
4	6°16.0	6°17.0	5°58.9	0.4 - 0.2	6.4 - 2.7	12.4 - 5.3
5	6°16.2	6°17.3	5°59.1	0.5 - 0.2	6.5 - 2.8	12.5 - 5.3
6	6°16.5	6°17.5	5°59.3	0.6 - 0.3	6.6 - 2.8	12.6 - 5.4
7	6°16.8	6°17.8	5°59.6	0.7 - 0.3	6.7 - 2.8	12.7 - 5.4
8	6°17.0	6°18.0	5°59.8	0.8 - 0.3	6.8 - 2.9	12.8 - 5.4
9	6°17.2	6°18.3	6°00.1	0.9 - 0.4	6.9 - 2.9	12.9 - 5.5
10	6°17.5	6°18.5	6°00.3	1.0 - 0.4	7.0 - 3.0	13.0 - 5.5
11	6°17.8	6°18.8	6°00.5	1.1 - 0.5	7.1 - 3.0	13.1 - 5.6
12	6°18.0	6°19.0	6°00.8	1.2 - 0.5	7.2 - 3.1	13.2 - 5.6
13	6°18.2	6°19.3	6°01.0	1.3 - 0.6	7.3 - 3.1	13.3 - 5.7
14	6°18.5	6°19.5	6°01.3	1.4 - 0.6	7.4 - 3.1	13.4 - 5.7
15	6°18.8	6°19.8	6°01.5	1.5 - 0.6	7.5 - 3.2	13.5 - 5.7
16	6°19.0	6°20.0	6°01.7	1.6 - 0.7	7.6 - 3.2	13.6 - 5.8
17	6°19.3	6°20.3	6°02.0	1.7 - 0.7	7.7 - 3.3	13.7 - 5.8
18	6°19.5	6°20.5	6°02.2	1.8 - 0.8	7.8 - 3.3	13.8 - 5.9
19	6°19.7	6°20.8	6°02.5	1.9 - 0.8	7.9 - 3.4	13.9 - 5.9
20	6°20.0	6°21.0	6°02.7	2.0 - 0.8	8.0 - 3.4	14.0 - 6.0
21	6°20.3	6°21.3	6°02.9	2.1 - 0.9	8.1 - 3.4	14.1 - 6.0
22	6°20.5	6°21.5	6°03.2	2.2 - 0.9	8.2 - 3.5	14.2 - 6.0
23	6°20.7	6°21.8	6°03.4	2.3 - 1.0	8.3 - 3.5	14.3 - 6.1
24	6°21.0	6°22.0	6°03.6	2.4 - 1.0	8.4 - 3.6	14.4 - 6.1
25	6°21.3	6°22.3	6°03.9	2.5 - 1.1	8.5 - 3.6	14.5 - 6.2
26	6°21.5	6°22.5	6°04.1	2.6 - 1.1	8.6 - 3.7	14.6 - 6.2
27	6°21.7	6°22.8	6°04.4	2.7 - 1.1	8.7 - 3.7	14.7 - 6.2
28	6°22.0	6°23.0	6°04.6	2.8 - 1.2	8.8 - 3.7	14.8 - 6.3
29	6°22.3	6°23.3	6°04.8	2.9 - 1.2	8.9 - 3.8	14.9 - 6.3
30	6°22.5	6°23.5	6°05.1	3.0 - 1.3	9.0 - 3.8	15.0 - 6.4
31	6°22.7	6°23.8	6°05.3	3.1 - 1.3	9.1 - 3.9	15.1 - 6.4
32	6°23.0	6°24.0	6°05.6	3.2 - 1.4	9.2 - 3.9	15.2 - 6.5
33	6°23.3	6°24.3	6°05.8	3.3 - 1.4	9.3 - 4.0	15.3 - 6.5
34	6°23.5	6°24.5	6°06.0	3.4 - 1.4	9.4 - 4.0	15.4 - 6.5
35	6°23.7	6°24.8	6°06.3	3.5 - 1.5	9.5 - 4.0	15.5 - 6.6
36	6°24.0	6°25.0	6°06.5	3.6 - 1.5	9.6 - 4.1	15.6 - 6.6
37	6°24.3	6°25.3	6°06.7	3.7 - 1.6	9.7 - 4.1	15.7 - 6.7
38	6°24.5	6°25.6	6°07.0	3.8 - 1.6	9.8 - 4.2	15.8 - 6.7
39	6°24.7	6°25.8	6°07.2	3.9 - 1.7	9.9 - 4.2	15.9 - 6.8
40	6°25.0	6°26.1	6°07.5	4.0 - 1.7	10.0 - 4.3	16.0 - 6.8
41	6°25.3	6°26.3	6°07.7	4.1 - 1.7	10.1 - 4.3	16.1 - 6.8
42	6°25.5	6°26.6	6°07.9	4.2 - 1.8	10.2 - 4.3	16.2 - 6.9
43	6°25.7	6°26.8	6°08.2	4.3 - 1.8	10.3 - 4.4	16.3 - 6.9
44	6°26.0	6°27.1	6°08.4	4.4 - 1.9	10.4 - 4.4	16.4 - 7.0
45	6°26.3	6°27.3	6°08.7	4.5 - 1.9	10.5 - 4.5	16.5 - 7.0
46	6°26.5	6°27.6	6°08.9	4.6 - 2.0	10.6 - 4.5	16.6 - 7.1
47	6°26.8	6°27.8	6°09.1	4.7 - 2.0	10.7 - 4.5	16.7 - 7.1
48	6°27.0	6°28.1	6°09.4	4.8 - 2.0	10.8 - 4.6	16.8 - 7.1
49	6°27.2	6°28.3	6°09.6	4.9 - 2.1	10.9 - 4.6	16.9 - 7.2
50	6°27.5	6°28.6	6°09.8	5.0 - 2.1	11.0 - 4.7	17.0 - 7.2
51	6°27.8	6°28.8	6°10.1	5.1 - 2.2	11.1 - 4.7	17.1 - 7.3
52	6°28.0	6°29.1	6°10.3	5.2 - 2.2	11.2 - 4.8	17.2 - 7.3
53	6°28.2	6°29.3	6°10.6	5.3 - 2.3	11.3 - 4.8	17.3 - 7.4
54	6°28.5	6°29.6	6°10.8	5.4 - 2.3	11.4 - 4.8	17.4 - 7.4
55	6°28.8	6°29.8	6°11.0	5.5 - 2.3	11.5 - 4.9	17.5 - 7.4
56	6°29.0	6°30.1	6°11.3	5.6 - 2.4	11.6 - 4.9	17.6 - 7.5
57	6°29.2	6°30.3	6°11.5	5.7 - 2.4	11.7 - 5.0	17.7 - 7.5
58	6°29.5	6°30.6	6°11.8	5.8 - 2.5	11.8 - 5.0	17.8 - 7.6
59	6°29.8	6°30.8	6°12.0	5.9 - 2.5	11.9 - 5.1	17.9 - 7.6

m 26	Sun Plan.	Aries	Moon	v and d corr		
0	6°30.0	6°31.1	6°12.2	0.0 - 0.0	6.0 - 2.6	12.0 - 5.3
1	6°30.2	6°31.3	6°12.5	0.1 - 0.0	6.1 - 2.7	12.1 - 5.3
2	6°30.5	6°31.6	6°12.7	0.2 - 0.1	6.2 - 2.7	12.2 - 5.4
3	6°30.8	6°31.8	6°12.9	0.3 - 0.1	6.3 - 2.8	12.3 - 5.4
4	6°31.0	6°32.1	6°13.2	0.4 - 0.2	6.4 - 2.8	12.4 - 5.5
5	6°31.2	6°32.3	6°13.4	0.5 - 0.2	6.5 - 2.9	12.5 - 5.5
6	6°31.5	6°32.6	6°13.7	0.6 - 0.3	6.6 - 2.9	12.6 - 5.6
7	6°31.8	6°32.8	6°13.9	0.7 - 0.3	6.7 - 3.0	12.7 - 5.6
8	6°32.0	6°33.1	6°14.1	0.8 - 0.4	6.8 - 3.0	12.8 - 5.7
9	6°32.2	6°33.3	6°14.4	0.9 - 0.4	6.9 - 3.0	12.9 - 5.7
10	6°32.5	6°33.6	6°14.6	1.0 - 0.4	7.0 - 3.1	13.0 - 5.7
11	6°32.8	6°33.8	6°14.9	1.1 - 0.5	7.1 - 3.1	13.1 - 5.8
12	6°33.0	6°34.1	6°15.1	1.2 - 0.5	7.2 - 3.2	13.2 - 5.8
13	6°33.2	6°34.3	6°15.3	1.3 - 0.6	7.3 - 3.2	13.3 - 5.9
14	6°33.5	6°34.6	6°15.6	1.4 - 0.6	7.4 - 3.3	13.4 - 5.9
15	6°33.8	6°34.8	6°15.8	1.5 - 0.7	7.5 - 3.3	13.5 - 6.0
16	6°34.0	6°35.1	6°16.1	1.6 - 0.7	7.6 - 3.4	13.6 - 6.0
17	6°34.3	6°35.3	6°16.3	1.7 - 0.8	7.7 - 3.4	13.7 - 6.1
18	6°34.5	6°35.6	6°16.5	1.8 - 0.8	7.8 - 3.4	13.8 - 6.1
19	6°34.8	6°35.8	6°16.8	1.9 - 0.8	7.9 - 3.5	13.9 - 6.1
20	6°35.0	6°36.1	6°17.0	2.0 - 0.9	8.0 - 3.5	14.0 - 6.2
21	6°35.3	6°36.3	6°17.2	2.1 - 0.9	8.1 - 3.6	14.1 - 6.2
22	6°35.5	6°36.6	6°17.5	2.2 - 1.0	8.2 - 3.6	14.2 - 6.3
23	6°35.7	6°36.8	6°17.7	2.3 - 1.0	8.3 - 3.7	14.3 - 6.3
24	6°36.0	6°37.1	6°18.0	2.4 - 1.1	8.4 - 3.7	14.4 - 6.4
25	6°36.3	6°37.3	6°18.2	2.5 - 1.1	8.5 - 3.8	14.5 - 6.4
26	6°36.5	6°37.6	6°18.4	2.6 - 1.1	8.6 - 3.8	14.6 - 6.4
27	6°36.7	6°37.8	6°18.7	2.7 - 1.2	8.7 - 3.8	14.7 - 6.5
28	6°37.0	6°38.1	6°18.9	2.8 - 1.2	8.8 - 3.9	14.8 - 6.5
29	6°37.3	6°38.3	6°19.2	2.9 - 1.3	8.9 - 3.9	14.9 - 6.6
30	6°37.5	6°38.6	6°19.4	3.0 - 1.3	9.0 - 4.0	15.0 - 6.6
31	6°37.7	6°38.8	6°19.6	3.1 - 1.4	9.1 - 4.0	15.1 - 6.7
32	6°38.0	6°39.1	6°19.9	3.2 - 1.4	9.2 - 4.1	15.2 - 6.7
33	6°38.3	6°39.3	6°20.1	3.3 - 1.5	9.3 - 4.1	15.3 - 6.8
34	6°38.5	6°39.6	6°20.3	3.4 - 1.5	9.4 - 4.2	15.4 - 6.8
35	6°38.7	6°39.8	6°20.6	3.5 - 1.5	9.5 - 4.2	15.5 - 6.8
36	6°39.0	6°40.1	6°20.8	3.6 - 1.6	9.6 - 4.2	15.6 - 6.9
37	6°39.3	6°40.3	6°21.1	3.7 - 1.6	9.7 - 4.3	15.7 - 6.9
38	6°39.5	6°40.6	6°21.3	3.8 - 1.7	9.8 - 4.3	15.8 - 7.0
39	6°39.7	6°40.8	6°21.5	3.9 - 1.7	9.9 - 4.4	15.9 - 7.0
40	6°40.0	6°41.1	6°21.8	4.0 - 1.8	10.0 - 4.4	16.0 - 7.1
41	6°40.3	6°41.3	6°22.0	4.1 - 1.8	10.1 - 4.5	16.1 - 7.1
42	6°40.5	6°41.6	6°22.3	4.2 - 1.9	10.2 - 4.5	16.2 - 7.2
43	6°40.7	6°41.8	6°22.5	4.3 - 1.9	10.3 - 4.5	16.3 - 7.2
44	6°41.0	6°42.1	6°22.7	4.4 - 1.9	10.4 - 4.6	16.4 - 7.2
45	6°41.3	6°42.3	6°23.0	4.5 - 2.0	10.5 - 4.6	16.5 - 7.3
46	6°41.5	6°42.6	6°23.2	4.6 - 2.0	10.6 - 4.7	16.6 - 7.3
47	6°41.8	6°42.8	6°23.4	4.7 - 2.1	10.7 - 4.7	16.7 - 7.4
48	6°42.0	6°43.1	6°23.7	4.8 - 2.1	10.8 - 4.8	16.8 - 7.4
49	6°42.3	6°43.3	6°23.9	4.9 - 2.2	10.9 - 4.8	16.9 - 7.5
50	6°42.5	6°43.6	6°24.2	5.0 - 2.2	11.0 - 4.9	17.0 - 7.5
51	6°42.8	6°43.9	6°24.4	5.1 - 2.3	11.1 - 4.9	17.1 - 7.6
52	6°43.0	6°44.1	6°24.6	5.2 - 2.3	11.2 - 4.9	17.2 - 7.6
53	6°43.2	6°44.4	6°24.9	5.3 - 2.3	11.3 - 5.0	17.3 - 7.6
54	6°43.5	6°44.6	6°25.1	5.4 - 2.4	11.4 - 5.0	17.4 - 7.7
55	6°43.8	6°44.9	6°25.4	5.5 - 2.4	11.5 - 5.1	17.5 - 7.7
56	6°44.0	6°45.1	6°25.6	5.6 - 2.5	11.6 - 5.1	17.6 - 7.8
57	6°44.2	6°45.4	6°25.8	5.7 - 2.5	11.7 - 5.2	17.7 - 7.8
58	6°44.5	6°45.6	6°26.1	5.8 - 2.6	11.8 - 5.2	17.8 - 7.9
59	6°44.8	6°45.9	6°26.3	5.9 - 2.6	11.9 - 5.3	17.9 - 7.9

Increments and Corrections

m 27	Sun Plan.	Aries	Moon	v and d corr		
0	6°45.0	6°46.1	6°26.5	0.0 - 0.0	6.0 - 2.8	12.0 - 5.5
1	6°45.2	6°46.4	6°26.8	0.1 - 0.0	6.1 - 2.8	12.1 - 5.5
2	6°45.5	6°46.6	6°27.0	0.2 - 0.1	6.2 - 2.8	12.2 - 5.6
3	6°45.8	6°46.9	6°27.3	0.3 - 0.1	6.3 - 2.9	12.3 - 5.6
4	6°46.0	6°47.1	6°27.5	0.4 - 0.2	6.4 - 2.9	12.4 - 5.7
5	6°46.2	6°47.4	6°27.7	0.5 - 0.2	6.5 - 3.0	12.5 - 5.7
6	6°46.5	6°47.6	6°28.0	0.6 - 0.3	6.6 - 3.0	12.6 - 5.8
7	6°46.8	6°47.9	6°28.2	0.7 - 0.3	6.7 - 3.1	12.7 - 5.8
8	6°47.0	6°48.1	6°28.5	0.8 - 0.4	6.8 - 3.1	12.8 - 5.9
9	6°47.2	6°48.4	6°28.7	0.9 - 0.4	6.9 - 3.2	12.9 - 5.9
10	6°47.5	6°48.6	6°28.9	1.0 - 0.5	7.0 - 3.2	13.0 - 6.0
11	6°47.8	6°48.9	6°29.2	1.1 - 0.5	7.1 - 3.3	13.1 - 6.0
12	6°48.0	6°49.1	6°29.4	1.2 - 0.6	7.2 - 3.3	13.2 - 6.0
13	6°48.2	6°49.4	6°29.7	1.3 - 0.6	7.3 - 3.3	13.3 - 6.1
14	6°48.5	6°49.6	6°29.9	1.4 - 0.6	7.4 - 3.4	13.4 - 6.1
15	6°48.8	6°49.9	6°30.1	1.5 - 0.7	7.5 - 3.4	13.5 - 6.2
16	6°49.0	6°50.1	6°30.4	1.6 - 0.7	7.6 - 3.5	13.6 - 6.2
17	6°49.3	6°50.4	6°30.6	1.7 - 0.8	7.7 - 3.5	13.7 - 6.3
18	6°49.5	6°50.6	6°30.8	1.8 - 0.8	7.8 - 3.6	13.8 - 6.3
19	6°49.8	6°50.9	6°31.1	1.9 - 0.9	7.9 - 3.6	13.9 - 6.4
20	6°50.0	6°51.1	6°31.3	2.0 - 0.9	8.0 - 3.7	14.0 - 6.4
21	6°50.3	6°51.4	6°31.6	2.1 - 1.0	8.1 - 3.7	14.1 - 6.5
22	6°50.5	6°51.6	6°31.8	2.2 - 1.0	8.2 - 3.8	14.2 - 6.5
23	6°50.7	6°51.9	6°32.0	2.3 - 1.1	8.3 - 3.8	14.3 - 6.6
24	6°51.0	6°52.1	6°32.3	2.4 - 1.1	8.4 - 3.9	14.4 - 6.6
25	6°51.3	6°52.4	6°32.5	2.5 - 1.1	8.5 - 3.9	14.5 - 6.6
26	6°51.5	6°52.6	6°32.8	2.6 - 1.2	8.6 - 3.9	14.6 - 6.7
27	6°51.7	6°52.9	6°33.0	2.7 - 1.2	8.7 - 4.0	14.7 - 6.7
28	6°52.0	6°53.1	6°33.2	2.8 - 1.3	8.8 - 4.0	14.8 - 6.8
29	6°52.3	6°53.4	6°33.5	2.9 - 1.3	8.9 - 4.1	14.9 - 6.8
30	6°52.5	6°53.6	6°33.7	3.0 - 1.4	9.0 - 4.1	15.0 - 6.9
31	6°52.7	6°53.9	6°33.9	3.1 - 1.4	9.1 - 4.2	15.1 - 6.9
32	6°53.0	6°54.1	6°34.2	3.2 - 1.5	9.2 - 4.2	15.2 - 7.0
33	6°53.3	6°54.4	6°34.4	3.3 - 1.5	9.3 - 4.3	15.3 - 7.0
34	6°53.5	6°54.6	6°34.7	3.4 - 1.6	9.4 - 4.3	15.4 - 7.1
35	6°53.7	6°54.9	6°34.9	3.5 - 1.6	9.5 - 4.4	15.5 - 7.1
36	6°54.0	6°55.1	6°35.1	3.6 - 1.6	9.6 - 4.4	15.6 - 7.1
37	6°54.3	6°55.4	6°35.4	3.7 - 1.7	9.7 - 4.4	15.7 - 7.2
38	6°54.5	6°55.6	6°35.6	3.8 - 1.7	9.8 - 4.5	15.8 - 7.2
39	6°54.7	6°55.9	6°35.9	3.9 - 1.8	9.9 - 4.5	15.9 - 7.3
40	6°55.0	6°56.1	6°36.1	4.0 - 1.8	10.0 - 4.6	16.0 - 7.3
41	6°55.3	6°56.4	6°36.3	4.1 - 1.9	10.1 - 4.6	16.1 - 7.4
42	6°55.5	6°56.6	6°36.6	4.2 - 1.9	10.2 - 4.7	16.2 - 7.4
43	6°55.7	6°56.9	6°36.8	4.3 - 2.0	10.3 - 4.7	16.3 - 7.5
44	6°56.0	6°57.1	6°37.0	4.4 - 2.0	10.4 - 4.8	16.4 - 7.5
45	6°56.3	6°57.4	6°37.3	4.5 - 2.1	10.5 - 4.8	16.5 - 7.6
46	6°56.5	6°57.6	6°37.5	4.6 - 2.1	10.6 - 4.9	16.6 - 7.6
47	6°56.8	6°57.9	6°37.8	4.7 - 2.2	10.7 - 4.9	16.7 - 7.7
48	6°57.0	6°58.1	6°38.0	4.8 - 2.2	10.8 - 5.0	16.8 - 7.7
49	6°57.3	6°58.4	6°38.2	4.9 - 2.2	10.9 - 5.0	16.9 - 7.7
50	6°57.5	6°58.6	6°38.5	5.0 - 2.3	11.0 - 5.0	17.0 - 7.8
51	6°57.8	6°58.9	6°38.7	5.1 - 2.3	11.1 - 5.1	17.1 - 7.8
52	6°58.0	6°59.1	6°39.0	5.2 - 2.4	11.2 - 5.1	17.2 - 7.9
53	6°58.2	6°59.4	6°39.2	5.3 - 2.4	11.3 - 5.2	17.3 - 7.9
54	6°58.5	6°59.6	6°39.4	5.4 - 2.5	11.4 - 5.2	17.4 - 8.0
55	6°58.8	6°59.9	6°39.7	5.5 - 2.5	11.5 - 5.3	17.5 - 8.0
56	6°59.0	7°00.1	6°39.9	5.6 - 2.6	11.6 - 5.3	17.6 - 8.1
57	6°59.2	7°00.4	6°40.2	5.7 - 2.6	11.7 - 5.4	17.7 - 8.1
58	6°59.5	7°00.6	6°40.4	5.8 - 2.7	11.8 - 5.4	17.8 - 8.2
59	6°59.8	7°00.9	6°40.6	5.9 - 2.7	11.9 - 5.5	17.9 - 8.2

m 28	Sun Plan.	Aries	Moon	v and d corr		
0	7°00.0	7°01.1	6°40.9	0.0 - 0.0	6.0 - 2.8	12.0 - 5.7
1	7°00.2	7°01.4	6°41.1	0.1 - 0.0	6.1 - 2.9	12.1 - 5.7
2	7°00.5	7°01.6	6°41.3	0.2 - 0.1	6.2 - 2.9	12.2 - 5.8
3	7°00.8	7°01.9	6°41.6	0.3 - 0.1	6.3 - 3.0	12.3 - 5.8
4	7°01.0	7°02.2	6°41.8	0.4 - 0.2	6.4 - 3.0	12.4 - 5.9
5	7°01.2	7°02.4	6°42.1	0.5 - 0.2	6.5 - 3.1	12.5 - 5.9
6	7°01.5	7°02.7	6°42.3	0.6 - 0.3	6.6 - 3.1	12.6 - 6.0
7	7°01.8	7°02.9	6°42.5	0.7 - 0.3	6.7 - 3.2	12.7 - 6.0
8	7°02.0	7°03.2	6°42.8	0.8 - 0.4	6.8 - 3.2	12.8 - 6.1
9	7°02.2	7°03.4	6°43.0	0.9 - 0.4	6.9 - 3.3	12.9 - 6.1
10	7°02.5	7°03.7	6°43.3	1.0 - 0.5	7.0 - 3.3	13.0 - 6.2
11	7°02.8	7°03.9	6°43.5	1.1 - 0.5	7.1 - 3.4	13.1 - 6.2
12	7°03.0	7°04.2	6°43.7	1.2 - 0.6	7.2 - 3.4	13.2 - 6.3
13	7°03.2	7°04.4	6°44.0	1.3 - 0.6	7.3 - 3.5	13.3 - 6.3
14	7°03.5	7°04.7	6°44.2	1.4 - 0.7	7.4 - 3.5	13.4 - 6.4
15	7°03.8	7°04.9	6°44.4	1.5 - 0.7	7.5 - 3.6	13.5 - 6.4
16	7°04.0	7°05.2	6°44.7	1.6 - 0.8	7.6 - 3.6	13.6 - 6.5
17	7°04.3	7°05.4	6°44.9	1.7 - 0.8	7.7 - 3.7	13.7 - 6.5
18	7°04.5	7°05.7	6°45.2	1.8 - 0.9	7.8 - 3.7	13.8 - 6.6
19	7°04.7	7°05.9	6°45.4	1.9 - 0.9	7.9 - 3.8	13.9 - 6.6
20	7°05.0	7°06.2	6°45.6	2.0 - 0.9	8.0 - 3.8	14.0 - 6.6
21	7°05.3	7°06.4	6°45.9	2.1 - 1.0	8.1 - 3.8	14.1 - 6.7
22	7°05.5	7°06.7	6°46.1	2.2 - 1.0	8.2 - 3.9	14.2 - 6.7
23	7°05.7	7°06.9	6°46.4	2.3 - 1.1	8.3 - 3.9	14.3 - 6.8
24	7°06.0	7°07.2	6°46.6	2.4 - 1.1	8.4 - 4.0	14.4 - 6.8
25	7°06.3	7°07.4	6°46.8	2.5 - 1.2	8.5 - 4.0	14.5 - 6.9
26	7°06.5	7°07.7	6°47.1	2.6 - 1.2	8.6 - 4.1	14.6 - 6.9
27	7°06.7	7°07.9	6°47.3	2.7 - 1.3	8.7 - 4.1	14.7 - 7.0
28	7°07.0	7°08.2	6°47.5	2.8 - 1.3	8.8 - 4.2	14.8 - 7.0
29	7°07.3	7°08.4	6°47.8	2.9 - 1.4	8.9 - 4.2	14.9 - 7.1
30	7°07.5	7°08.7	6°48.0	3.0 - 1.4	9.0 - 4.3	15.0 - 7.1
31	7°07.7	7°08.9	6°48.3	3.1 - 1.5	9.1 - 4.3	15.1 - 7.2
32	7°08.0	7°09.2	6°48.5	3.2 - 1.5	9.2 - 4.4	15.2 - 7.2
33	7°08.3	7°09.4	6°48.7	3.3 - 1.6	9.3 - 4.4	15.3 - 7.3
34	7°08.5	7°09.7	6°49.0	3.4 - 1.6	9.4 - 4.5	15.4 - 7.3
35	7°08.7	7°09.9	6°49.2	3.5 - 1.7	9.5 - 4.5	15.5 - 7.4
36	7°09.0	7°10.2	6°49.5	3.6 - 1.7	9.6 - 4.6	15.6 - 7.4
37	7°09.3	7°10.4	6°49.7	3.7 - 1.8	9.7 - 4.6	15.7 - 7.5
38	7°09.5	7°10.7	6°49.9	3.8 - 1.8	9.8 - 4.7	15.8 - 7.5
39	7°09.7	7°10.9	6°50.2	3.9 - 1.9	9.9 - 4.7	15.9 - 7.6
40	7°10.0	7°11.2	6°50.4	4.0 - 1.9	10.0 - 4.8	16.0 - 7.6
41	7°10.3	7°11.4	6°50.6	4.1 - 1.9	10.1 - 4.8	16.1 - 7.6
42	7°10.5	7°11.7	6°50.9	4.2 - 2.0	10.2 - 4.8	16.2 - 7.7
43	7°10.7	7°11.9	6°51.1	4.3 - 2.0	10.3 - 4.9	16.3 - 7.7
44	7°11.0	7°12.2	6°51.4	4.4 - 2.1	10.4 - 4.9	16.4 - 7.8
45	7°11.3	7°12.4	6°51.6	4.5 - 2.1	10.5 - 5.0	16.5 - 7.8
46	7°11.5	7°12.7	6°51.8	4.6 - 2.2	10.6 - 5.0	16.6 - 7.9
47	7°11.8	7°12.9	6°52.1	4.7 - 2.2	10.7 - 5.1	16.7 - 7.9
48	7°12.0	7°13.2	6°52.3	4.8 - 2.3	10.8 - 5.1	16.8 - 8.0
49	7°12.2	7°13.4	6°52.6	4.9 - 2.3	10.9 - 5.2	16.9 - 8.0
50	7°12.5	7°13.7	6°52.8	5.0 - 2.4	11.0 - 5.2	17.0 - 8.1
51	7°12.8	7°13.9	6°53.0	5.1 - 2.4	11.1 - 5.3	17.1 - 8.1
52	7°13.0	7°14.2	6°53.3	5.2 - 2.5	11.2 - 5.3	17.2 - 8.2
53	7°13.2	7°14.4	6°53.5	5.3 - 2.5	11.3 - 5.4	17.3 - 8.2
54	7°13.5	7°14.7	6°53.8	5.4 - 2.6	11.4 - 5.4	17.4 - 8.3
55	7°13.8	7°14.9	6°54.0	5.5 - 2.6	11.5 - 5.5	17.5 - 8.3
56	7°14.0	7°15.2	6°54.2	5.6 - 2.7	11.6 - 5.5	17.6 - 8.4
57	7°14.2	7°15.4	6°54.5	5.7 - 2.7	11.7 - 5.6	17.7 - 8.4
58	7°14.5	7°15.7	6°54.7	5.8 - 2.8	11.8 - 5.6	17.8 - 8.5
59	7°14.8	7°15.9	6°54.9	5.9 - 2.8	11.9 - 5.7	17.9 - 8.5

m 29	Sun Plan.	Aries	Moon	v and d corr		
0	7°15.0	7°16.2	6°55.2	0.0 - 0.0	6.0 - 2.9	12.0 - 5.9
1	7°15.2	7°16.4	6°55.4	0.1 - 0.0	6.1 - 3.0	12.1 - 5.9
2	7°15.5	7°16.7	6°55.7	0.2 - 0.1	6.2 - 3.0	12.2 - 6.0
3	7°15.8	7°16.9	6°55.9	0.3 - 0.1	6.3 - 3.1	12.3 - 6.0
4	7°16.0	7°17.2	6°56.1	0.4 - 0.2	6.4 - 3.1	12.4 - 6.1
5	7°16.2	7°17.4	6°56.4	0.5 - 0.2	6.5 - 3.2	12.5 - 6.1
6	7°16.5	7°17.7	6°56.6	0.6 - 0.3	6.6 - 3.2	12.6 - 6.2
7	7°16.8	7°17.9	6°56.9	0.7 - 0.3	6.7 - 3.3	12.7 - 6.2
8	7°17.0	7°18.2	6°57.1	0.8 - 0.4	6.8 - 3.3	12.8 - 6.3
9	7°17.2	7°18.4	6°57.3	0.9 - 0.4	6.9 - 3.4	12.9 - 6.3
10	7°17.5	7°18.7	6°57.6	1.0 - 0.5	7.0 - 3.4	13.0 - 6.4
11	7°17.8	7°18.9	6°57.8	1.1 - 0.5	7.1 - 3.5	13.1 - 6.4
12	7°18.0	7°19.2	6°58.0	1.2 - 0.6	7.2 - 3.5	13.2 - 6.5
13	7°18.2	7°19.4	6°58.3	1.3 - 0.6	7.3 - 3.6	13.3 - 6.5
14	7°18.5	7°19.7	6°58.5	1.4 - 0.7	7.4 - 3.6	13.4 - 6.6
15	7°18.8	7°19.9	6°58.8	1.5 - 0.7	7.5 - 3.7	13.5 - 6.6
16	7°19.0	7°20.2	6°59.0	1.6 - 0.8	7.6 - 3.7	13.6 - 6.7
17	7°19.3	7°20.5	6°59.2	1.7 - 0.8	7.7 - 3.8	13.7 - 6.7
18	7°19.5	7°20.7	6°59.5	1.8 - 0.9	7.8 - 3.8	13.8 - 6.8
19	7°19.7	7°21.0	6°59.7	1.9 - 0.9	7.9 - 3.9	13.9 - 6.8
20	7°20.0	7°21.2	7°00.0	2.0 - 1.0	8.0 - 3.9	14.0 - 6.9
21	7°20.3	7°21.5	7°00.2	2.1 - 1.0	8.1 - 4.0	14.1 - 6.9
22	7°20.5	7°21.7	7°00.4	2.2 - 1.1	8.2 - 4.0	14.2 - 7.0
23	7°20.7	7°22.0	7°00.7	2.3 - 1.1	8.3 - 4.1	14.3 - 7.0
24	7°21.0	7°22.2	7°00.9	2.4 - 1.2	8.4 - 4.1	14.4 - 7.1
25	7°21.3	7°22.5	7°01.1	2.5 - 1.2	8.5 - 4.2	14.5 - 7.1
26	7°21.5	7°22.7	7°01.4	2.6 - 1.3	8.6 - 4.2	14.6 - 7.2
27	7°21.7	7°23.0	7°01.6	2.7 - 1.3	8.7 - 4.3	14.7 - 7.2
28	7°22.0	7°23.2	7°01.9	2.8 - 1.4	8.8 - 4.3	14.8 - 7.3
29	7°22.3	7°23.5	7°02.1	2.9 - 1.4	8.9 - 4.4	14.9 - 7.3
30	7°22.5	7°23.7	7°02.3	3.0 - 1.5	9.0 - 4.4	15.0 - 7.4
31	7°22.7	7°24.0	7°02.6	3.1 - 1.5	9.1 - 4.5	15.1 - 7.4
32	7°23.0	7°24.2	7°02.8	3.2 - 1.6	9.2 - 4.5	15.2 - 7.5
33	7°23.3	7°24.5	7°03.1	3.3 - 1.6	9.3 - 4.6	15.3 - 7.5
34	7°23.5	7°24.7	7°03.3	3.4 - 1.7	9.4 - 4.6	15.4 - 7.6
35	7°23.7	7°25.0	7°03.5	3.5 - 1.7	9.5 - 4.7	15.5 - 7.6
36	7°24.0	7°25.2	7°03.8	3.6 - 1.8	9.6 - 4.7	15.6 - 7.7
37	7°24.3	7°25.5	7°04.0	3.7 - 1.8	9.7 - 4.8	15.7 - 7.7
38	7°24.5	7°25.7	7°04.3	3.8 - 1.9	9.8 - 4.8	15.8 - 7.8
39	7°24.7	7°26.0	7°04.5	3.9 - 1.9	9.9 - 4.9	15.9 - 7.8
40	7°25.0	7°26.2	7°04.7	4.0 - 2.0	10.0 - 4.9	16.0 - 7.9
41	7°25.3	7°26.5	7°05.0	4.1 - 2.0	10.1 - 5.0	16.1 - 7.9
42	7°25.5	7°26.7	7°05.2	4.2 - 2.1	10.2 - 5.0	16.2 - 8.0
43	7°25.7	7°27.0	7°05.4	4.3 - 2.1	10.3 - 5.1	16.3 - 8.0
44	7°26.0	7°27.2	7°05.7	4.4 - 2.2	10.4 - 5.1	16.4 - 8.1
45	7°26.3	7°27.5	7°05.9	4.5 - 2.2	10.5 - 5.2	16.5 - 8.1
46	7°26.5	7°27.7	7°06.2	4.6 - 2.3	10.6 - 5.2	16.6 - 8.2
47	7°26.8	7°28.0	7°06.4	4.7 - 2.3	10.7 - 5.3	16.7 - 8.2
48	7°27.0	7°28.2	7°06.6	4.8 - 2.4	10.8 - 5.3	16.8 - 8.3
49	7°27.2	7°28.5	7°06.9	4.9 - 2.4	10.9 - 5.4	16.9 - 8.3
50	7°27.5	7°28.7	7°07.1	5.0 - 2.5	11.0 - 5.4	17.0 - 8.4
51	7°27.8	7°29.0	7°07.4	5.1 - 2.5	11.1 - 5.5	17.1 - 8.4
52	7°28.0	7°29.2	7°07.6	5.2 - 2.6	11.2 - 5.5	17.2 - 8.5
53	7°28.2	7°29.5	7°07.8	5.3 - 2.6	11.3 - 5.6	17.3 - 8.5
54	7°28.5	7°29.7	7°08.1	5.4 - 2.7	11.4 - 5.6	17.4 - 8.6
55	7°28.8	7°30.0	7°08.3	5.5 - 2.7	11.5 - 5.7	17.5 - 8.6
56	7°29.0	7°30.2	7°08.5	5.6 - 2.8	11.6 - 5.7	17.6 - 8.7
57	7°29.2	7°30.5	7°08.8	5.7 - 2.8	11.7 - 5.8	17.7 - 8.7
58	7°29.5	7°30.7	7°09.0	5.8 - 2.9	11.8 - 5.8	17.8 - 8.8
59	7°29.8	7°31.0	7°09.3	5.9 - 2.9	11.9 - 5.9	17.9 - 8.8

Increments and Corrections

m 30	Sun Plan.	Aries	Moon	v and d corr		
0	7°30.0	7°31.2	7°09.5	0.0 - 0.0	6.0 - 3.0	12.0 - 6.1
1	7°30.2	7°31.5	7°09.7	0.1 - 0.1	6.1 - 3.1	12.1 - 6.2
2	7°30.5	7°31.7	7°10.0	0.2 - 0.1	6.2 - 3.2	12.2 - 6.2
3	7°30.8	7°32.0	7°10.2	0.3 - 0.2	6.3 - 3.2	12.3 - 6.3
4	7°31.0	7°32.2	7°10.5	0.4 - 0.2	6.4 - 3.3	12.4 - 6.3
5	7°31.2	7°32.5	7°10.7	0.5 - 0.3	6.5 - 3.3	12.5 - 6.4
6	7°31.5	7°32.7	7°10.9	0.6 - 0.3	6.6 - 3.4	12.6 - 6.4
7	7°31.7	7°33.0	7°11.2	0.7 - 0.4	6.7 - 3.4	12.7 - 6.5
8	7°32.0	7°33.2	7°11.4	0.8 - 0.4	6.8 - 3.5	12.8 - 6.5
9	7°32.2	7°33.5	7°11.6	0.9 - 0.5	6.9 - 3.5	12.9 - 6.6
10	7°32.5	7°33.7	7°11.9	1.0 - 0.5	7.0 - 3.6	13.0 - 6.6
11	7°32.8	7°34.0	7°12.1	1.1 - 0.6	7.1 - 3.6	13.1 - 6.7
12	7°33.0	7°34.2	7°12.4	1.2 - 0.6	7.2 - 3.7	13.2 - 6.7
13	7°33.3	7°34.5	7°12.6	1.3 - 0.7	7.3 - 3.7	13.3 - 6.8
14	7°33.5	7°34.7	7°12.8	1.4 - 0.7	7.4 - 3.8	13.4 - 6.8
15	7°33.8	7°35.0	7°13.1	1.5 - 0.8	7.5 - 3.8	13.5 - 6.9
16	7°34.0	7°35.2	7°13.3	1.6 - 0.8	7.6 - 3.9	13.6 - 6.9
17	7°34.3	7°35.5	7°13.6	1.7 - 0.9	7.7 - 3.9	13.7 - 7.0
18	7°34.5	7°35.7	7°13.8	1.8 - 0.9	7.8 - 4.0	13.8 - 7.0
19	7°34.8	7°36.0	7°14.0	1.9 - 1.0	7.9 - 4.0	13.9 - 7.1
20	7°35.0	7°36.2	7°14.3	2.0 - 1.0	8.0 - 4.1	14.0 - 7.1
21	7°35.3	7°36.5	7°14.5	2.1 - 1.1	8.1 - 4.1	14.1 - 7.2
22	7°35.5	7°36.7	7°14.7	2.2 - 1.1	8.2 - 4.2	14.2 - 7.2
23	7°35.7	7°37.0	7°15.0	2.3 - 1.2	8.3 - 4.2	14.3 - 7.3
24	7°36.0	7°37.2	7°15.2	2.4 - 1.2	8.4 - 4.3	14.4 - 7.3
25	7°36.2	7°37.5	7°15.5	2.5 - 1.3	8.5 - 4.3	14.5 - 7.4
26	7°36.5	7°37.7	7°15.7	2.6 - 1.3	8.6 - 4.4	14.6 - 7.4
27	7°36.7	7°38.0	7°15.9	2.7 - 1.4	8.7 - 4.4	14.7 - 7.5
28	7°37.0	7°38.2	7°16.2	2.8 - 1.4	8.8 - 4.5	14.8 - 7.5
29	7°37.3	7°38.5	7°16.4	2.9 - 1.5	8.9 - 4.5	14.9 - 7.6
30	7°37.5	7°38.8	7°16.7	3.0 - 1.5	9.0 - 4.6	15.0 - 7.6
31	7°37.7	7°39.0	7°16.9	3.1 - 1.6	9.1 - 4.6	15.1 - 7.7
32	7°38.0	7°39.3	7°17.1	3.2 - 1.6	9.2 - 4.7	15.2 - 7.7
33	7°38.3	7°39.5	7°17.4	3.3 - 1.7	9.3 - 4.7	15.3 - 7.8
34	7°38.5	7°39.8	7°17.6	3.4 - 1.7	9.4 - 4.8	15.4 - 7.8
35	7°38.7	7°40.0	7°17.9	3.5 - 1.8	9.5 - 4.8	15.5 - 7.9
36	7°39.0	7°40.3	7°18.1	3.6 - 1.8	9.6 - 4.9	15.6 - 7.9
37	7°39.3	7°40.5	7°18.3	3.7 - 1.9	9.7 - 4.9	15.7 - 8.0
38	7°39.5	7°40.8	7°18.6	3.8 - 1.9	9.8 - 5.0	15.8 - 8.0
39	7°39.8	7°41.0	7°18.8	3.9 - 2.0	9.9 - 5.0	15.9 - 8.1
40	7°40.0	7°41.3	7°19.0	4.0 - 2.0	10.0 - 5.1	16.0 - 8.1
41	7°40.3	7°41.5	7°19.3	4.1 - 2.1	10.1 - 5.1	16.1 - 8.2
42	7°40.5	7°41.8	7°19.5	4.2 - 2.1	10.2 - 5.2	16.2 - 8.2
43	7°40.7	7°42.0	7°19.8	4.3 - 2.2	10.3 - 5.2	16.3 - 8.3
44	7°41.0	7°42.3	7°20.0	4.4 - 2.2	10.4 - 5.3	16.4 - 8.3
45	7°41.2	7°42.5	7°20.2	4.5 - 2.3	10.5 - 5.3	16.5 - 8.4
46	7°41.5	7°42.8	7°20.5	4.6 - 2.3	10.6 - 5.4	16.6 - 8.4
47	7°41.8	7°43.0	7°20.7	4.7 - 2.4	10.7 - 5.4	16.7 - 8.5
48	7°42.0	7°43.3	7°21.0	4.8 - 2.4	10.8 - 5.5	16.8 - 8.5
49	7°42.3	7°43.5	7°21.2	4.9 - 2.5	10.9 - 5.5	16.9 - 8.6
50	7°42.5	7°43.8	7°21.4	5.0 - 2.5	11.0 - 5.6	17.0 - 8.6
51	7°42.8	7°44.0	7°21.7	5.1 - 2.6	11.1 - 5.6	17.1 - 8.7
52	7°43.0	7°44.3	7°21.9	5.2 - 2.6	11.2 - 5.7	17.2 - 8.7
53	7°43.2	7°44.5	7°22.1	5.3 - 2.7	11.3 - 5.7	17.3 - 8.8
54	7°43.5	7°44.8	7°22.4	5.4 - 2.7	11.4 - 5.8	17.4 - 8.8
55	7°43.8	7°45.0	7°22.6	5.5 - 2.8	11.5 - 5.8	17.5 - 8.9
56	7°44.0	7°45.3	7°22.9	5.6 - 2.8	11.6 - 5.9	17.6 - 8.9
57	7°44.3	7°45.5	7°23.1	5.7 - 2.9	11.7 - 5.9	17.7 - 9.0
58	7°44.5	7°45.8	7°23.3	5.8 - 2.9	11.8 - 6.0	17.8 - 9.0
59	7°44.8	7°46.0	7°23.6	5.9 - 3.0	11.9 - 6.0	17.9 - 9.1

m 31	Sun Plan.	Aries	Moon	v and d corr		
0	7°45.0	7°46.3	7°23.8	0.0 - 0.0	6.0 - 3.2	12.0 - 6.3
1	7°45.2	7°46.5	7°24.1	0.1 - 0.1	6.1 - 3.2	12.1 - 6.4
2	7°45.5	7°46.8	7°24.3	0.2 - 0.1	6.2 - 3.3	12.2 - 6.4
3	7°45.7	7°47.0	7°24.5	0.3 - 0.2	6.3 - 3.3	12.3 - 6.5
4	7°46.0	7°47.3	7°24.8	0.4 - 0.2	6.4 - 3.4	12.4 - 6.5
5	7°46.2	7°47.5	7°25.0	0.5 - 0.3	6.5 - 3.4	12.5 - 6.6
6	7°46.5	7°47.8	7°25.2	0.6 - 0.3	6.6 - 3.5	12.6 - 6.6
7	7°46.8	7°48.0	7°25.5	0.7 - 0.4	6.7 - 3.5	12.7 - 6.7
8	7°47.0	7°48.3	7°25.7	0.8 - 0.4	6.8 - 3.6	12.8 - 6.7
9	7°47.2	7°48.5	7°26.0	0.9 - 0.5	6.9 - 3.6	12.9 - 6.8
10	7°47.5	7°48.8	7°26.2	1.0 - 0.5	7.0 - 3.7	13.0 - 6.8
11	7°47.7	7°49.0	7°26.4	1.1 - 0.6	7.1 - 3.7	13.1 - 6.9
12	7°48.0	7°49.3	7°26.7	1.2 - 0.6	7.2 - 3.8	13.2 - 6.9
13	7°48.2	7°49.5	7°26.9	1.3 - 0.7	7.3 - 3.8	13.3 - 7.0
14	7°48.5	7°49.8	7°27.2	1.4 - 0.7	7.4 - 3.9	13.4 - 7.0
15	7°48.8	7°50.0	7°27.4	1.5 - 0.8	7.5 - 3.9	13.5 - 7.1
16	7°49.0	7°50.3	7°27.6	1.6 - 0.8	7.6 - 4.0	13.6 - 7.1
17	7°49.3	7°50.5	7°27.9	1.7 - 0.9	7.7 - 4.0	13.7 - 7.2
18	7°49.5	7°50.8	7°28.1	1.8 - 0.9	7.8 - 4.1	13.8 - 7.2
19	7°49.8	7°51.0	7°28.4	1.9 - 1.0	7.9 - 4.1	13.9 - 7.3
20	7°50.0	7°51.3	7°28.6	2.0 - 1.1	8.0 - 4.2	14.0 - 7.4
21	7°50.3	7°51.5	7°28.8	2.1 - 1.1	8.1 - 4.3	14.1 - 7.4
22	7°50.5	7°51.8	7°29.1	2.2 - 1.2	8.2 - 4.3	14.2 - 7.5
23	7°50.7	7°52.0	7°29.3	2.3 - 1.2	8.3 - 4.4	14.3 - 7.5
24	7°51.0	7°52.3	7°29.5	2.4 - 1.3	8.4 - 4.4	14.4 - 7.6
25	7°51.3	7°52.5	7°29.8	2.5 - 1.3	8.5 - 4.5	14.5 - 7.6
26	7°51.5	7°52.8	7°30.0	2.6 - 1.4	8.6 - 4.5	14.6 - 7.7
27	7°51.7	7°53.0	7°30.3	2.7 - 1.4	8.7 - 4.6	14.7 - 7.7
28	7°52.0	7°53.3	7°30.5	2.8 - 1.5	8.8 - 4.6	14.8 - 7.8
29	7°52.2	7°53.5	7°30.7	2.9 - 1.5	8.9 - 4.7	14.9 - 7.8
30	7°52.5	7°53.8	7°31.0	3.0 - 1.6	9.0 - 4.7	15.0 - 7.9
31	7°52.7	7°54.0	7°31.2	3.1 - 1.6	9.1 - 4.8	15.1 - 7.9
32	7°53.0	7°54.3	7°31.5	3.2 - 1.7	9.2 - 4.8	15.2 - 8.0
33	7°53.3	7°54.5	7°31.7	3.3 - 1.7	9.3 - 4.9	15.3 - 8.0
34	7°53.5	7°54.8	7°31.9	3.4 - 1.8	9.4 - 4.9	15.4 - 8.1
35	7°53.8	7°55.0	7°32.2	3.5 - 1.8	9.5 - 5.0	15.5 - 8.1
36	7°54.0	7°55.3	7°32.4	3.6 - 1.9	9.6 - 5.0	15.6 - 8.2
37	7°54.3	7°55.5	7°32.6	3.7 - 1.9	9.7 - 5.1	15.7 - 8.2
38	7°54.5	7°55.8	7°32.9	3.8 - 2.0	9.8 - 5.1	15.8 - 8.3
39	7°54.7	7°56.0	7°33.1	3.9 - 2.0	9.9 - 5.2	15.9 - 8.3
40	7°55.0	7°56.3	7°33.4	4.0 - 2.1	10.0 - 5.3	16.0 - 8.4
41	7°55.3	7°56.5	7°33.6	4.1 - 2.2	10.1 - 5.3	16.1 - 8.5
42	7°55.5	7°56.8	7°33.8	4.2 - 2.2	10.2 - 5.4	16.2 - 8.5
43	7°55.7	7°57.1	7°34.1	4.3 - 2.3	10.3 - 5.4	16.3 - 8.6
44	7°56.0	7°57.3	7°34.3	4.4 - 2.3	10.4 - 5.5	16.4 - 8.6
45	7°56.3	7°57.6	7°34.6	4.5 - 2.4	10.5 - 5.5	16.5 - 8.7
46	7°56.5	7°57.8	7°34.8	4.6 - 2.4	10.6 - 5.6	16.6 - 8.7
47	7°56.7	7°58.1	7°35.0	4.7 - 2.5	10.7 - 5.6	16.7 - 8.8
48	7°57.0	7°58.3	7°35.3	4.8 - 2.5	10.8 - 5.7	16.8 - 8.8
49	7°57.2	7°58.6	7°35.5	4.9 - 2.6	10.9 - 5.7	16.9 - 8.9
50	7°57.5	7°58.8	7°35.7	5.0 - 2.6	11.0 - 5.8	17.0 - 8.9
51	7°57.8	7°59.1	7°36.0	5.1 - 2.7	11.1 - 5.8	17.1 - 9.0
52	7°58.0	7°59.3	7°36.2	5.2 - 2.7	11.2 - 5.9	17.2 - 9.0
53	7°58.2	7°59.6	7°36.5	5.3 - 2.8	11.3 - 5.9	17.3 - 9.1
54	7°58.5	7°59.8	7°36.7	5.4 - 2.8	11.4 - 6.0	17.4 - 9.1
55	7°58.8	8°00.1	7°36.9	5.5 - 2.9	11.5 - 6.0	17.5 - 9.2
56	7°59.0	8°00.3	7°37.2	5.6 - 2.9	11.6 - 6.1	17.6 - 9.2
57	7°59.2	8°00.6	7°37.4	5.7 - 3.0	11.7 - 6.1	17.7 - 9.3
58	7°59.5	8°00.8	7°37.7	5.8 - 3.0	11.8 - 6.2	17.8 - 9.3
59	7°59.8	8°01.1	7°37.9	5.9 - 3.1	11.9 - 6.2	17.9 - 9.4

m 32	Sun Plan.	Aries	Moon	v and d corr		
0	8°00.0	8°01.3	7°38.1	0.0 - 0.0	6.0 - 3.3	12.0 - 6.5
1	8°00.2	8°01.6	7°38.4	0.1 - 0.1	6.1 - 3.3	12.1 - 6.6
2	8°00.5	8°01.8	7°38.6	0.2 - 0.1	6.2 - 3.4	12.2 - 6.6
3	8°00.7	8°02.1	7°38.8	0.3 - 0.2	6.3 - 3.4	12.3 - 6.7
4	8°01.0	8°02.3	7°39.1	0.4 - 0.2	6.4 - 3.5	12.4 - 6.7
5	8°01.3	8°02.6	7°39.3	0.5 - 0.3	6.5 - 3.5	12.5 - 6.8
6	8°01.5	8°02.8	7°39.6	0.6 - 0.3	6.6 - 3.6	12.6 - 6.8
7	8°01.8	8°03.1	7°39.8	0.7 - 0.4	6.7 - 3.6	12.7 - 6.9
8	8°02.0	8°03.3	7°40.0	0.8 - 0.4	6.8 - 3.7	12.8 - 6.9
9	8°02.2	8°03.6	7°40.3	0.9 - 0.5	6.9 - 3.7	12.9 - 7.0
10	8°02.5	8°03.8	7°40.5	1.0 - 0.5	7.0 - 3.8	13.0 - 7.0
11	8°02.7	8°04.1	7°40.8	1.1 - 0.6	7.1 - 3.8	13.1 - 7.1
12	8°03.0	8°04.3	7°41.0	1.2 - 0.7	7.2 - 3.9	13.2 - 7.1
13	8°03.3	8°04.6	7°41.2	1.3 - 0.7	7.3 - 4.0	13.3 - 7.2
14	8°03.5	8°04.8	7°41.5	1.4 - 0.8	7.4 - 4.0	13.4 - 7.3
15	8°03.8	8°05.1	7°41.7	1.5 - 0.8	7.5 - 4.1	13.5 - 7.3
16	8°04.0	8°05.3	7°42.0	1.6 - 0.9	7.6 - 4.1	13.6 - 7.4
17	8°04.2	8°05.6	7°42.2	1.7 - 0.9	7.7 - 4.2	13.7 - 7.4
18	8°04.5	8°05.8	7°42.4	1.8 - 1.0	7.8 - 4.2	13.8 - 7.5
19	8°04.8	8°06.1	7°42.7	1.9 - 1.0	7.9 - 4.3	13.9 - 7.5
20	8°05.0	8°06.3	7°42.9	2.0 - 1.1	8.0 - 4.3	14.0 - 7.6
21	8°05.3	8°06.6	7°43.1	2.1 - 1.1	8.1 - 4.4	14.1 - 7.6
22	8°05.5	8°06.8	7°43.4	2.2 - 1.2	8.2 - 4.4	14.2 - 7.7
23	8°05.7	8°07.1	7°43.6	2.3 - 1.2	8.3 - 4.5	14.3 - 7.7
24	8°06.0	8°07.3	7°43.9	2.4 - 1.3	8.4 - 4.5	14.4 - 7.8
25	8°06.2	8°07.6	7°44.1	2.5 - 1.4	8.5 - 4.6	14.5 - 7.9
26	8°06.5	8°07.8	7°44.3	2.6 - 1.4	8.6 - 4.7	14.6 - 7.9
27	8°06.8	8°08.1	7°44.6	2.7 - 1.5	8.7 - 4.7	14.7 - 8.0
28	8°07.0	8°08.3	7°44.8	2.8 - 1.5	8.8 - 4.8	14.8 - 8.0
29	8°07.3	8°08.6	7°45.1	2.9 - 1.6	8.9 - 4.8	14.9 - 8.1
30	8°07.5	8°08.8	7°45.3	3.0 - 1.6	9.0 - 4.9	15.0 - 8.1
31	8°07.7	8°09.1	7°45.5	3.1 - 1.7	9.1 - 4.9	15.1 - 8.2
32	8°08.0	8°09.3	7°45.8	3.2 - 1.7	9.2 - 5.0	15.2 - 8.2
33	8°08.2	8°09.6	7°46.0	3.3 - 1.8	9.3 - 5.0	15.3 - 8.3
34	8°08.5	8°09.8	7°46.2	3.4 - 1.8	9.4 - 5.1	15.4 - 8.3
35	8°08.8	8°10.1	7°46.5	3.5 - 1.9	9.5 - 5.1	15.5 - 8.4
36	8°09.0	8°10.3	7°46.7	3.6 - 1.9	9.6 - 5.2	15.6 - 8.4
37	8°09.3	8°10.6	7°47.0	3.7 - 2.0	9.7 - 5.3	15.7 - 8.5
38	8°09.5	8°10.8	7°47.2	3.8 - 2.1	9.8 - 5.3	15.8 - 8.6
39	8°09.7	8°11.1	7°47.4	3.9 - 2.1	9.9 - 5.4	15.9 - 8.6
40	8°10.0	8°11.3	7°47.7	4.0 - 2.2	10.0 - 5.4	16.0 - 8.7
41	8°10.2	8°11.6	7°47.9	4.1 - 2.2	10.1 - 5.5	16.1 - 8.7
42	8°10.5	8°11.8	7°48.2	4.2 - 2.3	10.2 - 5.5	16.2 - 8.8
43	8°10.8	8°12.1	7°48.4	4.3 - 2.3	10.3 - 5.6	16.3 - 8.8
44	8°11.0	8°12.3	7°48.6	4.4 - 2.4	10.4 - 5.6	16.4 - 8.9
45	8°11.3	8°12.6	7°48.9	4.5 - 2.4	10.5 - 5.7	16.5 - 8.9
46	8°11.5	8°12.8	7°49.1	4.6 - 2.5	10.6 - 5.7	16.6 - 9.0
47	8°11.7	8°13.1	7°49.3	4.7 - 2.5	10.7 - 5.8	16.7 - 9.0
48	8°12.0	8°13.3	7°49.6	4.8 - 2.6	10.8 - 5.8	16.8 - 9.1
49	8°12.3	8°13.6	7°49.8	4.9 - 2.7	10.9 - 5.9	16.9 - 9.2
50	8°12.5	8°13.8	7°50.1	5.0 - 2.7	11.0 - 6.0	17.0 - 9.2
51	8°12.8	8°14.1	7°50.3	5.1 - 2.8	11.1 - 6.0	17.1 - 9.3
52	8°13.0	8°14.3	7°50.5	5.2 - 2.8	11.2 - 6.1	17.2 - 9.3
53	8°13.2	8°14.6	7°50.8	5.3 - 2.9	11.3 - 6.1	17.3 - 9.4
54	8°13.5	8°14.8	7°51.0	5.4 - 2.9	11.4 - 6.2	17.4 - 9.4
55	8°13.7	8°15.1	7°51.3	5.5 - 3.0	11.5 - 6.2	17.5 - 9.5
56	8°14.0	8°15.4	7°51.5	5.6 - 3.0	11.6 - 6.3	17.6 - 9.5
57	8°14.3	8°15.6	7°51.7	5.7 - 3.1	11.7 - 6.3	17.7 - 9.6
58	8°14.5	8°15.9	7°52.0	5.8 - 3.1	11.8 - 6.4	17.8 - 9.6
59	8°14.8	8°16.1	7°52.2	5.9 - 3.2	11.9 - 6.4	17.9 - 9.7

Increments and Corrections

m 33	Sun Plan.	Aries	Moon	v and d corr		
0	8°15.0	8°16.4	7°52.5	0.0 - 0.0	6.0 - 3.4	12.0 - 6.7
1	8°15.2	8°16.6	7°52.7	0.1 - 0.1	6.1 - 3.4	12.1 - 6.8
2	8°15.5	8°16.9	7°52.9	0.2 - 0.1	6.2 - 3.5	12.2 - 6.8
3	8°15.7	8°17.1	7°53.2	0.3 - 0.2	6.3 - 3.5	12.3 - 6.9
4	8°16.0	8°17.4	7°53.4	0.4 - 0.2	6.4 - 3.6	12.4 - 6.9
5	8°16.3	8°17.6	7°53.6	0.5 - 0.3	6.5 - 3.6	12.5 - 7.0
6	8°16.5	8°17.9	7°53.9	0.6 - 0.3	6.6 - 3.7	12.6 - 7.0
7	8°16.8	8°18.1	7°54.1	0.7 - 0.4	6.7 - 3.7	12.7 - 7.1
8	8°17.0	8°18.4	7°54.4	0.8 - 0.4	6.8 - 3.8	12.8 - 7.1
9	8°17.2	8°18.6	7°54.6	0.9 - 0.5	6.9 - 3.9	12.9 - 7.2
10	8°17.5	8°18.9	7°54.8	1.0 - 0.6	7.0 - 3.9	13.0 - 7.3
11	8°17.7	8°19.1	7°55.1	1.1 - 0.6	7.1 - 4.0	13.1 - 7.3
12	8°18.0	8°19.4	7°55.3	1.2 - 0.7	7.2 - 4.0	13.2 - 7.4
13	8°18.3	8°19.6	7°55.6	1.3 - 0.7	7.3 - 4.1	13.3 - 7.4
14	8°18.5	8°19.9	7°55.8	1.4 - 0.8	7.4 - 4.1	13.4 - 7.5
15	8°18.8	8°20.1	7°56.0	1.5 - 0.8	7.5 - 4.2	13.5 - 7.5
16	8°19.0	8°20.4	7°56.3	1.6 - 0.9	7.6 - 4.2	13.6 - 7.6
17	8°19.2	8°20.6	7°56.5	1.7 - 0.9	7.7 - 4.3	13.7 - 7.6
18	8°19.5	8°20.9	7°56.7	1.8 - 1.0	7.8 - 4.4	13.8 - 7.7
19	8°19.8	8°21.1	7°57.0	1.9 - 1.1	7.9 - 4.4	13.9 - 7.8
20	8°20.0	8°21.4	7°57.2	2.0 - 1.1	8.0 - 4.5	14.0 - 7.8
21	8°20.3	8°21.6	7°57.5	2.1 - 1.2	8.1 - 4.5	14.1 - 7.9
22	8°20.5	8°21.9	7°57.7	2.2 - 1.2	8.2 - 4.6	14.2 - 7.9
23	8°20.7	8°22.1	7°57.9	2.3 - 1.3	8.3 - 4.6	14.3 - 8.0
24	8°21.0	8°22.4	7°58.2	2.4 - 1.3	8.4 - 4.7	14.4 - 8.0
25	8°21.2	8°22.6	7°58.4	2.5 - 1.4	8.5 - 4.7	14.5 - 8.1
26	8°21.5	8°22.9	7°58.7	2.6 - 1.5	8.6 - 4.8	14.6 - 8.2
27	8°21.8	8°23.1	7°58.9	2.7 - 1.5	8.7 - 4.9	14.7 - 8.2
28	8°22.0	8°23.4	7°59.1	2.8 - 1.6	8.8 - 4.9	14.8 - 8.3
29	8°22.3	8°23.6	7°59.4	2.9 - 1.6	8.9 - 5.0	14.9 - 8.3
30	8°22.5	8°23.9	7°59.6	3.0 - 1.7	9.0 - 5.0	15.0 - 8.4
31	8°22.7	8°24.1	7°59.8	3.1 - 1.7	9.1 - 5.1	15.1 - 8.4
32	8°23.0	8°24.4	8°00.1	3.2 - 1.8	9.2 - 5.1	15.2 - 8.5
33	8°23.2	8°24.6	8°00.3	3.3 - 1.8	9.3 - 5.2	15.3 - 8.5
34	8°23.5	8°24.9	8°00.6	3.4 - 1.9	9.4 - 5.2	15.4 - 8.6
35	8°23.8	8°25.1	8°00.8	3.5 - 2.0	9.5 - 5.3	15.5 - 8.7
36	8°24.0	8°25.4	8°01.0	3.6 - 2.0	9.6 - 5.4	15.6 - 8.7
37	8°24.3	8°25.6	8°01.3	3.7 - 2.1	9.7 - 5.4	15.7 - 8.8
38	8°24.5	8°25.9	8°01.5	3.8 - 2.1	9.8 - 5.5	15.8 - 8.8
39	8°24.7	8°26.1	8°01.8	3.9 - 2.2	9.9 - 5.5	15.9 - 8.9
40	8°25.0	8°26.4	8°02.0	4.0 - 2.2	10.0 - 5.6	16.0 - 8.9
41	8°25.2	8°26.6	8°02.2	4.1 - 2.3	10.1 - 5.6	16.1 - 9.0
42	8°25.5	8°26.9	8°02.5	4.2 - 2.3	10.2 - 5.7	16.2 - 9.0
43	8°25.8	8°27.1	8°02.7	4.3 - 2.4	10.3 - 5.8	16.3 - 9.1
44	8°26.0	8°27.4	8°02.9	4.4 - 2.5	10.4 - 5.8	16.4 - 9.2
45	8°26.3	8°27.6	8°03.2	4.5 - 2.5	10.5 - 5.9	16.5 - 9.2
46	8°26.5	8°27.9	8°03.4	4.6 - 2.6	10.6 - 5.9	16.6 - 9.3
47	8°26.7	8°28.1	8°03.7	4.7 - 2.6	10.7 - 6.0	16.7 - 9.3
48	8°27.0	8°28.4	8°03.9	4.8 - 2.7	10.8 - 6.0	16.8 - 9.4
49	8°27.3	8°28.6	8°04.1	4.9 - 2.7	10.9 - 6.1	16.9 - 9.4
50	8°27.5	8°28.9	8°04.4	5.0 - 2.8	11.0 - 6.1	17.0 - 9.5
51	8°27.8	8°29.1	8°04.6	5.1 - 2.8	11.1 - 6.2	17.1 - 9.5
52	8°28.0	8°29.4	8°04.9	5.2 - 2.9	11.2 - 6.3	17.2 - 9.6
53	8°28.2	8°29.6	8°05.1	5.3 - 3.0	11.3 - 6.3	17.3 - 9.7
54	8°28.5	8°29.9	8°05.3	5.4 - 3.0	11.4 - 6.4	17.4 - 9.7
55	8°28.7	8°30.1	8°05.6	5.5 - 3.1	11.5 - 6.4	17.5 - 9.8
56	8°29.0	8°30.4	8°05.8	5.6 - 3.1	11.6 - 6.5	17.6 - 9.8
57	8°29.3	8°30.6	8°06.1	5.7 - 3.2	11.7 - 6.5	17.7 - 9.9
58	8°29.5	8°30.9	8°06.3	5.8 - 3.2	11.8 - 6.6	17.8 - 9.9
59	8°29.8	8°31.1	8°06.5	5.9 - 3.3	11.9 - 6.6	17.9 - 10.0

m 34	Sun Plan.	Aries	Moon	v and d corr		
0	8°30.0	8°31.4	8°06.8	0.0 - 0.0	6.0 - 3.4	12.0 - 6.9
1	8°30.2	8°31.6	8°07.0	0.1 - 0.1	6.1 - 3.5	12.1 - 7.0
2	8°30.5	8°31.9	8°07.2	0.2 - 0.1	6.2 - 3.6	12.2 - 7.0
3	8°30.7	8°32.1	8°07.5	0.3 - 0.2	6.3 - 3.6	12.3 - 7.1
4	8°31.0	8°32.4	8°07.7	0.4 - 0.2	6.4 - 3.7	12.4 - 7.1
5	8°31.3	8°32.6	8°08.0	0.5 - 0.3	6.5 - 3.7	12.5 - 7.2
6	8°31.5	8°32.9	8°08.2	0.6 - 0.3	6.6 - 3.8	12.6 - 7.2
7	8°31.8	8°33.1	8°08.4	0.7 - 0.4	6.7 - 3.9	12.7 - 7.3
8	8°32.0	8°33.4	8°08.7	0.8 - 0.5	6.8 - 3.9	12.8 - 7.4
9	8°32.2	8°33.7	8°08.9	0.9 - 0.5	6.9 - 4.0	12.9 - 7.4
10	8°32.5	8°33.9	8°09.2	1.0 - 0.6	7.0 - 4.0	13.0 - 7.5
11	8°32.7	8°34.2	8°09.4	1.1 - 0.6	7.1 - 4.1	13.1 - 7.5
12	8°33.0	8°34.4	8°09.6	1.2 - 0.7	7.2 - 4.1	13.2 - 7.6
13	8°33.3	8°34.7	8°09.9	1.3 - 0.7	7.3 - 4.2	13.3 - 7.6
14	8°33.5	8°34.9	8°10.1	1.4 - 0.8	7.4 - 4.3	13.4 - 7.7
15	8°33.8	8°35.2	8°10.3	1.5 - 0.9	7.5 - 4.3	13.5 - 7.8
16	8°34.0	8°35.4	8°10.6	1.6 - 0.9	7.6 - 4.4	13.6 - 7.8
17	8°34.2	8°35.7	8°10.8	1.7 - 1.0	7.7 - 4.4	13.7 - 7.9
18	8°34.5	8°35.9	8°11.1	1.8 - 1.0	7.8 - 4.5	13.8 - 7.9
19	8°34.8	8°36.2	8°11.3	1.9 - 1.1	7.9 - 4.5	13.9 - 8.0
20	8°35.0	8°36.4	8°11.5	2.0 - 1.1	8.0 - 4.6	14.0 - 8.0
21	8°35.3	8°36.7	8°11.8	2.1 - 1.2	8.1 - 4.7	14.1 - 8.1
22	8°35.5	8°36.9	8°12.0	2.2 - 1.3	8.2 - 4.7	14.2 - 8.2
23	8°35.7	8°37.2	8°12.3	2.3 - 1.3	8.3 - 4.8	14.3 - 8.2
24	8°36.0	8°37.4	8°12.5	2.4 - 1.4	8.4 - 4.8	14.4 - 8.3
25	8°36.2	8°37.7	8°12.7	2.5 - 1.4	8.5 - 4.9	14.5 - 8.3
26	8°36.5	8°37.9	8°13.0	2.6 - 1.5	8.6 - 4.9	14.6 - 8.4
27	8°36.8	8°38.2	8°13.2	2.7 - 1.6	8.7 - 5.0	14.7 - 8.5
28	8°37.0	8°38.4	8°13.4	2.8 - 1.6	8.8 - 5.1	14.8 - 8.5
29	8°37.3	8°38.7	8°13.7	2.9 - 1.7	8.9 - 5.1	14.9 - 8.6
30	8°37.5	8°38.9	8°13.9	3.0 - 1.7	9.0 - 5.2	15.0 - 8.6
31	8°37.7	8°39.2	8°14.2	3.1 - 1.8	9.1 - 5.2	15.1 - 8.7
32	8°38.0	8°39.4	8°14.4	3.2 - 1.8	9.2 - 5.3	15.2 - 8.7
33	8°38.2	8°39.7	8°14.6	3.3 - 1.9	9.3 - 5.3	15.3 - 8.8
34	8°38.5	8°39.9	8°14.9	3.4 - 2.0	9.4 - 5.4	15.4 - 8.9
35	8°38.8	8°40.2	8°15.1	3.5 - 2.0	9.5 - 5.5	15.5 - 8.9
36	8°39.0	8°40.4	8°15.4	3.6 - 2.1	9.6 - 5.5	15.6 - 9.0
37	8°39.3	8°40.7	8°15.6	3.7 - 2.1	9.7 - 5.6	15.7 - 9.0
38	8°39.5	8°40.9	8°15.8	3.8 - 2.2	9.8 - 5.6	15.8 - 9.1
39	8°39.7	8°41.2	8°16.1	3.9 - 2.2	9.9 - 5.7	15.9 - 9.1
40	8°40.0	8°41.4	8°16.3	4.0 - 2.3	10.0 - 5.8	16.0 - 9.2
41	8°40.2	8°41.7	8°16.5	4.1 - 2.4	10.1 - 5.8	16.1 - 9.3
42	8°40.5	8°41.9	8°16.8	4.2 - 2.4	10.2 - 5.9	16.2 - 9.3
43	8°40.8	8°42.2	8°17.0	4.3 - 2.5	10.3 - 5.9	16.3 - 9.4
44	8°41.0	8°42.4	8°17.3	4.4 - 2.5	10.4 - 6.0	16.4 - 9.4
45	8°41.3	8°42.7	8°17.5	4.5 - 2.6	10.5 - 6.0	16.5 - 9.5
46	8°41.5	8°42.9	8°17.7	4.6 - 2.6	10.6 - 6.1	16.6 - 9.5
47	8°41.7	8°43.2	8°18.0	4.7 - 2.7	10.7 - 6.2	16.7 - 9.6
48	8°42.0	8°43.4	8°18.2	4.8 - 2.8	10.8 - 6.2	16.8 - 9.7
49	8°42.3	8°43.7	8°18.5	4.9 - 2.8	10.9 - 6.3	16.9 - 9.7
50	8°42.5	8°43.9	8°18.7	5.0 - 2.9	11.0 - 6.3	17.0 - 9.8
51	8°42.8	8°44.2	8°18.9	5.1 - 2.9	11.1 - 6.4	17.1 - 9.8
52	8°43.0	8°44.4	8°19.2	5.2 - 3.0	11.2 - 6.4	17.2 - 9.9
53	8°43.2	8°44.7	8°19.4	5.3 - 3.0	11.3 - 6.5	17.3 - 9.9
54	8°43.5	8°44.9	8°19.7	5.4 - 3.1	11.4 - 6.6	17.4 - 10.0
55	8°43.7	8°45.2	8°19.9	5.5 - 3.2	11.5 - 6.6	17.5 - 10.1
56	8°44.0	8°45.4	8°20.1	5.6 - 3.2	11.6 - 6.7	17.6 - 10.1
57	8°44.3	8°45.7	8°20.4	5.7 - 3.3	11.7 - 6.7	17.7 - 10.2
58	8°44.5	8°45.9	8°20.6	5.8 - 3.3	11.8 - 6.8	17.8 - 10.2
59	8°44.8	8°46.2	8°20.8	5.9 - 3.4	11.9 - 6.8	17.9 - 10.3

m 35	Sun Plan.	Aries	Moon	v and d corr		
0	8°45.0	8°46.4	8°21.1	0.0 - 0.0	6.0 - 3.5	12.0 - 7.1
1	8°45.2	8°46.7	8°21.3	0.1 - 0.1	6.1 - 3.6	12.1 - 7.2
2	8°45.5	8°46.9	8°21.6	0.2 - 0.1	6.2 - 3.7	12.2 - 7.2
3	8°45.7	8°47.2	8°21.8	0.3 - 0.2	6.3 - 3.7	12.3 - 7.3
4	8°46.0	8°47.4	8°22.0	0.4 - 0.2	6.4 - 3.8	12.4 - 7.3
5	8°46.3	8°47.7	8°22.3	0.5 - 0.3	6.5 - 3.8	12.5 - 7.4
6	8°46.5	8°47.9	8°22.5	0.6 - 0.4	6.6 - 3.9	12.6 - 7.5
7	8°46.8	8°48.2	8°22.8	0.7 - 0.4	6.7 - 4.0	12.7 - 7.5
8	8°47.0	8°48.4	8°23.0	0.8 - 0.5	6.8 - 4.0	12.8 - 7.6
9	8°47.2	8°48.7	8°23.2	0.9 - 0.5	6.9 - 4.1	12.9 - 7.6
10	8°47.5	8°48.9	8°23.5	1.0 - 0.6	7.0 - 4.1	13.0 - 7.7
11	8°47.7	8°49.2	8°23.7	1.1 - 0.7	7.1 - 4.2	13.1 - 7.8
12	8°48.0	8°49.4	8°23.9	1.2 - 0.7	7.2 - 4.3	13.2 - 7.8
13	8°48.3	8°49.7	8°24.2	1.3 - 0.8	7.3 - 4.3	13.3 - 7.9
14	8°48.5	8°49.9	8°24.4	1.4 - 0.8	7.4 - 4.4	13.4 - 7.9
15	8°48.8	8°50.2	8°24.7	1.5 - 0.9	7.5 - 4.4	13.5 - 8.0
16	8°49.0	8°50.4	8°24.9	1.6 - 0.9	7.6 - 4.5	13.6 - 8.0
17	8°49.2	8°50.7	8°25.1	1.7 - 1.0	7.7 - 4.6	13.7 - 8.1
18	8°49.5	8°50.9	8°25.4	1.8 - 1.1	7.8 - 4.6	13.8 - 8.2
19	8°49.8	8°51.2	8°25.6	1.9 - 1.1	7.9 - 4.7	13.9 - 8.2
20	8°50.0	8°51.4	8°25.9	2.0 - 1.2	8.0 - 4.7	14.0 - 8.3
21	8°50.3	8°51.7	8°26.1	2.1 - 1.2	8.1 - 4.8	14.1 - 8.3
22	8°50.5	8°52.0	8°26.3	2.2 - 1.3	8.2 - 4.9	14.2 - 8.4
23	8°50.7	8°52.2	8°26.6	2.3 - 1.4	8.3 - 4.9	14.3 - 8.5
24	8°51.0	8°52.5	8°26.8	2.4 - 1.4	8.4 - 5.0	14.4 - 8.5
25	8°51.2	8°52.7	8°27.0	2.5 - 1.5	8.5 - 5.0	14.5 - 8.6
26	8°51.5	8°53.0	8°27.3	2.6 - 1.5	8.6 - 5.1	14.6 - 8.6
27	8°51.8	8°53.2	8°27.5	2.7 - 1.6	8.7 - 5.1	14.7 - 8.7
28	8°52.0	8°53.5	8°27.8	2.8 - 1.7	8.8 - 5.2	14.8 - 8.8
29	8°52.3	8°53.7	8°28.0	2.9 - 1.7	8.9 - 5.3	14.9 - 8.8
30	8°52.5	8°54.0	8°28.2	3.0 - 1.8	9.0 - 5.3	15.0 - 8.9
31	8°52.7	8°54.2	8°28.5	3.1 - 1.8	9.1 - 5.4	15.1 - 8.9
32	8°53.0	8°54.5	8°28.7	3.2 - 1.9	9.2 - 5.4	15.2 - 9.0
33	8°53.2	8°54.7	8°29.0	3.3 - 2.0	9.3 - 5.5	15.3 - 9.1
34	8°53.5	8°55.0	8°29.2	3.4 - 2.0	9.4 - 5.6	15.4 - 9.1
35	8°53.8	8°55.2	8°29.4	3.5 - 2.1	9.5 - 5.6	15.5 - 9.2
36	8°54.0	8°55.5	8°29.7	3.6 - 2.1	9.6 - 5.7	15.6 - 9.2
37	8°54.3	8°55.7	8°29.9	3.7 - 2.2	9.7 - 5.7	15.7 - 9.3
38	8°54.5	8°56.0	8°30.2	3.8 - 2.2	9.8 - 5.8	15.8 - 9.3
39	8°54.7	8°56.2	8°30.4	3.9 - 2.3	9.9 - 5.9	15.9 - 9.4
40	8°55.0	8°56.5	8°30.6	4.0 - 2.4	10.0 - 5.9	16.0 - 9.5
41	8°55.2	8°56.7	8°30.9	4.1 - 2.4	10.1 - 6.0	16.1 - 9.5
42	8°55.5	8°57.0	8°31.1	4.2 - 2.5	10.2 - 6.0	16.2 - 9.6
43	8°55.8	8°57.2	8°31.3	4.3 - 2.5	10.3 - 6.1	16.3 - 9.6
44	8°56.0	8°57.5	8°31.6	4.4 - 2.6	10.4 - 6.2	16.4 - 9.7
45	8°56.3	8°57.7	8°31.8	4.5 - 2.7	10.5 - 6.2	16.5 - 9.8
46	8°56.5	8°58.0	8°32.1	4.6 - 2.7	10.6 - 6.3	16.6 - 9.8
47	8°56.7	8°58.2	8°32.3	4.7 - 2.8	10.7 - 6.3	16.7 - 9.9
48	8°57.0	8°58.5	8°32.5	4.8 - 2.8	10.8 - 6.4	16.8 - 9.9
49	8°57.3	8°58.7	8°32.8	4.9 - 2.9	10.9 - 6.4	16.9 - 10.0
50	8°57.5	8°59.0	8°33.0	5.0 - 3.0	11.0 - 6.5	17.0 - 10.1
51	8°57.8	8°59.2	8°33.3	5.1 - 3.0	11.1 - 6.6	17.1 - 10.1
52	8°58.0	8°59.5	8°33.5	5.2 - 3.1	11.2 - 6.6	17.2 - 10.2
53	8°58.2	8°59.7	8°33.7	5.3 - 3.1	11.3 - 6.7	17.3 - 10.2
54	8°58.5	9°00.0	8°34.0	5.4 - 3.2	11.4 - 6.7	17.4 - 10.3
55	8°58.7	9°00.2	8°34.2	5.5 - 3.3	11.5 - 6.8	17.5 - 10.4
56	8°59.0	9°00.5	8°34.4	5.6 - 3.3	11.6 - 6.9	17.6 - 10.4
57	8°59.3	9°00.7	8°34.7	5.7 - 3.4	11.7 - 6.9	17.7 - 10.5
58	8°59.5	9°01.0	8°34.9	5.8 - 3.4	11.8 - 7.0	17.8 - 10.5
59	8°59.8	9°01.2	8°35.2	5.9 - 3.5	11.9 - 7.0	17.9 - 10.6

Increments and Corrections

m 36	Sun Plan.	Aries	Moon	v and d corr		
0	9°00.0	9°01.5	8°35.4	0.0 - 0.0	6.0 - 3.6	12.0 - 7.3
1	9°00.2	9°01.7	8°35.6	0.1 - 0.1	6.1 - 3.7	12.1 - 7.4
2	9°00.5	9°02.0	8°35.9	0.2 - 0.1	6.2 - 3.8	12.2 - 7.4
3	9°00.7	9°02.2	8°36.1	0.3 - 0.2	6.3 - 3.8	12.3 - 7.5
4	9°01.0	9°02.5	8°36.4	0.4 - 0.2	6.4 - 3.9	12.4 - 7.5
5	9°01.3	9°02.7	8°36.6	0.5 - 0.3	6.5 - 4.0	12.5 - 7.6
6	9°01.5	9°03.0	8°36.8	0.6 - 0.4	6.6 - 4.0	12.6 - 7.7
7	9°01.8	9°03.2	8°37.1	0.7 - 0.4	6.7 - 4.1	12.7 - 7.7
8	9°02.0	9°03.5	8°37.3	0.8 - 0.5	6.8 - 4.1	12.8 - 7.8
9	9°02.2	9°03.7	8°37.5	0.9 - 0.5	6.9 - 4.2	12.9 - 7.8
10	9°02.5	9°04.0	8°37.8	1.0 - 0.6	7.0 - 4.3	13.0 - 7.9
11	9°02.7	9°04.2	8°38.0	1.1 - 0.7	7.1 - 4.3	13.1 - 8.0
12	9°03.0	9°04.5	8°38.3	1.2 - 0.7	7.2 - 4.4	13.2 - 8.0
13	9°03.3	9°04.7	8°38.5	1.3 - 0.8	7.3 - 4.4	13.3 - 8.1
14	9°03.5	9°05.0	8°38.7	1.4 - 0.9	7.4 - 4.5	13.4 - 8.2
15	9°03.8	9°05.2	8°39.0	1.5 - 0.9	7.5 - 4.6	13.5 - 8.2
16	9°04.0	9°05.5	8°39.2	1.6 - 1.0	7.6 - 4.6	13.6 - 8.3
17	9°04.2	9°05.7	8°39.5	1.7 - 1.0	7.7 - 4.7	13.7 - 8.3
18	9°04.5	9°06.0	8°39.7	1.8 - 1.1	7.8 - 4.7	13.8 - 8.4
19	9°04.8	9°06.2	8°39.9	1.9 - 1.2	7.9 - 4.8	13.9 - 8.5
20	9°05.0	9°06.5	8°40.2	2.0 - 1.2	8.0 - 4.9	14.0 - 8.5
21	9°05.3	9°06.7	8°40.4	2.1 - 1.3	8.1 - 4.9	14.1 - 8.6
22	9°05.5	9°07.0	8°40.6	2.2 - 1.3	8.2 - 5.0	14.2 - 8.6
23	9°05.7	9°07.2	8°40.9	2.3 - 1.4	8.3 - 5.0	14.3 - 8.7
24	9°06.0	9°07.5	8°41.1	2.4 - 1.5	8.4 - 5.1	14.4 - 8.8
25	9°06.2	9°07.7	8°41.4	2.5 - 1.5	8.5 - 5.2	14.5 - 8.8
26	9°06.5	9°08.0	8°41.6	2.6 - 1.6	8.6 - 5.2	14.6 - 8.9
27	9°06.8	9°08.2	8°41.8	2.7 - 1.6	8.7 - 5.3	14.7 - 8.9
28	9°07.0	9°08.5	8°42.1	2.8 - 1.7	8.8 - 5.4	14.8 - 9.0
29	9°07.3	9°08.7	8°42.3	2.9 - 1.8	8.9 - 5.4	14.9 - 9.1
30	9°07.5	9°09.0	8°42.6	3.0 - 1.8	9.0 - 5.5	15.0 - 9.1
31	9°07.7	9°09.2	8°42.8	3.1 - 1.9	9.1 - 5.5	15.1 - 9.2
32	9°08.0	9°09.5	8°43.0	3.2 - 1.9	9.2 - 5.6	15.2 - 9.2
33	9°08.2	9°09.7	8°43.3	3.3 - 2.0	9.3 - 5.7	15.3 - 9.3
34	9°08.5	9°10.0	8°43.5	3.4 - 2.1	9.4 - 5.7	15.4 - 9.4
35	9°08.8	9°10.2	8°43.8	3.5 - 2.1	9.5 - 5.8	15.5 - 9.4
36	9°09.0	9°10.5	8°44.0	3.6 - 2.2	9.6 - 5.8	15.6 - 9.5
37	9°09.3	9°10.8	8°44.2	3.7 - 2.3	9.7 - 5.9	15.7 - 9.6
38	9°09.5	9°11.0	8°44.5	3.8 - 2.3	9.8 - 6.0	15.8 - 9.6
39	9°09.7	9°11.3	8°44.7	3.9 - 2.4	9.9 - 6.0	15.9 - 9.7
40	9°10.0	9°11.5	8°44.9	4.0 - 2.4	10.0 - 6.1	16.0 - 9.7
41	9°10.2	9°11.8	8°45.2	4.1 - 2.5	10.1 - 6.1	16.1 - 9.8
42	9°10.5	9°12.0	8°45.4	4.2 - 2.6	10.2 - 6.2	16.2 - 9.9
43	9°10.8	9°12.3	8°45.7	4.3 - 2.6	10.3 - 6.3	16.3 - 9.9
44	9°11.0	9°12.5	8°45.9	4.4 - 2.7	10.4 - 6.3	16.4 - 10.0
45	9°11.3	9°12.8	8°46.1	4.5 - 2.7	10.5 - 6.4	16.5 - 10.0
46	9°11.5	9°13.0	8°46.4	4.6 - 2.8	10.6 - 6.4	16.6 - 10.1
47	9°11.7	9°13.3	8°46.6	4.7 - 2.9	10.7 - 6.5	16.7 - 10.2
48	9°12.0	9°13.5	8°46.9	4.8 - 2.9	10.8 - 6.6	16.8 - 10.2
49	9°12.3	9°13.8	8°47.1	4.9 - 3.0	10.9 - 6.6	16.9 - 10.3
50	9°12.5	9°14.0	8°47.3	5.0 - 3.0	11.0 - 6.7	17.0 - 10.3
51	9°12.8	9°14.3	8°47.6	5.1 - 3.1	11.1 - 6.8	17.1 - 10.4
52	9°13.0	9°14.5	8°47.8	5.2 - 3.2	11.2 - 6.8	17.2 - 10.5
53	9°13.2	9°14.8	8°48.0	5.3 - 3.2	11.3 - 6.9	17.3 - 10.5
54	9°13.5	9°15.0	8°48.3	5.4 - 3.3	11.4 - 6.9	17.4 - 10.6
55	9°13.7	9°15.3	8°48.5	5.5 - 3.3	11.5 - 7.0	17.5 - 10.6
56	9°14.0	9°15.5	8°48.8	5.6 - 3.4	11.6 - 7.1	17.6 - 10.7
57	9°14.3	9°15.8	8°49.0	5.7 - 3.5	11.7 - 7.1	17.7 - 10.8
58	9°14.5	9°16.0	8°49.2	5.8 - 3.5	11.8 - 7.2	17.8 - 10.8
59	9°14.8	9°16.3	8°49.5	5.9 - 3.6	11.9 - 7.2	17.9 - 10.9

m 37	Sun Plan.	Aries	Moon	v and d corr		
0	9°15.0	9°16.5	8°49.7	0.0 - 0.0	6.0 - 3.8	12.0 - 7.5
1	9°15.2	9°16.8	8°50.0	0.1 - 0.1	6.1 - 3.8	12.1 - 7.6
2	9°15.5	9°17.0	8°50.2	0.2 - 0.1	6.2 - 3.9	12.2 - 7.6
3	9°15.7	9°17.3	8°50.4	0.3 - 0.2	6.3 - 3.9	12.3 - 7.7
4	9°16.0	9°17.5	8°50.7	0.4 - 0.3	6.4 - 4.0	12.4 - 7.8
5	9°16.3	9°17.8	8°50.9	0.5 - 0.3	6.5 - 4.1	12.5 - 7.8
6	9°16.5	9°18.0	8°51.1	0.6 - 0.4	6.6 - 4.1	12.6 - 7.9
7	9°16.8	9°18.3	8°51.4	0.7 - 0.4	6.7 - 4.2	12.7 - 7.9
8	9°17.0	9°18.5	8°51.6	0.8 - 0.5	6.8 - 4.3	12.8 - 8.0
9	9°17.2	9°18.8	8°51.9	0.9 - 0.6	6.9 - 4.3	12.9 - 8.1
10	9°17.5	9°19.0	8°52.1	1.0 - 0.6	7.0 - 4.4	13.0 - 8.1
11	9°17.7	9°19.3	8°52.3	1.1 - 0.7	7.1 - 4.4	13.1 - 8.2
12	9°18.0	9°19.5	8°52.6	1.2 - 0.8	7.2 - 4.5	13.2 - 8.3
13	9°18.3	9°19.8	8°52.8	1.3 - 0.8	7.3 - 4.6	13.3 - 8.3
14	9°18.5	9°20.0	8°53.1	1.4 - 0.9	7.4 - 4.6	13.4 - 8.4
15	9°18.8	9°20.3	8°53.3	1.5 - 0.9	7.5 - 4.7	13.5 - 8.4
16	9°19.0	9°20.5	8°53.5	1.6 - 1.0	7.6 - 4.8	13.6 - 8.5
17	9°19.2	9°20.8	8°53.8	1.7 - 1.1	7.7 - 4.8	13.7 - 8.6
18	9°19.5	9°21.0	8°54.0	1.8 - 1.1	7.8 - 4.9	13.8 - 8.6
19	9°19.8	9°21.3	8°54.3	1.9 - 1.2	7.9 - 4.9	13.9 - 8.7
20	9°20.0	9°21.5	8°54.5	2.0 - 1.3	8.0 - 5.0	14.0 - 8.8
21	9°20.3	9°21.8	8°54.7	2.1 - 1.3	8.1 - 5.1	14.1 - 8.8
22	9°20.5	9°22.0	8°55.0	2.2 - 1.4	8.2 - 5.1	14.2 - 8.9
23	9°20.7	9°22.3	8°55.2	2.3 - 1.4	8.3 - 5.2	14.3 - 8.9
24	9°21.0	9°22.5	8°55.4	2.4 - 1.5	8.4 - 5.3	14.4 - 9.0
25	9°21.2	9°22.8	8°55.7	2.5 - 1.6	8.5 - 5.3	14.5 - 9.1
26	9°21.5	9°23.0	8°55.9	2.6 - 1.6	8.6 - 5.4	14.6 - 9.1
27	9°21.8	9°23.3	8°56.2	2.7 - 1.7	8.7 - 5.4	14.7 - 9.2
28	9°22.0	9°23.5	8°56.4	2.8 - 1.8	8.8 - 5.5	14.8 - 9.3
29	9°22.3	9°23.8	8°56.6	2.9 - 1.8	8.9 - 5.6	14.9 - 9.3
30	9°22.5	9°24.0	8°56.9	3.0 - 1.9	9.0 - 5.6	15.0 - 9.4
31	9°22.7	9°24.3	8°57.1	3.1 - 1.9	9.1 - 5.7	15.1 - 9.4
32	9°23.0	9°24.5	8°57.4	3.2 - 2.0	9.2 - 5.8	15.2 - 9.5
33	9°23.2	9°24.8	8°57.6	3.3 - 2.1	9.3 - 5.8	15.3 - 9.6
34	9°23.5	9°25.0	8°57.8	3.4 - 2.1	9.4 - 5.9	15.4 - 9.6
35	9°23.8	9°25.3	8°58.1	3.5 - 2.2	9.5 - 5.9	15.5 - 9.7
36	9°24.0	9°25.5	8°58.3	3.6 - 2.3	9.6 - 6.0	15.6 - 9.8
37	9°24.3	9°25.8	8°58.5	3.7 - 2.3	9.7 - 6.1	15.7 - 9.8
38	9°24.5	9°26.0	8°58.8	3.8 - 2.4	9.8 - 6.1	15.8 - 9.9
39	9°24.7	9°26.3	8°59.0	3.9 - 2.4	9.9 - 6.2	15.9 - 9.9
40	9°25.0	9°26.5	8°59.3	4.0 - 2.5	10.0 - 6.3	16.0 - 10.0
41	9°25.2	9°26.8	8°59.5	4.1 - 2.6	10.1 - 6.3	16.1 - 10.1
42	9°25.5	9°27.0	8°59.7	4.2 - 2.6	10.2 - 6.4	16.2 - 10.1
43	9°25.8	9°27.3	9°00.0	4.3 - 2.7	10.3 - 6.4	16.3 - 10.2
44	9°26.0	9°27.5	9°00.2	4.4 - 2.8	10.4 - 6.5	16.4 - 10.3
45	9°26.3	9°27.8	9°00.5	4.5 - 2.8	10.5 - 6.6	16.5 - 10.3
46	9°26.5	9°28.0	9°00.7	4.6 - 2.9	10.6 - 6.6	16.6 - 10.4
47	9°26.7	9°28.3	9°00.9	4.7 - 2.9	10.7 - 6.7	16.7 - 10.4
48	9°27.0	9°28.5	9°01.2	4.8 - 3.0	10.8 - 6.8	16.8 - 10.5
49	9°27.3	9°28.8	9°01.4	4.9 - 3.1	10.9 - 6.8	16.9 - 10.6
50	9°27.5	9°29.1	9°01.6	5.0 - 3.1	11.0 - 6.9	17.0 - 10.6
51	9°27.8	9°29.3	9°01.9	5.1 - 3.2	11.1 - 6.9	17.1 - 10.7
52	9°28.0	9°29.6	9°02.1	5.2 - 3.3	11.2 - 7.0	17.2 - 10.8
53	9°28.2	9°29.8	9°02.4	5.3 - 3.3	11.3 - 7.1	17.3 - 10.8
54	9°28.5	9°30.1	9°02.6	5.4 - 3.4	11.4 - 7.1	17.4 - 10.9
55	9°28.7	9°30.3	9°02.8	5.5 - 3.4	11.5 - 7.2	17.5 - 10.9
56	9°29.0	9°30.6	9°03.1	5.6 - 3.5	11.6 - 7.3	17.6 - 11.0
57	9°29.3	9°30.8	9°03.3	5.7 - 3.6	11.7 - 7.3	17.7 - 11.1
58	9°29.5	9°31.1	9°03.6	5.8 - 3.6	11.8 - 7.4	17.8 - 11.1
59	9°29.8	9°31.3	9°03.8	5.9 - 3.7	11.9 - 7.4	17.9 - 11.2

m 38	Sun Plan.	Aries	Moon	v and d corr		
0	9°30.0	9°31.6	9°04.0	0.0 - 0.0	6.0 - 3.9	12.0 - 7.7
1	9°30.2	9°31.8	9°04.3	0.1 - 0.1	6.1 - 3.9	12.1 - 7.8
2	9°30.5	9°32.1	9°04.5	0.2 - 0.1	6.2 - 4.0	12.2 - 7.8
3	9°30.7	9°32.3	9°04.7	0.3 - 0.2	6.3 - 4.0	12.3 - 7.9
4	9°31.0	9°32.6	9°05.0	0.4 - 0.3	6.4 - 4.1	12.4 - 8.0
5	9°31.3	9°32.8	9°05.2	0.5 - 0.3	6.5 - 4.2	12.5 - 8.0
6	9°31.5	9°33.1	9°05.5	0.6 - 0.4	6.6 - 4.2	12.6 - 8.1
7	9°31.8	9°33.3	9°05.7	0.7 - 0.4	6.7 - 4.3	12.7 - 8.1
8	9°32.0	9°33.6	9°05.9	0.8 - 0.5	6.8 - 4.4	12.8 - 8.2
9	9°32.2	9°33.8	9°06.2	0.9 - 0.6	6.9 - 4.4	12.9 - 8.3
10	9°32.5	9°34.1	9°06.4	1.0 - 0.6	7.0 - 4.5	13.0 - 8.3
11	9°32.7	9°34.3	9°06.7	1.1 - 0.7	7.1 - 4.6	13.1 - 8.4
12	9°33.0	9°34.6	9°06.9	1.2 - 0.8	7.2 - 4.6	13.2 - 8.5
13	9°33.3	9°34.8	9°07.1	1.3 - 0.8	7.3 - 4.7	13.3 - 8.5
14	9°33.5	9°35.1	9°07.4	1.4 - 0.9	7.4 - 4.7	13.4 - 8.6
15	9°33.8	9°35.3	9°07.6	1.5 - 1.0	7.5 - 4.8	13.5 - 8.7
16	9°34.0	9°35.6	9°07.9	1.6 - 1.0	7.6 - 4.9	13.6 - 8.7
17	9°34.2	9°35.8	9°08.1	1.7 - 1.1	7.7 - 4.9	13.7 - 8.8
18	9°34.5	9°36.1	9°08.3	1.8 - 1.2	7.8 - 5.0	13.8 - 8.9
19	9°34.8	9°36.3	9°08.6	1.9 - 1.2	7.9 - 5.1	13.9 - 8.9
20	9°35.0	9°36.6	9°08.8	2.0 - 1.3	8.0 - 5.1	14.0 - 9.0
21	9°35.3	9°36.8	9°09.0	2.1 - 1.3	8.1 - 5.2	14.1 - 9.0
22	9°35.5	9°37.1	9°09.3	2.2 - 1.4	8.2 - 5.3	14.2 - 9.1
23	9°35.7	9°37.3	9°09.5	2.3 - 1.5	8.3 - 5.3	14.3 - 9.2
24	9°36.0	9°37.6	9°09.8	2.4 - 1.5	8.4 - 5.4	14.4 - 9.2
25	9°36.2	9°37.8	9°10.0	2.5 - 1.6	8.5 - 5.5	14.5 - 9.3
26	9°36.5	9°38.1	9°10.2	2.6 - 1.7	8.6 - 5.5	14.6 - 9.4
27	9°36.8	9°38.3	9°10.5	2.7 - 1.7	8.7 - 5.6	14.7 - 9.4
28	9°37.0	9°38.6	9°10.7	2.8 - 1.8	8.8 - 5.6	14.8 - 9.5
29	9°37.3	9°38.8	9°11.0	2.9 - 1.9	8.9 - 5.7	14.9 - 9.6
30	9°37.5	9°39.1	9°11.2	3.0 - 1.9	9.0 - 5.8	15.0 - 9.6
31	9°37.7	9°39.3	9°11.4	3.1 - 2.0	9.1 - 5.8	15.1 - 9.7
32	9°38.0	9°39.6	9°11.7	3.2 - 2.1	9.2 - 5.9	15.2 - 9.8
33	9°38.2	9°39.8	9°11.9	3.3 - 2.1	9.3 - 6.0	15.3 - 9.8
34	9°38.5	9°40.1	9°12.1	3.4 - 2.2	9.4 - 6.0	15.4 - 9.9
35	9°38.8	9°40.3	9°12.4	3.5 - 2.2	9.5 - 6.1	15.5 - 9.9
36	9°39.0	9°40.6	9°12.6	3.6 - 2.3	9.6 - 6.2	15.6 - 10.0
37	9°39.3	9°40.8	9°12.9	3.7 - 2.4	9.7 - 6.2	15.7 - 10.1
38	9°39.5	9°41.1	9°13.1	3.8 - 2.4	9.8 - 6.3	15.8 - 10.1
39	9°39.7	9°41.3	9°13.3	3.9 - 2.5	9.9 - 6.4	15.9 - 10.2
40	9°40.0	9°41.6	9°13.6	4.0 - 2.6	10.0 - 6.4	16.0 - 10.3
41	9°40.2	9°41.8	9°13.8	4.1 - 2.6	10.1 - 6.5	16.1 - 10.3
42	9°40.5	9°42.1	9°14.1	4.2 - 2.7	10.2 - 6.5	16.2 - 10.4
43	9°40.8	9°42.3	9°14.3	4.3 - 2.8	10.3 - 6.6	16.3 - 10.5
44	9°41.0	9°42.6	9°14.5	4.4 - 2.8	10.4 - 6.7	16.4 - 10.5
45	9°41.3	9°42.8	9°14.8	4.5 - 2.9	10.5 - 6.7	16.5 - 10.6
46	9°41.5	9°43.1	9°15.0	4.6 - 3.0	10.6 - 6.8	16.6 - 10.7
47	9°41.7	9°43.3	9°15.2	4.7 - 3.0	10.7 - 6.9	16.7 - 10.7
48	9°42.0	9°43.6	9°15.5	4.8 - 3.1	10.8 - 6.9	16.8 - 10.8
49	9°42.3	9°43.8	9°15.7	4.9 - 3.1	10.9 - 7.0	16.9 - 10.8
50	9°42.5	9°44.1	9°16.0	5.0 - 3.2	11.0 - 7.1	17.0 - 10.9
51	9°42.8	9°44.3	9°16.2	5.1 - 3.3	11.1 - 7.1	17.1 - 11.0
52	9°43.0	9°44.6	9°16.4	5.2 - 3.3	11.2 - 7.2	17.2 - 11.0
53	9°43.2	9°44.8	9°16.7	5.3 - 3.4	11.3 - 7.3	17.3 - 11.1
54	9°43.5	9°45.1	9°16.9	5.4 - 3.5	11.4 - 7.3	17.4 - 11.2
55	9°43.7	9°45.3	9°17.2	5.5 - 3.5	11.5 - 7.4	17.5 - 11.2
56	9°44.0	9°45.6	9°17.4	5.6 - 3.6	11.6 - 7.4	17.6 - 11.3
57	9°44.3	9°45.8	9°17.6	5.7 - 3.7	11.7 - 7.5	17.7 - 11.4
58	9°44.5	9°46.1	9°17.9	5.8 - 3.7	11.8 - 7.6	17.8 - 11.4
59	9°44.8	9°46.3	9°18.1	5.9 - 3.8	11.9 - 7.6	17.9 - 11.5

Increments and Corrections

m 39	Sun Plan.	Aries	Moon	v and d corr		
0	9°45.0	9°46.6	9°18.4	0.0 - 0.0	6.0 - 4.0	12.0 - 7.9
1	9°45.2	9°46.8	9°18.6	0.1 - 0.1	6.1 - 4.0	12.1 - 8.0
2	9°45.5	9°47.1	9°18.8	0.2 - 0.1	6.2 - 4.1	12.2 - 8.0
3	9°45.7	9°47.4	9°19.1	0.3 - 0.2	6.3 - 4.1	12.3 - 8.1
4	9°46.0	9°47.6	9°19.3	0.4 - 0.3	6.4 - 4.2	12.4 - 8.2
5	9°46.3	9°47.9	9°19.5	0.5 - 0.3	6.5 - 4.3	12.5 - 8.2
6	9°46.5	9°48.1	9°19.8	0.6 - 0.4	6.6 - 4.3	12.6 - 8.3
7	9°46.8	9°48.4	9°20.0	0.7 - 0.5	6.7 - 4.4	12.7 - 8.4
8	9°47.0	9°48.6	9°20.3	0.8 - 0.5	6.8 - 4.5	12.8 - 8.4
9	9°47.2	9°48.9	9°20.5	0.9 - 0.6	6.9 - 4.5	12.9 - 8.5
10	9°47.5	9°49.1	9°20.7	1.0 - 0.7	7.0 - 4.6	13.0 - 8.6
11	9°47.7	9°49.4	9°21.0	1.1 - 0.7	7.1 - 4.7	13.1 - 8.6
12	9°48.0	9°49.6	9°21.2	1.2 - 0.8	7.2 - 4.7	13.2 - 8.7
13	9°48.3	9°49.9	9°21.5	1.3 - 0.9	7.3 - 4.8	13.3 - 8.8
14	9°48.5	9°50.1	9°21.7	1.4 - 0.9	7.4 - 4.9	13.4 - 8.8
15	9°48.8	9°50.4	9°21.9	1.5 - 1.0	7.5 - 4.9	13.5 - 8.9
16	9°49.0	9°50.6	9°22.2	1.6 - 1.1	7.6 - 5.0	13.6 - 9.0
17	9°49.2	9°50.9	9°22.4	1.7 - 1.1	7.7 - 5.1	13.7 - 9.0
18	9°49.5	9°51.1	9°22.6	1.8 - 1.2	7.8 - 5.1	13.8 - 9.1
19	9°49.8	9°51.4	9°22.9	1.9 - 1.3	7.9 - 5.2	13.9 - 9.2
20	9°50.0	9°51.6	9°23.1	2.0 - 1.3	8.0 - 5.3	14.0 - 9.2
21	9°50.3	9°51.9	9°23.4	2.1 - 1.4	8.1 - 5.3	14.1 - 9.3
22	9°50.5	9°52.1	9°23.6	2.2 - 1.4	8.2 - 5.4	14.2 - 9.3
23	9°50.7	9°52.4	9°23.8	2.3 - 1.5	8.3 - 5.5	14.3 - 9.4
24	9°51.0	9°52.6	9°24.1	2.4 - 1.6	8.4 - 5.5	14.4 - 9.5
25	9°51.2	9°52.9	9°24.3	2.5 - 1.6	8.5 - 5.6	14.5 - 9.5
26	9°51.5	9°53.1	9°24.6	2.6 - 1.7	8.6 - 5.7	14.6 - 9.6
27	9°51.8	9°53.4	9°24.8	2.7 - 1.8	8.7 - 5.7	14.7 - 9.7
28	9°52.0	9°53.6	9°25.0	2.8 - 1.8	8.8 - 5.8	14.8 - 9.7
29	9°52.3	9°53.9	9°25.3	2.9 - 1.9	8.9 - 5.9	14.9 - 9.8
30	9°52.5	9°54.1	9°25.5	3.0 - 2.0	9.0 - 5.9	15.0 - 9.9
31	9°52.7	9°54.4	9°25.7	3.1 - 2.0	9.1 - 6.0	15.1 - 9.9
32	9°53.0	9°54.6	9°26.0	3.2 - 2.1	9.2 - 6.1	15.2 - 10.0
33	9°53.2	9°54.9	9°26.2	3.3 - 2.2	9.3 - 6.1	15.3 - 10.1
34	9°53.5	9°55.1	9°26.5	3.4 - 2.2	9.4 - 6.2	15.4 - 10.1
35	9°53.8	9°55.4	9°26.7	3.5 - 2.3	9.5 - 6.3	15.5 - 10.2
36	9°54.0	9°55.6	9°26.9	3.6 - 2.4	9.6 - 6.3	15.6 - 10.3
37	9°54.3	9°55.9	9°27.2	3.7 - 2.4	9.7 - 6.4	15.7 - 10.3
38	9°54.5	9°56.1	9°27.4	3.8 - 2.5	9.8 - 6.5	15.8 - 10.4
39	9°54.7	9°56.4	9°27.7	3.9 - 2.6	9.9 - 6.5	15.9 - 10.5
40	9°55.0	9°56.6	9°27.9	4.0 - 2.6	10.0 - 6.6	16.0 - 10.5
41	9°55.2	9°56.9	9°28.1	4.1 - 2.7	10.1 - 6.6	16.1 - 10.6
42	9°55.5	9°57.1	9°28.4	4.2 - 2.8	10.2 - 6.7	16.2 - 10.7
43	9°55.8	9°57.4	9°28.6	4.3 - 2.8	10.3 - 6.8	16.3 - 10.7
44	9°56.0	9°57.6	9°28.8	4.4 - 2.9	10.4 - 6.8	16.4 - 10.8
45	9°56.3	9°57.9	9°29.1	4.5 - 3.0	10.5 - 6.9	16.5 - 10.9
46	9°56.5	9°58.1	9°29.3	4.6 - 3.0	10.6 - 7.0	16.6 - 10.9
47	9°56.7	9°58.4	9°29.6	4.7 - 3.1	10.7 - 7.0	16.7 - 11.0
48	9°57.0	9°58.6	9°29.8	4.8 - 3.2	10.8 - 7.1	16.8 - 11.1
49	9°57.3	9°58.9	9°30.0	4.9 - 3.2	10.9 - 7.2	16.9 - 11.1
50	9°57.5	9°59.1	9°30.3	5.0 - 3.3	11.0 - 7.2	17.0 - 11.2
51	9°57.8	9°59.4	9°30.5	5.1 - 3.4	11.1 - 7.3	17.1 - 11.3
52	9°58.0	9°59.6	9°30.8	5.2 - 3.4	11.2 - 7.4	17.2 - 11.3
53	9°58.2	9°59.9	9°31.0	5.3 - 3.5	11.3 - 7.4	17.3 - 11.4
54	9°58.5	10°00.1	9°31.2	5.4 - 3.6	11.4 - 7.5	17.4 - 11.5
55	9°58.7	10°00.4	9°31.5	5.5 - 3.6	11.5 - 7.6	17.5 - 11.5
56	9°59.0	10°00.6	9°31.7	5.6 - 3.7	11.6 - 7.6	17.6 - 11.6
57	9°59.3	10°00.9	9°32.0	5.7 - 3.8	11.7 - 7.7	17.7 - 11.7
58	9°59.5	10°01.1	9°32.2	5.8 - 3.8	11.8 - 7.8	17.8 - 11.7
59	9°59.8	10°01.4	9°32.4	5.9 - 3.9	11.9 - 7.8	17.9 - 11.8

m 40	Sun Plan.	Aries	Moon	v and d corr		
0	10°00.0	10°01.6	9°32.7	0.0 - 0.0	6.0 - 4.1	12.0 - 8.1
1	10°00.2	10°01.9	9°32.9	0.1 - 0.1	6.1 - 4.1	12.1 - 8.2
2	10°00.5	10°02.1	9°33.1	0.2 - 0.1	6.2 - 4.2	12.2 - 8.2
3	10°00.7	10°02.4	9°33.4	0.3 - 0.2	6.3 - 4.3	12.3 - 8.3
4	10°01.0	10°02.6	9°33.6	0.4 - 0.3	6.4 - 4.3	12.4 - 8.4
5	10°01.3	10°02.9	9°33.9	0.5 - 0.3	6.5 - 4.4	12.5 - 8.4
6	10°01.5	10°03.1	9°34.1	0.6 - 0.4	6.6 - 4.5	12.6 - 8.5
7	10°01.8	10°03.4	9°34.3	0.7 - 0.5	6.7 - 4.5	12.7 - 8.6
8	10°02.0	10°03.6	9°34.6	0.8 - 0.5	6.8 - 4.6	12.8 - 8.6
9	10°02.2	10°03.9	9°34.8	0.9 - 0.6	6.9 - 4.7	12.9 - 8.7
10	10°02.5	10°04.1	9°35.1	1.0 - 0.7	7.0 - 4.7	13.0 - 8.8
11	10°02.7	10°04.4	9°35.3	1.1 - 0.7	7.1 - 4.8	13.1 - 8.8
12	10°03.0	10°04.6	9°35.5	1.2 - 0.8	7.2 - 4.9	13.2 - 8.9
13	10°03.3	10°04.9	9°35.8	1.3 - 0.9	7.3 - 4.9	13.3 - 9.0
14	10°03.5	10°05.1	9°36.0	1.4 - 0.9	7.4 - 5.0	13.4 - 9.0
15	10°03.8	10°05.4	9°36.2	1.5 - 1.0	7.5 - 5.1	13.5 - 9.1
16	10°04.0	10°05.7	9°36.5	1.6 - 1.1	7.6 - 5.1	13.6 - 9.2
17	10°04.2	10°05.9	9°36.7	1.7 - 1.1	7.7 - 5.2	13.7 - 9.2
18	10°04.5	10°06.2	9°37.0	1.8 - 1.2	7.8 - 5.3	13.8 - 9.3
19	10°04.8	10°06.4	9°37.2	1.9 - 1.3	7.9 - 5.3	13.9 - 9.4
20	10°05.0	10°06.7	9°37.4	2.0 - 1.4	8.0 - 5.4	14.0 - 9.5
21	10°05.3	10°06.9	9°37.7	2.1 - 1.4	8.1 - 5.5	14.1 - 9.5
22	10°05.5	10°07.2	9°37.9	2.2 - 1.5	8.2 - 5.5	14.2 - 9.6
23	10°05.7	10°07.4	9°38.2	2.3 - 1.6	8.3 - 5.6	14.3 - 9.7
24	10°06.0	10°07.7	9°38.4	2.4 - 1.6	8.4 - 5.7	14.4 - 9.7
25	10°06.2	10°07.9	9°38.6	2.5 - 1.7	8.5 - 5.7	14.5 - 9.8
26	10°06.5	10°08.2	9°38.9	2.6 - 1.8	8.6 - 5.8	14.6 - 9.9
27	10°06.8	10°08.4	9°39.1	2.7 - 1.8	8.7 - 5.9	14.7 - 9.9
28	10°07.0	10°08.7	9°39.3	2.8 - 1.9	8.8 - 5.9	14.8 - 10.0
29	10°07.3	10°08.9	9°39.6	2.9 - 2.0	8.9 - 6.0	14.9 - 10.1
30	10°07.5	10°09.2	9°39.8	3.0 - 2.0	9.0 - 6.1	15.0 - 10.1
31	10°07.7	10°09.4	9°40.1	3.1 - 2.1	9.1 - 6.1	15.1 - 10.2
32	10°08.0	10°09.7	9°40.3	3.2 - 2.2	9.2 - 6.2	15.2 - 10.3
33	10°08.2	10°09.9	9°40.5	3.3 - 2.2	9.3 - 6.3	15.3 - 10.3
34	10°08.5	10°10.2	9°40.8	3.4 - 2.3	9.4 - 6.3	15.4 - 10.4
35	10°08.8	10°10.4	9°41.0	3.5 - 2.4	9.5 - 6.4	15.5 - 10.5
36	10°09.0	10°10.7	9°41.3	3.6 - 2.4	9.6 - 6.5	15.6 - 10.5
37	10°09.3	10°10.9	9°41.5	3.7 - 2.5	9.7 - 6.5	15.7 - 10.6
38	10°09.5	10°11.2	9°41.7	3.8 - 2.6	9.8 - 6.6	15.8 - 10.7
39	10°09.7	10°11.4	9°42.0	3.9 - 2.6	9.9 - 6.7	15.9 - 10.7
40	10°10.0	10°11.7	9°42.2	4.0 - 2.7	10.0 - 6.8	16.0 - 10.8
41	10°10.2	10°11.9	9°42.4	4.1 - 2.8	10.1 - 6.8	16.1 - 10.9
42	10°10.5	10°12.2	9°42.7	4.2 - 2.8	10.2 - 6.9	16.2 - 10.9
43	10°10.8	10°12.4	9°42.9	4.3 - 2.9	10.3 - 7.0	16.3 - 11.0
44	10°11.0	10°12.7	9°43.2	4.4 - 3.0	10.4 - 7.0	16.4 - 11.1
45	10°11.3	10°12.9	9°43.4	4.5 - 3.0	10.5 - 7.1	16.5 - 11.1
46	10°11.5	10°13.2	9°43.6	4.6 - 3.1	10.6 - 7.2	16.6 - 11.2
47	10°11.7	10°13.4	9°43.9	4.7 - 3.2	10.7 - 7.2	16.7 - 11.3
48	10°12.0	10°13.7	9°44.1	4.8 - 3.2	10.8 - 7.3	16.8 - 11.3
49	10°12.3	10°13.9	9°44.4	4.9 - 3.3	10.9 - 7.4	16.9 - 11.4
50	10°12.5	10°14.2	9°44.6	5.0 - 3.4	11.0 - 7.4	17.0 - 11.5
51	10°12.8	10°14.4	9°44.8	5.1 - 3.4	11.1 - 7.5	17.1 - 11.5
52	10°13.0	10°14.7	9°45.1	5.2 - 3.5	11.2 - 7.6	17.2 - 11.6
53	10°13.2	10°14.9	9°45.3	5.3 - 3.6	11.3 - 7.6	17.3 - 11.7
54	10°13.5	10°15.2	9°45.6	5.4 - 3.6	11.4 - 7.7	17.4 - 11.7
55	10°13.7	10°15.4	9°45.8	5.5 - 3.7	11.5 - 7.8	17.5 - 11.8
56	10°14.0	10°15.7	9°46.0	5.6 - 3.8	11.6 - 7.8	17.6 - 11.9
57	10°14.3	10°15.9	9°46.3	5.7 - 3.8	11.7 - 7.9	17.7 - 11.9
58	10°14.5	10°16.2	9°46.5	5.8 - 3.9	11.8 - 8.0	17.8 - 12.0
59	10°14.8	10°16.4	9°46.7	5.9 - 4.0	11.9 - 8.0	17.9 - 12.1

m 41	Sun Plan.	Aries	Moon	v and d corr		
0	10°15.0	10°16.7	9°47.0	0.0 - 0.0	6.0 - 4.2	12.0 - 8.3
1	10°15.2	10°16.9	9°47.2	0.1 - 0.1	6.1 - 4.2	12.1 - 8.4
2	10°15.5	10°17.2	9°47.5	0.2 - 0.1	6.2 - 4.3	12.2 - 8.4
3	10°15.7	10°17.4	9°47.7	0.3 - 0.2	6.3 - 4.4	12.3 - 8.5
4	10°16.0	10°17.7	9°47.9	0.4 - 0.3	6.4 - 4.4	12.4 - 8.6
5	10°16.3	10°17.9	9°48.2	0.5 - 0.3	6.5 - 4.5	12.5 - 8.6
6	10°16.5	10°18.2	9°48.4	0.6 - 0.4	6.6 - 4.6	12.6 - 8.7
7	10°16.8	10°18.4	9°48.7	0.7 - 0.5	6.7 - 4.6	12.7 - 8.8
8	10°17.0	10°18.7	9°48.9	0.8 - 0.6	6.8 - 4.7	12.8 - 8.9
9	10°17.2	10°18.9	9°49.1	0.9 - 0.6	6.9 - 4.8	12.9 - 8.9
10	10°17.5	10°19.2	9°49.4	1.0 - 0.7	7.0 - 4.8	13.0 - 9.0
11	10°17.7	10°19.4	9°49.6	1.1 - 0.8	7.1 - 4.9	13.1 - 9.1
12	10°18.0	10°19.7	9°49.8	1.2 - 0.8	7.2 - 5.0	13.2 - 9.1
13	10°18.3	10°19.9	9°50.1	1.3 - 0.9	7.3 - 5.0	13.3 - 9.2
14	10°18.5	10°20.2	9°50.3	1.4 - 1.0	7.4 - 5.1	13.4 - 9.3
15	10°18.8	10°20.4	9°50.6	1.5 - 1.0	7.5 - 5.2	13.5 - 9.3
16	10°19.0	10°20.7	9°50.8	1.6 - 1.1	7.6 - 5.3	13.6 - 9.4
17	10°19.2	10°20.9	9°51.0	1.7 - 1.2	7.7 - 5.3	13.7 - 9.5
18	10°19.5	10°21.2	9°51.3	1.8 - 1.2	7.8 - 5.4	13.8 - 9.5
19	10°19.8	10°21.4	9°51.5	1.9 - 1.3	7.9 - 5.5	13.9 - 9.6
20	10°20.0	10°21.7	9°51.8	2.0 - 1.4	8.0 - 5.5	14.0 - 9.7
21	10°20.3	10°21.9	9°52.0	2.1 - 1.5	8.1 - 5.6	14.1 - 9.8
22	10°20.5	10°22.2	9°52.2	2.2 - 1.5	8.2 - 5.7	14.2 - 9.8
23	10°20.7	10°22.4	9°52.5	2.3 - 1.6	8.3 - 5.7	14.3 - 9.9
24	10°21.0	10°22.7	9°52.7	2.4 - 1.7	8.4 - 5.8	14.4 - 10.0
25	10°21.2	10°22.9	9°52.9	2.5 - 1.7	8.5 - 5.9	14.5 - 10.0
26	10°21.5	10°23.2	9°53.2	2.6 - 1.8	8.6 - 5.9	14.6 - 10.1
27	10°21.8	10°23.4	9°53.4	2.7 - 1.9	8.7 - 6.0	14.7 - 10.2
28	10°22.0	10°23.7	9°53.7	2.8 - 1.9	8.8 - 6.1	14.8 - 10.2
29	10°22.3	10°24.0	9°53.9	2.9 - 2.0	8.9 - 6.2	14.9 - 10.3
30	10°22.5	10°24.2	9°54.1	3.0 - 2.1	9.0 - 6.2	15.0 - 10.4
31	10°22.7	10°24.5	9°54.4	3.1 - 2.1	9.1 - 6.3	15.1 - 10.4
32	10°23.0	10°24.7	9°54.6	3.2 - 2.2	9.2 - 6.4	15.2 - 10.5
33	10°23.2	10°25.0	9°54.9	3.3 - 2.3	9.3 - 6.4	15.3 - 10.6
34	10°23.5	10°25.2	9°55.1	3.4 - 2.4	9.4 - 6.5	15.4 - 10.7
35	10°23.8	10°25.5	9°55.3	3.5 - 2.4	9.5 - 6.6	15.5 - 10.7
36	10°24.0	10°25.7	9°55.6	3.6 - 2.5	9.6 - 6.6	15.6 - 10.8
37	10°24.3	10°26.0	9°55.8	3.7 - 2.6	9.7 - 6.7	15.7 - 10.9
38	10°24.5	10°26.2	9°56.1	3.8 - 2.6	9.8 - 6.8	15.8 - 10.9
39	10°24.7	10°26.5	9°56.3	3.9 - 2.7	9.9 - 6.8	15.9 - 11.0
40	10°25.0	10°26.7	9°56.5	4.0 - 2.8	10.0 - 6.9	16.0 - 11.1
41	10°25.2	10°27.0	9°56.8	4.1 - 2.8	10.1 - 7.0	16.1 - 11.1
42	10°25.5	10°27.2	9°57.0	4.2 - 2.9	10.2 - 7.1	16.2 - 11.2
43	10°25.8	10°27.5	9°57.2	4.3 - 3.0	10.3 - 7.1	16.3 - 11.3
44	10°26.0	10°27.7	9°57.5	4.4 - 3.0	10.4 - 7.2	16.4 - 11.3
45	10°26.3	10°28.0	9°57.7	4.5 - 3.1	10.5 - 7.3	16.5 - 11.4
46	10°26.5	10°28.2	9°58.0	4.6 - 3.2	10.6 - 7.3	16.6 - 11.5
47	10°26.7	10°28.5	9°58.2	4.7 - 3.3	10.7 - 7.4	16.7 - 11.6
48	10°27.0	10°28.7	9°58.4	4.8 - 3.3	10.8 - 7.5	16.8 - 11.6
49	10°27.3	10°29.0	9°58.7	4.9 - 3.4	10.9 - 7.5	16.9 - 11.7
50	10°27.5	10°29.2	9°58.9	5.0 - 3.5	11.0 - 7.6	17.0 - 11.8
51	10°27.8	10°29.5	9°59.2	5.1 - 3.5	11.1 - 7.7	17.1 - 11.8
52	10°28.0	10°29.7	9°59.4	5.2 - 3.6	11.2 - 7.7	17.2 - 11.9
53	10°28.2	10°30.0	9°59.6	5.3 - 3.7	11.3 - 7.8	17.3 - 12.0
54	10°28.5	10°30.2	9°59.9	5.4 - 3.7	11.4 - 7.9	17.4 - 12.0
55	10°28.7	10°30.5	10°00.1	5.5 - 3.8	11.5 - 8.0	17.5 - 12.1
56	10°29.0	10°30.7	10°00.3	5.6 - 3.9	11.6 - 8.0	17.6 - 12.2
57	10°29.3	10°31.0	10°00.6	5.7 - 3.9	11.7 - 8.1	17.7 - 12.2
58	10°29.5	10°31.2	10°00.8	5.8 - 4.0	11.8 - 8.2	17.8 - 12.3
59	10°29.8	10°31.5	10°01.1	5.9 - 4.1	11.9 - 8.2	17.9 - 12.4

Increments and Corrections

m 42	Sun Plan.	Aries	Moon	v and d corr		
0	10°30.0	10°31.7	10°01.3	0.0 - 0.0	6.0 - 4.3	12.0 - 8.5
1	10°30.2	10°32.0	10°01.5	0.1 - 0.1	6.1 - 4.3	12.1 - 8.6
2	10°30.5	10°32.2	10°01.8	0.2 - 0.1	6.2 - 4.4	12.2 - 8.6
3	10°30.7	10°32.5	10°02.0	0.3 - 0.2	6.3 - 4.5	12.3 - 8.7
4	10°31.0	10°32.7	10°02.3	0.4 - 0.3	6.4 - 4.5	12.4 - 8.8
5	10°31.3	10°33.0	10°02.5	0.5 - 0.4	6.5 - 4.6	12.5 - 8.9
6	10°31.5	10°33.2	10°02.7	0.6 - 0.4	6.6 - 4.7	12.6 - 8.9
7	10°31.8	10°33.5	10°03.0	0.7 - 0.5	6.7 - 4.7	12.7 - 9.0
8	10°32.0	10°33.7	10°03.2	0.8 - 0.6	6.8 - 4.8	12.8 - 9.1
9	10°32.2	10°34.0	10°03.4	0.9 - 0.6	6.9 - 4.9	12.9 - 9.1
10	10°32.5	10°34.2	10°03.7	1.0 - 0.7	7.0 - 5.0	13.0 - 9.2
11	10°32.7	10°34.5	10°03.9	1.1 - 0.8	7.1 - 5.0	13.1 - 9.3
12	10°33.0	10°34.7	10°04.2	1.2 - 0.9	7.2 - 5.1	13.2 - 9.3
13	10°33.3	10°35.0	10°04.4	1.3 - 0.9	7.3 - 5.2	13.3 - 9.4
14	10°33.5	10°35.2	10°04.6	1.4 - 1.0	7.4 - 5.2	13.4 - 9.5
15	10°33.8	10°35.5	10°04.9	1.5 - 1.1	7.5 - 5.3	13.5 - 9.6
16	10°34.0	10°35.7	10°05.1	1.6 - 1.1	7.6 - 5.4	13.6 - 9.6
17	10°34.2	10°36.0	10°05.4	1.7 - 1.2	7.7 - 5.5	13.7 - 9.7
18	10°34.5	10°36.2	10°05.6	1.8 - 1.3	7.8 - 5.5	13.8 - 9.8
19	10°34.8	10°36.5	10°05.8	1.9 - 1.3	7.9 - 5.6	13.9 - 9.8
20	10°35.0	10°36.7	10°06.1	2.0 - 1.4	8.0 - 5.7	14.0 - 9.9
21	10°35.3	10°37.0	10°06.3	2.1 - 1.5	8.1 - 5.7	14.1 - 10.0
22	10°35.5	10°37.2	10°06.5	2.2 - 1.6	8.2 - 5.8	14.2 - 10.1
23	10°35.7	10°37.5	10°06.8	2.3 - 1.6	8.3 - 5.9	14.3 - 10.1
24	10°36.0	10°37.7	10°07.0	2.4 - 1.7	8.4 - 6.0	14.4 - 10.2
25	10°36.2	10°38.0	10°07.3	2.5 - 1.8	8.5 - 6.0	14.5 - 10.3
26	10°36.5	10°38.2	10°07.5	2.6 - 1.8	8.6 - 6.1	14.6 - 10.3
27	10°36.8	10°38.5	10°07.7	2.7 - 1.9	8.7 - 6.2	14.7 - 10.4
28	10°37.0	10°38.7	10°08.0	2.8 - 2.0	8.8 - 6.2	14.8 - 10.5
29	10°37.3	10°39.0	10°08.2	2.9 - 2.1	8.9 - 6.3	14.9 - 10.6
30	10°37.5	10°39.2	10°08.5	3.0 - 2.1	9.0 - 6.4	15.0 - 10.6
31	10°37.7	10°39.5	10°08.7	3.1 - 2.2	9.1 - 6.4	15.1 - 10.7
32	10°38.0	10°39.7	10°08.9	3.2 - 2.3	9.2 - 6.5	15.2 - 10.8
33	10°38.2	10°40.0	10°09.2	3.3 - 2.3	9.3 - 6.6	15.3 - 10.8
34	10°38.5	10°40.2	10°09.4	3.4 - 2.4	9.4 - 6.7	15.4 - 10.9
35	10°38.8	10°40.5	10°09.7	3.5 - 2.5	9.5 - 6.7	15.5 - 11.0
36	10°39.0	10°40.7	10°09.9	3.6 - 2.6	9.6 - 6.8	15.6 - 11.1
37	10°39.3	10°41.0	10°10.1	3.7 - 2.6	9.7 - 6.9	15.7 - 11.1
38	10°39.5	10°41.2	10°10.4	3.8 - 2.7	9.8 - 6.9	15.8 - 11.2
39	10°39.7	10°41.5	10°10.6	3.9 - 2.8	9.9 - 7.0	15.9 - 11.3
40	10°40.0	10°41.7	10°10.8	4.0 - 2.8	10.0 - 7.1	16.0 - 11.3
41	10°40.2	10°42.0	10°11.1	4.1 - 2.9	10.1 - 7.2	16.1 - 11.4
42	10°40.5	10°42.3	10°11.3	4.2 - 3.0	10.2 - 7.2	16.2 - 11.5
43	10°40.8	10°42.5	10°11.6	4.3 - 3.0	10.3 - 7.3	16.3 - 11.5
44	10°41.0	10°42.8	10°11.8	4.4 - 3.1	10.4 - 7.4	16.4 - 11.6
45	10°41.3	10°43.0	10°12.0	4.5 - 3.2	10.5 - 7.4	16.5 - 11.7
46	10°41.5	10°43.3	10°12.3	4.6 - 3.3	10.6 - 7.5	16.6 - 11.8
47	10°41.7	10°43.5	10°12.5	4.7 - 3.3	10.7 - 7.6	16.7 - 11.8
48	10°42.0	10°43.8	10°12.8	4.8 - 3.4	10.8 - 7.7	16.8 - 11.9
49	10°42.3	10°44.0	10°13.0	4.9 - 3.5	10.9 - 7.7	16.9 - 12.0
50	10°42.5	10°44.3	10°13.2	5.0 - 3.5	11.0 - 7.8	17.0 - 12.0
51	10°42.8	10°44.5	10°13.5	5.1 - 3.6	11.1 - 7.9	17.1 - 12.1
52	10°43.0	10°44.8	10°13.7	5.2 - 3.7	11.2 - 7.9	17.2 - 12.2
53	10°43.2	10°45.0	10°13.9	5.3 - 3.8	11.3 - 8.0	17.3 - 12.3
54	10°43.5	10°45.3	10°14.2	5.4 - 3.8	11.4 - 8.1	17.4 - 12.3
55	10°43.7	10°45.5	10°14.4	5.5 - 3.9	11.5 - 8.1	17.5 - 12.4
56	10°44.0	10°45.8	10°14.7	5.6 - 4.0	11.6 - 8.2	17.6 - 12.5
57	10°44.3	10°46.0	10°14.9	5.7 - 4.0	11.7 - 8.3	17.7 - 12.5
58	10°44.5	10°46.3	10°15.1	5.8 - 4.1	11.8 - 8.4	17.8 - 12.6
59	10°44.8	10°46.5	10°15.4	5.9 - 4.2	11.9 - 8.4	17.9 - 12.7

m 43	Sun Plan.	Aries	Moon	v and d corr		
0	10°45.0	10°46.8	10°15.6	0.0 - 0.0	6.0 - 4.3	12.0 - 8.7
1	10°45.2	10°47.0	10°15.9	0.1 - 0.1	6.1 - 4.4	12.1 - 8.8
2	10°45.5	10°47.3	10°16.1	0.2 - 0.1	6.2 - 4.5	12.2 - 8.8
3	10°45.7	10°47.5	10°16.3	0.3 - 0.2	6.3 - 4.6	12.3 - 8.9
4	10°46.0	10°47.8	10°16.6	0.4 - 0.3	6.4 - 4.6	12.4 - 9.0
5	10°46.3	10°48.0	10°16.8	0.5 - 0.4	6.5 - 4.7	12.5 - 9.1
6	10°46.5	10°48.3	10°17.0	0.6 - 0.4	6.6 - 4.8	12.6 - 9.1
7	10°46.8	10°48.5	10°17.3	0.7 - 0.5	6.7 - 4.9	12.7 - 9.2
8	10°47.0	10°48.8	10°17.5	0.8 - 0.6	6.8 - 4.9	12.8 - 9.3
9	10°47.2	10°49.0	10°17.8	0.9 - 0.7	6.9 - 5.0	12.9 - 9.4
10	10°47.5	10°49.3	10°18.0	1.0 - 0.7	7.0 - 5.1	13.0 - 9.4
11	10°47.7	10°49.5	10°18.2	1.1 - 0.8	7.1 - 5.1	13.1 - 9.5
12	10°48.0	10°49.8	10°18.5	1.2 - 0.9	7.2 - 5.2	13.2 - 9.6
13	10°48.3	10°50.0	10°18.7	1.3 - 0.9	7.3 - 5.3	13.3 - 9.6
14	10°48.5	10°50.3	10°19.0	1.4 - 1.0	7.4 - 5.4	13.4 - 9.7
15	10°48.8	10°50.5	10°19.2	1.5 - 1.1	7.5 - 5.4	13.5 - 9.8
16	10°49.0	10°50.8	10°19.4	1.6 - 1.2	7.6 - 5.5	13.6 - 9.9
17	10°49.2	10°51.0	10°19.7	1.7 - 1.2	7.7 - 5.6	13.7 - 9.9
18	10°49.5	10°51.3	10°19.9	1.8 - 1.3	7.8 - 5.7	13.8 - 10.0
19	10°49.8	10°51.5	10°20.2	1.9 - 1.4	7.9 - 5.7	13.9 - 10.1
20	10°50.0	10°51.8	10°20.4	2.0 - 1.4	8.0 - 5.8	14.0 - 10.2
21	10°50.3	10°52.0	10°20.6	2.1 - 1.5	8.1 - 5.9	14.1 - 10.2
22	10°50.5	10°52.3	10°20.9	2.2 - 1.6	8.2 - 5.9	14.2 - 10.3
23	10°50.7	10°52.5	10°21.1	2.3 - 1.7	8.3 - 6.0	14.3 - 10.4
24	10°51.0	10°52.8	10°21.3	2.4 - 1.7	8.4 - 6.1	14.4 - 10.4
25	10°51.2	10°53.0	10°21.6	2.5 - 1.8	8.5 - 6.2	14.5 - 10.5
26	10°51.5	10°53.3	10°21.8	2.6 - 1.9	8.6 - 6.2	14.6 - 10.6
27	10°51.8	10°53.5	10°22.1	2.7 - 2.0	8.7 - 6.3	14.7 - 10.7
28	10°52.0	10°53.8	10°22.3	2.8 - 2.0	8.8 - 6.4	14.8 - 10.7
29	10°52.3	10°54.0	10°22.5	2.9 - 2.1	8.9 - 6.5	14.9 - 10.8
30	10°52.5	10°54.3	10°22.8	3.0 - 2.2	9.0 - 6.5	15.0 - 10.9
31	10°52.7	10°54.5	10°23.0	3.1 - 2.2	9.1 - 6.6	15.1 - 10.9
32	10°53.0	10°54.8	10°23.3	3.2 - 2.3	9.2 - 6.7	15.2 - 11.0
33	10°53.2	10°55.0	10°23.5	3.3 - 2.4	9.3 - 6.7	15.3 - 11.1
34	10°53.5	10°55.3	10°23.7	3.4 - 2.5	9.4 - 6.8	15.4 - 11.2
35	10°53.8	10°55.5	10°24.0	3.5 - 2.5	9.5 - 6.9	15.5 - 11.2
36	10°54.0	10°55.8	10°24.2	3.6 - 2.6	9.6 - 7.0	15.6 - 11.3
37	10°54.3	10°56.0	10°24.4	3.7 - 2.7	9.7 - 7.0	15.7 - 11.4
38	10°54.5	10°56.3	10°24.7	3.8 - 2.8	9.8 - 7.1	15.8 - 11.5
39	10°54.7	10°56.5	10°24.9	3.9 - 2.8	9.9 - 7.2	15.9 - 11.5
40	10°55.0	10°56.8	10°25.2	4.0 - 2.9	10.0 - 7.3	16.0 - 11.6
41	10°55.2	10°57.0	10°25.4	4.1 - 3.0	10.1 - 7.3	16.1 - 11.7
42	10°55.5	10°57.3	10°25.6	4.2 - 3.0	10.2 - 7.4	16.2 - 11.7
43	10°55.8	10°57.5	10°25.9	4.3 - 3.1	10.3 - 7.5	16.3 - 11.8
44	10°56.0	10°57.8	10°26.1	4.4 - 3.2	10.4 - 7.5	16.4 - 11.9
45	10°56.3	10°58.0	10°26.4	4.5 - 3.3	10.5 - 7.6	16.5 - 12.0
46	10°56.5	10°58.3	10°26.6	4.6 - 3.3	10.6 - 7.7	16.6 - 12.0
47	10°56.7	10°58.5	10°26.8	4.7 - 3.4	10.7 - 7.8	16.7 - 12.1
48	10°57.0	10°58.8	10°27.1	4.8 - 3.5	10.8 - 7.8	16.8 - 12.2
49	10°57.3	10°59.0	10°27.3	4.9 - 3.6	10.9 - 7.9	16.9 - 12.3
50	10°57.5	10°59.3	10°27.5	5.0 - 3.6	11.0 - 8.0	17.0 - 12.3
51	10°57.8	10°59.5	10°27.8	5.1 - 3.7	11.1 - 8.0	17.1 - 12.4
52	10°58.0	10°59.8	10°28.0	5.2 - 3.8	11.2 - 8.1	17.2 - 12.5
53	10°58.2	11°00.0	10°28.3	5.3 - 3.8	11.3 - 8.2	17.3 - 12.5
54	10°58.5	11°00.3	10°28.5	5.4 - 3.9	11.4 - 8.3	17.4 - 12.6
55	10°58.7	11°00.6	10°28.7	5.5 - 4.0	11.5 - 8.3	17.5 - 12.7
56	10°59.0	11°00.8	10°29.0	5.6 - 4.1	11.6 - 8.4	17.6 - 12.8
57	10°59.3	11°01.1	10°29.2	5.7 - 4.1	11.7 - 8.5	17.7 - 12.8
58	10°59.5	11°01.3	10°29.5	5.8 - 4.2	11.8 - 8.6	17.8 - 12.9
59	10°59.8	11°01.6	10°29.7	5.9 - 4.3	11.9 - 8.6	17.9 - 13.0

m 44	Sun Plan.	Aries	Moon	v and d corr		
0	11°00.0	11°01.8	10°29.9	0.0 - 0.0	6.0 - 4.5	12.0 - 8.9
1	11°00.2	11°02.1	10°30.2	0.1 - 0.1	6.1 - 4.5	12.1 - 9.0
2	11°00.5	11°02.3	10°30.4	0.2 - 0.1	6.2 - 4.6	12.2 - 9.0
3	11°00.7	11°02.6	10°30.6	0.3 - 0.2	6.3 - 4.7	12.3 - 9.1
4	11°01.0	11°02.8	10°30.9	0.4 - 0.3	6.4 - 4.7	12.4 - 9.2
5	11°01.3	11°03.1	10°31.1	0.5 - 0.4	6.5 - 4.8	12.5 - 9.3
6	11°01.5	11°03.3	10°31.4	0.6 - 0.4	6.6 - 4.9	12.6 - 9.3
7	11°01.8	11°03.6	10°31.6	0.7 - 0.5	6.7 - 5.0	12.7 - 9.4
8	11°02.0	11°03.8	10°31.8	0.8 - 0.6	6.8 - 5.0	12.8 - 9.5
9	11°02.2	11°04.1	10°32.1	0.9 - 0.7	6.9 - 5.1	12.9 - 9.6
10	11°02.5	11°04.3	10°32.3	1.0 - 0.7	7.0 - 5.2	13.0 - 9.6
11	11°02.7	11°04.6	10°32.6	1.1 - 0.8	7.1 - 5.3	13.1 - 9.7
12	11°03.0	11°04.8	10°32.8	1.2 - 0.9	7.2 - 5.3	13.2 - 9.8
13	11°03.3	11°05.1	10°33.0	1.3 - 1.0	7.3 - 5.4	13.3 - 9.9
14	11°03.5	11°05.3	10°33.3	1.4 - 1.0	7.4 - 5.5	13.4 - 9.9
15	11°03.8	11°05.6	10°33.5	1.5 - 1.1	7.5 - 5.6	13.5 - 10.0
16	11°04.0	11°05.8	10°33.8	1.6 - 1.2	7.6 - 5.6	13.6 - 10.1
17	11°04.2	11°06.1	10°34.0	1.7 - 1.3	7.7 - 5.7	13.7 - 10.2
18	11°04.5	11°06.3	10°34.2	1.8 - 1.3	7.8 - 5.8	13.8 - 10.2
19	11°04.8	11°06.6	10°34.5	1.9 - 1.4	7.9 - 5.9	13.9 - 10.3
20	11°05.0	11°06.8	10°34.7	2.0 - 1.5	8.0 - 5.9	14.0 - 10.4
21	11°05.3	11°07.1	10°34.9	2.1 - 1.6	8.1 - 6.0	14.1 - 10.5
22	11°05.5	11°07.3	10°35.2	2.2 - 1.6	8.2 - 6.1	14.2 - 10.5
23	11°05.7	11°07.6	10°35.4	2.3 - 1.7	8.3 - 6.2	14.3 - 10.6
24	11°06.0	11°07.8	10°35.7	2.4 - 1.8	8.4 - 6.2	14.4 - 10.7
25	11°06.2	11°08.1	10°35.9	2.5 - 1.9	8.5 - 6.3	14.5 - 10.8
26	11°06.5	11°08.3	10°36.1	2.6 - 1.9	8.6 - 6.4	14.6 - 10.8
27	11°06.8	11°08.6	10°36.4	2.7 - 2.0	8.7 - 6.5	14.7 - 10.9
28	11°07.0	11°08.8	10°36.6	2.8 - 2.1	8.8 - 6.5	14.8 - 11.0
29	11°07.3	11°09.1	10°36.9	2.9 - 2.2	8.9 - 6.6	14.9 - 11.1
30	11°07.5	11°09.3	10°37.1	3.0 - 2.2	9.0 - 6.7	15.0 - 11.1
31	11°07.7	11°09.6	10°37.3	3.1 - 2.3	9.1 - 6.7	15.1 - 11.2
32	11°08.0	11°09.8	10°37.6	3.2 - 2.4	9.2 - 6.8	15.2 - 11.3
33	11°08.2	11°10.1	10°37.8	3.3 - 2.4	9.3 - 6.9	15.3 - 11.3
34	11°08.5	11°10.3	10°38.0	3.4 - 2.5	9.4 - 7.0	15.4 - 11.4
35	11°08.8	11°10.6	10°38.3	3.5 - 2.6	9.5 - 7.0	15.5 - 11.5
36	11°09.0	11°10.8	10°38.5	3.6 - 2.7	9.6 - 7.1	15.6 - 11.6
37	11°09.3	11°11.1	10°38.8	3.7 - 2.7	9.7 - 7.2	15.7 - 11.6
38	11°09.5	11°11.3	10°39.0	3.8 - 2.8	9.8 - 7.3	15.8 - 11.7
39	11°09.7	11°11.6	10°39.2	3.9 - 2.9	9.9 - 7.3	15.9 - 11.8
40	11°10.0	11°11.8	10°39.5	4.0 - 3.0	10.0 - 7.4	16.0 - 11.9
41	11°10.2	11°12.1	10°39.7	4.1 - 3.0	10.1 - 7.5	16.1 - 11.9
42	11°10.5	11°12.3	10°40.0	4.2 - 3.1	10.2 - 7.6	16.2 - 12.0
43	11°10.8	11°12.6	10°40.2	4.3 - 3.2	10.3 - 7.6	16.3 - 12.1
44	11°11.0	11°12.8	10°40.4	4.4 - 3.3	10.4 - 7.7	16.4 - 12.2
45	11°11.3	11°13.1	10°40.7	4.5 - 3.3	10.5 - 7.8	16.5 - 12.2
46	11°11.5	11°13.3	10°40.9	4.6 - 3.4	10.6 - 7.9	16.6 - 12.3
47	11°11.7	11°13.6	10°41.1	4.7 - 3.5	10.7 - 7.9	16.7 - 12.4
48	11°12.0	11°13.8	10°41.4	4.8 - 3.6	10.8 - 8.0	16.8 - 12.5
49	11°12.3	11°14.1	10°41.6	4.9 - 3.6	10.9 - 8.1	16.9 - 12.5
50	11°12.5	11°14.3	10°41.9	5.0 - 3.7	11.0 - 8.2	17.0 - 12.6
51	11°12.8	11°14.6	10°42.1	5.1 - 3.8	11.1 - 8.2	17.1 - 12.7
52	11°13.0	11°14.8	10°42.3	5.2 - 3.9	11.2 - 8.3	17.2 - 12.8
53	11°13.2	11°15.1	10°42.6	5.3 - 3.9	11.3 - 8.4	17.3 - 12.8
54	11°13.5	11°15.3	10°42.8	5.4 - 4.0	11.4 - 8.5	17.4 - 12.9
55	11°13.7	11°15.6	10°43.1	5.5 - 4.1	11.5 - 8.5	17.5 - 13.0
56	11°14.0	11°15.8	10°43.3	5.6 - 4.2	11.6 - 8.6	17.6 - 13.1
57	11°14.3	11°16.1	10°43.5	5.7 - 4.2	11.7 - 8.7	17.7 - 13.1
58	11°14.5	11°16.3	10°43.8	5.8 - 4.3	11.8 - 8.8	17.8 - 13.2
59	11°14.8	11°16.6	10°44.0	5.9 - 4.4	11.9 - 8.8	17.9 - 13.3

Increments and Corrections

m 45	Sun Plan.	Aries	Moon	v and d corr		
0	11°15.0	11°16.8	10°44.3	0.0 - 0.0	6.0 - 4.5	12.0 - 9.1
1	11°15.2	11°17.1	10°44.5	0.1 - 0.1	6.1 - 4.6	12.1 - 9.2
2	11°15.5	11°17.3	10°44.7	0.2 - 0.2	6.2 - 4.7	12.2 - 9.3
3	11°15.7	11°17.6	10°45.0	0.3 - 0.2	6.3 - 4.8	12.3 - 9.3
4	11°16.0	11°17.8	10°45.2	0.4 - 0.3	6.4 - 4.9	12.4 - 9.4
5	11°16.3	11°18.1	10°45.4	0.5 - 0.4	6.5 - 4.9	12.5 - 9.5
6	11°16.5	11°18.3	10°45.7	0.6 - 0.5	6.6 - 5.0	12.6 - 9.6
7	11°16.8	11°18.6	10°45.9	0.7 - 0.5	6.7 - 5.1	12.7 - 9.6
8	11°17.0	11°18.9	10°46.2	0.8 - 0.6	6.8 - 5.2	12.8 - 9.7
9	11°17.2	11°19.1	10°46.4	0.9 - 0.7	6.9 - 5.2	12.9 - 9.8
10	11°17.5	11°19.4	10°46.6	1.0 - 0.8	7.0 - 5.3	13.0 - 9.9
11	11°17.7	11°19.6	10°46.9	1.1 - 0.8	7.1 - 5.4	13.1 - 9.9
12	11°18.0	11°19.9	10°47.1	1.2 - 0.9	7.2 - 5.5	13.2 - 10.0
13	11°18.3	11°20.1	10°47.4	1.3 - 1.0	7.3 - 5.5	13.3 - 10.1
14	11°18.5	11°20.4	10°47.6	1.4 - 1.1	7.4 - 5.6	13.4 - 10.2
15	11°18.8	11°20.6	10°47.8	1.5 - 1.1	7.5 - 5.7	13.5 - 10.2
16	11°19.0	11°20.9	10°48.1	1.6 - 1.2	7.6 - 5.8	13.6 - 10.3
17	11°19.2	11°21.1	10°48.3	1.7 - 1.3	7.7 - 5.8	13.7 - 10.4
18	11°19.5	11°21.4	10°48.5	1.8 - 1.4	7.8 - 5.9	13.8 - 10.5
19	11°19.8	11°21.6	10°48.8	1.9 - 1.4	7.9 - 6.0	13.9 - 10.5
20	11°20.0	11°21.9	10°49.0	2.0 - 1.5	8.0 - 6.1	14.0 - 10.6
21	11°20.3	11°22.1	10°49.3	2.1 - 1.6	8.1 - 6.1	14.1 - 10.7
22	11°20.5	11°22.4	10°49.5	2.2 - 1.7	8.2 - 6.2	14.2 - 10.8
23	11°20.7	11°22.6	10°49.7	2.3 - 1.7	8.3 - 6.3	14.3 - 10.8
24	11°21.0	11°22.9	10°50.0	2.4 - 1.8	8.4 - 6.4	14.4 - 10.9
25	11°21.2	11°23.1	10°50.2	2.5 - 1.9	8.5 - 6.4	14.5 - 11.0
26	11°21.5	11°23.4	10°50.5	2.6 - 2.0	8.6 - 6.5	14.6 - 11.1
27	11°21.8	11°23.6	10°50.7	2.7 - 2.0	8.7 - 6.6	14.7 - 11.1
28	11°22.0	11°23.9	10°50.9	2.8 - 2.1	8.8 - 6.7	14.8 - 11.2
29	11°22.3	11°24.1	10°51.2	2.9 - 2.2	8.9 - 6.7	14.9 - 11.3
30	11°22.5	11°24.4	10°51.4	3.0 - 2.3	9.0 - 6.8	15.0 - 11.4
31	11°22.7	11°24.6	10°51.6	3.1 - 2.4	9.1 - 6.9	15.1 - 11.5
32	11°23.0	11°24.9	10°51.9	3.2 - 2.4	9.2 - 7.0	15.2 - 11.5
33	11°23.2	11°25.1	10°52.1	3.3 - 2.5	9.3 - 7.1	15.3 - 11.6
34	11°23.5	11°25.4	10°52.4	3.4 - 2.6	9.4 - 7.1	15.4 - 11.7
35	11°23.8	11°25.6	10°52.6	3.5 - 2.7	9.5 - 7.2	15.5 - 11.8
36	11°24.0	11°25.9	10°52.8	3.6 - 2.7	9.6 - 7.3	15.6 - 11.8
37	11°24.3	11°26.1	10°53.1	3.7 - 2.8	9.7 - 7.4	15.7 - 11.9
38	11°24.5	11°26.4	10°53.3	3.8 - 2.9	9.8 - 7.4	15.8 - 12.0
39	11°24.7	11°26.6	10°53.6	3.9 - 3.0	9.9 - 7.5	15.9 - 12.1
40	11°25.0	11°26.9	10°53.8	4.0 - 3.0	10.0 - 7.6	16.0 - 12.1
41	11°25.2	11°27.1	10°54.0	4.1 - 3.1	10.1 - 7.7	16.1 - 12.2
42	11°25.5	11°27.4	10°54.3	4.2 - 3.2	10.2 - 7.7	16.2 - 12.3
43	11°25.8	11°27.6	10°54.5	4.3 - 3.3	10.3 - 7.8	16.3 - 12.4
44	11°26.0	11°27.9	10°54.7	4.4 - 3.3	10.4 - 7.9	16.4 - 12.4
45	11°26.3	11°28.1	10°55.0	4.5 - 3.4	10.5 - 8.0	16.5 - 12.5
46	11°26.5	11°28.4	10°55.2	4.6 - 3.5	10.6 - 8.0	16.6 - 12.6
47	11°26.7	11°28.6	10°55.5	4.7 - 3.6	10.7 - 8.1	16.7 - 12.7
48	11°27.0	11°28.9	10°55.7	4.8 - 3.6	10.8 - 8.2	16.8 - 12.7
49	11°27.3	11°29.1	10°55.9	4.9 - 3.7	10.9 - 8.3	16.9 - 12.8
50	11°27.5	11°29.4	10°56.2	5.0 - 3.8	11.0 - 8.3	17.0 - 12.9
51	11°27.8	11°29.6	10°56.4	5.1 - 3.9	11.1 - 8.4	17.1 - 13.0
52	11°28.0	11°29.9	10°56.7	5.2 - 3.9	11.2 - 8.5	17.2 - 13.0
53	11°28.2	11°30.1	10°56.9	5.3 - 4.0	11.3 - 8.6	17.3 - 13.1
54	11°28.5	11°30.4	10°57.1	5.4 - 4.1	11.4 - 8.6	17.4 - 13.2
55	11°28.7	11°30.6	10°57.4	5.5 - 4.2	11.5 - 8.7	17.5 - 13.3
56	11°29.0	11°30.9	10°57.6	5.6 - 4.2	11.6 - 8.8	17.6 - 13.3
57	11°29.3	11°31.1	10°57.9	5.7 - 4.3	11.7 - 8.9	17.7 - 13.4
58	11°29.5	11°31.4	10°58.1	5.8 - 4.4	11.8 - 8.9	17.8 - 13.5
59	11°29.8	11°31.6	10°58.3	5.9 - 4.5	11.9 - 9.0	17.9 - 13.6

m 46	Sun Plan.	Aries	Moon	v and d corr		
0	11°30.0	11°31.9	10°58.6	0.0 - 0.0	6.0 - 4.7	12.0 - 9.3
1	11°30.2	11°32.1	10°58.8	0.1 - 0.1	6.1 - 4.7	12.1 - 9.4
2	11°30.5	11°32.4	10°59.0	0.2 - 0.2	6.2 - 4.8	12.2 - 9.5
3	11°30.7	11°32.6	10°59.3	0.3 - 0.2	6.3 - 4.9	12.3 - 9.5
4	11°31.0	11°32.9	10°59.5	0.4 - 0.3	6.4 - 5.0	12.4 - 9.6
5	11°31.3	11°33.1	10°59.8	0.5 - 0.4	6.5 - 5.0	12.5 - 9.7
6	11°31.5	11°33.4	11°00.0	0.6 - 0.5	6.6 - 5.1	12.6 - 9.8
7	11°31.8	11°33.6	11°00.2	0.7 - 0.5	6.7 - 5.2	12.7 - 9.8
8	11°32.0	11°33.9	11°00.5	0.8 - 0.6	6.8 - 5.3	12.8 - 9.9
9	11°32.2	11°34.1	11°00.7	0.9 - 0.7	6.9 - 5.3	12.9 - 10.0
10	11°32.5	11°34.4	11°01.0	1.0 - 0.8	7.0 - 5.4	13.0 - 10.1
11	11°32.7	11°34.6	11°01.2	1.1 - 0.9	7.1 - 5.5	13.1 - 10.2
12	11°33.0	11°34.9	11°01.4	1.2 - 0.9	7.2 - 5.6	13.2 - 10.2
13	11°33.3	11°35.1	11°01.7	1.3 - 1.0	7.3 - 5.7	13.3 - 10.3
14	11°33.5	11°35.4	11°01.9	1.4 - 1.1	7.4 - 5.7	13.4 - 10.4
15	11°33.8	11°35.6	11°02.1	1.5 - 1.2	7.5 - 5.8	13.5 - 10.5
16	11°34.0	11°35.9	11°02.4	1.6 - 1.2	7.6 - 5.9	13.6 - 10.5
17	11°34.2	11°36.1	11°02.6	1.7 - 1.3	7.7 - 6.0	13.7 - 10.6
18	11°34.5	11°36.4	11°02.9	1.8 - 1.4	7.8 - 6.0	13.8 - 10.7
19	11°34.8	11°36.6	11°03.1	1.9 - 1.5	7.9 - 6.1	13.9 - 10.8
20	11°35.0	11°36.9	11°03.3	2.0 - 1.6	8.0 - 6.2	14.0 - 10.8
21	11°35.3	11°37.2	11°03.6	2.1 - 1.6	8.1 - 6.3	14.1 - 10.9
22	11°35.5	11°37.4	11°03.8	2.2 - 1.7	8.2 - 6.4	14.2 - 11.0
23	11°35.7	11°37.7	11°04.1	2.3 - 1.8	8.3 - 6.4	14.3 - 11.1
24	11°36.0	11°37.9	11°04.3	2.4 - 1.9	8.4 - 6.5	14.4 - 11.2
25	11°36.2	11°38.2	11°04.5	2.5 - 1.9	8.5 - 6.6	14.5 - 11.2
26	11°36.5	11°38.4	11°04.8	2.6 - 2.0	8.6 - 6.7	14.6 - 11.3
27	11°36.8	11°38.7	11°05.0	2.7 - 2.1	8.7 - 6.7	14.7 - 11.4
28	11°37.0	11°38.9	11°05.2	2.8 - 2.2	8.8 - 6.8	14.8 - 11.5
29	11°37.3	11°39.2	11°05.5	2.9 - 2.2	8.9 - 6.9	14.9 - 11.5
30	11°37.5	11°39.4	11°05.7	3.0 - 2.3	9.0 - 7.0	15.0 - 11.6
31	11°37.7	11°39.7	11°06.0	3.1 - 2.4	9.1 - 7.1	15.1 - 11.7
32	11°38.0	11°39.9	11°06.2	3.2 - 2.5	9.2 - 7.1	15.2 - 11.8
33	11°38.2	11°40.2	11°06.4	3.3 - 2.6	9.3 - 7.2	15.3 - 11.9
34	11°38.5	11°40.4	11°06.7	3.4 - 2.6	9.4 - 7.3	15.4 - 11.9
35	11°38.8	11°40.7	11°06.9	3.5 - 2.7	9.5 - 7.4	15.5 - 12.0
36	11°39.0	11°40.9	11°07.2	3.6 - 2.8	9.6 - 7.4	15.6 - 12.1
37	11°39.3	11°41.2	11°07.4	3.7 - 2.9	9.7 - 7.5	15.7 - 12.2
38	11°39.5	11°41.4	11°07.6	3.8 - 2.9	9.8 - 7.6	15.8 - 12.2
39	11°39.7	11°41.7	11°07.9	3.9 - 3.0	9.9 - 7.7	15.9 - 12.3
40	11°40.0	11°41.9	11°08.1	4.0 - 3.1	10.0 - 7.8	16.0 - 12.4
41	11°40.2	11°42.2	11°08.3	4.1 - 3.2	10.1 - 7.8	16.1 - 12.5
42	11°40.5	11°42.4	11°08.6	4.2 - 3.3	10.2 - 7.9	16.2 - 12.6
43	11°40.8	11°42.7	11°08.8	4.3 - 3.3	10.3 - 8.0	16.3 - 12.6
44	11°41.0	11°42.9	11°09.1	4.4 - 3.4	10.4 - 8.1	16.4 - 12.7
45	11°41.3	11°43.2	11°09.3	4.5 - 3.5	10.5 - 8.1	16.5 - 12.8
46	11°41.5	11°43.4	11°09.5	4.6 - 3.6	10.6 - 8.2	16.6 - 12.9
47	11°41.7	11°43.7	11°09.8	4.7 - 3.6	10.7 - 8.3	16.7 - 12.9
48	11°42.0	11°43.9	11°10.0	4.8 - 3.7	10.8 - 8.4	16.8 - 13.0
49	11°42.3	11°44.2	11°10.3	4.9 - 3.8	10.9 - 8.4	16.9 - 13.1
50	11°42.5	11°44.4	11°10.5	5.0 - 3.9	11.0 - 8.5	17.0 - 13.2
51	11°42.8	11°44.7	11°10.7	5.1 - 4.0	11.1 - 8.6	17.1 - 13.3
52	11°43.0	11°44.9	11°11.0	5.2 - 4.0	11.2 - 8.7	17.2 - 13.3
53	11°43.2	11°45.2	11°11.2	5.3 - 4.1	11.3 - 8.8	17.3 - 13.4
54	11°43.5	11°45.4	11°11.5	5.4 - 4.2	11.4 - 8.8	17.4 - 13.5
55	11°43.7	11°45.7	11°11.7	5.5 - 4.3	11.5 - 8.9	17.5 - 13.6
56	11°44.0	11°45.9	11°11.9	5.6 - 4.3	11.6 - 9.0	17.6 - 13.6
57	11°44.3	11°46.2	11°12.2	5.7 - 4.4	11.7 - 9.1	17.7 - 13.7
58	11°44.5	11°46.4	11°12.4	5.8 - 4.5	11.8 - 9.1	17.8 - 13.8
59	11°44.8	11°46.7	11°12.6	5.9 - 4.6	11.9 - 9.2	17.9 - 13.9

m 47	Sun Plan.	Aries	Moon	v and d corr		
0	11°45.0	11°46.9	11°12.9	0.0 - 0.0	6.0 - 4.8	12.0 - 9.5
1	11°45.2	11°47.2	11°13.1	0.1 - 0.1	6.1 - 4.8	12.1 - 9.6
2	11°45.5	11°47.4	11°13.4	0.2 - 0.2	6.2 - 4.9	12.2 - 9.7
3	11°45.7	11°47.7	11°13.6	0.3 - 0.2	6.3 - 5.0	12.3 - 9.7
4	11°46.0	11°47.9	11°13.8	0.4 - 0.3	6.4 - 5.1	12.4 - 9.8
5	11°46.3	11°48.2	11°14.1	0.5 - 0.4	6.5 - 5.1	12.5 - 9.9
6	11°46.5	11°48.4	11°14.3	0.6 - 0.5	6.6 - 5.2	12.6 - 10.0
7	11°46.8	11°48.7	11°14.6	0.7 - 0.6	6.7 - 5.3	12.7 - 10.1
8	11°47.0	11°48.9	11°14.8	0.8 - 0.6	6.8 - 5.4	12.8 - 10.1
9	11°47.2	11°49.2	11°15.0	0.9 - 0.7	6.9 - 5.5	12.9 - 10.2
10	11°47.5	11°49.4	11°15.3	1.0 - 0.8	7.0 - 5.5	13.0 - 10.3
11	11°47.7	11°49.7	11°15.5	1.1 - 0.9	7.1 - 5.6	13.1 - 10.4
12	11°48.0	11°49.9	11°15.7	1.2 - 1.0	7.2 - 5.7	13.2 - 10.4
13	11°48.3	11°50.2	11°16.0	1.3 - 1.0	7.3 - 5.8	13.3 - 10.5
14	11°48.5	11°50.4	11°16.2	1.4 - 1.1	7.4 - 5.9	13.4 - 10.6
15	11°48.8	11°50.7	11°16.5	1.5 - 1.2	7.5 - 5.9	13.5 - 10.7
16	11°49.0	11°50.9	11°16.7	1.6 - 1.3	7.6 - 6.0	13.6 - 10.8
17	11°49.2	11°51.2	11°16.9	1.7 - 1.3	7.7 - 6.1	13.7 - 10.8
18	11°49.5	11°51.4	11°17.2	1.8 - 1.4	7.8 - 6.2	13.8 - 10.9
19	11°49.8	11°51.7	11°17.4	1.9 - 1.5	7.9 - 6.3	13.9 - 11.0
20	11°50.0	11°51.9	11°17.7	2.0 - 1.6	8.0 - 6.3	14.0 - 11.1
21	11°50.3	11°52.2	11°17.9	2.1 - 1.7	8.1 - 6.4	14.1 - 11.2
22	11°50.5	11°52.4	11°18.1	2.2 - 1.7	8.2 - 6.5	14.2 - 11.2
23	11°50.7	11°52.7	11°18.4	2.3 - 1.8	8.3 - 6.6	14.3 - 11.3
24	11°51.0	11°52.9	11°18.6	2.4 - 1.9	8.4 - 6.7	14.4 - 11.4
25	11°51.2	11°53.2	11°18.8	2.5 - 2.0	8.5 - 6.7	14.5 - 11.5
26	11°51.5	11°53.4	11°19.1	2.6 - 2.1	8.6 - 6.8	14.6 - 11.6
27	11°51.8	11°53.7	11°19.3	2.7 - 2.1	8.7 - 6.9	14.7 - 11.6
28	11°52.0	11°53.9	11°19.6	2.8 - 2.2	8.8 - 7.0	14.8 - 11.7
29	11°52.3	11°54.2	11°19.8	2.9 - 2.3	8.9 - 7.0	14.9 - 11.8
30	11°52.5	11°54.4	11°20.0	3.0 - 2.4	9.0 - 7.1	15.0 - 11.9
31	11°52.7	11°54.7	11°20.3	3.1 - 2.5	9.1 - 7.2	15.1 - 12.0
32	11°53.0	11°54.9	11°20.5	3.2 - 2.5	9.2 - 7.3	15.2 - 12.0
33	11°53.2	11°55.2	11°20.8	3.3 - 2.6	9.3 - 7.4	15.3 - 12.1
34	11°53.5	11°55.5	11°21.0	3.4 - 2.7	9.4 - 7.4	15.4 - 12.2
35	11°53.8	11°55.7	11°21.2	3.5 - 2.8	9.5 - 7.5	15.5 - 12.3
36	11°54.0	11°56.0	11°21.5	3.6 - 2.9	9.6 - 7.6	15.6 - 12.3
37	11°54.3	11°56.2	11°21.7	3.7 - 2.9	9.7 - 7.7	15.7 - 12.4
38	11°54.5	11°56.5	11°22.0	3.8 - 3.0	9.8 - 7.8	15.8 - 12.5
39	11°54.7	11°56.7	11°22.2	3.9 - 3.1	9.9 - 7.8	15.9 - 12.6
40	11°55.0	11°57.0	11°22.4	4.0 - 3.2	10.0 - 7.9	16.0 - 12.7
41	11°55.2	11°57.2	11°22.7	4.1 - 3.2	10.1 - 8.0	16.1 - 12.7
42	11°55.5	11°57.5	11°22.9	4.2 - 3.3	10.2 - 8.1	16.2 - 12.8
43	11°55.8	11°57.7	11°23.1	4.3 - 3.4	10.3 - 8.2	16.3 - 12.9
44	11°56.0	11°58.0	11°23.4	4.4 - 3.5	10.4 - 8.2	16.4 - 13.0
45	11°56.3	11°58.2	11°23.6	4.5 - 3.6	10.5 - 8.3	16.5 - 13.1
46	11°56.5	11°58.5	11°23.9	4.6 - 3.6	10.6 - 8.4	16.6 - 13.1
47	11°56.7	11°58.7	11°24.1	4.7 - 3.7	10.7 - 8.5	16.7 - 13.2
48	11°57.0	11°59.0	11°24.3	4.8 - 3.8	10.8 - 8.6	16.8 - 13.3
49	11°57.3	11°59.2	11°24.6	4.9 - 3.9	10.9 - 8.6	16.9 - 13.4
50	11°57.5	11°59.5	11°24.8	5.0 - 4.0	11.0 - 8.7	17.0 - 13.5
51	11°57.8	11°59.7	11°25.1	5.1 - 4.0	11.1 - 8.8	17.1 - 13.5
52	11°58.0	12°00.0	11°25.3	5.2 - 4.1	11.2 - 8.9	17.2 - 13.6
53	11°58.2	12°00.2	11°25.5	5.3 - 4.2	11.3 - 8.9	17.3 - 13.7
54	11°58.5	12°00.5	11°25.8	5.4 - 4.3	11.4 - 9.0	17.4 - 13.8
55	11°58.7	12°00.7	11°26.0	5.5 - 4.4	11.5 - 9.1	17.5 - 13.9
56	11°59.0	12°01.0	11°26.2	5.6 - 4.4	11.6 - 9.2	17.6 - 13.9
57	11°59.3	12°01.2	11°26.5	5.7 - 4.5	11.7 - 9.3	17.7 - 14.0
58	11°59.5	12°01.5	11°26.7	5.8 - 4.6	11.8 - 9.3	17.8 - 14.1
59	11°59.8	12°01.7	11°27.0	5.9 - 4.7	11.9 - 9.4	17.9 - 14.2

Increments and Corrections

m 48	Sun Plan.	Aries	Moon	v and d corr		
0	12°00.0	12°02.0	11°27.2	0.0 - 0.0	6.0 - 4.8	12.0 - 9.7
1	12°00.2	12°02.2	11°27.4	0.1 - 0.1	6.1 - 4.9	12.1 - 9.8
2	12°00.5	12°02.5	11°27.7	0.2 - 0.2	6.2 - 5.0	12.2 - 9.9
3	12°00.7	12°02.7	11°27.9	0.3 - 0.2	6.3 - 5.1	12.3 - 9.9
4	12°01.0	12°03.0	11°28.2	0.4 - 0.3	6.4 - 5.2	12.4 - 10.0
5	12°01.3	12°03.2	11°28.4	0.5 - 0.4	6.5 - 5.3	12.5 - 10.1
6	12°01.5	12°03.5	11°28.6	0.6 - 0.5	6.6 - 5.3	12.6 - 10.2
7	12°01.8	12°03.7	11°28.9	0.7 - 0.6	6.7 - 5.4	12.7 - 10.3
8	12°02.0	12°04.0	11°29.1	0.8 - 0.6	6.8 - 5.5	12.8 - 10.3
9	12°02.2	12°04.2	11°29.3	0.9 - 0.7	6.9 - 5.6	12.9 - 10.4
10	12°02.5	12°04.5	11°29.6	1.0 - 0.8	7.0 - 5.7	13.0 - 10.5
11	12°02.7	12°04.7	11°29.8	1.1 - 0.9	7.1 - 5.7	13.1 - 10.6
12	12°03.0	12°05.0	11°30.1	1.2 - 1.0	7.2 - 5.8	13.2 - 10.7
13	12°03.3	12°05.2	11°30.3	1.3 - 1.1	7.3 - 5.9	13.3 - 10.8
14	12°03.5	12°05.5	11°30.5	1.4 - 1.1	7.4 - 6.0	13.4 - 10.8
15	12°03.8	12°05.7	11°30.8	1.5 - 1.2	7.5 - 6.1	13.5 - 10.9
16	12°04.0	12°06.0	11°31.0	1.6 - 1.3	7.6 - 6.1	13.6 - 11.0
17	12°04.2	12°06.2	11°31.3	1.7 - 1.4	7.7 - 6.2	13.7 - 11.1
18	12°04.5	12°06.5	11°31.5	1.8 - 1.5	7.8 - 6.3	13.8 - 11.2
19	12°04.8	12°06.7	11°31.7	1.9 - 1.5	7.9 - 6.4	13.9 - 11.2
20	12°05.0	12°07.0	11°32.0	2.0 - 1.6	8.0 - 6.5	14.0 - 11.3
21	12°05.3	12°07.2	11°32.2	2.1 - 1.7	8.1 - 6.5	14.1 - 11.4
22	12°05.5	12°07.5	11°32.4	2.2 - 1.8	8.2 - 6.6	14.2 - 11.5
23	12°05.7	12°07.7	11°32.7	2.3 - 1.9	8.3 - 6.7	14.3 - 11.6
24	12°06.0	12°08.0	11°32.9	2.4 - 1.9	8.4 - 6.8	14.4 - 11.6
25	12°06.2	12°08.2	11°33.2	2.5 - 2.0	8.5 - 6.9	14.5 - 11.7
26	12°06.5	12°08.5	11°33.4	2.6 - 2.1	8.6 - 7.0	14.6 - 11.8
27	12°06.8	12°08.7	11°33.6	2.7 - 2.2	8.7 - 7.0	14.7 - 11.9
28	12°07.0	12°09.0	11°33.9	2.8 - 2.3	8.8 - 7.1	14.8 - 12.0
29	12°07.3	12°09.2	11°34.1	2.9 - 2.3	8.9 - 7.2	14.9 - 12.0
30	12°07.5	12°09.5	11°34.4	3.0 - 2.4	9.0 - 7.3	15.0 - 12.1
31	12°07.7	12°09.7	11°34.6	3.1 - 2.5	9.1 - 7.4	15.1 - 12.2
32	12°08.0	12°10.0	11°34.8	3.2 - 2.6	9.2 - 7.4	15.2 - 12.3
33	12°08.2	12°10.2	11°35.1	3.3 - 2.7	9.3 - 7.5	15.3 - 12.4
34	12°08.5	12°10.5	11°35.3	3.4 - 2.7	9.4 - 7.6	15.4 - 12.4
35	12°08.8	12°10.7	11°35.6	3.5 - 2.8	9.5 - 7.7	15.5 - 12.5
36	12°09.0	12°11.0	11°35.8	3.6 - 2.9	9.6 - 7.8	15.6 - 12.6
37	12°09.3	12°11.2	11°36.0	3.7 - 3.0	9.7 - 7.8	15.7 - 12.7
38	12°09.5	12°11.5	11°36.3	3.8 - 3.1	9.8 - 7.9	15.8 - 12.8
39	12°09.7	12°11.7	11°36.5	3.9 - 3.2	9.9 - 8.0	15.9 - 12.9
40	12°10.0	12°12.0	11°36.7	4.0 - 3.2	10.0 - 8.1	16.0 - 12.9
41	12°10.2	12°12.2	11°37.0	4.1 - 3.3	10.1 - 8.2	16.1 - 13.0
42	12°10.5	12°12.5	11°37.2	4.2 - 3.4	10.2 - 8.2	16.2 - 13.1
43	12°10.8	12°12.7	11°37.5	4.3 - 3.5	10.3 - 8.3	16.3 - 13.2
44	12°11.0	12°13.0	11°37.7	4.4 - 3.6	10.4 - 8.4	16.4 - 13.3
45	12°11.3	12°13.2	11°37.9	4.5 - 3.6	10.5 - 8.5	16.5 - 13.3
46	12°11.5	12°13.5	11°38.2	4.6 - 3.7	10.6 - 8.6	16.6 - 13.4
47	12°11.7	12°13.8	11°38.4	4.7 - 3.8	10.7 - 8.6	16.7 - 13.5
48	12°12.0	12°14.0	11°38.7	4.8 - 3.9	10.8 - 8.7	16.8 - 13.6
49	12°12.3	12°14.3	11°38.9	4.9 - 4.0	10.9 - 8.8	16.9 - 13.7
50	12°12.5	12°14.5	11°39.1	5.0 - 4.0	11.0 - 8.9	17.0 - 13.7
51	12°12.8	12°14.8	11°39.4	5.1 - 4.1	11.1 - 9.0	17.1 - 13.8
52	12°13.0	12°15.0	11°39.6	5.2 - 4.2	11.2 - 9.1	17.2 - 13.9
53	12°13.2	12°15.3	11°39.8	5.3 - 4.3	11.3 - 9.1	17.3 - 14.0
54	12°13.5	12°15.5	11°40.1	5.4 - 4.4	11.4 - 9.2	17.4 - 14.1
55	12°13.7	12°15.8	11°40.3	5.5 - 4.4	11.5 - 9.3	17.5 - 14.1
56	12°14.0	12°16.0	11°40.6	5.6 - 4.5	11.6 - 9.4	17.6 - 14.2
57	12°14.3	12°16.3	11°40.8	5.7 - 4.6	11.7 - 9.5	17.7 - 14.3
58	12°14.5	12°16.5	11°41.0	5.8 - 4.7	11.8 - 9.5	17.8 - 14.4
59	12°14.8	12°16.8	11°41.3	5.9 - 4.8	11.9 - 9.6	17.9 - 14.5

m 49	Sun Plan.	Aries	Moon	v and d corr		
0	12°15.0	12°17.0	11°41.5	0.0 - 0.0	6.0 - 4.9	12.0 - 9.9
1	12°15.2	12°17.3	11°41.8	0.1 - 0.1	6.1 - 5.0	12.1 - 10.0
2	12°15.5	12°17.5	11°42.0	0.2 - 0.2	6.2 - 5.1	12.2 - 10.1
3	12°15.7	12°17.8	11°42.2	0.3 - 0.2	6.3 - 5.2	12.3 - 10.1
4	12°16.0	12°18.0	11°42.5	0.4 - 0.3	6.4 - 5.3	12.4 - 10.2
5	12°16.3	12°18.3	11°42.7	0.5 - 0.4	6.5 - 5.4	12.5 - 10.3
6	12°16.5	12°18.5	11°42.9	0.6 - 0.5	6.6 - 5.4	12.6 - 10.4
7	12°16.8	12°18.8	11°43.2	0.7 - 0.6	6.7 - 5.5	12.7 - 10.5
8	12°17.0	12°19.0	11°43.4	0.8 - 0.7	6.8 - 5.6	12.8 - 10.6
9	12°17.2	12°19.3	11°43.7	0.9 - 0.7	6.9 - 5.7	12.9 - 10.6
10	12°17.5	12°19.5	11°43.9	1.0 - 0.8	7.0 - 5.8	13.0 - 10.7
11	12°17.7	12°19.8	11°44.1	1.1 - 0.9	7.1 - 5.9	13.1 - 10.8
12	12°18.0	12°20.0	11°44.4	1.2 - 1.0	7.2 - 5.9	13.2 - 10.9
13	12°18.3	12°20.3	11°44.6	1.3 - 1.1	7.3 - 6.0	13.3 - 11.0
14	12°18.5	12°20.5	11°44.9	1.4 - 1.2	7.4 - 6.1	13.4 - 11.1
15	12°18.8	12°20.8	11°45.1	1.5 - 1.2	7.5 - 6.2	13.5 - 11.1
16	12°19.0	12°21.0	11°45.3	1.6 - 1.3	7.6 - 6.3	13.6 - 11.2
17	12°19.2	12°21.3	11°45.6	1.7 - 1.4	7.7 - 6.4	13.7 - 11.3
18	12°19.5	12°21.5	11°45.8	1.8 - 1.5	7.8 - 6.4	13.8 - 11.4
19	12°19.8	12°21.8	11°46.1	1.9 - 1.6	7.9 - 6.5	13.9 - 11.5
20	12°20.0	12°22.0	11°46.3	2.0 - 1.6	8.0 - 6.6	14.0 - 11.5
21	12°20.3	12°22.3	11°46.5	2.1 - 1.7	8.1 - 6.7	14.1 - 11.6
22	12°20.5	12°22.5	11°46.8	2.2 - 1.8	8.2 - 6.8	14.2 - 11.7
23	12°20.7	12°22.8	11°47.0	2.3 - 1.9	8.3 - 6.8	14.3 - 11.8
24	12°21.0	12°23.0	11°47.2	2.4 - 2.0	8.4 - 6.9	14.4 - 11.9
25	12°21.2	12°23.3	11°47.5	2.5 - 2.1	8.5 - 7.0	14.5 - 12.0
26	12°21.5	12°23.5	11°47.7	2.6 - 2.1	8.6 - 7.1	14.6 - 12.0
27	12°21.8	12°23.8	11°48.0	2.7 - 2.2	8.7 - 7.2	14.7 - 12.1
28	12°22.0	12°24.0	11°48.2	2.8 - 2.3	8.8 - 7.3	14.8 - 12.2
29	12°22.3	12°24.3	11°48.4	2.9 - 2.4	8.9 - 7.3	14.9 - 12.3
30	12°22.5	12°24.5	11°48.7	3.0 - 2.5	9.0 - 7.4	15.0 - 12.4
31	12°22.7	12°24.8	11°48.9	3.1 - 2.6	9.1 - 7.5	15.1 - 12.5
32	12°23.0	12°25.0	11°49.2	3.2 - 2.6	9.2 - 7.6	15.2 - 12.5
33	12°23.2	12°25.3	11°49.4	3.3 - 2.7	9.3 - 7.7	15.3 - 12.6
34	12°23.5	12°25.5	11°49.6	3.4 - 2.8	9.4 - 7.8	15.4 - 12.7
35	12°23.8	12°25.8	11°49.9	3.5 - 2.9	9.5 - 7.8	15.5 - 12.8
36	12°24.0	12°26.0	11°50.1	3.6 - 3.0	9.6 - 7.9	15.6 - 12.9
37	12°24.3	12°26.3	11°50.3	3.7 - 3.1	9.7 - 8.0	15.7 - 13.0
38	12°24.5	12°26.5	11°50.6	3.8 - 3.1	9.8 - 8.1	15.8 - 13.0
39	12°24.7	12°26.8	11°50.8	3.9 - 3.2	9.9 - 8.2	15.9 - 13.1
40	12°25.0	12°27.0	11°51.1	4.0 - 3.3	10.0 - 8.3	16.0 - 13.2
41	12°25.2	12°27.3	11°51.3	4.1 - 3.4	10.1 - 8.3	16.1 - 13.3
42	12°25.5	12°27.5	11°51.5	4.2 - 3.5	10.2 - 8.4	16.2 - 13.4
43	12°25.8	12°27.8	11°51.8	4.3 - 3.5	10.3 - 8.5	16.3 - 13.4
44	12°26.0	12°28.0	11°52.0	4.4 - 3.6	10.4 - 8.6	16.4 - 13.5
45	12°26.3	12°28.3	11°52.3	4.5 - 3.7	10.5 - 8.7	16.5 - 13.6
46	12°26.5	12°28.5	11°52.5	4.6 - 3.8	10.6 - 8.7	16.6 - 13.7
47	12°26.7	12°28.8	11°52.7	4.7 - 3.9	10.7 - 8.8	16.7 - 13.8
48	12°27.0	12°29.0	11°53.0	4.8 - 4.0	10.8 - 8.9	16.8 - 13.9
49	12°27.3	12°29.3	11°53.2	4.9 - 4.0	10.9 - 9.0	16.9 - 13.9
50	12°27.5	12°29.5	11°53.4	5.0 - 4.1	11.0 - 9.1	17.0 - 14.0
51	12°27.8	12°29.8	11°53.7	5.1 - 4.2	11.1 - 9.2	17.1 - 14.1
52	12°28.0	12°30.0	11°53.9	5.2 - 4.3	11.2 - 9.2	17.2 - 14.2
53	12°28.2	12°30.3	11°54.2	5.3 - 4.4	11.3 - 9.3	17.3 - 14.3
54	12°28.5	12°30.5	11°54.4	5.4 - 4.5	11.4 - 9.4	17.4 - 14.4
55	12°28.7	12°30.8	11°54.6	5.5 - 4.5	11.5 - 9.5	17.5 - 14.4
56	12°29.0	12°31.0	11°54.9	5.6 - 4.6	11.6 - 9.6	17.6 - 14.5
57	12°29.3	12°31.3	11°55.1	5.7 - 4.7	11.7 - 9.7	17.7 - 14.6
58	12°29.5	12°31.5	11°55.4	5.8 - 4.8	11.8 - 9.7	17.8 - 14.7
59	12°29.8	12°31.8	11°55.6	5.9 - 4.9	11.9 - 9.8	17.9 - 14.8

m 50	Sun Plan.	Aries	Moon	v and d corr		
0	12°30.0	12°32.1	11°55.8	0.0 - 0.0	6.0 - 5.0	12.0 - 10.1
1	12°30.2	12°32.3	11°56.1	0.1 - 0.1	6.1 - 5.1	12.1 - 10.2
2	12°30.5	12°32.6	11°56.3	0.2 - 0.2	6.2 - 5.2	12.2 - 10.3
3	12°30.7	12°32.8	11°56.5	0.3 - 0.3	6.3 - 5.3	12.3 - 10.4
4	12°31.0	12°33.1	11°56.8	0.4 - 0.3	6.4 - 5.4	12.4 - 10.4
5	12°31.3	12°33.3	11°57.0	0.5 - 0.4	6.5 - 5.5	12.5 - 10.5
6	12°31.5	12°33.6	11°57.3	0.6 - 0.5	6.6 - 5.6	12.6 - 10.6
7	12°31.8	12°33.8	11°57.5	0.7 - 0.6	6.7 - 5.6	12.7 - 10.7
8	12°32.0	12°34.1	11°57.7	0.8 - 0.7	6.8 - 5.7	12.8 - 10.8
9	12°32.2	12°34.3	11°58.0	0.9 - 0.8	6.9 - 5.8	12.9 - 10.9
10	12°32.5	12°34.6	11°58.2	1.0 - 0.8	7.0 - 5.9	13.0 - 10.9
11	12°32.7	12°34.8	11°58.5	1.1 - 0.9	7.1 - 6.0	13.1 - 11.0
12	12°33.0	12°35.1	11°58.7	1.2 - 1.0	7.2 - 6.1	13.2 - 11.1
13	12°33.3	12°35.3	11°58.9	1.3 - 1.1	7.3 - 6.1	13.3 - 11.2
14	12°33.5	12°35.6	11°59.2	1.4 - 1.2	7.4 - 6.2	13.4 - 11.3
15	12°33.8	12°35.8	11°59.4	1.5 - 1.3	7.5 - 6.3	13.5 - 11.4
16	12°34.0	12°36.1	11°59.7	1.6 - 1.3	7.6 - 6.4	13.6 - 11.4
17	12°34.2	12°36.3	11°59.9	1.7 - 1.4	7.7 - 6.5	13.7 - 11.5
18	12°34.5	12°36.6	12°00.1	1.8 - 1.5	7.8 - 6.6	13.8 - 11.6
19	12°34.8	12°36.8	12°00.4	1.9 - 1.6	7.9 - 6.6	13.9 - 11.7
20	12°35.0	12°37.1	12°00.6	2.0 - 1.7	8.0 - 6.7	14.0 - 11.8
21	12°35.3	12°37.3	12°00.8	2.1 - 1.8	8.1 - 6.8	14.1 - 11.9
22	12°35.5	12°37.6	12°01.1	2.2 - 1.9	8.2 - 6.9	14.2 - 12.0
23	12°35.7	12°37.8	12°01.3	2.3 - 1.9	8.3 - 7.0	14.3 - 12.0
24	12°36.0	12°38.1	12°01.6	2.4 - 2.0	8.4 - 7.1	14.4 - 12.1
25	12°36.2	12°38.3	12°01.8	2.5 - 2.1	8.5 - 7.2	14.5 - 12.2
26	12°36.5	12°38.6	12°02.0	2.6 - 2.2	8.6 - 7.2	14.6 - 12.3
27	12°36.8	12°38.8	12°02.3	2.7 - 2.3	8.7 - 7.3	14.7 - 12.4
28	12°37.0	12°39.1	12°02.5	2.8 - 2.4	8.8 - 7.4	14.8 - 12.5
29	12°37.3	12°39.3	12°02.8	2.9 - 2.4	8.9 - 7.5	14.9 - 12.5
30	12°37.5	12°39.6	12°03.0	3.0 - 2.5	9.0 - 7.6	15.0 - 12.6
31	12°37.7	12°39.8	12°03.2	3.1 - 2.6	9.1 - 7.7	15.1 - 12.7
32	12°38.0	12°40.1	12°03.5	3.2 - 2.7	9.2 - 7.7	15.2 - 12.8
33	12°38.2	12°40.3	12°03.7	3.3 - 2.8	9.3 - 7.8	15.3 - 12.9
34	12°38.5	12°40.6	12°03.9	3.4 - 2.9	9.4 - 7.9	15.4 - 13.0
35	12°38.8	12°40.8	12°04.2	3.5 - 2.9	9.5 - 8.0	15.5 - 13.0
36	12°39.0	12°41.1	12°04.4	3.6 - 3.0	9.6 - 8.1	15.6 - 13.1
37	12°39.3	12°41.3	12°04.7	3.7 - 3.1	9.7 - 8.2	15.7 - 13.2
38	12°39.5	12°41.6	12°04.9	3.8 - 3.2	9.8 - 8.2	15.8 - 13.3
39	12°39.7	12°41.8	12°05.1	3.9 - 3.3	9.9 - 8.3	15.9 - 13.4
40	12°40.0	12°42.1	12°05.4	4.0 - 3.4	10.0 - 8.4	16.0 - 13.5
41	12°40.2	12°42.3	12°05.6	4.1 - 3.5	10.1 - 8.5	16.1 - 13.6
42	12°40.5	12°42.6	12°05.9	4.2 - 3.5	10.2 - 8.6	16.2 - 13.6
43	12°40.8	12°42.8	12°06.1	4.3 - 3.6	10.3 - 8.7	16.3 - 13.7
44	12°41.0	12°43.1	12°06.3	4.4 - 3.7	10.4 - 8.8	16.4 - 13.8
45	12°41.3	12°43.3	12°06.6	4.5 - 3.8	10.5 - 8.8	16.5 - 13.9
46	12°41.5	12°43.6	12°06.8	4.6 - 3.9	10.6 - 8.9	16.6 - 14.0
47	12°41.7	12°43.8	12°07.0	4.7 - 4.0	10.7 - 9.0	16.7 - 14.1
48	12°42.0	12°44.1	12°07.3	4.8 - 4.0	10.8 - 9.1	16.8 - 14.1
49	12°42.3	12°44.3	12°07.5	4.9 - 4.1	10.9 - 9.2	16.9 - 14.2
50	12°42.5	12°44.6	12°07.8	5.0 - 4.2	11.0 - 9.3	17.0 - 14.3
51	12°42.8	12°44.8	12°08.0	5.1 - 4.3	11.1 - 9.3	17.1 - 14.4
52	12°43.0	12°45.1	12°08.2	5.2 - 4.4	11.2 - 9.4	17.2 - 14.5
53	12°43.2	12°45.3	12°08.5	5.3 - 4.5	11.3 - 9.5	17.3 - 14.6
54	12°43.5	12°45.6	12°08.7	5.4 - 4.5	11.4 - 9.6	17.4 - 14.6
55	12°43.7	12°45.8	12°09.0	5.5 - 4.6	11.5 - 9.7	17.5 - 14.7
56	12°44.0	12°46.1	12°09.2	5.6 - 4.7	11.6 - 9.8	17.6 - 14.8
57	12°44.3	12°46.3	12°09.4	5.7 - 4.8	11.7 - 9.8	17.7 - 14.9
58	12°44.5	12°46.6	12°09.7	5.8 - 4.9	11.8 - 9.9	17.8 - 15.0
59	12°44.8	12°46.8	12°09.9	5.9 - 5.0	11.9 - 10.0	17.9 - 15.1

Increments and Corrections

m 51	Sun Plan.	Aries	Moon	v and d corr		
0	12°45.0	12°47.1	12°10.1	0.0 - 0.0	6.0 - 5.1	12.0 - 10.3
1	12°45.2	12°47.3	12°10.4	0.1 - 0.1	6.1 - 5.2	12.1 - 10.4
2	12°45.5	12°47.6	12°10.6	0.2 - 0.2	6.2 - 5.3	12.2 - 10.5
3	12°45.7	12°47.8	12°10.9	0.3 - 0.3	6.3 - 5.4	12.3 - 10.6
4	12°46.0	12°48.1	12°11.1	0.4 - 0.3	6.4 - 5.5	12.4 - 10.6
5	12°46.3	12°48.3	12°11.3	0.5 - 0.4	6.5 - 5.6	12.5 - 10.7
6	12°46.5	12°48.6	12°11.6	0.6 - 0.5	6.6 - 5.7	12.6 - 10.8
7	12°46.8	12°48.8	12°11.8	0.7 - 0.6	6.7 - 5.8	12.7 - 10.9
8	12°47.0	12°49.1	12°12.1	0.8 - 0.7	6.8 - 5.8	12.8 - 11.0
9	12°47.2	12°49.3	12°12.3	0.9 - 0.8	6.9 - 5.9	12.9 - 11.1
10	12°47.5	12°49.6	12°12.5	1.0 - 0.9	7.0 - 6.0	13.0 - 11.2
11	12°47.7	12°49.8	12°12.8	1.1 - 0.9	7.1 - 6.1	13.1 - 11.2
12	12°48.0	12°50.1	12°13.0	1.2 - 1.0	7.2 - 6.2	13.2 - 11.3
13	12°48.3	12°50.3	12°13.3	1.3 - 1.1	7.3 - 6.3	13.3 - 11.4
14	12°48.5	12°50.6	12°13.5	1.4 - 1.2	7.4 - 6.4	13.4 - 11.5
15	12°48.8	12°50.9	12°13.7	1.5 - 1.3	7.5 - 6.4	13.5 - 11.6
16	12°49.0	12°51.1	12°14.0	1.6 - 1.4	7.6 - 6.5	13.6 - 11.7
17	12°49.2	12°51.4	12°14.2	1.7 - 1.5	7.7 - 6.6	13.7 - 11.8
18	12°49.5	12°51.6	12°14.4	1.8 - 1.5	7.8 - 6.7	13.8 - 11.8
19	12°49.8	12°51.9	12°14.7	1.9 - 1.6	7.9 - 6.8	13.9 - 11.9
20	12°50.0	12°52.1	12°14.9	2.0 - 1.7	8.0 - 6.9	14.0 - 12.0
21	12°50.3	12°52.4	12°15.2	2.1 - 1.8	8.1 - 7.0	14.1 - 12.1
22	12°50.5	12°52.6	12°15.4	2.2 - 1.9	8.2 - 7.0	14.2 - 12.2
23	12°50.7	12°52.9	12°15.6	2.3 - 2.0	8.3 - 7.1	14.3 - 12.3
24	12°51.0	12°53.1	12°15.9	2.4 - 2.1	8.4 - 7.2	14.4 - 12.4
25	12°51.2	12°53.4	12°16.1	2.5 - 2.1	8.5 - 7.3	14.5 - 12.4
26	12°51.5	12°53.6	12°16.4	2.6 - 2.2	8.6 - 7.4	14.6 - 12.5
27	12°51.8	12°53.9	12°16.6	2.7 - 2.3	8.7 - 7.5	14.7 - 12.6
28	12°52.0	12°54.1	12°16.8	2.8 - 2.4	8.8 - 7.6	14.8 - 12.7
29	12°52.3	12°54.4	12°17.1	2.9 - 2.5	8.9 - 7.6	14.9 - 12.8
30	12°52.5	12°54.6	12°17.3	3.0 - 2.6	9.0 - 7.7	15.0 - 12.9
31	12°52.7	12°54.9	12°17.5	3.1 - 2.7	9.1 - 7.8	15.1 - 13.0
32	12°53.0	12°55.1	12°17.8	3.2 - 2.7	9.2 - 7.9	15.2 - 13.0
33	12°53.2	12°55.4	12°18.0	3.3 - 2.8	9.3 - 8.0	15.3 - 13.1
34	12°53.5	12°55.6	12°18.3	3.4 - 2.9	9.4 - 8.1	15.4 - 13.2
35	12°53.8	12°55.9	12°18.5	3.5 - 3.0	9.5 - 8.2	15.5 - 13.3
36	12°54.0	12°56.1	12°18.7	3.6 - 3.1	9.6 - 8.2	15.6 - 13.4
37	12°54.3	12°56.4	12°19.0	3.7 - 3.2	9.7 - 8.3	15.7 - 13.5
38	12°54.5	12°56.6	12°19.2	3.8 - 3.3	9.8 - 8.4	15.8 - 13.6
39	12°54.7	12°56.9	12°19.5	3.9 - 3.3	9.9 - 8.5	15.9 - 13.6
40	12°55.0	12°57.1	12°19.7	4.0 - 3.4	10.0 - 8.6	16.0 - 13.7
41	12°55.2	12°57.4	12°19.9	4.1 - 3.5	10.1 - 8.7	16.1 - 13.8
42	12°55.5	12°57.6	12°20.2	4.2 - 3.6	10.2 - 8.8	16.2 - 13.9
43	12°55.8	12°57.9	12°20.4	4.3 - 3.7	10.3 - 8.8	16.3 - 14.0
44	12°56.0	12°58.1	12°20.6	4.4 - 3.8	10.4 - 8.9	16.4 - 14.1
45	12°56.3	12°58.4	12°20.9	4.5 - 3.9	10.5 - 9.0	16.5 - 14.2
46	12°56.5	12°58.6	12°21.1	4.6 - 3.9	10.6 - 9.1	16.6 - 14.2
47	12°56.7	12°58.9	12°21.4	4.7 - 4.0	10.7 - 9.2	16.7 - 14.3
48	12°57.0	12°59.1	12°21.6	4.8 - 4.1	10.8 - 9.3	16.8 - 14.4
49	12°57.3	12°59.4	12°21.8	4.9 - 4.2	10.9 - 9.4	16.9 - 14.5
50	12°57.5	12°59.6	12°22.1	5.0 - 4.3	11.0 - 9.4	17.0 - 14.6
51	12°57.8	12°59.9	12°22.3	5.1 - 4.4	11.1 - 9.5	17.1 - 14.7
52	12°58.0	13°00.1	12°22.6	5.2 - 4.5	11.2 - 9.6	17.2 - 14.8
53	12°58.2	13°00.4	12°22.8	5.3 - 4.5	11.3 - 9.7	17.3 - 14.8
54	12°58.5	13°00.6	12°23.0	5.4 - 4.6	11.4 - 9.8	17.4 - 14.9
55	12°58.7	13°00.9	12°23.3	5.5 - 4.7	11.5 - 9.9	17.5 - 15.0
56	12°59.0	13°01.1	12°23.5	5.6 - 4.8	11.6 - 10.0	17.6 - 15.1
57	12°59.3	13°01.4	12°23.8	5.7 - 4.9	11.7 - 10.0	17.7 - 15.2
58	12°59.5	13°01.6	12°24.0	5.8 - 5.0	11.8 - 10.1	17.8 - 15.3
59	12°59.8	13°01.9	12°24.2	5.9 - 5.1	11.9 - 10.2	17.9 - 15.4

m 52	Sun Plan.	Aries	Moon	v and d corr		
0	13°00.0	13°02.1	12°24.5	0.0 - 0.0	6.0 - 5.3	12.0 - 10.5
1	13°00.2	13°02.4	12°24.7	0.1 - 0.1	6.1 - 5.3	12.1 - 10.6
2	13°00.5	13°02.6	12°24.9	0.2 - 0.2	6.2 - 5.4	12.2 - 10.7
3	13°00.7	13°02.9	12°25.2	0.3 - 0.3	6.3 - 5.5	12.3 - 10.8
4	13°01.0	13°03.1	12°25.4	0.4 - 0.4	6.4 - 5.6	12.4 - 10.8
5	13°01.3	13°03.4	12°25.7	0.5 - 0.4	6.5 - 5.7	12.5 - 10.9
6	13°01.5	13°03.6	12°25.9	0.6 - 0.5	6.6 - 5.8	12.6 - 11.0
7	13°01.8	13°03.9	12°26.1	0.7 - 0.6	6.7 - 5.9	12.7 - 11.1
8	13°02.0	13°04.1	12°26.4	0.8 - 0.7	6.8 - 6.0	12.8 - 11.2
9	13°02.2	13°04.4	12°26.6	0.9 - 0.8	6.9 - 6.0	12.9 - 11.3
10	13°02.5	13°04.6	12°26.9	1.0 - 0.9	7.0 - 6.1	13.0 - 11.4
11	13°02.7	13°04.9	12°27.1	1.1 - 1.0	7.1 - 6.2	13.1 - 11.5
12	13°03.0	13°05.1	12°27.3	1.2 - 1.1	7.2 - 6.3	13.2 - 11.5
13	13°03.3	13°05.4	12°27.6	1.3 - 1.1	7.3 - 6.4	13.3 - 11.6
14	13°03.5	13°05.6	12°27.8	1.4 - 1.2	7.4 - 6.5	13.4 - 11.7
15	13°03.8	13°05.9	12°28.0	1.5 - 1.3	7.5 - 6.6	13.5 - 11.8
16	13°04.0	13°06.1	12°28.3	1.6 - 1.4	7.6 - 6.6	13.6 - 11.9
17	13°04.2	13°06.4	12°28.5	1.7 - 1.5	7.7 - 6.7	13.7 - 12.0
18	13°04.5	13°06.6	12°28.8	1.8 - 1.6	7.8 - 6.8	13.8 - 12.1
19	13°04.8	13°06.9	12°29.0	1.9 - 1.7	7.9 - 6.9	13.9 - 12.2
20	13°05.0	13°07.1	12°29.2	2.0 - 1.8	8.0 - 7.0	14.0 - 12.3
21	13°05.3	13°07.4	12°29.5	2.1 - 1.8	8.1 - 7.1	14.1 - 12.3
22	13°05.5	13°07.6	12°29.7	2.2 - 1.9	8.2 - 7.2	14.2 - 12.4
23	13°05.7	13°07.9	12°30.0	2.3 - 2.0	8.3 - 7.3	14.3 - 12.5
24	13°06.0	13°08.1	12°30.2	2.4 - 2.1	8.4 - 7.4	14.4 - 12.6
25	13°06.2	13°08.4	12°30.4	2.5 - 2.2	8.5 - 7.4	14.5 - 12.7
26	13°06.5	13°08.6	12°30.7	2.6 - 2.3	8.6 - 7.5	14.6 - 12.8
27	13°06.8	13°08.9	12°30.9	2.7 - 2.4	8.7 - 7.6	14.7 - 12.9
28	13°07.0	13°09.2	12°31.1	2.8 - 2.5	8.8 - 7.7	14.8 - 13.0
29	13°07.3	13°09.4	12°31.4	2.9 - 2.5	8.9 - 7.8	14.9 - 13.0
30	13°07.5	13°09.7	12°31.6	3.0 - 2.6	9.0 - 7.9	15.0 - 13.1
31	13°07.7	13°09.9	12°31.9	3.1 - 2.7	9.1 - 8.0	15.1 - 13.2
32	13°08.0	13°10.2	12°32.1	3.2 - 2.8	9.2 - 8.0	15.2 - 13.3
33	13°08.2	13°10.4	12°32.3	3.3 - 2.9	9.3 - 8.1	15.3 - 13.4
34	13°08.5	13°10.7	12°32.6	3.4 - 3.0	9.4 - 8.2	15.4 - 13.5
35	13°08.8	13°10.9	12°32.8	3.5 - 3.1	9.5 - 8.3	15.5 - 13.6
36	13°09.0	13°11.2	12°33.1	3.6 - 3.1	9.6 - 8.4	15.6 - 13.7
37	13°09.3	13°11.4	12°33.3	3.7 - 3.2	9.7 - 8.5	15.7 - 13.7
38	13°09.5	13°11.7	12°33.5	3.8 - 3.3	9.8 - 8.6	15.8 - 13.8
39	13°09.7	13°11.9	12°33.8	3.9 - 3.4	9.9 - 8.7	15.9 - 13.9
40	13°10.0	13°12.2	12°34.0	4.0 - 3.5	10.0 - 8.8	16.0 - 14.0
41	13°10.2	13°12.4	12°34.2	4.1 - 3.6	10.1 - 8.8	16.1 - 14.1
42	13°10.5	13°12.7	12°34.5	4.2 - 3.7	10.2 - 8.9	16.2 - 14.2
43	13°10.8	13°12.9	12°34.7	4.3 - 3.8	10.3 - 9.0	16.3 - 14.3
44	13°11.0	13°13.2	12°35.0	4.4 - 3.9	10.4 - 9.1	16.4 - 14.3
45	13°11.3	13°13.4	12°35.2	4.5 - 3.9	10.5 - 9.2	16.5 - 14.4
46	13°11.5	13°13.7	12°35.4	4.6 - 4.0	10.6 - 9.3	16.6 - 14.5
47	13°11.7	13°13.9	12°35.7	4.7 - 4.1	10.7 - 9.4	16.7 - 14.6
48	13°12.0	13°14.2	12°35.9	4.8 - 4.2	10.8 - 9.5	16.8 - 14.7
49	13°12.3	13°14.4	12°36.2	4.9 - 4.3	10.9 - 9.5	16.9 - 14.8
50	13°12.5	13°14.7	12°36.4	5.0 - 4.4	11.0 - 9.6	17.0 - 14.9
51	13°12.8	13°14.9	12°36.6	5.1 - 4.5	11.1 - 9.7	17.1 - 15.0
52	13°13.0	13°15.2	12°36.9	5.2 - 4.5	11.2 - 9.8	17.2 - 15.0
53	13°13.2	13°15.4	12°37.1	5.3 - 4.6	11.3 - 9.9	17.3 - 15.1
54	13°13.5	13°15.7	12°37.4	5.4 - 4.7	11.4 - 10.0	17.4 - 15.2
55	13°13.7	13°15.9	12°37.6	5.5 - 4.8	11.5 - 10.1	17.5 - 15.3
56	13°14.0	13°16.2	12°37.8	5.6 - 4.9	11.6 - 10.2	17.6 - 15.4
57	13°14.3	13°16.4	12°38.1	5.7 - 5.0	11.7 - 10.2	17.7 - 15.5
58	13°14.5	13°16.7	12°38.3	5.8 - 5.1	11.8 - 10.3	17.8 - 15.6
59	13°14.8	13°16.9	12°38.5	5.9 - 5.2	11.9 - 10.4	17.9 - 15.7

m 53	Sun Plan.	Aries	Moon	v and d corr		
0	13°15.0	13°17.2	12°38.8	0.0 - 0.0	6.0 - 5.4	12.0 - 10.7
1	13°15.2	13°17.4	12°39.0	0.1 - 0.1	6.1 - 5.4	12.1 - 10.8
2	13°15.5	13°17.7	12°39.3	0.2 - 0.2	6.2 - 5.5	12.2 - 10.9
3	13°15.7	13°17.9	12°39.5	0.3 - 0.3	6.3 - 5.6	12.3 - 11.0
4	13°16.0	13°18.2	12°39.7	0.4 - 0.4	6.4 - 5.7	12.4 - 11.1
5	13°16.3	13°18.4	12°40.0	0.5 - 0.4	6.5 - 5.8	12.5 - 11.1
6	13°16.5	13°18.7	12°40.2	0.6 - 0.5	6.6 - 5.9	12.6 - 11.2
7	13°16.8	13°18.9	12°40.5	0.7 - 0.6	6.7 - 6.0	12.7 - 11.3
8	13°17.0	13°19.2	12°40.7	0.8 - 0.7	6.8 - 6.1	12.8 - 11.4
9	13°17.2	13°19.4	12°40.9	0.9 - 0.8	6.9 - 6.2	12.9 - 11.5
10	13°17.5	13°19.7	12°41.2	1.0 - 0.9	7.0 - 6.2	13.0 - 11.6
11	13°17.7	13°19.9	12°41.4	1.1 - 1.0	7.1 - 6.3	13.1 - 11.7
12	13°18.0	13°20.2	12°41.6	1.2 - 1.1	7.2 - 6.4	13.2 - 11.8
13	13°18.3	13°20.4	12°41.9	1.3 - 1.2	7.3 - 6.5	13.3 - 11.9
14	13°18.5	13°20.7	12°42.1	1.4 - 1.2	7.4 - 6.6	13.4 - 11.9
15	13°18.8	13°20.9	12°42.4	1.5 - 1.3	7.5 - 6.7	13.5 - 12.0
16	13°19.0	13°21.2	12°42.6	1.6 - 1.4	7.6 - 6.8	13.6 - 12.1
17	13°19.2	13°21.4	12°42.8	1.7 - 1.5	7.7 - 6.9	13.7 - 12.2
18	13°19.5	13°21.7	12°43.1	1.8 - 1.6	7.8 - 7.0	13.8 - 12.3
19	13°19.8	13°21.9	12°43.3	1.9 - 1.7	7.9 - 7.0	13.9 - 12.4
20	13°20.0	13°22.2	12°43.6	2.0 - 1.8	8.0 - 7.1	14.0 - 12.5
21	13°20.3	13°22.4	12°43.8	2.1 - 1.9	8.1 - 7.2	14.1 - 12.6
22	13°20.5	13°22.7	12°44.0	2.2 - 2.0	8.2 - 7.3	14.2 - 12.7
23	13°20.7	13°22.9	12°44.3	2.3 - 2.1	8.3 - 7.4	14.3 - 12.8
24	13°21.0	13°23.2	12°44.5	2.4 - 2.1	8.4 - 7.5	14.4 - 12.8
25	13°21.2	13°23.4	12°44.7	2.5 - 2.2	8.5 - 7.6	14.5 - 12.9
26	13°21.5	13°23.7	12°45.0	2.6 - 2.3	8.6 - 7.7	14.6 - 13.0
27	13°21.8	13°23.9	12°45.2	2.7 - 2.4	8.7 - 7.8	14.7 - 13.1
28	13°22.0	13°24.2	12°45.5	2.8 - 2.5	8.8 - 7.8	14.8 - 13.2
29	13°22.3	13°24.4	12°45.7	2.9 - 2.6	8.9 - 7.9	14.9 - 13.3
30	13°22.5	13°24.7	12°45.9	3.0 - 2.7	9.0 - 8.0	15.0 - 13.4
31	13°22.7	13°24.9	12°46.2	3.1 - 2.8	9.1 - 8.1	15.1 - 13.5
32	13°23.0	13°25.2	12°46.4	3.2 - 2.9	9.2 - 8.2	15.2 - 13.6
33	13°23.2	13°25.4	12°46.7	3.3 - 2.9	9.3 - 8.3	15.3 - 13.6
34	13°23.5	13°25.7	12°46.9	3.4 - 3.0	9.4 - 8.4	15.4 - 13.7
35	13°23.8	13°25.9	12°47.1	3.5 - 3.1	9.5 - 8.5	15.5 - 13.8
36	13°24.0	13°26.2	12°47.4	3.6 - 3.2	9.6 - 8.6	15.6 - 13.9
37	13°24.3	13°26.4	12°47.6	3.7 - 3.3	9.7 - 8.6	15.7 - 14.0
38	13°24.5	13°26.7	12°47.9	3.8 - 3.4	9.8 - 8.7	15.8 - 14.1
39	13°24.7	13°26.9	12°48.1	3.9 - 3.5	9.9 - 8.8	15.9 - 14.2
40	13°25.0	13°27.2	12°48.3	4.0 - 3.6	10.0 - 8.9	16.0 - 14.3
41	13°25.2	13°27.5	12°48.6	4.1 - 3.7	10.1 - 9.0	16.1 - 14.4
42	13°25.5	13°27.7	12°48.8	4.2 - 3.7	10.2 - 9.1	16.2 - 14.4
43	13°25.8	13°28.0	12°49.0	4.3 - 3.8	10.3 - 9.2	16.3 - 14.5
44	13°26.0	13°28.2	12°49.3	4.4 - 3.9	10.4 - 9.3	16.4 - 14.6
45	13°26.3	13°28.5	12°49.5	4.5 - 4.0	10.5 - 9.4	16.5 - 14.7
46	13°26.5	13°28.7	12°49.8	4.6 - 4.1	10.6 - 9.5	16.6 - 14.8
47	13°26.7	13°29.0	12°50.0	4.7 - 4.2	10.7 - 9.5	16.7 - 14.9
48	13°27.0	13°29.2	12°50.2	4.8 - 4.3	10.8 - 9.6	16.8 - 15.0
49	13°27.3	13°29.5	12°50.5	4.9 - 4.4	10.9 - 9.7	16.9 - 15.1
50	13°27.5	13°29.7	12°50.7	5.0 - 4.5	11.0 - 9.8	17.0 - 15.2
51	13°27.8	13°30.0	12°51.0	5.1 - 4.5	11.1 - 9.9	17.1 - 15.2
52	13°28.0	13°30.2	12°51.2	5.2 - 4.6	11.2 - 10.0	17.2 - 15.3
53	13°28.2	13°30.5	12°51.4	5.3 - 4.7	11.3 - 10.1	17.3 - 15.4
54	13°28.5	13°30.7	12°51.7	5.4 - 4.8	11.4 - 10.2	17.4 - 15.5
55	13°28.7	13°31.0	12°51.9	5.5 - 4.9	11.5 - 10.3	17.5 - 15.6
56	13°29.0	13°31.2	12°52.1	5.6 - 5.0	11.6 - 10.3	17.6 - 15.7
57	13°29.3	13°31.5	12°52.4	5.7 - 5.1	11.7 - 10.4	17.7 - 15.8
58	13°29.5	13°31.7	12°52.6	5.8 - 5.2	11.8 - 10.5	17.8 - 15.9
59	13°29.8	13°32.0	12°52.9	5.9 - 5.3	11.9 - 10.6	17.9 - 16.0

Increments and Corrections

m 54	Sun Plan.	Aries	Moon	v and d corr		
0	13°30.0	13°32.2	12°53.1	0.0 - 0.0	6.0 - 5.5	12.0 - 10.9
1	13°30.2	13°32.5	12°53.3	0.1 - 0.1	6.1 - 5.5	12.1 - 11.0
2	13°30.5	13°32.7	12°53.6	0.2 - 0.2	6.2 - 5.6	12.2 - 11.1
3	13°30.7	13°33.0	12°53.8	0.3 - 0.3	6.3 - 5.7	12.3 - 11.2
4	13°31.0	13°33.2	12°54.1	0.4 - 0.4	6.4 - 5.8	12.4 - 11.3
5	13°31.3	13°33.5	12°54.3	0.5 - 0.5	6.5 - 5.9	12.5 - 11.4
6	13°31.5	13°33.7	12°54.5	0.6 - 0.5	6.6 - 6.0	12.6 - 11.4
7	13°31.8	13°34.0	12°54.8	0.7 - 0.6	6.7 - 6.1	12.7 - 11.5
8	13°32.0	13°34.2	12°55.0	0.8 - 0.7	6.8 - 6.2	12.8 - 11.6
9	13°32.2	13°34.5	12°55.2	0.9 - 0.8	6.9 - 6.3	12.9 - 11.7
10	13°32.5	13°34.7	12°55.5	1.0 - 0.9	7.0 - 6.4	13.0 - 11.8
11	13°32.7	13°35.0	12°55.7	1.1 - 1.0	7.1 - 6.4	13.1 - 11.9
12	13°33.0	13°35.2	12°56.0	1.2 - 1.1	7.2 - 6.5	13.2 - 12.0
13	13°33.3	13°35.5	12°56.2	1.3 - 1.2	7.3 - 6.6	13.3 - 12.1
14	13°33.5	13°35.7	12°56.4	1.4 - 1.3	7.4 - 6.7	13.4 - 12.2
15	13°33.8	13°36.0	12°56.7	1.5 - 1.4	7.5 - 6.8	13.5 - 12.3
16	13°34.0	13°36.2	12°56.9	1.6 - 1.5	7.6 - 6.9	13.6 - 12.4
17	13°34.2	13°36.5	12°57.2	1.7 - 1.5	7.7 - 7.0	13.7 - 12.4
18	13°34.5	13°36.7	12°57.4	1.8 - 1.6	7.8 - 7.1	13.8 - 12.5
19	13°34.8	13°37.0	12°57.6	1.9 - 1.7	7.9 - 7.2	13.9 - 12.6
20	13°35.0	13°37.2	12°57.9	2.0 - 1.8	8.0 - 7.3	14.0 - 12.7
21	13°35.3	13°37.5	12°58.1	2.1 - 1.9	8.1 - 7.4	14.1 - 12.8
22	13°35.5	13°37.7	12°58.3	2.2 - 2.0	8.2 - 7.4	14.2 - 12.9
23	13°35.7	13°38.0	12°58.6	2.3 - 2.1	8.3 - 7.5	14.3 - 13.0
24	13°36.0	13°38.2	12°58.8	2.4 - 2.2	8.4 - 7.6	14.4 - 13.1
25	13°36.2	13°38.5	12°59.1	2.5 - 2.3	8.5 - 7.7	14.5 - 13.2
26	13°36.5	13°38.7	12°59.3	2.6 - 2.4	8.6 - 7.8	14.6 - 13.3
27	13°36.8	13°39.0	12°59.5	2.7 - 2.5	8.7 - 7.9	14.7 - 13.4
28	13°37.0	13°39.2	12°59.8	2.8 - 2.5	8.8 - 8.0	14.8 - 13.4
29	13°37.3	13°39.5	13°00.0	2.9 - 2.6	8.9 - 8.1	14.9 - 13.5
30	13°37.5	13°39.7	13°00.3	3.0 - 2.7	9.0 - 8.2	15.0 - 13.6
31	13°37.7	13°40.0	13°00.5	3.1 - 2.8	9.1 - 8.3	15.1 - 13.7
32	13°38.0	13°40.2	13°00.7	3.2 - 2.9	9.2 - 8.4	15.2 - 13.8
33	13°38.2	13°40.5	13°01.0	3.3 - 3.0	9.3 - 8.4	15.3 - 13.9
34	13°38.5	13°40.7	13°01.2	3.4 - 3.1	9.4 - 8.5	15.4 - 14.0
35	13°38.8	13°41.0	13°01.5	3.5 - 3.2	9.5 - 8.6	15.5 - 14.1
36	13°39.0	13°41.2	13°01.7	3.6 - 3.3	9.6 - 8.7	15.6 - 14.2
37	13°39.3	13°41.5	13°01.9	3.7 - 3.4	9.7 - 8.8	15.7 - 14.3
38	13°39.5	13°41.7	13°02.2	3.8 - 3.5	9.8 - 8.9	15.8 - 14.4
39	13°39.7	13°42.0	13°02.4	3.9 - 3.5	9.9 - 9.0	15.9 - 14.4
40	13°40.0	13°42.2	13°02.6	4.0 - 3.6	10.0 - 9.1	16.0 - 14.5
41	13°40.2	13°42.5	13°02.9	4.1 - 3.7	10.1 - 9.2	16.1 - 14.6
42	13°40.5	13°42.7	13°03.1	4.2 - 3.8	10.2 - 9.3	16.2 - 14.7
43	13°40.8	13°43.0	13°03.4	4.3 - 3.9	10.3 - 9.4	16.3 - 14.8
44	13°41.0	13°43.2	13°03.6	4.4 - 4.0	10.4 - 9.4	16.4 - 14.9
45	13°41.3	13°43.5	13°03.8	4.5 - 4.1	10.5 - 9.5	16.5 - 15.0
46	13°41.5	13°43.7	13°04.1	4.6 - 4.2	10.6 - 9.6	16.6 - 15.1
47	13°41.7	13°44.0	13°04.3	4.7 - 4.3	10.7 - 9.7	16.7 - 15.2
48	13°42.0	13°44.2	13°04.6	4.8 - 4.4	10.8 - 9.8	16.8 - 15.3
49	13°42.3	13°44.5	13°04.8	4.9 - 4.5	10.9 - 9.9	16.9 - 15.4
50	13°42.5	13°44.7	13°05.0	5.0 - 4.5	11.0 - 10.0	17.0 - 15.4
51	13°42.8	13°45.0	13°05.3	5.1 - 4.6	11.1 - 10.1	17.1 - 15.5
52	13°43.0	13°45.2	13°05.5	5.2 - 4.7	11.2 - 10.2	17.2 - 15.6
53	13°43.2	13°45.5	13°05.7	5.3 - 4.8	11.3 - 10.3	17.3 - 15.7
54	13°43.5	13°45.8	13°06.0	5.4 - 4.9	11.4 - 10.4	17.4 - 15.8
55	13°43.7	13°46.0	13°06.2	5.5 - 5.0	11.5 - 10.4	17.5 - 15.9
56	13°44.0	13°46.3	13°06.5	5.6 - 5.1	11.6 - 10.5	17.6 - 16.0
57	13°44.3	13°46.5	13°06.7	5.7 - 5.2	11.7 - 10.6	17.7 - 16.1
58	13°44.5	13°46.8	13°06.9	5.8 - 5.3	11.8 - 10.7	17.8 - 16.2
59	13°44.8	13°47.0	13°07.2	5.9 - 5.4	11.9 - 10.8	17.9 - 16.3

m 55	Sun Plan.	Aries	Moon	v and d corr		
0	13°45.0	13°47.3	13°07.4	0.0 - 0.0	6.0 - 5.6	12.0 - 11.1
1	13°45.2	13°47.5	13°07.7	0.1 - 0.1	6.1 - 5.6	12.1 - 11.2
2	13°45.5	13°47.8	13°07.9	0.2 - 0.2	6.2 - 5.7	12.2 - 11.3
3	13°45.7	13°48.0	13°08.1	0.3 - 0.3	6.3 - 5.8	12.3 - 11.4
4	13°46.0	13°48.3	13°08.4	0.4 - 0.4	6.4 - 5.9	12.4 - 11.5
5	13°46.3	13°48.5	13°08.6	0.5 - 0.5	6.5 - 6.0	12.5 - 11.6
6	13°46.5	13°48.8	13°08.8	0.6 - 0.6	6.6 - 6.1	12.6 - 11.7
7	13°46.8	13°49.0	13°09.1	0.7 - 0.6	6.7 - 6.2	12.7 - 11.7
8	13°47.0	13°49.3	13°09.3	0.8 - 0.7	6.8 - 6.3	12.8 - 11.8
9	13°47.2	13°49.5	13°09.6	0.9 - 0.8	6.9 - 6.4	12.9 - 11.9
10	13°47.5	13°49.8	13°09.8	1.0 - 0.9	7.0 - 6.5	13.0 - 12.0
11	13°47.7	13°50.0	13°10.0	1.1 - 1.0	7.1 - 6.6	13.1 - 12.1
12	13°48.0	13°50.3	13°10.3	1.2 - 1.1	7.2 - 6.7	13.2 - 12.2
13	13°48.3	13°50.5	13°10.5	1.3 - 1.2	7.3 - 6.8	13.3 - 12.3
14	13°48.5	13°50.8	13°10.8	1.4 - 1.3	7.4 - 6.8	13.4 - 12.4
15	13°48.8	13°51.0	13°11.0	1.5 - 1.4	7.5 - 6.9	13.5 - 12.5
16	13°49.0	13°51.3	13°11.2	1.6 - 1.5	7.6 - 7.0	13.6 - 12.6
17	13°49.2	13°51.5	13°11.5	1.7 - 1.6	7.7 - 7.1	13.7 - 12.7
18	13°49.5	13°51.8	13°11.7	1.8 - 1.7	7.8 - 7.2	13.8 - 12.8
19	13°49.8	13°52.0	13°12.0	1.9 - 1.8	7.9 - 7.3	13.9 - 12.9
20	13°50.0	13°52.3	13°12.2	2.0 - 1.9	8.0 - 7.4	14.0 - 13.0
21	13°50.3	13°52.5	13°12.4	2.1 - 1.9	8.1 - 7.5	14.1 - 13.0
22	13°50.5	13°52.8	13°12.7	2.2 - 2.0	8.2 - 7.6	14.2 - 13.1
23	13°50.7	13°53.0	13°12.9	2.3 - 2.1	8.3 - 7.7	14.3 - 13.2
24	13°51.0	13°53.3	13°13.1	2.4 - 2.2	8.4 - 7.8	14.4 - 13.3
25	13°51.2	13°53.5	13°13.4	2.5 - 2.3	8.5 - 7.9	14.5 - 13.4
26	13°51.5	13°53.8	13°13.6	2.6 - 2.4	8.6 - 8.0	14.6 - 13.5
27	13°51.8	13°54.0	13°13.9	2.7 - 2.5	8.7 - 8.0	14.7 - 13.6
28	13°52.0	13°54.3	13°14.1	2.8 - 2.6	8.8 - 8.1	14.8 - 13.7
29	13°52.3	13°54.5	13°14.3	2.9 - 2.7	8.9 - 8.2	14.9 - 13.8
30	13°52.5	13°54.8	13°14.6	3.0 - 2.8	9.0 - 8.3	15.0 - 13.9
31	13°52.7	13°55.0	13°14.8	3.1 - 2.9	9.1 - 8.4	15.1 - 14.0
32	13°53.0	13°55.3	13°15.1	3.2 - 3.0	9.2 - 8.5	15.2 - 14.1
33	13°53.2	13°55.5	13°15.3	3.3 - 3.1	9.3 - 8.6	15.3 - 14.2
34	13°53.5	13°55.8	13°15.5	3.4 - 3.1	9.4 - 8.7	15.4 - 14.2
35	13°53.8	13°56.0	13°15.8	3.5 - 3.2	9.5 - 8.8	15.5 - 14.3
36	13°54.0	13°56.3	13°16.0	3.6 - 3.3	9.6 - 8.9	15.6 - 14.4
37	13°54.3	13°56.5	13°16.2	3.7 - 3.4	9.7 - 9.0	15.7 - 14.5
38	13°54.5	13°56.8	13°16.5	3.8 - 3.5	9.8 - 9.1	15.8 - 14.6
39	13°54.7	13°57.0	13°16.7	3.9 - 3.6	9.9 - 9.2	15.9 - 14.7
40	13°55.0	13°57.3	13°17.0	4.0 - 3.7	10.0 - 9.3	16.0 - 14.8
41	13°55.2	13°57.5	13°17.2	4.1 - 3.8	10.1 - 9.3	16.1 - 14.9
42	13°55.5	13°57.8	13°17.4	4.2 - 3.9	10.2 - 9.4	16.2 - 15.0
43	13°55.8	13°58.0	13°17.7	4.3 - 4.0	10.3 - 9.5	16.3 - 15.1
44	13°56.0	13°58.3	13°17.9	4.4 - 4.1	10.4 - 9.6	16.4 - 15.2
45	13°56.3	13°58.5	13°18.2	4.5 - 4.2	10.5 - 9.7	16.5 - 15.3
46	13°56.5	13°58.8	13°18.4	4.6 - 4.3	10.6 - 9.8	16.6 - 15.4
47	13°56.7	13°59.0	13°18.6	4.7 - 4.3	10.7 - 9.9	16.7 - 15.4
48	13°57.0	13°59.3	13°18.9	4.8 - 4.4	10.8 - 10.0	16.8 - 15.5
49	13°57.3	13°59.5	13°19.1	4.9 - 4.5	10.9 - 10.1	16.9 - 15.6
50	13°57.5	13°59.8	13°19.3	5.0 - 4.6	11.0 - 10.2	17.0 - 15.7
51	13°57.8	14°00.0	13°19.6	5.1 - 4.7	11.1 - 10.3	17.1 - 15.8
52	13°58.0	14°00.3	13°19.8	5.2 - 4.8	11.2 - 10.4	17.2 - 15.9
53	13°58.2	14°00.5	13°20.1	5.3 - 4.9	11.3 - 10.5	17.3 - 16.0
54	13°58.5	14°00.8	13°20.3	5.4 - 5.0	11.4 - 10.5	17.4 - 16.1
55	13°58.7	14°01.0	13°20.5	5.5 - 5.1	11.5 - 10.6	17.5 - 16.2
56	13°59.0	14°01.3	13°20.8	5.6 - 5.2	11.6 - 10.7	17.6 - 16.3
57	13°59.3	14°01.5	13°21.0	5.7 - 5.3	11.7 - 10.8	17.7 - 16.4
58	13°59.5	14°01.8	13°21.3	5.8 - 5.4	11.8 - 10.9	17.8 - 16.5
59	13°59.8	14°02.0	13°21.5	5.9 - 5.5	11.9 - 11.0	17.9 - 16.6

m 56	Sun Plan.	Aries	Moon	v and d corr		
0	14°00.0	14°02.3	13°21.7	0.0 - 0.0	6.0 - 5.7	12.0 - 11.3
1	14°00.2	14°02.5	13°22.0	0.1 - 0.1	6.1 - 5.7	12.1 - 11.4
2	14°00.5	14°02.8	13°22.2	0.2 - 0.2	6.2 - 5.8	12.2 - 11.5
3	14°00.7	14°03.0	13°22.4	0.3 - 0.3	6.3 - 5.9	12.3 - 11.6
4	14°01.0	14°03.3	13°22.7	0.4 - 0.4	6.4 - 6.0	12.4 - 11.7
5	14°01.3	14°03.5	13°22.9	0.5 - 0.5	6.5 - 6.1	12.5 - 11.8
6	14°01.5	14°03.8	13°23.2	0.6 - 0.6	6.6 - 6.2	12.6 - 11.9
7	14°01.8	14°04.1	13°23.4	0.7 - 0.7	6.7 - 6.3	12.7 - 12.0
8	14°02.0	14°04.3	13°23.6	0.8 - 0.8	6.8 - 6.4	12.8 - 12.1
9	14°02.2	14°04.6	13°23.9	0.9 - 0.8	6.9 - 6.5	12.9 - 12.1
10	14°02.5	14°04.8	13°24.1	1.0 - 0.9	7.0 - 6.6	13.0 - 12.2
11	14°02.7	14°05.1	13°24.4	1.1 - 1.0	7.1 - 6.7	13.1 - 12.3
12	14°03.0	14°05.3	13°24.6	1.2 - 1.1	7.2 - 6.8	13.2 - 12.4
13	14°03.3	14°05.6	13°24.8	1.3 - 1.2	7.3 - 6.9	13.3 - 12.5
14	14°03.5	14°05.8	13°25.1	1.4 - 1.3	7.4 - 7.0	13.4 - 12.6
15	14°03.8	14°06.1	13°25.3	1.5 - 1.4	7.5 - 7.1	13.5 - 12.7
16	14°04.0	14°06.3	13°25.6	1.6 - 1.5	7.6 - 7.2	13.6 - 12.8
17	14°04.2	14°06.6	13°25.8	1.7 - 1.6	7.7 - 7.3	13.7 - 12.9
18	14°04.5	14°06.8	13°26.0	1.8 - 1.7	7.8 - 7.3	13.8 - 13.0
19	14°04.8	14°07.1	13°26.3	1.9 - 1.8	7.9 - 7.4	13.9 - 13.1
20	14°05.0	14°07.3	13°26.5	2.0 - 1.9	8.0 - 7.5	14.0 - 13.2
21	14°05.3	14°07.6	13°26.7	2.1 - 2.0	8.1 - 7.6	14.1 - 13.3
22	14°05.5	14°07.8	13°27.0	2.2 - 2.1	8.2 - 7.7	14.2 - 13.4
23	14°05.7	14°08.1	13°27.2	2.3 - 2.2	8.3 - 7.8	14.3 - 13.5
24	14°06.0	14°08.3	13°27.5	2.4 - 2.3	8.4 - 7.9	14.4 - 13.6
25	14°06.2	14°08.6	13°27.7	2.5 - 2.4	8.5 - 8.0	14.5 - 13.7
26	14°06.5	14°08.8	13°27.9	2.6 - 2.4	8.6 - 8.1	14.6 - 13.7
27	14°06.8	14°09.1	13°28.2	2.7 - 2.5	8.7 - 8.2	14.7 - 13.8
28	14°07.0	14°09.3	13°28.4	2.8 - 2.6	8.8 - 8.3	14.8 - 13.9
29	14°07.3	14°09.6	13°28.7	2.9 - 2.7	8.9 - 8.4	14.9 - 14.0
30	14°07.5	14°09.8	13°28.9	3.0 - 2.8	9.0 - 8.5	15.0 - 14.1
31	14°07.7	14°10.1	13°29.1	3.1 - 2.9	9.1 - 8.6	15.1 - 14.2
32	14°08.0	14°10.3	13°29.4	3.2 - 3.0	9.2 - 8.7	15.2 - 14.3
33	14°08.2	14°10.6	13°29.6	3.3 - 3.1	9.3 - 8.8	15.3 - 14.4
34	14°08.5	14°10.8	13°29.8	3.4 - 3.2	9.4 - 8.9	15.4 - 14.5
35	14°08.8	14°11.1	13°30.1	3.5 - 3.3	9.5 - 8.9	15.5 - 14.6
36	14°09.0	14°11.3	13°30.3	3.6 - 3.4	9.6 - 9.0	15.6 - 14.7
37	14°09.3	14°11.6	13°30.6	3.7 - 3.5	9.7 - 9.1	15.7 - 14.8
38	14°09.5	14°11.8	13°30.8	3.8 - 3.6	9.8 - 9.2	15.8 - 14.9
39	14°09.7	14°12.1	13°31.0	3.9 - 3.7	9.9 - 9.3	15.9 - 15.0
40	14°10.0	14°12.3	13°31.3	4.0 - 3.8	10.0 - 9.4	16.0 - 15.1
41	14°10.2	14°12.6	13°31.5	4.1 - 3.9	10.1 - 9.5	16.1 - 15.2
42	14°10.5	14°12.8	13°31.8	4.2 - 4.0	10.2 - 9.6	16.2 - 15.3
43	14°10.8	14°13.1	13°32.0	4.3 - 4.0	10.3 - 9.7	16.3 - 15.3
44	14°11.0	14°13.3	13°32.2	4.4 - 4.1	10.4 - 9.8	16.4 - 15.4
45	14°11.3	14°13.6	13°32.5	4.5 - 4.2	10.5 - 9.9	16.5 - 15.5
46	14°11.5	14°13.8	13°32.7	4.6 - 4.3	10.6 - 10.0	16.6 - 15.6
47	14°11.7	14°14.1	13°32.9	4.7 - 4.4	10.7 - 10.1	16.7 - 15.7
48	14°12.0	14°14.3	13°33.2	4.8 - 4.5	10.8 - 10.2	16.8 - 15.8
49	14°12.3	14°14.6	13°33.4	4.9 - 4.6	10.9 - 10.3	16.9 - 15.9
50	14°12.5	14°14.8	13°33.7	5.0 - 4.7	11.0 - 10.4	17.0 - 16.0
51	14°12.8	14°15.1	13°33.9	5.1 - 4.8	11.1 - 10.5	17.1 - 16.1
52	14°13.0	14°15.3	13°34.1	5.2 - 4.9	11.2 - 10.5	17.2 - 16.2
53	14°13.2	14°15.6	13°34.4	5.3 - 5.0	11.3 - 10.6	17.3 - 16.3
54	14°13.5	14°15.8	13°34.6	5.4 - 5.1	11.4 - 10.7	17.4 - 16.4
55	14°13.7	14°16.1	13°34.9	5.5 - 5.2	11.5 - 10.8	17.5 - 16.5
56	14°14.0	14°16.3	13°35.1	5.6 - 5.3	11.6 - 10.9	17.6 - 16.6
57	14°14.3	14°16.6	13°35.3	5.7 - 5.4	11.7 - 11.0	17.7 - 16.7
58	14°14.5	14°16.8	13°35.6	5.8 - 5.5	11.8 - 11.1	17.8 - 16.8
59	14°14.8	14°17.1	13°35.8	5.9 - 5.6	11.9 - 11.2	17.9 - 16.9

Increments and Corrections

m	Sun	Aries	Moon	v and d corr		
57	Plan.					
0	14°15.0	14°17.3	13°36.0	0.0 - 0.0	6.0 - 5.8	12.0 - 11.5
1	14°15.2	14°17.6	13°36.3	0.1 - 0.1	6.1 - 5.8	12.1 - 11.6
2	14°15.5	14°17.8	13°36.5	0.2 - 0.2	6.2 - 5.9	12.2 - 11.7
3	14°15.7	14°18.1	13°36.8	0.3 - 0.3	6.3 - 6.0	12.3 - 11.8
4	14°16.0	14°18.3	13°37.0	0.4 - 0.4	6.4 - 6.1	12.4 - 11.9
5	14°16.3	14°18.6	13°37.2	0.5 - 0.5	6.5 - 6.2	12.5 - 12.0
6	14°16.5	14°18.8	13°37.5	0.6 - 0.6	6.6 - 6.3	12.6 - 12.1
7	14°16.8	14°19.1	13°37.7	0.7 - 0.7	6.7 - 6.4	12.7 - 12.2
8	14°17.0	14°19.3	13°38.0	0.8 - 0.8	6.8 - 6.5	12.8 - 12.3
9	14°17.2	14°19.6	13°38.2	0.9 - 0.9	6.9 - 6.6	12.9 - 12.4
10	14°17.5	14°19.8	13°38.4	1.0 - 1.0	7.0 - 6.7	13.0 - 12.5
11	14°17.7	14°20.1	13°38.7	1.1 - 1.1	7.1 - 6.8	13.1 - 12.6
12	14°18.0	14°20.3	13°38.9	1.2 - 1.2	7.2 - 6.9	13.2 - 12.7
13	14°18.3	14°20.6	13°39.2	1.3 - 1.2	7.3 - 7.0	13.3 - 12.7
14	14°18.5	14°20.8	13°39.4	1.4 - 1.3	7.4 - 7.1	13.4 - 12.8
15	14°18.8	14°21.1	13°39.6	1.5 - 1.4	7.5 - 7.2	13.5 - 12.9
16	14°19.0	14°21.3	13°39.9	1.6 - 1.5	7.6 - 7.3	13.6 - 13.0
17	14°19.2	14°21.6	13°40.1	1.7 - 1.6	7.7 - 7.4	13.7 - 13.1
18	14°19.5	14°21.8	13°40.3	1.8 - 1.7	7.8 - 7.5	13.8 - 13.2
19	14°19.8	14°22.1	13°40.6	1.9 - 1.8	7.9 - 7.6	13.9 - 13.3
20	14°20.0	14°22.4	13°40.8	2.0 - 1.9	8.0 - 7.7	14.0 - 13.4
21	14°20.3	14°22.6	13°41.1	2.1 - 2.0	8.1 - 7.8	14.1 - 13.5
22	14°20.5	14°22.9	13°41.3	2.2 - 2.1	8.2 - 7.9	14.2 - 13.6
23	14°20.7	14°23.1	13°41.5	2.3 - 2.2	8.3 - 8.0	14.3 - 13.7
24	14°21.0	14°23.4	13°41.8	2.4 - 2.3	8.4 - 8.1	14.4 - 13.8
25	14°21.2	14°23.6	13°42.0	2.5 - 2.4	8.5 - 8.1	14.5 - 13.9
26	14°21.5	14°23.9	13°42.3	2.6 - 2.5	8.6 - 8.2	14.6 - 14.0
27	14°21.8	14°24.1	13°42.5	2.7 - 2.6	8.7 - 8.3	14.7 - 14.1
28	14°22.0	14°24.4	13°42.7	2.8 - 2.7	8.8 - 8.4	14.8 - 14.2
29	14°22.3	14°24.6	13°43.0	2.9 - 2.8	8.9 - 8.5	14.9 - 14.3
30	14°22.5	14°24.9	13°43.2	3.0 - 2.9	9.0 - 8.6	15.0 - 14.4
31	14°22.7	14°25.1	13°43.4	3.1 - 3.0	9.1 - 8.7	15.1 - 14.5
32	14°23.0	14°25.4	13°43.7	3.2 - 3.1	9.2 - 8.8	15.2 - 14.6
33	14°23.2	14°25.6	13°43.9	3.3 - 3.2	9.3 - 8.9	15.3 - 14.7
34	14°23.5	14°25.9	13°44.2	3.4 - 3.3	9.4 - 9.0	15.4 - 14.8
35	14°23.8	14°26.1	13°44.4	3.5 - 3.4	9.5 - 9.1	15.5 - 14.9
36	14°24.0	14°26.4	13°44.6	3.6 - 3.5	9.6 - 9.2	15.6 - 15.0
37	14°24.3	14°26.6	13°44.9	3.7 - 3.5	9.7 - 9.3	15.7 - 15.0
38	14°24.5	14°26.9	13°45.1	3.8 - 3.6	9.8 - 9.4	15.8 - 15.1
39	14°24.7	14°27.1	13°45.4	3.9 - 3.7	9.9 - 9.5	15.9 - 15.2
40	14°25.0	14°27.4	13°45.6	4.0 - 3.8	10.0 - 9.6	16.0 - 15.3
41	14°25.2	14°27.6	13°45.8	4.1 - 3.9	10.1 - 9.7	16.1 - 15.4
42	14°25.5	14°27.9	13°46.1	4.2 - 4.0	10.2 - 9.8	16.2 - 15.5
43	14°25.8	14°28.1	13°46.3	4.3 - 4.1	10.3 - 9.9	16.3 - 15.6
44	14°26.0	14°28.4	13°46.5	4.4 - 4.2	10.4 - 10.0	16.4 - 15.7
45	14°26.3	14°28.6	13°46.8	4.5 - 4.3	10.5 - 10.1	16.5 - 15.8
46	14°26.5	14°28.9	13°47.0	4.6 - 4.4	10.6 - 10.2	16.6 - 15.9
47	14°26.7	14°29.1	13°47.3	4.7 - 4.5	10.7 - 10.3	16.7 - 16.0
48	14°27.0	14°29.4	13°47.5	4.8 - 4.6	10.8 - 10.4	16.8 - 16.1
49	14°27.3	14°29.6	13°47.7	4.9 - 4.7	10.9 - 10.4	16.9 - 16.2
50	14°27.5	14°29.9	13°48.0	5.0 - 4.8	11.0 - 10.5	17.0 - 16.3
51	14°27.8	14°30.1	13°48.2	5.1 - 4.9	11.1 - 10.6	17.1 - 16.4
52	14°28.0	14°30.4	13°48.5	5.2 - 5.0	11.2 - 10.7	17.2 - 16.5
53	14°28.2	14°30.6	13°48.7	5.3 - 5.1	11.3 - 10.8	17.3 - 16.6
54	14°28.5	14°30.9	13°48.9	5.4 - 5.2	11.4 - 10.9	17.4 - 16.7
55	14°28.7	14°31.1	13°49.2	5.5 - 5.3	11.5 - 11.0	17.5 - 16.8
56	14°29.0	14°31.4	13°49.4	5.6 - 5.4	11.6 - 11.1	17.6 - 16.9
57	14°29.3	14°31.6	13°49.7	5.7 - 5.5	11.7 - 11.2	17.7 - 17.0
58	14°29.5	14°31.9	13°49.9	5.8 - 5.6	11.8 - 11.3	17.8 - 17.1
59	14°29.8	14°32.1	13°50.1	5.9 - 5.7	11.9 - 11.4	17.9 - 17.2

m	Sun	Aries	Moon	v and d corr		
58	Plan.					
0	14°30.0	14°32.4	13°50.4	0.0 - 0.0	6.0 - 5.8	12.0 - 11.7
1	14°30.2	14°32.6	13°50.6	0.1 - 0.1	6.1 - 5.9	12.1 - 11.8
2	14°30.5	14°32.9	13°50.8	0.2 - 0.2	6.2 - 6.0	12.2 - 11.9
3	14°30.7	14°33.1	13°51.1	0.3 - 0.3	6.3 - 6.1	12.3 - 12.0
4	14°31.0	14°33.4	13°51.3	0.4 - 0.4	6.4 - 6.2	12.4 - 12.1
5	14°31.3	14°33.6	13°51.6	0.5 - 0.5	6.5 - 6.3	12.5 - 12.2
6	14°31.5	14°33.9	13°51.8	0.6 - 0.6	6.6 - 6.4	12.6 - 12.3
7	14°31.8	14°34.1	13°52.0	0.7 - 0.7	6.7 - 6.5	12.7 - 12.4
8	14°32.0	14°34.4	13°52.3	0.8 - 0.8	6.8 - 6.6	12.8 - 12.5
9	14°32.2	14°34.6	13°52.5	0.9 - 0.9	6.9 - 6.7	12.9 - 12.6
10	14°32.5	14°34.9	13°52.8	1.0 - 1.0	7.0 - 6.8	13.0 - 12.7
11	14°32.7	14°35.1	13°53.0	1.1 - 1.1	7.1 - 6.9	13.1 - 12.8
12	14°33.0	14°35.4	13°53.2	1.2 - 1.2	7.2 - 7.0	13.2 - 12.9
13	14°33.3	14°35.6	13°53.5	1.3 - 1.3	7.3 - 7.1	13.3 - 13.0
14	14°33.5	14°35.9	13°53.7	1.4 - 1.4	7.4 - 7.2	13.4 - 13.1
15	14°33.8	14°36.1	13°53.9	1.5 - 1.5	7.5 - 7.3	13.5 - 13.2
16	14°34.0	14°36.4	13°54.2	1.6 - 1.6	7.6 - 7.4	13.6 - 13.3
17	14°34.2	14°36.6	13°54.4	1.7 - 1.7	7.7 - 7.5	13.7 - 13.4
18	14°34.5	14°36.9	13°54.7	1.8 - 1.8	7.8 - 7.6	13.8 - 13.5
19	14°34.8	14°37.1	13°54.9	1.9 - 1.9	7.9 - 7.7	13.9 - 13.6
20	14°35.0	14°37.4	13°55.1	2.0 - 1.9	8.0 - 7.8	14.0 - 13.7
21	14°35.3	14°37.6	13°55.4	2.1 - 2.0	8.1 - 7.9	14.1 - 13.7
22	14°35.5	14°37.9	13°55.6	2.2 - 2.1	8.2 - 8.0	14.2 - 13.8
23	14°35.7	14°38.1	13°55.9	2.3 - 2.2	8.3 - 8.1	14.3 - 13.9
24	14°36.0	14°38.4	13°56.1	2.4 - 2.3	8.4 - 8.2	14.4 - 14.0
25	14°36.2	14°38.6	13°56.3	2.5 - 2.4	8.5 - 8.3	14.5 - 14.1
26	14°36.5	14°38.9	13°56.6	2.6 - 2.5	8.6 - 8.4	14.6 - 14.2
27	14°36.8	14°39.1	13°56.8	2.7 - 2.6	8.7 - 8.5	14.7 - 14.3
28	14°37.0	14°39.4	13°57.0	2.8 - 2.7	8.8 - 8.6	14.8 - 14.4
29	14°37.3	14°39.6	13°57.3	2.9 - 2.8	8.9 - 8.7	14.9 - 14.5
30	14°37.5	14°39.9	13°57.5	3.0 - 2.9	9.0 - 8.8	15.0 - 14.6
31	14°37.7	14°40.1	13°57.8	3.1 - 3.0	9.1 - 8.9	15.1 - 14.7
32	14°38.0	14°40.4	13°58.0	3.2 - 3.1	9.2 - 9.0	15.2 - 14.8
33	14°38.2	14°40.7	13°58.2	3.3 - 3.2	9.3 - 9.1	15.3 - 14.9
34	14°38.5	14°40.9	13°58.5	3.4 - 3.3	9.4 - 9.2	15.4 - 15.0
35	14°38.8	14°41.2	13°58.7	3.5 - 3.4	9.5 - 9.3	15.5 - 15.1
36	14°39.0	14°41.4	13°59.0	3.6 - 3.5	9.6 - 9.4	15.6 - 15.2
37	14°39.3	14°41.7	13°59.2	3.7 - 3.6	9.7 - 9.5	15.7 - 15.3
38	14°39.5	14°41.9	13°59.4	3.8 - 3.7	9.8 - 9.6	15.8 - 15.4
39	14°39.7	14°42.2	13°59.7	3.9 - 3.8	9.9 - 9.7	15.9 - 15.5
40	14°40.0	14°42.4	13°59.9	4.0 - 3.9	10.0 - 9.8	16.0 - 15.6
41	14°40.2	14°42.7	14°00.1	4.1 - 4.0	10.1 - 9.8	16.1 - 15.7
42	14°40.5	14°42.9	14°00.4	4.2 - 4.1	10.2 - 9.9	16.2 - 15.8
43	14°40.8	14°43.2	14°00.6	4.3 - 4.2	10.3 - 10.0	16.3 - 15.9
44	14°41.0	14°43.4	14°00.9	4.4 - 4.3	10.4 - 10.1	16.4 - 16.0
45	14°41.3	14°43.7	14°01.1	4.5 - 4.4	10.5 - 10.2	16.5 - 16.1
46	14°41.5	14°43.9	14°01.3	4.6 - 4.5	10.6 - 10.3	16.6 - 16.2
47	14°41.7	14°44.2	14°01.6	4.7 - 4.6	10.7 - 10.4	16.7 - 16.3
48	14°42.0	14°44.4	14°01.8	4.8 - 4.7	10.8 - 10.5	16.8 - 16.4
49	14°42.3	14°44.7	14°02.1	4.9 - 4.8	10.9 - 10.6	16.9 - 16.5
50	14°42.5	14°44.9	14°02.3	5.0 - 4.9	11.0 - 10.7	17.0 - 16.6
51	14°42.8	14°45.2	14°02.5	5.1 - 5.0	11.1 - 10.8	17.1 - 16.7
52	14°43.0	14°45.4	14°02.8	5.2 - 5.1	11.2 - 10.9	17.2 - 16.8
53	14°43.2	14°45.7	14°03.0	5.3 - 5.2	11.3 - 11.0	17.3 - 16.9
54	14°43.5	14°45.9	14°03.3	5.4 - 5.3	11.4 - 11.1	17.4 - 17.0
55	14°43.7	14°46.2	14°03.5	5.5 - 5.4	11.5 - 11.2	17.5 - 17.1
56	14°44.0	14°46.4	14°03.7	5.6 - 5.5	11.6 - 11.3	17.6 - 17.2
57	14°44.3	14°46.7	14°04.0	5.7 - 5.6	11.7 - 11.4	17.7 - 17.3
58	14°44.5	14°46.9	14°04.2	5.8 - 5.7	11.8 - 11.5	17.8 - 17.4
59	14°44.8	14°47.2	14°04.4	5.9 - 5.8	11.9 - 11.6	17.9 - 17.5

m	Sun	Aries	Moon	v and d corr		
59	Plan.					
0	14°45.0	14°47.4	14°04.7	0.0 - 0.0	6.0 - 6.0	12.0 - 11.9
1	14°45.2	14°47.7	14°04.9	0.1 - 0.1	6.1 - 6.0	12.1 - 12.0
2	14°45.5	14°47.9	14°05.2	0.2 - 0.2	6.2 - 6.1	12.2 - 12.1
3	14°45.7	14°48.2	14°05.4	0.3 - 0.3	6.3 - 6.2	12.3 - 12.2
4	14°46.0	14°48.4	14°05.6	0.4 - 0.4	6.4 - 6.3	12.4 - 12.3
5	14°46.3	14°48.7	14°05.9	0.5 - 0.5	6.5 - 6.4	12.5 - 12.4
6	14°46.5	14°48.9	14°06.1	0.6 - 0.6	6.6 - 6.5	12.6 - 12.5
7	14°46.8	14°49.2	14°06.4	0.7 - 0.7	6.7 - 6.6	12.7 - 12.6
8	14°47.0	14°49.4	14°06.6	0.8 - 0.8	6.8 - 6.7	12.8 - 12.7
9	14°47.2	14°49.7	14°06.8	0.9 - 0.9	6.9 - 6.8	12.9 - 12.8
10	14°47.5	14°49.9	14°07.1	1.0 - 1.0	7.0 - 6.9	13.0 - 12.9
11	14°47.7	14°50.2	14°07.3	1.1 - 1.1	7.1 - 7.0	13.1 - 13.0
12	14°48.0	14°50.4	14°07.5	1.2 - 1.2	7.2 - 7.1	13.2 - 13.1
13	14°48.3	14°50.7	14°07.8	1.3 - 1.3	7.3 - 7.2	13.3 - 13.2
14	14°48.5	14°50.9	14°08.0	1.4 - 1.4	7.4 - 7.3	13.4 - 13.3
15	14°48.8	14°51.2	14°08.3	1.5 - 1.5	7.5 - 7.4	13.5 - 13.4
16	14°49.0	14°51.4	14°08.5	1.6 - 1.6	7.6 - 7.5	13.6 - 13.5
17	14°49.2	14°51.7	14°08.7	1.7 - 1.7	7.7 - 7.6	13.7 - 13.6
18	14°49.5	14°51.9	14°09.0	1.8 - 1.8	7.8 - 7.7	13.8 - 13.7
19	14°49.8	14°52.2	14°09.2	1.9 - 1.9	7.9 - 7.8	13.9 - 13.8
20	14°50.0	14°52.4	14°09.5	2.0 - 2.0	8.0 - 7.9	14.0 - 13.9
21	14°50.3	14°52.7	14°09.7	2.1 - 2.1	8.1 - 8.0	14.1 - 14.0
22	14°50.5	14°52.9	14°09.9	2.2 - 2.2	8.2 - 8.1	14.2 - 14.1
23	14°50.7	14°53.2	14°10.2	2.3 - 2.3	8.3 - 8.2	14.3 - 14.2
24	14°51.0	14°53.4	14°10.4	2.4 - 2.4	8.4 - 8.3	14.4 - 14.3
25	14°51.2	14°53.7	14°10.6	2.5 - 2.5	8.5 - 8.4	14.5 - 14.4
26	14°51.5	14°53.9	14°10.9	2.6 - 2.6	8.6 - 8.5	14.6 - 14.5
27	14°51.8	14°54.2	14°11.1	2.7 - 2.7	8.7 - 8.6	14.7 - 14.6
28	14°52.0	14°54.4	14°11.4	2.8 - 2.8	8.8 - 8.7	14.8 - 14.7
29	14°52.3	14°54.7	14°11.6	2.9 - 2.9	8.9 - 8.8	14.9 - 14.8
30	14°52.5	14°54.9	14°11.8	3.0 - 3.0	9.0 - 8.9	15.0 - 14.9
31	14°52.7	14°55.2	14°12.1	3.1 - 3.1	9.1 - 9.0	15.1 - 15.0
32	14°53.0	14°55.4	14°12.3	3.2 - 3.2	9.2 - 9.1	15.2 - 15.1
33	14°53.2	14°55.7	14°12.6	3.3 - 3.3	9.3 - 9.2	15.3 - 15.2
34	14°53.5	14°55.9	14°12.8	3.4 - 3.4	9.4 - 9.3	15.4 - 15.3
35	14°53.8	14°56.2	14°13.0	3.5 - 3.5	9.5 - 9.4	15.5 - 15.4
36	14°54.0	14°56.4	14°13.3	3.6 - 3.6	9.6 - 9.5	15.6 - 15.5
37	14°54.3	14°56.7	14°13.5	3.7 - 3.7	9.7 - 9.6	15.7 - 15.6
38	14°54.5	14°56.9	14°13.8	3.8 - 3.8	9.8 - 9.7	15.8 - 15.7
39	14°54.7	14°57.2	14°14.0	3.9 - 3.9	9.9 - 9.8	15.9 - 15.8
40	14°55.0	14°57.4	14°14.2	4.0 - 4.0	10.0 - 9.9	16.0 - 15.9
41	14°55.2	14°57.7	14°14.5	4.1 - 4.1	10.1 - 10.0	16.1 - 16.0
42	14°55.5	14°57.9	14°14.7	4.2 - 4.2	10.2 - 10.1	16.2 - 16.1
43	14°55.8	14°58.2	14°14.9	4.3 - 4.3	10.3 - 10.2	16.3 - 16.2
44	14°56.0	14°58.4	14°15.2	4.4 - 4.4	10.4 - 10.3	16.4 - 16.3
45	14°56.3	14°58.7	14°15.4	4.5 - 4.5	10.5 - 10.4	16.5 - 16.4
46	14°56.5	14°59.0	14°15.7	4.6 - 4.6	10.6 - 10.5	16.6 - 16.5
47	14°56.7	14°59.2	14°15.9	4.7 - 4.7	10.7 - 10.6	16.7 - 16.6
48	14°57.0	14°59.5	14°16.1	4.8 - 4.8	10.8 - 10.7	16.8 - 16.7
49	14°57.3	14°59.7	14°16.4	4.9 - 4.9	10.9 - 10.8	16.9 - 16.8
50	14°57.5	15°00.0	14°16.6	5.0 - 5.0	11.0 - 10.9	17.0 - 16.9
51	14°57.8	15°00.2	14°16.9	5.1 - 5.1	11.1 - 11.0	17.1 - 17.0
52	14°58.0	15°00.5	14°17.1	5.2 - 5.2	11.2 - 11.1	17.2 - 17.1
53	14°58.2	15°00.7	14°17.3	5.3 - 5.3	11.3 - 11.2	17.3 - 17.2
54	14°58.5	15°01.0	14°17.6	5.4 - 5.4	11.4 - 11.3	17.4 - 17.3
55	14°58.7	15°01.2	14°17.8	5.5 - 5.5	11.5 - 11.4	17.5 - 17.4
56	14°59.0	15°01.5	14°18.0	5.6 - 5.6	11.6 - 11.5	17.6 - 17.5
57	14°59.3	15°01.7	14°18.3	5.7 - 5.7	11.7 - 11.6	17.7 - 17.6
58	14°59.5	15°02.0	14°18.5	5.8 - 5.8	11.8 - 11.7	17.8 - 17.7
59	14°59.8	15°02.2	14°18.8	5.9 - 5.9	11.9 - 11.8	17.9 - 17.8

Conversion of Arc to Time

0° - 59°		
°	h	m
0	0	00
1	0	04
2	0	08
3	0	12
4	0	16
5	0	20
6	0	24
7	0	28
8	0	32
9	0	36
10	0	40
11	0	44
12	0	48
13	0	52
14	0	56
15	1	00
16	1	04
17	1	08
18	1	12
19	1	16
20	1	20
21	1	24
22	1	28
23	1	32
24	1	36
25	1	40
26	1	44
27	1	48
28	1	52
29	1	56
30	2	00
31	2	04
32	2	08
33	2	12
34	2	16
35	2	20
36	2	24
37	2	28
38	2	32
39	2	36
40	2	40
41	2	44
42	2	48
43	2	52
44	2	56
45	3	00
46	3	04
47	3	08
48	3	12
49	3	16
50	3	20
51	3	24
52	3	28
53	3	32
54	3	36
55	3	40
56	3	44
57	3	48
58	3	52
59	3	56
60	4	00

60° - 119°		
°	h	m
60	4	00
61	4	04
62	4	08
63	4	12
64	4	16
65	4	20
66	4	24
67	4	28
68	4	32
69	4	36
70	4	40
71	4	44
72	4	48
73	4	52
74	4	56
75	5	00
76	5	04
77	5	08
78	5	12
79	5	16
80	5	20
81	5	24
82	5	28
83	5	32
84	5	36
85	5	40
86	5	44
87	5	48
88	5	52
89	5	56
90	6	00
91	6	04
92	6	08
93	6	12
94	6	16
95	6	20
96	6	24
97	6	28
98	6	32
99	6	36
100	6	40
101	6	44
102	6	48
103	6	52
104	6	56
105	7	00
106	7	04
107	7	08
108	7	12
109	7	16
110	7	20
111	7	24
112	7	28
113	7	32
114	7	36
115	7	40
116	7	44
117	7	48
118	7	52
119	7	56
120	8	00

120° - 179°		
°	h	m
120	8	00
121	8	04
122	8	08
123	8	12
124	8	16
125	8	20
126	8	24
127	8	28
128	8	32
129	8	36
130	8	40
131	8	44
132	8	48
133	8	52
134	8	56
135	9	00
136	9	04
137	9	08
138	9	12
139	9	16
140	9	20
141	9	24
142	9	28
143	9	32
144	9	36
145	9	40
146	9	44
147	9	48
148	9	52
149	9	56
150	10	00
151	10	04
152	10	08
153	10	12
154	10	16
155	10	20
156	10	24
157	10	28
158	10	32
159	10	36
160	10	40
161	10	44
162	10	48
163	10	52
164	10	56
165	11	00
166	11	04
167	11	08
168	11	12
169	11	16
170	11	20
171	11	24
172	11	28
173	11	32
174	11	36
175	11	40
176	11	44
177	11	48
178	11	52
179	11	56
180	12	00

180° - 239°		
°	h	m
180	12	00
181	12	04
182	12	08
183	12	12
184	12	16
185	12	20
186	12	24
187	12	28
188	12	32
189	12	36
190	12	40
191	12	44
192	12	48
193	12	52
194	12	56
195	13	00
196	13	04
197	13	08
198	13	12
199	13	16
200	13	20
201	13	24
202	13	28
203	13	32
204	13	36
205	13	40
206	13	44
207	13	48
208	13	52
209	13	56
210	14	00
211	14	04
212	14	08
213	14	12
214	14	16
215	14	20
216	14	24
217	14	28
218	14	32
219	14	36
220	14	40
221	14	44
222	14	48
223	14	52
224	14	56
225	15	00
226	15	04
227	15	08
228	15	12
229	15	16
230	15	20
231	15	24
232	15	28
233	15	32
234	15	36
235	15	40
236	15	44
237	15	48
238	15	52
239	15	56
240	16	00

240° - 299°		
°	h	m
240	16	00
241	16	04
242	16	08
243	16	12
244	16	16
245	16	20
246	16	24
247	16	28
248	16	32
249	16	36
250	16	40
251	16	44
252	16	48
253	16	52
254	16	56
255	17	00
256	17	04
257	17	08
258	17	12
259	17	16
260	17	20
261	17	24
262	17	28
263	17	32
264	17	36
265	17	40
266	17	44
267	17	48
268	17	52
269	17	56
270	18	00
271	18	04
272	18	08
273	18	12
274	18	16
275	18	20
276	18	24
277	18	28
278	18	32
279	18	36
280	18	40
281	18	44
282	18	48
283	18	52
284	18	56
285	19	00
286	19	04
287	19	08
288	19	12
289	19	16
290	19	20
291	19	24
292	19	28
293	19	32
294	19	36
295	19	40
296	19	44
297	19	48
298	19	52
299	19	56
300	20	00

300° - 360°		
°	h	m
300	20	00
301	20	04
302	20	08
303	20	12
304	20	16
305	20	20
306	20	24
307	20	28
308	20	32
309	20	36
310	20	40
311	20	44
312	20	48
313	20	52
314	20	56
315	21	00
316	21	04
317	21	08
318	21	12
319	21	16
320	21	20
321	21	24
322	21	28
323	21	32
324	21	36
325	21	40
326	21	44
327	21	48
328	21	52
329	21	56
330	22	00
331	22	04
332	22	08
333	22	12
334	22	16
335	22	20
336	22	24
337	22	28
338	22	32
339	22	36
340	22	40
341	22	44
342	22	48
343	22	52
344	22	56
345	23	00
346	23	04
347	23	08
348	23	12
349	23	16
350	23	20
351	23	24
352	23	28
353	23	32
354	23	36
355	23	40
356	23	44
357	23	48
358	23	52
359	23	56
360	24	00

0′ - 59′		
′	m	s
0	0	00
1	0	04
2	0	08
3	0	12
4	0	16
5	0	20
6	0	24
7	0	28
8	0	32
9	0	36
10	0	40
11	0	44
12	0	48
13	0	52
14	0	56
15	1	00
16	1	04
17	1	08
18	1	12
19	1	16
20	1	20
21	1	24
22	1	28
23	1	32
24	1	36
25	1	40
26	1	44
27	1	48
28	1	52
29	1	56
30	2	00
31	2	04
32	2	08
33	2	12
34	2	16
35	2	20
36	2	24
37	2	28
38	2	32
39	2	36
40	2	40
41	2	44
42	2	48
43	2	52
44	2	56
45	3	00
46	3	04
47	3	08
48	3	12
49	3	16
50	3	20
51	3	24
52	3	28
53	3	32
54	3	36
55	3	40
56	3	44
57	3	48
58	3	52
59	3	56
60	4	00

0″ - 59″	
″	s
0	0.00
1	0.07
2	0.13
3	0.20
4	0.27
5	0.33
6	0.40
7	0.47
8	0.53
9	0.60
10	0.67
11	0.73
12	0.80
13	0.87
14	0.93
15	1.00
16	1.07
17	1.13
18	1.20
19	1.27
20	1.33
21	1.40
22	1.47
23	1.53
24	1.60
25	1.67
26	1.73
27	1.80
28	1.87
29	1.93
30	2.00
31	2.07
32	2.13
33	2.20
34	2.27
35	2.33
36	2.40
37	2.47
38	2.53
39	2.60
40	2.67
41	2.73
42	2.80
43	2.87
44	2.93
45	3.00
46	3.07
47	3.13
48	3.20
49	3.27
50	3.33
51	3.40
52	3.47
53	3.53
54	3.60
55	3.67
56	3.73
57	3.80
58	3.87
59	3.93
60	4.00

h= hours of time **m**= minutes of time **s** = seconds of time **′** = minutes of arc **″** = seconds of arc

Altitude Correction Tables for 10° to 90° — Sun, Stars, Planets

SUN
October – March

App. Alt.	Lower Limb	Upper Limb
° ′	′	′
9 33	+10.8	– 21.5
9 45	+10.9	– 21.4
9 56	+11.0	– 21.3
10 08	+11.1	– 21.2
10 20	+11.2	– 21.1
10 33	+11.3	– 21.0
10 46	+11.4	– 20.9
11 00	+11.5	– 20.8
11 15	+11.6	– 20.7
11 30	+11.7	– 20.6
11 45	+11.8	– 20.5
12 01	+11.9	– 20.4
12 18	+12.0	– 20.3
12 36	+12.1	– 20.2
12 54	+12.2	– 20.1
13 14	+12.3	– 20.0
13 34	+12.4	– 19.9
13 55	+12.5	– 19.8
14 17	+12.6	– 19.7
14 41	+12.7	– 19.6
15 05	+12.8	– 19.5
15 31	+12.9	– 19.4
15 59	+13.0	– 19.3
16 27	+13.1	– 19.2
16 58	+13.2	– 19.1
17 30	+13.3	– 19.0
18 05	+13.4	– 18.9
18 41	+13.5	– 18.8
19 20	+13.6	– 18.7
20 02	+13.7	– 18.6
20 46	+13.8	– 18.5
21 34	+13.9	– 18.4
22 25	+14.0	– 18.3
23 20	+14.1	– 18.2
24 20	+14.2	– 18.1
25 24	+14.3	– 18.0
26 34	+14.4	– 17.9
27 50	+14.5	– 17.8
29 13	+14.6	– 17.7
30 44	+14.7	– 17.6
32 24	+14.8	– 17.5
34 15	+14.9	– 17.4
36 17	+15.0	– 17.3
38 34	+15.1	– 17.2
41 06	+15.2	– 17.1
43 56	+15.3	– 17.0
47 07	+15.4	– 16.9
50 43	+15.5	– 16.8
54 46	+15.6	– 16.7
59 21	+15.7	– 16.6
64 28	+15.8	– 16.5
70 10	+15.9	– 16.4
76 24	+16.0	– 16.3
83 05	+16.1	– 16.2
90 00		

SUN
April – September

App. Alt.	Lower Limb	Upper Limb
° ′	′	′
9 39	+10.6	– 21.2
9 50	+10.7	– 21.1
10 02	+10.8	– 21.0
10 14	+10.9	– 20.9
10 27	+11.0	– 20.8
10 40	+11.1	– 20.7
10 53	+11.2	– 20.6
11 07	+11.3	– 20.5
11 22	+11.4	– 20.4
11 37	+11.5	– 20.3
11 53	+11.6	– 20.2
12 10	+11.7	– 20.1
12 27	+11.8	– 20.0
14 45	+11.9	– 19.9
13 04	+12.0	– 19.8
13 24	+12.1	– 19.7
13 44	+12.2	– 19.6
14 06	+12.3	– 19.5
14 29	+12.4	– 19.4
14 53	+12.5	– 19.3
15 18	+12.6	– 19.2
15 45	+12.7	– 19.1
16 13	+12.8	– 19.0
16 43	+12.9	– 18.9
17 14	+13.0	– 18.8
17 47	+13.1	– 18.7
18 23	+13.2	– 18.6
19 00	+13.3	– 18.5
19 41	+13.4	– 18.4
20 24	+13.5	– 18.3
21 10	+13.6	– 18.2
21 59	+13.7	– 18.1
22 52	+13.8	– 18.0
23 49	+13.9	– 17.9
24 51	+14.0	– 17.8
25 58	+14.1	– 17.7
27 11	+14.2	– 17.6
28 31	+14.3	– 17.5
29 58	+14.4	– 17.4
31 33	+14.5	– 17.3
33 18	+14.6	– 17.2
35 15	+14.7	– 17.1
37 24	+14.8	– 17.0
39 48	+14.9	– 16.9
42 28	+15.0	– 16.8
45 29	+15.1	– 16.7
48 52	+15.2	– 16.6
51 41	+15.3	– 16.5
56 59	+15.4	– 16.4
61 50	+15.5	– 16.3
67 15	+15.6	– 16.2
73 14	+15.7	– 16.1
79 42	+15.8	– 16.0
86 21	+15.9	– 15.9
90 00		

Stars & Planets

App. Alt.	Corr
° ′	′
9 55	– 5.3
10 07	– 5.2
10 20	– 5.1
10 32	– 5.0
10 46	– 4.9
10 59	– 4.8
11 14	– 4.7
11 29	– 4.6
11 44	– 4.5
12 00	– 4.4
12 17	– 4.3
12 35	– 4.2
12 53	– 4.1
13 12	– 4.0
13 32	– 3.9
13 53	– 3.8
14 16	– 3.7
14 39	– 3.6
15 03	– 3.5
15 29	– 3.4
15 56	– 3.3
16 25	– 3.2
16 55	– 3.1
17 27	– 3.0
18 01	– 2.9
18 37	– 2.8
19 16	– 2.7
19 56	– 2.6
20 40	– 2.5
21 27	– 2.4
22 17	– 2.3
23 11	– 2.2
24 09	– 2.1
25 12	– 2.0
26 20	– 1.9
27 34	– 1.8
28 54	– 1.7
30 22	– 1.6
31 58	– 1.5
33 43	– 1.4
35 38	– 1.3
37 45	– 1.2
40 06	– 1.1
42 42	– 1.0
45 34	– 0.9
48 45	– 0.8
52 16	– 0.7
56 09	– 0.6
60 26	– 0.5
65 06	– 0.4
70 09	– 0.3
75 32	– 0.2
81 12	– 0.1
87 03	0.0
90 00	

Additional Altitude Correction for Mars & Venus

A small additional altitude correction for Mars & Venus can be obtained in the Daily Pages of The Nautical Almanac for the day of the observation.

Find the correction in the block labeled **Horizontal parallax**.

The figure will cover the range of 3 days found on that Daily Page.

The correction is to be subtracted from Apparent Altitude.

Refraction

App. Alt.	Corr
°	′
5.5	– 9.1
6.0	– 8.5
6.5	– 7.9
7.0	– 7.5
7.5	– 7.0
8.0	– 6.6
8.5	– 6.3
9.0	– 5.9
9.5	– 5.7
10.0	– 5.4
10.5	– 5.1
11.0	– 4.9
11.5	– 4.7
12.0	– 4.5
12.5	– 4.4
13.0	– 4.2
13.5	– 4.0
14.0	– 3.9
14.5	– 3.8
15.0	– 3.6
15.5	– 3.5
16.0	– 3.4
16.5	– 3.3
17.0	– 3.2
17.5	– 3.1
18.0	– 3.0
18.5	– 2.9
19.0	– 2.9
19.5	– 2.8
20.0	– 2.7
21.0	– 2.6
22.0	– 2.4
23.0	– 2.3
24.0	– 2.2
25.0	– 2.1
26.0	– 2.0
27.0	– 1.9
28.0	– 1.9
29.0	– 1.8
30.0	– 1.7
31.0	– 1.7
32.0	– 1.6
33.0	– 1.5
34.0	– 1.5
35.0	– 1.4
36.0	– 1.4
37.0	– 1.3
38.0	– 1.3
39.0	– 1.2
40.0	– 1.2
45.0	– 1.0
50.0	– 0.8
55.0	– 0.7
60.0	– 0.6
65.0	– 0.5
70.0	– 0.4
75.0	– 0.3
80.0	– 0.2
85.0	– 0.1

DIP
always subtracted from Hs

Ht. of Eye	Corr	Ht. of Eye	Ht. of Eye	Corr
meters	′	**feet**	**meters**	′
2.4	**– 2.8**	8.0	1.0	**– 1.8**
2.6	**– 2.9**	8.6	1.5	**– 2.2**
2.8	**– 3.0**	9.2	2.0	**– 2.5**
3.0	**– 3.1**	9.8	2.5	**– 2.8**
3.2	**– 3.2**	10.5	3.0	**– 3.0**
3.4	**– 3.3**	11.2		
3.6	**– 3.4**	11.9	See table ←	
3.8	**– 3.5**	12.6		
4.0	**– 3.6**	13.3	**meters**	
4.3	**– 3.7**	14.1	20	**– 7.9**
4.5	**– 3.8**	14.9	22	**– 8.3**
4.7	**– 3.9**	15.7	24	**– 8.6**
5.0	**– 4.0**	16.5	26	**– 9.0**
5.2	**– 4.1**	17.4	28	**– 9.3**
5.5	**– 4.2**	18.3		
5.8	**– 4.3**	19.1	30	**– 9.6**
6.1	**– 4.4**	20.1	32	**– 10.0**
6.3	**– 4.5**	21.0	34	**– 10.3**
6.6	**– 4.6**	22.0	36	**– 10.6**
6.9	**– 4.7**	22.9	38	**– 10.8**
7.2	**– 4.8**	23.9		
7.5	**– 4.9**	24.9	40	**– 11.1**
7.9	**– 5.0**	26.0	42	**– 11.4**
8.2	**– 5.1**	27.1	44	**– 11.7**
8.5	**– 5.2**	28.1	46	**– 11.9**
8.8	**– 5.3**	29.2	48	**– 12.2**
9.2	**– 5.4**	30.4	**feet**	′
9.5	**– 5.5**	31.5	2	**– 1.4**
9.9	**– 5.6**	32.7	4	**– 1.9**
10.3	**– 5.7**	33.9	6	**– 2.4**
10.6	**– 5.8**	35.1	8	**– 2.7**
11.0	**– 5.9**	36.3	10	**– 3.1**
11.4	**– 6.0**	37.6	See table ←	
11.8	**– 6.1**	38.9		
12.2	**– 6.2**	40.1	**feet**	′
12.6	**– 6.3**	41.5	70	**– 8.1**
13.0	**– 6.4**	42.8	75	**– 8.4**
13.4	**– 6.5**	44.2	80	**– 8.7**
13.8	**– 6.6**	45.5	85	**– 8.9**
14.2	**– 6.7**	46.9	90	**– 9.2**
14.7	**– 6.8**	48.4	95	**9.5**
15.1	**– 6.9**	49.8	100	**– 9.7**
15.5	**– 7.0**	51.3	105	**– 9.9**
16.0	**– 7.1**	52.8	110	**– 10.2**
16.5	**– 7.2**	54.3	115	**– 10.4**
16.9	**– 7.3**	55.8	120	**– 10.6**
17.4	**– 7.4**	57.4	125	**– 10.8**
17.9	**– 7.5**	58.9	130	**– 11.1**
18.4	**– 7.6**	60.5	135	**– 11.3**
18.8	**– 7.7**	62.1	140	**– 11.5**
19.3	**– 7.8**	63.8	145	**– 11.7**
19.8	**– 7.9**	65.4	150	**– 11.9**
20.4	**– 8.0**	67.1	155	**– 12.1**
20.9	**– 8.1**	68.8		
21.4		70.5		

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

ALTITUDE CORRECTION TABLES 0° – 35° — MOON

App. Alt.	0° – 4°		5° – 9°		10° – 14°		15° – 19°		20° – 24°		25° – 29°		30° – 34°		App. Alt.
	Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		
'	'		'		'		'		'		'		'		'
	0°		5°		10°		15°		20°		25°		30°		
00	34.5		58.2		62.1		62.8		62.2		60.8		58.9		00
10	36.5		58.5		62.2		62.8		62.2		60.8		58.8		10
20	38.3		58.7		62.2		62.8		62.1		60.7		58.8		20
30	40.0		58.9		62.3		62.8		62.1		60.7		58.7		30
40	41.5		59.1		62.3		62.8		62.0		60.6		58.6		40
50	42.9		59.3		62.4		62.7		62.0		60.6		58.5		50
	1°		6°		11°		16°		21°		26°		31°		
00	44.2		59.5		62.4		62.7		62.0		60.5		58.5		00
10	45.4		59.7		62.4		62.7		61.9		60.4		58.4		10
20	46.5		59.9		62.5		62.7		61.9		60.4		58.3		20
30	47.5		60.0		62.5		62.7		61.9		60.3		58.2		30
40	48.4		60.2		62.5		62.7		61.8		60.3		58.2		40
50	49.3		60.3		62.6		62.7		61.8		60.2		58.1		50
	2°		7°		12°		17°		22°		27°		32°		
00	50.1		60.5		62.6		62.7		61.7		60.1		58.0		00
10	50.8		60.6		62.6		62.6		61.7		60.1		57.9		10
20	51.5		60.7		62.6		62.6		61.6		60.0		57.8		20
30	52.2		60.9		62.7		62.6		61.6		59.9		57.8		30
40	52.8		61.0		62.7		62.6		61.6		59.9		57.7		40
50	53.4		61.1		62.7		62.6		61.5		59.8		57.6		50
	3°		8°		13°		18°		23°		28°		33°		
00	53.9		61.2		62.7		62.5		61.5		59.7		57.5		00
10	54.4		61.3		62.7		62.5		61.4		59.7		57.4		10
20	54.9		61.4		62.7		62.5		61.4		59.6		57.4		20
30	55.3		61.5		62.8		62.5		61.3		59.5		57.3		30
40	55.7		61.6		62.8		62.4		61.3		59.5		57.2		40
50	56.1		61.6		62.8		62.4		61.2		59.4		57.1		50
	4°		9°		14°		19°		24°		29°		34°		
00	56.4		61.7		62.8		62.4		61.2		59.3		57.0		00
10	56.8		61.8		62.8		62.4		61.1		59.3		56.9		10
20	57.1		61.9		62.8		62.3		61.1		59.2		56.9		20
30	57.4		61.9		62.8		62.3		61.0		59.1		56.8		30
40	57.7		62.0		62.8		62.3		61.0		59.1		56.7		40
50	58.0		62.1		62.8		62.2		60.9		59.0		56.6		50
HP	L	U	L	U	L	U	L	U	L	U	L	U	L	U	HP
'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
54.0	0.3	0.9	0.3	0.9	0.4	1.0	0.5	1.1	0.6	1.2	0.7	1.3	0.9	1.5	54.0
54.3	0.7	1.1	0.7	1.2	0.8	1.2	0.8	1.3	0.9	1.4	1.1	1.5	1.2	1.7	54.3
54.6	1.1	1.4	1.1	1.4	1.1	1.4	1.2	1.5	1.3	1.6	1.4	1.7	1.5	1.8	54.6
54.9	1.4	1.6	1.4	1.6	1.5	1.6	1.6	1.7	1.6	1.8	1.8	1.9	1.9	2.0	54.9
55.2	1.8	1.8	1.8	1.8	1.9	1.8	1.9	1.9	2.0	2.0	2.1	2.1	2.2	2.2	55.2
55.5	2.2	2.0	2.2	2.0	2.3	2.1	2.3	2.1	2.4	2.2	2.4	2.3	2.5	2.4	55.5
55.8	2.6	2.2	2.6	2.2	2.6	2.3	2.7	2.3	2.7	2.4	2.8	2.4	2.9	2.5	55.8
56.1	3.0	2.4	3.0	2.5	3.0	2.5	3.0	2.5	3.1	2.6	3.1	2.6	3.2	2.7	56.1
56.4	3.3	2.7	3.3	2.7	3.4	2.7	3.4	2.7	3.4	2.8	3.5	2.8	3.5	2.9	56.4
56.7	3.7	2.9	3.7	2.9	3.8	2.9	3.8	2.9	3.8	3.0	3.8	3.0	3.9	3.0	56.7
57.0	4.1	3.1	4.1	3.1	4.1	3.1	4.1	3.1	4.2	3.2	4.2	3.2	4.2	3.2	57.0
57.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.4	4.6	3.4	57.3
57.6	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.6	57.6
57.9	5.3	3.8	5.3	3.8	5.2	3.8	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	57.9
58.2	5.6	4.0	5.6	4.0	5.6	4.0	5.6	4.0	5.6	3.9	5.6	3.9	5.6	3.9	58.2
58.5	6.0	4.2	6.0	4.2	6.0	4.2	6.0	4.2	6.0	4.1	5.9	4.1	5.9	4.1	58.5
58.8	6.4	4.4	6.4	4.4	6.4	4.4	6.3	4.4	6.3	4.3	6.3	4.3	6.2	4.2	58.8
59.1	6.8	4.6	6.8	4.6	6.7	4.6	6.7	4.6	6.7	4.5	6.6	4.5	6.6	4.4	59.1
59.4	7.2	4.8	7.1	4.8	7.1	4.8	7.1	4.8	7.0	4.7	7.0	4.7	6.9	4.6	59.4
59.7	7.5	5.1	7.5	5.0	7.5	5.0	7.5	5.0	7.4	4.9	7.3	4.8	7.2	4.8	59.7
60.0	7.9	5.3	7.9	5.3	7.9	5.2	7.8	5.2	7.8	5.1	7.7	5.0	7.6	4.9	60.0
60.3	8.3	5.5	8.3	5.5	8.2	5.4	8.2	5.4	8.1	5.3	8.0	5.2	7.9	5.1	60.3
60.6	8.7	5.7	8.7	5.7	8.6	5.7	8.6	5.6	8.5	5.5	8.4	5.4	8.2	5.3	60.6
60.9	9.1	5.9	9.0	5.9	9.0	5.9	8.9	5.8	8.8	5.7	8.7	5.6	8.6	5.4	60.9
61.2	9.5	6.2	9.4	6.1	9.4	6.1	9.3	6.0	9.2	5.9	9.1	5.8	8.9	5.6	61.2
61.5	9.8	6.4	9.8	6.3	9.7	6.3	9.7	6.2	9.5	6.1	9.4	5.9	9.2	5.8	61.5

DIP					
Ht. of Eye	Corrⁿ	Ht. of Eye	Ht. of Eye	Corrⁿ	Ht. of Eye
m	'	ft	m	'	ft
2.4	-2.8	7.9	9.5	-5.5	31.2
2.6	-2.9	8.5	9.9	-5.6	32.5
2.8	-3.0	9.2	10.3	-5.7	33.8
3.0	-3.1	9.8	10.6	-5.8	34.8
3.2	-3.2	10.5	11.0	-5.9	36.1
3.4	-3.3	11.2	11.4	-6.0	37.4
3.6	-3.4	11.8	11.8	-6.1	38.7
3.8	-3.5	12.5	12.2	-6.2	40.0
4.0	-3.6	13.1	12.6	-6.3	41.3
4.3	-3.7	14.1	13.0	-6.4	42.7
4.5	-3.8	14.8	13.4	-6.5	44.0
4.7	-3.9	15.4	13.8	-6.6	45.3
5.0	-4.0	16.4	14.2	-6.7	46.6
5.2	-4.1	17.1	14.7	-6.8	48.2
5.5	-4.2	18.0	15.1	-6.9	49.5
5.8	-4.3	19.0	15.5	-7.0	50.9
6.1	-4.4	20.0	16.0	-7.1	52.5
6.3	-4.5	20.7	16.5	-7.2	54.1
6.6	-4.6	21.7	16.9	-7.3	55.4
6.9	-4.7	22.6	17.4	-7.4	57.1
7.2	-4.8	23.6	17.9	-7.5	58.7
7.5	-4.9	24.6	18.4	-7.6	60.4
7.9	-5.0	25.9	18.8	-7.7	61.7
8.2	-5.1	26.9	19.3	-7.8	63.3
8.5	-5.2	27.9	19.8	-7.9	65.0
8.8	-5.3	28.9	20.4	-8.0	66.9
9.2	-5.4	30.2	20.9	-8.1	68.6
9.5		31.2	21.4		70.2

MOON CORRECTION TABLE

The correction is in two parts; the first correction is taken from the upper part of the table with argument apparent altitude, and the second from the lower part, with argument HP, in the same column as that from which the first correction was taken. Separate corrections are given in the lower part for lower (L) and upper (U) limbs. All corrections are to be **added** to apparent altitude, *but* 30' *is to be subtracted from the altitude of the upper limb.*

For corrections for pressure and temperature see page A4.

For bubble sextant observations ignore dip, take the mean of upper and lower limb corrections and subtract 15' from the altitude.

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

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ALTITUDE CORRECTION TABLES 35° – 90° — MOON

App. Alt.	35° – 39°		40° – 44°		45° – 49°		50° – 54°		55° – 59°		60° – 64°		65° – 69°		70° – 74°		75° – 79°		80° – 84°		85° – 89°		App. Alt.
	Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		Corrⁿ		
'	35°	'	40°	'	45°	'	50°	'	55°	'	60°	'	65°	'	70°	'	75°	'	80°	'	85°	'	'
00		56.5		53.7		50.5		46.9		43.1		38.9		34.6		30.0		25.3		20.5		15.6	00
10		56.4		53.6		50.4		46.8		42.9		38.8		34.4		29.9		25.2		20.4		15.5	10
20		56.3		53.5		50.2		46.7		42.8		38.7		34.3		29.7		25.0		20.2		15.3	20
30		56.2		53.4		50.1		46.5		42.7		38.5		34.1		29.6		24.9		20.0		15.1	30
40		56.2		53.3		50.0		46.4		42.5		38.4		34.0		29.4		24.7		19.9		15.0	40
50		56.1		53.2		49.9		46.3		42.4		38.2		33.8		29.3		24.5		19.7		14.8	50
	36°		41°		46°		51°		56°		61°		66°		71°		76°		81°		86°		
00		56.0		53.1		49.8		46.2		42.3		38.1		33.7		29.1		24.4		19.6		14.6	00
10		55.9		53.0		49.7		46.0		42.1		37.9		33.5		29.0		24.2		19.4		14.5	10
20		55.8		52.9		49.5		45.9		42.0		37.8		33.4		28.8		24.1		19.2		14.3	20
30		55.7		52.8		49.4		45.8		41.9		37.7		33.2		28.7		23.9		19.1		14.2	30
40		55.6		52.6		49.3		45.7		41.7		37.5		33.1		28.5		23.8		18.9		14.0	40
50		55.5		52.5		49.2		45.5		41.6		37.4		32.9		28.3		23.6		18.7		13.8	50
	37°		42°		47°		52°		57°		62°		67°		72°		77°		82°		87°		
00		55.4		52.4		49.1		45.4		41.4		37.2		32.8		28.2		23.4		18.6		13.7	00
10		55.3		52.3		49.0		45.3		41.3		37.1		32.6		28.0		23.3		18.4		13.5	10
20		55.2		52.2		48.8		45.2		41.2		36.9		32.5		27.9		23.1		18.2		13.3	20
30		55.1		52.1		48.7		45.0		41.0		36.8		32.3		27.7		22.9		18.1		13.2	30
40		55.0		52.0		48.6		44.9		40.9		36.6		32.2		27.6		22.8		17.9		13.0	40
50		55.0		51.9		48.5		44.8		40.8		36.5		32.0		27.4		22.6		17.8		12.8	50
	38°		43°		48°		53°		58°		63°		68°		73°		78°		83°		88°		
00		54.9		51.8		48.4		44.6		40.6		36.4		31.9		27.2		22.5		17.6		12.7	00
10		54.8		51.7		48.3		44.5		40.5		36.2		31.7		27.1		22.3		17.4		12.5	10
20		54.7		51.6		48.1		44.4		40.3		36.1		31.6		26.9		22.1		17.3		12.3	20
30		54.6		51.5		48.0		44.2		40.2		35.9		31.4		26.8		22.0		17.1		12.2	30
40		54.5		51.4		47.9		44.1		40.1		35.8		31.3		26.6		21.8		16.9		12.0	40
50		54.4		51.2		47.8		44.0		39.9		35.6		31.1		26.5		21.7		16.8		11.8	50
	39°		44°		49°		54°		59°		64°		69°		74°		79°		84°		89°		
00		54.3		51.1		47.7		43.9		39.8		35.5		31.0		26.3		21.5		16.6		11.7	00
10		54.2		51.0		47.5		43.7		39.6		35.3		30.8		26.1		21.3		16.4		11.5	10
20		54.1		50.9		47.4		43.6		39.5		35.2		30.7		26.0		21.2		16.3		11.4	20
30		54.0		50.8		47.3		43.5		39.4		35.0		30.5		25.8		21.0		16.1		11.2	30
40		53.9		50.7		47.2		43.3		39.2		34.9		30.4		25.7		20.9		16.0		11.0	40
50		53.8		50.6		47.0		43.2		39.1		34.7		30.2		25.5		20.7		15.8		10.9	50
HP	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	L	U	HP
'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
54.0	1.1	1.7	1.3	1.9	1.5	2.1	1.7	2.4	2.0	2.6	2.3	2.9	2.6	3.2	2.9	3.5	3.2	3.8	3.5	4.1	3.8	4.5	54.0
54.3	1.4	1.8	1.6	2.0	1.8	2.2	2.0	2.5	2.2	2.7	2.5	3.0	2.8	3.2	3.1	3.5	3.3	3.8	3.6	4.1	3.9	4.4	54.3
54.6	1.7	2.0	1.9	2.2	2.1	2.4	2.3	2.6	2.5	2.8	2.7	3.0	3.0	3.3	3.2	3.5	3.5	3.8	3.8	4.0	4.0	4.3	54.6
54.9	2.0	2.2	2.2	2.3	2.4	2.5	2.5	2.7	2.7	2.9	2.9	3.1	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.3	54.9
55.2	2.3	2.3	2.5	2.4	2.6	2.6	2.8	2.8	3.0	2.9	3.2	3.1	3.4	3.3	3.6	3.5	3.8	3.7	4.0	4.0	4.2	4.2	55.2
55.5	2.7	2.5	2.8	2.6	2.9	2.7	3.1	2.9	3.2	3.0	3.4	3.2	3.6	3.4	3.7	3.5	3.9	3.7	4.1	3.9	4.3	4.1	55.5
55.8	3.0	2.6	3.1	2.7	3.2	2.8	3.3	3.0	3.5	3.1	3.6	3.3	3.8	3.4	3.9	3.6	4.1	3.7	4.2	3.9	4.4	4.0	55.8
56.1	3.3	2.8	3.4	2.9	3.5	3.0	3.6	3.1	3.7	3.2	3.8	3.3	4.0	3.4	4.1	3.6	4.2	3.7	4.4	3.8	4.5	4.0	56.1
56.4	3.6	2.9	3.7	3.0	3.8	3.1	3.9	3.2	3.9	3.3	4.0	3.4	4.1	3.5	4.3	3.6	4.4	3.7	4.5	3.8	4.6	3.9	56.4
56.7	3.9	3.1	4.0	3.1	4.1	3.2	4.1	3.3	4.2	3.3	4.3	3.4	4.3	3.5	4.4	3.6	4.5	3.7	4.6	3.8	4.7	3.8	56.7
57.0	4.3	3.2	4.3	3.3	4.3	3.3	4.4	3.4	4.4	3.4	4.5	3.5	4.5	3.5	4.6	3.6	4.7	3.6	4.7	3.7	4.8	3.8	57.0
57.3	4.6	3.4	4.6	3.4	4.6	3.4	4.6	3.5	4.7	3.5	4.7	3.5	4.7	3.6	4.8	3.6	4.8	3.6	4.8	3.7	4.9	3.7	57.3
57.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	4.9	3.6	5.0	3.6	5.0	3.6	5.0	3.6	57.6
57.9	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	5.2	3.7	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	5.1	3.6	57.9
58.2	5.5	3.9	5.5	3.8	5.5	3.8	5.4	3.8	5.4	3.7	5.4	3.7	5.3	3.7	5.3	3.6	5.2	3.6	5.2	3.5	5.2	3.5	58.2
58.5	5.9	4.0	5.8	4.0	5.8	3.9	5.7	3.9	5.6	3.8	5.6	3.8	5.5	3.7	5.5	3.6	5.4	3.6	5.3	3.5	5.3	3.4	58.5
58.8	6.2	4.2	6.1	4.1	6.0	4.1	6.0	4.0	5.9	3.9	5.8	3.8	5.7	3.7	5.6	3.6	5.5	3.5	5.4	3.5	5.3	3.4	58.8
59.1	6.5	4.3	6.4	4.3	6.3	4.2	6.2	4.1	6.1	4.0	6.0	3.9	5.9	3.8	5.8	3.6	5.7	3.5	5.6	3.4	5.4	3.3	59.1
59.4	6.8	4.5	6.7	4.4	6.6	4.3	6.5	4.2	6.4	4.1	6.2	3.9	6.1	3.8	6.0	3.7	5.8	3.5	5.7	3.4	5.5	3.2	59.4
59.7	7.1	4.7	7.0	4.5	6.9	4.4	6.8	4.3	6.6	4.1	6.5	4.0	6.3	3.8	6.1	3.7	6.0	3.5	5.8	3.3	5.6	3.2	59.7
60.0	7.5	4.8	7.3	4.7	7.2	4.5	7.0	4.4	6.9	4.2	6.7	4.0	6.5	3.9	6.3	3.7	6.1	3.5	5.9	3.3	5.7	3.1	60.0
60.3	7.8	5.0	7.6	4.8	7.5	4.7	7.3	4.5	7.1	4.3	6.9	4.1	6.7	3.9	6.5	3.7	6.3	3.5	6.0	3.2	5.8	3.0	60.3
60.6	8.1	5.1	7.9	5.0	7.7	4.8	7.6	4.6	7.3	4.4	7.1	4.2	6.9	3.9	6.7	3.7	6.4	3.4	6.2	3.2	5.9	2.9	60.6
60.9	8.4	5.3	8.2	5.1	8.0	4.9	7.8	4.7	7.6	4.5	7.3	4.2	7.1	4.0	6.8	3.7	6.6	3.4	6.3	3.2	6.0	2.9	60.9
61.2	8.7	5.4	8.5	5.2	8.3	5.0	8.1	4.8	7.8	4.5	7.6	4.3	7.3	4.0	7.0	3.7	6.7	3.4	6.4	3.1	6.1	2.8	61.2
61.5	9.1	5.6	8.8	5.4	8.6	5.1	8.3	4.9	8.1	4.6	7.8	4.3	7.5	4.0	7.2	3.7	6.9	3.4	6.5	3.1	6.2	2.7	61.5

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