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# The Nautical Almanac 2016

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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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*freely ye received, freely give*

## Explanation of The Nautical Almanac Daily Pages

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

10	<b>d</b> - the daily average change, per hour, in the Sun's declination in minutes of arc.
11	<b>SD</b> - 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	<b>HP</b> - 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. <i>Source- starpath.com</i>
13	<b>Sun- Eqn. of Time</b> - 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 <sup>h</sup> and 12 <sup>h</sup> . 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 <b>Example</b> - Meridian Passage on May 30, 2020 equals 12:00 – EoT of 2 minutes 21 seconds MP= 11:57:39 <i>Local Apparent Noon</i> <b>Example</b> - Meridian Passage on August 25, 2020 equals 12:00 + EoT of 1 minute 59 seconds MP= 12:01:59 <i>Local Apparent Noon</i>
14	<b>Sun- Mer. Pass</b> just to the right of the <b>Eqn. of Time</b> is the approximate GMT/UT when the Sun crosses The Prime Meridian (at Greenwich) for that specific date.
15	<b>Moon- Mer. Pass</b> - is the approximate GMT/UT when the Moon crosses The Prime Meridian (at Greenwich) or the 180° line of longitude. <b>Upper</b> means the GMT/UT when the Moon crosses The Prime Meridian (Greenwich). <b>Lower</b> means the GMT/UT when the Moon crosses the 180° line of longitude.
16	<b>Moon- Age</b> - 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	<b>(morning) Twilight- Naut.</b> - 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 <b>Lat.</b> column and then follow across horizontally to the right to find the time.
17* see notes at bottom	<b>(morning) Twilight- Civil</b> - 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 <b>Lat.</b> column and then follow across horizontally to the right to find the time.
17* see notes at bottom	<b>Sunrise</b> - the approximate GMT/UT when the Sun is 0° 50' (semi-diameter plus refraction) below the horizon. First locate your approximate Latitude in the <b>Lat.</b> column and then follow across horizontally to the right to find the time.

17* see notes at bottom	<b>Sunset-</b> the approximate GMT/UT when the Sun is $0^{\circ} 50'$ (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	<b>(evening) Twilight- Civil-</b> the approximate GMT/UT of evening civil twilight that ends when the geometric center of the sun is $6^{\circ}$ below the horizon.  First locate your approximate Latitude in the <b>Lat.</b> column and then follow across horizontally to the right to find the time.
17* see notes at bottom	<b>(evening) Twilight- Naut.-</b> the approximate GMT/UT of when evening Nautical Twilight ends.  Nautical twilight is the time when the center of the sun is $12^{\circ}$ 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	<b>Moonrise-</b> the approximate GMT/UT when the Moon is about $0^{\circ} 05'$ to $0^{\circ} 10'$ 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	<b>Moonset-</b> the approximate GMT/UT when the Moon is about $0^{\circ} 05'$ to $0^{\circ} 10'$ 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  $0^{\circ}$  (Greenwich) and can be considered as approximate LMT (Local Mean Time) with a tolerance of +/- 30 minutes depending on where you are within a time zone.

Wednesday, February 24, 2021

Explanation\_of\_The\_Nautical\_Almanac\_Daily\_Pages.odt

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	100°32.5	181°58.1	\$23°38.5	318°04.0	N18°45.1	131°37.2	\$13°36.5	275°29.9	N00°18.5	Alpheratz	357°46.2	29°09.0					
1	115°35.0	196°57.1	38.4	333°06.8	45.4	146°39.2	36.4	290°32.3	18.5	Ankaa	353°18.1	-42°15.2					
2	130°37.4	211°56.1	38.3	348°09.6	45.6	161°41.2	36.2	305°34.7	18.5	Schedar	349°43.6	56°35.9					
3	145°39.9	226°55.1	.. 38.2	3°12.4	.. 45.8	176°43.2	.. 36.0	320°37.1	.. 18.5	Diphda	348°58.3	-17°55.9					
4	160°42.4	241°54.2	38.1	18°15.2	46.0	191°45.1	35.8	335°39.5	18.5	Achernar	335°28.3	-57°11.3					
5	175°44.8	256°53.2	38.0	33°18.1	46.2	206°47.1	35.7	350°41.9	18.5	Hamal	328°03.5	23°30.8					
6	190°47.3	271°52.2	\$23°37.9	48°20.9	N18°46.5	221°49.1	\$13°35.5	5°44.3	N00°18.5	Polaris	318°47.1	89°18.8					
7	205°49.8	286°51.3	37.8	63°23.7	46.7	236°51.1	35.3	20°46.7	18.5	Akamar	315°19.9	-40°16.0					
8	220°52.2	301°50.3	37.7	78°26.5	46.9	251°53.0	35.1	35°49.2	18.5	Menkar	314°17.5	4°07.8					
9	235°54.7	316°49.3	.. 37.6	93°29.4	.. 47.1	266°55.0	.. 35.0	50°51.6	.. 18.4	Mirfak	308°43.7	49°54.0					
10	250°57.2	331°48.4	37.5	108°32.2	47.3	281°57.0	34.8	65°54.0	18.4	Aldebaran	290°52.0	16°31.9					
11	265°59.6	346°47.4	37.4	123°35.0	47.6	296°59.0	34.6	80°56.4	18.4	Rigel	281°14.1	-8°11.4					
12	281°02.1	1°46.4	\$23°37.3	138°37.9	N18°47.8	312°00.9	\$13°34.4	95°58.8	N00°18.4	Capella	280°37.8	46°00.6					
13	296°04.5	16°45.5	37.2	153°40.7	48.0	327°02.9	34.3	111°01.2	18.4	Bellatrix	278°34.4	6°21.5					
14	311°07.0	31°44.5	37.1	168°43.5	48.2	342°04.9	34.1	126°03.6	18.4	Elnath	278°15.5	28°37.0					
15	326°09.5	46°43.5	.. 37.0	183°46.4	.. 48.5	357°06.8	.. 33.9	141°06.0	.. 18.4	Alnilam	275°48.6	-1°11.7					
16	341°11.9	61°42.6	36.9	198°49.2	48.7	12°08.8	33.7	156°08.4	18.4	Betelgeuse	271°03.7	7°24.5					
17	356°14.4	76°41.6	36.8	213°52.0	48.9	27°10.8	33.6	171°10.8	18.4	Canopus	263°56.7	-52°42.1					
18	11°16.9	91°40.6	\$23°36.7	228°54.9	N18°49.1	42°12.8	\$13°33.4	186°13.2	N00°18.3	Sirius	258°35.5	-16°43.6					
19	26°19.3	106°39.6	36.5	243°57.7	49.4	57°14.7	33.2	201°15.7	18.3	Adara	255°14.1	-28°59.2					
20	41°21.8	121°38.7	36.4	259°00.6	49.6	72°16.7	33.0	216°18.1	18.3	Procyon	245°01.9	5°12.0					
21	56°24.3	136°37.7	.. 36.3	274°03.4	.. 49.8	87°18.7	.. 32.9	231°20.5	.. 18.3	Pollux	243°30.3	28°00.0					
22	71°26.7	151°36.7	36.2	289°06.3	50.0	102°20.7	32.7	246°22.9	18.3	Avior	234°18.6	-59°32.4					
23	86°29.2	166°35.8	36.1	304°09.1	50.3	117°22.6	32.5	261°25.3	18.3	Suhail	222°54.0	-43°28.3					
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			Miaplacidus				
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	101°31.7	181°34.8	\$23°36.0	319°12.0	N18°50.5	132°24.6	\$13°32.3	276°27.7	N00°18.3	Denebola	182°36.0	14°30.8					
1	116°34.1	196°33.8	35.8	334°14.8	50.7	147°26.6	32.2	291°30.1	18.3	Gienah	175°54.9	-17°35.9					
2	131°36.6	211°32.9	35.7	349°17.7	51.0	162°28.6	32.0	306°32.5	18.3	Acrux	173°12.3	-63°09.1					
3	146°39.0	226°31.9	.. 35.6	4°20.5	.. 51.2	177°30.5	.. 31.8	321°34.9	.. 18.3	Gacrux	172°03.9	-57°10.0					
4	161°41.5	241°30.9	35.5	19°23.4	51.4	192°32.5	31.6	336°37.3	18.2	Alioth	166°22.8	55°53.9					
5	176°44.0	256°30.0	35.3	34°26.2	51.6	207°34.5	31.5	351°39.8	18.2	Spica	158°34.0	-11°12.9					
6	191°46.4	271°29.0	\$23°35.2	49°29.1	N18°51.9	222°36.4	\$13°31.3	6°42.2	N00°18.2	Alcaid	153°00.9	49°15.4					
7	206°48.9	286°28.0	35.1	64°31.9	52.1	237°38.4	31.1	21°44.6	18.2	Hadar	148°51.9	-60°25.1					
8	221°51.4	301°27.1	34.9	79°34.8	52.3	252°40.4	30.9	36°47.0	18.2	Menkent	148°10.8	-36°25.1					
9	236°53.8	316°26.1	.. 34.8	94°37.7	.. 52.6	267°42.4	.. 30.8	51°49.4	.. 18.2	Arcturus	145°58.0	19°07.9					
10	251°56.3	331°25.1	34.7	109°40.5	52.8	282°44.3	30.6	66°51.8	18.2	Rigil Kent	139°55.6	-60°52.4					
11	266°58.8	346°24.2	34.5	124°43.4	53.0	297°46.3	30.4	81°54.2	18.2	Zubenelgik	137°08.4	-16°05.0					
12	282°01.2	1°23.2	\$23°34.4	139°46.3	N18°53.3	312°48.3	\$13°30.2	96°56.6	N00°18.2	Kochab	137°20.2	74°06.5					
13	297°03.7	16°22.2	34.3	154°49.1	53.5	327°50.2	30.1	111°59.1	18.2	Alphecca	126°13.4	26°40.7					
14	312°06.1	31°21.3	34.1	169°52.0	53.7	342°52.2	29.9	127°01.5	18.2	Antares	112°29.7	-26°27.2					
15	327°08.6	46°20.3	.. 34.0	184°54.9	.. 54.0	357°54.2	.. 29.7	142°03.9	.. 18.1	Atria	107°34.4	-69°02.6					
16	342°11.1	61°19.3	33.8	199°57.7	54.2	12°56.2	29.5	157°06.3	18.1	Sabik	102°15.8	-15°44.3					
17	357°13.5	76°18.4	33.7	215°00.6	54.4	27°58.1	29.3	172°08.7	18.1	Shaula	96°25.8	-37°06.6					
18	12°16.0	91°17.4	\$23°33.6	230°03.5	N18°54.7	43°00.1	\$13°29.2	187°11.1	N00°18.1	Rasalhague	96°09.1	12°33.1					
19	27°18.5	106°16.5	33.4	245°06.4	54.9	58°02.1	29.0	202°13.5	18.1	Eltanin	90°47.8	51°29.2					
20	42°20.9	121°15.5	33.3	260°09.3	55.1	73°04.0	28.8	217°16.0	18.1	Kaus Aust.	83°47.5	-34°22.8					
21	57°23.4	136°14.5	.. 33.1	275°12.1	.. 55.4	88°06.0	.. 28.6	232°18.4	.. 18.1	Vega	80°41.1	38°47.5					
22	72°25.9	151°13.6	33.0	290°15.0	55.6	103°08.0	28.5	247°20.8	18.1	Nunki	76°01.8	-26°17.1					
23	87°28.3	166°12.6	32.8	305°17.9	55.9	118°09.9	28.3	262°23.2	18.1	Altair	62°11.1	8°53.7					
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			Peacock				
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	102°30.8	181°11.6	\$23°32.7	320°20.8	N18°56.1	133°11.9	\$13°28.1	277°25.6	N00°18.1	Markab	13°41.0	15°15.7					
1	117°33.3	196°10.7	32.5	335°23.7	56.3	148°13.9	27.9	292°28.0	18.1	Jan 01 Fri	81°25.5	11:53					
2	132°35.7	211°09.7	32.4	350°26.6	56.6	163°15.9	27.8	307°30.4	18.1	Venus	81°25.5	11:53					
3	147°38.2	226°08.7	.. 32.2	5°29.4	.. 56.8	178°17.8	.. 27.6	322°32.9	.. 18.0	Mars	217°31.4	02:47					
4	162°40.6	241°07.8	32.0	20°32.3	57.0	193°19.8	27.4	337°35.3	18.0	Jupiter	31°04.7	15:19					
5	177°43.1	256°06.8	31.9	35°35.2	57.3	208°21.8	27.2	352°37.7	18.0	Saturn	174°57.4	05:37					
6	192°45.6	271°05.8	\$23°31.7	50°38.1	N18°57.5	223°23.7	\$13°27.0	7°40.1	N00°18.0	Jan 02 Sat	80°03.2	11:54					
7	207°48.0	286°04.9	31.6	65°41.0	57.8	238°25.7	26.9	22°42.5	18.0	Venus	80°03.2	11:54					
8	222°50.5	301°03.9	31.4	80°43.9	58.0	253°27.7	26.7	37°44.9	18.0	Mars	217°40.3	02:43					
9	237°53.0	316°03.0	.. 31.2	95°46.8	.. 58.2	268°29.6	.. 26.5	52°47.4	.. 18.0	Jupiter	30°53.0	15:08					
10	252°55.4	331°02.0	31.1	110°49.7	58.5	283°31.6	26.3	67°49.8	18.0	Saturn	174°56.1	05:33					
11	267°57.9	346°01.0	30.9	125°52.6	58.7	298°33.6	26.2	82°52.2	18.0	Jan 03 Sun	78°40.8	11:56					
12	283°00.4	1°00.1	\$23°30.7	140°55.5	N18°59.0	313°35.5	\$13°26.0	97°54.6	N00°18.0	Horizontal parallax	Venus:	217°50.0	02:38				
13	298°02.8	15°59.1	30.6	155°58.4	59.2	328°37.5	25.8	112°57.0	18.0	Mars:	30°41.1	15:05					
14	313°05.3	30°58.1	30.4	171°01.3	59.5	343°39.5	25.6	127°59.4	18.0	Jupiter:	174°54.8	05:29					
15	328°07.8	45°57.2	.. 3														

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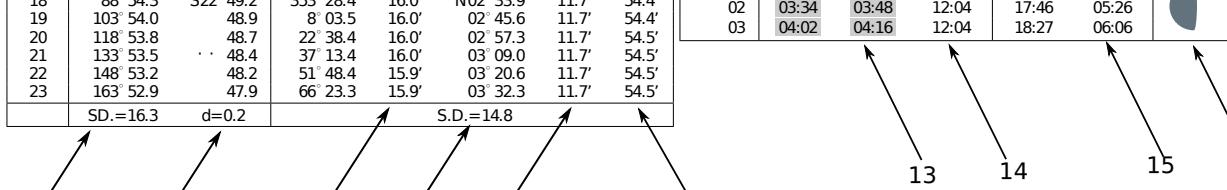
2020 January 01 to Jan. 03

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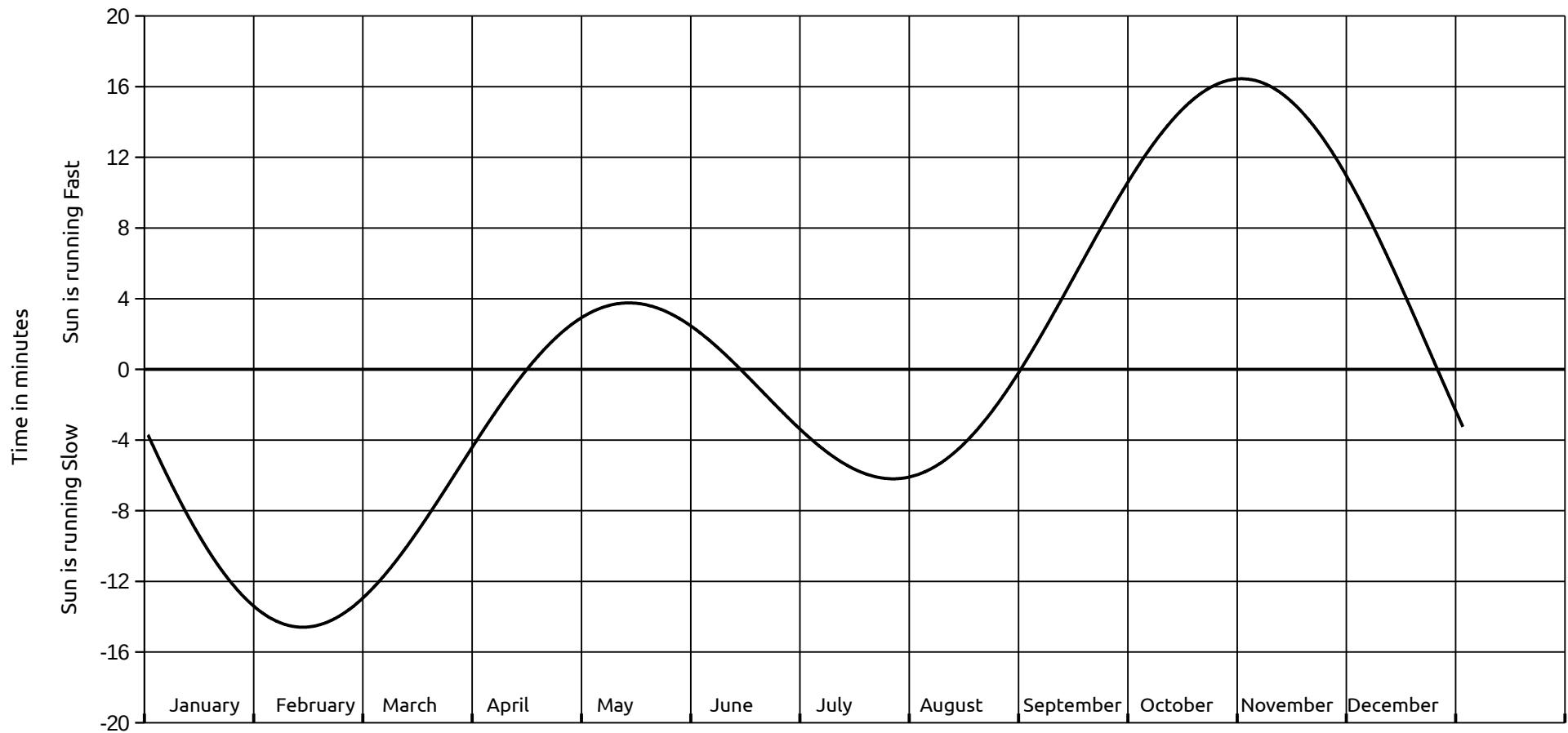
h	Sun						Moon						Lat.	Twilight			Sunrise	Sunset	Twilight		
	GHA	Dec	GHA	v	Dec	d	HP	Naut.	Civil	Sunrise	Sunset	Civil		Naut.					Civil	Naut.	
0	179° 13.7	S23° 03.5	110° 56.9	15.3'	S09° 58.5	10.7'	54.3'	N 72°	08:23	10:41	■■■	■■■	13:27	15:45							
1	194° 13.4	03.3	125° 31.3	15.4'	09° 47.8	10.7'	54.3'	N 70°	08:05	09:49	■■■	■■■	14:19	16:03							
2	209° 13.1	03.1	140° 05.7	15.4'	09° 37.1	10.7'	54.3'	68°	07:50	09:16	■■■	■■■	14:52	16:18							
3	224° 12.8	.. 03.0	154° 40.1	15.5'	09° 26.3	10.8'	54.3'	66°	07:37	08:53	10:27	13:41	15:15	16:31							
4	239° 12.5	02.8	169° 14.6	15.5'	09° 15.5	10.8'	54.3'	64°	07:26	08:34	09:49	14:19	15:34	16:41							
5	254° 12.2	02.6	183° 49.1	15.5'	09° 04.7	10.8'	54.2'	62°	07:17	08:18	09:23	14:45	15:49	16:51							
6	269° 11.9	S23° 02.4	198° 23.6	15.6'	S08° 53.8	10.9'	54.2'	60°	07:09	08:05	09:02	15:06	16:02	16:59							
7	284° 11.6	02.2	212° 58.2	15.6'	08° 42.9	10.9'	54.2'	N 58°	07:02	07:54	08:45	15:23	16:14	17:06							
8	299° 11.3	02.0	227° 32.8	15.6'	08° 32.0	10.9'	54.2'	56°	06:56	07:44	08:31	15:37	16:24	17:12							
9	314° 11.0	.. 01.8	242° 07.5	15.7'	08° 21.0	11.0'	54.2'	54°	06:50	07:35	08:19	15:49	16:32	17:18							
10	329° 10.7	01.6	256° 42.2	15.7'	08° 10.0	11.0'	54.2'	52°	06:44	07:28	08:08	16:00	16:40	17:24							
11	344° 10.4	01.4	271° 16.9	15.7'	07° 59.0	11.0'	54.2'	50°	06:39	07:20	07:58	16:09	16:47	17:29							
12	359° 10.1	S23° 01.2	285° 51.7	15.8'	S07° 48.0	11.1'	54.2'	45°	06:28	07:05	07:38	16:29	17:03	17:40							
13	14° 09.8	01.0	300° 26.4	15.8'	07° 36.9	11.1'	54.2'	N 40°	06:18	06:52	07:22	16:46	17:16	17:50							
14	29° 09.5	00.8	315° 01.2	15.8'	07° 25.8	11.1'	54.2'	35°	06:08	06:40	07:08	17:00	17:28	17:59							
15	44° 09.2	.. 00.6	329° 36.1	15.9'	07° 14.7	11.1'	54.2'	30°	06:00	06:30	06:56	17:12	17:38	18:08							
16	59° 08.9	00.4	344° 10.9	15.9'	07° 03.5	11.2'	54.2'	20°	05:44	06:11	06:35	17:32	17:56	18:24							
17	74° 08.6	00.2	358° 45.8	15.9'	06° 52.3	11.2'	54.2'	10°	05:28	05:54	06:17	17:50	18:13	18:40							
18	89° 08.3	S23° 00.0	13° 20.7	15.9'	S06° 41.1	11.2'	54.2'	0°	05:11	05:38	06:00	18:08	18:30	18:56							
19	104° 08.0	22° 59.7	27° 55.7	16.0'	06° 29.9	11.2'	54.2'	S 10°	04:53	05:20	05:43	18:25	18:48	19:15							
20	119° 07.7	59.5	42° 30.7	16.0'	06° 18.7	11.3'	54.2'	20°	04:31	05:00	05:24	18:43	19:08	19:37							
21	134° 07.5	.. 59.3	57° 05.6	16.0'	06° 07.4	11.3'	54.2'	30°	04:02	04:35	05:03	19:05	19:32	20:05							
22	149° 07.2	59.1	71° 40.6	16.0'	05° 56.1	11.3'	54.2'	35°	03:44	04:20	04:50	19:17	19:47	20:23							
23	164° 06.9	58.9	86° 15.7	16.0'	05° 44.8	11.3'	54.2'	40°	03:21	04:03	04:35	19:32	20:05	20:46							
			SD.=16.3	d=0.2		S.D.=14.8															

Thu	Sun						Moon						Lat.	Twilight			Sunrise	Sunset	Twilight		
	GHA	Dec	GHA	v	Dec	d	HP	Naut.	Civil	Sunrise	Sunset	Civil		Naut.					Civil	Naut.	
0	179° 06.6	S22° 58.7	100° 50.7	16.1'	S05° 33.4	11.3'	54.2'	N 72°	12:37	12:18	12:00	21:58	23:43	-:-							
1	194° 06.3	58.5	115° 25.8	16.1'	05° 22.1	11.4'	54.2'	N 70°	12:26	12:13	12:02	22:06	23:44	-:-							
2	209° 06.0	58.3	130° 09.9	16.1'	05° 10.7	11.4'	54.2'	68°	12:17	12:10	12:03	22:14	23:45	-:-							
3	224° 05.7	.. 58.1	144° 36.0	16.1'	04° 59.3	11.4'	54.2'	66°	12:09	12:07	12:04	22:20	23:46	-:-							
4	239° 05.4	57.9	159° 11.1	16.1'	04° 47.9	11.4'	54.2'	64°	12:02	12:04	12:05	22:25	23:47	-:-							
5	254° 05.1	57.6	173° 46.3	16.1'	04° 36.5	11.4'	54.2'	62°	11:57	12:02	12:06	22:29	23:48	-:-							
6	269° 04.8	S22° 57.4	188° 21.4	16.2'	S04° 25.0	11.5'	54.2'	60°	11:52	12:00	12:07	22:33	23:49	-:-							
7	284° 04.5	57.2	202° 56.6	16.2'	04° 13.5	11.5'	54.2'	N 58°	11:48	11:58	12:08	22:36	23:49	-:-							
8	299° 04.2	57.0	217° 31.7	16.2'	04° 02.1	11.5'	54.2'	56°	11:44	11:56	12:08	22:39	23:50	-:-							
9	314° 03.9	.. 56.8	232° 06.9	16.2'	03° 50.6	11.5'	54.2'	54°	11:40	11:55	12:09	22:42	23:50	-:-							
10	329° 03.6	56.6	246° 42.1	16.2'	03° 39.0	11.5'	54.2'	52°	11:37	11:54	12:10	22:44	23:51	-:-							
11	344° 03.3	56.3	261° 17.3	16.2'	03° 27.5	11.5'	54.2'	50°	11:34	11:52	12:10	22:46	23:51	-:-							
12	359° 03.0	S22° 56.1	275° 52.6	16.2'	S03° 16.0	11.5'	54.2'	45°	11:28	11:50	12:11	22:51	23:52	-:-							
13	14° 02.8	55.9	290° 27.8	16.2'	03° 04.4	11.6'	54.2'	S 10°	10:49	11:34	12:18	23:19	23:57	-:-							
14	29° 02.5	55.7	305° 03.0	16.2'	02 52.8	11.6'	54.2'	20°	10:43	11:31	12:19	23:24	23:57	-:-							
15	44° 02.2	.. 55.5	319° 38.3	16.2'	02° 41.3	11.6'	54.2'	30°	10:36	11:28	12:20	23:29	23:58	-:-							
16	59° 01.9	55.2	334° 13.5	16.2'	02° 29.7	11.6'	54.2'	35°	10:32	11:26	12:21	23:31	23:59	-:-							
17	74° 01.6	55.0	348° 48.8	16.3'	02° 18.1	11.6'	54.2'	40°	10:27	11:25	12:22	23:35	23:59	-:-							
18	89° 01.3	S22° 54.8	3° 24.0	16.3'	S02° 06.5	11.6'	54.2'	45°	10:21	11:22	12:23	23:38	-:-	00:00							
19	104° 01.0	54.6	17° 59.3	16.3'	01° 54.8	11.6'	54.2'	S 10°	10:49	11:34	12:18	23:19	23:57	-:-							
20	119° 00.7	54.3	32° 34.5	16.3'	01° 43.2	11.6'	54.2'	20°	10:43	11:31	12:19	23:24	23:57	-:-							
21	134° 00.4	.. 54.1	47° 09.8	16.3'	01° 31.6	11.6'	54.2'	30°	10:36	11:28	12:20	23:29	23:58	-:-							
22	149° 00.1	53.9	61° 45.0	16.3'	01° 19.9	11.7'	54.2'	35°	10:32	11:26	12:21	23:31	23:59	-:-							
23	163° 59.8	53.7	76° 20.3	16.3'	01° 08.2	11.7'	54.3'	40°	10:27	11:22	12:27	23:52	-:-	00:02							
			SD.=16.3	d=0.2		S.D.=14.8															

Day	Sun			Moon		
	Eqn.of Time 0h mm:ss	Mer. Pass 12h mm:ss	Mer. Pass Upper hh:mm	Mer. Pass Lower hh:mm	Moon 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	



## Equation of Time *for the Sun*



## 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

$$Hc = \sin[\sin(\text{Declination}) * \sin(\text{Latitude}) + \cos(\text{Latitude}) * \cos(\text{Declination}) * \cos(\text{LHA})]$$

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

$$\text{Sin}^{-1}(\sin(\text{Ap Latitude}) \times \sin(\text{Declination}) + \cos(\text{Ap Latitude}) \times \cos(\text{Declination}) \times \cos(\text{LHA}))$$

**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 ( $a\lambda$ )** "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 ( $a\lambda$ ) whole degree value from the whole degree **GHA** (Greenwich Hour Angle) value. If GHA is less than the  $a\lambda$  than the add 360° to it then subtract the  $a\lambda$ . *Ignore the arc minutes of GHA and  $a\lambda$ .*

**Example** when GHA is less than  $a\lambda$      $\text{GHA} = 43^\circ 25.2'$      $a\lambda = W 55^\circ 15.1'$

$$360^\circ + 43^\circ = 403^\circ \quad \text{Then....} 403^\circ - 55^\circ = 348^\circ \quad (\text{LHA})$$

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 ( $a\lambda$ ) *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-**     $\text{GHA} = 58^\circ 01.2'$      $a\lambda = E 9^\circ 10.1'$  (ignore the 10.1')

**Step 1-** get GHA degree difference;     $59^\circ - 58^\circ 01.2' = 0^\circ 58.8'$

**Step 2-** add  $a\lambda$  degrees to difference found in step 1;     $9^\circ + 0^\circ 58.8' = 9^\circ 58.8' a\lambda$

**Step 3-** get LHA;     $58^\circ 01.2 + 9^\circ 58.8' = 68^\circ$  (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

$$Z = \text{acos}[(\sin(\text{Declination}) - \sin(\text{Ap Latitude}) \times \sin(Hc)) \div (\cos(\text{Ap Latitude}) \times \cos(Hc))]$$

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

$$\text{Cos}^{-1}((\text{Sin}(\text{Declination}) - \text{Sin}(\text{AP Latitude}) \times \text{Sin}(Hc)) \div (\text{Cos}(\text{AP Latitude}) \times \text{Cos}(Hc)))$$

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

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

"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

$$Z = \tan^{-1} ((\sin(LHA) \div (\cos(\text{AP latitude}) \times \tan(\text{declination})) - (\sin(\text{AP latitude}) \times \cos(LHA)))$$

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  $180^\circ$ , it is treated as a negative quantity. If the azimuth angle as calculated is negative, add  $180^\circ$  to obtain the desired value.

**To obtain Zn apply the following rules**

In Northern Latitudes	In Southern Latitudes
LHA greater than $180^\circ$ ....Zn=Z	LHA greater than $180^\circ$ ....Zn= $180^\circ - Z$
LHA less than $180^\circ$ .....Zn= $360^\circ - Z$	LHA less than $180^\circ$ .....Zn= $180^\circ + Z$

**Determine Refraction**  $0.96 \div \text{Tan of } (Ha)$

Gives good results down to about  $8^\circ$  from the horizon but not less.

**Refraction** (good overall formula from  $90^\circ$  to below  $8^\circ$  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...

$$1 \div \tan((\text{Ha} + (7.31 \div (\text{Ha} + 4.4)))$$

Both refraction formulas use the standard pressure and temperature of;

1010 mb    10° C  
29.83 in    53° F

**Determine Dip using feet**                   $0.97 \times (\text{Square Root of } He \text{ (Height of Eye) in feet})$

**Determine Dip using meters**                   $1.76 \times (\text{Square Root of } He \text{ (Height of eye) in meters})$

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

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

$$\text{Latitude} = (90^\circ - \text{Ho}) + \text{declination}$$

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

$$\text{Latitude} = \text{Declination} - (90^\circ - \text{Ho})$$

**3-** Latitude and declination *Contrary name*:

$$\text{Latitude} = (90^\circ - \text{Ho}) - \text{Declination}$$

## 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  $\lambda$  figure will be used when plotting the LOP on the UPS.

### In Eastern longitudes

In Eastern longitudes the Ap  $\lambda$  is determined as follows;

$$\text{DR longitude} + (0^\circ 60' \text{ minus GHA minutes of arc})$$

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



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

## 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

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

### Bowditch    *2017- The American Practical Navigator*

[https://TheNauticalAlmanac.com/2017\\_Bowditch\\_American\\_Practical\\_Navigator.html](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](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](https://TheNauticalAlmanac.com/Pub._No._229.html)

### Sight Reduction Forms & Methods

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

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

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	100°05.4	219°42.3	\$18°36.9	253°00.9	\$09°33.5	285°53.1	N03°51.3	210°16.0	\$20°29.6	Alpheratz	357°41.7	29°10.9					
1	115°07.9	234°41.6	37.6	268°02.1	34.0	300°55.5	51.3	225°18.2	29.6	Ankaa	353°14.1	-42°13.4					
2	130°10.4	249°41.0	38.3	283°03.2	34.5	315°57.9	51.3	240°20.4	29.7	Schedar	349°38.4	56°37.7					
3	145°12.8	264°40.3	38.9	298°04.4	35.0	331°00.3	51.3	255°22.6	29.7	Diphda	348°54.2	-17°54.1					
4	160°15.3	279°39.6	39.6	313°05.5	35.5	346°02.7	51.3	270°24.7	29.7	Achernar	335°25.5	-57°09.7					
5	175°17.8	294°39.0	40.3	328°06.7	36.0	1°05.1	51.3	285°26.9	29.8	Hamal	327°58.6	23°32.3					
6	190°20.2	309°38.3	\$18°40.9	343°07.8	\$09°36.5	16°07.5	N03°51.3	300°29.1	\$20°29.8	Polaris	316°40.7	89°20.1					
7	205°22.7	324°37.6	41.6	358°09.0	37.0	31°10.0	51.3	315°31.3	29.8	Acamar	315°16.8	-40°14.8					
8	220°25.2	339°37.0	42.2	13°10.1	37.5	46°12.4	51.2	330°33.4	29.9	Menkar	314°13.0	4°09.0					
9	235°27.6	354°36.3	38.9	28°11.3	37.9	61°14.8	51.2	345°35.6	29.9	Mirfak	308°37.4	49°55.1					
10	250°30.1	9°35.7	43.6	43°12.4	38.4	76°17.2	51.2	0°37.8	30.0	Aldebaran	290°47.1	16°32.3					
11	265°32.6	24°35.0	44.2	58°13.6	38.9	91°19.6	51.2	15°40.0	30.0	Rigel	281°10.1	-8°11.3					
12	280°35.0	39°34.3	\$18°44.9	73°14.7	\$09°39.4	106°22.0	N03°51.2	30°42.1	\$20°30.0	Capella	280°31.4	46°00.7					
13	295°37.5	54°33.7	45.5	88°15.8	39.9	121°24.4	51.2	45°44.3	30.1	Bellatrix	278°29.8	6°21.6					
14	310°39.9	69°33.0	46.2	103°17.0	40.4	136°26.8	51.2	60°46.5	30.1	Elnath	278°10.1	28°37.0					
15	325°42.4	84°32.3	46.8	118°18.1	40.9	151°29.2	51.2	75°48.7	30.1	Alnilam	275°44.3	-1°11.8					
16	340°44.9	99°31.7	47.5	133°19.3	41.4	166°31.6	51.2	90°50.9	30.2	Betelgeuse	270°59.1	7°24.3					
17	355°47.3	114°31.0	48.2	148°20.4	41.9	181°34.1	51.2	105°53.0	30.2	Canopus	263°54.8	-52°42.5					
18	10°49.8	129°30.3	\$18°48.8	163°21.6	\$09°42.4	196°36.5	N03°51.1	120°55.2	\$20°30.2	Sirius	258°31.8	-16°44.5					
19	25°52.3	144°29.7	49.5	178°22.7	42.8	211°38.9	51.1	135°57.4	30.3	Adhara	255°10.8	-28°59.9					
20	40°54.7	159°29.0	50.1	193°23.9	43.3	226°41.3	51.1	150°59.6	30.3	Procyon	244°57.6	5°10.8					
21	55°57.2	174°28.3	50.8	208°25.0	43.8	241°43.7	51.1	166°01.7	30.4	Pollux	243°25.3	27°59.0					
22	70°59.7	189°27.7	51.4	223°26.2	44.3	256°46.1	51.1	181°03.9	30.4	Avior	234°16.6	-59°33.7					
23	86°02.1	204°27.0	52.1	238°27.3	44.8	271°48.5	51.1	196°06.1	30.4	Suhail	222°50.7	-43°29.8					
Mer.pass.:17:17			v-0.7 d-0.7 m-3.9	v1.1 d-0.5 m1.3	v2.4 d-0.0 m-2.0	v2.2 d-0.0 m0.5	Miaplacidus			v2.1 d-0.5 m1.2	v2.4 d-0.0 m-2.0	v2.2 d-0.0 m0.5	v2.1 d-0.5 m1.2	v2.4 d-0.0 m-2.0	v2.2 d-0.0 m0.5		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	101°04.6	219°26.3	\$18°52.7	253°28.5	\$09°45.3	286°50.9	N03°51.1	211°08.3	\$20°30.5	Denebola	182°31.9	14°28.8					
1	116°07.0	234°25.7	53.4	268°29.6	45.8	301°53.4	51.1	226°10.5	30.5	Gienah	175°50.5	-17°37.7					
2	131°09.5	249°25.0	54.0	283°30.8	46.3	316°55.8	51.1	241°12.6	30.5	Acrux	173°07.1	-63°10.9					
3	146°12.0	264°24.3	54.6	298°31.9	46.7	331°58.2	51.1	256°14.8	30.6	Gacrux	171°58.8	-57°11.9					
4	161°14.4	279°23.6	55.3	313°33.1	47.2	347°00.6	51.1	271°17.0	30.6	Alioth	166°19.3	55°52.1					
5	176°16.9	294°23.0	55.9	328°34.2	47.7	2°03.0	51.0	286°19.2	30.6	Alkaid	152°57.8	49°13.8					
6	191°19.4	309°22.3	\$18°56.6	343°35.4	\$09°48.2	17°05.4	N03°51.0	301°21.3	\$20°30.7	Hadar	148°45.5	-60°26.6					
7	206°21.8	324°21.6	57.2	358°36.5	48.7	32°07.8	51.0	316°23.5	30.7	Menkent	148°05.6	-36°26.6					
8	221°24.3	339°20.9	57.9	13°37.7	49.2	47°10.3	51.0	331°25.7	30.7	Arcturus	145°54.3	19°05.9					
9	236°26.8	354°20.3	58.5	28°38.8	49.7	62°12.7	51.0	346°27.9	30.8	Rigil Kent.	139°49.5	-60°53.6					
10	251°29.2	9°19.6	59.1	43°40.0	50.2	77°15.1	51.0	1°30.1	30.8	Kochab	137°21.0	74°05.2					
11	266°31.7	24°18.9	18°59.8	58°41.1	50.6	92°17.5	51.0	16°32.2	30.9	Zuben' ubi	137°03.7	-16°06.3					
12	281°34.2	39°18.2	\$19°00.4	73°42.3	\$09°51.1	107°19.9	N03°51.0	31°34.4	\$20°30.9	Alphecca	126°09.8	26°39.7					
13	296°36.6	54°17.6	01.1	88°43.4	51.6	122°22.3	51.0	46°36.6	30.9	Antares	112°24.4	-26°27.8					
14	311°39.1	69°16.9	01.7	103°44.6	52.1	137°24.8	51.0	61°38.8	31.0	Atria	107°25.2	-69°03.0					
15	326°41.5	84°16.2	02.3	118°45.7	52.6	152°27.2	51.0	76°41.0	31.0	Sabik	102°10.9	-15°44.4					
16	341°44.0	99°15.5	03.0	133°46.9	53.1	167°29.6	51.0	91°43.1	31.0	Shaula	96°20.0	-37°06.6					
17	356°46.5	114°14.9	03.6	148°48.0	53.6	182°32.0	51.0	106°45.3	31.1	Rasalhague	96°05.2	12°33.1					
18	11°48.9	129°14.2	\$19°04.2	163°49.2	\$09°54.0	197°34.4	N03°50.9	121°47.5	\$20°31.1	Eltanin	90°45.9	51°29.3					
19	26°51.4	144°13.5	04.9	178°50.3	54.5	212°36.9	50.9	136°49.7	31.1	Kaus Aust.	83°41.9	-34°22.4					
20	41°53.9	159°12.8	05.5	193°51.4	55.0	227°39.3	50.9	151°51.8	31.2	Vega	80°38.2	38°48.1					
21	56°56.3	174°12.1	06.1	208°52.6	55.5	242°41.7	50.9	166°54.0	31.2	Nunki	75°56.6	-26°16.4					
22	71°58.8	189°11.4	06.8	223°53.7	56.0	257°44.1	50.9	181°56.2	31.2	Altair	62°06.9	8°54.8					
23	87°01.3	204°10.8	07.4	238°54.9	56.5	272°46.5	50.9	196°58.4	31.3	Peacock	53°17.2	-56°41.0					
Mer.pass.:17:13			v-0.7 d-0.6 m-3.9	v1.1 d-0.5 m1.2	v2.4 d-0.0 m-2.0	v2.2 d-0.0 m0.5	Deneb			v2.1 d-0.5 m1.2	v2.4 d-0.0 m-2.0	v2.2 d-0.0 m0.5	v2.1 d-0.5 m1.2	v2.4 d-0.0 m-2.0	v2.2 d-0.0 m0.5		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	102°03.7	219°10.1	\$19°08.0	253°56.0	\$09°56.9	287°49.0	N03°50.9	212°06.6	\$20°31.3	Jan 01 Fri	15°22.3	-29°32.4					
1	117°06.2	234°09.4	08.6	268°57.2	57.4	302°51.4	50.9	227°02.7	31.4	Venus	119°36.8	09:22					
2	132°08.7	249°08.7	09.3	283°58.3	57.9	317°53.8	50.9	242°04.9	31.4	Mars	152°55.5	07:07					
3	147°11.1	264°08.0	09.9	298°59.5	58.4	332°56.2	50.9	257°07.1	31.4	Jupiter	185°47.7	04:56					
4	162°13.6	279°07.3	10.5	314°00.6	58.9	347°58.6	50.9	272°09.3	31.5	Saturn	110°10.6	09:57					
5	177°16.0	294°06.7	11.1	329°01.8	59.4	3°01.1	50.9	287°11.5	31.5	Jan 02 Sat	13°51.8	28°10.3					
6	192°18.5	309°06.0	\$19°11.8	344°02.9	\$09°59.9	18°03.5	N03°50.9	302°13.6	\$20°31.5	Jan 02 Sat	13°36.7	15°37.6					
7	207°21.0	324°05.3	12.4	359°04.1	10°00.3	33°05.9	50.9	317°15.8	31.6	Venus	118°21.7	09:23					
8	222°23.4	339°04.6	13.0	14°05.3	00.8	48°08.3	50.9	332°18.0	31.6	Mars	152°23.9	07:06					
9	237°25.9	354°03.9	13.6	29°06.4	01.3	63°10.8	50.9	347°20.2	31.6	Jupiter	185°46.4	04:52					
10	252°28.4	9°03.2	14.2	44°07.6	01.8	78°13.2	50.9	2°22.4	31.7	Saturn	110°03.7	09:54					
11	267°30.8	24°02.5	14.9	59°08.7	02.3	93°15.6	50.9	17°24.5	31.7	Jan 03 Sun	117°06.4	09:24					
12	282°33.3	39°01.9	\$19°15.5	74°09.9	\$10°02.7	108°18.0	N03°50.9	32°26.7	\$20°31.7	Venus	117°06.4	09:24					
13	297°35.8	54°01.2	16.1	89°11.0	03.2	123°20.5	50.8	47°28.9	31.8	Mars	151°52.3	07:04					
14	312°38.2	69°00.5	16.7	104°12.2	03.7	138°22.9	50.8	62°31.1	31.8	Jupiter	185°45.2	04:48					
15	327°40.7	83°59.8	17.3	119°13.3	04.2	153°25.3	50.8	77°33.3	31.8	Saturn	109°56.8	09:51					
16	342°43.1	98°59.1	17.9	134°14.5	04.7	168°27.7	50.8	92°35.4	31.9	Horizontal parallax							
17	357°45.6	113°58.4	18.6	149°15.6	05.2	183°30.2	50.8	107°37.6	31.9	Venus:	0.1						
18	12°48.1	128°57.7	\$19°19.2	164°16.8	\$10°05.6	198°32.6	N03°50.8	122°39.8	\$20°31.9	Mars:	0.1						
19	27°50.5	143°57.0	19.8	179°17.9	06.1	213°35.0	50.8	137°42.0	32.0								
2																	

DUT1 = UT1-UTC = +0.0816 sec ΔT = TT-UT1 = +68.1024 sec

2016 January 01 to Jan. 03 UT

h	Sun	Moon					
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°13.9	S23°03.5	283°03.3	15.2'	N01°27.6	-9.4'	54.4'
1	194°13.6	03.4	297°37.4	15.2'	01°18.2	-9.4'	54.4'
2	209°13.3	03.2	312°11.6	15.2'	01°08.8	-9.4'	54.4'
3	224°13.0	.. 03.0	326°45.8	15.2'	00°59.5	-9.4'	54.4'
4	239°12.7	02.8	341°20.0	15.2'	00°50.1	-9.4'	54.4'
5	254°12.4	02.6	355°54.3	15.2'	00°40.7	-9.4'	54.4'
6	269°12.1	S23°02.4	10°28.5	15.2'	N00°31.3	-9.4'	54.4'
7	284°11.8	02.2	25°02.8	15.3'	00°21.9	-9.4'	54.4'
8	299°11.5	02.0	39°37.0	15.3'	00°12.6	-9.4'	54.4'
9	314°11.2	.. 01.8	54°11.3	15.3'	N00°03.2	-9.4'	54.3'
10	329°10.9	01.6	68°45.6	15.3'	S00°06.2	-9.4'	54.3'
11	344°10.6	01.4	83°19.9	15.3'	00°15.5	-9.4'	54.3'
12	359°10.3	S23°01.2	97°54.2	15.3'	S00°24.9	-9.4'	54.3'
13	14°10.0	01.0	112°28.5	15.3'	00°34.3	-9.4'	54.3'
14	29°09.7	00.8	127°02.8	15.3'	00°43.6	-9.3'	54.3'
15	44°09.5	.. 00.6	141°37.1	15.3'	00°52.9	-9.3'	54.3'
16	59°09.2	00.4	156°11.4	15.3'	01°02.3	-9.3'	54.3'
17	74°08.9	00.2	170°45.8	15.3'	01°11.6	-9.3'	54.3'
18	89°08.6	S23°00.0	185°20.1	15.3'	S01°20.9	-9.3'	54.3'
19	104°08.3	22°59.8	199°54.4	15.3'	01°30.3	-9.3'	54.3'
20	119°08.0	59.6	214°28.8	15.3'	01°39.6	-9.3'	54.3'
21	134°07.7	.. 59.4	229°03.1	15.3'	01°48.9	-9.3'	54.3'
22	149°07.4	59.2	243°37.5	15.3'	01°58.2	-9.3'	54.3'
23	164°07.1	58.9	258°11.8	15.3'	02°07.5	-9.3'	54.3'
	SD.=16.3	d=0.2			S.D.=14.8		

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°06.8	S22°58.7	272°46.1	15.3'	S02°16.7	-9.3'	54.3'
1	194°06.5	58.5	287°20.5	15.3'	02°26.0	-9.3'	54.3'
2	209°06.2	58.3	301°54.8	15.3'	02°35.2	-9.2'	54.3'
3	224°05.9	.. 58.1	316°29.1	15.3'	02°44.5	-9.2'	54.2'
4	239°05.6	57.9	331°03.4	15.3'	02°53.7	-9.2'	54.2'
5	254°05.3	57.7	345°37.8	15.3'	03°02.9	-9.2'	54.2'
6	269°05.0	S22°57.5	0°12.1	15.3'	S03°12.1	-9.2'	54.2'
7	284°04.7	57.2	14°46.4	15.3'	03°21.3	-9.2'	54.2'
8	299°04.4	57.0	29°20.7	15.3'	03°30.5	-9.2'	54.2'
9	314°04.2	.. 56.8	43°55.0	15.3'	03°39.7	-9.2'	54.2'
10	329°03.9	56.6	58°29.3	15.3'	03°48.8	-9.1'	54.2'
11	344°03.6	56.4	73°03.5	15.3'	03°57.9	-9.1'	54.2'
12	359°03.3	S22°56.2	87°37.8	15.3'	S04°07.1	-9.1'	54.2'
13	14°03.0	55.9	102°12.0	15.2'	04°16.2	-9.1'	54.2'
14	29°02.7	55.7	116°46.3	15.2'	04°25.2	-9.1'	54.2'
15	44°02.4	.. 55.5	131°20.5	15.2'	04°34.3	-9.1'	54.2'
16	59°02.1	55.3	145°54.7	15.2'	04°43.3	-9.0'	54.2'
17	74°01.8	55.0	160°28.9	15.2'	04°52.4	-9.0'	54.2'
18	89°01.5	S22°54.8	175°03.1	15.2'	S05°01.4	-9.0'	54.2'
19	104°01.2	54.6	189°37.3	15.2'	05°10.4	-9.0'	54.2'
20	119°00.9	54.4	204°11.4	15.1'	05°19.3	-9.0'	54.2'
21	134°00.7	.. 54.1	218°45.6	15.1'	05°28.3	-8.9'	54.2'
22	149°00.4	53.9	233°19.7	15.1'	05°37.2	-8.9'	54.3'
23	164°00.1	53.7	247°53.8	15.1'	05°46.1	-8.9'	54.3'
	SD.=16.3	d=0.2			S.D.=14.8		

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°59.8	S22°53.5	262°27.9	15.1'	S05°55.0	-8.9'	54.3'
1	193°59.5	53.2	277°01.9	15.1'	06°03.9	-8.9'	54.3'
2	208°59.2	53.0	291°36.0	15.0'	06°12.7	-8.8'	54.3'
3	223°58.9	.. 52.8	306°10.0	15.0'	06°21.5	-8.8'	54.3'
4	238°58.6	52.5	320°44.0	15.0'	06°30.3	-8.8'	54.3'
5	253°58.3	52.3	335°18.0	15.0'	06°39.1	-8.8'	54.3'
6	268°58.0	S22°52.1	349°51.9	14.9'	S06°47.8	-8.7'	54.3'
7	283°57.7	51.8	4°25.9	14.9'	06°56.5	-8.7'	54.3'
8	298°57.5	51.6	18°59.8	14.9'	07°05.2	-8.7'	54.3'
9	313°57.2	.. 51.4	33°33.6	14.9'	07°13.9	-8.6'	54.3'
10	328°56.9	51.1	48°07.5	14.8'	07°22.5	-8.6'	54.3'
11	343°56.6	50.9	62°41.3	14.8'	07°31.1	-8.6'	54.3'
12	358°56.3	S22°50.7	77°15.1	14.8'	S07°39.7	-8.6'	54.3'
13	13°56.0	50.4	91°48.9	14.8'	07°48.3	-8.5'	54.3'
14	28°55.7	50.2	106°22.6	14.7'	07°56.8	-8.5'	54.3'
15	43°55.4	.. 49.9	120°56.3	14.7'	08°05.3	-8.5'	54.3'
16	58°55.1	49.7	135°30.0	14.7'	08°13.7	-8.4'	54.4'
17	73°54.9	49.4	150°03.7	14.6'	08°22.2	-8.4'	54.4'
18	88°54.6	S22°49.2	164°37.3	14.6'	S08°30.6	-8.4'	54.4'
19	103°54.3	49.0	179°10.9	14.6'	08°38.9	-8.4'	54.4'
20	118°54.0	48.7	193°44.4	14.5'	08°47.3	-8.3'	54.4'
21	133°53.7	.. 48.5	208°17.9	14.5'	08°55.6	-8.3'	54.4'
22	148°53.4	48.2	222°51.4	14.5'	09°03.8	-8.2'	54.4'
23	163°53.1	48.0	237°24.9	14.4'	09°12.1	-8.2'	54.4'
	SD.=16.3	d=0.2			S.D.=14.8		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	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	09:22	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
48°	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	18:39
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	03:19	20:48	21:48	22:58
58°	■	01:51	03:03	21:04	22:15	23:08
S 60°	■	01:08	02:44	21:23	22:58	23:08

Day	Sun		Mer.	Moon	
	Eqn.of Time	Mer.		Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Upper hh:mm	Lower hh:mm
01	03:04	03:19	12:03	05:17	17:38
02	03:33	03:47	12:04	05:59	18:20
03	04:01	04:15	12:04	06:42	19:03



**January 04, 05, 06 UT (Mon., Tue., Wed.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	103°02.9	218°53.6	\$19°22.8	254°23.7	\$10°08.5	288°47.2	N03°50.8	212°52.9	\$20°32.2	Alpheratz	357°41.7	29°10.8					
1	118°05.3	233°52.9	23.4	269°24.8	09.0	303°49.6	50.8	227°55.1	32.2	Ankaa	353°14.1	-42°13.4					
2	133°07.8	248°52.2	24.0	284°26.0	09.5	318°52.0	50.8	242°57.3	32.2	Schedar	349°38.4	56°37.7					
3	148°10.3	263°51.5	· · 24.6	299°27.1	· · 10.0	333°54.4	· · 50.8	257°59.4	· · 32.3	Diphda	348°54.2	-17°54.1					
4	163°12.7	278°50.8	25.2	314°28.3	10.5	348°56.9	50.8	273°01.6	32.3	Achernar	335°25.5	-57°09.7					
5	178°15.2	293°50.1	25.8	329°29.4	10.9	3°59.3	50.8	288°03.8	32.3	Hamal	327°58.6	23°32.3					
6	193°17.6	308°49.4	\$19°26.4	344°30.6	\$10°11.4	19°01.7	N03°50.8	303°06.0	\$20°32.4	Polaris	316°41.8	89°20.1					
7	208°20.1	323°48.7	27.0	359°31.7	11.9	34°04.2	50.8	318°08.2	32.4	Acamar	315°16.8	-40°14.8					
8	223°22.6	338°48.0	27.6	14°32.9	12.4	49°06.6	50.8	333°10.3	32.4	Menkar	314°13.0	4°09.0					
9	238°25.0	353°47.3	· · 28.2	29°34.0	· · 12.9	64°09.0	· · 50.8	348°12.5	· · 32.5	Mirfak	308°37.5	49°55.1					
10	253°27.5	8°46.6	28.8	44°35.2	13.3	79°11.5	50.8	3°14.7	32.5	Aldebaran	290°47.1	16°32.3					
11	268°30.0	23°45.9	29.4	59°36.3	13.8	94°13.9	50.8	18°16.9	32.5	Rigel	281°10.1	-8°11.3					
12	283°32.4	38°45.2	\$19°30.0	74°37.5	\$10°14.3	109°16.3	N03°50.8	33°19.1	\$20°32.6	Capella	280°31.4	46°00.7					
13	298°34.9	53°44.5	30.6	89°38.6	14.8	124°18.7	50.8	48°21.3	32.6	Bellatrix	278°29.8	6°21.6					
14	313°37.4	68°43.8	31.2	104°39.8	15.2	139°21.2	50.8	63°23.4	32.6	El Nath	278°10.1	28°37.0					
15	328°39.8	83°43.1	· · 31.8	119°41.0	· · 15.7	154°23.6	· · 50.8	78°25.6	· · 32.7	Alnilam	275°44.3	-1°11.8					
16	343°42.3	98°42.4	32.4	134°42.1	16.2	169°26.0	50.8	93°27.8	32.7	Betelgeuse	270°59.1	7°24.3					
17	358°44.8	113°41.7	33.0	149°43.3	16.7	184°28.5	50.8	108°30.0	32.7	Canopus	263°54.8	-52°42.5					
18	13°47.2	128°41.0	\$19°33.6	164°44.4	\$10°17.2	199°30.9	N03°50.8	123°32.2	\$20°32.8	Sirius	258°31.8	-16°44.5					
19	28°49.7	143°40.3	34.2	179°45.6	17.6	214°33.3	50.8	138°34.4	32.8	Adhara	255°10.8	-28°59.9					
20	43°52.1	158°39.6	34.8	194°46.7	18.1	229°35.8	50.8	153°36.5	32.9	Procyon	244°57.6	5°10.8					
21	58°54.6	173°38.9	· · 35.4	209°47.9	· · 18.6	244°38.2	· · 50.8	168°38.7	· · 32.9	Pollux	243°25.3	27°59.0					
22	73°57.1	188°38.2	36.0	224°49.0	19.1	259°40.7	50.8	183°40.9	32.9	Avior	234°16.6	-59°33.7					
23	88°59.5	203°37.4	36.6	239°50.2	19.6	274°43.1	50.8	198°43.1	33.0	Suhail	222°50.7	-43°29.9					
Mer.pass.:17:05			v-0.7 d-0.6 m-3.9	v1.2 d-0.5 m1.2	v2.4 d-0.0 m-2.0	v2.2 d-0.0 m0.5	Miaplacidus			221°38.3	-69°46.9						
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.1	-8°43.8	
0	104°02.0	218°36.7	\$19°37.1	254°51.3	\$10°20.0	289°45.5	N03°50.8	213°45.3	\$20°33.0	Regulus	207°41.5	11°53.1					
1	119°04.5	233°36.0	37.7	269°52.5	20.5	304°48.0	50.8	228°47.4	33.0	Dubhe	193°49.4	61°39.5					
2	134°06.9	248°35.3	38.3	284°53.6	21.0	319°50.4	50.8	243°49.6	33.1	Denebola	182°31.8	14°28.8					
3	149°09.4	263°34.6	· · 38.9	299°54.8	· · 21.5	334°52.8	· · 50.8	258°51.8	· · 33.1	Gienah	175°50.4	-17°37.8					
4	164°11.9	278°33.9	39.5	314°55.9	21.9	349°55.3	50.8	273°54.0	33.1	Gacrux	173°07.1	-63°10.9					
5	179°14.3	293°33.2	40.1	329°57.1	22.4	4°57.7	50.8	288°56.2	33.2	Alioth	171°58.8	-57°11.9					
6	194°16.8	308°32.5	\$19°40.6	344°58.3	\$10°22.9	20°00.1	N03°50.8	303°58.4	\$20°33.2	Alkaid	166°19.3	55°52.1					
7	209°19.2	323°31.8	41.2	359°59.4	23.4	35°02.6	50.8	319°05.5	33.2	Hadar	152°57.8	49°13.8					
8	224°21.7	338°31.1	41.8	15°00.6	23.8	50°05.0	50.8	334°02.7	33.3	Menkent	148°05.6	-36°26.6					
9	239°24.2	353°30.4	· · 42.4	30°01.7	· · 24.3	65°07.5	· · 50.8	349°04.9	· · 33.3	Arcturus	145°54.3	19°05.9					
10	254°26.6	8°29.7	43.0	45°02.9	24.8	80°09.9	50.8	4°07.1	33.3	Rigel Kent.	139°49.5	-60°53.6					
11	269°29.1	23°28.9	43.5	60°04.0	25.3	95°12.3	50.8	19°09.3	33.4	Kochab	137°20.9	74°05.2					
12	284°31.6	38°28.2	\$19°44.1	75°05.2	\$10°25.7	110°14.8	N03°50.8	34°11.5	\$20°33.4	Zuben' ubi	137°03.7	-16°06.3					
13	299°34.0	53°27.5	44.7	90°06.3	26.2	125°17.2	50.8	49°13.6	33.4	Alphecca	126°09.8	26°39.7					
14	314°36.5	68°26.8	45.3	105°07.5	26.7	140°19.7	50.8	64°15.8	33.5	Antares	112°24.4	-26°27.8					
15	329°39.0	83°26.1	· · 45.8	120°08.6	· · 27.2	155°22.1	· · 50.8	79°18.0	· · 33.5	Atria	107°25.1	-69°03.0					
16	344°41.4	98°25.4	46.4	135°09.8	27.6	170°24.5	50.8	94°20.2	33.5	Sabik	102°10.9	-15°44.4					
17	359°43.9	113°24.7	47.0	150°11.0	28.1	185°27.0	50.8	109°22.4	33.6	Rasalhague	96°05.2	12°33.1					
18	14°46.4	128°23.9	\$19°47.5	165°12.1	\$10°28.6	200°29.4	N03°50.8	124°24.6	\$20°33.6	Eltanin	90°45.9	51°29.3					
19	29°48.8	143°23.2	48.1	180°13.3	29.1	215°31.9	50.8	139°26.8	33.6	Kaus Aust.	83°41.9	-34°22.4					
20	44°51.3	158°22.5	48.7	195°14.4	29.5	230°34.3	50.8	154°28.9	33.7	Vega	80°38.2	38°48.1					
21	59°53.7	173°21.8	· · 49.2	210°15.6	· · 30.0	245°36.7	· · 50.8	169°31.1	· · 33.7	Nunki	75°56.6	-26°16.4					
22	74°56.2	188°21.1	49.8	225°16.7	30.5	260°39.2	50.8	184°33.3	33.7	Altair	62°06.9	8°54.8					
23	89°58.7	203°20.4	50.4	240°17.9	31.0	275°41.6	50.8	199°35.5	33.8	Peacock	53°17.2	-56°40.9					
Mer.pass.:17:01			v-0.7 d-0.6 m-3.9	v1.2 d-0.5 m1.2	v2.4 d0.0 m-2.0	v2.2 d-0.0 m0.5	Deneb			Enif	33°45.7	9°57.0					
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Al Na'ir	27°42.0	-46°53.1					
0	105°01.1	218°19.6	\$19°50.9	255°19.0	\$10°31.4	290°44.1	N03°50.8	214°37.7	\$20°33.8	Fomalhaut	15°22.3	-29°32.4					
1	120°03.6	233°18.9	51.5	270°20.2	31.9	305°46.5	50.8	229°39.9	33.8	Scheat	13°51.8	28°10.3					
2	135°06.1	248°18.2	52.1	285°21.4	32.4	320°49.0	50.8	244°42.0	33.9	Markab	13°36.7	15°17.6					
3	150°08.5	263°17.5	· · 52.6	300°22.5	· · 32.9	335°51.4	· · 50.9	259°44.2	· · 33.9	Jan 04 Mon	SHA	Mer.pass					
4	165°11.0	278°16.8	53.2	315°23.7	33.3	350°53.8	50.9	274°46.4	33.9	Venus	115°50.7	09:25					
5	180°13.5	293°16.1	53.8	330°24.8	33.8	5°56.3	50.9	289°48.6	34.0	Mars	151°20.8	07:02					
6	195°15.9	308°15.3	\$19°54.3	345°26.0	\$10°34.3	20°58.7	N03°50.9	304°50.8	\$20°34.0	Jupiter	185°44.3	04:44					
7	210°18.4	323°14.6	54.9	0°27.1	34.8	36°01.2	50.9	319°53.0	34.0	Saturn	109°50.0	09:47					
8	225°20.9	338°13.9	55.4	15°28.3	35.2	51°03.6	50.9	334°55.2	34.1	Jan 05 Tue	SHA	Mer.pass					
9	240°23.3	353°13.2	· · 56.0	30°29.4	· · 35.7	66°06.1	· · 50.9	349°57.3	· · 34.1	Venus	114°34.7	09:26					
10	255°25.8	8°12.4	56.5	45°30.6	36.2	81°08.5	50.9	4°59.5	34.1	Mars	150°49.3	07:00					
11	270°28.2	23°11.7	57.1	60°31.8	36.6	96°11.0	50.9	20°01.7	34.2	Jupiter	185°43.5	04:40					
12	285°30.7	38°11.0	\$19°57.7	75°32.9	\$10°37.1	111°13.4	N03°50.9	35°03.9	\$20°34.2	Saturn	109°43.3	09:44					
13	300°33.2	53°10.3	58.2	90°34.1	37.6	126°15.9	50.9	50°06.1	34.2	Jan 06 Wed	SHA	Mer.pass					
14	315°35.6	68°09.5	58.8	105°35.2	38.1	141°18.3	50.9	65°08.3	34.3	Venus	113°18.5	09:27					
15	330°38.1	83°08.8	· · 59.3	120°36.4	· · 38.5	156°20.8	· · 50.9	80°10.5	· · 34.3	Mars	150°17.9	06:58					
16	345°40.6	98°08.1	19°59.9	135°37.5	39.0	171°23.2	50.9	95°12.6	34.3	Jupiter	185°42.9	04:36					
17	0°43.0	113°07.4	20°00.4	150°38.7	39.5	186°25.6	50.9	110°14.8	34.4	Saturn	109°36.5	09:40					
18	15°45.5	128°06.6	\$20°01.0	165°39.9	\$10°39.9	201°28.1	N03°50.9	125°17.0	\$20°34.4	Horizontal parallax							
19	30°48.0	143°05.9	01.5	180°41.0	40.4	216°30.5	50.9	140°19.2	34.4	Venus:	0						

DUT1 = UT1-UTC = +0.0762 sec ΔT = TT-UT1 = +68.1078 sec

2016 January 04 to Jan. 06 UT

h		Sun		Moon				Lat.		Twilight		Sunrise		Sunset		Twilight	
Mon		GHA	Dec	GHA	ν	Dec	d	HP	Naut.	Civil			Civil	Naut.	Civil	Naut.	
0		178°52.8	S22°47.7	251°58.3	14.4'	S09°20.3	-8.2'	54.4'	N 72°	08:20	10:31	■	■	13:39	15:51		
1		193°52.6	47.5	266°31.7	14.4'	09°28.4	-8.1'	54.4'	N 70°	08:02	09:44	■	■	14:27	16:09		
2		208°52.3	47.2	281°05.0	14.3'	09°36.6	-8.1'	54.5'	68°	07:47	09:13	11:33	12:38	14:58	16:23		
3		223°52.0	.. 47.0	295°38.3	14.3'	09°44.6	-8.1'	54.5'	66°	07:35	08:50	10:21	13:50	15:21	16:35		
4		238°51.7	46.7	310°11.6	14.2'	09°52.7	-8.0'	54.5'	64°	07:25	08:32	09:45	14:25	15:39	16:46		
5		253°51.4	46.5	324°44.8	14.2'	10°00.7	-8.0'	54.5'	62°	07:16	08:17	09:20	14:51	15:54	16:55		
6		268°51.1	S22°46.2	339°18.0	14.2'	S10°08.7	-8.0'	54.5'	60°	07:08	08:04	09:00	15:11	16:06	17:02		
7		283°50.8	46.0	353°51.2	14.1'	10°16.6	-7.9'	54.5'	N 58°	07:01	07:53	08:44	15:27	16:17	17:09		
8		298°50.5	45.7	8°24.3	14.1'	10°24.5	-7.9'	54.5'	56°	06:55	07:44	08:30	15:41	16:27	17:16		
9		313°50.3	.. 45.5	22°57.3	14.1'	10°32.4	-7.8'	54.5'	54°	06:49	07:35	08:18	15:53	16:36	17:21		
10		328°50.0	45.2	37°30.4	14.0'	10°40.2	-7.8'	54.6'	52°	06:44	07:27	08:07	16:03	16:43	17:27		
11		343°49.7	45.0	52°03.4	14.0'	10°48.0	-7.8'	54.6'	50°	06:39	07:20	07:58	16:13	16:51	17:32		
12		358°49.4	S22°44.7	66°36.3	13.9'	S10°55.7	-7.7'	54.6'	45°	06:28	07:05	07:38	16:32	17:06	17:43		
13		13°49.1	44.4	81°09.2	13.9'	11°03.4	-7.7'	54.6'	N 40°	06:18	06:52	07:22	16:48	17:19	17:53		
14		28°48.8	44.2	95°42.1	13.8'	11°11.0	-7.6'	54.6'	35°	06:09	06:41	07:08	17:02	17:30	18:01		
15		43°48.6	.. 43.9	110°14.9	13.8'	11°18.6	-7.6'	54.6'	30°	06:01	06:30	06:57	17:14	17:40	18:10		
16		58°48.3	43.7	124°47.7	13.7'	11°26.2	-7.5'	54.6'	20°	05:45	06:12	06:36	17:34	17:58	18:25		
17		73°48.0	43.4	139°20.4	13.7'	11°33.7	-7.5'	54.7'	N 10°	05:29	05:56	06:18	17:52	18:15	18:41		
18		88°47.7	S22°43.1	153°53.1	13.7'	S11°41.2	-7.4'	54.7'	0°	05:13	05:39	06:01	18:09	18:31	18:57		
19		103°47.4	42.9	168°25.7	13.6'	11°48.6	-7.4'	54.7'	S 10°	04:55	05:22	05:44	18:26	18:49	19:16		
20		118°47.1	42.6	182°58.3	13.6'	11°56.0	-7.4'	54.7'	20°	04:33	05:02	05:26	18:44	19:08	19:37		
21		133°46.8	.. 42.3	197°30.8	13.5'	12°03.3	-7.3'	54.7'	30°	04:05	04:38	05:05	19:05	19:32	20:05		
22		148°46.6	42.1	212°03.3	13.5'	12°10.6	-7.3'	54.7'	35°	03:47	04:23	04:52	19:18	19:47	20:23		
23		163°46.3	41.8	226°35.8	13.4'	12°17.8	-7.2'	54.8'	40°	03:24	04:05	04:38	19:32	20:05	20:45		
		SD.=16.3	d=0.2			S.D.=14.9			45°	02:55	03:44	04:21	19:49	20:26	21:14		
Tue		GHA	Dec	GHA	ν	Dec	d	HP	S 50°	02:13	03:15	03:59	20:11	20:54	21:57		
0		178°46.0	S22°41.5	241°08.2	13.4'	S12°25.0	-7.2'	54.8'	52°	01:48	03:01	03:49	20:21	21:08	22:21		
1		193°45.7	41.3	255°40.5	13.3'	12°32.1	-7.1'	54.8'	54°	01:11	02:44	03:37	20:33	21:25	22:57		
2		208°45.4	41.0	270°12.8	13.3'	12°39.2	-7.1'	54.8'	56°	□	02:24	03:24	20:46	21:45	□		
3		223°45.1	.. 40.7	284°45.1	13.2'	12°46.2	-7.0'	54.8'	58°	□	01:57	03:08	21:02	22:12	□		
4		238°44.9	40.5	299°17.3	13.2'	12°53.2	-7.0'	54.8'	S 60°	□	01:17	02:49	21:21	22:50	□		
		SD.=16.3	d=0.3			S.D.=15.0											
Wed		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Mon	Tue	Wed	Mon	Tue	Wed	Moonrise	Moonset
0		178°39.2	S22°34.9	229°50.2	12.1'	S15°00.9	-5.8'	55.2'	N 72°	03:28	05:08	06:55	11:06	11:00	10:51		
1		193°39.0	34.6	244°21.3	12.0'	15°06.6	-5.7'	55.3'	N 70°	03:12	04:43	06:15	11:24	11:27	11:32		
2		208°38.7	34.3	258°52.3	12.0'	15°12.2	-5.6'	55.3'	68°	02:59	04:23	05:48	11:38	11:47	12:00		
3		223°38.4	.. 34.1	273°23.3	11.9'	15°17.8	-5.6'	55.3'	66°	02:49	04:08	05:27	11:50	12:03	12:22		
4		238°38.1	33.8	287°54.2	11.9'	15°23.4	-5.5'	55.3'	64°	02:40	03:56	05:10	11:59	12:16	12:39		
5		253°37.9	33.5	302°25.0	11.8'	15°28.8	-5.4'	55.4'	62°	02:32	03:45	04:57	12:08	12:27	12:53		
6		268°37.6	S22°33.2	316°55.8	11.8'	S15°34.2	-5.4'	55.4'	60°	02:26	03:36	04:45	12:15	12:37	13:05		
7		283°37.3	32.9	331°26.5	11.7'	15°39.6	-5.3'	55.4'	N 58°	02:20	03:28	04:35	12:21	12:45	13:15		
8		298°37.0	32.6	345°57.2	11.6'	15°44.8	-5.2'	55.4'	56°	02:15	03:21	04:27	12:27	12:53	13:24		
9		313°36.7	.. 32.3	0°27.8	11.6'	15°50.0	-5.1'	55.5'	54°	02:11	03:15	04:19	12:32	12:59	13:32		
10		328°36.5	32.0	14°58.4	11.5'	15°55.1	-5.1'	55.5'	52°	02:07	03:10	04:12	12:36	13:05	13:39		
11		343°36.2	31.7	29°28.9	11.5'	16°00.1	-5.0'	55.5'	50°	02:03	03:05	04:06	12:41	13:11	13:46		
12		358°35.9	S22°31.4	43°59.3	11.4'	S16°05.1	-4.9'	55.5'	45°	01:55	02:54	03:53	12:50	13:22	14:00		
13		13°35.6	31.1	58°29.7	11.4'	16°10.0	-4.8'	55.6'	N 40°	01:48	02:45	03:42	12:57	13:32	14:11		
14		28°35.4	30.8	73°00.1	11.3'	16°14.8	-4.8'	55.6'	35°	01:43	02:37	03:32	13:04	13:40	14:21		
15		43°35.1	.. 30.5	87°30.3	11.2'	16°19.5	-4.7'	55.6'	30°	01:38	02:30	03:24	13:09	13:48	14:30		
16		58°34.8	30.2	102°00.5	11.2'	16°24.2	-4.6'	55.6'	20°	01:29	02:19	03:10	13:19	14:00	14:45		
17		73°34.5	30.0	116°30.7	11.1'	16°28.7	-4.5'	55.6'	N 10°	01:22	02:09	02:58	13:28	14:11	14:58		
		SD.=16.3	d=0.3			S.D.=15.1			01:15	02:00	02:46	13:36	14:22	15:10			
Day									S 50°	01:08	01:50	02:35	13:44	14:32	15:22	Eqn.of Time	Moon
04		04:29	04:42	12:05		07:25	19:48		52°	01:00	01:40	02:23	13:53	14:43	15:35	00 <sup>h</sup>	Mer. Pass.
05		04:56	05:10	12:05		08:11	20:34		54°	00:52	01:29	02:09	14:03	14:56	15:50	00 <sup>h</sup>	Upper Pass.
06		05:23	05:36	12:06		08:58	21:23		56°	00:47	01:23	02:01	14:09	15:04	15:59	00 <sup>h</sup>	Lower Pass.
		SD.=16.3	d=0.3			S.D.=15.1			58°	00:17	00:41	01:09	14:47	15:52	16:57	mm:ss	hh:mm
		SD.=16.3	d=0.3			S.D.=15.1			S 60°	00:07	00:27	00:52	14:59	16:09	17:17	hh:mm	Age

**January 07, 08, 09 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	106°00.3	218°02.3	\$20°04.2	255°46.8	\$10°42.8	291°42.8	N03°51.0	215°30.1	\$20°34.6	Alpheratz	357°41.7	29°10.8					
1	121°02.7	233°01.6	04.8	270°48.0	43.2	306°45.2	51.0	230°32.3	34.6	Ankaa	353°14.1	-42°13.4					
2	136°05.2	248°00.8	05.3	285°49.1	43.7	321°47.7	51.0	245°34.5	34.7	Schedar	349°38.4	56°37.7					
3	151°07.7	263°00.1	.. 05.9	300°50.3	.. 44.2	336°50.1	.. 51.0	260°36.7	.. 34.7	Diphda	348°54.2	-17°54.1					
4	166°10.1	277°59.4	06.4	315°51.4	44.7	351°52.6	51.0	275°38.9	34.7	Achernar	335°25.5	-57°09.7					
5	181°12.6	292°58.6	06.9	330°52.6	45.1	6°55.1	51.0	290°41.1	34.8	Hamal	327°58.6	23°32.3					
6	196°15.1	307°57.9	\$20°07.5	345°53.7	\$10°45.6	21°57.5	N03°51.0	305°43.3	\$20°34.8	Polaris	316°42.8	89°20.1					
7	211°17.5	322°57.2	08.0	0°54.9	46.1	37°00.0	51.0	320°45.4	34.8	Acamar	315°16.9	-40°14.8					
8	226°20.0	337°56.4	08.5	15°56.1	46.5	52°02.4	51.0	335°47.6	34.9	Menkar	314°13.1	4°09.0					
9	241°22.5	352°55.7	.. 09.1	30°57.2	.. 47.0	67°04.9	.. 51.0	350°49.8	.. 34.9	Mirfak	308°37.5	49°55.1					
10	256°24.9	7°55.0	09.6	45°58.4	47.5	82°07.3	51.0	5°52.0	34.9	Aldebaran	290°47.1	16°32.3					
11	271°27.4	22°54.2	10.1	60°59.5	47.9	97°09.8	51.1	20°54.2	35.0	Rigel	281°10.1	-8°11.3					
12	286°29.8	37°53.5	\$20°10.7	76°00.7	\$10°48.4	112°12.2	N03°51.1	35°56.4	\$20°35.0	Capella	280°31.4	46°00.7					
13	301°32.3	52°52.8	11.2	91°01.9	48.9	127°14.7	51.1	50°58.6	35.0	Bellatrix	278°29.8	6°21.6					
14	316°34.8	67°52.0	11.7	106°03.0	49.3	142°17.1	51.1	66°00.8	35.1	Elnath	278°10.1	28°37.0					
15	331°37.2	82°51.3	.. 12.3	121°04.2	.. 49.8	157°19.6	.. 51.1	81°02.9	.. 35.1	Alnilam	275°44.3	-1°11.8					
16	346°39.7	97°50.6	12.8	136°05.3	50.3	172°22.0	51.1	96°05.1	35.1	Betelgeuse	270°59.1	7°24.3					
17	1°42.2	112°49.8	13.3	151°06.5	50.7	187°24.5	51.1	111°07.3	35.2	Canopus	263°54.8	-52°42.5					
18	16°44.6	127°49.1	\$20°13.8	166°07.7	\$10°51.2	202°27.0	N03°51.1	126°09.5	\$20°35.2	Sirius	258°31.8	-16°44.6					
19	31°47.1	142°48.3	14.4	181°08.8	51.7	217°29.4	51.1	141°11.7	35.2	Adhara	255°10.8	-28°59.9					
20	46°49.6	157°47.6	14.9	196°10.0	52.1	232°31.9	51.1	156°13.9	35.3	Procyon	244°57.6	5°10.8					
21	61°52.0	172°46.9	.. 15.4	211°11.1	.. 52.6	247°34.3	.. 51.1	171°16.1	.. 35.3	Pollux	243°25.3	27°59.0					
22	76°54.5	187°46.1	15.9	226°12.3	53.1	262°36.8	51.2	186°18.3	35.3	Avior	234°16.6	-59°33.7					
23	91°57.0	202°45.4	16.5	241°13.4	53.5	277°39.2	51.2	201°20.4	35.4	Suhail	222°50.7	-43°29.9					
Mer.pass.:16:53			v-0.7 d-0.5 m-3.9			v1.2 d-0.5 m1.2			v2.5 d0.0 m-2.1			v2.2 d-0.0 m0.5					
Fri			GHA			GHA			GHA			GHA					
0	106°59.4	217°44.6	\$20°17.0	256°14.6	\$10°54.0	292°41.7	N03°51.2	216°22.6	\$20°35.4	Denebola	193°49.4	61°39.5					
1	122°01.9	232°43.9	17.5	271°15.8	54.5	307°44.2	51.2	231°24.8	35.4	Gienah	182°31.8	14°28.8					
2	137°04.3	247°43.2	18.0	286°16.9	54.9	322°46.6	51.2	246°27.0	35.5	Acrux	175°50.4	-17°37.8					
3	152°06.8	262°42.4	.. 18.5	301°18.1	.. 55.4	337°49.1	.. 51.2	261°29.2	.. 35.5	Gacrux	173°07.1	-63°11.0					
4	167°09.3	277°41.7	19.1	316°19.2	55.9	352°51.5	51.2	276°31.4	35.5	Alioth	171°58.7	-57°11.9					
5	182°11.7	292°40.9	19.6	331°20.4	56.3	7°54.0	51.2	291°33.6	35.6	Alkaid	166°19.3	55°52.1					
6	197°14.2	307°40.2	\$20°20.1	346°21.6	\$10°56.8	22°55.6	N03°51.2	306°35.8	\$20°35.6	Hadar	158°29.4	-11°14.6					
7	212°16.7	322°39.5	20.6	1°22.7	57.3	37°58.9	51.2	321°38.0	35.6	Menkent	152°57.7	49°13.8					
8	227°19.1	337°38.7	21.1	16°23.9	57.7	53°01.4	51.3	336°40.1	35.7	Arcturus	148°05.6	-36°26.6					
9	242°21.6	352°38.0	.. 21.6	31°25.0	.. 58.2	68°03.8	.. 51.3	351°42.3	.. 35.7	Rigel Kent.	145°54.3	19°05.9					
10	257°24.1	7°37.2	22.1	46°26.2	58.7	83°06.3	51.3	6°44.5	35.7	Kochab	139°49.5	-60°53.6					
11	272°26.5	22°36.5	22.7	61°27.4	59.1	98°08.8	51.3	21°46.7	35.8	Zuben' ubi	137°20.9	74°05.2					
12	287°29.0	37°35.7	\$20°23.2	76°28.5	\$10°59.6	113°11.2	N03°51.3	36°48.9	\$20°35.8	Alphecca	137°03.6	-16°06.3					
13	302°31.5	52°35.0	23.7	91°29.7	11°00.1	128°13.7	51.3	51°51.1	35.8	Antares	126°09.8	26°39.7					
14	317°33.9	67°34.2	24.2	106°30.9	00.5	143°16.1	51.3	66°53.3	35.9	Atria	122°24.4	-26°27.8					
15	332°36.4	82°33.5	.. 24.7	121°32.0	.. 01.0	158°18.6	.. 51.3	81°55.5	.. 35.9	Sabik	107°25.1	-69°03.0					
16	347°38.8	97°32.8	25.2	136°33.2	01.5	173°21.1	51.3	96°57.7	35.9	Shaula	102°08.8	-15°44.4					
17	2°41.3	112°32.0	25.7	151°34.3	01.9	188°23.5	51.4	111°59.8	36.0	Rasalhague	96°19.9	-37°06.6					
18	17°43.8	127°31.3	\$20°26.2	166°35.5	\$11°02.4	203°26.0	N03°51.4	127°02.0	\$20°36.0	Eltanin	96°05.2	12°33.1					
19	32°46.2	142°30.5	26.7	181°36.7	02.8	218°28.5	51.4	142°04.2	36.0	Kaus Aust.	83°41.9	-34°22.4					
20	47°48.7	157°29.8	27.2	196°37.8	03.3	233°30.9	51.4	157°06.4	36.1	Vega	80°38.2	38°48.1					
21	62°51.2	172°29.0	.. 27.7	211°39.0	.. 03.8	248°33.4	.. 51.4	172°08.6	.. 36.1	Nunki	75°56.6	-26°16.4					
22	77°53.6	187°28.3	28.2	226°40.1	04.2	263°35.9	51.4	187°10.8	36.1	Altair	62°06.9	8°54.8					
23	92°56.1	202°27.5	28.7	241°41.3	04.7	278°38.3	51.4	202°13.0	36.2	Peacock	53°17.2	-56°40.9					
Mer.pass.:16:49			v-0.7 d-0.5 m-3.9			v1.2 d-0.5 m1.2			v2.5 d0.0 m-2.1			v2.2 d-0.0 m0.5					
Sat			GHA			GHA			GHA			GHA					
0	107°58.6	217°26.8	\$20°29.2	256°42.5	\$11°05.2	293°40.8	N03°51.5	217°15.2	\$20°36.2	Jan 07 Thu	112°02.0	09:28					
1	123°01.0	232°26.0	29.7	271°43.6	05.6	308°43.2	51.5	232°17.4	36.2	Venus	110°45.2	09:29					
2	138°03.5	247°25.3	30.2	286°44.8	06.1	323°45.7	51.5	247°19.6	36.3	Mars	149°46.5	06:56					
3	153°06.0	262°24.5	.. 30.7	301°46.0	.. 06.6	338°48.2	.. 51.5	262°21.7	.. 36.3	Jupiter	185°42.5	04:32					
4	168°08.4	277°23.8	31.2	316°47.1	07.0	353°50.6	51.5	277°23.9	36.3	Saturn	109°29.9	09:37					
5	183°10.9	292°23.0	31.7	331°48.3	07.5	8°53.1	51.5	292°26.1	36.4	Jan 08 Fri	112°02.0	09:28					
6	198°13.3	307°22.3	\$20°32.2	346°49.4	\$11°07.9	23°55.6	N03°51.5	307°28.3	\$20°36.4	Alpheratz	110°15.2	09:29					
7	213°15.8	322°21.5	32.7	1°50.6	08.4	38°58.1	51.5	322°30.5	36.4	Ankaa	109°46.5	06:54					
8	228°18.3	337°20.7	33.2	16°51.8	08.9	54°00.5	51.6	337°32.7	36.4	Schedar	108°16.9	4°09.0					
9	243°20.7	352°20.0	.. 33.6	31°52.9	.. 09.3	69°03.0	.. 51.6	352°34.9	.. 36.5	Diphda	107°54.2	-17°54.1					
10	258°23.2	7°19.2	34.1	46°54.1	09.8	84°05.5	51.6	7°37.1	36.5	Achernar	106°54.2	-57°09.7					
11	273°25.7	22°18.5	34.6	61°55.3	10.2	99°07.9	51.6	22°39.3	36.5	Hamal	105°31.8	23°32.3					
12	288°28.1	37°17.7	\$20°35.1	76°56.4	\$11°10.7	114°10.4	N03°51.6	37°41.5	\$20°36.6	Polaris	104°42.8	09:31					
13	303°30.6	52°17.0	35.6	91°57.6	11.2	129°12.9	51.6	52°43.7	36.6	Alnيلام	103°16.9	4°09.0					
14	318°33.1	67°16.2	36.1	106°58.7	11.6	144°15.3	51.7	67°45.9	36.6	Betelgeuse	102°54.2	-17°54.1					
15	333°35.5	82°15.5	.. 36.6	121°59.9	.. 12.1	159°17.8	.. 51.7	82°48.0	.. 36.7	Canopus	101°31.8	23°32.3					
16	348°38.0	97°14.7	37.0	137°01.1	12.5	174°20.3	51.7	97°50.2	36.7	Sirius	100°16.6	09:30					
17	3°40.5	112°13.9	37.5	152°02.2	13.0	189°22.7	51.7	112°52.4	36.7	Alphard	99°31.8	-8°11.3					
18	18°42.9	127°13.2	\$20°38.0	167°03.4	\$11°13.5	204°25.2											

DUT1 = UT1-UTC = +0.0709 sec ΔT = TT-UT1 = +68.1131 sec

2016 January 07 to Jan. 09 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	178°32.6	S22°27.8	218°00.2	10.7'	\$16°58.6	-4.0'	55.8'	
1	193°32.3	27.5	232°29.9	10.7'	17°02.5	-3.9'	55.9'	
2	208°32.1	27.2	246°59.6	10.6'	17°06.4	-3.8'	55.9'	
3	223°31.8	.. 26.9	261°29.2	10.6'	17°10.1	-3.7'	55.9'	
4	238°31.5	26.6	275°58.7	10.5'	17°13.8	-3.6'	55.9'	
5	253°31.2	26.3	290°28.2	10.5'	17°17.4	-3.6'	56.0'	
6	268°31.0	S22°26.0	304°57.6	10.4'	\$17°21.0	-3.5'	56.0'	
7	283°30.7	25.7	319°27.0	10.3'	17°24.4	-3.4'	56.0'	
8	298°30.4	25.4	333°56.3	10.3'	17°27.7	-3.3'	56.0'	
9	313°30.1	.. 25.1	348°25.6	10.2'	17°31.0	-3.2'	56.1'	
10	328°29.9	24.8	2°54.8	10.2'	17°34.1	-3.1'	56.1'	
11	343°29.6	24.4	17°23.9	10.1'	17°37.2	-3.0'	56.1'	
12	358°29.3	S22°24.1	31°53.0	10.1'	\$17°40.2	-2.9'	56.1'	
13	13°29.1	23.8	46°22.1	10.0'	17°43.1	-2.9'	56.2'	
14	28°28.8	23.5	60°51.1	10.0'	17°45.9	-2.8'	56.2'	
15	43°28.5	.. 23.2	75°20.0	9.9'	17°48.6	-2.7'	56.2'	
16	58°28.2	22.9	89°48.9	9.9'	17°51.2	-2.6'	56.3'	
17	73°28.0	22.6	104°17.7	9.8'	17°53.8	-2.5'	56.3'	
18	88°27.7	S22°22.2	118°46.5	9.8'	\$17°56.2	-2.4'	56.3'	
19	103°27.4	21.9	133°15.3	9.7'	17°58.5	-2.3'	56.3'	
20	118°27.2	21.6	147°44.0	9.7'	18°00.8	-2.2'	56.4'	
21	133°26.9	.. 21.3	162°12.6	9.6'	18°02.9	-2.1'	56.4'	
22	148°26.6	21.0	176°41.2	9.6'	18°05.0	-2.0'	56.4'	
23	163°26.4	20.6	191°09.7	9.5'	18°07.0	-1.9'	56.4'	
SD.=16.3		S.D.=15.3						
Fri		S.D.=15.3						
Sat		GHA	Dec	GHA	ν	Dec	d	HP
0	178°26.1	S22°20.3	205°38.2	9.5'	\$18°08.8	-1.8'	56.5'	
1	193°25.8	20.0	220°06.7	9.4'	18°10.6	-1.7'	56.5'	
2	208°25.5	19.7	234°35.1	9.4'	18°12.2	-1.6'	56.5'	
3	223°25.3	.. 19.3	249°03.4	9.3'	18°13.8	-1.5'	56.6'	
4	238°25.0	19.0	263°31.8	9.3'	18°15.3	-1.4'	56.6'	
5	253°24.7	18.7	278°00.0	9.2'	18°16.7	-1.3'	56.6'	
6	268°24.5	S22°18.4	292°28.2	9.2'	\$18°17.9	-1.2'	56.6'	
7	283°24.2	18.0	306°56.4	9.2'	18°19.1	-1.1'	56.7'	
8	298°23.9	17.7	321°24.5	9.1'	18°20.2	-1.0'	56.7'	
9	313°23.7	.. 17.4	335°52.6	9.1'	18°21.1	-0.9'	56.7'	
10	328°23.4	17.1	350°20.7	9.0'	18°22.0	-0.8'	56.7'	
11	343°23.1	16.7	4°48.7	9.0'	18°22.8	-0.7'	56.8'	
12	358°22.9	S22°16.4	19°16.7	8.9'	\$18°23.5	-0.6'	56.8'	
13	13°22.6	16.1	33°44.6	8.9'	18°24.0	-0.5'	56.8'	
14	28°22.3	15.7	48°12.5	8.9'	18°24.5	-0.4'	56.9'	
15	43°22.1	.. 15.4	62°40.3	8.8'	18°24.8	-0.3'	56.9'	
16	58°21.8	15.1	77°08.2	8.8'	18°25.1	-0.2'	56.9'	
17	73°21.5	14.7	91°35.9	8.8'	18°25.2	-0.1'	56.9'	
18	88°21.3	S22°14.4	106°03.7	8.7'	\$18°25.3	0.0'	57.0'	
19	103°21.0	14.1	120°31.4	8.7'	18°25.2	0.1'	57.0'	
20	118°20.7	13.7	134°59.1	8.7'	18°25.0	0.2'	57.0'	
21	133°20.5	.. 13.4	149°26.7	8.6'	18°24.8	0.3'	57.1'	
22	148°20.2	13.0	163°54.3	8.6'	18°24.4	0.4'	57.1'	
23	163°19.9	12.7	178°21.9	8.6'	18°23.9	0.5'	57.1'	
SD.=16.3		S.D.=15.5						
Sat		S.D.=15.5						

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	08:16	10:21	■	■	13:53	15:58
N 70°	07:58	09:37	■	■	14:36	16:15
68°	07:45	09:08	11:12	13:01	15:05	16:29
66°	07:33	08:47	10:14	14:00	15:27	16:41
64°	07:23	08:29	09:41	14:33	15:44	16:50
62°	07:14	08:15	09:16	14:57	15:59	16:59
60°	07:07	08:02	08:57	15:16	16:11	17:06
N 58°	07:00	07:52	08:42	15:32	16:22	17:13
56°	06:54	07:42	08:28	15:45	16:31	17:19
54°	06:48	07:34	08:16	15:57	16:39	17:25
52°	06:43	07:26	08:06	16:07	16:47	17:30
50°	06:38	07:19	07:57	16:16	16:54	17:35
48°	06:28	07:04	07:38	16:36	17:09	17:46
N 40°	06:18	06:52	07:22	16:51	17:21	17:55
35°	06:09	06:41	07:09	17:05	17:32	18:04
30°	06:01	06:31	06:57	17:16	17:42	18:12
20°	05:46	06:13	06:37	17:36	18:00	18:27
N 10°	05:31	05:57	06:19	17:54	18:16	18:42
0°	05:14	05:40	06:03	18:10	18:33	18:59
S 10°	04:56	05:23	05:46	18:27	18:50	19:16
20°	04:35	05:04	05:28	18:45	19:09	19:38
30°	04:07	04:40	05:07	19:06	19:33	20:05
35°	03:50	04:26	04:55	19:18	19:47	20:23
40°	03:28	04:08	04:41	19:32	20:04	20:45
45°	02:59	03:47	04:24	19:49	20:25	21:13
S 50°	02:18	03:20	04:03	20:10	20:53	21:54
52°	01:54	03:06	03:53	20:20	21:06	22:17
54°	01:21	02:49	03:41	20:31	21:22	22:50
56°	■	02:30	03:28	20:44	21:42	22:00
58°	■	02:04	03:13	20:59	22:07	22:44
S 60°	■	01:28	02:54	21:17	22:42	22:44
Lat.	Thu	Fri	Sat	Thu	Fri	Sat
N 72°	08:58	■	■	10:32	■	■
N 70°	07:45	09:03	09:52	11:45	12:16	13:19
68°	07:08	08:18	09:09	12:23	13:01	14:02
66°	06:42	07:48	08:40	12:49	13:31	14:30
64°	06:22	07:26	08:18	13:10	13:53	14:52
62°	06:06	07:08	08:01	13:26	14:11	15:09
60°	05:52	06:53	07:46	13:40	14:26	15:24
N 58°	05:40	06:41	07:34	13:52	14:39	15:36
56°	05:30	06:30	07:23	14:02	14:50	15:47
54°	05:21	06:20	07:13	14:11	14:59	15:56
52°	05:13	06:12	07:05	14:19	15:08	16:05
50°	05:06	06:04	06:57	14:27	15:15	16:12
48°	04:51	05:48	06:41	14:42	15:32	16:28
N 40°	04:38	05:34	06:28	14:55	15:45	16:41
35°	04:28	05:23	06:17	15:06	15:57	16:52
30°	04:19	05:13	06:07	15:16	16:07	17:02
20°	04:03	04:56	05:50	15:32	16:24	17:19
N 10°	03:49	04:41	05:35	15:47	16:39	17:33
0°	03:36	04:27	05:21	16:00	16:53	17:47
S 10°	03:23	04:14	05:07	16:14	17:07	18:00
20°	03:09	03:59	04:52	16:28	17:22	18:15
30°	02:53	03:42	04:35	16:45	17:39	18:31
35°	02:44	03:32	04:25	16:54	17:49	18:41
40°	02:34	03:21	04:14	17:05	18:00	18:52
45°	02:22	03:08	04:01	17:18	18:13	19:05
S 50°	02:07	02:52	03:45	17:34	18:29	19:20
52°	02:00	02:44	03:37	17:41	18:37	19:27
54°	01:52	02:36	03:29	17:49	18:46	19:36
56°	01:44	02:27	03:19	17:59	18:55	19:45
58°	01:34	02:16	03:08	18:09	19:06	19:55
S 60°	01:23	02:04	02:56	18:21	19:18	20:07
Day	Sun		Moon		Moon	
Day	Eqn.of Time 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer. Pass hh:mm	Upper hh:mm	Lower hh:mm
07	05:50	06:03	12:06	09:48	22:14	
08	06:16	06:29	12:06	10:40	23:07	
09	06:41	06:54	12:07	11:34	--:-	

**January 10, 11, 12 UT (Sun., Mon., Tue.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	108°57.7	217°08.6	\$20°40.9	257°10.4	\$11°16.2	294°40.0	N03°51.8	218°07.8	\$20°37.0	Alpheratz	357°41.7	29°10.8					
1	124°00.2	232°07.9	41.3	272°11.5	16.7	309°42.5	51.8	233°10.0	37.0	Ankaa	353°14.1	-42°13.4					
2	139°02.6	247°07.1	41.8	287°12.7	17.1	324°45.0	51.8	248°12.2	37.0	Schedar	349°38.5	56°37.7					
3	154°05.1	262°06.3	42.3	302°13.9	17.6	339°47.5	51.9	263°14.3	37.1	Diphda	348°54.2	-17°54.1					
4	169°07.6	277°05.6	42.8	317°15.0	18.1	354°49.9	51.9	278°16.5	37.1	Achernar	335°25.5	-57°09.7					
5	184°10.0	292°04.8	43.2	332°16.2	18.5	9°52.4	51.9	293°18.7	37.1	Hamal	327°58.7	23°32.3					
6	199°12.5	307°04.1	\$20°43.7	347°17.4	\$11°19.0	24°54.9	N03°51.9	308°20.9	\$20°37.2	Polaris	316°44.0	89°20.1					
7	214°15.0	322°03.3	44.2	2°18.5	19.4	39°57.4	51.9	323°23.1	37.2	Acamar	315°16.9	-40°14.8					
8	229°17.4	337°02.5	44.6	17°19.7	19.9	54°59.8	51.9	338°25.3	37.2	Menkar	314°13.1	4°09.0					
9	244°19.9	352°01.8	45.1	32°20.9	20.3	70°02.3	52.0	353°27.5	37.2	Mirfak	308°37.5	49°55.1					
10	259°22.3	7°01.0	45.6	47°22.0	20.8	85°04.8	52.0	8°29.7	37.3	Aldebaran	290°47.1	16°32.3					
11	274°24.8	22°00.2	46.0	62°23.2	21.3	100°07.3	52.0	23°31.9	37.3	Rigel	281°10.1	-8°11.3					
12	289°27.3	36°59.5	\$20°46.5	77°24.4	\$11°21.7	115°09.7	N03°52.0	38°34.1	\$20°37.3	Capella	280°31.4	46°00.7					
13	304°29.7	51°58.7	46.9	92°25.5	22.2	130°12.2	52.0	53°36.3	37.4	Bellatrix	278°29.8	6°21.6					
14	319°32.2	66°57.9	47.4	107°26.7	22.6	145°14.7	52.1	68°38.5	37.4	El Nath	278°10.1	28°37.0					
15	334°34.7	81°57.2	47.9	122°27.9	23.1	160°17.2	52.1	83°40.7	37.4	Alnilam	275°44.3	-1°11.8					
16	349°37.1	96°56.4	48.3	137°29.0	23.5	175°19.7	52.1	98°42.9	37.5	Betelgeuse	270°59.1	7°24.3					
17	4°39.6	111°55.6	48.8	152°30.2	24.0	190°22.1	52.1	113°45.1	37.5	Canopus	263°54.8	-52°42.5					
18	19°42.1	126°54.9	\$20°49.2	167°31.4	\$11°24.5	205°24.6	N03°52.1	128°47.2	\$20°37.5	Sirius	258°31.8	-16°44.6					
19	34°44.5	141°54.1	49.7	182°32.5	24.9	220°27.1	52.1	143°49.4	37.6	Adhara	255°10.7	-28°59.9					
20	49°47.0	156°53.3	50.2	197°33.7	25.4	235°29.6	52.2	158°51.6	37.6	Procyon	244°57.6	5°10.8					
21	64°49.4	171°52.6	50.6	212°34.9	25.8	250°32.0	52.2	173°53.8	37.6	Pollux	243°25.2	27°59.0					
22	79°51.9	186°51.8	51.1	227°36.0	26.3	265°34.5	52.2	188°56.0	37.7	Avior	234°16.6	-59°33.8					
23	94°54.4	201°51.0	51.5	242°37.2	26.7	280°37.0	52.2	203°58.2	37.7	Suhail	222°50.7	-43°29.9					
Mer.pass.:16:41			v-0.8 d-0.5 m-3.9	v1.2 d-0.5 m1.2			v2.5 d0.0 m-2.1			v2.2 d-0.0 m0.5			Miaplacidus				
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	109°56.8	216°50.2	\$20°52.0	257°38.4	\$11°27.2	295°39.5	N03°52.2	219°00.4	\$20°37.7	Denebola	182°31.8	14°28.8					
1	124°59.3	231°49.5	52.4	272°39.5	27.6	310°42.0	52.3	234°02.6	37.7	Gienah	175°50.4	-17°37.8					
2	140°01.8	246°48.7	52.9	287°40.7	28.1	325°44.5	52.3	249°04.8	37.8	Gacrux	173°07.0	-63°11.0					
3	155°04.2	261°47.9	53.3	302°41.9	28.6	340°46.9	52.3	264°07.0	37.8	Alioth	171°58.7	-57°11.9					
4	170°06.7	276°47.2	53.8	317°43.0	29.0	355°49.4	52.3	279°09.2	37.8	Spica	166°19.2	55°52.1					
5	185°09.2	291°46.4	54.2	332°44.2	29.5	10°51.9	52.3	294°11.4	37.9	Alkaid	152°57.7	-11°14.6					
6	200°11.6	306°45.6	\$20°54.7	347°45.4	\$11°29.9	25°54.4	N03°52.4	309°13.6	\$20°37.9	Hadar	148°45.4	-60°26.6					
7	215°14.1	321°44.8	55.1	2°46.5	30.4	40°56.9	52.4	324°15.8	37.9	Menkent	148°05.5	-36°26.6					
8	230°16.6	336°44.1	55.5	17°47.7	30.8	55°59.3	52.4	339°18.0	38.0	Arcturus	145°54.3	19°05.9					
9	245°19.0	351°43.3	56.0	32°48.9	31.3	71°01.8	52.4	354°20.2	38.0	Rigel Kent.	139°49.4	-60°53.6					
10	260°21.5	6°42.5	56.4	47°50.0	31.7	86°04.3	52.4	9°22.4	38.0	Kochab	137°20.8	74°05.2					
11	275°23.9	21°41.7	56.9	62°51.2	32.2	101°06.8	52.5	24°24.6	38.1	Zuben' ubi	137°03.6	-16°06.3					
12	290°26.4	36°41.0	\$20°57.3	77°52.4	\$11°32.6	116°09.3	N03°52.5	39°26.8	\$20°38.1	Alphecca	126°09.8	26°39.7					
13	305°28.9	51°40.2	57.7	92°53.5	33.1	131°11.8	52.5	54°29.0	38.1	Antares	112°24.4	-26°27.8					
14	320°31.3	66°39.4	58.2	107°54.7	33.6	146°14.2	52.5	69°31.1	38.2	Atria	107°25.0	-69°03.0					
15	335°33.8	81°38.6	58.6	122°55.9	34.0	161°16.7	52.6	84°33.3	38.2	Sabik	102°10.8	-15°44.4					
16	350°36.3	96°37.9	59.1	137°57.0	34.5	176°19.2	52.6	99°35.5	38.2	Shaula	96°19.9	-37°06.6					
17	5°38.7	111°37.1	59.5	152°58.2	34.9	191°21.7	52.6	114°37.7	38.2	Rasalhague	96°05.1	12°33.0					
18	20°41.2	126°36.3	\$20°59.9	167°35.4	\$11°35.4	206°24.2	N03°52.6	129°39.9	\$20°38.3	Eltanin	90°45.8	51°29.3					
19	35°43.7	141°35.5	21°00.4	183°00.5	35.8	221°26.7	52.6	144°42.1	38.3	Kaus Aust.	83°41.9	-34°22.4					
20	50°46.1	156°34.8	00.8	198°01.7	36.3	236°29.2	52.7	159°44.3	38.3	Vega	80°38.2	38°48.0					
21	65°48.6	171°34.0	01.2	213°02.9	36.7	251°31.6	52.7	174°46.5	38.4	Nunki	75°56.5	-26°16.4					
22	80°51.1	186°33.2	01.6	228°04.0	37.2	266°34.1	52.7	189°48.7	38.4	Altair	62°06.9	8°54.8					
23	95°53.5	201°32.4	02.1	243°05.2	37.6	281°36.6	52.7	204°50.9	38.4	Peacock	53°17.2	-56°40.9					
Mer.pass.:16:37			v-0.8 d-0.5 m-3.9	v1.2 d-0.5 m1.1			v2.5 d0.0 m-2.1			Deneb	49°30.7	45°20.5					
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Scheat	33°45.7	9°57.0					
0	110°56.0	216°31.6	\$21°02.5	258°06.4	\$11°38.1	296°39.1	N03°52.8	219°53.1	\$20°38.5	Al Na'ir	27°42.0	-46°53.1					
1	125°58.4	231°30.9	02.9	273°07.6	38.5	311°41.6	52.8	234°55.3	38.5	Fomalhaut	15°22.3	-29°32.4					
2	141°00.9	246°30.1	03.4	288°08.7	39.0	326°44.1	52.8	249°57.5	38.5	Smarkab	13°51.8	28°10.3					
3	156°03.4	261°29.3	03.8	303°09.9	39.4	341°46.6	52.8	264°59.7	38.6	Jan 10 Sun			13°36.8	15°17.6			
4	171°05.8	276°28.5	04.2	318°11.1	39.9	356°49.1	52.8	280°01.9	38.6	Venus	108°10.9	09:32					
5	186°08.3	291°27.7	04.6	333°12.2	40.3	11°51.6	52.9	295°04.1	38.6	Mars	148°12.7	06:51					
6	201°10.8	306°27.0	\$21°05.0	348°13.4	\$11°40.8	26°54.0	N03°52.9	310°06.3	\$20°38.6	Jupiter	185°42.3	04:21					
7	216°13.2	321°26.2	05.5	3°14.6	41.2	41°56.5	52.9	325°08.5	38.7	Saturn	109°10.1	09:26					
8	231°15.7	336°25.4	05.9	18°15.7	41.7	56°59.0	52.9	340°10.7	38.7	Jan 11 Mon			109°03.6	09:23			
9	246°18.2	351°24.6	06.3	33°16.9	42.1	72°01.5	53.0	355°12.9	38.7	Venus	106°53.4	09:33					
10	261°20.6	6°23.8	06.7	48°18.1	42.6	87°04.0	53.0	10°15.1	38.8	Mars	147°41.5	06:49					
11	276°23.1	21°23.0	07.1	63°19.3	43.0	102°06.5	53.0	25°17.3	38.8	Jupiter	185°42.6	04:17					
12	291°25.6	36°22.3	\$21°07.5	78°20.4	\$11°43.5	117°09.0	N03°53.0	40°19.5	\$20°38.8	Saturn	109°03.6	09:23					
13	306°28.0	51°21.5	08.0	93°21.6	43.9	132°11.5	53.1	55°21.7	38.9	Jan 12 Tue			109°01.0	09:26			
14	321°30.5	66°20.7	08.4	108°22.8	44												

DUT1 = UT1-UTC = +0.0655 sec ΔT = TT-UT1 = +68.1185 sec

2016 January 10 to Jan. 12 UT

h		Sun			Moon			
Sun		GHA	Dec	GHA	ν	Dec	d	HP
0	178°13.4	S22°04.0	179°43.3	8.0'	S17°36.9	3.2'	57.8'	
1	193°13.1	03.6	194°10.4	8.0'	17°33.6	3.3'	57.8'	
2	208°12.9	03.2	208°37.4	8.0'	17°30.2	3.4'	57.8'	
3	223°12.6	.. 02.9	223°04.4	8.0'	17°26.7	3.6'	57.8'	
4	238°12.4	02.5	237°31.4	8.0'	17°23.1	3.7'	57.9'	
5	253°12.1	02.2	251°58.5	8.0'	17°19.4	3.8'	57.9'	
6	268°11.9	S22°01.8	266°25.5	8.0'	S17°15.6	3.9'	57.9'	
7	283°11.6	01.4	280°52.5	8.0'	17°11.7	4.0'	57.9'	
8	298°11.3	.. 01.1	295°19.5	8.0'	17°07.6	4.1'	58.0'	
9	313°11.1	.. 00.7	309°46.5	8.0'	17°03.5	4.2'	58.0'	
10	328°10.8	00.3	324°13.5	8.0'	16°59.2	4.3'	58.0'	
11	343°10.6	22°00.0	338°40.5	8.0'	16°54.9	4.4'	58.0'	
12	358°10.3	S21°59.6	353°07.5	8.0'	S16°50.4	4.5'	58.1'	
13	13°10.1	59.2	7°34.5	8.0'	16°45.9	4.6'	58.1'	
14	28°09.8	58.9	22°01.4	8.0'	16°41.2	4.7'	58.1'	
15	43°09.6	.. 58.5	36°28.4	8.0'	16°36.5	4.8'	58.1'	
16	58°09.3	58.1	50°55.4	8.0'	16°31.6	4.9'	58.1'	
17	73°09.0	57.8	65°22.4	8.0'	16°26.6	5.0'	58.2'	
18	88°08.8	S21°57.4	79°49.5	8.0'	S16°21.5	5.1'	58.2'	
19	103°08.5	57.0	94°16.5	8.0'	16°16.4	5.2'	58.2'	
20	118°08.3	56.6	108°43.5	8.0'	16°11.1	5.3'	58.2'	
21	133°08.0	.. 56.3	123°10.5	8.0'	16°05.7	5.4'	58.3'	
22	148°07.8	55.9	137°37.5	8.0'	16°00.2	5.5'	58.3'	
23	163°07.5	55.5	152°04.6	8.0'	15°54.6	5.6'	58.3'	
	SD.=16.3	d=0.4			S.D.=15.8			
Mon	GHA	Dec	GHA	ν	Dec	d	HP	
0	178°07.3	S21°55.1	166°31.6	8.1'	S15°49.0	5.7'	58.3'	
1	193°07.0	54.8	180°58.7	8.1'	15°43.2	5.8'	58.3'	
2	208°06.8	54.4	195°25.8	8.1'	15°37.3	5.9'	58.4'	
3	223°06.5	.. 54.0	209°52.8	8.1'	15°31.3	6.0'	58.4'	
4	238°06.3	53.6	224°19.9	8.1'	15°25.2	6.1'	58.4'	
5	253°06.0	53.2	238°47.0	8.1'	15°19.1	6.2'	58.4'	
6	268°05.8	S21°52.9	253°14.1	8.1'	S15°12.8	6.3'	58.4'	
7	283°05.5	52.5	267°41.3	8.1'	15°06.4	6.4'	58.5'	
8	298°05.3	52.1	280°08.4	8.1'	15°00.0	6.5'	58.5'	
9	313°05.0	.. 51.7	296°35.6	8.2'	14°53.4	6.6'	58.5'	
10	328°04.8	51.3	311°02.7	8.2'	14°46.8	6.7'	58.5'	
11	343°04.5	50.9	325°29.9	8.2'	14°40.1	6.8'	58.5'	
12	358°04.3	S21°50.6	339°57.1	8.2'	S14°33.2	6.9'	58.5'	
13	13°04.0	50.2	354°24.3	8.2'	14°26.3	7.0'	58.6'	
14	28°03.8	49.8	8°51.5	8.2'	14°19.3	7.1'	58.6'	
15	43°03.5	.. 49.4	23°18.8	8.3'	14°12.2	7.1'	58.6'	
16	58°03.3	49.0	37°46.1	8.3'	14°05.0	7.2'	58.6'	
17	73°03.0	48.6	52°13.3	8.3'	13°57.7	7.3'	58.6'	
18	88°02.8	S21°48.2	66°40.6	8.3'	S13°50.3	7.4'	58.7'	
19	103°02.5	47.8	81°08.0	8.3'	13°42.9	7.5'	58.7'	
20	118°02.3	47.4	95°35.3	8.3'	13°35.3	7.6'	58.7'	
21	133°02.0	.. 47.1	110°02.7	8.4'	13°27.7	7.7'	58.7'	
22	148°01.8	46.7	124°30.0	8.4'	13°20.0	7.8'	58.7'	
23	163°01.5	46.3	138°57.4	8.4'	13°12.2	7.8'	58.7'	
	SD.=16.3	d=0.4			S.D.=16.0			
Tue	GHA	Dec	GHA	ν	Dec	d	HP	
0	178°01.3	S21°45.9	153°24.9	8.4'	S13°04.3	7.9'	58.8'	
1	193°01.0	45.5	167°52.3	8.4'	12°56.4	8.0'	58.8'	
2	208°00.8	45.1	182°19.7	8.5'	12°48.3	8.1'	58.8'	
3	223°00.5	.. 44.7	196°47.2	8.5'	12°40.2	8.2'	58.8'	
4	238°00.3	44.3	211°14.7	8.5'	12°32.0	8.2'	58.8'	
5	253°00.0	43.9	225°42.3	8.5'	12°23.7	8.3'	58.8'	
6	267°59.8	S21°43.5	240°09.8	8.6'	S12°15.4	8.4'	58.8'	
7	282°59.6	43.1	254°37.4	8.6'	12°06.9	8.5'	58.9'	
8	297°59.3	42.7	269°05.0	8.6'	11°58.4	8.5'	58.9'	
9	312°59.1	.. 42.3	283°32.6	8.6'	11°49.8	8.6'	58.9'	
10	327°58.8	41.9	298°00.2	8.6'	11°41.2	8.7'	58.9'	
11	342°58.6	41.5	312°27.9	8.7'	11°32.4	8.8'	58.9'	
12	357°58.3	S21°41.1	326°55.6	8.7'	S11°23.6	8.8'	58.9'	
13	12°58.1	40.7	341°23.3	8.7'	11°14.8	8.9'	58.9'	
14	27°57.8	40.3	355°51.0	8.7'	11°05.8	9.0'	59.0'	
15	42°57.6	.. 39.9	10°18.7	8.8'	10°56.8	9.0'	59.0'	
16	57°57.4	39.5	24°46.5	8.8'	10°47.7	9.1'	59.0'	
17	72°57.1	39.1	39°14.3	8.8'	10°38.6	9.2'	59.0'	
18	87°56.9	S21°38.7	53°42.1	8.8'	S10°29.4	9.2'	59.0'	
19	102°56.6	38.3	68°10.0	8.9'	10°20.1	9.3'	59.0'	
20	117°56.4	37.8	82°37.8	8.9'	10°10.7	9.4'	59.0'	
21	132°56.1	.. 37.4	97°05.7	8.9'	10°01.3	9.4'	59.0'	
22	147°55.9	37.0	111°33.6	8.9'	09°51.9	9.5'	59.0'	
23	162°55.7	36.6	126°01.6	8.9'	09°42.3	9.6'	59.1'	
	SD.=16.3	d=0.4			S.D.=16.1			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	08:10	10:10	■	■	14:07	16:06
N 70°	07:54	09:30	■	■	14:46	16:22
68°	07:41	09:03	10:55	13:21	15:13	16:35
66°	07:30	08:42	10:06	14:10	15:34	16:46
64°	07:20	08:26	09:35	14:41	15:50	16:56
62°	07:12	08:12	09:12	15:04	16:04	17:04
60°	07:05	08:00	08:54	15:22	16:16	17:11
N 58°	06:58	07:49	08:39	15:37	16:26	17:17
56°	06:53	07:40	08:26	15:50	16:35	17:23
54°	06:47	07:32	08:15	16:01	16:44	17:29
52°	06:42	07:25	08:05	16:11	16:51	17:34
50°	06:38	07:18	07:56	16:20	16:58	17:38
48°	06:27	07:04	07:37	16:39	17:12	17:49
N 40°	06:18	06:51	07:21	16:54	17:24	17:58
35°	06:09	06:41	07:08	17:07	17:35	18:06
30°	06:01	06:31	06:57	17:19	17:45	18:14
20°	05:46	06:14	06:37	17:38	18:02	18:29
N 10°	05:32	05:58	06:20	17:55	18:18	18:44
0°	05:16	05:42	06:04	18:11	18:34	19:00
S 10°	04:58	05:25	05:48	18:28	18:50	19:17
20°	04:37	05:06	05:30	18:45	19:09	19:38
30°	04:10	04:43	05:10	19:06	19:32	20:05
35°	03:53	04:29	04:58	19:17	19:47	20:22
40°	03:31	04:12	04:44	19:31	20:03	20:43
45°	03:04	03:51	04:27	19:48	20:24	21:11
S 50°	02:24	03:24	04:07	20:08	20:50	21:50
52°	02:02	03:11	03:57	20:18	21:04	22:12
54°	01:31	02:55	03:46	20:29	21:19	22:42
56°	00:25	02:36	03:33	20:41	21:38	23:39
S 60°	01:39	03:01	03:01	21:13	22:34	23:39
Lat.	Sun	Moonrise		Sunset	Moon	
Day	Eqn.of Time 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Upper hh:mm	Lower hh:mm	Age 0-2 0-7%
10	07:06	07:19	12:07	12:29	00:01	
11	07:31	07:43	12:08	13:23	00:56	
12	07:55	08:07	12:08	14:17	01:50	

**January 13, 14, 15 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Week	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	111°55.1	216°12.8	\$21°12.4	258°34.5	\$11°48.9	297°38.9	N03°53.3	220°45.9	\$20°39.2	Alpheratz	357°41.8	29°10.8					
1	126°57.6	231°12.0	12.9	273°35.6	49.3	312°41.4	53.4	235°48.1	39.2	Ankaa	353°14.2	-42°13.4					
2	142°00.0	246°11.2	13.3	288°36.8	49.7	327°43.9	53.4	250°50.3	39.3	Schedar	349°38.5	56°37.7					
3	157°02.5	261°10.4	· · 13.7	303°38.0	· · 50.2	342°46.4	· · 53.4	265°52.4	· · 39.3	Diphda	348°54.2	-17°54.1					
4	172°05.0	276°09.7	14.1	318°39.2	50.6	357°48.9	53.4	280°54.6	39.3	Achernar	335°25.6	-57°09.7					
5	187°07.4	291°08.9	14.4	333°40.3	51.1	12°51.4	53.5	295°56.8	39.3	Hamal	327°58.7	23°32.2					
6	202°09.9	306°08.1	\$21°14.8	348°41.5	\$11°51.5	27°53.9	N03°53.5	310°59.0	\$20°39.4	Polaris	316°45.4	89°20.1					
7	217°12.4	321°07.3	15.2	3°42.7	52.0	42°56.4	53.5	326°01.2	39.4	Acamar	315°16.9	-40°14.8					
8	232°14.8	336°06.5	15.6	18°43.9	52.4	57°58.9	53.6	341°03.4	39.4	Menkar	314°13.1	4°09.0					
9	247°17.3	351°05.7	· · 16.0	33°45.0	· · 52.9	73°01.4	· · 53.6	356°05.6	· · 39.5	Mirfak	308°37.5	49°55.1					
10	262°19.8	6°04.9	16.4	48°46.2	53.3	88°03.9	53.6	11°07.8	39.5	Aldebaran	290°47.1	16°32.3					
11	277°22.2	21°04.1	16.8	63°47.4	53.8	103°06.4	53.6	26°10.0	39.5	Rigel	281°10.1	-8°11.3					
12	292°24.7	36°03.3	\$21°17.2	78°48.5	\$11°54.2	118°08.9	N03°53.7	41°12.2	\$20°39.6	Capella	280°31.4	46°00.7					
13	307°27.1	51°02.5	17.6	93°49.7	54.7	133°11.4	53.7	56°14.4	39.6	Bellatrix	278°29.8	6°21.6					
14	322°29.6	66°01.7	18.0	108°50.9	55.1	148°13.9	53.7	71°16.6	39.6	El Nath	278°10.1	28°37.0					
15	337°32.1	81°00.9	· · 18.4	123°52.1	· · 55.5	163°16.4	· · 53.7	86°18.8	· · 39.6	Alnilam	275°44.3	-1°11.8					
16	352°34.5	96°00.1	18.8	138°53.2	56.0	178°18.9	53.8	101°21.0	39.7	Betelgeuse	270°59.1	7°24.3					
17	7°37.0	110°59.3	19.1	153°54.4	56.4	193°21.4	53.8	116°23.2	39.7	Canopus	263°54.8	-52°42.6					
18	22°39.5	125°58.6	\$21°19.5	168°55.6	\$11°56.9	208°23.9	N03°53.8	131°25.4	\$20°39.7	Sirius	258°31.8	-16°44.6					
19	37°41.9	140°57.8	19.9	183°56.8	57.3	223°26.4	53.9	146°27.6	39.8	Adhara	255°10.7	-28°59.9					
20	52°44.4	155°57.0	20.3	198°57.9	57.8	238°28.9	53.9	161°29.8	39.8	Procyon	244°57.6	5°10.8					
21	67°46.9	170°56.2	· · 20.7	213°59.1	· · 58.2	253°31.4	· · 53.9	176°32.0	· · 39.8	Pollux	243°25.2	27°59.0					
22	82°49.3	185°55.4	21.1	229°00.3	58.7	268°33.9	53.9	191°34.2	39.9	Avior	234°16.6	-59°33.8					
23	97°51.8	200°54.6	21.4	244°01.5	59.1	283°36.4	54.0	206°36.4	39.9	Suhail	222°50.7	-43°29.9					
Mer.pass.:16:30			v-0.8 d-0.4 m-3.9	v1.2 d-0.4 m1.1			v2.5 d0.0 m-2.1			v2.2 d-0.0 m0.5			Miaplacidus				
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	112°54.3	215°53.8	\$21°21.8	259°02.6	\$11°59.5	298°38.9	N03°54.0	221°38.7	\$20°39.9	Denebola	182°31.8	14°28.8					
1	127°56.7	230°53.0	22.2	274°03.8	12°00.0	313°41.4	54.0	236°40.9	39.9	Gienah	175°50.4	-17°37.8					
2	142°59.2	245°52.2	22.6	289°05.0	00.4	328°43.9	54.1	251°43.1	40.0	Gacrux	173°07.0	-63°11.0					
3	158°01.7	260°51.4	· · 22.9	304°06.1	· · 00.9	343°46.4	· · 54.1	266°45.3	· · 40.0	Alioth	171°58.6	-57°11.9					
4	173°04.1	275°50.6	23.3	319°07.3	01.3	358°48.9	54.1	281°47.5	40.0	Spica	166°19.2	55°52.1					
5	188°06.6	290°49.8	23.7	334°08.5	01.8	13°51.4	54.2	296°49.7	40.1	Alkaid	152°57.7	49°13.8					
6	203°09.0	305°49.0	\$21°24.1	349°09.7	\$12°02.2	28°53.9	N03°54.2	311°51.9	\$20°40.1	Hadar	148°45.4	-60°26.6					
7	218°11.5	320°48.2	24.4	4°10.8	02.6	43°56.4	54.2	326°54.1	40.1	Menkent	148°05.5	-36°26.6					
8	233°14.0	335°47.4	24.8	19°12.0	03.1	58°58.9	54.2	341°56.3	40.2	Arcturus	145°54.2	19°05.9					
9	248°16.4	350°46.6	· · 25.2	34°13.2	· · 03.5	74°01.4	· · 54.3	356°58.5	· · 40.2	Rigel Kent.	139°49.4	-60°53.6					
10	263°18.9	5°45.8	25.5	49°14.4	04.0	89°03.9	54.3	12°00.7	40.2	Kochab	137°20.7	74°05.2					
11	278°21.4	20°45.0	25.9	64°15.6	04.4	104°06.4	54.3	27°02.9	40.2	Zuben' ubi	137°03.6	-16°06.3					
12	293°23.8	35°44.2	\$21°26.3	79°16.7	\$12°04.9	119°08.9	N03°54.4	42°05.1	\$20°40.3	Alphecca	126°09.7	26°39.6					
13	308°26.3	50°43.4	26.6	94°17.9	05.3	134°11.5	54.4	57°07.3	40.3	Antares	112°24.4	-26°27.8					
14	323°28.8	65°42.6	27.0	109°19.1	05.7	149°14.0	54.4	72°09.5	40.3	Atria	107°25.0	-69°03.0					
15	338°31.2	80°41.8	· · 27.4	124°20.3	· · 06.2	164°16.5	· · 54.5	87°11.7	· · 40.4	Sabik	102°10.8	-15°44.5					
16	353°33.7	95°41.0	27.7	139°21.4	06.6	179°19.0	54.5	102°13.9	40.4	Shaula	96°19.9	-37°06.6					
17	8°36.1	110°40.2	28.1	154°22.6	07.1	194°21.5	54.5	117°16.1	40.4	Rasalhague	96°05.1	12°33.0					
18	23°38.6	125°39.4	\$21°28.4	169°23.8	\$12°07.5	209°24.0	N03°54.6	132°18.3	\$20°40.4	Eltanin	90°45.8	51°29.3					
19	38°41.1	140°38.6	28.8	184°25.0	07.9	224°26.5	54.6	147°20.5	40.5	Kaus Aust.	83°41.9	-34°22.4					
20	53°43.5	155°37.8	29.2	199°26.1	08.4	239°29.0	54.6	162°22.7	40.5	Vega	80°38.2	38°48.0					
21	68°46.0	170°36.9	· · 29.5	214°27.3	· · 08.8	254°31.5	· · 54.6	177°24.9	· · 40.5	Nunki	75°56.5	-26°16.4					
22	83°48.5	185°36.1	29.9	229°28.5	09.3	269°34.0	54.7	192°27.1	40.6	Altair	62°06.9	8°54.8					
23	98°50.9	200°35.3	30.2	244°29.7	09.7	284°36.5	54.7	207°29.3	40.6	Peacock	53°17.2	-56°40.9					
Mer.pass.:16:26			v-0.8 d-0.4 m-3.9	v1.2 d-0.4 m1.1			v2.5 d0.0 m-2.1			Deneb			Enif	33°45.7	9°57.0		
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	113°53.4	215°34.5	\$21°30.6	259°30.8	\$12°10.1	299°39.0	N03°54.7	222°31.5	\$20°40.6	Jan 13 Wed	104°17.7	09:36					
1	128°55.9	230°33.7	30.9	274°32.0	10.6	314°41.6	54.8	237°33.7	40.6	Venus	104°17.7	09:36					
2	143°58.3	245°32.9	31.3	289°33.2	11.0	329°44.1	54.8	252°35.9	40.7	Mars	146°39.4	06:45					
3	159°00.8	260°32.1	· · 31.6	304°34.4	· · 11.5	344°46.6	· · 54.8	267°38.1	· · 40.7	Jupiter	185°43.8	04:09					
4	174°03.3	275°31.3	32.0	319°35.6	11.9	359°49.1	54.9	282°40.3	40.7	Saturn	108°50.7	09:16					
5	189°05.7	290°30.5	32.3	334°36.7	12.3	14°51.6	54.9	297°42.5	40.8	Jan 14 Thu	102°59.5	09:37					
6	204°08.2	305°29.7	\$21°32.7	349°37.9	\$12°12.8	29°54.1	N03°54.9	312°44.7	\$20°40.8	Venus	102°59.5	09:37					
7	219°10.6	320°28.9	33.0	4°39.1	13.2	44°56.6	55.0	327°46.9	40.8	Mars	146°08.4	06:43					
8	234°13.1	335°28.1	33.4	19°40.3	13.7	59°59.1	55.0	342°49.1	40.9	Jupiter	185°44.6	04:05					
9	249°15.6	350°27.3	· · 33.7	34°41.4	· · 14.1	75°01.7	· · 55.0	357°51.3	· · 40.9	Saturn	108°44.4	09:12					
10	264°18.0	5°26.5	34.0	49°42.6	14.5	90°04.2	55.1	12°53.5	40.9	Jan 15 Fri	101°41.1	09:38					
11	279°20.5	20°25.6	34.4	64°43.8	15.0	105°06.7	55.1	27°55.7	40.9	Venus	145°37.4	06:41					
12	294°23.0	35°24.8	\$21°34.7	79°45.0	\$12°15.4	120°09.2	N03°55.1	42°57.9	\$20°41.0	Mars	145°45.7	04:01					
13	309°25.4	50°24.0	35.1	94°46.2	15.8	135°11.7	55.2	58°00.2	41.0	Jupiter	185°45.7	04:01</					

DUT1 = UT1-UTC = +0.0602 sec ΔT = TT-UT1 = +68.1238 sec

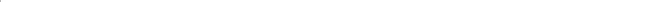
2016 January 13 to Jan. 15 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	177°55.4	S21°36.2	140°29.5	9.0'	S09°32.7	9.6'	59.1'	
1	192°55.2	35.8	154°57.5	9.0'	09°23.1	9.7'	59.1'	
2	207°54.9	35.4	169°25.5	9.0'	09°13.4	9.7'	59.1'	
3	222°54.7	.. 35.0	183°53.6	9.0'	09°03.6	9.8'	59.1'	
4	237°54.5	34.5	198°21.6	9.1'	08°53.8	9.8'	59.1'	
5	252°54.2	34.1	212°49.7	9.1'	08°43.9	9.9'	59.1'	
6	267°54.0	S21°33.7	227°17.8	9.1'	S08°34.0	10.0'	59.1'	
7	282°53.8	33.3	241°45.9	9.1'	08°24.0	10.0'	59.1'	
8	297°53.5	32.9	256°14.0	9.2'	08°14.0	10.1'	59.1'	
9	312°53.3	.. 32.5	270°42.2	9.2'	08°03.9	10.1'	59.1'	
10	327°53.0	32.0	285°10.4	9.2'	07°53.8	10.2'	59.2'	
11	342°52.8	31.6	299°38.6	9.2'	07°43.6	10.2'	59.2'	
12	357°52.6	S21°31.2	314°06.8	9.2'	S07°33.4	10.2'	59.2'	
13	12°52.3	30.8	328°35.1	9.3'	07°23.1	10.3'	59.2'	
14	27°52.1	30.4	343°03.3	9.3'	07°12.8	10.3'	59.2'	
15	42°51.9	.. 29.9	357°31.6	9.3'	07°02.4	10.4'	59.2'	
16	57°51.6	29.5	11°59.9	9.3'	06°52.0	10.4'	59.2'	
17	72°51.4	29.1	26°28.2	9.3'	06°41.6	10.5'	59.2'	
18	87°51.1	S21°28.7	40°56.6	9.4'	S06°31.1	10.5'	59.2'	
19	102°50.9	28.2	55°25.0	9.4'	06°20.5	10.5'	59.2'	
20	117°50.7	27.8	69°53.3	9.4'	06°10.0	10.6'	59.2'	
21	132°50.4	.. 27.4	84°21.7	9.4'	05°59.4	10.6'	59.2'	
22	147°50.2	27.0	98°50.2	9.4'	05°48.7	10.7'	59.2'	
23	162°50.0	26.5	113°18.6	9.4'	05°38.1	10.7'	59.2'	
	SD.=16.2	d=0.4			S.D.=16.1			

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
13	08:18	08:30	12:08	3-5
14	08:41	08:52	12:09	3-5
15	09:03	09:14	12:09	14-34%



SD.=16.2	d=0.4	S.D.=16.2
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**January 16, 17, 18 UT (Sat., Sun., Mon.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	114°52.5	215°15.1	\$21°38.7	259°59.1	\$12°20.6	300°39.4	N03°55.6	223°24.4	\$20°41.3	Alpheratz	357°41.8	29°10.8											
1	129°55.0	230°14.3	39.1	275°00.3	21.1	315°41.9	55.6	238°26.6	41.3	Ankaa	353°14.2	-42°13.4											
2	144°57.5	245°13.5	39.4	290°01.5	21.5	330°44.4	55.6	253°28.8	41.4	Schedar	349°38.5	56°37.7											
3	159°59.9	260°12.7	· · 39.7	305°02.7	· · 21.9	345°46.9	· · 55.7	268°31.0	· · 41.4	Diphda	348°54.2	-17°54.1											
4	175°02.4	275°11.8	40.0	320°03.8	22.4	0°49.5	55.7	283°33.2	41.4	Achernar	335°25.6	-57°09.7											
5	190°04.9	290°11.0	40.4	335°05.0	22.8	15°52.0	55.7	298°35.4	41.5	Hamal	327°58.7	23°32.2											
6	205°07.3	305°10.2	\$21°40.7	350°06.2	\$12°23.2	30°54.5	N03°55.8	313°37.6	\$20°41.5	Polaris	316°46.7	89°20.1											
7	220°09.8	320°09.4	41.0	5°07.4	23.7	45°57.0	55.8	328°39.9	41.5	Acamar	315°16.9	-40°14.8											
8	235°12.2	335°08.6	41.3	20°08.6	24.1	60°59.5	55.8	343°42.1	41.5	Menkar	314°13.1	4°09.0											
9	250°14.7	350°07.8	· · 41.6	35°09.7	· · 24.6	76°02.1	· · 55.9	358°44.3	· · 41.6	Mirfak	308°37.5	49°55.1											
10	265°17.2	5°06.9	42.0	50°10.9	25.0	91°04.6	55.9	13°46.5	41.6	Aldebaran	290°47.1	16°32.3											
11	280°19.6	20°06.1	42.3	65°12.1	25.4	106°07.1	56.0	28°48.7	41.6	Rigel	281°10.1	-8°11.3											
12	295°22.1	35°05.3	\$21°42.6	80°13.3	\$12°25.9	121°09.6	N03°56.0	43°50.9	\$20°41.7	Capella	280°31.4	46°00.7											
13	310°24.6	50°04.5	42.9	95°14.5	26.3	136°12.1	56.0	58°53.1	41.7	Bellatrix	278°29.8	6°21.6											
14	325°27.0	65°03.7	43.2	110°15.7	26.7	151°14.7	56.1	73°55.3	41.7	El Nath	278°10.1	28°37.0											
15	340°29.5	80°02.9	· · 43.5	125°16.8	· · 27.2	166°17.2	· · 56.1	88°57.5	· · 41.7	Alnilam	275°44.3	-1°11.8											
16	355°32.0	95°02.0	43.8	140°18.0	27.6	181°19.7	56.1	103°59.7	41.8	Betelgeuse	270°59.1	7°24.3											
17	10°34.4	110°01.2	44.1	155°19.2	28.0	196°22.2	56.2	119°01.9	41.8	Canopus	263°54.8	-52°42.6											
18	25°36.9	125°00.4	\$21°44.5	170°20.4	\$12°28.4	211°24.7	N03°56.2	134°04.1	\$20°41.8	Sirius	258°31.8	-16°44.6											
19	40°39.4	139°59.6	44.8	185°21.6	28.9	226°27.3	56.3	149°06.3	41.9	Adhara	255°10.7	-28°59.9											
20	55°41.8	154°58.8	45.1	200°22.7	29.3	241°29.8	56.3	164°08.5	41.9	Procyon	244°57.6	5°10.8											
21	70°44.3	169°57.9	· · 45.4	215°23.9	· · 29.7	256°32.3	· · 56.3	179°10.7	· · 41.9	Pollux	243°25.2	27°59.0											
22	85°46.7	184°57.1	45.7	230°25.1	30.2	271°34.8	56.4	194°13.0	41.9	Avior	234°16.6	-59°33.8											
23	100°49.2	199°56.3	46.0	245°26.3	30.6	286°37.4	56.4	209°15.2	42.0	Suhail	222°50.7	-43°29.9											
Mer.pass.:16:18				v-0.8 d-0.3 m-3.9				v1.2 d-0.4 m1.1				v2.5 d0.0 m-2.1				v2.2 d-0.0 m0.5							
Sun				GHA				GHA				GHA				GHA							
0	115°51.7	214°55.5	\$21°46.3	260°27.5	\$12°31.0	301°39.9	N03°56.4	224°17.4	\$20°42.0	Denebola	182°31.7	14°28.8											
1	130°54.1	229°54.7	46.6	275°28.7	31.5	316°42.4	56.5	239°19.6	42.0	Gienah	175°50.3	-17°37.8											
2	145°56.6	244°53.8	46.9	290°29.8	31.9	331°44.9	56.5	254°21.8	42.0	Gacrux	173°06.9	-63°11.0											
3	160°59.1	259°53.0	· · 47.2	305°31.0	· · 32.3	346°47.5	· · 56.6	269°24.0	· · 42.1	Alioth	171°58.6	-57°11.9											
4	176°01.5	274°52.2	47.5	320°32.2	32.8	1°50.0	56.6	284°26.2	42.1	Spica	166°19.2	55°52.1											
5	191°04.0	289°51.4	47.8	335°33.4	33.2	16°52.5	56.6	299°28.4	42.1	Alkaid	152°57.6	49°13.8											
6	206°06.5	304°50.6	\$21°48.1	350°34.6	\$12°33.6	31°55.0	N03°56.7	314°30.6	\$20°42.2	Hadar	148°45.3	-60°26.6											
7	221°08.9	319°49.7	48.4	5°35.8	34.1	46°57.6	56.7	329°32.8	42.2	Menkent	148°05.5	-36°26.7											
8	236°11.4	334°48.9	48.7	20°36.9	34.5	62°00.1	56.8	344°35.0	42.2	Arcturus	145°54.2	19°05.9											
9	251°13.8	349°48.1	· · 49.0	35°38.1	· · 34.9	77°02.6	· · 56.8	359°37.2	· · 42.2	Rigel Kent.	139°49.3	-60°53.6											
10	266°16.3	4°47.3	49.2	50°39.3	35.3	92°05.2	56.8	14°39.5	42.3	Kochab	137°20.7	74°05.2											
11	281°18.8	19°46.4	49.5	65°40.5	35.8	107°07.7	56.9	29°41.7	42.3	Zuben' ubi	137°03.6	-16°06.3											
12	296°21.2	34°45.6	\$21°49.8	80°41.7	\$12°36.2	122°10.2	N03°56.9	44°43.9	\$20°42.3	Alphecca	126°09.7	26°39.6											
13	311°23.7	49°44.8	50.1	95°42.9	36.6	137°12.7	57.0	59°46.1	42.4	Antares	112°24.3	-26°27.8											
14	326°26.2	64°44.0	50.4	110°44.0	37.1	152°15.3	57.0	74°48.3	42.4	Atria	107°25.0	-69°02.9											
15	341°28.6	79°43.1	· · 50.7	125°45.2	· · 37.5	167°17.8	· · 57.0	89°50.5	· · 42.4	Sabik	102°10.8	-15°44.5											
16	356°31.1	94°42.3	51.0	140°46.4	37.9	182°20.3	57.1	104°52.7	42.4	Shaula	96°19.9	-37°06.6											
17	11°33.6	109°41.5	51.3	155°47.6	38.4	197°22.9	57.1	119°54.9	42.5	Rasalhague	96°05.1	12°33.0											
18	26°36.0	124°40.7	\$21°51.5	170°48.8	\$12°38.8	212°25.4	N03°57.2	134°57.1	\$20°42.5	Eltanin	90°45.8	51°29.3											
19	41°38.5	139°39.8	51.8	185°50.0	39.2	227°27.9	57.2	149°59.3	42.5	Kaus Aust.	83°41.9	-34°22.4											
20	56°41.0	154°39.0	52.1	200°51.1	39.6	242°30.5	57.2	165°01.6	42.6	Vega	80°38.2	38°48.0											
21	71°43.4	169°38.2	· · 52.4	215°52.3	· · 40.1	257°33.0	· · 57.3	180°03.8	· · 42.6	Nunki	75°56.5	-26°16.4											
22	86°45.9	184°37.4	52.7	230°53.5	40.5	272°35.5	57.3	195°06.0	42.6	Altair	62°06.9	8°54.8											
23	101°48.3	199°36.5	52.9	245°54.7	40.9	287°38.0	57.4	210°08.2	42.6	Peacock	53°17.2	-56°40.9											
Mer.pass.:16:14				v-0.8 d-0.3 m-3.9				v1.2 d-0.4 m1.1				v2.5 d0.0 m-2.1				v2.2 d-0.0 m0.5							
Mon				GHA				GHA				GHA				GHA							
0	116°50.8	214°35.7	\$21°53.2	260°55.9	\$12°41.3	302°40.6	N03°57.4	225°10.4	\$20°42.7	Jan 16 Sat	SHA	Mer.pass											
1	131°53.3	229°34.9	53.5	275°57.1	41.8	317°43.1	57.4	240°12.6	42.7	Venus	100°22.6	09:40											
2	146°55.7	244°34.1	53.8	290°58.3	42.2	332°45.6	57.5	255°14.8	42.7	Mars	145°06.6	06:40											
3	161°58.2	259°33.2	· · 54.0	305°59.4	· · 42.6	347°48.2	· · 57.5	270°17.0	· · 42.7	Jupiter	185°46.8	03:57											
4	177°00.7	274°32.4	54.3	321°00.6	43.1	2°50.7	57.6	285°19.2	42.8	Saturn	108°31.9	09:05											
5	192°03.1	289°31.6	54.6	336°01.8	43.5	17°53.2	57.6	300°21.4	42.8	Jan 17 Sun	SHA	Mer.pass											
6	207°05.6	304°30.7	\$21°54.8	351°03.0	\$12°43.9	32°55.8	N03°57.7	315°23.7	\$20°42.8	Venus	99°03.8	09:41											
7	222°08.1	319°29.9	55.1	6°04.2	44.																		

DUT1 = UT1-UTC = +0.0548 sec ΔT = TT-UT1 = +68.1292 sec

2016 January 16 to Jan. 18 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	177°38.9	S21°04.7	102°44.4	9.7'	N03°23.9	11.0'	59.3'
1	192°38.6	04.2	117°13.1	9.7'	03°34.9	11.0'	59.3'
2	207°38.4	03.8	131°41.8	9.7'	03°45.8	10.9'	59.3'
3	222°38.2	.. 03.3	146°10.5	9.7'	03°56.8	10.9'	59.3'
4	237°38.0	02.8	160°39.2	9.7'	04°07.7	10.9'	59.3'
5	252°37.8	02.4	175°07.8	9.7'	04°18.5	10.9'	59.3'
6	267°37.6	S21°01.9	189°36.5	9.7'	N04°29.4	10.8'	59.2'
7	282°37.3	01.4	204°05.2	9.7'	04°40.2	10.8'	59.2'
8	297°37.1	.. 01.0	218°33.8	9.6'	04°51.0	10.8'	59.2'
9	312°36.9	.. 00.5	233°02.4	9.6'	05°01.8	10.7'	59.2'
10	327°36.7	21°00.0	247°31.1	9.6'	05°12.5	10.7'	59.2'
11	342°36.5	20°59.5	261°59.7	9.6'	05°23.2	10.7'	59.2'
12	357°36.3	S20°59.1	276°28.3	9.6'	N05°33.9	10.6'	59.2'
13	12°36.0	58.6	290°56.8	9.6'	05°44.5	10.6'	59.2'
14	27°35.8	58.1	305°25.4	9.6'	05°55.1	10.6'	59.2'
15	42°35.6	.. 57.7	319°54.0	9.5'	06°05.6	10.5'	59.2'
16	57°35.4	57.2	334°22.5	9.5'	06°16.2	10.5'	59.2'
17	72°35.2	56.7	348°51.0	9.5'	06°26.7	10.5'	59.2'
18	87°35.0	S20°56.2	3°19.5	9.5'	N06°37.1	10.4'	59.2'
19	102°34.7	55.8	17°48.0	9.5'	06°47.5	10.4'	59.2'
20	117°34.5	55.3	32°16.5	9.5'	06°57.9	10.3'	59.2'
21	132°34.3	.. 54.8	46°44.9	9.4'	07°08.2	10.3'	59.2'
22	147°34.1	54.3	61°13.3	9.4'	07°18.5	10.3'	59.2'
23	162°33.9	53.8	75°41.8	9.4'	07°28.7	10.2'	59.2'
	SD.=16.2	d=0.5			S.D.=16.1		

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	177°33.7	S20°53.4	90°10.2	9.4'	N07°38.9	10.2'	59.2'
1	192°33.5	52.9	104°38.5	9.4'	07°49.0	10.1'	59.1'
2	207°33.3	52.4	119°06.9	9.3'	07°59.1	10.1'	59.1'
3	222°33.0	.. 51.9	133°35.2	9.3'	08°09.2	10.0'	59.1'
4	237°32.8	51.4	148°03.5	9.3'	08°19.1	10.0'	59.1'
5	252°32.6	51.0	162°31.8	9.3'	08°29.1	9.9'	59.1'
6	267°32.4	S20°50.5	177°00.1	9.3'	N08°39.0	9.9'	59.1'
7	282°32.2	50.0	191°28.3	9.2'	08°48.8	9.8'	59.1'
8	297°32.0	49.5	205°56.6	9.2'	08°58.6	9.8'	59.1'
9	312°31.8	.. 49.0	220°24.8	9.2'	09°08.3	9.7'	59.1'
10	327°31.6	48.5	234°52.9	9.2'	09°18.0	9.6'	59.1'
11	342°31.4	48.0	249°21.1	9.1'	09°27.6	9.6'	59.1'
12	357°31.2	S20°47.6	263°49.2	9.1'	N09°37.2	9.5'	59.1'
13	12°31.0	47.1	278°17.3	9.1'	09°46.7	9.5'	59.1'
14	27°30.7	46.6	292°45.4	9.1'	09°56.1	9.4'	59.0'
15	42°30.5	.. 46.1	307°13.5	9.0'	10°05.5	9.3'	59.0'
16	57°30.3	45.6	321°41.5	9.0'	10°14.8	9.3'	59.0'
17	72°30.1	45.1	336°09.5	9.0'	10°24.1	9.2'	59.0'
18	87°29.9	S20°44.6	350°37.5	9.0'	N10°33.2	9.2'	59.0'
19	102°29.7	44.1	5°05.5	8.9'	10°42.4	9.1'	59.0'
20	117°29.5	43.6	19°33.4	8.9'	10°51.4	9.0'	59.0'
21	132°29.3	.. 43.1	34°01.3	8.9'	11°00.4	9.0'	59.0'
22	147°29.1	42.6	48°29.2	8.9'	11°09.4	8.9'	59.0'
23	162°28.9	42.1	62°57.1	8.8'	11°18.2	8.8'	59.0'
	SD.=16.2	d=0.5			S.D.=16.1		

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	177°28.7	S20°41.6	77°24.9	8.8'	N11°27.0	8.8'	59.0'
1	192°28.5	41.1	91°52.7	8.8'	11°35.7	8.7'	59.0'
2	207°28.3	40.7	106°20.5	8.8'	11°44.4	8.6'	58.9'
3	222°28.1	.. 40.2	120°48.2	8.7'	11°52.9	8.5'	58.9'
4	237°27.9	39.7	135°16.0	8.7'	12°01.4	8.5'	58.9'
5	252°27.7	39.2	149°43.7	8.7'	12°09.9	8.4'	58.9'
6	267°27.5	S20°38.7	164°11.3	8.7'	N12°18.2	8.3'	58.9'
7	282°27.3	38.2	178°39.0	8.6'	12°26.5	8.2'	58.9'
8	297°27.1	37.7	193°06.6	8.6'	12°34.7	8.2'	58.9'
9	312°26.9	.. 37.2	207°34.2	8.6'	12°42.8	8.1'	58.9'
10	327°26.7	36.6	222°01.8	8.6'	12°50.9	8.0'	58.9'
11	342°26.4	36.1	236°29.3	8.5'	12°58.8	7.9'	58.9'
12	357°26.2	S20°35.6	250°56.8	8.5'	N13°06.7	7.8'	58.8'
13	12°26.0	35.1	265°24.3	8.5'	13°14.5	7.8'	58.8'
14	27°25.8	34.6	279°51.8	8.4'	13°22.3	7.7'	58.8'
15	42°25.6	.. 34.1	294°19.2	8.4'	13°29.9	7.6'	58.8'
16	57°25.4	33.6	308°46.6	8.4'	13°37.4	7.5'	58.8'
17	72°25.2	33.1	323°14.0	8.4'	13°44.9	7.4'	58.8'
18	87°25.0	S20°32.6	337°41.4	8.3'	N13°52.3	7.3'	58.8'
19	102°24.8	32.1	352°08.7	8.3'	13°59.6	7.3'	58.8'
20	117°24.7	31.6	6°36.0	8.3'	14°06.8	7.2'	58.8'
21	132°24.5	.. 31.1	21°03.3	8.3'	14°14.0	7.1'	58.7'
22	147°24.3	30.6	35°30.5	8.2'	14°21.0	7.0'	58.7'
23	162°24.1	30.0	49°57.8	8.2'	14°28.0	6.9'	58.7'
	SD.=16.2	d=0.5			S.D.=16.0		

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

**January 19, 20, 21 UT (Tue., Wed., Thu.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	117°49.9	214°15.8	\$21°59.5	261°24.4	\$12°51.6	303°41.4	N03°58.4	226°03.5	S20°43.3	Alpheratz	357°41.8	29°10.8											
1	132°52.4	229°14.9	21°59.8	276°25.6	52.0	318°44.0	58.5	241°05.7	43.3	Ankaa	353°14.2	-42°13.4											
2	147°54.9	244°14.1	22°00.0	291°26.7	52.4	333°46.5	58.5	256°07.9	43.4	Schedar	349°38.5	56°37.7											
3	162°57.3	259°13.3	.. 0.2	306°27.9	.. 52.8	348°49.1	.. 58.6	271°10.1	.. 43.4	Diphda	348°54.2	-17°54.1											
4	177°59.8	274°12.4	00.5	321°29.1	53.2	3°51.6	58.6	286°12.3	43.4	Achernar	335°25.6	-57°09.7											
5	193°02.3	289°11.6	00.7	336°30.3	53.7	18°54.1	58.7	301°14.5	43.5	Hamal	327°58.7	23°32.2											
6	208°04.7	304°10.8	\$22°01.0	351°31.5	\$12°54.1	33°56.7	N03°58.7	316°16.8	S20°43.5	Polaris	316°47.8	89°20.1											
7	223°07.2	319°09.9	01.2	6°32.7	54.5	48°59.2	58.8	331°19.0	43.5	Acamar	315°16.9	-40°14.8											
8	238°09.7	334°09.1	01.5	21°33.9	54.9	64°01.8	58.8	346°21.2	43.5	Menkar	314°13.1	4°08.9											
9	253°12.1	349°08.3	.. 0.7	36°35.1	.. 55.4	79°04.3	.. 58.9	1°23.4	.. 43.6	Mirfak	308°37.5	49°55.1											
10	268°14.6	4°07.4	01.9	51°36.3	55.8	94°06.9	58.9	16°25.6	43.6	Aldebaran	290°47.1	16°32.3											
11	283°17.1	19°06.6	02.2	66°37.5	56.2	109°09.4	58.9	31°27.8	43.6	Rigel	281°10.1	-8°11.3											
12	298°19.5	34°05.7	\$22°02.4	81°38.6	\$12°56.6	124°11.9	N03°59.0	46°30.0	S20°43.6	Capella	280°31.4	46°00.7											
13	313°22.0	49°04.9	02.7	96°39.8	57.0	139°14.5	59.0	61°32.3	43.7	Bellatrix	278°29.8	6°21.6											
14	328°24.4	64°04.1	02.9	111°41.0	57.5	154°17.0	59.1	76°34.5	43.7	El Nath	278°10.1	28°37.1											
15	343°26.9	79°03.2	.. 0.3.1	126°42.2	.. 57.9	169°19.6	.. 59.1	91°36.7	.. 43.7	Alnilam	275°44.3	-1°11.8											
16	358°29.4	94°02.4	03.4	141°43.4	58.3	184°22.1	59.2	106°38.9	43.7	Betelgeuse	270°59.1	7°24.3											
17	13°31.8	109°01.6	03.6	156°44.6	58.7	199°24.7	59.2	121°41.1	43.8	Canopus	263°54.8	-52°42.6											
18	28°34.3	124°00.7	\$22°03.8	171°45.8	\$12°59.1	214°27.2	N03°59.3	136°43.3	S20°43.8	Sirius	258°31.8	-16°44.6											
19	43°36.8	138°59.9	04.0	186°47.0	12°59.6	229°29.7	59.3	151°45.7	43.8	Adhara	255°10.7	-28°59.9											
20	58°39.2	153°59.0	04.3	201°48.2	13°00.0	244°32.3	59.4	166°47.8	43.9	Procyon	244°57.6	5°10.8											
21	73°41.7	168°58.2	.. 0.4.5	216°49.4	.. 00.4	259°34.8	.. 59.4	181°50.0	.. 43.9	Pollux	243°25.2	27°59.0											
22	88°44.2	183°57.4	04.7	231°50.5	00.8	274°37.4	59.5	196°52.2	43.9	Avior	234°16.5	-59°33.8											
23	103°46.6	198°56.5	04.9	246°51.7	01.2	289°39.9	59.5	211°54.4	43.9	Suhail	222°50.6	-43°30.0											
Mer.pass.:16:06				v-0.8 d-0.2 m-3.9				v1.2 d-0.4 m1.0				v2.5 d0.0 m-2.1				v2.2 d-0.0 m0.5							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	118°49.1	213°55.7	\$22°05.2	261°52.9	\$13°01.7	304°42.5	N03°59.6	226°56.6	S20°44.0	Denebola	182°31.7	14°28.8											
1	133°51.6	228°54.8	05.4	276°54.1	02.1	319°45.0	59.6	241°58.8	44.0	Gienah	175°50.3	-17°37.8											
2	148°54.0	243°54.0	05.6	291°55.3	02.5	334°47.6	59.6	257°01.0	44.0	Gacrux	173°06.9	-63°11.0											
3	163°56.5	258°53.2	.. 0.8	306°56.5	.. 0.2.9	349°50.1	.. 59.7	272°03.3	.. 44.0	Alioth	171°58.6	-57°11.9											
4	178°58.9	273°52.3	06.1	321°57.7	03.3	4°52.7	59.7	287°05.5	44.1	Spica	166°19.1	55°52.1											
5	194°01.4	288°51.5	06.3	336°58.9	03.8	19°55.2	59.8	302°07.7	44.1	Alkaid	152°57.6	49°13.8											
6	209°03.9	303°50.6	\$22°06.5	352°00.1	\$13°04.2	34°57.8	N03°59.8	317°09.9	S20°44.1	Hadar	148°45.3	-60°26.6											
7	224°06.3	318°49.8	06.7	7°01.3	04.6	50°00.3	59.9	332°12.1	44.1	Menkent	148°05.5	-36°26.7											
8	239°08.8	333°49.0	06.9	22°02.5	05.0	65°02.9	03°59.9	347°14.3	44.2	Arcturus	145°54.2	19°05.9											
9	254°11.3	348°48.1	.. 0.7.1	37°03.7	.. 05.4	80°05.4	04°00.0	2°16.6	.. 44.2	Rigel Kent.	139°49.3	-60°53.7											
10	269°13.7	3°47.3	07.3	52°04.8	05.8	95°08.0	00.0	17°18.8	44.2	Kochab	137°20.6	74°05.2											
11	284°16.2	18°46.4	07.6	67°06.0	06.3	110°10.5	00.1	32°21.0	44.2	Zuben' ubi	137°03.5	-16°06.3											
12	299°18.7	33°45.6	\$22°07.8	82°07.2	\$13°06.7	125°13.1	N04°00.1	47°23.2	S20°44.3	Alphecca	126°09.7	26°39.6											
13	314°21.1	48°44.7	08.0	97°08.4	07.1	140°15.6	00.2	62°25.4	44.3	Antares	112°24.3	-26°27.8											
14	329°23.6	63°43.9	08.2	112°09.6	07.5	155°18.2	00.2	77°27.6	44.3	Atria	107°24.9	-69°02.9											
15	344°26.1	78°43.1	.. 0.8.4	127°10.8	.. 07.9	170°20.7	.. 00.3	92°29.9	.. 44.4	Sabik	102°08.8	-15°44.5											
16	359°28.5	93°42.2	08.6	142°12.0	08.4	185°23.3	00.3	107°32.1	44.4	Shaula	96°19.9	-37°06.6											
17	14°31.0	108°41.4	08.8	157°13.2	08.8	200°25.8	00.4	122°34.3	44.4	Rasalhague	96°05.1	12°33.0											
18	29°33.4	123°40.5	\$22°09.0	172°14.4	\$13°09.2	215°28.4	N04°00.4	137°36.5	S20°44.4	Eltanin	90°45.8	51°29.2											
19	44°35.9	138°39.7	09.2	187°15.6	09.6	230°30.9	00.5	152°38.7	44.5	Kaus Aust.	83°41.9	-34°22.4											
20	59°38.4	153°38.8	09.4	202°16.8	10.0	245°33.5	00.5	167°40.9	44.5	Vega	80°38.2	38°48.0											
21	74°40.8	168°38.0	.. 0.9.6	217°18.0	.. 10.4	260°36.0	.. 0.6	182°43.2	.. 44.5	Nunki	75°56.5	-26°16.4											
22	89°43.3	183°37.2	09.8	232°19.2	10.8	275°38.6	00.6	197°45.4	44.5	Altair	62°06.8	8°54.8											
23	104°45.8	198°36.3	10.0	247°20.4	11.3	290°41.1	00.7	212°47.6	44.6	Peacock	53°17.2	-56°40.9											
Mer.pass.:16:02				v-0.8 d-0.2 m-3.9				v1.2 d-0.4 m1.0				v2.5 d0.0 m-2.1				v2.2 d-0.0 m0.5							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	119°48.2	213°35.5	\$22°10.2	262°21.6	\$13°11.7	305°43.7	N04°00.7	227°49.8	S20°44.6	Jan 19 Tue	96°25.8	09:43											
1	134°50.7	228°34.6	10.4	277°22.8	12.1	320°46.2	00.8	242°52.0	44.6	Venus	95°06.6	09:45											
2	149°53.2	243°33.8	10.6	292°23.9	12.5	335°48.8	00.8	257°54.2	44.6	Mars	143°34.4	06:34											
3	164°55.6	258°32.9	.. 10.8	307°25.1	.. 12.9	350°51.3	.. 0.9	272°56.5	.. 44.7	Jupiter	185°51.5	03:45											
4	179°58.1	273°32.1	11.0	322°26.3	13.3	5°53.9	00.9	287°58.7	44.7	Saturn	108°13.5	08:54											
5	195°00.6	288°31.2	11.2	337°27.5	13.8	20°56.5	01.0	303°09.9	44.7	Jan 20 Wed	95°06.6	09:45											
6	210°03.0	303°30.4	\$22°11.4	352°28.7	\$13°14.2	35°59.0	N04°01.0	318°03.1	S20°44.7	Venus	95°06.6	09:45											
7	225°05.5	318°29.5	11.5	7°29.9	14.6	51°01.6	01.1	333°05.3	44.8	Mars	143°03.8	06:32											
8	240°07.9	333°28.7	11.7	22°31.1	15.0	66°04.1	01.1	348°07.6	44.8	Jupiter	185°53.4</												

DUT1 = UT1-UTC = +0.0495 sec ΔT = TT-UT1 = +68.1345 sec

2016 January 19 to Jan. 21 UT

h		Sun			Moon			
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	177°23.9	S20°29.5	64°25.0	8.2'	N14°34.8	6.8'	58.7'	
1	192°23.7	29.0	78°52.1	8.2'	14°41.6	6.7'	58.7'	
2	207°23.5	28.5	93°19.3	8.1'	14°48.3	6.6'	58.7'	
3	222°23.3	.. 28.0	107°46.4	8.1'	14°54.9	6.5'	58.7'	
4	237°23.1	27.5	122°13.5	8.1'	15°01.4	6.5'	58.7'	
5	252°22.9	27.0	136°40.6	8.1'	15°07.8	6.4'	58.7'	
6	267°22.7	S20°26.4	151°07.7	8.0'	N15°14.1	6.3'	58.6'	
7	282°22.5	25.9	165°34.7	8.0'	15°20.3	6.2'	58.6'	
8	297°22.3	25.4	180°01.7	8.0'	15°26.4	6.1'	58.6'	
9	312°22.1	.. 24.9	194°28.7	8.0'	15°32.4	6.0'	58.6'	
10	327°21.9	24.4	208°55.7	8.0'	15°38.4	5.9'	58.6'	
11	342°21.7	23.9	223°22.7	7.9'	15°44.2	5.8'	58.6'	
12	357°21.5	S20°23.3	237°49.6	7.9'	N15°49.9	5.7'	58.6'	
13	12°21.3	22.8	252°16.5	7.9'	15°55.6	5.6'	58.6'	
14	27°21.1	22.3	266°43.4	7.9'	16°01.1	5.5'	58.5'	
15	42°20.9	.. 21.8	281°10.3	7.9'	16°06.5	5.4'	58.5'	
16	57°20.8	21.2	295°37.1	7.8'	16°11.9	5.3'	58.5'	
17	72°20.6	20.7	310°03.9	7.8'	16°17.1	5.2'	58.5'	
18	87°20.4	S20°20.2	324°30.8	7.8'	N16°22.3	5.1'	58.5'	
19	102°20.2	19.7	338°57.6	7.8'	16°27.3	5.0'	58.5'	
20	117°20.0	19.1	353°24.3	7.8'	16°32.2	4.9'	58.5'	
21	132°19.8	.. 18.6	7°51.1	7.8'	16°37.1	4.8'	58.4'	
22	147°19.6	18.1	22°17.9	7.7'	16°41.8	4.7'	58.4'	
23	162°19.4	17.6	36°44.6	7.7'	16°46.4	4.6'	58.4'	
	SD.=16.2	d=0.5			S.D.=16.0			

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	177°19.2	S20°17.0	51°11.3	7.7'	N16°50.9	4.5'	58.4'
1	192°19.0	16.5	65°38.0	7.7'	16°55.3	4.4'	58.4'
2	207°18.8	16.0	80°04.7	7.7'	16°59.6	4.3'	58.4'
3	222°18.7	.. 15.5	94°31.4	7.7'	17°03.8	4.1'	58.4'
4	237°18.5	14.9	108°58.1	7.7'	17°07.9	4.0'	58.3'
5	252°18.3	14.4	123°24.7	7.7'	17°11.9	3.9'	58.3'
6	267°18.1	S20°13.9	137°51.4	7.6'	N17°15.8	3.8'	58.3'
7	282°17.9	13.3	152°18.0	7.6'	17°19.6	3.7'	58.3'
8	297°17.7	12.8	166°44.7	7.6'	17°23.3	3.6'	58.3'
9	312°17.5	.. 12.3	181°11.3	7.6'	17°26.8	3.5'	58.3'
10	327°17.4	11.7	195°37.9	7.6'	17°30.3	3.4'	58.3'
11	342°17.2	11.2	210°04.5	7.6'	17°33.6	3.3'	58.2'
12	357°17.0	S20°10.6	224°31.1	7.6'	N17°36.8	3.2'	58.2'
13	12°16.8	10.1	238°57.7	7.6'	17°40.0	3.1'	58.2'
14	27°16.6	09.6	253°24.3	7.6'	17°43.0	3.0'	58.2'
15	42°16.4	.. 09.0	267°50.9	7.6'	17°45.9	2.9'	58.2'
16	57°16.2	08.5	282°17.5	7.6'	17°48.7	2.7'	58.2'
17	72°16.1	08.0	296°44.1	7.6'	17°51.4	2.6'	58.1'
18	87°15.9	S20°07.4	311°10.7	7.6'	N17°54.0	2.5'	58.1'
19	102°15.7	06.9	325°37.3	7.6'	17°56.4	2.4'	58.1'
20	117°15.5	06.3	340°03.9	7.6'	17°58.8	2.3'	58.1'
21	132°15.3	.. 05.8	354°30.5	7.6'	18°01.0	2.2'	58.1'
22	147°15.1	05.3	8°57.1	7.6'	18°03.2	2.1'	58.1'
23	162°15.0	04.7	23°23.7	7.6'	18°05.2	2.0'	58.1'
	SD.=16.2	d=0.5			S.D.=15.9		

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	177°14.8	S20°04.2	37°50.3	7.6'	N18°07.1	1.9'	58.0'
1	192°14.6	03.6	52°16.9	7.6'	18°08.9	1.7'	58.0'
2	207°14.4	03.1	66°43.5	7.6'	18°10.6	1.6'	58.0'
3	222°14.2	.. 02.5	81°10.1	7.6'	18°12.2	1.5'	58.0'
4	237°14.1	02.0	95°36.7	7.6'	18°13.6	1.4'	58.0'
5	252°13.9	01.4	110°03.4	7.6'	18°15.0	1.3'	57.9'
6	267°13.7	S20°09.9	124°30.0	7.7'	N18°16.2	1.2'	57.9'
7	282°13.5	20°00.3	138°56.7	7.7'	18°17.4	1.1'	57.9'
8	297°13.3	19°59.8	153°23.3	7.7'	18°18.4	1.0'	57.9'
9	312°13.2	.. 59.2	167°50.0	7.7'	18°19.3	0.9'	57.9'
10	327°13.0	58.7	182°16.7	7.7'	18°20.1	0.7'	57.9'
11	342°12.8	58.1	196°43.4	7.7'	18°20.8	0.6'	57.8'
12	357°12.6	S19°57.6	211°10.1	7.7'	N18°21.4	0.5'	57.8'
13	12°12.5	57.0	225°36.9	7.7'	18°21.8	0.4'	57.8'
14	27°12.3	56.5	240°03.6	7.8'	18°22.2	0.3'	57.8'
15	42°12.1	.. 55.9	254°30.4	7.8'	18°22.4	0.2'	57.8'
16	57°11.9	55.4	268°57.2	7.8'	18°22.6	0.1'	57.8'
17	72°11.7	54.8	283°24.0	7.8'	18°22.6	-0.0'	57.7'
18	87°11.6	S19°54.3	297°50.9	7.8'	N18°22.5	-0.1'	57.7'
19	102°11.4	53.7	312°17.7	7.9'	18°22.3	-0.3'	57.7'
20	117°11.2	53.1	326°44.6	7.9'	18°22.0	-0.4'	57.7'
21	132°11.0	.. 52.6	341°11.5	7.9'	18°21.6	-0.5'	57.7'
22	147°10.9	52.0	355°38.4	7.9'	18°21.1	-0.6'	57.6'
23	162°10.7	51.5	10°05.4	8.0'	18°20.4	-0.7'	57.6'
	SD.=16.2	d=0.5			S.D.=15.8		

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

**January 22, 23, 24 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	120°47.4	213°15.1	S22°14.6	262°50.3	S13°21.6	306°45.1	N04°02.0	228°43.1	S20°45.2	Alpheratz	357°41.8	29°10.8					
1	135°49.8	228°14.3	14.8	277°51.5	22.0	321°47.6	02.0	243°45.3	45.2	Ankaa	353°14.2	-42°13.4					
2	150°52.3	243°13.4	14.9	292°52.7	22.4	336°50.2	02.1	258°47.5	45.3	Schedar	349°38.6	56°37.7					
3	165°54.8	258°12.6	.. 15.1	307°53.9	.. 22.8	351°52.8	.. 02.1	273°49.7	.. 45.3	Diphda	348°54.2	-17°54.1					
4	180°57.2	273°11.7	15.3	322°55.1	23.2	6°55.3	02.2	288°52.0	45.3	Achernar	335°25.6	-57°09.7					
5	195°59.7	288°10.9	15.4	337°56.3	23.6	21°57.9	02.3	303°54.2	45.3	Hamal	327°58.7	23°32.2					
6	211°02.2	303°10.0	S22°15.6	352°57.4	S13°24.1	37°00.4	N04°02.3	318°56.4	S20°45.4	Polaris	316°49.1	89°20.1					
7	226°04.6	318°09.2	15.7	7°58.6	24.5	52°03.0	02.4	333°58.6	45.4	Acamar	315°16.9	-40°14.8					
8	241°07.1	333°08.3	15.9	22°59.8	24.9	67°05.6	02.4	349°00.8	45.4	Menkar	314°13.1	4°08.9					
9	256°09.5	348°07.5	.. 16.1	38°01.0	.. 25.3	82°08.1	.. 02.5	4°03.1	.. 45.4	Mirfak	308°37.5	49°55.1					
10	271°12.0	3°06.6	16.2	53°02.2	25.7	97°10.7	02.5	19°05.3	45.5	Aldebaran	290°47.1	16°32.3					
11	286°14.5	18°05.8	16.4	68°03.4	26.1	112°13.3	02.6	34°07.5	45.5	Rigel	281°10.1	-8°11.3					
12	301°16.9	33°04.9	S22°16.5	83°04.6	S13°26.5	127°15.8	N04°02.6	49°09.7	S20°45.5	Capella	280°31.4	46°00.7					
13	316°19.4	48°04.0	16.7	98°05.8	26.9	142°18.4	02.7	64°12.0	45.5	Bellatrix	278°29.8	6°21.6					
14	331°21.9	63°03.2	16.8	113°07.0	27.3	157°21.0	02.8	79°14.2	45.6	Elnath	278°10.1	28°37.1					
15	346°24.3	78°02.3	.. 17.0	128°08.2	.. 27.7	172°23.5	.. 02.8	94°16.4	.. 45.6	Alnilam	275°44.3	-1°11.8					
16	1°26.8	93°01.5	17.2	143°09.4	28.1	187°26.1	02.9	109°18.6	45.6	Betelgeuse	270°59.1	7°24.3					
17	16°29.3	108°00.6	17.3	158°10.6	28.6	202°28.6	02.9	124°20.8	45.6	Canopus	263°54.8	-52°42.6					
18	31°31.7	122°59.8	S22°17.5	173°11.8	S13°29.0	217°31.2	N04°03.0	139°23.1	S20°45.7	Sirius	258°31.8	-16°44.6					
19	46°34.2	137°58.9	17.6	188°13.0	29.4	232°33.8	03.0	154°25.3	45.7	Adhara	255°10.7	-29°00.0					
20	61°36.7	152°58.1	17.7	203°14.2	29.8	247°36.3	03.1	169°27.5	45.7	Procyon	244°57.5	5°10.7					
21	76°39.1	167°57.2	.. 17.9	218°15.4	.. 30.2	262°38.9	.. 03.1	184°29.7	.. 45.7	Pollux	243°25.2	27°59.0					
22	91°41.6	182°56.4	18.0	233°16.6	30.6	277°41.5	03.2	199°32.0	45.8	Avior	234°16.5	-59°33.8					
23	106°44.0	197°55.5	18.2	248°17.8	31.0	292°44.0	03.3	214°34.2	45.8	Suhail	222°50.6	-43°30.0					
Mer.pass.:15:54			v-0.9 d-0.2 m-3.9	v1.2 d-0.4 m1.0	v2.6 d0.1 m-2.1	v2.2 d-0.0 m0.5	Miaplacidus			v211°38.2	v-0.9 d-0.2 m-3.9	v1.2 d-0.4 m1.0	v2.6 d0.1 m-2.1	v2.2 d-0.0 m0.5			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	121°46.5	212°54.7	S22°18.3	263°19.0	S13°31.4	307°46.6	N04°03.3	229°36.4	S20°45.8	Denebola	182°31.7	14°28.8					
1	136°49.0	227°53.8	18.5	278°20.2	31.8	322°49.2	03.4	244°38.6	45.8	Gienah	175°50.3	-17°37.8					
2	151°51.4	242°53.0	18.6	293°21.4	32.2	337°51.8	03.4	259°40.8	45.9	Acrux	173°06.8	-63°11.0					
3	166°53.9	257°52.1	.. 18.7	308°22.6	.. 32.6	352°54.3	.. 03.5	274°43.1	.. 45.9	Gacrux	171°58.5	-57°11.9					
4	181°56.4	272°51.2	18.9	323°23.8	33.0	7°56.9	03.5	289°45.3	45.9	Alioth	166°19.1	55°52.1					
5	196°58.8	287°50.4	19.0	338°25.0	33.4	22°59.5	03.6	304°47.5	45.9	Spica	158°29.3	-11°14.6					
6	212°01.3	302°49.5	S22°19.2	353°26.2	S13°33.8	38°02.0	N04°03.7	319°49.7	S20°46.0	Alkaid	152°57.6	49°13.8					
7	227°03.8	317°48.7	19.3	8°27.5	34.2	53°04.6	03.7	334°52.0	46.0	Hadar	148°45.2	-60°26.6					
8	242°06.2	332°47.8	19.4	23°28.7	34.7	68°07.2	03.8	349°54.2	46.0	Menkent	148°05.4	-36°26.7					
9	257°08.7	347°47.0	.. 19.6	38°29.9	.. 35.1	83°09.7	.. 03.8	4°56.4	.. 46.0	Arcturus	145°54.2	19°05.9					
10	272°11.2	2°46.1	19.7	53°31.1	35.5	98°12.3	03.9	19°58.6	46.1	Rigel Kent.	139°49.2	-60°53.7					
11	287°13.6	17°45.3	19.8	68°32.3	35.9	113°14.9	03.9	35°00.9	46.1	Kochab	137°20.6	74°05.2					
12	302°16.1	32°44.4	S22°19.9	83°33.5	S13°36.3	128°17.5	N04°04.0	50°03.1	S20°46.1	Zuben' ubi	137°03.5	-16°06.3					
13	317°18.5	47°43.5	20.1	98°34.7	36.7	143°20.0	04.1	65°05.3	46.1	Alphecca	126°09.7	26°39.6					
14	332°21.0	62°42.7	20.2	113°35.9	37.1	158°22.6	04.1	80°07.5	46.2	Antares	112°24.3	-26°27.8					
15	347°23.5	77°41.8	.. 20.3	128°37.1	.. 37.5	173°25.2	.. 04.2	95°09.8	.. 46.2	Atria	107°24.8	-69°02.9					
16	2°25.9	92°41.0	20.5	143°38.3	37.9	188°27.7	04.2	110°12.0	46.2	Sabik	102°10.7	-15°44.5					
17	17°28.4	107°40.1	20.6	158°39.5	38.3	203°30.3	04.3	125°14.2	46.2	Rasalhague	96°05.1	12°33.0					
18	32°30.9	122°39.3	S22°20.7	173°40.7	S13°38.7	218°32.9	N04°04.4	140°16.4	S20°46.3	Eltanin	90°45.8	51°29.2					
19	47°33.3	137°38.4	20.8	188°41.9	39.1	233°35.5	04.4	155°18.7	46.3	Kaus Aust.	83°41.8	-34°22.4					
20	62°35.8	152°37.5	20.9	203°43.1	39.5	248°38.0	04.5	170°20.9	46.3	Vega	80°38.1	38°48.0					
21	77°38.3	167°36.7	.. 21.1	218°44.3	.. 39.9	263°40.6	.. 04.5	185°23.1	.. 46.3	Nunki	75°56.5	-26°16.4					
22	92°40.7	182°35.8	21.2	233°45.5	40.3	278°43.2	04.6	200°25.3	46.4	Altair	62°06.8	8°54.8					
23	107°43.2	197°35.0	21.3	248°46.7	40.7	293°45.8	04.6	215°27.6	46.4	Peacock	53°17.1	-56°40.9					
Mer.pass.:15:50			v-0.9 d-0.1 m-3.9	v1.2 d-0.4 m1.0	v2.6 d0.1 m-2.2	v2.2 d-0.0 m0.5	Deneb			v211°38.2	v-0.9 d-0.1 m-3.9	v1.2 d-0.4 m1.0	v2.6 d0.1 m-2.2	v2.2 d-0.0 m0.5			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	122°45.7	212°34.1	S22°21.4	263°47.9	S13°41.1	308°48.3	N04°04.7	230°29.8	S20°46.4	Jan 22 Fri	92°27.7	09:48					
1	137°48.1	227°33.2	21.5	278°49.1	41.5	323°50.9	04.8	245°32.0	46.4	Venus	91°08.1	09:49					
2	152°50.6	242°32.4	21.6	293°50.3	41.9	338°53.5	04.8	260°34.2	46.5	Mars	142°02.9	06:28					
3	167°53.0	257°31.5	.. 21.7	308°51.5	.. 42.3	353°56.1	.. 04.9	275°36.5	.. 46.5	Jupiter	185°57.7	03:32					
4	182°55.5	272°30.7	21.9	323°52.7	42.7	8°58.6	04.9	290°38.7	46.5	Saturn	107°55.7	08:44					
5	197°58.0	287°29.8	22.0	338°53.9	43.1	24°01.2	05.0	305°40.9	46.5	Jan 23 Sat	91°08.1	09:49					
6	213°00.4	302°29.0	S22°22.1	353°55.1	S13°43.5	39°03.8	N04°05.1	320°43.1	S20°46.5	Venus	91°32.5	06:26					
7	228°02.9	317°28.1	22.2	8°56.3	43.9	54°06.4	05.1	335°45.4	46.6	Mars	141°32.5	06:26					
8	243°05.4	332°27.2	22.3	23°57.5	44.3	69°08.9	05.2	350°47.6	46.6	Jupiter	186°00.1	03:28					
9	258°07.8	347°26.4	.. 22.4	38°58.7	.. 44.7	84°11.5	.. 05.3	5°49.8	.. 46.6	Saturn	107°49.9	08:40					
10	273°10.3	2°25.5	22.5	54°00.0	45.1	99°14.1	05.3	20°52.1	46.6	Jan 24 Sun	89°48.5	09:50					
11	288°12.8	17°24.7	22.6	69°01.2	45.5	114°16.7	05.4	35°54.3	46.7	Venus	89°48.5	09:50					
12	303°15.2	32°23.8	S22°22.7	84°02.4	S13°45.9	129°19.3	N04°05.4	50°56.5	S20°46.7	Mars	141°02.3	06:24					
13	318°17.7	47°22.9	22.8	99°03.6	46.3	144°21.8	05.5	65°58.7	46.7	Jupiter	186°02.7	03:24					
14	333°20.1	62°22.1	22.9	114°04.8	46.7	159°24.4	05.6	81°01.0	46.7	Saturn	107°44.1	08:37					
15	348°22.6	77°21.2	.. 23.0	129°06.0	.. 47.1	174°27.0	.. 05.6	96°03.2	.. 46.8	Horizontal parallax							
16	3°25.1	92°20.4	23.1	144°07.2	47.5	189°29.6	05.7	111°05.4	46.8	Venus:	0.1						
17	18°27.5	107°19.5	23.2	159°08.4	47.9	204°32.2	05.7	126°07.6	46.8	Mars:	0.1						
18	33°30.0	122°18.6	S22°23.3	174°09.6	S13°48.3	219°34.7	N04°05.8	141°09.9	S20°46.8								
19	48°32.5	137°17.8	23.4	189°10.8	48.7	234°37.3	05.9	156°12.1	46.9								

DUT1 = UT1-UTC = +0.0441 sec ΔT = TT-UT1 = +68.1399 sec

2016 January 22 to Jan. 24 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	177°10.5	S19°50.9	24°32.4	8.0'	N18°19.7	-0.8'	57.6'
1	192°10.4	50.4	38°59.4	8.0'	18°18.8	-0.9'	57.6'
2	207°10.2	49.8	53°26.4	8.0'	18°17.9	-1.0'	57.6'
3	222°10.0	.. 49.2	67°53.4	8.1'	18°16.8	-1.1'	57.5'
4	237°09.8	48.7	82°20.5	8.1'	18°15.6	-1.2'	57.5'
5	252°09.7	48.1	96°47.7	8.1'	18°14.4	-1.3'	57.5'
6	267°09.5	S19°47.5	111°14.8	8.2'	N18°13.0	-1.4'	57.5'
7	282°09.3	47.0	125°42.0	8.2'	18°11.5	-1.5'	57.5'
8	297°09.1	46.4	140°09.2	8.2'	18°09.9	-1.7'	57.4'
9	312°09.0	.. 45.8	154°36.5	8.3'	18°08.2	-1.8'	57.4'
10	327°08.8	45.3	169°03.7	8.3'	18°06.4	-1.9'	57.4'
11	342°08.6	44.7	183°31.1	8.3'	18°04.4	-2.0'	57.4'
12	357°08.5	S19°44.1	197°58.4	8.4'	N18°02.4	-2.1'	57.4'
13	12°08.3	43.6	212°25.8	8.4'	18°00.3	-2.2'	57.3'
14	27°08.1	43.0	226°53.2	8.4'	17°58.1	-2.3'	57.3'
15	42°08.0	.. 42.4	241°20.7	8.5'	17°55.7	-2.4'	57.3'
16	57°07.8	41.9	255°48.2	8.5'	17°53.3	-2.5'	57.3'
17	72°07.6	41.3	270°15.8	8.6'	17°50.8	-2.6'	57.3'
18	87°07.5	S19°40.7	284°43.4	8.6'	N17°48.1	-2.7'	57.2'
19	102°07.3	40.2	299°11.0	8.7'	17°45.4	-2.8'	57.2'
20	117°07.1	39.6	313°38.7	8.7'	17°42.6	-2.9'	57.2'
21	132°07.0	.. 39.0	328°06.4	8.7'	17°39.6	-3.0'	57.2'
22	147°06.8	38.4	342°34.1	8.8'	17°36.6	-3.1'	57.2'
23	162°06.6	37.9	357°01.9	8.8'	17°33.5	-3.2'	57.1'
	SD.=16.2	d=0.6			S.D.=15.6		

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

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

Day	Sun		Moon	
	Eqn. of Time	Mer. Pass.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
22	11:18	11:26	12:11	10:45
23	11:34	11:42	12:12	11:39
24	11:50	11:57	12:12	00:05 12:30

SD.=16.2	d=0.6	S.D.=15.3
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**January 25, 26, 27 UT (Mon., Tue., Wed.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	123°44.8	212°13.5	\$22°23.8	264°16.8	\$13°50.7	309°50.2	N04°06.2	231°23.2	S20°47.0	Alpheratz	357°41.8	29°10.8											
1	138°47.3	227°12.6	23.9	279°18.1	51.1	324°52.8	06.2	246°25.5	47.0	Ankaa	353°14.2	-42°13.4											
2	153°49.7	242°11.7	24.0	294°19.3	51.5	339°55.4	06.3	261°27.7	47.0	Schedar	349°38.6	56°37.7											
3	168°52.2	257°10.9	· · 24.1	309°20.5	· · 51.9	354°58.0	· · 06.4	276°29.9	· · 47.1	Diphda	348°54.3	-17°54.1											
4	183°54.6	272°10.0	24.2	324°21.7	52.3	10°00.6	06.4	291°32.2	47.1	Achernar	335°25.7	-57°09.7											
5	198°57.1	287°09.2	24.3	339°22.9	52.7	25°03.1	06.5	306°34.4	47.1	Hamal	327°58.7	23°32.2											
6	213°59.6	302°08.3	\$22°24.3	354°24.1	\$13°53.1	40°05.7	N04°06.6	321°36.6	S20°47.1	Polaris	316°50.5	89°20.2											
7	229°02.0	317°07.4	24.4	9°25.3	53.5	55°08.3	06.6	336°38.8	47.1	Acamar	315°17.0	-40°14.8											
8	244°04.5	332°06.6	24.5	24°26.5	53.9	70°10.9	06.7	351°41.1	47.2	Menkar	314°13.1	4°08.9											
9	259°07.0	347°05.7	· · 24.6	39°27.7	· · 54.3	85°13.5	· · 06.7	6°43.3	· · 47.2	Mirfak	308°37.6	49°55.1											
10	274°09.4	2°04.8	24.7	54°28.9	54.7	100°16.1	06.8	21°45.5	47.2	Aldebaran	290°47.1	16°32.3											
11	289°11.9	17°04.0	24.7	69°30.1	55.1	115°18.7	06.9	36°47.8	47.2	Rigel	281°10.1	-8°11.3											
12	304°14.4	32°03.1	\$22°24.8	84°31.3	\$13°55.5	130°21.2	N04°06.9	51°50.0	S20°47.3	Capella	280°31.4	46°00.7											
13	319°16.8	47°02.3	24.9	99°32.6	55.9	145°23.8	07.0	66°52.2	47.3	Bellatrix	278°29.8	6°21.6											
14	334°19.3	62°01.4	25.0	114°33.8	56.3	160°26.4	07.1	81°54.5	47.3	Elnath	278°10.1	28°37.1											
15	349°21.8	77°00.5	· · 25.0	129°35.0	· · 56.7	175°29.0	· · 07.1	96°56.7	· · 47.3	Alnilam	275°44.3	-1°11.8											
16	4°24.2	91°59.7	25.1	144°36.2	57.1	190°31.6	07.2	111°58.9	47.4	Betelgeuse	270°59.1	7°24.3											
17	19°26.7	106°58.8	25.2	159°37.4	57.5	205°34.2	07.3	127°01.1	47.4	Canopus	263°54.9	-52°42.6											
18	34°29.1	121°57.9	\$22°25.5	174°38.6	\$13°57.9	220°36.8	N04°07.3	142°03.4	S20°47.4	Sirius	258°31.8	-16°44.6											
19	49°31.6	136°57.1	25.3	189°39.8	58.3	235°39.3	07.4	157°05.6	47.4	Adhara	255°10.7	-29°00.0											
20	64°34.1	151°56.2	25.4	204°41.0	58.7	250°41.9	07.5	172°07.8	47.5	Procyon	244°57.5	5°10.7											
21	79°36.5	166°55.3	· · 25.4	219°42.2	· · 59.1	265°44.5	· · 07.5	187°10.1	· · 47.5	Pollux	243°25.2	27°59.0											
22	94°39.0	181°54.5	25.5	234°43.4	59.5	280°47.1	07.6	202°12.3	47.5	Avior	234°16.5	-59°33.8											
23	109°41.5	196°53.6	25.5	249°44.7	59.8	295°49.7	07.6	217°14.5	47.5	Suhail	222°50.6	-43°30.0											
Mer.pass.:15:42				v-0.9 d-0.1 m-3.9				v1.2 d-0.4 m0.9				v2.6 d0.1 m-2.2				v2.2 d-0.0 m0.5							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	124°43.9	211°52.8	\$22°25.6	264°45.9	\$14°00.2	310°52.3	N04°07.7	232°16.8	S20°47.5	Denebola	182°31.7	14°28.8											
1	139°46.4	226°51.9	25.7	279°47.1	00.6	325°54.9	07.8	247°19.0	47.6	Gienah	175°50.3	-17°37.8											
2	154°48.9	241°51.0	25.7	294°48.3	01.0	340°57.5	07.8	262°21.2	47.6	Gacrux	173°06.8	-63°11.0											
3	169°51.3	256°50.2	· · 25.8	309°49.5	· · 01.4	356°00.1	· · 07.9	277°23.5	· · 47.6	Alioth	171°58.5	-57°11.9											
4	184°53.8	271°49.3	25.8	324°50.7	01.8	11°02.6	08.0	292°25.7	47.6	Spica	166°19.0	55°52.1											
5	199°56.2	286°48.4	25.9	339°51.9	02.2	26°05.2	08.0	307°27.9	47.7	Alkaid	152°57.5	49°13.8											
6	214°58.7	301°47.6	\$22°25.9	354°53.1	\$14°02.6	41°07.8	N04°08.1	322°30.2	S20°47.7	Hadar	148°45.2	-60°26.6											
7	230°01.2	316°46.7	26.0	9°54.4	03.0	56°10.4	08.2	337°32.4	47.7	Menkent	148°05.4	-36°26.7											
8	245°03.6	331°45.8	26.0	24°55.6	03.4	71°13.0	08.2	352°34.6	47.7	Arcturus	145°54.1	19°05.9											
9	260°06.1	346°45.0	· · 26.1	39°56.8	· · 03.8	86°15.6	· · 08.3	7°36.9	· · 47.8	Rigel Kent.	139°49.2	-60°53.7											
10	275°08.6	1°44.1	26.1	54°58.0	04.2	101°18.2	08.4	22°39.1	47.8	Kochab	137°20.5	74°05.2											
11	290°11.0	16°43.2	26.2	69°59.2	04.6	116°20.8	08.4	37°41.3	47.8	Zuben' ubi	137°03.5	-16°06.3											
12	305°13.5	31°42.4	\$22°26.2	85°00.4	\$14°05.0	131°23.4	N04°08.5	52°43.6	S20°47.8	Alphecca	126°09.7	26°39.6											
13	320°16.0	46°41.5	26.3	100°01.6	05.4	146°26.0	08.6	67°45.8	47.8	Antares	112°24.3	-26°27.8											
14	335°18.4	61°40.6	26.3	115°02.8	05.7	161°28.6	08.6	82°48.0	47.9	Atria	107°24.8	-69°02.9											
15	350°20.9	76°39.8	· · 26.4	130°04.1	· · 06.1	176°31.2	· · 08.7	97°50.3	· · 47.9	Sabik	102°10.7	-15°44.5											
16	5°23.4	91°38.9	26.4	145°05.3	06.5	191°33.8	08.8	112°52.5	47.9	Rasalhague	96°05.1	12°33.0											
17	20°25.8	106°38.0	26.5	160°06.5	06.9	206°36.3	08.8	127°54.7	47.9	Eltanin	90°45.8	51°29.2											
18	35°28.3	121°37.2	\$22°26.5	175°07.7	\$14°07.3	221°38.9	N04°08.9	142°57.0	S20°48.0	Kaus Aust.	83°41.8	-34°22.4											
19	50°30.7	136°36.3	26.5	190°08.9	07.7	236°41.5	09.0	157°59.2	48.0	Vega	80°38.1	38°48.0											
20	65°33.2	151°35.4	26.6	205°10.1	08.1	251°44.1	09.0	173°01.4	48.0	Nunki	75°56.5	-26°16.4											
21	80°35.7	166°34.6	· · 26.6	220°11.3	· · 08.5	266°46.7	· · 09.1	188°03.7	· · 48.0	Altair	62°06.8	8°54.8											
22	95°38.1	181°33.7	26.6	235°12.6	08.9	281°49.3	09.2	203°05.9	48.1	Peacock	53°17.1	-56°40.9											
23	110°40.6	196°32.8	26.7	250°13.8	09.3	296°51.9	09.2	218°08.1	48.1	Deneb	49°30.7	45°20.4											
Mer.pass.:15:39				v-0.9 d-0.1 m-3.9				v1.2 d-0.4 m0.9				v2.6 d0.1 m-2.2				v2.2 d-0.0 m0.5							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	125°43.1	211°32.0	\$22°26.7	265°15.0	\$14°09.7	311°54.5	N04°09.3	233°10.4	S20°48.1	Jan 25 Mon	88°28.7	09:52											
1	140°45.5	226°31.1	26.7	280°16.2	10.0	326°57.1	09.4	248°12.6	48.1	Venus	140°32.1	06:22											
2	155°48.0	241°30.2	26.8	295°17.4	10.4	341°59.7	09.5	263°14.8	48.1	Mars	186°05.4	03:20											
3	170°50.5	256°29.4	· · 26.8	310°18.6	· · 10.8	357°02.3	· · 09.5	278°17.1	· · 48.2	Jupiter	107°38.5	08:33											
4	185°52.9	271°28.5	26.8	325°19.8	11.2	12°04.9	09.6	293°19.3	48.2	Saturn	107°32.8	08:30											
5	200°55.4	286°27.6	26.9	340°21.1	11.6	27°07.5	09.7	308°21.5	48.2	Jan 26 Tue	87°08.8	09:53											
6	215°57.9	301°26.8	\$22°26.9	355°22.3	\$14°12.0	42°10.1	N04°09.7	323°23.8	S20°48.2	Venus	140°01.9	06:20											
7	231°00.3	316°25.9	26.9	10°23.5	12.4	57°12.7	09.8	338°26.0	48.														

DUT1 = UT1-UTC = +0.0388 sec ΔT = TT-UT1 = +68.1452 sec

2016 January 25 to Jan. 27 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	ν	Dec	d	HP
0	176°58.9	S19°09.0		346°47.9	11.5'	N13°14.1	-7.1'	56.0'
1	191°58.8	08.4		1°18.5	11.5'	13°06.9	-7.2'	56.0'
2	206°58.6	07.7		15°49.0	11.6'	12°59.7	-7.2'	56.0'
3	221°58.5	.. 07.1		30°19.7	11.7'	12°52.5	-7.3'	56.0'
4	236°58.3	06.5		44°50.3	11.7'	12°45.2	-7.3'	56.0'
5	251°58.2	05.9		59°21.1	11.8'	12°37.9	-7.4'	55.9'
6	266°58.0	S19°05.3		73°51.9	11.8'	N12°30.4	-7.4'	55.9'
7	281°57.9	04.7		88°22.8	11.9'	12°23.0	-7.5'	55.9'
8	296°57.7	04.1		102°53.7	11.9'	12°15.5	-7.5'	55.9'
9	311°57.6	.. 03.5		117°24.6	12.0'	12°07.9	-7.6'	55.8'
10	326°57.4	02.9		131°55.7	12.1'	12°00.3	-7.7'	55.8'
11	341°57.3	02.3		146°26.8	12.1'	11°52.6	-7.7'	55.8'
12	356°57.2	S19°01.7		160°57.9	12.2'	N11°44.9	-7.8'	55.8'
13	11°57.0	01.0		175°29.1	12.2'	11°37.1	-7.8'	55.8'
14	26°56.9	19°00.4		190°00.4	12.3'	11°29.2	-7.9'	55.7'
15	41°56.7	18°59.8		204°31.7	12.3'	11°21.4	-7.9'	55.7'
16	56°56.6	59.2		219°03.0	12.4'	11°13.4	-7.9'	55.7'
17	71°56.4	58.6		233°34.4	12.4'	11°05.5	-8.0'	55.7'
18	86°56.3	S18°58.0		248°05.9	12.5'	N10°57.5	-8.0'	55.6'
19	101°56.1	57.4		262°37.4	12.6'	10°49.4	-8.1'	55.6'
20	116°56.0	56.7		277°09.0	12.6'	10°41.3	-8.1'	55.6'
21	131°55.9	.. 56.1		291°40.7	12.7'	10°33.2	-8.2'	55.6'
22	146°55.7	55.5		306°12.3	12.7'	10°25.0	-8.2'	55.6'
23	161°55.6	54.9		320°44.1	12.8'	10°16.7	-8.3'	55.5'
	SD.=16.2	d=0.6				S.D.=15.2		
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	176°55.4	S18°54.3		335°15.9	12.8'	N10°08.5	-8.3'	55.5'
1	191°55.3	53.6		349°47.7	12.9'	10°00.1	-8.3'	55.5'
2	206°55.2	53.0		4°19.6	12.9'	09°51.8	-8.4'	55.5'
3	221°55.0	.. 52.4		18°51.6	13.0'	09°43.4	-8.4'	55.5'
4	236°54.9	51.8		33°23.6	13.0'	09°35.0	-8.4'	55.4'
5	251°54.7	51.2		47°55.6	13.1'	09°26.5	-8.5'	55.4'
6	266°54.6	S18°50.5		62°27.7	13.1'	N09°18.0	-8.5'	55.4'
7	281°54.5	49.9		76°59.8	13.2'	09°09.5	-8.6'	55.4'
8	296°54.3	49.3		91°32.0	13.2'	09°00.9	-8.6'	55.3'
9	311°54.2	.. 48.7		106°04.3	13.3'	08°52.3	-8.6'	55.3'
10	326°54.1	48.0		120°36.6	13.3'	08°43.7	-8.7'	55.3'
11	341°53.9	47.4		135°08.9	13.4'	08°35.0	-8.7'	55.3'
12	356°53.8	S18°46.8		149°41.3	13.4'	N08°26.3	-8.7'	55.3'
13	11°53.6	46.2		164°13.7	13.5'	08°17.5	-8.7'	55.2'
14	26°53.5	45.5		178°46.2	13.5'	08°08.8	-8.8'	55.2'
15	41°53.4	.. 44.9		193°18.7	13.5'	08°00.0	-8.8'	55.2'
16	56°53.2	44.3		207°51.3	13.6'	07°51.2	-8.8'	55.2'
17	71°53.1	43.6		222°23.9	13.6'	07°42.3	-8.9'	55.2'
18	86°53.0	S18°43.0		236°56.6	13.7'	N07°33.4	-8.9'	55.1'
19	101°52.8	42.4		251°29.3	13.7'	07°24.5	-8.9'	55.1'
20	116°52.7	41.8		266°02.0	13.8'	07°15.6	-8.9'	55.1'
21	131°52.6	.. 41.1		280°34.8	13.8'	07°06.7	-9.0'	55.1'
22	146°52.4	40.5		295°07.6	13.9'	06°57.7	-9.0'	55.1'
23	161°52.3	39.9		309°40.5	13.9'	06°48.7	-9.0'	55.1'
	SD.=16.2	d=0.6				S.D.=15.1		
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	176°52.2	S18°39.2		324°13.4	13.9'	N06°39.7	-9.0'	55.0'
1	191°52.0	38.6		338°46.4	14.0'	06°30.6	-9.1'	55.0'
2	206°51.9	38.0		353°19.4	14.0'	06°21.5	-9.1'	55.0'
3	221°51.8	.. 37.3		7°52.4	14.1'	06°12.5	-9.1'	55.0'
4	236°51.6	36.7		22°25.5	14.1'	06°03.4	-9.1'	55.0'
5	251°51.5	36.0		36°58.6	14.1'	05°54.2	-9.1'	54.9'
6	266°51.4	S18°35.4		51°31.7	14.2'	N05°45.1	-9.2'	54.9'
7	281°51.2	34.8		66°04.9	14.2'	05°35.9	-9.2'	54.9'
8	296°51.1	34.1		80°38.1	14.2'	05°26.7	-9.2'	54.9'
9	311°51.0	.. 33.5		95°11.4	14.3'	05°17.5	-9.2'	54.9'
10	326°50.9	32.9		109°44.7	14.3'	05°08.3	-9.2'	54.9'
11	341°50.7	32.2		124°18.0	14.3'	04°59.1	-9.2'	54.8'
12	356°50.6	S18°31.6		138°51.4	14.4'	N04°49.9	-9.3'	54.8'
13	11°50.5	30.9		153°24.8	14.4'	04°40.6	-9.3'	54.8'
14	26°50.3	30.3		167°58.2	14.4'	04°31.3	-9.3'	54.8'
15	41°50.2	.. 29.6		182°31.6	14.5'	04°22.0	-9.3'	54.8'
16	56°50.1	29.0		197°05.1	14.5'	04°12.7	-9.3'	54.8'
17	71°50.0	28.4		211°38.7	14.5'	04°03.4	-9.3'	54.7'
18	86°49.8	S18°27.7		226°12.2	14.6'	N03°54.1	-9.3'	54.7'
19	101°49.7	27.1		240°45.8	14.6'	03°44.8	-9.3'	54.7'
20	116°49.6	26.4		255°19.4	14.6'	03°35.5	-9.3'	54.7'
21	131°49.5	.. 25.8		269°53.0	14.7'	03°26.1	-9.3'	54.7'
22	146°49.3	25.1		284°26.7	14.7'	03°16.8	-9.4'	54.7'
23	161°49.2	24.5		299°00.4	14.7'	03°07.4	-9.4'	54.6'
	SD.=16.2	d=0.6				S.D.=14.9		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	07:32	09:07	11:54	12:32	15:19	16:55
N 70°	07:21	08:44	10:24	14:02	15:42	17:05
68°	07:12	08:26	09:46	14:40	16:00	17:14
66°	07:05	08:11	09:19	15:07	16:15	17:21
64°	06:58	07:59	08:59	15:27	16:27	17:28
62°	06:52	07:48	08:42	15:43	16:37	17:33
60°	06:47	07:39	08:28	15:57	16:46	17:38
N 58°	06:43	07:31	08:17	16:09	16:54	17:43
56°	06:38	07:24	08:07	16:19	17:01	17:47
54°	06:34	07:18	07:58	16:28	17:08	17:51
52°	06:31	07:12	07:50	16:36	17:13	17:55
50°	06:27	07:07	07:42	16:43	17:19	17:58
48°	06:19	06:55	07:27	16:58	17:30	18:06
N 40°	06:12	06:45	07:14	17:11	17:40	18:13
35°	06:06	06:36	07:03	17:22	17:49	18:20
30°	05:59	06:28	06:54	17:31	17:57	18:26
20°	05:47	06:14	06:37	17:48	18:11	18:38
N 10°	05:35	06:00	06:23	18:02	18:24	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°	04:48	05:16	05:40	18:45	19:08	19:36
30°	04:25	04:57	05:23	19:02	19:28	19:59
35°	04:10	04:45	05:13	19:12	19:40	20:14
40°	03:52	04:30	05:01	19:23	19:54	20:32
45°	03:29	04:13	04:47	19:37	20:11	20:54
S 50°	02:58	03:51	04:30	19:54	20:33	21:25
52°	02:42	03:40	04:22	20:02	20:43	21:41
54°	02:22	03:28	04:13	20:10	20:56	22:00
56°	01:56	03:13	04:03	20:20	21:10	22:26
58°	01:15	02:56	03:52	20:32	21:27	23:03
S 60°	02:35	03:38	04:45	20:45	21:47	
Day	Sun		Mer.	Moon		Age
	Eqn.of Time 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss		Pass Upper hh:mm	Pass Lower hh:mm	
25	12:04	12:11	12:12	00:55	13:19	
26	12:18	12:25	12:12	01:42	14:05	
27	12:31	12:38	12:13	02:28	14:50	

**January 28, 29, 30 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	126°42.2	211°11.2	\$22°27.2	265°44.2	S14°19.0	312°56.9	N04°11.0	234°04.0	S20°48.6	Alpheratz	357°41.8	29°10.8					
1	141°44.7	226°10.3	27.2	280°45.4	19.3	327°59.5	11.1	249°06.2	48.7	Ankaa	353°14.2	-42°13.4					
2	156°47.1	241°09.4	27.2	295°46.6	19.7	343°02.1	11.1	264°08.5	48.7	Schedar	349°38.6	56°37.7					
3	171°49.6	256°08.6	.. 27.2	310°47.8	.. 20.1	358°04.7	.. 11.2	279°10.7	.. 48.7	Diphda	348°54.3	-17°54.1					
4	186°52.1	271°07.7	27.2	325°49.1	20.5	13°07.3	11.3	294°13.0	48.7	Achernar	335°25.7	-57°09.7					
5	201°54.5	286°06.8	27.2	340°50.3	20.9	28°09.9	11.3	309°15.2	48.8	Hamal	327°58.7	23°32.2					
6	216°57.0	301°06.0	\$22°27.2	355°51.5	S14°21.3	43°12.5	N04°11.4	324°17.4	S20°48.8	Polaris	316°52.0	89°20.2					
7	231°59.5	316°05.1	27.2	10°52.7	21.7	58°15.1	11.5	339°19.7	48.8	Acamar	315°17.0	-40°14.8					
8	247°01.9	331°04.2	27.2	25°53.9	22.0	73°17.7	11.6	354°21.9	48.8	Menkar	314°13.1	4°08.9					
9	262°04.4	346°03.3	.. 27.1	40°55.2	.. 22.4	88°20.3	.. 11.6	9°24.1	.. 48.8	Mirfak	308°37.6	49°55.1					
10	277°06.8	1°02.5	27.1	55°56.4	22.8	103°22.9	11.7	24°26.4	48.9	Aldebaran	290°47.1	16°32.3					
11	292°09.3	16°01.6	27.1	70°57.6	23.2	118°25.5	11.8	39°28.6	48.9	Rigel	281°10.1	-8°11.3					
12	307°11.8	31°00.7	\$22°27.1	85°58.8	S14°23.6	133°28.2	N04°11.9	54°30.9	S20°48.9	Capella	280°31.5	46°00.7					
13	322°14.2	45°59.9	27.1	101°00.0	24.0	148°30.8	11.9	69°33.1	48.9	Bellatrix	278°29.9	6°21.6					
14	337°16.7	60°59.0	27.1	116°01.3	24.3	163°33.4	12.0	84°35.3	49.0	Elnath	278°10.1	28°37.1					
15	352°19.2	75°58.1	.. 27.1	131°02.5	.. 24.7	178°36.0	.. 12.1	99°37.6	.. 49.0	Alnilam	275°44.3	-1°11.8					
16	7°21.6	90°57.3	27.1	146°03.7	25.1	193°38.6	12.1	114°39.8	49.0	Betelgeuse	270°59.1	7°24.3					
17	22°24.1	105°56.4	27.1	161°04.9	25.5	208°41.2	12.2	129°42.1	49.0	Canopus	263°54.9	-52°42.6					
18	37°26.6	120°55.5	\$22°27.0	176°06.2	S14°25.9	223°43.8	N04°12.3	144°44.3	S20°49.0	Sirius	258°31.8	-16°44.6					
19	52°29.0	135°54.7	27.0	191°07.4	26.2	238°46.4	12.4	159°46.5	49.1	Adhara	255°10.8	-29°00.0					
20	67°31.5	150°53.8	27.0	206°08.6	26.6	253°49.0	12.4	174°48.8	49.1	Procyon	244°57.5	5°10.7					
21	82°33.9	165°52.9	.. 27.0	221°09.8	.. 27.0	268°51.6	.. 12.5	189°51.0	.. 49.1	Pollux	243°25.2	27°59.0					
22	97°36.4	180°52.1	27.0	236°11.0	27.4	283°54.2	12.6	204°53.3	49.1	Avior	234°16.5	-59°33.9					
23	112°38.9	195°51.2	27.0	251°12.3	27.8	298°56.8	12.7	219°55.6	49.1	Suhail	222°50.6	-43°30.0					
Mer.pass.:15:31			v-0.9 d-0.0 m-3.9	v1.2 d-0.4 m0.9	v2.6 d0.1 m-2.2	v2.2 d-0.0 m0.5	Merplacidus			Zuben' ubi	221°38.2	-69°47.1					
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.0	-8°43.9					
0	127°41.3	210°50.3	\$22°26.9	266°13.5	S14°28.2	313°59.5	N04°12.7	234°57.7	S20°49.2	Regulus	207°41.3	11°53.1					
1	142°43.8	225°49.4	26.9	281°14.7	28.5	329°02.1	12.8	250°00.0	49.2	Dubhe	193°49.1	61°39.6					
2	157°46.3	240°48.6	26.9	296°15.9	28.9	344°04.7	12.9	265°02.2	49.2	Denebola	182°31.7	14°28.8					
3	172°48.7	255°47.7	.. 26.9	311°17.2	.. 29.3	359°07.3	.. 13.0	280°04.5	.. 49.2	Gienah	175°50.2	-17°37.8					
4	187°51.2	270°46.8	26.8	326°18.4	29.7	14°09.9	13.0	295°06.7	49.3	Gacrux	173°06.8	-63°11.0					
5	202°53.7	285°46.0	26.8	341°19.6	30.1	29°12.5	13.1	310°08.9	49.3	Alioth	171°58.5	-57°12.0					
6	217°56.1	300°45.1	\$22°26.8	356°20.8	S14°30.4	44°15.1	N04°13.2	325°11.2	S20°49.3	Alkaid	166°19.0	55°52.1					
7	232°58.6	315°44.2	26.7	11°22.0	30.8	59°17.7	13.3	340°13.4	49.3	Hadar	152°57.5	11°14.6					
8	248°01.1	330°43.4	26.7	26°23.3	31.2	74°20.3	13.3	355°15.7	49.3	Menkent	148°05.4	-60°26.7					
9	263°03.5	345°42.5	.. 26.7	41°24.5	.. 31.6	89°23.0	.. 13.4	10°17.9	.. 49.4	Arcturus	145°54.1	-36°26.7					
10	278°06.0	0°41.6	26.6	56°25.7	32.0	104°25.6	13.5	25°20.1	49.4	Rigel Kent.	139°49.2	19°05.9					
11	293°08.4	15°40.8	26.6	71°26.9	32.3	119°28.2	13.6	40°22.4	49.4	Kochab	137°20.4	74°05.1					
12	308°10.9	30°39.9	\$22°26.6	86°28.2	S14°32.7	134°30.8	N04°13.6	55°24.6	S20°49.4	Zuben' ubi	137°03.5	-16°06.3					
13	323°13.4	45°39.0	26.5	101°29.4	33.1	149°33.4	13.7	70°26.9	49.5	Alphecca	126°09.6	26°39.6					
14	338°15.8	60°38.1	26.5	116°30.6	33.5	164°36.0	13.8	85°29.1	49.5	Antares	112°24.2	-26°27.8					
15	353°18.3	75°37.3	.. 26.4	131°31.8	.. 33.9	179°38.6	.. 13.9	100°31.4	.. 49.5	Atria	107°24.7	-69°02.9					
16	8°20.8	90°36.4	26.4	146°33.1	34.2	194°41.2	13.9	115°33.6	49.5	Sabik	102°10.7	-15°44.5					
17	23°23.2	105°35.5	26.4	161°34.3	34.6	209°43.9	14.0	130°35.8	49.5	Rasalhague	96°05.0	12°33.0					
18	38°25.7	120°34.7	\$22°26.3	176°35.5	S14°35.0	224°46.5	N04°14.1	145°38.1	S20°49.6	Eltanin	90°45.7	51°29.2					
19	53°28.2	135°33.8	26.3	191°36.7	35.4	239°49.1	14.2	160°40.3	49.6	Kaus Aust.	83°41.8	-34°22.4					
20	68°30.6	150°32.9	26.2	206°38.0	35.7	254°51.7	14.2	175°42.6	49.6	Vega	80°38.1	38°48.0					
21	83°33.1	165°32.1	.. 26.2	221°39.2	.. 36.1	269°54.3	.. 14.3	190°44.8	.. 49.6	Nunki	75°56.5	-26°16.4					
22	98°35.6	180°31.2	26.1	236°40.4	36.5	284°56.9	14.4	205°47.0	49.6	Altair	62°06.8	8°54.7					
23	113°38.0	195°30.3	26.1	251°41.7	36.9	299°59.5	14.5	220°49.3	49.7	Peacock	53°17.1	-56°40.9					
Mer.pass.:15:27			v-0.9 d0.0 m-3.9	v1.2 d-0.4 m0.9	v2.6 d0.1 m-2.2	v2.2 d-0.0 m0.5	Deneb			Deneb	182°31.7	14°28.8					
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Gienah	175°50.2	-17°37.8					
0	128°40.5	210°29.5	\$22°26.0	266°42.9	S14°37.3	315°02.2	N04°14.5	235°51.5	S20°49.7	Acrux	173°06.8	-63°11.0					
1	143°42.9	225°28.6	26.0	281°44.1	37.6	330°04.8	14.6	250°53.8	49.7	Gacrux	171°58.5	-57°12.0					
2	158°45.4	240°27.7	25.9	296°45.3	38.0	345°07.4	14.7	265°56.0	49.7	Alioth	166°19.0	55°52.1					
3	173°47.9	255°26.8	.. 25.9	311°46.6	.. 38.4	0°10.0	.. 14.8	280°58.3	.. 49.7	Alkaid	152°57.5	11°14.6					
4	188°50.3	270°26.0	25.8	326°47.8	38.8	15°12.6	14.8	296°00.5	49.8	Hadar	148°45.1	-60°26.7					
5	203°52.8	285°25.1	25.8	341°49.0	39.1	30°15.3	14.9	311°02.8	49.8	Menkent	148°05.4	-36°26.7					
6	218°55.3	300°24.2	\$22°25.7	356°50.2	S14°39.5	45°17.9	N04°15.0	326°05.0	S20°49.8	Arcturus	145°54.1	19°05.9					
7	233°57.7	315°23.4	25.6	11°51.5	39.9	60°20.5	15.1	341°07.2	49.8	Rigel Kent.	139°49.2	-60°53.7					
8	249°00.2	330°22.5	25.6	26°52.7	40.3	75°23.1	15.2	356°09.5	49.9	Kochab	137°20.4	74°05.1					
9	264°02.7	345°21.6	.. 25.5	41°53.9	.. 40.6	90°25.7	.. 15.2	11°11.7	.. 49.9	Zuben' ubi	137°03.5	-16°06.3					
10	279°05.1	0°20.8	25.5	56°55.2	41.0	105°28.3	15.3	26°14.0	49.9	Alphecca	126°09.6	26°39.6					
11	294°07.6	15°19.9	25.4	71°56.4	41.4	120°31.0	15.4	41°16.2	49.9	Regulus	112°24.2	-26°27.8					
12	309°10.0	30°19.0	\$22°25.3	86°57.6	S14°41.8	135°33.6	N04°15.5	56°18.5	S20°49.9	Dubhe	102°10.7	14°28.8					
13	324°12.5	45°18.1	25.3	101°58.8	42.1	150°36.2	15.5	71°20.7	50.0	Gienah	96°05.0	12°33.0					
14	339°15.0	60°17.3	25.2	117°00.1	42.5	165°38.8	15.6	86°22.9	50.0	Acrux	83°09.0	09:57					
15	354°17.4	75°16.4	.. 25.1	132°01.3	.. 42.9	180°41.4	.. 15.7	101°25.2	.. 50.0	Gacrux	83°02.0	06:17					
16	9°19.9	90°15.5	25.1	147°02.5	43.3	195°44.1	15.8	116°27.4	50.0	Alioth	186°14.7	03:08					
17	24°22.4	105°14.7	25.0	162°03.8	43.6	210°46.7	15.9	131°29.7	50.0	Alkaid	107°21.8	08:22					
18	39°24.8	120°13.8	\$22°24.9	177°05.0	S14°44.0	225°49.3	N04°15.9	146°31.9	S20°50.1	Jan 28 Thu	15°22.4	-29°32.3					
19	54°27.3	135°12.9	24.9	192°06.2	44.4	240°51.9	16.0	161°34.2	50								

DUT1 = UT1-UTC = +0.0334 sec ΔT = TT-UT1 = +68.1506 sec

2016 January 28 to Jan. 30 UT

h		Sun		Moon				Lat.		Twilight		Sunrise		Sunset		Twilight	
Thu		GHA	Dec	GHA	ν	Dec	d	HP	Naut.	Civil			Civil	Naut.	Civil	Naut.	
0	176°49.1	S18°23.8		313°34.1	14.7'	N02°58.0	-9.4'	54.6'	N 72°	07:22	08:54	11:01	13:26	15:33	17:06		
1	191°49.0	23.2		328°07.9	14.8'	02°48.7	-9.4'	54.6'	N 70°	07:12	08:33	10:05	14:22	15:54	17:15		
2	206°48.8	22.5		342°41.6	14.8'	02°39.3	-9.4'	54.6'	68°	07:05	08:16	09:33	14:55	16:11	17:23		
3	221°48.7	.. 21.9		357°15.4	14.8'	02°29.9	-9.4'	54.6'	66°	06:58	08:03	09:09	15:18	16:24	17:29		
4	236°48.6	21.2		11°49.3	14.8'	02°20.5	-9.4'	54.6'	64°	06:52	07:52	08:50	15:37	16:35	17:35		
5	251°48.5	20.6		26°23.1	14.9'	02°11.1	-9.4'	54.6'	62°	06:47	07:42	08:35	15:52	16:45	17:40		
6	266°48.3	S18°19.9		40°57.0	14.9'	N02°01.7	-9.4'	54.6'	60°	06:42	07:34	08:22	16:05	16:53	17:45		
7	281°48.2	19.3		55°30.9	14.9'	01°52.3	-9.4'	54.5'	N 58°	06:38	07:26	08:11	16:16	17:01	17:49		
8	296°48.1	18.6		70°04.8	14.9'	01°42.9	-9.4'	54.5'	56°	06:34	07:20	08:01	16:25	17:07	17:53		
9	311°48.0	.. 18.0		84°38.7	14.9'	01°33.5	-9.4'	54.5'	54°	06:31	07:14	07:53	16:34	17:13	17:56		
10	326°47.9	17.3		99°12.6	15.0'	01°24.1	-9.4'	54.5'	52°	06:27	07:08	07:45	16:41	17:18	17:59		
11	341°47.7	16.7		113°46.6	15.0'	01°14.7	-9.4'	54.5'	50°	06:24	07:03	07:38	16:48	17:23	18:03		
12	356°47.6	S18°16.0		128°20.6	15.0'	N01°05.3	-9.4'	54.5'	45°	06:17	06:52	07:24	17:03	17:34	18:10		
13	11°47.5	15.4		142°54.6	15.0'	00°55.9	-9.4'	54.5'	N 40°	06:10	06:43	07:12	17:15	17:44	18:16		
14	26°47.4	14.7		157°28.6	15.0'	00°46.5	-9.4'	54.5'	35°	06:04	06:35	07:01	17:25	17:52	18:22		
15	41°47.3	.. 14.1		172°02.7	15.0'	00°37.1	-9.4'	54.4'	30°	05:58	06:27	06:52	17:34	17:59	18:28		
16	56°47.1	13.4		186°36.7	15.1'	00°27.7	-9.4'	54.4'	20°	05:47	06:13	06:36	17:50	18:13	18:39		
17	71°47.0	12.7		201°10.8	15.1'	00°18.3	-9.4'	54.4'	N 10°	05:35	06:01	06:23	18:04	18:26	18:51		
18	86°46.9	S18°12.1		215°44.9	15.1'	N00°08.9	-9.4'	54.4'	0°	05:22	05:48	06:09	18:17	18:38	19:04		
19	101°46.8	11.4		230°19.0	15.1'	S00°00.5	-9.4'	54.4'	S 10°	05:08	05:34	05:56	18:30	18:52	19:18		
20	116°46.7	10.8		244°53.1	15.1'	00°09.9	-9.4'	54.4'	20°	04:51	05:18	05:42	18:44	19:07	19:35		
21	131°46.5	.. 10.1		259°27.2	15.1'	00°19.3	-9.4'	54.4'	30°	04:28	04:59	05:25	19:00	19:26	19:57		
22	146°46.4	09.4		274°01.3	15.1'	00°28.6	-9.4'	54.4'	35°	04:14	04:48	05:16	19:10	19:38	20:11		
23	161°46.3	08.8		288°35.5	15.2'	00°38.0	-9.4'	54.4'	40°	03:57	04:34	05:05	19:21	19:51	20:28		
	SD.=16.2	d=0.6				S.D.=14.8			45°	03:35	04:18	04:51	19:34	20:07	20:50		
Fri		GHA	Dec	GHA	ν	Dec	d	HP	S 50°	03:05	03:57	04:35	19:50	20:28	21:19		
0	176°46.2	S18°08.1		303°09.6	15.2'	S00°47.4	-9.4'	54.4'	52°	02:50	03:46	04:28	19:57	20:38	21:34		
1	191°46.1	07.5		317°43.8	15.2'	00°56.7	-9.3'	54.3'	54°	02:32	03:35	04:19	20:05	20:50	21:52		
2	206°46.0	06.8		332°18.0	15.2'	01°06.1	-9.3'	54.3'	56°	02:08	03:21	04:10	20:15	21:03	22:15		
3	221°45.8	.. 06.1		346°52.2	15.2'	01°15.4	-9.3'	54.3'	58°	01:35	03:05	03:59	20:25	21:19	22:46		
4	236°45.7	05.5		1°26.3	15.2'	01°24.7	-9.3'	54.3'	S 60°		02:46	03:46	20:38	21:38			
5	251°45.6	04.8		16°00.5	15.2'	01°34.1	-9.3'	54.3'									
6	266°45.5	S18°04.1		30°34.7	15.2'	S01°43.4	-9.3'	54.3'									
7	281°45.4	03.5		45°09.0	15.2'	01°52.7	-9.3'	54.3'									
8	296°45.3	02.8		59°43.2	15.2'	02°01.9	-9.3'	54.3'									
9	311°45.2	.. 02.1		74°17.4	15.2'	02°11.2	-9.3'	54.3'									
10	326°45.1	01.5		88°51.6	15.2'	02°20.5	-9.3'	54.3'									
11	341°44.9	00.8		103°25.8	15.2'	02°29.7	-9.2'	54.3'									
12	356°44.8	S18°00.1		118°00.1	15.2'	S02°39.0	-9.2'	54.3'									
13	11°44.7	17°59.5		132°34.3	15.2'	02°48.2	-9.2'	54.3'									
14	26°44.6	58.8		147°08.5	15.2'	02°57.4	-9.2'	54.3'									
15	41°44.5	.. 58.1		161°42.7	15.2'	03°06.6	-9.2'	54.2'									
16	56°44.4	57.5		176°17.0	15.2'	03°15.8	-9.2'	54.2'									
17	71°44.3	56.8		190°51.2	15.2'	03°25.0	-9.2'	54.2'									
18	86°44.2	S17°56.1		205°25.4	15.2'	S03°34.1	-9.1'	54.2'									
19	101°44.1	55.5		219°59.6	15.2'	03°43.2	-9.1'	54.2'									
20	116°43.9	54.8		234°33.9	15.2'	03°52.4	-9.1'	54.2'									
21	131°43.8	.. 54.1		249°08.1	15.2'	04°01.4	-9.1'	54.2'									
22	146°43.7	53.4		263°42.3	15.2'	04°10.5	-9.1'	54.2'									
23	161°43.6	52.8		278°16.5	15.2'	04°19.6	-9.1'	54.2'									
	SD.=16.2	d=0.7				S.D.=14.8											
Sat		GHA	Dec	GHA	ν	Dec	d	HP									
0	176°43.5	S17°52.1		292°50.7	15.2'	S04°28.6	-9.0'	54.2'									
1	191°43.4	51.4		307°24.9	15.2'	04°37.6	-9.0'	54.2'									
2	206°43.3	50.7		321°59.0	15.2'	04°46.7	-9.0'	54.2'									
3	221°43.2	.. 50.1		336°33.2	15.2'	04°55.6	-9.0'	54.2'									
4	236°43.1	49.4		351°07.4	15.2'	05°04.6	-8.9'	54.2'									
5	251°43.0	48.7		5°41.5	15.1'	05°13.5	-8.9'	54.2'									
6	266°42.9	S17°48.0		20°15.7	15.1'	S05°22.4	-8.9'	54.2'									
7	281°42.8	47.3		34°49.8	15.1'	05°31.3	-8.9'	54.2'									
8	296°42.7	46.7		49°23.9	15.1'	05°40.2	-8.9'	54.2'									
9	311°42.6	.. 46.0		63°58.0	15.1'	05°49.1	-8.8'	54.2'									
10	326°42.5	45.3		78°32.1	15.1'	05°57.9	-8.8'	54.2'									
11	341°42.3	44.6		93°06.2	15.1'	06°06.7	-8.8'	54.2'									
12	356°42.2	S17°43.9		107°40.3	15.1'	S06°15.4	-8.8'	54.2'									
13	11°42.1	43.3		122°14.3	15.0'	06°24.2	-8.7'	54.2'									
14	26°42.0	42.6		136°48.4	15.0'	06°32.9	-8.7'	54.2'									
15	41°41.9	.. 41.9		151°22.4	15.0'	06°41.6	-8.7'	54.2'									
16	56°41.8	41.2		165°56.4	15.0'	06°50.3	-8.7'	54.2'									
17	71°41.7	40.5		180°30.4	15.0'	06°58.9	-8.6'	54.2'									
18	86°41.6	S17°39.8		195°04.3	15.0'	S07°07.5	-8.6'	54.2'									
19	101°41.5	39.2		209°38.3	14.9'	07°16.1	-8.6'	54.2'									
20	116°41.4	38.5		224°12.2	14.9'	07°24.6	-8.5'	54.2'									
21	131°41.3	.. 37.8		238°46.1	14.9'	07°33.2	-8.5'	54.2'									
22	146°41.2	37.1		253°20.0	14.9'	07°41.7	-8.5'	54.2'									
23	161°41.1	36.4		267°53.8	14.9'	07°50.1	-8.4'	54.2'									
	SD.=16.2	d=0.7				S.D.=14.8											

Day	Sun		Moon	
Eqn.of Time				

**January 31, 01, 02 UT (Sun., Mon., Tue.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	129°39.6	210°08.6	\$22°24.5	267°12.4	\$14°46.3	316°05.0	N04°16.4	236°45.4	\$20°50.2	Alpheratz	357°41.8	29°10.8					
1	144°42.1	225°07.7	24.4	282°13.6	46.6	331°07.7	16.5	251°47.6	50.2	Ankaa	353°14.2	-42°13.4					
2	159°44.5	240°06.8	24.3	297°14.8	47.0	346°10.3	16.6	266°49.9	50.2	Schedar	349°38.6	56°37.7					
3	174°47.0	255°06.0	.. 24.2	312°16.1	.. 47.4	1°12.9	.. 16.6	281°52.1	.. 50.3	Diphda	348°54.3	-17°54.1					
4	189°49.5	270°05.1	24.1	327°17.3	47.7	16°15.5	16.7	296°54.4	50.3	Achernar	335°25.7	-57°09.7					
5	204°51.9	285°04.2	24.1	342°18.5	48.1	31°18.2	16.8	311°56.6	50.3	Hamal	327°58.7	23°32.2					
6	219°54.4	300°03.4	\$22°24.0	357°19.8	\$14°48.5	46°20.8	N04°16.9	326°58.9	\$20°50.3	Polaris	316°53.4	89°20.2					
7	234°56.9	315°02.5	23.9	12°21.0	48.9	61°23.4	17.0	342°01.1	50.3	Acamar	315°17.0	-40°14.8					
8	249°59.3	330°01.6	23.8	27°22.2	49.2	76°26.0	17.0	357°03.4	50.4	Menkar	314°13.1	4°08.9					
9	265°01.8	345°00.8	.. 23.7	42°23.5	.. 49.6	91°28.7	.. 17.1	12°05.6	.. 50.4	Mirfak	308°37.6	49°55.1					
10	280°04.3	359°59.9	23.6	57°24.7	50.0	106°31.3	17.2	27°07.9	50.4	Aldebaran	290°47.1	16°32.3					
11	295°06.7	14°59.0	23.5	72°25.9	50.3	121°33.9	17.3	42°10.1	50.4	Rigel	281°10.1	-8°11.3					
12	310°09.2	29°58.1	\$22°23.4	87°27.2	\$14°50.7	136°36.5	N04°17.4	57°12.4	\$20°50.4	Capella	280°31.5	46°00.7					
13	325°11.6	44°57.3	23.3	102°28.4	51.1	151°39.2	17.5	72°14.6	50.5	Bellatrix	278°29.9	6°21.6					
14	340°14.1	59°56.4	23.3	117°29.6	51.4	166°41.8	17.5	87°16.9	50.5	Elnath	278°10.1	28°37.1					
15	355°16.6	74°55.5	.. 23.2	132°30.9	.. 51.8	181°44.4	.. 17.6	102°19.1	.. 50.5	Alnilam	275°44.3	-1°11.8					
16	10°19.0	89°54.7	23.1	147°32.1	52.2	196°47.0	17.7	117°21.4	50.5	Betelgeuse	270°59.1	7°24.3					
17	25°21.5	104°53.8	23.0	162°33.3	52.6	211°49.7	17.8	132°23.6	50.5	Canopus	263°54.9	-52°42.7					
18	40°24.0	119°52.9	\$22°22.9	177°34.6	\$14°52.9	226°52.3	N04°17.9	147°25.9	\$20°50.6	Sirius	258°31.8	-16°44.6					
19	55°26.4	134°52.1	22.8	192°35.8	53.3	241°54.9	17.9	162°28.1	50.6	Adhara	255°10.8	-29°00.0					
20	70°28.9	149°51.2	22.7	207°37.0	53.7	256°57.6	18.0	177°30.3	50.6	Procyon	244°57.5	5°10.7					
21	85°31.4	164°50.3	.. 22.6	222°38.3	.. 54.0	272°00.2	.. 18.1	192°32.6	.. 50.6	Pollux	243°25.2	27°59.0					
22	100°33.8	179°49.5	22.5	237°39.5	54.4	287°02.8	18.2	207°34.8	50.6	Avior	234°16.6	-59°33.9					
23	115°36.3	194°48.6	22.3	252°40.7	54.8	302°05.4	18.3	222°37.1	50.7	Suhail	222°50.6	-43°30.0					
Mer.pass.:15:19			v-0.9 d0.1 m-3.9	v1.2 d-0.4 m0.9			v2.6 d0.1 m-2.2			v2.2 d-0.0 m0.5			Miaplacidus				
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	130°38.8	209°47.7	\$22°22.2	267°42.0	\$14°55.1	317°08.1	N04°18.3	237°39.3	\$20°50.7	Denebola	182°31.6	14°28.8					
1	145°41.2	224°46.9	22.1	282°43.2	55.5	332°10.7	18.4	252°41.6	50.7	Gienah	175°50.2	-17°37.9					
2	160°43.7	239°46.0	22.0	297°44.5	55.9	347°13.3	18.5	267°43.8	50.7	Gacrux	173°06.7	-63°11.1					
3	175°46.1	254°45.1	.. 21.9	312°45.7	.. 56.2	2°16.0	.. 18.6	282°46.1	.. 50.7	Alioth	171°58.4	-57°12.0					
4	190°48.6	269°44.2	21.8	327°46.9	56.6	17°18.6	18.7	297°48.3	50.8	Spica	166°19.0	55°52.1					
5	205°51.1	284°43.4	21.7	342°48.2	57.0	32°21.2	18.8	312°50.6	50.8	Alkaid	158°29.2	-11°14.7					
6	220°53.5	299°42.5	\$22°21.6	357°49.4	\$14°57.3	47°23.9	N04°18.8	327°52.8	\$20°50.8	Hadar	152°57.5	49°13.8					
7	235°56.0	314°41.6	21.5	12°50.6	57.7	62°26.5	18.9	342°55.1	50.8	Menken	148°05.3	-36°26.7					
8	250°58.5	329°40.8	21.3	27°51.9	58.1	77°29.1	19.0	357°57.3	50.8	Arcturus	145°54.1	19°05.8					
9	266°00.9	344°39.9	.. 21.2	42°53.1	.. 58.4	92°31.7	.. 19.1	12°59.6	.. 50.9	Rigel Kent.	139°49.1	-60°53.7					
10	281°03.4	359°39.0	21.1	57°54.4	58.8	107°34.4	19.2	28°01.8	50.9	Kochab	137°20.4	74°05.1					
11	296°05.9	14°38.2	21.0	72°55.6	59.2	122°37.0	19.3	43°04.1	50.9	Zuben' ubi	137°03.4	-16°06.4					
12	311°08.3	29°37.3	\$22°20.9	87°56.8	\$14°59.5	137°39.6	N04°19.3	58°06.3	\$20°50.9	Alphecca	126°09.6	26°39.6					
13	326°10.8	44°36.4	20.8	102°58.1	14°59.9	152°42.3	19.4	73°08.6	50.9	Antares	112°24.2	-26°27.8					
14	341°13.3	59°35.6	20.6	117°59.3	15°00.3	167°44.9	19.5	88°10.8	51.0	Atria	107°24.7	-69°02.9					
15	356°15.7	74°34.7	.. 20.5	133°00.5	.. 00.6	182°47.5	.. 19.6	103°13.1	.. 51.0	Sabik	102°10.7	-15°44.5					
16	11°18.2	89°33.8	20.4	148°01.8	01.0	197°50.2	19.7	118°15.3	51.0	Shaula	96°19.8	-37°06.6					
17	26°20.6	104°33.0	20.3	163°03.0	01.4	212°52.8	19.8	133°17.6	51.0	Rasalhague	96°05.0	12°33.0					
18	41°23.1	119°32.1	\$22°20.1	178°04.3	\$15°01.7	225°55.4	N04°19.8	148°19.9	\$20°51.0	Eltanin	90°45.7	51°29.2					
19	56°25.6	134°31.2	20.0	193°05.5	02.1	242°58.1	19.9	163°22.1	51.1	Kaus Aust.	83°41.8	-34°22.4					
20	71°28.0	149°30.4	19.9	208°06.7	02.5	258°00.7	20.0	178°24.4	51.1	Vega	80°38.1	38°47.9					
21	86°30.5	164°29.5	.. 19.7	223°08.0	.. 02.8	273°03.4	.. 20.1	193°26.6	.. 51.1	Nunki	75°56.4	-26°16.4					
22	101°33.0	179°28.6	19.6	238°09.2	03.2	288°06.0	20.2	208°28.9	51.1	Altair	62°06.8	8°54.7					
23	116°35.4	194°27.8	19.5	253°10.5	03.6	303°08.6	20.3	223°31.1	51.1	Peacock	53°17.1	-56°40.8					
Mer.pass.:15:15			v-0.9 d0.1 m-3.9	v1.2 d-0.4 m0.8			v2.6 d0.1 m-2.2			Deneb			Enif	33°45.7	9°57.0		
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	131°37.9	209°26.9	\$22°19.3	268°11.7	\$15°03.9	318°11.3	N04°20.3	238°33.4	\$20°51.2	Al Na'ir	27°42.0	-46°53.0					
1	146°40.4	224°26.0	19.2	283°12.9	04.3	333°13.9	20.4	253°35.6	51.2	Fomalhaut	15°22.4	-29°32.3					
2	161°42.8	239°25.2	19.1	298°14.2	04.7	348°16.5	20.5	268°37.9	51.2	Scheat	13°51.9	28°10.3					
3	176°45.3	254°24.3	.. 18.9	313°15.4	.. 05.0	3°19.2	.. 20.6	283°40.1	.. 51.2	Markab	13°36.8	15°17.5					
4	191°47.7	269°23.4	18.8	328°16.7	05.4	18°21.8	20.7	298°42.4	51.2	Jan 31 Sun	15°22.4						
5	206°50.2	284°22.6	18.7	343°17.9	05.7	33°24.4	20.8	313°44.6	51.3	Venus	80°29.0	10:00					
6	221°52.7	299°21.7	\$22°18.5	358°19.1	\$15°06.1	48°27.1	N04°20.9	328°46.9	\$20°51.3	Mars	137°32.8	06:11					
7	236°55.1	314°20.8	18.4	13°20.4	06.5	65°29.7	20.9	343°49.1	51.3	Jupiter	186°25.4	02:55					
8	251°57.6	329°20.0	18.2	28°21.6	06.8	78°32.4	21.0	358°51.4	51.3	Saturn	107°05.8	08:12					
9	267°00.1	344°19.1	.. 18.1	43°22.9	.. 07.2	93°35.0	.. 21.1	13°53.6	.. 51.3	Feb 01 Mon	15°00.0						
10	282°02.5	359°18.2	17.9	58°24.1	07.6	108°37.6	21.2	28°55.9	51.4	Venus	79°09.0	10:01					
11	297°05.0	14°17.4	17.8	73°25.4	07.9	123°40.3	21.3	43°58.1	51.4	Mars	137°03.2	06:09					
12	312°07.5	29°16.5	\$22°17.6	88°26.6	\$15°08.3	138°42.9	N04°21.4	59°00.4	\$20°51.4	Jupiter	186°29.3	02:51					
13	327°09.9	44°15.6	17.5	103°27.8	08.6	153°45.5	21.5	74°02.7	51.4	Saturn	107°00.6	08:08					
14	342°12.4																

DUT1 = UT1-UTC = +0.0281 sec ΔT = TT-UT1 = +68.1559 sec

2016 January 31 to Feb. 02 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°41.0	S17°35.7	282°27.7	14.8'	S07°58.5	-8.4'	54.2'
1	191°40.9	35.0	297°01.5	14.8'	08°06.9	-8.4'	54.2'
2	206°40.8	34.3	311°35.3	14.8'	08°15.3	-8.3'	54.2'
3	221°40.7	.. 33.7	326°09.1	14.8'	08°23.6	-8.3'	54.2'
4	236°40.6	33.0	340°42.8	14.7'	08°31.9	-8.3'	54.3'
5	251°40.5	32.3	355°16.5	14.7'	08°40.2	-8.2'	54.3'
6	266°40.4	S17°31.6	9°50.2	14.7'	S08°48.4	-8.2'	54.3'
7	281°40.3	30.9	24°23.9	14.6'	08°56.6	-8.2'	54.3'
8	296°40.2	30.2	38°57.5	14.6'	09°04.8	-8.1'	54.3'
9	311°40.1	.. 29.5	53°31.1	14.6'	09°12.9	-8.1'	54.3'
10	326°40.0	28.8	68°04.7	14.6'	09°21.0	-8.1'	54.3'
11	341°40.0	28.1	82°38.2	14.5'	09°29.1	-8.0'	54.3'
12	356°39.9	S17°27.4	97°11.8	14.5'	S09°37.1	-8.0'	54.3'
13	11°39.8	26.7	111°45.3	14.5'	09°45.0	-8.0'	54.3'
14	26°39.7	26.0	126°18.7	14.4'	09°53.0	-7.9'	54.3'
15	41°39.6	.. 25.3	140°52.1	14.4'	10°00.9	-7.9'	54.3'
16	56°39.5	24.6	155°25.5	14.4'	10°08.7	-7.8'	54.3'
17	71°39.4	23.9	169°58.9	14.3'	10°16.6	-7.8'	54.4'
18	86°39.3	S17°23.2	184°32.2	14.3'	S10°24.3	-7.8'	54.4'
19	101°39.2	22.5	199°05.5	14.3'	10°32.1	-7.7'	54.4'
20	116°39.1	21.8	213°38.8	14.2'	10°39.8	-7.7'	54.4'
21	131°39.0	.. 21.1	228°12.0	14.2'	10°47.4	-7.6'	54.4'
22	146°38.9	20.4	242°45.2	14.2'	10°55.0	-7.6'	54.4'
23	161°38.8	19.7	257°18.3	14.1'	11°02.6	-7.5'	54.4'
SD.=16.2		d=0.7	S.D.=14.8				
Mon		GHA	Dec	GHA	ν	Dec	d
0	176°38.7	S17°19.0	271°51.4	14.1'	S11°10.1	-7.5'	54.4'
1	191°38.7	18.3	286°24.5	14.1'	11°17.6	-7.5'	54.4'
2	206°38.6	17.6	300°57.5	14.0'	11°25.0	-7.4'	54.4'
3	221°38.5	.. 16.9	315°30.5	14.0'	11°32.4	-7.4'	54.5'
4	236°38.4	16.2	330°03.5	13.9'	11°39.7	-7.3'	54.5'
5	251°38.3	15.5	344°36.4	13.9'	11°47.0	-7.3'	54.5'
6	266°38.2	S17°14.8	359°09.3	13.9'	S11°54.3	-7.2'	54.5'
7	281°38.1	14.1	13°42.1	13.8'	12°01.5	-7.2'	54.5'
8	296°38.0	13.4	28°14.9	13.8'	12°08.6	-7.1'	54.5'
9	311°37.9	.. 12.7	42°47.7	13.7'	12°15.7	-7.1'	54.5'
10	326°37.8	12.0	57°20.4	13.7'	12°22.8	-7.0'	54.6'
11	341°37.8	11.3	71°53.0	13.6'	12°29.8	-7.0'	54.6'
12	356°37.7	S17°10.6	86°25.7	13.6'	S12°36.7	-6.9'	54.6'
13	11°37.6	09.9	100°58.2	13.6'	12°43.6	-6.9'	54.6'
14	26°37.5	09.2	115°30.8	13.5'	12°50.5	-6.8'	54.6'
15	41°37.4	.. 08.5	130°03.3	13.5'	12°57.3	-6.8'	54.6'
16	56°37.3	07.8	144°35.7	13.4'	13°04.0	-6.7'	54.7'
17	71°37.2	07.1	159°08.1	13.4'	13°10.7	-6.7'	54.7'
18	86°37.2	S17°06.3	173°40.4	13.3'	S13°17.3	-6.6'	54.7'
19	101°37.1	05.6	188°12.8	13.3'	13°23.9	-6.6'	54.7'
20	116°37.0	04.9	202°45.0	13.2'	13°30.4	-6.5'	54.7'
21	131°36.9	.. 04.2	217°17.2	13.2'	13°36.9	-6.4'	54.7'
22	146°36.8	03.5	231°49.4	13.1'	13°43.3	-6.4'	54.8'
23	161°36.7	02.8	246°21.5	13.1'	13°49.7	-6.3'	54.8'
SD.=16.2		d=0.7	S.D.=14.9				
Tue		GHA	Dec	GHA	ν	Dec	d
0	176°36.7	S17°02.1	260°53.6	13.0'	S13°56.0	-6.3'	54.8'
1	191°36.6	01.4	275°25.6	13.0'	14°02.2	-6.2'	54.8'
2	206°36.5	17°00.6	289°57.5	12.9'	14°08.4	-6.1'	54.8'
3	221°36.4	16°59.9	304°29.4	12.9'	14°14.5	-6.1'	54.8'
4	236°36.3	59.2	319°01.3	12.8'	14°20.6	-6.0'	54.9'
5	251°36.2	58.5	333°33.1	12.8'	14°26.6	-6.0'	54.9'
6	266°36.2	S16°57.8	348°04.9	12.7'	S14°32.5	-5.9'	54.9'
7	281°36.1	57.1	2°36.6	12.7'	14°38.4	-5.8'	54.9'
8	296°36.0	56.3	17°08.3	12.6'	14°44.2	-5.8'	55.0'
9	311°35.9	.. 55.6	31°39.9	12.6'	14°49.9	-5.7'	55.0'
10	326°35.8	54.9	46°11.4	12.5'	14°55.6	-5.7'	55.0'
11	341°35.8	54.2	60°42.9	12.5'	15°01.2	-5.6'	55.0'
12	356°35.7	S16°53.5	75°14.4	12.4'	S15°06.8	-5.5'	55.0'
13	11°35.6	52.7	89°45.8	12.4'	15°12.3	-5.5'	55.1'
14	26°35.5	52.0	104°17.1	12.3'	15°17.7	-5.4'	55.1'
15	41°35.5	.. 51.3	118°48.4	12.3'	15°23.1	-5.3'	55.1'
16	56°35.4	50.6	133°19.6	12.2'	15°28.4	-5.3'	55.1'
17	71°35.3	49.9	147°50.8	12.2'	15°33.6	-5.2'	55.2'
18	86°35.2	S16°49.1	162°21.9	12.1'	S15°38.7	-5.1'	55.2'
19	101°35.1	48.4	176°53.0	12.0'	15°43.8	-5.0'	55.2'
20	116°35.1	47.7	191°24.0	12.0'	15°48.8	-5.0'	55.2'
21	131°35.0	.. 47.0	205°55.0	11.9'	15°53.8	-4.9'	55.2'
22	146°34.9	46.2	220°25.9	11.9'	15°58.6	-4.8'	55.3'
23	161°34.8	45.5	234°56.7	11.8'	16°03.4	-4.8'	55.3'
SD.=16.2		d=0.7	S.D.=15.0				

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

**February 03, 04, 05 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Week	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	132°37.0	209°06.1	\$22°15.8	268°41.5	\$15°12.6	319°14.6	N04°22.4	239°27.5	S20°51.6	Alpheratz	357°41.8	29°10.8					
1	147°39.5	224°05.2	15.6	283°42.8	13.0	334°17.2	22.5	254°29.7	51.6	Ankaa	353°14.3	-42°13.4					
2	162°42.0	239°04.4	15.4	298°44.0	13.3	349°19.9	22.6	269°32.0	51.7	Schedar	349°38.6	56°37.7					
3	177°44.4	254°03.5	15.3	313°45.3	13.7	4°22.5	22.7	284°34.2	51.7	Diphda	348°54.3	-17°54.1					
4	192°46.9	269°02.6	15.1	328°46.5	14.0	19°25.2	22.8	299°36.5	51.7	Achernar	335°25.7	-57°09.7					
5	207°49.4	284°01.8	14.9	343°47.8	14.4	34°27.8	22.8	314°38.7	51.7	Hamal	327°58.8	23°32.2					
6	222°51.8	299°00.9	\$22°14.8	358°49.0	\$15°14.8	49°30.5	N04°22.9	329°41.0	S20°51.7	Polaris	316°54.7	89°20.2					
7	237°54.3	314°00.0	14.6	13°50.3	15.1	64°33.1	23.0	344°43.2	51.8	Acamar	315°17.0	-40°14.8					
8	252°56.7	328°59.2	14.4	28°51.5	15.5	79°35.7	23.1	359°45.5	51.8	Menkar	314°13.1	4°08.9					
9	267°59.2	343°58.3	14.3	43°52.7	15.8	94°38.4	23.2	14°47.8	51.8	Mirfak	308°37.6	49°55.1					
10	283°01.7	358°57.4	14.1	58°54.0	16.2	109°41.0	23.3	29°50.0	51.8	Aldebaran	290°47.1	16°32.3					
11	298°04.1	13°56.6	13.9	73°55.2	16.5	124°43.7	23.4	44°52.3	51.8	Rigel	281°10.1	-8°11.3					
12	313°06.6	28°55.7	\$22°13.7	88°56.5	\$15°16.9	139°46.3	N04°23.5	59°54.5	S20°51.8	Capella	280°31.5	46°00.7					
13	328°09.1	43°54.9	13.6	103°57.7	17.3	154°49.0	23.5	74°56.8	51.9	Bellatrix	278°29.9	6°21.6					
14	343°11.5	58°54.0	13.4	118°59.0	17.6	169°51.6	23.6	89°59.0	51.9	El Nath	278°10.1	28°37.1					
15	358°14.0	73°53.1	13.2	134°00.2	18.0	184°54.3	23.7	105°01.3	51.9	Alnilam	275°44.3	-1°11.8					
16	13°16.5	88°52.3	13.0	149°01.5	18.3	199°56.9	23.8	120°03.6	51.9	Betelgeuse	270°59.1	7°24.3					
17	28°18.9	103°51.4	12.8	164°02.7	18.7	214°59.6	23.9	135°05.8	51.9	Canopus	263°54.9	-52°42.7					
18	43°21.4	118°50.5	\$22°12.7	179°04.0	\$15°19.0	230°02.2	N04°24.0	150°08.1	S20°52.0	Sirius	258°31.8	-16°44.7					
19	58°23.9	133°49.7	12.5	194°05.2	19.4	245°04.9	24.1	165°10.3	52.0	Adhara	255°10.8	-29°00.0					
20	73°26.3	148°48.8	12.3	209°06.5	19.8	260°07.5	24.2	180°12.6	52.0	Procyon	244°57.5	5°10.7					
21	88°28.8	163°47.9	12.1	224°07.7	20.1	275°10.1	24.3	195°14.8	52.0	Pollux	243°25.2	27°59.0					
22	103°31.2	178°47.1	11.9	239°09.0	20.5	290°12.8	24.3	210°17.1	52.0	Avior	234°16.6	-59°33.9					
23	118°33.7	193°46.2	11.7	254°10.2	20.8	305°15.4	24.4	225°19.4	52.1	Suhail	222°50.6	-43°30.0					
Mer.pass.:15:07			v-0.9 d0.2 m-3.8			v1.2 d-0.4 m0.8			v2.6 d0.1 m-2.2			v2.3 d-0.0 m0.5					
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	133°36.2	208°45.4	\$22°11.5	269°11.5	\$15°21.2	320°18.1	N04°24.5	240°21.6	S20°52.1	Denebola	182°31.6	14°28.8					
1	148°38.6	223°44.5	11.4	284°12.7	21.5	335°20.7	24.6	255°23.9	52.1	Gienah	175°50.2	-17°37.9					
2	163°41.1	238°43.6	11.2	299°14.0	21.9	350°23.4	24.7	270°26.1	52.1	Gacrux	173°06.7	-63°11.1					
3	178°43.6	253°42.8	11.0	314°15.2	22.2	5°26.0	24.8	285°28.4	52.1	Alioth	166°19.0	55°52.1					
4	193°46.0	268°41.9	10.8	329°16.5	22.6	20°28.7	24.9	300°30.7	52.1	Spica	158°29.2	-11°14.7					
5	208°48.5	283°41.0	10.6	344°17.7	22.9	35°31.3	25.0	315°32.9	52.2	Alkaid	152°57.4	49°13.8					
6	223°51.0	298°40.2	\$22°10.4	359°19.0	\$15°23.3	50°34.0	N04°25.1	330°35.2	S20°52.2	Hadar	148°45.1	-60°26.7					
7	238°53.4	313°39.3	10.2	14°20.2	23.7	65°36.6	25.2	345°37.4	52.2	Menkent	148°05.3	-36°26.7					
8	253°55.9	328°38.5	10.0	29°21.5	24.0	80°39.3	25.2	0°39.7	52.2	Arcturus	145°54.1	19°05.8					
9	268°58.3	343°37.6	09.8	44°22.7	24.4	95°41.9	25.3	15°42.0	52.2	Rigel Kent.	139°49.1	-60°53.7					
10	284°00.8	358°36.7	09.6	59°24.0	24.7	110°44.6	25.4	30°44.2	52.3	Kochab	137°20.3	74°05.1					
11	299°03.3	13°35.9	09.4	74°25.2	25.1	125°47.2	25.5	45°46.5	52.3	Zuben' ubi	137°03.4	-16°06.4					
12	314°05.7	28°35.0	\$22°09.2	89°26.5	\$15°25.4	140°49.9	N04°25.6	60°48.7	S20°52.3	Alphecca	126°09.6	26°39.6					
13	329°08.2	43°34.1	09.0	104°27.8	25.8	155°52.5	25.7	75°51.0	52.3	Antares	112°24.2	-26°27.8					
14	344°10.7	58°33.3	08.8	119°29.0	26.1	170°55.2	25.8	90°53.3	52.3	Atria	107°24.6	-69°02.9					
15	359°13.1	73°32.4	08.6	134°30.3	26.5	185°57.9	25.9	105°55.5	52.4	Sabik	102°10.7	-15°44.5					
16	14°15.6	88°31.6	08.4	149°31.5	26.8	201°00.5	26.0	120°57.8	52.4	Shaula	96°19.7	-37°06.6					
17	29°18.1	103°30.7	08.1	164°32.8	27.2	216°03.2	26.1	136°00.0	52.4	Rasalhague	96°05.0	12°33.0					
18	44°20.5	118°29.8	\$22°07.9	179°34.0	\$15°27.5	231°05.8	N04°26.2	151°02.3	S20°52.4	Eltanin	90°45.7	51°29.2					
19	59°23.0	133°29.0	07.7	194°35.3	27.9	246°08.5	26.2	166°04.6	52.4	Kaus Aust.	83°41.8	-34°22.3					
20	74°25.5	148°28.1	07.5	209°36.5	28.2	261°11.1	26.3	181°06.8	52.4	Vega	80°38.1	38°47.9					
21	89°27.9	163°27.3	07.3	224°37.8	28.6	276°13.8	26.4	196°09.1	52.5	Nunki	75°56.4	-26°16.4					
22	104°30.4	178°26.4	07.1	239°39.0	28.9	291°16.4	26.5	211°11.3	52.5	Altair	62°06.8	8°54.7					
23	119°32.8	193°25.5	06.9	254°40.3	29.3	306°19.1	26.6	226°13.6	52.5	Peacock	53°17.1	-56°40.8					
Mer.pass.:15:03			v-0.9 d0.2 m-3.8			v1.3 d-0.4 m0.8			v2.6 d0.1 m-2.2			v2.3 d-0.0 m0.5					
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	134°35.3	208°24.7	\$22°06.6	269°41.6	\$15°29.6	321°21.7	N04°26.7	241°15.9	S20°52.5	Feb 03 Wed	76°29.1	10:04					
1	149°37.8	223°28.3	06.4	284°42.8	30.0	336°24.4	26.8	256°18.1	52.5	Venus	136°04.5	06:05					
2	164°40.2	238°23.0	06.2	299°44.1	30.3	351°27.0	26.9	271°20.4	52.6	Mars	186°37.6	02:43					
3	179°42.7	253°22.1	06.0	314°45.3	30.7	6°29.7	27.0	286°22.7	52.6	Jupiter	106°50.4	08:01					
4	194°45.2	268°21.2	05.8	329°46.6	31.0	21°32.4	27.1	301°24.9	52.6	Saturn	106°45.4	07:57					
5	209°47.6	283°20.4	05.5	344°47.8	31.4	36°35.0	27.2	316°27.2	52.6	Feb 04 Thu	75°09.2	10:06					
6	224°50.1	298°19.5	\$22°05.3	359°49.1	\$15°31.7	51°37.7	N04°27.3	331°29.4	S20°52.6	Venus	135°35.3	06:03					
7	239°52.6	313°18.7	05.1	14°50.3	32.1	66°40.3	27.4	346°31.7	52.6	Mars	186°41.9	02:38					
8	254°55.0	328°17.8	04.9	29°51.6	32.4	81°43.0	27.4	1°34.0	52.7	Jupiter	106°45.4	07:57					
9	269°57.5	343°16.9	04.6	44°52.9	32.8	96°45.6	27.5	16°36.2	52.7	Saturn	106°40.6	07:54					
10	285°00.0	358°16.1	04.4	59°54.1	33.1	111°48.3	27.6	31°38.5	52.7	Feb 05 Fri	73°49.4	10:07					
11	300°02.4	13°15.2	04.2	74°55.4	33.5	126°51.0	27.7	46°40.8	52.7	Venus	135°06.2	06:01					
12	315°04.9	28°14.4	\$22°03.9	89°56.6	\$15°33.8	141°53.6	N04°27.8	61°43.0	S20°52.7	Mars	186°46.4	02:34					
13	330°07.3	43°13.5	03.7	104°57.9	34.2	156°56.3	27.9	76°45.3	52.7	Jupiter	106°40.6	07:54					
14	345°09.8	58°12.7	03.5	119°59.2	34.5	171°58.9	28.0	91°47.5	52.8	Saturn	106°22.4	-29°32.3					
15	0°12.3	73°11.8	03.2	135°00.4	34.9	187°01.6	28.1	106°49.8	52.8	Horizontal parallax	Venus:	0.1					
16	15°14.7	88°10.9	03.0	150°01.7	35.2	202°04.2	28.2	121°52.1	52.8	Mars:	0.1						
17	30°17.2	103°10.1	02.8	165°02.9	35.6	217°06.9	28.3	136°54.3	52.8	Mer.pass.:14:59	v-0.9 d0.2 m-3.8	v1.3 d-0.4 m0.8	v2.6 d0.1 m-2.2	v2.3 d-0.0 m0.5			

DUT1 = UT1-UTC = +0.0231 sec ΔT = TT-UT1 = +68.1609 sec

2016 February 03 to Feb. 05 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	176°34.8	S16°44.8	249°27.5	11.8'	S16°08.2	-4.7'	55.3'	
1	191°34.7	44.1	263°58.3	11.7'	16°12.8	-4.6'	55.3'	
2	206°34.6	43.3	278°28.9	11.7'	16°17.4	-4.5'	55.4'	
3	221°34.5	.. 42.6	292°59.6	11.6'	16°21.9	-4.5'	55.4'	
4	236°34.5	41.9	307°30.1	11.5'	16°26.3	-4.4'	55.4'	
5	251°34.4	41.1	322°00.6	11.5'	16°30.7	-4.3'	55.5'	
6	266°34.3	S16°40.4	336°31.1	11.4'	S16°34.9	-4.2'	55.5'	
7	281°34.3	39.7	351°01.5	11.4'	16°39.1	-4.2'	55.5'	
8	296°34.2	39.0	5°31.8	11.3'	16°43.3	-4.1'	55.5'	
9	311°34.1	.. 38.2	20°02.1	11.3'	16°47.3	-4.0'	55.6'	
10	326°34.0	37.5	34°32.4	11.2'	16°51.3	-3.9'	55.6'	
11	341°34.0	36.8	49°02.5	11.1'	16°55.1	-3.8'	55.6'	
12	356°33.9	S16°36.0	63°32.7	11.1'	S16°58.9	-3.8'	55.6'	
13	11°33.8	35.3	78°02.7	11.0'	17°02.7	-3.7'	55.7'	
14	26°33.8	34.6	92°32.7	11.0'	17°06.3	-3.6'	55.7'	
15	41°33.7	.. 33.8	107°02.7	10.9'	17°09.9	-3.5'	55.7'	
16	56°33.6	33.1	121°32.6	10.9'	17°13.3	-3.4'	55.8'	
17	71°33.6	32.4	136°02.4	10.8'	17°16.7	-3.3'	55.8'	
18	86°33.5	S16°31.6	150°32.2	10.8'	S17°20.0	-3.3'	55.8'	
19	101°33.4	30.9	165°01.9	10.7'	17°23.3	-3.2'	55.8'	
20	116°33.3	30.2	179°31.6	10.6'	17°26.4	-3.1'	55.9'	
21	131°33.3	.. 29.4	194°01.2	10.6'	17°29.4	-3.0'	55.9'	
22	146°33.2	28.7	208°30.7	10.5'	17°32.4	-2.9'	55.9'	
23	161°33.1	27.9	223°00.2	10.5'	17°35.3	-2.8'	56.0'	
	SD.=16.2	d=0.7			S.D.=15.2			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°33.1	S16°27.2	237°29.7	10.4'	S17°38.1	-2.7'	56.0'
1	191°33.0	26.5	251°59.1	10.4'	17°40.8	-2.7'	56.0'
2	206°32.9	25.7	266°28.4	10.3'	17°43.4	-2.6'	56.1'
3	221°32.9	.. 25.0	280°57.7	10.3'	17°45.9	-2.5'	56.1'
4	236°32.8	24.2	295°26.9	10.2'	17°48.3	-2.4'	56.1'
5	251°32.8	23.5	309°56.1	10.1'	17°50.7	-2.3'	56.1'
6	266°32.7	S16°22.8	324°25.2	10.1'	S17°52.9	-2.2'	56.2'
7	281°32.6	22.0	338°54.3	10.0'	17°55.1	-2.1'	56.2'
8	296°32.6	21.3	353°23.3	10.0'	17°57.2	-2.0'	56.2'
9	311°32.5	.. 20.5	7°52.2	9.9'	17°59.1	-1.9'	56.3'
10	326°32.4	19.8	22°21.1	9.9'	18°01.0	-1.8'	56.3'
11	341°32.4	19.1	36°50.0	9.8'	18°02.8	-1.7'	56.3'
12	356°32.3	S16°18.3	51°18.8	9.8'	S18°04.5	-1.6'	56.4'
13	11°32.3	17.6	65°47.5	9.7'	18°06.1	-1.5'	56.4'
14	26°32.2	16.8	80°16.2	9.7'	18°07.6	-1.5'	56.4'
15	41°32.1	.. 16.1	94°44.9	9.6'	18°09.0	-1.4'	56.5'
16	56°32.1	15.3	109°13.5	9.6'	18°10.3	-1.3'	56.5'
17	71°32.0	14.6	123°42.0	9.5'	18°11.5	-1.2'	56.5'
18	86°31.9	S16°13.8	138°10.5	9.5'	S18°12.6	-1.1'	56.6'
19	101°31.9	13.1	152°38.9	9.4'	18°13.6	-1.0'	56.6'
20	116°31.8	12.3	167°07.3	9.4'	18°14.5	-0.9'	56.6'
21	131°31.8	.. 11.6	181°35.7	9.3'	18°15.4	-0.8'	56.7'
22	146°31.7	10.8	196°04.0	9.3'	18°16.1	-0.7'	56.7'
23	161°31.7	10.1	210°32.2	9.2'	18°16.7	-0.6'	56.7'
	SD.=16.2	d=0.7			S.D.=15.4		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	176°31.6	S16°09.3	225°00.4	9.2'	S18°17.2	-0.5'	56.8'
1	191°31.5	08.6	239°28.6	9.1'	18°17.6	-0.4'	56.8'
2	206°31.5	07.8	253°56.7	9.1'	18°17.9	-0.3'	56.8'
3	221°31.4	.. 07.1	268°24.8	9.0'	18°18.1	-0.2'	56.9'
4	236°31.4	06.3	282°52.8	9.0'	18°18.2	-0.1'	56.9'
5	251°31.3	05.6	297°20.7	9.0'	18°18.3	0.0'	56.9'
6	266°31.3	S16°04.8	311°48.7	8.9'	S18°18.2	0.1'	57.0'
7	281°31.2	04.1	326°16.6	8.9'	18°18.0	0.3'	57.0'
8	296°31.1	03.3	340°44.4	8.8'	18°17.6	0.4'	57.0'
9	311°31.1	.. 02.6	355°12.2	8.8'	18°17.2	0.5'	57.1'
10	326°31.0	01.8	9°40.0	8.7'	18°16.7	0.6'	57.1'
11	341°31.0	01.1	24°07.7	8.7'	18°16.1	0.7'	57.1'
12	356°30.9	S16°00.3	38°35.4	8.7'	S18°15.4	0.8'	57.2'
13	11°30.9	15°59.5	53°03.0	8.6'	18°14.6	0.9'	57.2'
14	26°30.8	58.8	67°30.6	8.6'	18°13.6	1.0'	57.2'
15	41°30.8	.. 58.0	81°58.2	8.5'	18°12.6	1.1'	57.3'
16	56°30.7	57.3	96°25.7	8.5'	18°11.4	1.2'	57.3'
17	71°30.7	56.5	110°53.2	8.5'	18°10.2	1.3'	57.3'
18	86°30.6	S15°55.8	125°20.6	8.4'	S18°08.8	1.4'	57.4'
19	101°30.6	55.0	139°48.1	8.4'	18°07.3	1.5'	57.4'
20	116°30.5	54.2	154°15.4	8.4'	18°05.8	1.6'	57.4'
21	131°30.5	.. 53.5	168°42.8	8.3'	18°04.1	1.7'	57.5'
22	146°30.4	52.7	183°10.1	8.3'	18°02.3	1.8'	57.5'
23	161°30.4	52.0	197°37.4	8.3'	18°00.4	2.0'	57.6'
	SD.=16.2	d=0.8			S.D.=15.6		

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> 00:mm		Mer. Pass	Age
03	13:41	13:44	12:14	07:37	20:02
04	13:48	13:51	12:14	08:27	20:53
05	13:54	13:56	12:14	09:20	21:47



**February 06, 07, 08 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	135°34.5	208°04.1	\$22°01.1	270°11.8	\$15°38.0	322°25.5	N04°28.9	242°10.2	\$20°52.9	Alpheratz	357°41.8	29°10.8					
1	150°36.9	223°03.2	00.8	285°13.0	38.3	337°28.2	29.0	257°12.5	53.0	Ankaa	353°14.3	-42°13.4					
2	165°39.4	238°02.4	00.6	300°14.3	38.7	352°30.8	29.1	272°14.7	53.0	Schedar	349°38.7	56°37.7					
3	180°41.8	253°01.5	.. 00.3	315°15.5	.. 39.0	7°33.5	.. 29.2	287°17.0	.. 53.0	Diphda	348°54.3	-17°54.1					
4	195°44.3	268°00.7	22°00.1	330°16.8	39.4	22°36.2	29.3	302°19.3	53.0	Achernar	335°25.8	-57°09.7					
5	210°46.8	282°59.8	21°59.8	345°18.1	39.7	37°38.8	29.4	317°21.5	53.0	Hamal	327°58.8	23°32.2					
6	225°49.2	297°59.0	\$21°59.6	0°19.3	\$15°40.1	52°41.5	N04°29.5	332°23.8	\$20°53.0	Polaris	316°56.1	89°20.2					
7	240°51.7	312°58.1	59.3	15°20.6	40.4	67°44.2	29.6	347°26.1	53.1	Acamar	315°17.0	-40°14.8					
8	255°54.2	327°57.2	59.1	30°21.9	40.8	82°46.8	29.7	2°28.3	53.1	Menkar	314°13.2	4°08.9					
9	270°56.6	342°56.4	.. 58.8	45°23.1	.. 41.1	97°49.5	.. 29.8	17°30.6	.. 53.1	Mirfak	308°37.6	49°55.1					
10	285°59.1	357°55.5	58.6	60°24.4	41.4	112°52.1	29.9	32°32.9	53.1	Aldebaran	290°47.2	16°32.3					
11	301°01.6	12°54.7	58.3	75°25.6	41.8	127°54.8	30.0	47°35.1	53.1	Rigel	281°10.1	-8°11.3					
12	316°04.0	27°53.8	\$21°58.1	90°26.9	\$15°42.1	142°57.5	N04°30.1	62°37.4	\$20°53.2	Capella	280°31.5	46°00.7					
13	331°06.5	42°53.0	57.8	105°28.2	42.5	158°00.1	30.2	77°39.7	53.2	Bellatrix	278°29.9	6°21.6					
14	346°08.9	57°52.1	57.5	120°29.4	42.8	173°02.8	30.3	92°41.9	53.2	Elnath	278°10.1	28°37.1					
15	1°11.4	72°51.3	.. 57.3	135°30.7	.. 43.2	188°05.5	.. 30.4	107°44.2	.. 53.2	Alnilam	275°44.3	-1°11.8					
16	16°13.9	87°50.4	57.0	150°32.0	43.5	203°08.1	30.5	122°46.5	53.2	Betelgeuse	270°59.1	7°24.3					
17	31°16.3	102°49.6	56.7	165°33.2	43.8	218°10.8	30.6	137°48.7	53.2	Canopus	263°54.9	-52°42.7					
18	46°18.8	117°48.7	\$21°56.5	180°34.5	\$15°44.2	233°13.5	N04°30.7	152°51.0	\$20°53.2	Sirius	258°31.8	-16°44.7					
19	61°21.3	132°47.9	56.2	195°35.8	44.5	248°16.1	30.8	167°53.3	53.3	Adhara	255°10.8	-29°00.0					
20	76°23.7	147°47.0	55.9	210°37.0	44.9	263°18.8	30.9	182°55.5	53.3	Procyon	244°57.5	5°10.7					
21	91°26.2	162°46.1	.. 55.7	225°38.3	.. 45.2	278°21.5	.. 31.0	197°57.8	.. 53.3	Pollux	243°25.2	27°59.0					
22	106°28.7	177°45.3	55.4	240°39.6	45.6	293°24.1	31.0	213°00.1	53.3	Avior	234°16.6	-59°33.9					
23	121°31.1	192°44.4	55.1	255°40.8	45.9	308°26.8	31.1	228°02.3	53.3	Suhail	222°50.6	-43°30.1					
Mer.pass.:14:55			v-0.9 d0.2 m-3.8	v1.3 d-0.3 m0.8	v2.7 d0.1 m-2.2	v2.3 d-0.0 m0.5	Miaplacidus			Zuben ubi	221°38.2	-69°47.1					
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.0	-8°43.9					
0	136°33.6	207°43.6	\$21°54.9	270°42.1	\$15°46.2	323°29.5	N04°31.2	243°04.6	\$20°53.4	Regulus	207°41.3	11°53.1					
1	151°36.1	222°42.7	54.6	285°43.4	46.6	338°32.1	31.3	258°06.9	53.4	Dubhe	193°49.1	61°39.6					
2	166°38.5	237°41.9	54.3	300°44.6	46.9	353°34.8	31.4	273°09.1	53.4	Denebola	182°31.6	14°28.8					
3	181°41.0	252°41.0	.. 54.0	315°45.9	.. 47.3	8°37.5	.. 31.5	288°11.4	.. 53.4	Gienah	175°50.2	-17°37.9					
4	196°43.4	267°40.2	53.8	330°47.2	47.6	23°40.1	31.6	303°13.7	53.4	Acrux	173°06.7	-63°11.1					
5	211°45.9	282°39.3	53.5	345°48.4	47.9	38°42.8	31.7	318°15.9	53.4	Gacrux	171°58.4	-57°12.0					
6	226°48.4	297°38.5	\$21°53.2	0°49.7	\$15°48.3	53°45.5	N04°31.8	333°18.2	\$20°53.5	Alioth	166°18.9	55°52.1					
7	241°50.8	312°37.6	52.9	15°51.0	48.6	68°48.1	31.9	348°20.5	53.5	Spica	158°29.2	-11°14.7					
8	256°53.3	327°36.8	52.6	30°52.2	49.0	83°50.8	32.0	3°22.8	53.5	Alkaid	152°57.4	49°13.8					
9	271°55.8	342°35.9	.. 52.4	45°53.5	.. 49.3	98°53.5	.. 32.1	18°25.0	.. 53.5	Hadar	148°45.0	-60°26.7					
10	286°58.2	357°35.1	52.1	60°54.8	49.6	113°56.1	32.2	33°27.3	53.5	Menken	148°05.3	-36°26.7					
11	302°00.7	12°34.2	51.8	75°56.0	50.0	128°58.8	32.3	48°29.6	53.5	Arcturus	145°54.0	19°05.8					
12	317°03.2	27°33.4	\$21°51.5	90°57.3	\$15°50.3	144°01.5	N04°32.4	63°31.8	\$20°53.6	Rigel Kent.	139°49.0	-60°53.7					
13	332°05.6	42°32.5	51.2	105°58.6	50.7	159°04.1	32.5	78°34.1	53.6	Kochab	137°20.2	74°05.1					
14	347°08.1	57°31.7	50.9	120°59.8	51.0	174°06.8	32.6	93°36.4	53.6	Zuben ubi	137°03.4	-16°06.4					
15	2°10.6	72°30.8	.. 50.6	136°01.1	.. 51.3	189°09.5	.. 32.7	108°38.6	.. 53.6	Alphecca	126°09.6	26°39.6					
16	17°13.0	87°30.0	50.4	151°02.4	51.7	204°12.2	32.8	123°40.9	53.6	Antares	112°24.2	-26°27.8					
17	32°15.6	102°29.1	50.1	166°03.7	52.0	219°14.8	32.9	138°43.2	53.6	Atria	107°24.6	-69°02.9					
18	47°17.9	117°28.3	\$21°49.8	181°04.9	\$15°52.4	234°17.5	N04°33.0	153°45.5	\$20°53.7	Sabik	102°10.6	-15°44.5					
19	62°20.4	132°27.4	49.5	196°06.2	52.7	249°20.2	33.1	168°47.7	53.7	Shaula	96°19.7	-37°06.6					
20	77°22.9	147°26.6	49.2	211°07.5	53.0	264°22.8	33.2	183°50.0	53.7	Rasalhague	96°05.0	12°33.0					
21	92°25.3	162°25.7	.. 48.9	226°08.7	.. 53.4	279°25.5	.. 33.3	198°52.3	.. 53.7	Eltanin	90°45.7	51°29.2					
22	107°27.8	177°24.9	48.6	241°10.0	53.7	294°28.2	33.4	213°54.5	53.7	Kaus Aust.	83°41.7	-34°22.3					
23	122°30.3	192°24.0	48.3	256°11.3	54.0	309°30.9	33.5	228°56.8	53.7	Vega	80°38.1	38°47.9					
Mer.pass.:14:51			v-0.9 d0.3 m-3.8	v1.3 d-0.3 m0.7	v2.7 d0.1 m-2.2	v2.3 d-0.0 m0.5	Nunki			Nunki	75°56.4	-26°16.4					
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Altair	62°06.8	8°54.7					
0	137°32.7	207°23.2	\$21°48.0	271°12.6	\$15°54.4	324°33.5	N04°33.6	243°59.1	\$20°53.8	Peacock	53°17.1	-56°40.8					
1	152°35.2	222°24.4	47.7	286°13.8	54.7	339°36.2	33.7	259°01.4	53.8	Deneb	49°30.7	45°20.3					
2	167°37.7	237°21.5	47.4	301°15.1	55.1	354°38.9	33.8	274°03.6	53.8	Fomalhaut	15°22.4	-29°32.3					
3	182°40.1	252°20.7	.. 47.1	316°16.4	.. 55.4	9°41.5	.. 33.9	289°05.9	.. 53.8	Scheat	13°51.9	28°10.2					
4	197°42.6	267°19.8	46.8	331°17.7	55.7	24°44.2	34.0	304°08.2	53.8	Markab	13°36.8	15°17.5					
5	212°45.1	282°19.0	46.5	346°18.9	56.1	39°46.9	34.1	319°10.4	53.8	Feb 06 Sat	72°29.6	Mer.pass					
6	227°47.5	297°18.1	\$21°46.2	1°20.2	\$15°56.4	54°49.6	N04°34.2	334°12.7	\$20°53.9	Venus	71°10.0	10:08					
7	242°50.0	312°17.3	45.9	16°21.5	56.7	69°52.2	34.3	349°15.0	53.9	Mars	134°37.3	05:59					
8	257°52.4	327°16.4	45.6	31°22.8	57.1	84°54.9	34.4	4°17.3	53.9	Jupiter	186°51.1	02:30					
9	272°54.9	342°15.6	.. 45.2	46°24.0	.. 57.4	99°57.6	.. 34.5	19°19.5	.. 53.9	Saturn	106°35.7	07:50					
10	287°57.4	357°14.7	44.9	61°25.3	57.7	115°00.3	34.6	34°21.8	53.9	Feb 07 Sun	71°10.0	Mer.pass					
11	302°59.8	12°13.9	44.6	76°26.6	58.1	130°02.9	34.7	49°24.1	53.9	Venus	71°10.0	10:10					
12	318°02.3	27°13.1	\$21°44.3	91°27.9	\$15°58.4	145°05.6	N04°34.8	64°26.4	\$20°54.0	Mars	134°08.5	05:57					
13	333°04.8	42°12.2	44.0	106°29.1	58.7	160°08.3	34.9	79°28.6	54.0	Jupiter	186°55.9	02:26					
14	348°07.2	57°11.4	43.7	121°30.4	59.1	175°11.0	35.0	94°30.9	54.0	Saturn	106°31.0	07:47					
15	3°09.7	72°10.5	.. 43.4	136°31.7	.. 59.4	190°13.6	.. 35.1	109°33.2	.. 54.0	Feb 08 Mon	69°50.5	Mer.pass					
16	18°12.2	87°09.7	43.1	151°33.0	15°59.8	205°16.3	35.2	124°35.5	54.0	Venus	69°50.5	10:11					
17	33°14.6	102°08.8	42.7	166°34.2	16°00.1	220°19.0	35.3	139°37.7	54.0	Mars	133°39.8	05:55					
18	48°17.1	117°08.0	\$21°42.4	181°35.5	\$16°00.4	235°21.7	N04°35.4	154°40.0	\$20°54.1	Jupiter	187°00.8	02:21					
19	63°19.5	132°07.1	42.1	196°36.8	00.8	250°24.3	35.5	169°42.3	54.1	Saturn	106°26.4	07:43					
20</																	

DUT1 = UT1-UTC = +0.0182 sec ΔT = TT-UT1 = +68.1658 sec

2016 February 06 to Feb. 08 UT

h		Sun			Moon			
Sat		GHA	Dec	GHA	ν	Dec	d	HP
0	176°30.3	S15°51.2	212°04.6	8.2'	S17°58.4	2.1'	57.6'	
1	191°30.3	50.4	226°31.9	8.2'	17°56.3	2.2'	57.6'	
2	206°30.2	49.7	240°59.1	8.2'	17°54.0	2.3'	57.7'	
3	221°30.2	.. 48.9	255°26.2	8.1'	17°51.7	2.4'	57.7'	
4	236°30.1	48.1	269°53.3	8.1'	17°49.3	2.5'	57.7'	
5	251°30.1	47.4	284°20.4	8.1'	17°46.7	2.6'	57.8'	
6	266°30.0	S15°46.6	298°47.5	8.1'	S17°44.0	2.7'	57.8'	
7	281°30.0	45.9	313°14.6	8.0'	17°41.3	2.8'	57.8'	
8	296°29.9	45.1	327°41.6	8.0'	17°38.4	2.9'	57.9'	
9	311°29.9	.. 44.3	342°08.6	8.0'	17°35.4	3.0'	57.9'	
10	326°29.8	43.6	356°35.6	8.0'	17°32.3	3.2'	57.9'	
11	341°29.8	42.8	11°02.5	7.9'	17°29.1	3.3'	58.0'	
12	356°29.7	S15°42.0	25°29.5	7.9'	S17°25.8	3.4'	58.0'	
13	11°29.7	41.3	39°56.4	7.9'	17°22.4	3.5'	58.0'	
14	26°29.6	40.5	54°23.2	7.9'	17°18.8	3.6'	58.1'	
15	41°29.6	.. 39.7	68°50.1	7.9'	17°15.2	3.7'	58.1'	
16	56°29.6	39.0	83°17.0	7.8'	17°11.4	3.8'	58.1'	
17	71°29.5	38.2	97°43.8	7.8'	17°07.6	3.9'	58.2'	
18	86°29.5	S15°37.4	112°10.6	7.8'	S17°03.6	4.0'	58.2'	
19	101°29.4	36.6	126°37.4	7.8'	16°59.5	4.1'	58.2'	
20	116°29.4	35.9	141°04.2	7.8'	16°55.4	4.2'	58.3'	
21	131°29.3	.. 35.1	155°30.9	7.8'	16°51.1	4.3'	58.3'	
22	146°29.3	34.3	169°57.7	7.7'	16°46.7	4.5'	58.3'	
23	161°29.3	33.6	184°24.4	7.7'	16°42.2	4.6'	58.4'	
SD.=16.2		d=0.8			S.D.=15.8			
Sun		GHA	Dec	GHA	ν	Dec	d	HP
0	176°29.2	S15°32.8	198°51.1	7.7'	S16°37.6	4.7'	58.4'	
1	191°29.2	32.0	213°17.8	7.7'	16°32.8	4.8'	58.4'	
2	206°29.1	31.2	227°44.5	7.7'	16°28.0	4.9'	58.5'	
3	221°29.1	.. 30.5	242°11.2	7.7'	16°23.1	5.0'	58.5'	
4	236°29.1	29.7	256°37.9	7.7'	16°18.0	5.1'	58.5'	
5	251°29.0	28.9	271°04.5	7.7'	16°12.9	5.2'	58.5'	
6	266°29.0	S15°28.1	285°31.2	7.7'	S16°07.6	5.3'	58.6'	
7	281°28.9	27.4	299°57.8	7.6'	16°02.3	5.4'	58.6'	
8	296°28.9	26.6	314°24.5	7.6'	15°56.8	5.5'	58.6'	
9	311°28.9	.. 25.8	328°51.1	7.6'	15°51.3	5.6'	58.7'	
10	326°28.8	25.0	343°17.7	7.6'	15°45.6	5.7'	58.7'	
11	341°28.8	24.3	357°44.4	7.6'	15°39.8	5.8'	58.7'	
12	356°28.7	S15°23.5	12°11.0	7.6'	S15°33.9	5.9'	58.8'	
13	11°28.7	22.7	26°37.6	7.6'	15°28.0	6.0'	58.8'	
14	26°28.7	21.9	41°04.2	7.6'	15°21.9	6.1'	58.8'	
15	41°28.6	.. 21.1	55°30.8	7.6'	15°15.7	6.2'	58.9'	
16	56°28.6	20.4	69°57.4	7.6'	15°09.4	6.3'	58.9'	
17	71°28.6	19.6	84°24.0	7.6'	15°03.0	6.4'	58.9'	
18	86°28.5	S15°18.8	98°50.5	7.6'	S14°56.5	6.5'	58.9'	
19	101°28.5	18.0	113°17.2	7.6'	14°49.9	6.6'	59.0'	
20	116°28.5	17.2	127°43.8	7.6'	14°43.3	6.7'	59.0'	
21	131°28.4	.. 16.5	142°10.5	7.6'	14°36.5	6.8'	59.0'	
22	146°28.4	15.7	156°37.1	7.6'	14°29.6	6.9'	59.1'	
23	161°28.4	14.9	171°03.7	7.6'	14°22.6	7.0'	59.1'	
SD.=16.2		d=0.8			S.D.=16.0			
Mon		GHA	Dec	GHA	ν	Dec	d	HP
0	176°28.3	S15°14.1	185°30.3	7.6'	S14°15.6	7.1'	59.1'	
1	191°28.3	13.3	199°56.9	7.6'	14°08.4	7.2'	59.1'	
2	206°28.3	12.5	214°23.5	7.6'	14°01.1	7.3'	59.2'	
3	221°28.2	.. 11.7	228°50.2	7.6'	13°53.8	7.4'	59.2'	
4	236°28.2	11.0	243°16.8	7.6'	13°46.3	7.5'	59.2'	
5	251°28.2	10.2	257°43.5	7.6'	13°38.8	7.6'	59.2'	
6	266°28.1	S15°09.4	272°10.1	7.7'	S13°31.1	7.7'	59.3'	
7	281°28.1	08.6	286°36.8	7.7'	13°23.4	7.8'	59.3'	
8	296°28.1	07.8	301°03.4	7.7'	13°15.6	7.9'	59.3'	
9	311°28.0	.. 07.0	315°30.1	7.7'	13°07.7	8.0'	59.3'	
10	326°28.0	06.2	329°56.8	7.7'	12°59.7	8.0'	59.4'	
11	341°28.0	05.5	344°23.5	7.7'	12°51.6	8.1'	59.4'	
12	356°27.9	S15°04.7	358°50.2	7.7'	S12°43.4	8.2'	59.4'	
13	11°27.9	03.9	13°16.9	7.7'	12°35.2	8.3'	59.4'	
14	26°27.9	03.1	27°43.6	7.7'	12°26.8	8.4'	59.5'	
15	41°27.9	.. 02.3	42°10.3	7.7'	12°18.4	8.5'	59.5'	
16	56°27.8	01.5	56°37.1	7.7'	12°09.9	8.6'	59.5'	
17	71°27.8	15°00.7	71°03.8	7.8'	12°01.3	8.6'	59.5'	
18	86°27.8	S14°59.9	85°30.6	7.8'	S11°52.6	8.7'	59.5'	
19	101°27.8	59.1	99°57.4	7.8'	11°43.9	8.8'	59.6'	
20	116°27.7	58.3	114°24.2	7.8'	11°35.0	8.9'	59.6'	
21	131°27.7	.. 57.5	128°51.0	7.8'	11°26.1	9.0'	59.6'	
22	146°27.7	56.7	143°17.8	7.8'	11°17.1	9.0'	59.6'	
23	161°27.7	56.0	157°44.6	7.8'	11°08.1	9.1'	59.7'	
SD.=16.2		d=0.8			S.D.=16.2			

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

**February 09, 10, 11 UT (Tue., Wed., Thu.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	138°31.9	207°02.9	\$21°40.5	271°43.2	\$16°02.4	325°37.7	N04°36.0	244°53.7	S20°54.2	Alpheratz	357°41.8	29°10.8					
1	153°34.3	222°02.1	40.1	286°44.5	02.7	340°40.4	36.1	259°55.9	54.2	Ankaa	353°14.3	-42°13.4					
2	168°36.8	237°01.3	39.8	301°45.7	03.1	355°43.1	36.2	274°58.2	54.2	Schedar	349°38.7	56°37.7					
3	183°39.3	252°00.4	· · 39.5	316°47.0	· · 03.4	10°45.8	· · 36.3	290°00.5	· · 54.2	Diphda	348°54.3	-17°54.1					
4	198°41.7	266°59.6	39.2	331°48.3	03.7	25°48.4	36.4	305°02.8	54.2	Achernar	335°25.8	-57°09.7					
5	213°44.2	281°58.7	38.8	346°49.6	04.1	40°51.1	36.5	320°05.0	54.2	Hamal	327°58.8	23°32.2					
6	228°46.7	296°57.9	\$21°38.5	1°50.9	\$16°04.4	55°53.8	N04°36.6	335°07.3	S20°54.3	Polaris	316°57.6	89°20.2					
7	243°49.1	311°57.0	38.2	16°52.1	04.7	70°56.5	36.7	350°09.6	54.3	Acamar	315°17.0	-40°14.8					
8	258°51.6	326°56.2	37.8	31°53.4	05.1	85°59.2	36.8	5°11.9	54.3	Menkar	314°13.2	4°08.9					
9	273°54.0	341°55.4	· · 37.5	46°54.7	· · 05.4	101°01.8	· · 36.9	20°14.1	· · 54.3	Mirfak	308°37.7	49°55.1					
10	288°56.5	356°54.5	37.1	61°56.0	05.7	116°04.5	37.0	35°16.4	54.3	Aldebaran	290°47.2	16°32.3					
11	303°59.0	11°53.7	36.8	76°57.3	06.1	131°07.2	37.1	50°18.7	54.3	Rigel	281°10.1	-8°11.3					
12	319°01.4	26°52.8	\$21°36.5	91°58.5	\$16°06.4	146°09.9	N04°37.2	65°21.0	S20°54.3	Capella	280°31.5	46°00.7					
13	334°03.9	41°52.0	36.1	106°59.8	06.7	161°12.6	37.3	80°23.2	54.4	Bellatrix	278°29.9	6°21.6					
14	349°06.4	56°51.2	35.8	122°01.1	07.1	176°15.3	37.4	95°25.5	54.4	El Nath	278°10.1	28°37.1					
15	4°08.8	71°50.3	· · 35.4	137°02.4	· · 07.4	191°17.9	· · 37.5	110°27.8	· · 54.4	Alnilam	275°44.3	-1°11.8					
16	19°11.3	86°49.5	35.1	152°03.7	07.7	206°20.6	37.6	125°30.1	54.4	Betelgeuse	270°59.1	7°24.3					
17	34°13.8	101°48.7	34.8	167°05.0	08.0	221°23.3	37.7	140°32.4	54.4	Canopus	263°54.9	-52°42.7					
18	49°16.2	116°47.8	\$21°34.4	182°06.2	\$16°08.4	236°26.0	N04°37.8	155°34.6	S20°54.4	Sirius	258°31.9	-16°44.7					
19	64°18.7	131°47.0	34.1	197°07.5	08.7	251°28.7	37.9	170°36.9	54.5	Adhara	255°10.8	-29°00.0					
20	79°21.2	146°46.1	33.7	212°08.8	09.0	266°31.3	38.0	185°39.2	54.5	Procyon	244°57.5	5°10.7					
21	94°23.6	161°45.3	· · 33.4	227°10.1	· · 09.4	281°34.0	· · 38.1	200°41.5	· · 54.5	Pollux	243°25.2	27°59.0					
22	109°26.1	176°44.5	33.0	242°11.4	09.7	296°36.7	38.2	215°43.8	54.5	Avior	234°16.6	-59°33.9					
23	124°28.5	191°43.6	32.7	257°12.7	10.0	311°39.4	38.4	230°46.0	54.5	Suhail	222°50.6	-43°30.1					
Mer.pass.:14:43			v-0.8 d0.3 m-3.8	v1.3 d-0.3 m0.7	v2.7 d0.1 m-2.2	v2.3 d-0.0 m0.5	Miaplacidus			221°38.2	-69°47.2						
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.0	-8°43.9	
0	139°31.0	206°42.8	\$21°32.3	272°13.9	\$16°10.3	326°42.1	N04°38.5	245°48.3	S20°54.5	Regulus	207°41.3	11°53.1					
1	154°33.5	221°42.0	31.9	287°15.2	10.7	341°44.8	38.6	260°50.6	54.5	Dubhe	193°49.0	61°39.6					
2	169°35.9	236°41.1	31.6	302°16.5	11.0	356°47.4	38.7	275°52.9	54.6	Denebola	182°31.6	14°28.8					
3	184°38.4	251°40.3	· · 31.2	317°17.8	· · 11.3	11°50.1	· · 38.8	290°55.1	· · 54.6	Gienah	175°50.2	-17°37.9					
4	199°40.9	266°39.5	30.9	332°19.1	11.7	26°52.8	38.9	305°57.4	54.6	Acrux	173°06.6	-63°11.1					
5	214°43.3	281°38.6	30.5	347°20.4	12.0	41°55.5	39.0	320°59.7	54.6	Gacrux	171°58.4	-57°12.0					
6	229°45.8	296°37.8	\$21°30.2	2°21.7	\$16°12.3	56°58.2	N04°39.1	336°02.0	S20°54.6	Alioth	166°18.9	55°52.1					
7	244°48.3	311°37.0	29.8	17°22.9	12.6	72°00.9	39.2	351°04.3	54.6	Spica	158°29.2	-11°14.7					
8	259°50.7	326°36.1	29.4	32°24.2	13.0	87°03.6	39.3	6°06.5	54.7	Alkaid	152°57.4	49°13.8					
9	274°53.2	341°35.3	· · 29.1	47°25.5	· · 13.3	102°06.2	· · 39.4	21°08.8	· · 54.7	Hadar	148°45.0	-60°26.7					
10	289°55.6	356°34.5	28.7	62°26.8	13.6	117°08.9	39.5	36°11.1	54.7	Menken	148°05.3	-36°26.7					
11	304°58.1	11°33.6	28.3	77°28.1	13.9	132°11.6	39.6	51°13.4	54.7	Arcturus	145°54.0	19°05.8					
12	320°00.6	26°32.8	\$21°28.0	92°29.4	\$16°14.3	147°14.3	N04°39.7	66°15.7	S20°54.7	Rigel Kent.	139°49.0	-60°53.7					
13	335°03.0	41°32.0	27.6	107°30.7	14.6	162°17.0	39.8	81°17.9	54.7	Kochab	137°20.2	74°05.1					
14	350°05.5	56°31.1	27.2	122°32.0	14.9	177°19.7	39.9	96°20.2	54.7	Zuben' ubi	137°03.4	-16°06.4					
15	5°08.0	71°30.3	· · 26.9	137°33.3	· · 15.2	192°22.4	· · 40.0	111°22.5	· · 54.8	Alphecca	126°09.5	26°39.6					
16	20°10.4	86°29.5	26.5	152°34.5	15.6	207°25.0	40.1	126°24.8	54.8	Antares	112°24.1	-26°27.8					
17	35°12.9	101°28.6	26.1	167°35.8	15.9	222°27.7	40.2	141°27.1	54.8	Atria	107°24.5	-69°02.9					
18	50°15.4	116°27.8	\$21°25.8	182°37.1	\$16°16.2	237°30.4	N04°40.3	156°29.4	S20°54.8	Sabik	102°10.6	-15°44.5					
19	65°17.8	131°27.0	25.4	197°38.4	16.5	252°33.1	40.4	171°31.6	54.8	Rasalhague	96°05.0	12°33.0					
20	80°20.3	146°26.1	25.0	212°39.7	16.9	267°35.8	40.5	186°33.9	54.8	Eltanin	90°45.6	51°29.1					
21	95°22.8	161°25.3	· · 24.6	227°41.0	· · 17.2	282°38.5	· · 40.6	201°36.2	· · 54.9	Kaus Aust.	83°41.7	-34°22.3					
22	110°25.2	176°24.5	24.2	242°42.3	17.5	297°41.2	40.8	216°38.5	54.9	Vega	80°38.0	38°47.9					
23	125°27.7	191°23.6	23.9	257°43.6	17.8	312°43.9	40.9	231°40.8	54.9	Nunki	75°56.4	-26°16.4					
Mer.pass.:14:40			v-0.8 d0.4 m-3.8	v1.3 d-0.3 m0.7	v2.7 d0.1 m-2.3	v2.3 d-0.0 m0.5	Altair			Altair	62°06.8	8°54.7					
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°17.1	-56°40.8					
0	140°30.1	206°22.8	\$21°23.5	272°44.9	\$16°18.2	327°46.5	N04°41.0	246°43.0	Deneb	49°30.6	45°20.3						
1	155°32.6	221°22.0	23.1	287°46.2	18.5	342°49.2	41.1	261°45.3	54.9	Markab	33°45.7	9°57.0					
2	170°35.1	236°21.2	22.7	302°47.4	18.8	357°51.9	41.2	276°47.6	54.9	Fomalhaut	15°22.4	-29°32.3					
3	185°37.5	251°20.3	· · 22.3	317°48.7	· · 19.1	12°54.6	· · 41.3	291°49.9	· · 54.9	Scheat	13°51.9	28°10.2					
4	200°40.0	266°19.5	22.0	332°50.0	19.4	27°57.3	41.4	306°52.2	55.0	Markab	13°36.8	15°17.5					
5	215°42.5	281°18.7	21.6	347°51.3	19.8	43°00.0	41.5	321°54.5	55.0	Feb 09 Tue	15°22.4	-29°32.3					
6	230°44.9	296°17.8	\$21°21.2	2°52.6	\$16°20.1	58°02.7	N04°41.6	336°56.7	S20°55.0	Venus	68°31.1	10:12					
7	245°47.4	311°17.0	20.8	17°53.9	20.4	73°05.4	41.7	351°59.0	55.0	Mars	133°11.3	05:53					
8	260°49.9	326°16.2	20.4	32°55.2	20.7	88°08.1	41.8	7°01.3	55.0	Jupiter	187°05.9	02:17					
9	275°52.3	341°15.4	· · 20.0	47°56.5	· · 21.1	103°10.8	· · 41.9	22°03.6	· · 55.0	Saturn	106°21.8	07:39					
10	290°54.8	356°14.5	19.6	62°57.8	21.4	118°13.4	42.0	37°05.9	55.0	Feb 10 Wed	15°22.4	-29°32.3					
11	305°57.2	11°13.7	19.2	77°59.1	21.7	133°16.1	42.1	52°08.2	55.1	Venus	67°11.8	10:14					
12	320°59.7	26°12.9	\$21°18.8	93°00.4	\$16°22.0	148°18.8	N04°42.2	67°10.4	S20°55.1	Mars	132°42.9	05:51					
13	336°02.2	41°12.1	18.4	108°01.7	22.3	163°21.5	42.3	82°12.7	55.1	Jupiter	187°11.1	02:13					
14	351°04.6	56°11															

DUT1 = UT1-UTC = +0.0134 sec ΔT = TT-UT1 = +68.1706 sec

2016 February 09 to Feb. 11 UT

h		Sun			Moon			
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.6	S14°55.2	172°11.4	7.9'	S10°58.9	9.2'	59.7'	
1	191°27.6	54.4	186°38.3	7.9'	10°49.7	9.3'	59.7'	
2	206°27.6	53.6	201°05.2	7.9'	10°40.4	9.3'	59.7'	
3	221°27.6	.. 52.8	215°32.1	7.9'	10°31.0	9.4'	59.7'	
4	236°27.5	52.0	229°59.0	7.9'	10°21.6	9.5'	59.7'	
5	251°27.5	51.2	244°25.9	7.9'	10°12.1	9.5'	59.8'	
6	266°27.5	S14°50.4	258°52.8	7.9'	S10°02.5	9.6'	59.8'	
7	281°27.5	49.6	273°19.8	8.0'	09°52.9	9.7'	59.8'	
8	296°27.4	48.8	287°46.7	8.0'	09°43.2	9.7'	59.8'	
9	311°27.4	.. 48.0	302°13.7	8.0'	09°33.4	9.8'	59.8'	
10	326°27.4	47.2	316°40.7	8.0'	09°23.6	9.9'	59.8'	
11	341°27.4	46.4	331°07.7	8.0'	09°13.7	9.9'	59.9'	
12	356°27.4	S14°45.6	345°34.7	8.0'	S09°03.7	10.0'	59.9'	
13	11°27.3	44.8	0°01.8	8.0'	08°53.7	10.1'	59.9'	
14	26°27.3	44.0	14°28.8	8.1'	08°43.6	10.1'	59.9'	
15	41°27.3	.. 43.2	28°55.9	8.1'	08°33.4	10.2'	59.9'	
16	56°27.3	42.4	43°23.0	8.1'	08°23.2	10.2'	59.9'	
17	71°27.3	41.6	57°50.1	8.1'	08°12.9	10.3'	59.9'	
18	86°27.2	S14°40.8	72°17.2	8.1'	S08°02.6	10.3'	60.0'	
19	101°27.2	40.0	86°44.3	8.1'	07°52.3	10.4'	60.0'	
20	116°27.2	39.2	101°11.5	8.2'	07°41.8	10.5'	60.0'	
21	131°27.2	.. 38.4	115°38.7	8.2'	07°31.4	10.5'	60.0'	
22	146°27.2	37.6	130°05.8	8.2'	07°20.8	10.6'	60.0'	
23	161°27.1	36.8	144°33.0	8.2'	07°10.3	10.6'	60.0'	
	SD.=16.2	d=0.8			S.D.=16.3			
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.1	S14°36.0	159°00.3	8.2'	S06°59.6	10.6'	60.0'	
1	191°27.1	35.2	173°27.5	8.2'	06°49.0	10.7'	60.0'	
2	206°27.1	34.4	187°54.7	8.3'	06°38.2	10.7'	60.1'	
3	221°27.1	.. 33.6	202°22.0	8.3'	06°27.5	10.8'	60.1'	
4	236°27.1	32.7	216°49.3	8.3'	06°16.7	10.8'	60.1'	
5	251°27.1	31.9	231°16.6	8.3'	06°05.8	10.9'	60.1'	
6	266°27.0	S14°31.1	245°43.9	8.3'	S05°55.0	10.9'	60.1'	
7	281°27.0	30.3	260°11.2	8.3'	05°44.0	10.9'	60.1'	
8	296°27.0	29.5	274°38.6	8.4'	05°33.1	11.0'	60.1'	
9	311°27.0	.. 28.7	289°05.9	8.4'	05°22.1	11.0'	60.1'	
10	326°27.0	27.9	303°33.3	8.4'	05°11.0	11.0'	60.1'	
11	341°27.0	27.1	318°00.7	8.4'	05°00.0	11.1'	60.1'	
12	356°27.0	S14°26.3	332°28.1	8.4'	S04°48.9	11.1'	60.1'	
13	11°26.9	25.5	346°55.5	8.4'	04°37.8	11.1'	60.1'	
14	26°26.9	24.7	1°22.9	8.4'	04°26.6	11.2'	60.1'	
15	41°26.9	.. 23.9	15°50.4	8.5'	04°15.4	11.2'	60.1'	
16	56°26.9	23.0	30°17.9	8.5'	04°04.2	11.2'	60.1'	
17	71°26.9	22.2	44°45.3	8.5'	03°52.9	11.3'	60.1'	
18	86°26.9	S14°21.4	59°12.8	8.5'	S03°41.7	11.3'	60.2'	
19	101°26.9	20.6	73°40.3	8.5'	03°30.4	11.3'	60.2'	
20	116°26.9	19.8	88°07.8	8.5'	03°19.1	11.3'	60.2'	
21	131°26.9	.. 19.0	102°35.3	8.5'	03°07.8	11.3'	60.2'	
22	146°26.8	18.2	117°02.9	8.5'	02°56.4	11.4'	60.2'	
23	161°26.8	17.4	131°30.4	8.6'	02°45.0	11.4'	60.2'	
	SD.=16.2	d=0.8			S.D.=16.4			
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	176°26.8	S14°16.5	145°58.0	8.6'	S02°33.7	11.4'	60.2'	
1	191°26.8	15.7	160°25.6	8.6'	02°22.3	11.4'	60.2'	
2	206°26.8	14.9	174°53.2	8.6'	02°10.8	11.4'	60.2'	
3	221°26.8	.. 14.1	189°20.7	8.6'	01°59.4	11.4'	60.2'	
4	236°26.8	13.3	203°48.4	8.6'	01°48.0	11.4'	60.2'	
5	251°26.8	12.5	218°16.0	8.6'	01°36.5	11.5'	60.2'	
6	266°26.8	S14°11.6	232°43.6	8.6'	S01°25.1	11.5'	60.2'	
7	281°26.8	10.8	247°11.2	8.6'	01°13.6	11.5'	60.2'	
8	296°26.8	10.0	261°38.9	8.6'	01°02.1	11.5'	60.2'	
9	311°26.8	.. 09.2	276°06.5	8.7'	00°50.7	11.5'	60.2'	
10	326°26.8	08.4	290°34.2	8.7'	00°39.2	11.5'	60.2'	
11	341°26.8	07.5	305°01.9	8.7'	00°27.7	11.5'	60.2'	
12	356°26.8	S14°06.7	319°29.5	8.7'	S00°16.2	11.5'	60.2'	
13	11°26.7	05.9	333°57.2	8.7'	S00°04.8	11.5'	60.1'	
14	26°26.7	05.1	348°24.9	8.7'	N00°06.7	11.5'	60.1'	
15	41°26.7	.. 04.3	2°52.6	8.7'	00°18.2	11.5'	60.1'	
16	56°26.7	03.4	17°20.3	8.7'	00°29.7	11.5'	60.1'	
17	71°26.7	02.6	31°48.0	8.7'	00°41.1	11.5'	60.1'	
18	86°26.7	S14°01.8	46°15.8	8.7'	N00°52.6	11.5'	60.1'	
19	101°26.7	01.0	60°43.5	8.7'	01°04.0	11.4'	60.1'	
20	116°26.7	14°00.2	75°11.2	8.7'	01°15.5	11.4'	60.1'	
21	131°26.7	13°59.3	89°38.9	8.7'	01°26.9	11.4'	60.1'	
22	146°26.7	58.5	104°06.7	8.7'	01°38.3	11.4'	60.1'	
23	161°26.7	57.7	118°34.4	8.7'	01°49.7	11.4'	60.1'	
	SD.=16.2	d=0.8			S.D.=16.4			

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	Mer.		Mer. Pass.	Upper
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass	hh:mm	hh:mm
09	14:09	14:11	12:14	13:00	00:32
10	14:11	14:12	12:14	13:54	01:27
11	14:13	14:13	12:14	14:48	02:21



**February 12, 13, 14 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	141°29.3	206°03.0	S21°14.0	273°15.9	S16°25.9	328°51.1	N04°43.5	247°37.9	S20°55.3	Alpheratz	357°41.9	29°10.8					
1	156°31.7	221°02.2	13.6	288°17.2	26.2	343°53.8	43.6	262°40.2	55.3	Ankaa	353°14.3	-42°13.4					
2	171°34.2	236°01.3	13.2	303°18.5	26.5	358°56.5	43.7	277°42.4	55.3	Schedar	349°38.7	56°37.6					
3	186°36.7	251°00.5	.. 12.8	318°19.8	.. 26.8	13°59.2	.. 43.8	292°44.7	.. 55.3	Diphda	348°54.3	-17°54.1					
4	201°39.1	265°59.7	12.4	333°21.1	27.1	29°01.9	43.9	307°47.0	55.3	Achernar	335°25.8	-57°09.7					
5	216°41.6	280°58.9	12.0	348°22.4	27.5	44°04.6	44.1	322°49.3	55.3	Hamal	327°58.8	23°32.2					
6	231°44.1	295°58.1	S21°11.6	3°23.7	S16°27.8	59°07.3	N04°44.2	337°51.6	S20°55.3	Polaris	316°59.1	89°20.2					
7	246°46.5	310°57.2	11.2	18°25.0	28.1	74°10.0	44.3	352°53.9	55.4	Acamar	315°17.1	-40°14.8					
8	261°49.0	325°56.4	10.7	33°26.3	28.4	89°12.7	44.4	7°56.2	55.4	Menkar	314°13.2	4°08.9					
9	276°51.5	340°55.6	.. 10.3	48°27.6	.. 28.7	104°15.4	.. 44.5	22°58.5	.. 55.4	Mirfak	308°37.7	49°55.1					
10	291°53.9	355°54.8	09.9	63°28.9	29.0	119°18.1	44.6	38°00.7	55.4	Aldebaran	290°47.2	16°32.3					
11	306°56.4	10°54.0	09.5	78°30.2	29.4	134°20.8	44.7	53°03.0	55.4	Rigel	281°10.2	-8°11.3					
12	321°58.8	25°53.1	S21°09.1	93°31.5	S16°29.7	149°23.5	N04°44.8	68°05.3	S20°55.4	Capella	280°31.5	46°00.7					
13	337°01.3	40°52.3	08.7	108°32.8	30.0	164°26.2	44.9	83°07.6	55.4	Bellatrix	278°29.9	6°21.6					
14	352°03.8	55°51.5	08.2	123°34.1	30.3	179°28.9	45.0	98°09.9	55.5	Elnath	278°10.1	28°37.1					
15	7°06.2	70°50.7	.. 07.8	138°35.4	.. 30.6	194°31.6	.. 45.1	113°12.2	.. 55.5	Alnilam	275°44.4	-1°11.8					
16	22°08.7	85°49.9	07.4	153°36.7	30.9	209°34.3	45.2	128°14.5	55.5	Betelgeuse	270°59.1	7°24.3					
17	37°11.2	100°49.0	07.0	168°38.1	31.3	224°37.0	45.4	143°16.8	55.5	Canopus	263°55.0	-52°42.7					
18	52°13.6	115°48.2	S21°06.5	183°39.4	S16°31.6	239°39.7	N04°45.5	158°19.0	S20°55.5	Sirius	258°31.9	-16°44.7					
19	67°16.1	130°47.4	06.1	198°40.7	31.9	254°42.4	45.6	173°21.3	55.5	Adhara	255°10.8	-29°00.0					
20	82°18.6	145°46.6	05.7	213°42.0	32.2	269°45.1	45.7	188°23.6	55.5	Procyon	244°57.6	5°10.7					
21	97°21.0	160°45.8	.. 05.3	228°43.3	.. 32.5	284°47.8	.. 45.8	203°25.9	.. 55.6	Pollux	243°25.2	27°59.0					
22	112°23.5	175°45.0	04.8	243°44.6	32.8	299°50.5	45.9	218°28.2	55.6	Avior	234°16.6	-59°34.0					
23	127°26.0	190°44.1	04.4	258°45.9	33.1	314°53.2	46.0	233°30.5	55.6	Suhail	222°50.6	-43°30.1					
Mer.pass.:14:32			v-0.8 d0.4 m-3.8	v1.3 d-0.3 m0.7	v2.7 d0.1 m-2.3	v2.3 d-0.0 m0.5	Miaplacidus			Zuben el ubi	221°38.2	-69°47.2					
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.0	-8°43.9					
0	142°28.4	205°43.3	S21°04.0	273°47.2	S16°33.5	329°55.9	N04°46.1	248°32.8	S20°55.6	Regulus	207°41.3	11°53.1					
1	157°30.9	220°42.5	03.5	288°48.5	33.8	344°58.6	46.2	263°35.1	55.6	Dubhe	193°49.0	61°39.6					
2	172°33.3	235°41.7	03.1	303°49.8	34.1	0°01.3	46.3	278°37.4	55.6	Denebola	182°31.6	14°28.8					
3	187°35.8	250°40.9	.. 02.7	318°51.1	.. 34.4	15°04.0	.. 46.4	293°39.7	.. 55.6	Gienah	175°50.2	-17°37.9					
4	202°38.3	265°40.1	02.2	333°52.4	34.7	30°06.7	46.6	308°41.9	55.7	Acrux	173°06.6	-63°11.1					
5	217°40.7	280°39.3	01.8	348°53.7	35.0	45°09.4	46.7	323°44.2	55.7	Gacrux	171°58.3	-57°12.0					
6	232°43.2	295°38.4	S21°01.3	3°55.0	S16°35.3	60°12.1	N04°46.8	338°46.5	S20°55.7	Alioth	166°18.9	55°52.1					
7	247°45.7	310°37.6	00.9	18°56.3	35.6	75°14.8	46.9	353°48.8	55.7	Alkaid	152°57.3	-11°14.7					
8	262°48.1	325°36.8	00.5	33°57.6	36.0	90°17.5	47.0	8°51.1	55.7	Hadar	148°44.9	-60°26.7					
9	277°50.6	340°36.0	21°00.0	48°58.9	.. 36.3	105°20.2	.. 47.1	23°53.4	.. 55.7	Menkent	148°05.2	-36°26.7					
10	292°53.1	355°35.2	20°59.6	64°00.2	36.6	120°22.9	47.2	38°55.7	55.7	Arcturus	145°54.0	19°05.8					
11	307°55.5	10°34.4	59.1	79°01.5	36.9	135°25.6	47.3	53°58.0	55.7	Rigil Kent.	139°49.0	-60°53.7					
12	322°58.0	25°33.6	S20°58.7	94°02.9	S16°37.2	150°28.3	N04°47.4	69°00.3	S20°55.8	Kochab	137°20.1	74°05.1					
13	338°00.5	40°32.8	58.2	109°04.2	37.5	165°31.0	47.5	84°02.6	55.8	Zuben el ubi	137°03.3	-16°06.4					
14	353°02.9	55°31.9	57.8	124°05.5	37.8	180°33.7	47.7	99°04.9	55.8	Alphecca	126°09.5	26°39.6					
15	8°05.4	70°31.1	.. 57.3	139°06.8	.. 38.1	195°36.4	.. 47.8	114°07.1	.. 55.8	Antares	112°24.1	-26°27.8					
16	23°07.8	85°30.3	56.9	154°08.1	38.5	210°39.1	47.9	129°09.4	55.8	Atria	107°24.5	-69°02.9					
17	38°10.3	100°29.5	56.4	169°09.4	38.8	225°41.8	48.0	144°11.7	55.8	Sabik	102°10.6	-15°44.5					
18	53°12.8	115°28.7	S20°56.0	184°10.7	S16°39.1	240°44.5	N04°48.1	159°14.0	S20°55.8	Shaula	96°19.7	-37°06.6					
19	68°15.2	130°27.9	55.5	199°12.0	39.4	255°47.2	48.2	174°16.3	55.9	Rasalhague	96°04.9	12°32.9					
20	83°17.7	145°27.1	55.1	214°13.3	39.7	270°49.9	48.3	189°18.6	55.9	Eltanin	90°45.6	51°29.1					
21	98°20.2	160°26.3	.. 54.6	229°14.6	.. 40.0	285°52.6	.. 48.4	204°20.9	.. 55.9	Kaus Aust.	83°41.7	-34°22.3					
22	113°22.6	175°25.5	54.2	244°16.0	40.3	300°55.3	48.5	219°23.2	55.9	Vega	80°38.0	38°47.9					
23	128°25.1	190°24.7	53.7	259°17.3	40.6	315°58.0	48.7	234°25.5	55.9	Nunki	75°56.4	-26°16.4					
Mer.pass.:14:28			v-0.8 d0.4 m-3.8	v1.3 d-0.3 m0.6	v2.7 d0.1 m-2.3	v2.3 d-0.0 m0.5	Altair			Altair	62°06.8	8°54.7					
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°17.0	-56°40.8					
0	143°27.6	205°23.8	S20°53.3	274°18.6	S16°40.9	331°00.7	N04°48.8	249°27.8	S20°55.9	Deneb	49°30.6	45°20.3					
1	158°30.0	220°23.0	52.8	289°19.9	41.3	346°03.4	48.9	264°30.1	55.9	Scheat	33°45.7	9°56.9					
2	173°32.5	235°22.2	52.3	304°21.2	41.6	1°06.1	49.0	279°32.4	56.0	Markab	13°51.9	28°10.2					
3	188°34.9	250°21.4	.. 51.9	319°22.5	.. 41.9	16°08.8	.. 49.1	294°34.7	.. 56.0	Feb 12 Fri	15°22.4	-29°32.3					
4	203°37.4	265°20.6	51.4	334°23.8	42.2	31°11.5	49.2	309°37.0	56.0	Venus	64°33.7	10:16					
5	218°39.9	280°19.8	50.9	349°25.1	42.5	46°14.2	49.3	324°39.2	56.0	Mars	131°46.7	05:46					
6	233°42.3	295°19.0	S20°50.5	4°26.5	S16°42.8	61°16.9	N04°49.4	339°41.5	S20°56.0	Jupiter	187°21.9	02:04					
7	248°44.8	310°18.2	50.0	19°27.8	43.1	76°19.6	49.5	354°43.8	56.0	Saturn	106°08.6	07:28					
8	263°47.3	325°17.4	49.5	34°29.1	43.4	91°22.3	49.7	9°46.1	56.0	Feb 13 Sat	63°14.9	10:18					
9	278°49.7	340°16.6	.. 49.1	49°30.4	.. 43.7	106°25.1	.. 49.8	24°48.4	.. 56.0	Venus	131°18.8	05:44					
10	293°52.2	355°15.8	48.6	64°31.7	44.0	121°27.8	49.9	39°50.7	56.1	Mars	187°27.4	02:00					
11	308°54.7	10°15.0	48.1	79°33.0	44.3	136°30.5	50.0	54°53.0	56.1	Jupiter	106°04.4	07:25					
12	323°57.1	25°14.2	S20°47.7	94°34.3	S16°44.6	151°33.2	N04°50.1	69°55.3	S20°56.1	Saturn	106°04.4	07:25					
13	338°59.6	40°13.4	47.2	109°35.7	45.0	166°35.9	50.2	84°57.6	56.1	Feb 14 Sun	61°56.3	10:19					
14	354°02.1	55°12.6	46.7	124°37.0	45.3	181°38.6	50.3	99°59.9	56.1	Venus	130°51.0	05:42					
15	9°04.5	70°11.8	.. 46.2	139°38.3	.. 45.6	196°41.3	.. 50.4	115°02.2	.. 56.1	Mars	187°33.2	01:56					
16	24°07.0	85°11.0	45.8	154°39.6	45.9	211°44.0	50.6	130°04.5	56.1	Jupiter	106°00.2	07:21					
17	39°09.4	100°10.2	45.3	169°40.9	46.2	226°46.7	50.7	145°06.8	56.1	Saturn	235°20.6	56.2					
18	54°11.9	115°09.4	S20°44.8	184°42.2	S16°46.5	241°49.4	N04°50.8	160°09.1	S20°56.2	Horizontal parallax							
19	69°14.4	130°08.6	44.3	199°43.6	46.8	256°52.1	50.9	175°11.4	56.2	Venus:	0.1						
20	84°16.8	145°0															

DUT1 = UT1-UTC = +0.0086 sec ΔT = TT-UT1 = +68.1754 sec

2016 February 12 to Feb. 14 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	176°26.7	S13°56.9	133°02.2	8.7'	N02°01.1	11.4'	60.1'
1	191°26.7	56.0	147°29.9	8.7'	02°12.5	11.4'	60.1'
2	206°26.7	55.2	161°57.7	8.8'	02°23.8	11.3'	60.1'
3	221°26.7	.. 54.4	176°25.4	8.8'	02°35.2	11.3'	60.1'
4	236°26.7	53.6	190°53.2	8.8'	02°46.5	11.3'	60.1'
5	251°26.7	52.7	205°20.9	8.8'	02°57.8	11.3'	60.0'
6	266°26.7	S13°51.9	219°48.7	8.8'	N03°09.0	11.3'	60.0'
7	281°26.7	51.1	234°16.4	8.8'	03°20.3	11.2'	60.0'
8	296°26.7	50.3	248°44.2	8.8'	03°31.5	11.2'	60.0'
9	311°26.7	.. 49.4	263°12.0	8.8'	03°42.7	11.2'	60.0'
10	326°26.7	48.6	277°39.7	8.8'	03°53.9	11.2'	60.0'
11	341°26.7	47.8	292°07.5	8.8'	04°05.0	11.1'	60.0'
12	356°26.7	S13°46.9	306°35.2	8.8'	N04°16.1	11.1'	60.0'
13	11°26.8	46.1	321°03.0	8.8'	04°27.2	11.1'	60.0'
14	26°26.8	45.3	335°30.7	8.8'	04°38.2	11.0'	59.9'
15	41°26.8	.. 44.5	349°58.5	8.8'	04°49.2	11.0'	59.9'
16	56°26.8	43.6	4°26.2	8.7'	05°00.2	11.0'	59.9'
17	71°26.8	42.8	18°54.0	8.7'	05°11.2	10.9'	59.9'
18	86°26.8	S13°42.0	33°21.7	8.7'	N05°22.1	10.9'	59.9'
19	101°26.8	41.1	47°49.5	8.7'	05°32.9	10.8'	59.9'
20	116°26.8	40.3	62°17.2	8.7'	05°43.8	10.8'	59.9'
21	131°26.8	.. 39.5	76°44.9	8.7'	05°54.5	10.8'	59.9'
22	146°26.8	38.6	91°12.7	8.7'	06°05.3	10.7'	59.8'
23	161°26.8	37.8	105°40.4	8.7'	06°16.0	10.7'	59.8'
	SD.=16.2	d=0.8			S.D.=16.3		

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°26.8	S13°37.0	120°08.1	8.7'	N06°26.6	10.6'	59.8'
1	191°26.8	36.1	134°35.8	8.7'	06°37.3	10.6'	59.8'
2	206°26.8	35.3	149°03.5	8.7'	06°47.8	10.5'	59.8'
3	221°26.8	.. 34.5	163°31.2	8.7'	06°58.3	10.5'	59.8'
4	236°26.9	33.6	177°58.9	8.7'	07°08.8	10.4'	59.8'
5	251°26.9	32.8	192°26.6	8.7'	07°19.2	10.4'	59.7'
6	266°26.9	S13°32.0	206°54.3	8.7'	N07°29.6	10.3'	59.7'
7	281°26.9	31.1	221°22.0	8.7'	07°39.9	10.3'	59.7'
8	296°26.9	30.3	235°49.6	8.7'	07°50.2	10.2'	59.7'
9	311°26.9	.. 29.4	250°17.3	8.7'	08°00.4	10.2'	59.7'
10	326°26.9	28.6	264°44.9	8.6'	08°10.6	10.1'	59.7'
11	341°26.9	27.8	279°12.6	8.6'	08°20.7	10.1'	59.6'
12	356°26.9	S13°26.9	293°40.2	8.6'	N08°30.7	10.0'	59.6'
13	11°26.9	26.1	308°07.8	8.6'	08°40.7	10.0'	59.6'
14	26°27.0	25.3	322°35.5	8.6'	08°50.6	9.9'	59.6'
15	41°27.0	.. 24.4	337°03.1	8.6'	09°00.5	9.8'	59.6'
16	56°27.0	23.6	351°30.7	8.6'	09°10.3	9.8'	59.6'
17	71°27.0	22.7	5°58.3	8.6'	09°20.0	9.7'	59.5'
18	86°27.0	S13°21.9	20°25.8	8.6'	N09°29.7	9.6'	59.5'
19	101°27.0	21.1	34°53.4	8.6'	09°39.3	9.6'	59.5'
20	116°27.0	20.2	49°21.0	8.6'	09°48.9	9.5'	59.5'
21	131°27.1	.. 19.4	63°48.5	8.5'	09°58.4	9.5'	59.5'
22	146°27.1	18.5	78°16.0	8.5'	10°07.8	9.4'	59.5'
23	161°27.1	17.7	92°43.6	8.5'	10°17.2	9.3'	59.4'
	SD.=16.2	d=0.8			S.D.=16.3		

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.1	S13°16.8	107°11.1	8.5'	N10°26.4	9.2'	59.4'
1	191°27.1	16.0	121°38.6	8.5'	10°35.7	9.2'	59.4'
2	206°27.1	15.2	136°06.1	8.5'	10°44.8	9.1'	59.4'
3	221°27.2	.. 14.3	150°33.6	8.5'	10°53.9	9.0'	59.4'
4	236°27.2	13.5	165°01.0	8.5'	11°02.9	9.0'	59.3'
5	251°27.2	12.6	179°28.5	8.5'	11°11.8	8.9'	59.3'
6	266°27.2	S13°11.8	193°55.9	8.4'	N11°20.6	8.8'	59.3'
7	281°27.2	10.9	208°23.4	8.4'	11°29.4	8.7'	59.3'
8	296°27.2	10.1	222°50.8	8.4'	11°38.1	8.7'	59.3'
9	311°27.3	.. 09.2	237°18.2	8.4'	11°46.7	8.6'	59.2'
10	326°27.3	08.4	251°45.6	8.4'	11°55.3	8.5'	59.2'
11	341°27.3	07.5	266°13.0	8.4'	12°03.8	8.4'	59.2'
12	356°27.3	S13°06.7	280°40.4	8.4'	N12°12.1	8.3'	59.2'
13	11°27.3	05.8	295°07.7	8.4'	12°20.5	8.3'	59.2'
14	26°27.4	05.0	309°35.1	8.3'	12°28.7	8.2'	59.1'
15	41°27.4	.. 04.2	324°02.4	8.3'	12°36.8	8.1'	59.1'
16	56°27.4	03.3	338°29.8	8.3'	12°44.9	8.0'	59.1'
17	71°27.4	02.5	352°57.1	8.3'	12°52.9	7.9'	59.1'
18	86°27.4	S13°01.6	7°24.4	8.3'	N13°00.8	7.9'	59.1'
19	101°27.5	13°00.8	21°51.7	8.3'	13°08.6	7.8'	59.0'
20	116°27.5	12°59.9	36°19.0	8.3'	13°16.3	7.7'	59.0'
21	131°27.5	.. 59.1	50°46.3	8.3'	13°24.0	7.6'	59.0'
22	146°27.5	58.2	65°13.5	8.3'	13°31.5	7.5'	59.0'
23	161°27.6	57.4	79°40.8	8.2'	13°39.0	7.4'	58.9'
	SD.=16.2	d=0.8			S.D.=16.1		

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	Mer.		Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Upper hh:mm	Lower hh:mm
12	14:13	14:13	12:14	15:42	03:15
13	14:13	14:12	12:14	16:35	04:08
14	14:12	14:11	12:14	17:29	05:02



**February 15, 16, 17 UT (Mon., Tue., Wed.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	144°26.7	205°04.6	\$20°41.9	274°50.2	\$16°48.3	332°05.7	N04°51.5	250°22.9	\$20°56.2	Alpheratz	357°41.9	
1	159°29.2	220°03.8	41.4	289°51.5	48.6	347°08.4	51.6	265°25.2	56.3	Ankaa	353°14.3	
2	174°31.6	235°03.0	41.0	304°52.8	48.9	2°11.1	51.7	280°27.5	56.3	Schedar	349°38.7	
3	189°34.1	250°02.2	.. 40.5	319°54.1	.. 49.2	17°13.8	.. 51.8	295°29.8	.. 56.3	Diphda	348°54.3	
4	204°36.6	265°01.4	40.0	334°55.4	49.5	32°16.5	51.9	310°32.1	56.3	Achernar	335°25.8	
5	219°39.0	280°00.6	39.5	349°56.8	49.8	47°19.2	52.0	325°34.4	56.3	Hamal	327°58.8	
6	234°41.5	294°59.8	\$20°39.0	4°58.1	\$16°50.1	62°21.9	N04°52.1	340°36.7	\$20°56.3	Polaris	317°00.4	
7	249°43.9	309°59.0	38.5	19°59.4	50.5	77°24.6	52.2	355°38.9	56.3	Alcamar	315°17.1	
8	264°46.4	324°58.2	38.0	35°00.7	50.8	92°27.3	52.4	10°41.2	56.3	Menkar	314°13.2	
9	279°48.9	339°57.4	.. 37.5	50°02.0	.. 51.1	107°30.0	.. 52.5	25°43.5	.. 56.4	Mirfak	308°37.7	
10	294°51.3	354°56.6	37.0	65°03.4	51.4	122°32.8	52.6	40°45.8	56.4	Aldebaran	290°47.2	
11	309°53.8	9°55.8	36.5	80°04.7	51.7	137°35.5	52.7	55°48.1	56.4	Rigel	281°10.2	
12	324°56.3	24°55.0	\$20°36.0	95°06.0	\$16°52.0	152°38.2	N04°52.8	70°50.4	\$20°56.4	Capella	280°31.5	
13	339°58.7	39°54.2	35.5	110°07.3	52.3	167°40.9	52.9	85°52.7	56.4	Bellatrix	278°29.9	
14	355°01.2	54°53.4	35.0	125°08.6	52.6	182°43.6	53.0	100°55.0	56.4	Elnath	278°10.1	
15	10°03.7	69°52.6	.. 34.5	140°10.0	.. 52.9	197°46.3	.. 53.2	115°57.3	.. 56.4	Alnilam	275°44.4	
16	25°06.1	84°51.8	34.0	155°11.3	53.2	212°49.0	53.3	130°59.6	56.4	Betelgeuse	270°59.1	
17	40°08.6	99°51.0	33.5	170°12.6	53.5	227°51.7	53.4	146°01.9	56.5	Canopus	263°55.0	
18	55°11.0	114°50.2	\$20°33.0	185°13.9	\$16°53.8	242°54.4	N04°53.5	161°04.2	\$20°56.5	Sirius	258°31.9	
19	70°13.5	129°49.4	32.5	200°15.3	54.1	257°57.2	53.6	176°06.5	56.5	Adhara	255°10.8	
20	85°16.0	144°48.6	32.0	215°16.6	54.4	272°59.9	53.7	191°08.8	56.5	Procyon	244°57.6	
21	100°18.4	159°47.8	.. 31.5	230°17.9	.. 54.7	288°02.6	.. 53.8	206°11.1	.. 56.5	Pollux	243°25.2	
22	115°20.9	174°47.1	31.0	245°19.2	55.0	303°05.3	54.0	221°13.4	56.5	Avior	234°16.6	
23	130°23.4	189°46.3	30.5	260°20.6	55.3	318°08.0	54.1	236°15.7	56.5	Suhail	222°50.6	
Mer.pass.:14:20		v-0.8 d0.5 m-3.8		v1.3 d-0.3 m0.6		v2.7 d0.1 m-2.3		v2.3 d-0.0 m0.5		Miaplacidus		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.0	
0	145°25.8	204°45.5	\$20°30.0	275°21.9	\$16°55.6	333°10.7	N04°54.2	251°18.0	\$20°56.5	Regulus	207°41.3	
1	160°28.3	219°44.7	29.5	290°23.2	55.9	348°13.4	54.3	266°20.3	56.6	Dubhe	191°39.6	
2	175°30.8	234°43.9	29.0	305°24.5	56.2	3°16.2	54.4	281°22.6	56.6	Denebola	182°31.6	
3	190°33.2	249°43.1	.. 28.5	320°25.9	.. 56.5	18°18.9	.. 54.5	296°24.9	.. 56.6	Gienah	175°50.1	
4	205°35.7	264°42.3	27.9	335°27.2	56.8	33°21.6	54.6	311°27.2	56.6	Acrux	173°06.6	
5	220°38.2	279°41.5	27.4	350°28.5	57.1	48°24.3	54.8	326°29.5	56.6	Gacrux	171°58.3	
6	235°40.6	294°40.7	\$20°26.9	5°29.9	\$16°57.4	63°27.0	N04°54.9	341°31.8	\$20°56.6	Alioth	166°18.8	
7	250°43.1	309°39.9	26.4	20°31.2	57.7	78°29.7	55.0	356°34.2	56.6	Alkaid	152°57.3	
8	265°45.5	324°39.2	25.9	35°32.5	58.0	93°32.4	55.1	11°36.5	56.6	Hadar	148°44.9	
9	280°48.0	339°38.4	.. 25.4	50°33.8	.. 58.3	108°35.2	.. 55.2	26°38.8	.. 56.7	Menkent	148°05.2	
10	295°50.5	354°37.6	24.8	65°35.2	58.6	123°37.9	.. 55.3	41°41.1	56.7	Arcturus	145°54.0	
11	310°52.9	9°36.8	24.3	80°36.5	58.9	138°40.6	55.5	56°43.4	56.7	Rigil Kent.	139°48.9	
12	325°55.4	24°36.0	\$20°23.8	95°37.8	\$16°59.2	153°43.3	N04°55.6	71°45.7	\$20°56.7	Kochab	137°20.0	
13	340°57.9	39°35.2	23.3	110°39.2	59.5	168°46.0	55.7	86°48.0	56.7	Zuben'ubi	137°03.3	
14	356°00.3	54°34.4	22.7	125°40.5	16°59.8	183°48.7	55.8	101°50.3	56.7	Alphecca	126°09.5	
15	11°02.8	69°33.6	.. 22.2	140°41.8	17°00.1	198°51.4	.. 55.9	116°52.6	.. 56.7	Antares	112°24.1	
16	26°05.3	84°32.9	21.7	155°43.2	00.4	213°54.2	56.0	131°54.9	56.7	Atria	107°24.4	
17	41°07.7	99°32.1	21.2	170°44.5	00.7	228°56.9	56.1	146°57.2	56.8	Sabik	102°10.6	
18	56°10.2	114°31.3	\$20°20.6	185°45.8	\$17°01.0	243°59.6	N04°56.3	161°59.5	\$20°56.8	Shaula	96°19.6	
19	71°12.7	129°30.5	20.1	200°47.2	01.3	259°02.3	56.4	177°01.8	56.8	Rasalhague	96°04.9	
20	86°15.1	144°29.7	19.6	215°48.5	01.6	274°05.0	56.5	192°04.1	56.8	Eltanin	90°45.6	
21	101°17.6	159°28.9	.. 19.1	230°49.8	.. 01.9	289°07.7	.. 56.6	207°06.4	.. 56.8	Kaus Aust.	83°41.7	
22	116°20.0	174°28.1	18.5	245°51.2	02.2	304°10.5	56.7	222°08.7	56.8	Vega	80°38.0	
23	131°22.5	189°27.4	18.0	260°52.5	02.5	319°13.2	56.8	237°11.0	56.8	Nunki	75°56.3	
Mer.pass.:14:16		v-0.8 d0.5 m-3.8		v1.3 d-0.3 m0.6		v2.7 d0.1 m-2.3		v2.3 d-0.0 m0.5		Altair		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Peacock <td>53°17.0</td>	53°17.0	
0	146°25.0	204°26.6	\$20°17.5	275°53.8	\$17°02.8	334°15.9	N04°57.0	252°13.3	\$20°56.8	Deneb	49°30.6	
1	161°27.4	219°25.8	16.9	290°55.2	03.0	349°18.6	57.1	267°15.6	56.9	Enif	33°45.7	
2	176°29.9	234°25.0	16.4	305°56.5	03.3	4°21.3	57.2	282°17.9	56.9	Al Na'ir	27°42.0	
3	191°32.4	249°24.2	.. 15.8	320°57.8	.. 03.6	19°24.0	.. 57.3	297°20.2	.. 56.9	Fomalhaut	15°22.4	
4	206°34.8	264°23.5	15.3	335°59.2	03.9	34°26.8	57.4	312°22.5	56.9	Scheat	13°51.9	
5	221°37.3	279°22.7	14.8	351°00.5	04.2	49°29.5	57.5	327°24.8	56.9	Markab	13°36.8	
6	236°39.8	294°21.9	\$20°14.2	6°01.8	\$17°04.5	64°32.2	N04°57.7	342°27.1	\$20°56.9	Feb 15 Mon	SHA	Mer.pass
7	251°42.2	309°21.1	13.7	21°03.2	04.8	79°34.9	57.8	357°29.4	56.9	Venus	60°37.9	10:20
8	266°44.7	324°20.3	13.1	36°04.5	05.1	94°37.6	57.9	12°31.7	56.9	Mars	130°23.5	05:40
9	281°47.2	339°19.6	.. 12.6	51°05.8	.. 05.4	109°40.4	.. 58.0	27°34.1	.. 56.9	Jupiter	187°39.0	01:51
10	296°49.6	354°18.8	12.0	66°07.2	05.7	124°43.1	58.1	42°36.4	57.0	Saturn	105°56.2	07:17
11	311°52.1	9°18.0	11.5	81°08.5	06.0	139°45.8	58.2	57°38.7	57.0	Feb 16 Tue	SHA	Mer.pass
12	326°54.5	24°17.2	\$20°11.0	96°09.8	\$17°06.3	154°48.5	N04°58.4	72°41.0	\$20°57.0	Venus	59°19.6	10:22
13	341°57.0	39°16.4	10.4	111°11.2	06.6	169°51.2	58.5	87°43.3	57.0	Mars	129°28.8	05:36
14	356°59.5	54°15.7	09.9	126°12.5	06.9	184°54.0	58.6	102°45.6	57.0	Jupiter	187°44.9	01:47
15	12°01.9	69°14.9	.. 09.3	141°13.9	.. 07.2	199°56.7	.. 58.7	117°47.9	.. 57.0	Saturn	105°52.2	07:14
16	27°04.4	84°14.1	08.8	156°15.2	07.5	214°59.4	58.8	132°50.2	57.0	Feb 17 Wed	SHA	Mer.pass
17	42°06.9	99°13.3	08.2	171°16.5	07.8	230°02.1	58.9	147°52.5	57.0	Venus	58°01.6	10:23
18	57°09.3	114°12.6	\$20°07.7	186°17.9	\$17°08.1	245°04.8	N04°59.1	162°54.8	\$20°57.1	Mars	129°28.8	05:36
19	72°11.8	129°11.8	07.1	201°19.2	08.3	260°07.6	59.2	177°57.1	57.1	Jupiter	187°50.9	01:43
20	87°14.3	144°11.0	06.5	216°20.6	08.6	275°10.3	59.3	192°59.4	57.1	Saturn	105°48.3	07:10
21	102°16.7	159°10.2	.. 06.0	231°21.9	.. 08.9	290°13.0	.. 59.4	208°01.7	.. 57.1	Horizontal parallax		
22	117°19.2	174°09.5	05.4	246°23.2	09.2	305°15.7	59.5	223°04.0	57.1	Venus:	0.1	
23	132°21.6	189°08.7	04.9	261°24.6	09.5	320°18.4	59.6	238°06.4	57.1	Mars:	0.1	
Mer.pass.:14:12		v-0.8 d0.5 m-3.8		v1.3 d-0.3 m0.6		v2.7 d0.1 m-2.3		v2.3 d-0.0 m0.5				

DUT1 = UT1-UTC = +0.0038 sec ΔT = TT-UT1 = +68.1802 sec

2016 February 15 to Feb. 17 UT

h	Sun			Moon			
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°27.6	S12°56.5	94°08.0	8.2'	N13°46.4	7.3'	58.9'
1	191°27.6	55.6	108°35.2	8.2'	13°53.6	7.2'	58.9'
2	206°27.6	54.8	123°02.5	8.2'	14°00.8	7.2'	58.9'
3	221°27.7	.. 53.9	137°29.7	8.2'	14°07.9	7.1'	58.9'
4	236°27.7	53.1	151°56.9	8.2'	14°15.0	7.0'	58.8'
5	251°27.7	52.2	166°24.1	8.2'	14°21.9	6.9'	58.8'
6	266°27.7	S12°51.4	180°51.2	8.2'	N14°28.7	6.8'	58.8'
7	281°27.8	50.5	195°18.4	8.2'	14°35.5	6.7'	58.8'
8	296°27.8	49.7	209°45.6	8.2'	14°42.1	6.6'	58.8'
9	311°27.8	.. 48.8	224°12.7	8.1'	14°48.7	6.5'	58.7'
10	326°27.8	48.0	238°39.9	8.1'	14°55.1	6.4'	58.7'
11	341°27.9	47.1	253°07.0	8.1'	15°01.5	6.3'	58.7'
12	356°27.9	S12°46.3	267°34.1	8.1'	N15°07.8	6.2'	58.7'
13	11°27.9	45.4	282°01.2	8.1'	15°13.9	6.1'	58.6'
14	26°27.9	44.5	296°28.3	8.1'	15°20.0	6.0'	58.6'
15	41°28.0	.. 43.7	310°55.5	8.1'	15°26.0	5.9'	58.6'
16	56°28.0	42.8	325°22.5	8.1'	15°31.9	5.8'	58.6'
17	71°28.0	42.0	339°49.6	8.1'	15°37.7	5.7'	58.6'
18	86°28.1	S12°41.1	354°16.7	8.1'	N15°43.3	5.6'	58.5'
19	101°28.1	40.3	8°43.8	8.1'	15°48.9	5.5'	58.5'
20	116°28.1	39.4	23°10.9	8.1'	15°54.4	5.4'	58.5'
21	131°28.1	.. 38.5	37°37.9	8.1'	15°59.8	5.3'	58.5'
22	146°28.2	37.7	52°05.0	8.1'	16°05.1	5.2'	58.4'
23	161°28.2	36.8	66°32.0	8.1'	16°10.3	5.1'	58.4'
	SD.=16.2	d=0.9			S.D.=16.0		
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	176°28.2	S12°36.0	80°59.1	8.0'	N16°15.4	5.0'	58.4'
1	191°28.3	35.1	95°26.1	8.0'	16°20.3	4.9'	58.4'
2	206°28.3	34.2	109°53.2	8.0'	16°25.2	4.8'	58.4'
3	221°28.3	.. 33.4	124°20.2	8.0'	16°30.0	4.7'	58.3'
4	236°28.4	32.5	138°47.3	8.0'	16°34.7	4.6'	58.3'
5	251°28.4	31.6	153°14.3	8.0'	16°39.2	4.5'	58.3'
6	266°28.4	S12°30.8	167°41.3	8.0'	N16°43.7	4.4'	58.3'
7	281°28.5	29.9	182°08.4	8.0'	16°48.1	4.3'	58.2'
8	296°28.5	29.1	196°35.4	8.0'	16°52.3	4.2'	58.2'
9	311°28.5	.. 28.2	211°02.4	8.0'	16°56.5	4.1'	58.2'
10	326°28.6	27.3	225°29.5	8.0'	17°00.5	4.0'	58.2'
11	341°28.6	26.5	239°56.5	8.0'	17°04.5	3.9'	58.1'
12	356°28.6	S12°25.6	254°23.5	8.0'	N17°08.3	3.8'	58.1'
13	11°28.7	24.7	268°50.6	8.0'	17°12.0	3.7'	58.1'
14	26°28.7	23.9	283°17.6	8.0'	17°15.7	3.6'	58.1'
15	41°28.8	.. 23.0	297°44.7	8.0'	17°19.2	3.5'	58.1'
16	56°28.8	22.1	312°11.7	8.1'	17°22.6	3.4'	58.0'
17	71°28.8	21.3	326°38.8	8.1'	17°25.9	3.3'	58.0'
18	86°28.9	S12°20.4	341°05.8	8.1'	N17°29.1	3.1'	58.0'
19	101°28.9	19.5	355°32.9	8.1'	17°32.2	3.0'	58.0'
20	116°28.9	18.7	9°59.9	8.1'	17°35.2	2.9'	57.9'
21	131°29.0	.. 17.8	24°27.0	8.1'	17°38.1	2.8'	57.9'
22	146°29.0	16.9	38°54.1	8.1'	17°40.9	2.7'	57.9'
23	161°29.1	16.1	53°21.2	8.1'	17°43.5	2.6'	57.9'
	SD.=16.2	d=0.9			S.D.=15.8		
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°29.1	S12°15.2	67°48.3	8.1'	N17°46.1	2.5'	57.9'
1	191°29.1	14.3	82°15.4	8.1'	17°48.5	2.4'	57.8'
2	206°29.2	13.5	96°42.5	8.1'	17°50.9	2.3'	57.8'
3	221°29.2	.. 12.6	111°09.7	8.1'	17°53.1	2.2'	57.8'
4	236°29.3	11.7	125°36.8	8.1'	17°55.2	2.1'	57.8'
5	251°29.3	10.9	140°03.9	8.2'	17°57.3	2.0'	57.7'
6	266°29.3	S12°10.0	154°31.1	8.2'	N17°59.2	1.9'	57.7'
7	281°29.4	09.1	168°58.3	8.2'	18°01.0	1.8'	57.7'
8	296°29.4	08.2	183°25.5	8.2'	18°02.7	1.6'	57.7'
9	311°29.5	.. 07.4	197°52.7	8.2'	18°04.3	1.5'	57.7'
10	326°29.5	06.5	212°19.9	8.2'	18°05.8	1.4'	57.6'
11	341°29.5	05.6	226°47.1	8.2'	18°07.1	1.3'	57.6'
12	356°29.6	S12°04.8	241°14.4	8.3'	N18°08.4	1.2'	57.6'
13	11°29.6	03.9	255°41.6	8.3'	18°09.6	1.1'	57.6'
14	26°29.7	03.0	270°08.9	8.3'	18°10.6	1.0'	57.5'
15	41°29.7	.. 02.1	284°36.2	8.3'	18°11.6	0.9'	57.5'
16	56°29.8	01.3	299°03.5	8.3'	18°12.4	0.8'	57.5'
17	71°29.8	12°00.4	313°30.9	8.3'	18°13.1	0.7'	57.5'
18	86°29.8	S11°59.5	327°58.2	8.4'	N18°13.8	0.6'	57.5'
19	101°29.9	58.6	342°25.6	8.4'	18°14.3	0.5'	57.4'
20	116°29.9	57.8	356°53.0	8.4'	18°14.7	0.4'	57.4'
21	131°30.0	.. 56.9	11°20.5	8.4'	18°15.0	0.3'	57.4'
22	146°30.0	56.0	25°47.9	8.5'	18°15.2	0.1'	57.4'
23	161°30.1	55.1	40°15.4	8.5'	18°15.3	0.0'	57.3'
	SD.=16.2	d=0.9			S.D.=15.7		

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

**February 18, 19, 20 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	147°24.1	204°07.9	\$20°04.3	276°25.9	\$17°09.8	335°21.2	N04°59.8	253°08.7	\$20°57.1	Alpheratz	357°41.9	29°10.7					
1	162°26.6	219°07.1	03.8	291°27.3	10.1	350°23.9	04°59.9	268°11.0	57.1	Ankaa	353°14.3	-42°13.3					
2	177°29.0	234°06.4	03.2	306°28.6	10.4	5°26.6	05°00.0	283°13.3	57.1	Schedar	349°38.7	56°37.6					
3	192°31.5	249°05.6	.. 02.6	321°29.9	.. 10.7	20°29.3	.. 00.1	298°15.6	.. 57.2	Diphda	348°54.3	-17°54.1					
4	207°34.0	264°04.8	02.1	336°31.3	11.0	35°32.1	00.2	313°17.9	57.2	Achernar	335°25.9	-57°09.7					
5	222°36.4	279°04.1	01.5	351°32.6	11.3	50°34.8	00.4	328°20.2	57.2	Hamal	327°58.8	23°32.2					
6	237°38.9	294°03.3	\$20°00.9	6°34.0	\$17°11.6	65°37.5	N05°00.5	343°22.5	\$20°57.2	Polaris	317°01.7	89°20.2					
7	252°41.4	309°02.5	20°00.4	21°35.3	11.8	80°40.2	00.6	358°24.8	57.2	Acamar	315°17.1	-40°14.8					
8	267°43.8	324°01.7	19°59.8	36°36.7	12.1	95°42.9	00.7	13°27.1	57.2	Menkar	314°13.2	4°08.9					
9	282°46.3	339°01.0	.. 59.2	51°38.0	.. 12.4	110°45.7	.. 00.8	28°29.4	.. 57.2	Mirfak	308°37.7	49°55.1					
10	297°48.8	354°00.2	58.7	66°39.4	12.7	125°48.4	00.9	43°31.8	57.2	Aldebaran	290°47.2	16°32.3					
11	312°51.2	8°59.4	58.1	81°40.7	13.0	140°51.1	01.1	58°34.1	57.2	Rigel	281°10.2	-8°11.4					
12	327°53.7	23°58.7	\$19°57.5	96°42.0	\$17°13.3	155°53.8	N05°01.2	73°36.4	\$20°57.3	Capella	280°31.6	46°00.7					
13	342°56.1	38°57.9	57.0	111°43.4	13.6	170°56.6	01.3	88°38.7	57.3	Bellatrix	278°29.9	6°21.6					
14	357°58.6	53°57.1	56.4	126°44.7	13.9	185°59.3	01.4	103°41.0	57.3	Elnath	278°10.2	28°37.1					
15	13°01.1	68°56.4	.. 55.8	141°46.1	.. 14.2	201°02.0	.. 01.5	118°43.3	.. 57.3	Alnilam	275°44.4	-1°11.8					
16	28°03.5	83°55.6	55.2	156°47.4	14.5	216°04.7	01.7	133°45.6	57.3	Betelgeuse	270°59.2	7°24.3					
17	43°06.0	98°54.8	54.7	171°48.8	14.7	231°07.5	01.8	148°47.9	57.3	Canopus	263°55.0	-52°42.7					
18	58°08.5	113°54.1	\$19°54.1	186°50.1	\$17°15.0	246°10.2	N05°01.9	163°50.2	\$20°57.3	Sirius	258°31.9	-16°44.7					
19	73°10.9	128°53.3	53.5	201°51.5	15.3	261°12.9	02.0	178°52.5	57.3	Adhara	255°10.8	-29°00.0					
20	88°13.4	143°52.5	52.9	216°52.8	15.6	276°15.6	02.1	193°54.9	57.3	Procyon	244°57.6	5°10.7					
21	103°15.9	158°51.8	.. 52.3	231°54.2	.. 15.9	291°18.4	.. 02.2	208°57.2	.. 57.4	Pollux	243°25.2	27°59.0					
22	118°18.3	173°51.0	51.8	246°55.5	16.2	306°21.1	02.4	223°59.5	57.4	Avior	234°16.6	-59°34.0					
23	133°20.8	188°50.2	51.2	261°56.9	16.5	321°23.8	02.5	239°01.8	57.4	Suhail	222°50.6	-43°30.1					
Mer.pass.:14:08			v-0.8 d0.6 m-3.8	v1.3 d-0.3 m0.5	v2.7 d0.1 m-2.3	v2.3 d-0.0 m0.5	Miaplacidus			221°38.2	-69°47.2						
Fri			GHA			GHA			GHA			GHA			GHA		
0	148°23.3	203°49.5	\$19°50.6	276°58.2	\$17°16.8	336°26.5	N05°02.6	254°04.1	\$20°57.4	Denebola	182°31.5	14°28.8					
1	163°25.7	218°48.7	50.0	291°59.6	17.0	351°29.3	02.7	269°06.4	57.4	Gienah	175°50.1	-17°37.9					
2	178°28.2	233°47.9	49.4	307°00.9	17.3	6°32.0	02.8	284°08.7	57.4	Gacrux	173°06.6	-63°11.1					
3	193°30.6	248°47.2	.. 48.8	322°02.3	.. 17.6	21°34.7	.. 03.0	299°11.0	.. 57.4	Gacrux	171°58.3	-57°12.1					
4	208°33.1	263°46.4	48.2	337°03.6	17.9	36°37.4	03.1	314°13.4	57.4	Alioth	166°18.8	55°52.1					
5	223°35.6	278°45.6	47.7	352°05.0	18.2	51°40.2	03.2	329°15.7	57.4	Alkaid	152°57.3	49°13.8					
6	238°38.0	293°44.9	\$19°47.1	7°06.3	\$17°18.5	66°42.9	N05°03.3	344°18.0	\$20°57.5	Hadar	148°44.9	-60°26.7					
7	253°40.5	308°44.1	46.5	22°07.7	18.8	81°45.6	03.4	359°20.3	57.5	Menkent	148°05.2	-36°26.8					
8	268°43.0	323°43.4	45.9	37°09.0	19.1	96°48.3	03.6	14°22.6	57.5	Arcturus	145°54.0	19°05.8					
9	283°45.4	338°42.6	.. 45.3	52°10.4	.. 19.3	111°51.1	.. 03.7	29°24.9	.. 57.5	Rigel Kent.	139°48.9	-60°53.7					
10	298°47.9	353°41.8	44.7	67°11.7	19.6	126°53.8	03.8	44°27.2	57.5	Kochab	137°20.0	74°05.1					
11	313°50.4	8°41.1	44.1	82°13.1	19.9	141°56.5	03.9	59°29.6	57.5	Zuben' ubi	137°03.3	-16°06.4					
12	328°52.8	23°40.3	\$19°43.5	97°14.4	\$17°20.2	156°59.3	N05°04.0	74°31.9	\$20°57.5	Alphecca	126°09.5	26°39.5					
13	343°55.3	38°39.6	42.9	112°15.8	20.5	172°02.0	04.2	89°34.2	57.5	Antares	112°24.1	-26°27.8					
14	358°57.8	53°38.8	42.3	127°17.1	20.8	187°04.7	04.3	104°36.5	57.5	Atria	107°24.3	-69°02.9					
15	14°00.2	68°38.0	.. 41.7	142°18.5	.. 21.0	202°07.4	.. 04.4	119°38.8	.. 57.6	Sabik	102°10.6	-15°44.5					
16	29°02.7	83°37.3	41.1	157°19.9	21.3	217°10.2	04.5	134°41.1	57.6	Rasalhague	96°19.6	-37°06.6					
17	44°05.1	98°36.5	40.5	172°21.2	21.6	232°12.9	04.6	149°43.4	57.6	Eltanin	90°45.6	51°29.1					
18	59°07.6	113°35.8	\$19°39.9	187°22.6	\$17°21.9	247°15.6	N05°04.8	164°45.8	\$20°57.6	Kaus Aust.	83°41.6	-34°22.3					
19	74°10.1	128°35.0	39.3	202°23.9	22.2	262°18.4	04.9	179°48.1	57.6	Vega	80°38.0	38°47.9					
20	89°12.5	143°34.3	38.7	217°25.3	22.5	277°21.1	05.0	194°50.4	57.6	Nunki	75°56.3	-26°16.4					
21	104°15.0	158°33.5	.. 38.1	232°26.6	.. 22.8	292°23.8	.. 05.1	209°52.7	.. 57.6	Altair	62°06.7	8°54.7					
22	119°17.5	173°32.7	37.5	247°28.0	23.0	307°26.5	05.2	224°55.0	57.6	Peacock	53°17.0	-56°40.8					
23	134°19.9	188°32.0	36.9	262°29.3	23.3	322°29.3	05.4	239°57.3	57.6	Deneb	49°30.6	45°20.3					
Mer.pass.:14:04			v-0.8 d0.6 m-3.8	v1.3 d-0.3 m0.5	v2.7 d0.1 m-2.3	v2.3 d-0.0 m0.5	Enif			33°45.6	9°56.9						
Sat			GHA			GHA			GHA			GHA			GHA		
0	149°22.4	203°31.2	\$19°36.3	277°30.7	\$17°23.6	337°32.0	N05°05.5	254°59.6	\$20°57.6	Fomalhaut	15°22.4	-29°32.3					
1	164°24.9	218°30.5	35.7	292°32.1	23.9	352°34.7	05.6	270°02.0	57.7	Scheat	13°51.9	28°10.2					
2	179°27.3	233°29.7	35.1	307°33.4	24.2	7°37.5	05.7	285°04.3	57.7	Markab	13°36.8	15°17.5					
3	194°29.8	248°29.0	.. 34.5	322°34.8	.. 24.4	22°40.2	.. 05.8	300°06.6	.. 57.7	Feb 18 Thu	56°43.8	10:24					
4	209°32.2	263°28.2	33.8	337°36.1	24.7	37°42.9	06.0	315°08.9	57.7	Venus	55°26.2	10:25					
5	224°34.7	278°27.5	33.2	352°37.5	25.0	52°45.7	06.1	330°11.2	57.7	Mars	128°35.0	05:32					
6	239°37.2	293°26.7	\$19°32.6	7°38.9	\$17°25.3	67°48.4	N05°06.2	345°13.5	\$20°57.7	Jupiter	187°57.1	01:38					
7	254°39.6	308°26.0	32.0	22°40.2	25.6	82°51.1	06.3	0°15.9	57.7	Saturn	105°44.5	07:06					
8	269°42.1	323°25.2	31.4	37°41.6	25.9	97°53.8	06.4	15°18.2	57.7	Feb 19 Fri	55°26.2	05:32					
9	284°44.6	338°24.5	.. 30.8	52°42.9	.. 26.1	112°56.6	.. 06.6	30°20.5	.. 57.7	Venus	188°03.3	01:34					
10	299°47.0	353°23.7	30.2	67°44.3	26.4	127°59.3	06.7	45°22.8	57.8	Mars	105°40.9	07:03					
11	314°49.5	8°23.0	29.5	82°45.7	26.7	143°02.0	06.8	60°25.1	57.8	Jupiter	188°09.6	01:30					
12	329°52.0	23°22.2	\$19°28.9	97°47.0	\$17°27.0	158°04.8	N05°06.9	75°27.5	\$20°57.8	Saturn	105°37.3	06:59					
13	344°54.4	38°21.5	28.3	112°48.4	27.3	173°07.5	07.1	90°29.8	57.8	Feb 20 Sat	54°08.8	10:26					
14	359°56.9	53°20.7	27.7	127°49.7	27.5	188°10.2	07.2	105°32.1	57.8	Venus	128°08.3	05:29					
15	14°59.4	68°20.0	.. 27.1	142°51.1	.. 27.8	203°13.0	.. 07.3	120°34.4	.. 57.8	Mars	188°09.6	01:30					
16	30°01.8	83°19.2	26.4	157°52.5	28.1	218°15.7	07.4	135°36.7	57.8	Jupiter	105°37.3	06:59					
17	45°04.3	98°18.5	25.8	172°53.8	28.4	233°18.4	07.5	150°39.0	57.8	Horizontal parallax							
18	60°06.7	113°17.7	\$19°25.2	187°28.7	248°21.2	N05°07.7	165°41.4	\$20°57.8	Venus:	0.1							
19																	

DUT1 = UT1-UTC = -0.0011 sec ΔT = TT-UT1 = +68.1851 sec

2016 February 18 to Feb. 20 UT

h		Sun			Moon										
Thu		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight	Sunrise	Sunset	Twilight		
									Naut.	Civil		Civil	Naut.		
0	176°30.1	S11°54.3	54°42.9	8.5'	N18°15.3	-0.1'	57.3'		N 72°	06:00	07:18	08:34	15:55	17:11	18:30
1	191°30.2	53.4	69°10.4	8.5'	18°15.2	-0.2'	57.3'		N 70°	05:59	07:11	08:17	16:12	17:19	18:30
2	206°30.2	52.5	83°37.9	8.6'	18°14.9	-0.3'	57.3'		68°	05:59	07:04	08:04	16:25	17:25	18:30
3	221°30.3	.. 51.6	98°05.5	8.6'	18°14.6	-0.4'	57.3'		66°	05:59	06:58	07:53	16:36	17:31	18:31
4	236°30.3	50.7	112°33.1	8.6'	18°14.2	-0.5'	57.2'		64°	05:58	06:54	07:43	16:46	17:36	18:31
5	251°30.4	49.9	127°00.7	8.6'	18°13.6	-0.6'	57.2'		62°	05:58	06:49	07:36	16:53	17:40	18:31
6	266°30.4	S11°49.0	141°28.4	8.7'	N18°13.0	-0.7'	57.2'		60°	05:57	06:46	07:29	17:00	17:43	18:32
7	281°30.5	48.1	155°56.0	8.7'	18°12.3	-0.8'	57.2'								
8	296°30.5	47.2	170°23.7	8.7'	18°11.4	-0.9'	57.1'								
9	311°30.6	.. 46.4	184°51.5	8.8'	18°10.4	-1.0'	57.1'								
10	326°30.6	45.5	199°19.2	8.8'	18°09.4	-1.1'	57.1'								
11	341°30.7	44.6	213°47.0	8.8'	18°08.2	-1.2'	57.1'								
12	356°30.7	S11°43.7	228°14.9	8.8'	N18°07.0	-1.3'	57.1'								
13	11°30.8	42.8	242°42.7	8.9'	18°05.6	-1.4'	57.0'								
14	26°30.8	42.0	257°10.6	8.9'	18°04.1	-1.5'	57.0'								
15	41°30.9	.. 41.1	271°38.6	8.9'	18°02.6	-1.6'	57.0'								
16	56°30.9	40.2	286°06.5	9.0'	18°00.9	-1.7'	57.0'								
17	71°31.0	39.3	300°34.5	9.0'	17°59.1	-1.8'	57.0'								
18	86°31.0	S11°38.4	315°02.5	9.0'	N17°57.3	-1.9'	56.9'								
19	101°31.1	37.5	329°30.6	9.1'	17°55.3	-2.0'	56.9'								
20	116°31.1	36.7	343°58.7	9.1'	17°53.2	-2.1'	56.9'								
21	131°31.2	.. 35.8	358°26.8	9.2'	17°51.1	-2.2'	56.9'								
22	146°31.2	34.9	12°55.0	9.2'	17°48.8	-2.3'	56.8'								
23	161°31.3	34.0	27°23.2	9.2'	17°46.4	-2.4'	56.8'								
	SD.=16.2	d=0.9			S.D.=15.6										
Fri		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Moonrise		Moonset			
									Thu	Fri	Sat	Thu	Fri	Sat	
0	176°31.3	S11°33.1	41°51.5	9.3'	N17°44.0	-2.5'	56.8'		N 72°	03:54	04:38	05:12	19:14	19:49	20:32
1	191°31.4	32.2	56°19.8	9.3'	17°41.4	-2.6'	56.8'		52°	03:45	04:31	05:08	19:19	19:55	20:41
2	206°31.4	31.4	70°48.1	9.3'	17°38.8	-2.7'	56.8'		54°	03:34	04:24	05:03	19:24	20:02	20:51
3	221°31.5	.. 30.5	85°16.4	9.4'	17°36.0	-2.8'	56.7'		56°	03:22	04:16	04:57	19:29	20:10	21:03
4	236°31.5	29.6	99°44.9	9.4'	17°33.2	-2.9'	56.7'		58°	03:08	04:07	04:51	19:35	20:19	21:17
5	251°31.6	28.7	114°13.3	9.5'	17°30.3	-3.0'	56.7'		S 60°	02:50	03:56	04:44	19:42	20:29	21:34
6	266°31.7	S11°27.8	128°41.8	9.5'	N17°27.2	-3.1'	56.7'								
7	281°31.7	26.9	143°10.3	9.5'	17°24.1	-3.2'	56.7'								
8	296°31.8	26.0	157°38.9	9.6'	17°20.9	-3.3'	56.6'								
9	311°31.8	.. 25.2	172°07.5	9.6'	17°17.6	-3.4'	56.6'								
10	326°31.9	24.3	186°36.1	9.7'	17°14.2	-3.5'	56.6'								
11	341°31.9	23.4	201°04.8	9.7'	17°10.7	-3.5'	56.6'								
12	356°32.0	S11°22.5	215°33.6	9.8'	N17°07.1	-3.6'	56.6'								
13	11°32.1	21.6	230°02.4	9.8'	17°03.4	-3.7'	56.5'								
14	26°32.1	20.7	244°31.2	9.9'	16°59.6	-3.8'	56.5'								
15	41°32.2	.. 19.8	259°00.1	9.9'	16°55.8	-3.9'	56.5'								
16	56°32.2	18.9	273°29.0	9.9'	16°51.8	-4.0'	56.5'								
17	71°32.3	18.0	287°57.9	10.0'	16°47.8	-4.1'	56.5'								
18	86°32.4	S11°17.2	302°27.0	10.0'	N16°43.7	-4.2'	56.4'								
19	101°32.4	16.3	316°56.0	10.1'	16°39.5	-4.3'	56.4'								
20	116°32.5	15.4	331°25.1	10.1'	16°35.2	-4.3'	56.4'								
21	131°32.5	.. 14.5	345°54.3	10.2'	16°30.8	-4.4'	56.4'								
22	146°32.6	13.6	0°23.4	10.2'	16°26.3	-4.5'	56.4'								
23	161°32.7	12.7	14°52.7	10.3'	16°21.8	-4.6'	56.3'								
	SD.=16.2	d=0.9			S.D.=15.4										
Sat		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Moonrise		Moonset			
									Thu	Fri	Sat	Thu	Fri	Sat	
0	176°32.7	S11°11.8	29°22.0	10.3'	N16°17.1	-4.7'	56.3'		N 72°	10:30	11:49	13:20	06:51	07:23	07:37
1	191°32.8	10.9	43°51.3	10.4'	16°12.4	-4.8'	56.3'		70°	11:11	12:22	13:45	06:10	06:48	07:12
2	206°32.8	10.0	58°20.7	10.4'	16°07.6	-4.8'	56.3'		68°	11:39	12:47	14:04	05:42	06:24	06:52
3	221°32.9	.. 09.1	72°50.1	10.5'	16°02.7	-4.9'	56.3'		66°	12:00	13:06	14:19	05:21	06:04	06:36
4	236°33.0	08.2	87°19.6	10.5'	15°57.8	-5.0'	56.2'		64°	12:17	13:21	14:32	05:04	05:49	06:23
5	251°33.0	07.4	101°49.1	10.6'	15°52.7	-5.1'	56.2'		60°	12:31	13:34	14:43	04:49	05:35	06:11
6	266°33.1	S11°06.5	116°18.7	10.6'	N15°47.6	-5.2'	56.2'		N 58°	12:44	13:45	14:52	04:37	05:24	06:01
7	281°33.1	05.6	130°48.3	10.6'	15°42.4	-5.2'	56.2'		56°	12:54	13:55	15:00	04:27	05:14	05:53
8	296°33.2	04.7	145°18.0	10.7'	15°37.1	-5.3'	56.2'		54°	13:03	14:03	15:08	04:17	05:05	05:45
9	311°33.3	.. 03.8	159°47.7	10.7'	15°31.8	-5.4'	56.1'		52°	13:12	14:11	15:14	04:09	04:57	05:38
10	326°33.3	02.9	174°17.5	10.8'	15°26.4	-5.5'	56.1'		50°	13:19	14:18	15:20	04:01	04:50	05:32
11	341°33.4	02.0	188°47.3	10.8'	15°20.9	-5.5'	56.1'		45°	13:35	14:33	15:33	03:45	04:35	05:19
12	356°33.5	S11°01.1	203°17.2	10.9'	N15°15.3	-5.6'	56.1'		N 40°	13:48	14:45	15:43	03:32	04:23	05:08
13	11°33.5	11°00.2	217°47.1	10.9'	15°09.6	-5.7'	56.1'		35°	13:59	14:55	15:52	03:21	04:12	04:58
14	26°33.6	10°59.3	232°17.1	11.0'	15°03.9	-5.8'	56.0'		30°	14:09	15:04	16:00	03:11	04:03	04:50
15	41°33.7	.. 58.4	246°47.1	11.0'	14°58.1	-5.8'	56.0'		20°	14:25	15:20	16:14	02:54	03:46	04:35
16	56°33.7	57.5	261°17.2	11.1'	14°52.2	-5.9'	56.0'		10°	14:40	15:33	16:25	02:40	03:32	04:23
17	71°33.8	56.6	275°47.3	11.1'	14°46.3	-6.0'	56.0'		0°	14:54	15:46	16:37	02:26	03:19	04:11
18	86°33.9	S10°55.7	290°17.4	11.2'	N14°40.2	-6.1'	56.0'		S 10°	15:07	15:59	16:48	02:12	03:06	03:59
19	101°33.9	54.8	304°47.7	11.2'	14°34.1	-6.1'	55.9'		20°	15:22	16:12	16:59	01:57	02:52	03:46
20	116°34.0	53.9	319°17.9	11.3'	14°28.0	-6.2'	55.9'		30°	15:39	16:28	17:13	01:40	02:35	03:31
21	131°34.1	.. 53.0	333°48.2	11.3'	14°21.8	-6.3'	55.9'		35°	15:48	16:37	17:21	01:30	02:26	03:22
22	146°34.1	52.1	348°18.6	11.4'	14°15.5	-6.3'	55.9'		40°	16:00	16:47	17:29	01:19	02:15	03:13
23	161°34.2	51.2	2°49.0	11.4'	14°09.1	-6.4'	55.9'		45°	16:13	16:59	17:40	01:06	02:02	03:01
	SD.=16.2	d=0.9			S.D.=15.3				S 50°	16:29	17:14	17:52	00:49	01:46	02:47
									52°	16:36	17:20	17:58	00:42		

**February 21, 22, 23 UT (Sun., Mon., Tue.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	150°21.5	203°13.2	\$19°21.4	278°03.4	\$17°30.3	338°37.6	N05°08.4	255°55.3	\$20°57.9	Alpheratz	357°41.9	29°10.7											
1	165°24.0	218°12.5	20.8	293°04.8	30.6	353°40.3	08.5	270°57.6	57.9	Ankaa	353°14.3	-42°13.3											
2	180°26.5	233°11.8	20.1	308°06.1	30.9	8°43.0	08.6	285°59.9	57.9	Schedar	349°38.7	56°37.6											
3	195°28.9	248°11.0	· · 19.5	323°07.5	· · 31.2	23°45.8	· · 08.8	301°02.2	· · 57.9	Diphda	348°54.3	-17°54.1											
4	210°31.4	263°10.3	18.9	338°08.9	31.4	38°48.5	08.9	316°04.6	57.9	Achernar	335°25.9	-57°09.7											
5	225°33.9	278°09.5	18.2	353°10.2	31.7	53°51.2	09.0	331°06.9	57.9	Hamal	327°58.8	23°32.2											
6	240°36.3	293°08.8	\$19°17.6	8°11.6	\$17°32.0	68°54.0	N05°09.1	346°09.2	\$20°58.0	Polaris	317°03.1	89°20.2											
7	255°38.8	308°08.0	17.0	23°13.0	32.3	83°56.7	09.2	1°11.5	58.0	Acamar	315°17.1	-40°14.8											
8	270°41.2	323°07.3	16.3	38°14.3	32.6	98°59.4	09.4	16°13.8	58.0	Menkar	314°13.2	4°08.9											
9	285°43.7	338°06.6	· · 15.7	53°15.7	· · 32.8	114°02.2	· · 09.5	31°16.2	· · 58.0	Mirfak	308°37.7	49°55.1											
10	300°46.2	353°05.8	15.0	68°17.1	33.1	129°04.9	09.6	46°18.5	58.0	Aldebaran	290°47.2	16°32.3											
11	315°48.6	8°05.1	14.4	83°18.4	33.4	144°07.6	09.7	61°20.8	58.0	Rigel	281°10.2	-8°11.4											
12	330°51.1	23°04.3	\$19°13.8	98°19.8	\$17°33.7	159°10.4	N05°09.9	76°23.1	\$20°58.0	Capella	280°31.6	46°00.8											
13	345°53.6	38°03.6	13.1	113°21.2	33.9	174°13.1	10.0	91°25.5	58.0	Bellatrix	278°29.9	6°21.6											
14	0°56.0	53°02.9	12.5	128°22.5	34.2	189°15.8	10.1	106°27.8	58.0	Elnath	278°10.2	28°37.1											
15	15°58.5	68°02.1	· · 11.8	143°23.9	· · 34.5	204°18.6	· · 10.2	121°30.1	· · 58.0	Alnilam	275°44.4	-1°11.8											
16	31°01.0	83°01.4	11.2	158°25.3	34.8	219°21.3	10.3	136°32.4	58.1	Betelgeuse	270°59.2	7°24.3											
17	46°03.4	98°00.6	10.5	173°26.7	35.0	234°24.0	10.5	151°34.7	58.1	Canopus	263°55.0	-52°42.7											
18	61°05.9	112°59.9	\$19°09.9	188°28.0	\$17°35.3	249°26.8	N05°10.6	166°37.1	\$20°58.1	Sirius	258°31.9	-16°44.7											
19	76°08.3	127°59.2	09.2	203°29.4	35.6	264°29.5	10.7	181°39.4	58.1	Adhara	255°10.8	-29°00.1											
20	91°10.8	142°58.4	08.6	218°30.8	35.9	279°32.2	10.8	196°41.7	58.1	Procyon	244°57.6	5°10.7											
21	106°13.3	157°57.7	· · 07.9	233°32.1	· · 36.1	294°35.0	· · 11.0	211°44.0	· · 58.1	Pollux	243°25.2	27°59.0											
22	121°15.7	172°57.0	07.3	248°33.5	36.4	309°37.7	11.1	226°46.4	58.1	Avior	234°16.6	-59°34.0											
23	136°18.2	187°56.2	06.6	263°34.9	36.7	324°40.5	11.2	241°48.7	58.1	Suhail	222°50.6	-43°30.1											
Mer.pass.:13:56				v-0.7 d0.6 m-3.8				v1.4 d-0.3 m0.5				v2.7 d0.1 m-2.3				v2.3 d-0.0 m0.5							
Mon				GHA				GHA				GHA				GHA							
0	151°20.7	202°55.5	\$19°06.0	278°36.3	\$17°37.0	339°43.2	N05°11.3	256°51.0	\$20°58.1	Denebola	182°31.5	14°28.8											
1	166°23.1	217°54.8	05.3	293°37.6	37.2	354°45.9	11.4	271°53.3	58.1	Gienah	175°50.1	-17°37.9											
2	181°25.6	232°54.0	04.7	308°39.0	37.5	9°48.7	11.6	286°55.7	58.1	Gacrux	173°06.5	-63°11.2											
3	196°28.1	247°53.3	· · 04.0	323°40.4	· · 37.8	24°51.4	· · 11.7	301°58.0	· · 58.2	Gacrux	171°58.3	-57°12.1											
4	211°30.5	262°52.6	03.3	338°41.8	38.1	39°54.1	11.8	317°00.3	58.2	Alioth	166°18.8	55°52.1											
5	226°33.0	277°51.8	02.7	353°43.1	38.3	54°56.9	11.9	332°02.6	58.2	Spica	158°29.1	-11°14.7											
6	241°35.5	292°51.1	\$19°02.0	8°44.5	\$17°38.6	69°59.6	N05°12.1	347°05.0	\$20°58.2	Alkaid	152°57.3	49°13.8											
7	256°37.9	307°50.4	01.4	23°45.9	38.9	85°02.4	12.2	2°07.3	58.2	Hadar	148°44.8	-60°26.7											
8	271°40.4	322°49.6	00.7	38°47.3	39.2	100°05.1	12.3	17°09.6	58.2	Menkent	148°05.2	-36°26.8											
9	286°42.8	337°48.9	19°00.0	53°48.7	· · 39.4	115°07.8	· · 12.4	32°11.9	· · 58.2	Arcturus	145°53.9	19°05.8											
10	301°45.3	352°48.2	18°59.4	68°50.0	39.7	130°10.6	12.6	47°14.3	58.2	Rigel Kent.	139°48.8	-60°53.7											
11	316°47.8	7°47.4	58.7	83°51.4	40.0	145°13.3	12.7	62°16.6	58.2	Kochab	137°19.9	74°05.1											
12	331°50.2	22°46.7	\$18°58.0	98°52.8	\$17°40.2	160°16.0	N05°12.8	77°18.9	\$20°58.2	Zuben' ubi	137°03.3	-16°06.4											
13	346°52.7	37°46.0	57.4	113°54.2	40.5	175°18.8	12.9	92°21.2	58.3	Alphecca	126°09.4	26°39.5											
14	1°55.2	52°45.3	56.7	128°55.6	40.8	190°21.5	13.0	107°23.6	58.3	Antares	112°24.0	-26°27.8											
15	16°57.6	67°44.5	· · 56.0	143°56.9	· · 41.1	205°24.3	· · 13.2	122°25.9	· · 58.3	Atria	107°24.3	-69°02.9											
16	32°00.1	82°43.8	55.4	158°58.3	41.3	220°27.0	13.3	137°28.2	58.3	Sabik	102°10.5	-15°44.5											
17	47°02.6	97°43.7	54.7	173°59.7	41.6	235°29.7	13.4	152°30.5	58.3	Shaula	96°19.6	-37°06.6											
18	62°05.0	112°42.3	\$18°54.0	189°01.1	\$17°41.9	250°32.5	N05°13.5	167°32.9	\$20°58.3	Rasalhague	96°04.9	12°32.9											
19	77°07.5	127°41.6	53.3	204°02.5	42.1	265°35.2	13.7	182°35.2	58.3	Eltanin	90°45.5	51°29.1											
20	92°09.9	142°40.9	52.7	219°03.8	42.4	280°38.0	13.8	197°37.5	58.3	Kaus Aust.	83°41.6	-34°22.3											
21	107°12.4	157°40.2	· · 52.0	234°05.2	· · 42.7	295°40.7	· · 13.9	212°39.8	· · 58.3	Vega	80°38.0	38°47.9											
22	122°14.9	172°39.4	51.3	249°06.6	43.0	310°43.4	14.0	227°42.2	58.3	Nunki	75°56.3	-26°16.4											
23	137°17.3	187°38.7	50.6	264°08.0	43.2	325°46.2	14.2	242°44.5	58.3	Altair	62°06.7	8°54.7											
Mer.pass.:13:52				v-0.7 d0.7 m-3.8				v1.4 d-0.3 m0.5				v2.7 d0.1 m-2.3				v2.3 d-0.0 m0.5							
Tue				GHA				GHA				GHA				GHA							
0	152°19.8	202°38.0	\$18°50.0	279°09.4	\$17°43.5	340°48.9	N05°14.3	257°46.8	\$20°58.4	Feb 21 Sun	52°51.7	10:28											
1	167°22.3	217°37.3	49.3	294°10.8	43.8	355°51.7	14.4	272°49.2	58.4	Venus	52°51.7	10:28											
2	182°24.7	232°36.5	48.6	309°12.1	44.0	10°54.4	14.5	287°51.5	58.4	Mars	127°41.9	05:27											
3	197°27.2	247°35.8	· · 47.9	324°13.5	· · 44.3	25°57.1	· · 14.7	302°53.8	· · 58.4	Jupiter	188°16.0	01:25											
4	212°29.7	262°35.1	47.3	339°14.9	44.6	40°59.9	14.8	317°56.1	58.4	Saturn	105°33.8	06:55											
5	227°32.1	277°34.4	46.6	354°16.3	44.8	56°02.6	14.9	332°58.5	58.4	Feb 22 Mon	51°34.8	10:29											
6	242°34.6	292°33.7	\$18°45.9	9°17.7	\$17°45.1	71°05.4	N05°15.0	348°00.8	\$20°58.4	Venus	51°34.8	10:29											
7	257°37.1	307°32.9	45.2	24°19.1	45.4	86°08.1																	

DUT1 = UT1-UTC = -0.0059 sec ΔT = TT-UT1 = +68.1899 sec

2016 February 21 to Feb. 23 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	176°34.3	S10°50.3	17°19.5	11.5'	N14°02.7	-6.5'	55.8'
1	191°34.3	49.4	31°50.0	11.5'	13°56.2	-6.5'	55.8'
2	206°34.4	48.5	46°20.6	11.6'	13°49.6	-6.6'	55.8'
3	221°34.5	.. 47.6	60°51.2	11.6'	13°43.0	-6.7'	55.8'
4	236°34.5	46.7	75°21.9	11.7'	13°36.3	-6.7'	55.8'
5	251°34.6	45.8	89°52.6	11.7'	13°29.5	-6.8'	55.8'
6	266°34.7	S10°44.9	104°23.4	11.8'	N13°22.7	-6.8'	55.7'
7	281°34.7	44.0	118°54.2	11.8'	13°15.9	-6.9'	55.7'
8	296°34.8	43.1	133°25.0	11.9'	13°08.9	-7.0'	55.7'
9	311°34.9	.. 42.2	147°56.0	11.9'	13°01.9	-7.0'	55.7'
10	326°35.0	41.3	162°26.9	12.0'	12°54.9	-7.1'	55.7'
11	341°35.0	40.4	176°57.9	12.0'	12°47.8	-7.1'	55.6'
12	356°35.1	S10°39.5	191°29.0	12.1'	N12°40.6	-7.2'	55.6'
13	11°35.2	38.6	206°00.1	12.1'	12°33.4	-7.3'	55.6'
14	26°35.2	37.7	220°31.3	12.2'	12°26.1	-7.3'	55.6'
15	41°35.3	.. 36.8	235°02.5	12.2'	12°18.7	-7.4'	55.6'
16	56°35.4	35.9	249°33.8	12.3'	12°11.4	-7.4'	55.5'
17	71°35.5	35.0	264°05.1	12.3'	12°03.9	-7.5'	55.5'
18	86°35.5	S10°34.1	278°36.4	12.4'	N11°56.4	-7.5'	55.5'
19	101°35.6	33.2	293°07.8	12.4'	11°48.9	-7.6'	55.5'
20	116°35.7	32.3	307°39.3	12.5'	11°41.3	-7.6'	55.5'
21	131°35.8	.. 31.4	322°10.8	12.5'	11°33.6	-7.7'	55.5'
22	146°35.8	30.5	336°42.3	12.6'	11°25.9	-7.7'	55.4'
23	161°35.9	29.6	351°13.9	12.6'	11°18.2	-7.8'	55.4'
	SD.=16.2	d=0.9			S.D.=15.2		

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	176°36.0	S10°28.7	5°45.5	12.7'	N11°10.4	-7.8'	55.4'
1	191°36.1	27.8	20°17.2	12.7'	11°02.5	-7.9'	55.4'
2	206°36.1	26.9	34°49.0	12.8'	10°54.6	-7.9'	55.4'
3	221°36.2	.. 26.0	49°20.7	12.8'	10°46.7	-8.0'	55.4'
4	236°36.3	25.0	63°52.6	12.8'	10°38.7	-8.0'	55.3'
5	251°36.4	24.1	78°24.4	12.9'	10°30.7	-8.1'	55.3'
6	266°36.4	S10°23.2	92°56.4	12.9'	N10°22.6	-8.1'	55.3'
7	281°36.5	22.3	107°28.3	13.0'	10°14.5	-8.1'	55.3'
8	296°36.6	21.4	122°00.3	13.0'	10°06.3	-8.2'	55.3'
9	311°36.7	.. 20.5	136°32.4	13.1'	09°58.1	-8.2'	55.2'
10	326°36.7	19.6	151°04.5	13.1'	09°49.9	-8.3'	55.2'
11	341°36.8	18.7	165°36.6	13.2'	09°41.6	-8.3'	55.2'
12	356°36.9	S10°17.8	180°08.8	13.2'	N09°33.3	-8.3'	55.2'
13	11°37.0	16.9	194°41.0	13.2'	09°24.9	-8.4'	55.2'
14	26°37.1	16.0	209°13.3	13.3'	09°16.5	-8.4'	55.2'
15	41°37.1	.. 15.1	223°45.6	13.3'	09°08.1	-8.5'	55.1'
16	56°37.2	14.1	238°17.9	13.4'	08°59.6	-8.5'	55.1'
17	71°37.3	13.2	252°50.3	13.4'	08°51.1	-8.5'	55.1'
18	86°37.4	S10°12.3	267°22.7	13.5'	N08°42.6	-8.6'	55.1'
19	101°37.5	11.4	281°55.2	13.5'	08°34.0	-8.6'	55.1'
20	116°37.5	10.5	296°27.7	13.5'	08°25.4	-8.6'	55.1'
21	131°37.6	.. 09.6	311°00.3	13.6'	08°16.8	-8.7'	55.0'
22	146°37.7	08.7	325°32.9	13.6'	08°08.1	-8.7'	55.0'
23	161°37.8	07.8	340°05.5	13.6'	07°59.4	-8.7'	55.0'
	SD.=16.2	d=0.9			S.D.=15.0		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	176°37.9	S10°06.9	354°38.2	13.7'	N07°50.7	-8.7'	55.0'
1	191°37.9	05.9	9°10.9	13.7'	07°41.9	-8.8'	55.0'
2	206°38.0	05.0	23°43.6	13.8'	07°33.1	-8.8'	55.0'
3	221°38.1	.. 04.1	38°16.4	13.8'	07°24.3	-8.8'	55.0'
4	236°38.2	03.2	52°49.2	13.8'	07°15.4	-8.9'	54.9'
5	251°38.3	02.3	67°22.1	13.9'	07°06.6	-8.9'	54.9'
6	266°38.4	S10°01.4	81°55.0	13.9'	N06°57.7	-8.9'	54.9'
7	281°38.4	10°00.5	96°27.9	13.9'	06°48.7	-8.9'	54.9'
8	296°38.5	09°59.5	111°00.9	14.0'	06°39.8	-9.0'	54.9'
9	311°38.6	.. 58.6	125°33.9	14.0'	06°30.8	-9.0'	54.9'
10	326°38.7	57.7	140°06.9	14.0'	06°21.8	-9.0'	54.8'
11	341°38.8	56.8	154°39.9	14.1'	06°12.8	-9.0'	54.8'
12	356°38.9	S09°55.9	169°13.0	14.1'	N06°03.8	-9.1'	54.8'
13	11°38.9	55.0	183°46.2	14.1'	05°54.7	-9.1'	54.8'
14	26°39.0	54.1	198°19.3	14.2'	05°45.6	-9.1'	54.8'
15	41°39.1	.. 53.1	212°52.5	14.2'	05°36.5	-9.1'	54.8'
16	56°39.2	52.2	227°25.8	14.2'	05°27.4	-9.1'	54.8'
17	71°39.3	51.3	241°59.0	14.3'	05°18.3	-9.1'	54.7'
18	86°39.4	S09°50.4	256°32.3	14.3'	N05°09.1	-9.2'	54.7'
19	101°39.5	49.5	271°05.6	14.3'	04°59.9	-9.2'	54.7'
20	116°39.5	48.6	285°39.0	14.4'	04°50.8	-9.2'	54.7'
21	131°39.6	.. 47.6	300°12.4	14.4'	04°41.5	-9.2'	54.7'
22	146°39.7	46.7	314°45.8	14.4'	04°32.3	-9.2'	54.7'
23	161°39.8	45.8	329°19.2	14.4'	04°23.1	-9.2'	54.7'
	SD.=16.2	d=0.9			S.D.=14.9		

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

**February 24, 25, 26 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	153°18.9	202°20.7	\$18°33.4	279°42.7	\$17°49.9	341°54.7	N05°17.3	258°42.7	S20°58.6	Alpheratz	357°41.9	29°10.7					
1	168°21.4	217°20.0	32.7	294°44.1	50.2	356°57.5	17.4	273°45.1	58.6	Ankaa	353°14.3	-42°13.3					
2	183°23.9	232°19.3	32.0	309°45.5	50.4	12°00.2	17.5	288°47.4	58.6	Schedar	349°38.8	56°37.6					
3	198°26.3	247°18.6	· · 31.3	324°46.9	· · 50.7	27°02.9	· · 17.7	303°49.7	· · 58.6	Diphda	348°54.3	-17°54.1					
4	213°28.8	262°17.9	30.6	339°48.3	51.0	42°05.7	17.8	318°52.1	58.6	Achernar	335°25.9	-57°09.7					
5	228°31.3	277°17.2	29.9	354°49.6	51.2	57°08.4	17.9	333°54.4	58.6	Hamal	327°58.8	23°32.2					
6	243°33.7	292°16.5	\$18°29.2	9°51.0	\$17°51.5	72°11.2	N05°18.0	348°56.7	S20°58.6	Polaris	317°04.6	89°20.1					
7	258°36.2	307°15.7	28.5	24°52.4	51.8	87°13.9	18.2	3°59.1	58.6	Acamar	315°17.1	-40°14.8					
8	273°38.7	322°15.0	27.8	39°53.8	52.0	102°16.7	18.3	19°01.4	58.6	Menkar	314°13.2	4°08.9					
9	288°41.1	337°14.3	· · 27.1	54°55.2	· · 52.3	117°19.4	· · 18.4	34°03.7	· · 58.6	Mirfak	308°37.8	49°55.1					
10	303°43.6	352°13.6	26.4	69°56.6	52.6	132°22.1	18.5	49°06.1	58.6	Aldebaran	290°47.2	16°32.3					
11	318°46.0	7°12.9	25.7	84°58.0	52.8	147°24.9	18.7	64°08.4	58.7	Rigel	281°10.2	-8°11.4					
12	333°48.5	22°12.2	\$18°25.0	99°59.4	\$17°53.1	162°27.6	N05°18.8	79°10.7	S20°58.7	Capella	280°31.6	46°00.8					
13	348°51.0	37°11.5	24.2	115°00.8	53.3	177°30.4	18.9	94°13.1	58.7	Bellatrix	278°29.9	6°21.6					
14	3°53.4	52°10.8	23.5	130°02.2	53.6	192°33.1	19.0	109°15.4	58.7	Elnath	278°10.2	28°37.1					
15	18°55.9	67°10.1	· · 22.8	145°03.6	· · 53.9	207°35.9	· · 19.2	124°17.7	· · 58.7	Alnilam	275°44.4	-1°11.8					
16	33°58.4	82°09.4	22.1	160°05.0	54.1	222°38.6	19.3	139°20.1	58.7	Betelgeuse	270°59.2	7°24.3					
17	49°00.8	97°08.7	21.4	175°06.4	54.4	237°41.4	19.4	154°22.4	58.7	Canopus	263°55.0	-52°42.7					
18	64°03.3	112°07.9	\$18°20.7	190°07.8	\$17°54.7	252°44.1	N05°19.5	169°24.7	S20°58.7	Sirius	258°31.9	-16°44.7					
19	79°05.8	127°07.2	20.0	205°09.2	54.9	267°46.9	19.7	184°27.1	58.7	Adhara	255°10.8	-29°00.1					
20	94°08.2	142°06.5	19.2	220°10.6	55.2	282°49.6	19.8	199°29.4	58.7	Procyon	244°57.6	5°10.7					
21	109°10.7	157°05.8	· · 18.5	235°12.0	· · 55.4	297°52.3	· · 19.9	214°31.7	· · 58.7	Pollux	243°25.2	27°59.0					
22	124°13.2	172°05.1	17.8	250°13.4	55.7	312°55.1	20.0	229°34.1	58.7	Avior	234°16.6	-59°34.0					
23	139°15.6	187°04.4	17.1	265°14.8	56.0	327°57.8	20.2	244°36.4	58.8	Suhail	222°50.6	-43°30.1					
Mer.pass.:13:44			v-0.7 d0.7 m-3.8	v1.4 d-0.3 m0.4	v2.7 d0.1 m-2.3	v2.3 d-0.0 m0.5	Miaplacidus			Zuben' ubi	221°38.2	-69°47.2					
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	217°54.0	-8°44.0	
0	154°18.1	202°03.7	\$18°16.4	280°16.2	\$17°56.2	343°00.6	N05°20.3	259°38.8	S20°58.8	Denebola	193°49.0	61°39.7					
1	169°20.5	217°03.0	15.6	295°17.6	56.5	358°03.3	20.4	274°41.1	58.8	Gienah	182°31.5	14°28.8					
2	184°23.0	232°02.3	14.9	310°19.0	56.7	13°06.1	20.5	289°43.4	58.8	Acrux	175°50.1	-17°37.9					
3	199°25.5	247°01.6	· · 14.2	325°20.4	· · 57.0	28°08.8	· · 20.7	304°45.8	· · 58.8	Gacrux	173°06.5	-63°11.2					
4	214°27.9	262°00.9	13.5	340°21.8	57.3	43°11.6	20.8	319°48.1	58.8	Alioth	171°58.2	-57°12.1					
5	229°30.4	277°00.2	12.7	355°23.2	57.5	58°14.3	20.9	334°50.4	58.8	Alkaid	166°18.8	55°52.1					
6	244°32.9	291°59.5	\$18°12.0	10°24.6	\$17°57.8	73°17.1	N05°21.0	349°52.8	S20°58.8	Hadar	158°29.1	-11°14.7					
7	259°35.3	306°58.8	11.3	25°26.0	58.0	88°19.8	21.2	4°55.1	58.8	Menkent	152°57.2	49°13.8					
8	274°37.8	321°58.1	10.5	40°27.4	58.3	103°22.6	21.3	19°57.4	58.8	Arcurus	148°05.1	-36°26.8					
9	289°40.3	336°57.4	· · 09.8	55°28.9	· · 58.6	118°25.3	· · 21.4	34°59.8	· · 58.8	Rigel Kent.	145°53.9	19°05.8					
10	304°42.7	351°56.7	09.1	70°30.3	58.8	133°28.0	21.6	50°02.1	58.8	Kochab	139°48.8	-60°53.7					
11	319°45.2	6°56.0	08.4	85°31.7	59.1	148°30.8	21.7	65°04.5	58.9	Zuben' ubi	137°19.8	74°05.1					
12	334°47.6	21°55.3	\$18°07.6	100°33.1	\$17°59.3	163°33.5	N05°21.8	80°06.8	S20°58.9	Alphecca	126°09.4	26°39.5					
13	349°50.1	36°54.6	06.9	115°34.5	59.6	178°36.3	21.9	95°09.1	58.9	Antares	112°24.0	-26°27.8					
14	4°52.6	51°53.9	06.2	130°35.9	17°59.9	193°39.0	22.1	110°11.5	58.9	Atria	107°24.2	-69°02.9					
15	19°55.0	66°53.2	· · 05.4	145°37.3	18°00.1	208°41.8	· · 22.2	125°13.8	· · 58.9	Sabik	102°10.5	-15°44.5					
16	34°57.5	81°52.5	04.7	160°38.7	00.4	223°44.5	22.3	140°16.1	58.9	Rasalhague	96°19.6	-37°06.6					
17	50°00.0	96°51.8	03.9	175°40.1	00.6	238°47.3	22.4	155°18.5	58.9	Eltanin	90°45.5	51°29.1					
18	65°02.4	111°51.1	\$18°03.2	190°41.5	\$18°00.9	253°50.0	N05°22.6	170°20.8	S20°58.9	Kaus Aust.	83°41.6	-34°22.3					
19	80°04.9	126°50.4	02.5	205°42.9	01.1	268°52.8	22.7	185°23.2	58.9	Vega	80°37.9	38°47.9					
20	95°07.4	141°49.7	01.7	220°44.3	01.4	283°55.5	22.8	200°25.5	58.9	Nunki	75°56.3	-26°16.4					
21	110°09.8	156°49.0	· · 01.0	235°45.8	· · 01.7	298°58.3	· · 22.9	215°27.8	· · 58.9	Altair	62°06.7	8°54.7					
22	125°12.3	171°48.3	18°00.2	250°47.2	01.9	314°01.0	23.1	230°30.2	58.9	Peacock	53°17.0	-56°40.7					
23	140°14.8	186°47.7	17°59.5	265°48.6	02.2	329°03.8	23.2	245°32.5	58.9	Deneb	49°30.6	45°20.2					
Mer.pass.:13:41			v-0.7 d0.7 m-3.8	v1.4 d-0.3 m0.4	v2.7 d0.1 m-2.3	v2.3 d-0.0 m0.5	Enif			Al Na'ir	33°45.6	9°56.9					
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	27°42.0	-46°52.9					
0	155°17.2	201°47.0	\$17°58.8	280°50.0	\$18°02.4	344°06.5	N05°23.3	260°34.9	S20°59.0	Scheat	15°22.4	-29°32.3					
1	170°19.7	216°46.3	58.0	295°51.4	02.7	359°09.3	23.5	275°37.2	59.0	Markab	13°51.9	28°10.2					
2	185°22.1	231°45.6	57.3	310°52.8	02.9	14°12.0	23.6	290°39.5	59.0	Feb 24 Wed	13°36.8	15°17.5					
3	200°24.6	246°44.9	· · 56.5	325°54.2	· · 03.2	29°14.8	· · 23.7	305°41.9	· · 59.0	Venus	49°01.8	10:31					
4	215°27.1	261°44.2	55.8	340°55.6	03.5	44°17.5	23.8	320°44.2	59.0	Mars	126°23.7	05:21					
5	230°29.5	276°43.5	55.0	355°57.0	03.7	59°20.3	24.0	335°46.6	59.0	Jupiter	188°35.8	01:12					
6	245°32.0	291°42.8	10°58.5	\$18°04.0	74°23.0	N05°24.1	350°48.9	S20°59.0	Saturn	105°23.8	06:44						
7	260°34.5	306°42.1	53.5	25°59.9	04.2	89°25.8	24.2	5°51.2	59.0	Feb 25 Thu	49°01.8	10:32					
8	275°36.9	321°41.4	52.8	41°01.3	04.5	104°28.5	24.3	20°53.6	59.0	Venus	47°45.6	05:18					
9	290°39.4	336°40.7	· · 52.0	56°02.7	· · 04.7	119°31.3	· · 24.5	35°55.9	· · 59.0	Mars	125°58.1	01:08					
10	305°41.9	351°40.1	51.3	71°04.1	05.0	134°34.0	24.6	50°58.3	59.0	Jupiter	188°42.5	01:08					
11	320°44.3	6°39.4	50.5	86°05.5	05.2	149°36.8	24.7	66°00.6	59.0	Saturn	105°20.7	06:40					
12	335°46.8	21°38.7	\$17°49.8	101°07.0	\$18°05.5	164°39.5	N05°24.9	81°03.0	S20°59.0	Feb 26 Fri	49°01.8	10:33					
13	350°49.2	36°38.0	49.0	116°08.4	05.8	179°42.3	25.0	96°05.3	59.0	Venus	46°29.7	05:16					
14	5°51.7	51°37.3	48.2	131°09.8	06.0	194°45.0	25.1	111°07.6	59.1	Mars	125°32.8	01:03					
15	20°54.2	66°36.6	· · 47.5	146°11.2	· · 06.3	209°47.8	· · 25.2	126°10.0	· · 59.1	Jupiter	188°49.3	01:03					
16	35°56.6	81°35.9	46.7	161°12.6	06.5	224°50.5	25.4	141°12.3	59.1	Saturn	105°17.6	06:37					
17	50°59.1	96°35.2	46.0	176°14.0	06.8	239°53.3	25.5	156°14.7	59.1	Horizontal parallax							
18	66°01.6	111°34.6	\$17°45.2	191°15.5	\$18°07.0	254°56.0	N05°25.6	171°17.0	S20°59.1	Venus:	0.1						
19	81°04.0	126°33.9	44.5	206°16.9	07.3	269°58.8	25.7	186°19.4	59.1	Mars:</							

DUT1 = UT1-UTC = -0.0107 sec ΔT = TT-UT1 = +68.1947 sec

2016 February 24 to Feb. 26 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	176°39.9	S09°44.9		343°52.7	14.5'	N04°13.8	-9.3'	54.6'
1	191°40.0	44.0		358°26.2	14.5'	04°04.6	-9.3'	54.6'
2	206°40.1	43.0		12°59.7	14.5'	03°55.3	-9.3'	54.6'
3	221°40.2	42.1		27°33.2	14.6'	03°46.0	-9.3'	54.6'
4	236°40.2	41.2		42°06.8	14.6'	03°36.7	-9.3'	54.6'
5	251°40.3	40.3		56°40.4	14.6'	03°27.4	-9.3'	54.6'
6	266°40.4	S09°39.4		71°14.0	14.6'	N03°18.1	-9.3'	54.6'
7	281°40.5	38.4		85°47.6	14.7'	03°08.8	-9.3'	54.6'
8	296°40.6	37.5		100°21.3	14.7'	02°59.5	-9.3'	54.5'
9	311°40.7	36.6		114°55.0	14.7'	02°50.1	-9.3'	54.5'
10	326°40.8	35.7		129°28.7	14.7'	02°40.8	-9.4'	54.5'
11	341°40.9	34.8		144°02.4	14.7'	02°31.4	-9.4'	54.5'
12	356°41.0	S09°33.8		158°36.2	14.8'	N02°22.1	-9.4'	54.5'
13	11°41.1	32.9		173°10.0	14.8'	02°12.7	-9.4'	54.5'
14	26°41.1	32.0		187°43.7	14.8'	02°03.3	-9.4'	54.5'
15	41°41.2	31.1		202°17.6	14.8'	01°54.0	-9.4'	54.5'
16	56°41.3	30.2		216°51.4	14.8'	01°44.6	-9.4'	54.5'
17	71°41.4	29.2		231°25.2	14.9'	01°35.2	-9.4'	54.4'
18	86°41.5	S09°28.3		245°59.1	14.9'	N01°25.8	-9.4'	54.4'
19	101°41.6	27.4		260°33.0	14.9'	01°16.4	-9.4'	54.4'
20	116°41.7	26.5		275°06.9	14.9'	01°07.1	-9.4'	54.4'
21	131°41.8	25.5		289°40.8	14.9'	00°57.7	-9.4'	54.4'
22	146°41.9	24.6		304°14.7	14.9'	00°48.3	-9.4'	54.4'
23	161°42.0	23.7		318°48.7	15.0'	00°38.9	-9.4'	54.4'
	SD.=16.2	d=0.9				S.D.=14.9		

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	176°42.1	S09°22.8	333°22.6	15.0'	N00°29.5	-9.4'	54.4'
1	191°42.2	21.8	347°56.6	15.0'	00°20.1	-9.4'	54.4'
2	206°42.3	20.9	2°30.6	15.0'	00°10.8	-9.4'	54.3'
3	221°42.4	20.0	17°04.6	15.0'	N00°01.4	-9.4'	54.3'
4	236°42.5	19.1	31°38.6	15.0'	S00°08.0	-9.4'	54.3'
5	251°42.5	18.1	46°12.7	15.0'	00°17.3	-9.4'	54.3'
6	266°42.6	S09°17.2	60°46.7	15.0'	S00°26.7	-9.4'	54.3'
7	281°42.7	16.3	75°20.7	15.1'	00°36.0	-9.3'	54.3'
8	296°42.8	15.4	89°54.8	15.1'	00°45.4	-9.3'	54.3'
9	311°42.9	14.4	104°28.9	15.1'	00°54.7	-9.3'	54.3'
10	326°43.0	13.5	119°02.9	15.1'	01°04.0	-9.3'	54.3'
11	341°43.1	12.6	133°37.0	15.1'	01°13.4	-9.3'	54.3'
12	356°43.2	S09°11.6	148°11.1	15.1'	S01°22.7	-9.3'	54.3'
13	11°43.3	10.7	162°45.2	15.1'	01°32.0	-9.3'	54.2'
14	26°43.4	09.8	177°19.3	15.1'	01°41.3	-9.3'	54.2'
15	41°43.5	08.9	191°53.4	15.1'	01°50.6	-9.3'	54.2'
16	56°43.6	07.9	206°27.5	15.1'	01°59.8	-9.3'	54.2'
17	71°43.7	07.0	221°01.7	15.1'	02°09.1	-9.3'	54.2'
18	86°43.8	S09°06.1	235°35.8	15.1'	S02°18.4	-9.2'	54.2'
19	101°43.9	05.2	250°09.9	15.1'	02°27.6	-9.2'	54.2'
20	116°44.0	04.2	264°44.1	15.1'	02°36.8	-9.2'	54.2'
21	131°44.1	03.3	279°18.2	15.1'	02°46.0	-9.2'	54.2'
22	146°44.2	02.4	293°52.3	15.1'	02°55.2	-9.2'	54.2'
23	161°44.3	01.4	308°26.5	15.1'	03°04.4	-9.2'	54.2'
	SD.=16.1	d=0.9			S.D.=14.8		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	176°44.4	S09°00.5	323°00.6	15.1'	S03°13.6	-9.2'	54.2'
1	191°44.5	08°59.6	337°34.7	15.1'	03°22.7	-9.1'	54.2'
2	206°44.6	58.6	352°08.9	15.1'	03°31.8	-9.1'	54.2'
3	221°44.7	57.7	6°43.0	15.1'	03°41.0	-9.1'	54.2'
4	236°44.8	56.8	21°17.1	15.1'	03°50.1	-9.1'	54.1'
5	251°44.9	55.8	35°51.3	15.1'	03°59.1	-9.1'	54.1'
6	266°45.0	S08°54.9	50°25.4	15.1'	S04°08.2	-9.1'	54.1'
7	281°45.1	54.0	64°59.5	15.1'	04°17.2	-9.0'	54.1'
8	296°45.2	53.1	79°33.7	15.1'	04°26.3	-9.0'	54.1'
9	311°45.3	52.1	94°07.8	15.1'	04°35.3	-9.0'	54.1'
10	326°45.4	51.2	108°41.9	15.1'	04°44.2	-9.0'	54.1'
11	341°45.5	50.3	123°16.0	15.1'	04°53.2	-8.9'	54.1'
12	356°45.6	S08°49.3	137°50.1	15.1'	S05°02.1	-8.9'	54.1'
13	11°45.7	48.4	152°24.2	15.1'	05°11.1	-8.9'	54.1'
14	26°45.8	47.5	166°58.3	15.1'	05°19.9	-8.9'	54.1'
15	41°45.9	46.5	181°32.4	15.1'	05°28.8	-8.9'	54.1'
16	56°46.0	45.6	196°06.4	15.1'	05°37.7	-8.8'	54.1'
17	71°46.1	44.7	210°40.5	15.1'	05°46.5	-8.8'	54.1'
18	86°46.2	S08°43.7	225°14.6	15.0'	S05°55.3	-8.8'	54.1'
19	101°46.3	42.8	239°48.6	15.0'	06°04.0	-8.8'	54.1'
20	116°46.5	41.8	254°22.6	15.0'	06°12.8	-8.7'	54.1'
21	131°46.6	40.9	268°56.7	15.0'	06°21.5	-8.7'	54.1'
22	146°46.7	40.0	283°30.7	15.0'	06°30.2	-8.7'	54.1'
23	161°46.8	39.0	298°04.7	15.0'	06°38.8	-8.6'	54.1'
	SD.=16.1	d=0.9			S.D.=14.7		

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Mer. Pass hh:mm
24	13:20		13:16		12:13
25	13:12		13:07		12:13
26	13:02		12:58		12:13



**February 27, 28, 29 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	156°16.4	201°30.5	\$17°40.6	281°24.0	\$18°08.5	345°12.5	N05°26.4	261°31.1	\$20°59.1	Alpheratz	357°41.9	29°10.7					
1	171°18.8	216°29.8	39.9	296°25.4	08.8	0°15.3	26.5	276°33.4	59.1	Ankaa	353°14.3	-42°13.3					
2	186°21.3	231°29.1	39.1	311°26.8	09.0	15°18.0	26.6	291°35.8	59.1	Schedar	349°38.8	56°37.6					
3	201°23.7	246°28.4	· · 38.3	326°28.3	· · 09.3	30°20.8	· · 26.8	306°38.1	· · 59.1	Diphda	348°54.3	-17°54.1					
4	216°26.2	261°27.7	37.6	341°29.7	09.5	45°23.5	26.9	321°40.4	59.2	Achernar	335°25.9	-57°09.6					
5	231°28.7	276°27.1	36.8	356°31.1	09.8	60°26.3	27.0	336°42.8	59.2	Hamal	327°58.9	23°32.2					
6	246°31.1	291°26.4	\$17°36.0	11°32.5	\$18°10.0	75°29.0	N05°27.1	351°45.1	\$20°59.2	Polaris	317°05.9	89°20.1					
7	261°33.6	306°25.7	35.3	26°34.0	10.3	90°31.8	27.3	6°47.5	59.2	Acamar	315°17.2	-40°14.8					
8	276°36.1	321°25.0	34.5	41°35.4	10.6	105°34.5	27.4	21°49.8	59.2	Menkar	314°13.2	4°08.9					
9	291°38.5	336°24.3	· · 33.7	56°36.8	· · 10.8	120°37.3	· · 27.5	36°52.2	· · 59.2	Mirfak	308°37.8	49°55.1					
10	306°41.0	351°23.7	32.9	71°38.2	11.1	135°40.0	27.7	51°54.5	59.2	Aldebaran	290°47.3	16°32.3					
11	321°43.5	6°23.0	32.2	86°39.7	11.3	150°42.8	27.8	66°56.9	59.2	Rigel	281°10.2	-8°11.4					
12	336°45.9	21°22.3	\$17°31.4	101°41.1	\$18°11.6	165°45.5	N05°27.9	81°59.2	\$20°59.2	Capella	280°31.6	46°00.8					
13	351°48.4	36°21.6	30.6	116°42.5	11.8	180°48.3	28.0	97°01.6	59.2	Bellatrix	278°30.0	6°21.5					
14	6°50.9	51°21.0	29.8	131°43.9	12.1	195°51.0	28.2	112°03.9	59.2	Elnath	278°10.2	28°37.1					
15	21°53.3	66°20.3	· · 29.1	146°45.4	· · 12.3	210°53.8	· · 28.3	127°06.2	· · 59.2	Alnilam	275°44.4	-1°11.8					
16	36°55.8	81°19.6	28.3	161°46.8	12.6	225°56.5	28.4	142°08.6	59.2	Betelgeuse	270°59.2	7°24.3					
17	51°58.2	96°18.9	27.5	176°48.2	12.8	240°59.3	28.6	157°10.9	59.2	Canopus	263°55.1	-52°42.7					
18	67°00.7	111°18.3	\$17°26.7	191°49.7	\$18°13.0	256°02.1	N05°28.7	172°13.3	\$20°59.3	Sirius	258°31.9	-16°44.7					
19	82°03.2	126°17.6	25.9	206°51.1	13.3	271°04.8	28.8	187°15.6	59.3	Adhara	255°10.9	-29°00.1					
20	97°05.6	141°16.9	25.2	221°52.5	13.5	286°07.6	28.9	202°18.0	59.3	Procyon	244°57.6	5°10.7					
21	112°08.1	156°16.2	· · 24.4	236°53.9	· · 13.8	301°10.3	· · 29.1	217°20.3	· · 59.3	Pollux	243°25.2	27°59.0					
22	127°10.6	171°15.6	23.6	251°55.4	14.0	316°13.1	29.2	232°22.7	59.3	Avior	234°16.7	-59°34.0					
23	142°13.0	186°14.9	22.8	266°56.8	14.3	331°15.8	29.3	247°25.0	59.3	Suhail	222°50.6	-43°30.2					
Mer.pass.:13:33			v-0.7 d0.8 m-3.8	v1.4 d-0.3 m0.3	v2.8 d0.1 m-2.3	v2.3 d-0.0 m0.5	Miaplacidus			Zuben ubi	221°38.3	-69°47.3					
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Denebola	193°48.9	61°39.7					
0	157°15.5	201°14.2	\$17°22.0	281°58.2	\$18°14.5	346°18.6	N05°29.4	262°27.4	\$20°59.3	Alphard	217°54.0	-8°44.0					
1	172°18.0	216°13.6	21.2	296°59.7	14.8	1°21.3	29.6	277°29.7	59.3	Regulus	207°41.3	11°53.1					
2	187°20.4	231°12.9	20.4	312°01.1	15.0	16°24.1	29.7	292°32.1	59.3	Dubhe	193°48.9	61°39.7					
3	202°22.9	246°12.2	· · 19.7	327°02.5	· · 15.3	31°26.8	· · 29.8	307°34.4	· · 59.3	Denebola	182°31.5	14°28.8					
4	217°25.3	261°11.5	18.9	342°04.0	15.5	46°29.6	30.0	322°36.8	59.3	Gienah	175°50.1	-17°37.9					
5	232°27.8	276°10.9	18.1	357°05.4	15.8	61°32.3	30.1	337°39.1	59.3	Acrux	173°06.5	-63°11.2					
6	247°30.3	291°10.2	\$17°17.3	12°06.8	\$18°16.0	76°35.1	N05°30.2	352°41.5	\$20°59.3	Gacrux	171°58.2	-57°12.1					
7	262°32.7	306°09.5	16.5	27°08.3	16.3	91°37.9	30.3	7°43.8	59.3	Alioth	166°18.7	55°52.2					
8	277°35.2	321°08.9	15.7	42°09.7	16.5	106°40.6	30.5	22°46.2	59.3	Spica	158°29.1	-11°14.7					
9	292°37.7	336°08.2	· · 14.9	57°11.1	· · 16.8	121°43.4	· · 30.6	37°48.5	· · 59.4	Alkaid	152°57.2	49°13.8					
10	307°40.1	351°07.5	14.1	72°12.6	17.0	136°46.1	30.7	52°50.9	59.4	Hadar	148°44.8	-60°26.8					
11	322°42.6	6°06.9	13.3	87°14.0	17.3	151°48.9	30.9	67°53.2	59.4	Menken	148°05.1	-36°26.8					
12	337°45.1	21°06.2	\$17°12.5	102°15.5	\$18°17.5	166°51.6	N05°31.0	82°55.6	\$20°59.4	Arcturus	145°53.9	19°05.8					
13	352°47.5	36°05.5	11.7	117°16.9	17.7	181°54.4	31.1	97°57.9	59.4	Rigel Kent.	139°48.8	-60°53.8					
14	7°50.0	51°04.9	10.9	132°18.3	18.0	196°57.1	31.2	113°00.3	59.4	Kochab	137°19.8	74°05.2					
15	22°52.5	66°04.2	· · 10.1	147°19.8	· · 18.2	211°59.9	· · 31.4	128°02.6	· · 59.4	Zuben ubi	137°03.2	-16°06.4					
16	37°54.9	81°03.5	09.3	162°21.2	18.5	227°02.6	31.5	143°05.0	59.4	Alphecca	126°09.4	26°39.5					
17	52°57.4	96°02.9	08.5	177°22.7	18.7	242°05.4	31.6	158°07.3	59.4	Antares	112°24.0	-26°27.8					
18	67°59.8	111°02.2	\$17°07.7	192°24.1	\$18°19.0	257°08.2	N05°31.8	173°09.7	\$20°59.4	Atria	107°24.2	-69°02.9					
19	83°02.3	126°01.6	06.9	207°25.5	19.2	272°10.9	31.9	188°12.0	59.4	Sabik	102°10.5	-15°44.5					
20	98°04.8	141°00.9	06.1	222°27.0	19.5	287°13.7	32.0	203°14.4	59.4	Shaula	96°19.5	-37°06.6					
21	113°07.2	156°00.2	· · 05.3	237°28.4	· · 19.7	302°16.4	· · 32.1	218°16.7	· · 59.4	Rasalhague	96°04.8	12°32.9					
22	128°09.7	170°59.6	04.5	252°29.9	20.0	317°19.2	32.3	233°19.1	59.4	Eltanin	90°45.5	51°29.1					
23	143°12.2	185°58.9	03.7	267°31.3	20.2	332°21.9	32.4	248°21.4	59.4	Kaus Aust.	83°41.6	-34°22.3					
Mer.pass.:13:29			v-0.7 d0.8 m-3.8	v1.4 d-0.2 m0.3	v2.8 d0.1 m-2.3	v2.3 d-0.0 m0.5	Vega			Vega	80°37.9	38°47.8					
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Nunki	75°56.3	-26°16.4					
0	158°14.6	200°58.2	\$17°02.9	282°32.7	\$18°20.4	347°24.7	N05°32.5	263°23.8	\$20°59.4	Altair	62°06.7	8°54.7					
1	173°17.1	215°57.6	02.1	297°34.2	20.7	2°27.4	32.7	278°26.1	59.5	Peacock	53°16.9	-56°40.7					
2	188°19.6	230°56.9	01.3	312°35.6	20.9	17°30.2	32.8	293°28.5	59.5	Deneb	49°30.6	45°20.2					
3	203°22.0	245°56.3	17°00.5	327°37.1	· · 21.2	32°33.0	· · 32.9	308°30.8	· · 59.5	Enif	33°45.6	9°56.9					
4	218°24.5	260°55.6	16°59.7	342°38.5	21.4	47°35.7	33.0	323°33.2	59.5	Al Na'ir	27°42.0	-46°52.9					
5	233°26.9	275°55.0	58.9	357°40.0	21.7	62°38.5	33.2	338°35.5	59.5	Fomalhaut	15°22.4	-29°32.3					
6	248°29.4	290°54.3	\$16°58.0	12°41.4	\$18°21.9	77°41.2	N05°33.3	353°37.9	\$20°59.5	Scheat	13°51.9	28°10.2					
7	263°31.9	305°53.6	57.2	27°42.9	22.1	92°44.0	33.4	8°40.2	59.5	Markab	13°36.8	15°17.5					
8	278°34.3	320°53.0	56.4	42°44.3	22.4	107°46.7	33.6	23°42.6	59.5	<b>Feb 27 Sat</b>	<b>SHA</b>	<b>Mer.pass</b>					
9	293°36.8	335°52.3	· · 55.6	57°45.7	· · 22.6	122°49.5	· · 33.7	38°45.0	· · 59.5	Venus	45°14.1	10:34					
10	308°39.3	350°51.7	54.8	72°47.2	22.9	137°52.2	33.8	53°47.3	59.5	Mars	125°07.6	05:14					
11	323°41.7	5°51.0	54.0	87°48.6	23.1	152°55.0	34.0	68°49.7	59.5	Jupiter	188°56.2	00:59					
12	338°44.2	20°50.4	\$16°53.2	102°50.1	\$18°23.4	167°57.8	N05°34.1	83°52.0	\$20°59.5	Saturn	105°14.7	06:33					
13	353°46.7	35°49.7	52.3	117°51.5	23.6	183°00.5	34.2	98°54.4	59.5	<b>Feb 28 Sun</b>	<b>SHA</b>	<b>Mer.pass</b>					
14	8°49.1	50°49.0	51.5	132°53.0	23.8	198°03.3	34.3	113°56.7	59.5	Venus	43°58.7	10:36					
15	23°51.6	65°48.4	· · 50.7	147°54.4	· · 24.1	213°06.0	· · 34.5	128°59.1	· · 59.5	Mars	124°42.7	05:12					
16	38°54.1	80°47.7	49.9	162°55.9	24.3	228°08.8	34.6	144°01.4	59.5	Jupiter	189°03.1	00:55					
17	53°56.5	95°47.1	49.1	177°57.3	24.6	243°11.5	34.7	159°03.8	59.5	Saturn	105°11.9	06:29					
18	68°59.0	110°46.4	\$16°48.2	192°58.8	\$18°24.8	258°14.3	N05°34.9	174°06.1	\$20°59.6	<b>Feb 29 Mon</b>	<b>SHA</b>	<b>Mer.pass</b>					
19	84°01.4	125°45.8	47.4	208°00.2	25.0	273°17.1	35.0										

DUT1 = UT1-UTC = -0.0156 sec ΔT = TT-UT1 = +68.1996 sec

2016 February 27 to Feb. 29 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	176°46.9	S08°38.1	312°38.6	15.0'	S06°47.5	-8.6'	54.1'
1	191°47.0	37.2	327°12.6	15.0'	06°56.1	-8.6'	54.1'
2	206°47.1	36.2	341°46.6	14.9'	07°04.7	-8.6'	54.1'
3	221°47.2	.. 35.3	356°20.5	14.9'	07°13.2	-8.5'	54.1'
4	236°47.3	34.4	10°54.4	14.9'	07°21.7	-8.5'	54.1'
5	251°47.4	33.4	25°28.3	14.9'	07°30.2	-8.5'	54.1'
6	266°47.5	S08°32.5	40°02.2	14.9'	S07°38.6	-8.4'	54.1'
7	281°47.6	31.5	54°36.1	14.9'	07°47.1	-8.4'	54.1'
8	296°47.7	30.6	69°10.0	14.9'	07°55.4	-8.4'	54.1'
9	311°47.8	.. 29.7	83°43.8	14.8'	08°03.8	-8.3'	54.1'
10	326°47.9	28.7	98°17.6	14.8'	08°12.1	-8.3'	54.1'
11	341°48.1	27.8	112°51.4	14.8'	08°20.4	-8.3'	54.1'
12	356°48.2	S08°26.9	127°25.2	14.8'	S08°28.7	-8.2'	54.1'
13	11°48.3	25.9	141°59.0	14.8'	08°36.9	-8.2'	54.1'
14	26°48.4	25.0	156°32.7	14.7'	08°45.1	-8.2'	54.1'
15	41°48.5	.. 24.0	171°06.5	14.7'	08°53.2	-8.1'	54.1'
16	56°48.6	23.1	185°40.2	14.7'	09°01.3	-8.1'	54.1'
17	71°48.7	22.2	200°13.8	14.7'	09°09.4	-8.1'	54.1'
18	86°48.8	S08°21.2	214°47.5	14.6'	S09°17.4	-8.0'	54.1'
19	101°48.9	20.3	229°21.1	14.6'	09°25.4	-8.0'	54.1'
20	116°49.0	19.3	243°54.7	14.6'	09°33.4	-7.9'	54.1'
21	131°49.1	.. 18.4	258°28.3	14.6'	09°41.3	-7.9'	54.1'
22	146°49.3	17.5	273°01.9	14.5'	09°49.2	-7.9'	54.1'
23	161°49.4	16.5	287°35.4	14.5'	09°57.0	-7.8'	54.1'
	SD.=16.1	d=0.9			S.D.=14.7		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
27	12:53	12:47	12:13	15:37
28	12:42	12:37	12:13	16:21
29	12:31	12:25	12:12	17:06



SD.=16.1	d=0.9	S.D.=14.9
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## March 01, 02, 03 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	159°13.8	200°42.5	\$16°43.3	283°07.5	\$18°26.2	348°30.8	N05°35.6	264°20.3	\$20°59.6	Alpheratz	357°41.9	29°10.7					
1	174°16.2	215°41.9	42.5	298°09.0	26.5	3°33.6	35.8	279°22.6	59.6	Ankaa	353°14.3	-42°13.3					
2	189°18.7	230°41.2	41.6	313°10.4	26.7	18°36.4	35.9	294°25.0	59.6	Schedar	349°38.8	56°37.6					
3	204°21.2	245°40.6	· · 40.8	328°11.9	· · 27.0	33°39.1	· · 36.0	309°27.3	· · 59.6	Diphda	348°54.4	-17°54.1					
4	219°23.6	260°39.9	40.0	343°13.3	27.2	48°41.9	36.1	324°29.7	59.6	Achernar	335°25.9	-57°09.6					
5	234°26.1	275°39.3	39.2	358°14.8	27.4	63°44.6	36.3	339°32.1	59.6	Hamal	327°58.9	23°32.2					
6	249°28.6	290°38.6	\$16°38.3	13°16.2	\$18°27.7	78°47.4	N05°36.4	354°34.4	\$20°59.6	Polaris	317°07.1	89°20.1					
7	264°31.0	305°38.0	37.5	28°17.7	27.9	93°50.2	36.5	9°36.8	59.6	Acamar	315°17.2	-40°14.8					
8	279°33.5	320°37.4	36.7	43°19.2	28.1	108°52.9	36.7	24°39.1	59.6	Menkar	314°13.3	4°08.9					
9	294°35.9	335°36.7	· · 35.8	58°20.6	· · 28.4	123°55.7	· · 36.8	39°41.5	· · 59.6	Mirfak	308°37.8	49°55.1					
10	309°38.4	350°36.1	35.0	73°22.1	28.6	138°58.4	36.9	54°43.9	59.6	Aldebaran	290°47.3	16°32.3					
11	324°40.9	5°35.4	34.2	88°23.5	28.9	154°01.2	37.1	69°46.2	59.7	Rigel	281°10.2	-8°11.4					
12	339°43.3	20°34.8	\$16°33.3	103°25.0	\$18°29.1	169°03.9	N05°37.2	84°48.6	\$20°59.7	Capella	280°31.6	46°00.8					
13	354°45.8	35°34.1	32.5	118°26.4	29.3	184°06.7	37.3	99°50.9	59.7	Bellatrix	278°30.0	6°21.5					
14	9°48.3	50°33.5	31.6	133°27.9	29.6	199°09.5	37.4	114°53.3	59.7	El Nath	278°10.2	28°37.1					
15	24°50.7	65°32.8	· · 30.8	148°29.4	· · 29.8	214°12.2	· · 37.6	129°55.6	· · 59.7	Alnilam	275°44.4	-1°11.8					
16	39°53.2	80°32.2	30.0	163°30.8	30.0	229°15.0	37.7	144°58.0	59.7	Betelgeuse	270°59.2	7°24.3					
17	54°55.7	95°31.6	29.1	178°32.3	30.3	244°17.7	37.8	160°00.4	59.7	Canopus	263°55.1	-52°42.8					
18	69°58.1	110°30.9	\$16°28.3	193°33.8	\$18°30.5	259°20.5	N05°38.0	175°02.7	\$20°59.7	Sirius	258°31.9	-16°44.7					
19	85°00.6	125°30.3	27.4	208°35.2	30.8	274°23.3	38.1	190°05.1	59.7	Adhara	255°10.9	-29°00.1					
20	100°03.0	140°29.6	26.6	223°36.7	31.0	289°26.0	38.2	205°07.4	59.7	Procyon	244°57.6	5°10.7					
21	115°05.5	155°29.0	· · 25.8	238°38.1	· · 31.2	304°28.8	· · 38.3	220°09.8	· · 59.7	Pollux	243°25.3	27°59.0					
22	130°08.0	170°28.4	24.9	253°39.6	31.5	319°31.5	38.5	235°12.2	59.7	Avior	234°16.7	-59°34.0					
23	145°10.4	185°27.7	24.1	268°41.1	31.7	334°34.3	38.6	250°14.5	59.7	Suhail	222°50.6	-43°30.2					
Mer.pass.:13:21			v-0.6 d0.8 m-3.8	v1.5 d-0.2 m0.3	v2.8 d0.1 m-2.3	v2.4 d-0.0 m0.5	Miaplacidus			Zuben ubi	221°38.3	-69°47.3					
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.0	-8°44.0	
0	160°12.9	200°27.1	\$16°23.2	283°42.5	\$18°31.9	349°37.1	N05°38.7	265°16.9	\$20°59.7	Regulus	207°41.3	11°53.1					
1	175°15.4	215°26.4	22.4	298°44.0	32.2	4°39.8	38.9	280°19.2	59.7	Dubhe	193°48.9	61°39.7					
2	190°17.8	230°25.8	21.5	313°45.5	32.4	19°42.6	39.0	295°21.6	59.7	Denebola	182°31.5	14°28.8					
3	205°20.3	245°25.2	· · 20.7	328°46.9	· · 32.6	34°45.3	· · 39.1	310°24.0	· · 59.7	Gienah	175°50.1	-17°38.0					
4	220°22.8	260°24.5	19.8	343°48.4	32.9	49°48.1	39.3	325°26.3	59.7	Acrux	173°06.5	-63°11.2					
5	235°25.2	275°23.9	19.0	358°49.9	33.1	64°50.8	39.4	340°28.7	59.7	Gacrux	171°58.2	-57°12.1					
6	250°27.7	290°23.3	\$16°18.1	13°51.3	\$18°33.3	79°53.6	N05°39.5	355°31.0	\$20°59.8	Alioth	166°18.7	55°52.2					
7	265°30.2	305°22.6	17.3	28°52.8	33.6	94°56.4	39.6	10°33.4	59.8	Spica	158°29.1	-11°14.7					
8	280°32.6	320°22.0	16.4	43°54.3	33.8	109°59.1	39.8	25°35.8	59.8	Alkaid	152°57.2	49°13.8					
9	295°35.1	335°21.4	· · 15.6	58°55.8	· · 34.0	125°01.9	· · 39.9	40°38.1	· · 59.8	Hadar	148°44.7	-60°26.8					
10	310°37.5	350°20.7	14.7	73°57.2	34.3	140°04.6	40.0	55°40.5	59.8	Menkent	148°05.1	-36°26.8					
11	325°40.0	5°20.1	13.9	88°58.7	34.5	155°07.4	40.2	70°42.9	59.8	Arcturus	145°53.9	19°05.8					
12	340°42.5	20°19.5	\$16°13.0	104°00.2	\$18°34.7	170°10.2	N05°40.3	85°45.2	\$20°59.8	Rigel Kent.	139°48.7	-60°53.8					
13	355°44.9	35°18.8	12.2	119°01.6	35.0	185°12.9	40.4	100°47.6	59.8	Kochab	137°19.7	74°05.2					
14	10°47.4	50°18.2	11.3	134°03.1	35.2	200°15.7	40.6	115°49.9	59.8	Zuben ubi	137°03.2	-16°06.4					
15	25°49.9	65°17.6	· · 10.4	149°04.6	· · 35.4	215°18.4	· · 40.7	130°52.3	· · 59.8	Alphecca	126°09.4	26°39.5					
16	40°52.3	80°16.9	09.6	164°06.1	35.7	230°21.2	40.8	145°54.7	59.8	Antares	112°24.0	-26°27.8					
17	55°54.8	95°16.3	08.7	179°07.5	35.9	245°24.0	40.9	160°57.5	59.8	Atria	107°24.1	-69°02.9					
18	70°57.3	110°15.7	\$16°07.9	194°09.0	\$18°36.1	260°26.7	N05°41.1	175°59.4	\$20°59.8	Sabik	102°10.5	-15°44.5					
19	85°59.7	125°15.0	07.0	209°10.5	36.4	275°29.5	41.2	191°01.8	59.8	Rasalhague	96°19.5	-37°06.6					
20	101°02.2	140°14.4	06.1	224°11.9	36.6	290°32.3	41.3	206°04.1	59.8	Eltanin	90°45.4	51°29.1					
21	116°04.7	155°13.8	· · 05.3	239°13.4	· · 36.8	305°35.0	· · 41.5	221°06.5	· · 59.8	Kaus Aust.	83°41.5	-34°22.3					
22	131°07.1	170°13.1	04.4	254°14.9	37.1	320°37.8	41.6	236°08.9	59.8	Vega	80°37.9	38°47.8					
23	146°09.6	185°12.5	03.6	269°16.4	37.3	335°40.5	41.7	251°11.2	59.8	Nunki	75°56.2	-26°16.4					
Mer.pass.:13:17			v-0.6 d0.8 m-3.8	v1.5 d-0.2 m0.3	v2.8 d0.1 m-2.3	v2.4 d-0.0 m0.5	Altair			Altair	62°06.7	8°54.7					
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°16.9	-56°40.7					
0	161°12.0	200°11.9	\$16°02.7	284°17.9	\$18°37.5	350°43.3	N05°41.9	266°13.6	\$20°59.8	Deneb	49°30.6	45°20.2					
1	176°14.5	215°11.3	01.8	299°19.3	37.8	5°46.1	42.0	281°15.9	59.8	AI Na'ir	33°45.6	9°56.9					
2	191°17.0	230°10.6	01.0	314°20.8	38.0	20°48.8	42.1	296°18.3	59.9	Fomalhaut	27°42.0	-46°52.9					
3	206°19.4	245°10.0	16°00.1	329°22.3	· · 38.2	35°51.6	· · 42.2	311°20.7	· · 59.9	Scheat	15°22.4	-29°32.3					
4	221°21.9	260°09.4	15°59.2	344°23.8	38.5	50°54.3	42.4	326°23.0	59.9	Markab	13°51.9	28°10.2					
5	236°24.4	275°08.8	58.4	359°25.2	38.7	65°57.1	42.5	341°25.4	59.9	Mar 01 Tue	13°36.8	15°17.5					
6	251°26.8	290°08.1	\$15°57.5	14°26.7	\$18°38.9	80°59.9	N05°42.6	356°27.8	\$20°59.9	SHA	Mer.pass						
7	266°29.3	305°07.5	56.6	29°28.2	39.1	96°02.6	42.8	11°30.1	59.9	Venus	41°28.8	10:38					
8	281°31.8	320°06.9	55.8	44°29.7	39.4	111°05.4	42.9	26°32.5	59.9	Mars	123°53.7	05:07					
9	296°34.2	335°06.3	· · 54.9	59°31.2	· · 39.6	126°08.1	· · 43.0	41°34.9	· · 59.9	Jupiter	189°17.1	00:46					
10	311°36.7	350°05.6	54.0	74°32.7	39.8	141°10.9	43.2	56°37.2	59.9	Saturn	105°06.5	06:22					
11	326°39.2	5°05.0	53.1	89°34.1	40.1	156°13.7	43.3	71°39.6	59.9	Mar 02 Wed	SHA	Mer.pass					
12	341°41.6	20°04.4	\$15°52.3	104°35.6	\$18°40.3	171°16.4	N05°43.4	86°42.0	\$20°59.9	Venus	40°14.2	10:39					
13	356°44.1	35°03.8	51.4	119°37.1	40.5	186°19.2	43.5	101°44.3	59.9	Mars	123°29.6	05:05					
14	11°46.5	50°03.2	50.5	134°38.6	40.7	201°22.0	43.7	116°46.7	59.9	Jupiter	189°24.1	00:41					
15	26°49.0	65°02.5	· · 49.6	149°40.1	· · 41.0	216°24.7	· · 43.8	131°49.1	· · 59.9	Saturn	105°04.0	06:18					
16	41°51.5	80°01.9	48.8	164°41.6	41.2	231°27.5	43.9	146°51.4	59.9	Mar 03 Thu	SHA	Mer.pass					
17	56°53.9	95°01.3	47.9	179°43.0	41.4	246°30.2	44.1	161°53.8	59.9	Venus	38°59.8	10:40					
18	71°56.4	110°00.7	\$15°47.0	194°44.5	\$18°41.7	261°33.0	N05°44.2	176°56.2	\$20°59.9	Mars	123°05.8	05:02					
19	86°58.9	125°00.1	46.1	209°46.0	41.9	276°35.8	44.3	191°58.5	59.								

DUT1 = UT1-UTC = -0.0204 sec ΔT = TT-UT1 = +68.2044 sec

2016 March 01 to Mar. 03 UT

h	Sun			Moon			
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	176°55.1	S07°30.2	280°17.8	12.7'	\$15°20.8	-5.2'	54.7'
1	191°55.2	29.2	294°49.5	12.7'	15°25.9	-5.1'	54.7'
2	206°55.3	28.3	309°21.2	12.6'	15°31.0	-5.1'	54.7'
3	221°55.4	.. 27.3	323°52.8	12.6'	15°36.0	-5.0'	54.8'
4	236°55.6	26.4	338°24.3	12.5'	15°41.0	-4.9'	54.8'
5	251°55.7	25.4	352°55.9	12.5'	15°45.9	-4.8'	54.8'
6	266°55.8	S07°24.5	7°27.3	12.4'	\$15°50.7	-4.8'	54.8'
7	281°55.9	23.5	21°58.8	12.4'	15°55.4	-4.7'	54.8'
8	296°56.1	22.6	36°30.1	12.4'	16°00.1	-4.6'	54.9'
9	311°56.2	.. 21.6	51°01.5	12.3'	16°04.7	-4.6'	54.9'
10	326°56.3	20.7	65°32.7	12.3'	16°09.2	-4.5'	54.9'
11	341°56.4	19.7	80°04.0	12.2'	16°13.7	-4.4'	54.9'
12	356°56.6	S07°18.7	94°35.2	12.2'	\$16°18.0	-4.3'	54.9'
13	11°56.7	17.8	109°06.3	12.1'	16°22.4	-4.3'	55.0'
14	26°56.8	16.8	123°37.4	12.1'	16°26.6	-4.2'	55.0'
15	41°56.9	.. 15.9	138°08.4	12.0'	16°30.7	-4.1'	55.0'
16	56°57.1	14.9	152°39.4	12.0'	16°34.8	-4.0'	55.0'
17	71°57.2	14.0	167°10.4	11.9'	16°38.8	-4.0'	55.1'
18	86°57.3	S07°13.0	181°41.3	11.9'	\$16°42.8	-3.9'	55.1'
19	101°57.4	12.1	196°12.1	11.8'	16°46.6	-3.8'	55.1'
20	116°57.6	11.1	210°42.9	11.8'	16°50.4	-3.7'	55.1'
21	131°57.7	.. 10.2	225°13.7	11.7'	16°54.1	-3.7'	55.2'
22	146°57.8	09.2	239°44.4	11.7'	16°57.7	-3.6'	55.2'
23	161°57.9	08.2	254°15.0	11.6'	17°01.3	-3.5'	55.2'
	SD.=16.1		d=1.0			S.D.=15.0	
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	176°58.1	S07°07.3	268°45.6	11.6'	\$17°04.8	-3.4'	55.2'
1	191°58.2	06.3	283°16.2	11.5'	17°08.1	-3.3'	55.3'
2	206°58.3	05.4	297°46.7	11.5'	17°11.4	-3.3'	55.3'
3	221°58.4	.. 04.4	312°17.2	11.4'	17°14.7	-3.2'	55.3'
4	236°58.6	03.5	326°47.6	11.4'	17°17.8	-3.1'	55.3'
5	251°58.7	02.5	341°17.9	11.3'	17°20.9	-3.0'	55.4'
6	266°58.8	S07°01.6	355°48.3	11.3'	\$17°23.9	-2.9'	55.4'
7	281°59.0	07°00.6	10°18.5	11.2'	17°26.7	-2.9'	55.4'
8	296°59.1	06°59.6	24°48.7	11.2'	17°29.6	-2.8'	55.4'
9	311°59.2	.. 58.7	39°18.9	11.1'	17°32.3	-2.7'	55.5'
10	326°59.3	57.7	53°49.0	11.1'	17°34.9	-2.6'	55.5'
11	341°59.5	56.8	68°19.1	11.0'	17°37.5	-2.5'	55.5'
12	356°59.6	S06°55.8	82°49.1	11.0'	\$17°40.0	-2.4'	55.6'
13	11°59.7	54.9	97°19.1	10.9'	17°42.4	-2.3'	55.6'
14	26°59.9	53.9	111°49.0	10.9'	17°44.7	-2.3'	55.6'
15	42°00.0	.. 52.9	126°18.9	10.8'	17°46.9	-2.2'	55.6'
16	57°00.1	52.0	140°48.7	10.8'	17°49.0	-2.1'	55.7'
17	72°00.3	51.0	155°18.5	10.8'	17°51.0	-2.0'	55.7'
18	87°00.4	S06°50.1	169°48.2	10.7'	\$17°53.0	-1.9'	55.7'
19	102°00.5	49.1	184°17.9	10.7'	17°54.8	-1.8'	55.8'
20	117°00.6	48.2	198°47.5	10.6'	17°56.6	-1.7'	55.8'
21	132°00.8	.. 47.2	213°17.1	10.6'	17°58.3	-1.6'	55.8'
22	147°00.9	46.2	227°46.6	10.5'	17°59.9	-1.5'	55.9'
23	162°01.0	45.3	242°16.1	10.5'	18°01.4	-1.5'	55.9'
	SD.=16.1		d=1.0			S.D.=15.1	
Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	177°01.2	S06°44.3	256°45.6	10.4'	\$18°02.8	-1.4'	55.9'
1	192°01.3	43.4	271°15.0	10.4'	18°04.1	-1.3'	56.0'
2	207°01.4	42.4	285°44.3	10.3'	18°05.3	-1.2'	56.0'
3	222°01.6	.. 41.4	300°13.6	10.3'	18°06.4	-1.1'	56.0'
4	237°01.7	40.5	314°42.9	10.2'	18°07.5	-1.0'	56.0'
5	252°01.8	39.5	329°12.1	10.2'	18°08.4	-0.9'	56.1'
6	267°02.0	S06°38.6	343°41.3	10.1'	\$18°09.3	-0.8'	56.1'
7	282°02.1	37.6	358°10.4	10.1'	18°10.0	-0.7'	56.1'
8	297°02.2	36.6	12°39.4	10.1'	18°10.7	-0.6'	56.2'
9	312°02.4	.. 35.7	27°08.5	10.0'	18°11.2	-0.5'	56.2'
10	327°02.5	34.7	41°37.5	10.0'	18°11.7	-0.4'	56.2'
11	342°02.6	33.8	56°06.4	9.9'	18°12.1	-0.3'	56.3'
12	357°02.8	S06°32.8	70°35.3	9.9'	\$18°12.4	-0.2'	56.3'
13	12°02.9	31.8	85°04.1	9.8'	18°12.5	-0.1'	56.3'
14	27°03.0	30.9	99°33.0	9.8'	18°12.6	-0.0'	56.4'
15	42°03.2	.. 29.9	114°01.7	9.7'	18°12.6	0.1'	56.4'
16	57°03.3	28.9	128°30.4	9.7'	18°12.5	0.2'	56.5'
17	72°03.4	28.0	142°59.1	9.7'	18°12.3	0.3'	56.5'
18	87°03.6	S06°27.0	157°27.8	9.6'	\$18°12.0	0.4'	56.5'
19	102°03.7	26.1	171°56.4	9.6'	18°11.5	0.5'	56.6'
20	117°03.8	25.1	186°24.9	9.5'	18°11.0	0.6'	56.6'
21	132°04.0	.. 24.1	200°53.4	9.5'	18°10.4	0.7'	56.6'
22	147°04.1	23.2	215°21.9	9.5'	18°09.7	0.8'	56.7'
23	162°04.2	22.2	229°50.3	9.4'	18°08.9	0.9'	56.7'
	SD.=16.1		d=1.0			S.D.=15.3	

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

## March 04, 05, 06 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	162°11.2	199°57.0	S15°41.7	284°53.5	S18°43.0	351°49.6	N05°45.0	267°10.4	S21°00.0	Alpheratz	357°41.9	29°10.7					
1	177°13.6	214°56.3	40.8	299°54.9	43.2	6°52.3	45.1	282°12.8	00.0	Ankaa	353°14.3	-42°13.3					
2	192°16.1	229°55.7	39.9	314°56.4	43.5	21°55.1	45.2	297°15.1	00.0	Schedar	349°38.8	56°37.6					
3	207°18.6	244°55.1	· · 39.1	329°57.9	· · 43.7	36°57.9	· · 45.4	312°17.5	· · 00.0	Diphda	348°54.4	-17°54.1					
4	222°21.0	259°54.5	38.2	344°59.4	43.9	52°00.6	45.5	327°19.9	00.0	Achernar	335°25.9	-57°09.6					
5	237°23.5	274°53.9	37.3	0°00.9	44.2	67°03.4	45.6	342°22.2	00.0	Hamal	327°58.9	23°32.2					
6	252°26.0	289°53.3	S15°36.4	15°02.4	S18°44.4	82°06.1	N05°45.8	357°24.6	S21°00.0	Polaris	317°08.2	89°20.1					
7	267°28.4	304°52.7	35.5	30°03.9	44.6	97°08.9	45.9	12°27.0	00.0	Acamar	315°17.2	-40°14.8					
8	282°30.9	319°52.0	34.6	45°05.4	44.8	112°11.7	46.0	27°29.3	00.0	Menkar	314°13.3	4°08.9					
9	297°33.4	334°51.4	· · 33.7	60°06.9	· · 45.1	127°14.4	· · 46.1	42°31.7	· · 00.0	Mirfak	308°37.8	49°55.1					
10	312°35.8	349°50.8	32.8	75°08.4	45.3	142°17.2	46.3	57°34.1	00.0	Aldebaran	290°47.3	16°32.3					
11	327°38.3	4°50.2	31.9	90°09.9	45.5	157°20.0	46.4	72°36.5	00.0	Rigel	281°10.3	-8°11.4					
12	342°40.8	19°49.6	S15°31.1	105°11.4	S18°45.7	172°22.7	N05°46.5	87°38.8	S21°00.0	Capella	280°31.7	46°00.8					
13	357°43.2	34°49.0	30.2	120°12.9	46.0	187°25.5	46.7	102°41.2	00.0	Bellatrix	278°30.0	6°21.5					
14	12°45.7	49°48.4	29.3	135°14.4	46.2	202°28.2	46.8	117°43.6	00.0	Elnath	278°10.2	28°37.1					
15	27°48.1	64°47.8	· · 28.4	150°15.9	· · 46.4	217°31.0	· · 46.9	132°45.9	· · 00.0	Alnilam	275°44.4	-1°11.8					
16	42°50.6	79°47.2	27.5	165°17.4	46.6	232°33.8	47.1	147°48.3	00.0	Betelgeuse	270°59.2	7°24.3					
17	57°53.1	94°46.6	26.6	180°18.9	46.9	247°36.5	47.2	162°50.7	00.0	Canopus	263°55.1	-52°42.8					
18	72°55.5	109°45.9	S15°25.7	195°20.4	S18°47.1	262°39.3	N05°47.3	177°53.1	S21°00.0	Sirius	258°31.9	-16°44.7					
19	87°58.0	124°45.3	24.8	210°21.9	47.3	277°42.1	47.4	192°55.4	00.0	Adhara	255°10.9	-29°00.1					
20	103°00.5	139°44.7	23.9	225°23.4	47.5	292°44.8	47.6	207°57.8	00.0	Procyon	244°57.6	5°10.7					
21	118°02.9	154°44.1	· · 23.0	240°24.9	· · 47.7	307°47.6	· · 47.7	223°00.2	· · 00.0	Pollux	243°25.3	27°59.0					
22	133°05.4	169°43.5	22.1	255°26.4	48.0	322°50.3	47.8	238°02.6	00.0	Avior	234°16.7	-59°34.1					
23	148°07.9	184°42.9	21.2	270°27.9	48.2	337°53.1	48.0	253°04.9	00.0	Suhail	222°50.6	-43°30.2					
Mer.pass.:13:09			v-0.6 d0.9 m-3.8	v1.5 d-0.2 m0.2	v2.8 d0.1 m-2.3	v2.4 d-0.0 m0.5	Miaplacidus			221°38.3	-69°47.3						
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	163°10.3	199°42.3	S15°20.3	285°29.4	S18°48.4	352°55.9	N05°48.1	268°07.3	S21°00.1	Denebola	182°31.5	61°39.7					
1	178°12.8	214°41.7	19.4	300°30.9	48.6	7°58.6	48.2	283°09.7	00.1	Gienah	175°50.1	-17°38.0					
2	193°15.3	229°41.1	18.5	315°32.4	48.9	23°01.4	48.4	298°12.0	00.1	Gacrux	173°06.4	-63°11.2					
3	208°17.7	244°40.5	· · 17.6	330°33.9	· · 49.1	38°04.2	· · 48.5	313°14.4	· · 00.1	Gacrux	171°58.2	-57°12.1					
4	223°20.2	259°39.9	16.7	345°35.4	49.3	53°06.9	48.6	328°16.8	00.1	Alioth	166°18.7	55°52.2					
5	238°22.6	274°39.3	15.8	0°36.9	49.5	68°09.7	48.7	343°19.2	00.1	Alkaid	152°57.2	49°13.8					
6	253°25.1	289°38.7	S15°14.9	15°38.4	S18°49.8	83°12.5	N05°48.9	358°21.5	S21°00.1	Hadar	148°44.7	-60°26.8					
7	268°27.6	304°38.1	14.0	30°39.9	50.0	98°15.2	49.0	13°23.9	00.1	Menkent	148°05.1	-36°26.8					
8	283°30.0	319°37.5	13.1	45°41.4	50.2	113°18.0	49.1	28°26.3	00.1	Arcturus	145°53.9	19°05.8					
9	298°32.5	334°36.9	· · 12.1	60°42.9	· · 50.4	128°20.7	· · 49.3	43°28.7	· · 00.1	Rigel Kent.	139°48.7	-60°53.8					
10	313°35.0	349°36.3	11.2	75°44.4	50.6	143°23.5	49.4	58°31.0	00.1	Kochab	137°19.7	74°05.2					
11	328°37.4	4°35.7	10.3	90°45.9	50.9	158°26.3	49.5	73°33.4	00.1	Zuben ubi	137°03.2	-16°06.4					
12	343°39.9	19°35.1	S15°09.4	105°47.4	S18°51.1	173°29.0	N05°49.7	88°35.8	S21°00.1	Alphecca	126°09.3	26°39.5					
13	358°42.4	34°34.5	08.5	120°48.9	51.3	188°31.8	49.8	103°38.2	00.1	Antares	112°23.9	-26°27.8					
14	13°44.8	49°33.9	07.6	135°50.4	51.5	203°34.6	49.9	118°40.5	00.1	Atria	107°24.1	-69°02.9					
15	28°47.3	64°33.3	· · 06.7	150°51.9	· · 51.7	218°37.3	· · 50.1	133°42.9	· · 00.1	Sabik	102°10.4	-15°44.5					
16	43°49.7	79°32.7	05.8	165°53.5	52.0	233°40.1	50.2	148°45.3	00.1	Rasalhague	96°04.8	12°32.9					
17	58°52.2	94°32.1	04.9	180°55.0	52.2	248°42.9	50.3	163°47.7	00.1	Eltanin	90°45.4	51°29.1					
18	73°54.7	109°31.5	S15°03.9	195°56.5	S18°52.4	263°45.6	N05°50.4	178°50.0	S21°00.1	Kaus Aust.	83°41.5	-34°22.3					
19	88°57.1	124°30.9	03.0	210°58.0	52.6	278°48.4	50.6	193°52.4	00.1	Vega	80°37.9	38°47.8					
20	103°59.6	139°30.3	02.1	225°59.5	52.8	293°51.1	50.7	208°54.8	00.1	Nunki	75°56.2	-26°16.4					
21	119°02.1	154°29.7	· · 01.2	241°01.0	· · 53.1	308°53.9	· · 50.8	223°57.2	· · 00.1	Altair	62°06.7	8°54.7					
22	134°04.5	169°29.1	15°00.3	256°02.5	53.3	323°56.7	51.0	238°59.6	00.1	Peacock	53°16.9	-56°40.7					
23	149°07.0	184°28.5	14°59.4	271°04.0	53.5	338°59.4	51.1	254°01.9	00.1	Deneb	49°30.5	45°20.2					
Mer.pass.:13:05			v-0.6 d0.9 m-3.8	v1.5 d-0.2 m0.2	v2.8 d0.1 m-2.3	v2.4 d-0.0 m0.5	Enif			33°45.6	9°56.9						
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	164°09.5	199°27.9	S14°58.4	286°05.6	S18°53.7	354°02.2	N05°51.2	269°04.3	S21°00.1	Al Na'ir	27°41.9	-46°52.9					
1	179°11.9	214°27.3	57.5	301°07.1	53.9	9°05.0	51.4	284°06.7	00.1	Fomalhaut	15°22.4	-29°32.3					
2	194°14.4	229°26.7	56.6	316°08.6	54.1	24°07.7	51.5	299°09.1	00.1	Scheat	13°51.9	28°10.2					
3	209°16.9	244°26.1	· · 55.7	331°10.1	· · 54.4	39°10.5	· · 51.6	314°11.4	· · 00.2	Markab	13°36.8	15°17.5					
4	224°19.3	259°25.5	54.8	346°11.6	54.6	54°13.3	51.7	329°13.8	00.2	<b>Mar 04 Fri</b>							
5	239°21.8	274°24.9	53.8	1°13.1	54.8	69°16.0	51.9	344°16.2	00.2	<b>SHA</b>	37°45.8	Mer.pass					
6	254°24.2	289°24.3	S14°52.9	16°14.7	S18°55.0	84°18.8	N05°52.0	359°18.6	S21°00.2	Venus	37°32.0	10:41					
7	269°26.7	304°23.8	52.0	311°16.2	55.2	99°21.6	52.1	14°21.0	00.2	Mars	122°42.3	05:00					
8	284°29.2	319°23.2	51.1	46°17.7	55.5	114°24.3	52.3	29°23.3	00.2	Jupiter	189°38.4	00:33					
9	299°31.6	334°22.6	· · 50.1	61°19.2	· · 55.7	129°27.1	· · 52.4	44°25.7	· · 00.2	Saturn	104°59.2	06:10					
10	314°34.1	349°22.0	49.2	76°20.7	55.9	144°29.8	52.5	59°28.1	00.2	<b>Mar 05 Sat</b>							
11	329°36.6	4°21.4	48.3	91°22.3	56.1	159°32.6	52.7	74°30.5	00.2	<b>SHA</b>	36°32.0	10:42					
12	344°39.0	19°20.8	S14°47.4	106°23.8	S18°56.3	174°35.4	N05°52.8	89°32.9	S21°00.2	Venus	36°32.0	10:42					
13	359°41.5	34°20.2	46.4	121°25.3	56.5	189°38.1	52.9	104°35.2	00.2	Mars	122°19.0	04:58					
14	14°44.0	49°19.6	45.5	136°26.8	56.8	204°40.9	53.0	119°37.6	00.2	Jupiter	189°45.6	00:28					
15	29°46.4	64°19.0	· · 44.6	151°28.4	· · 57.0	219°43.7	· · 53.2	134°40.0	· · 00.2	Saturn	104°57.0	06:07					
16	44°48.9	79°18.4	43.6	166°29.9	57.2	234°46.4	53.3	149°42.4	00.2	<b>Mar 06 Sun</b>							
17	59°51.4	94°17.9	42.7	181°31.4	57.4	249°49.2	53.4	164°44.8	00.2	<b>SHA</b>	35°18.4	10:43					
18	74°53.8	109°17.3	S14°41.8	196°32.9	S18°57.6	264°52.0	N05°53.6	179°47.1	S21°00.2	Venus	35°18.4	10:43					
19	89°56.3	124°16.7	40.8	211°34.4	57.8	279°54.7											

DUT1 = UT1-UTC = -0.0264 sec  $\Delta T$  = TT-UT1 = +68.2104 sec

2016 March 04 to Mar. 06 UT

h		Sun		Moon				
Fri		GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°04.4	S06°21.2	244°18.7	9.4'	\$18°08.0	1.0'	56.7'	
1	192°04.5	20.3	258°47.1	9.3'	18°07.0	1.1'	56.8'	
2	207°04.7	19.3	273°15.4	9.3'	18°05.8	1.2'	56.8'	
3	222°04.8	.. 18.4	287°43.7	9.3'	18°04.6	1.3'	56.8'	
4	237°04.9	17.4	302°11.9	9.2'	18°03.3	1.4'	56.9'	
5	252°05.1	16.4	316°40.1	9.2'	18°01.9	1.5'	56.9'	
6	267°05.2	S06°15.5	331°08.2	9.1'	\$18°00.3	1.6'	57.0'	
7	282°05.3	14.5	345°36.4	9.1'	17°58.7	1.7'	57.0'	
8	297°05.5	13.5	0°04.5	9.1'	17°57.0	1.8'	57.0'	
9	312°05.6	.. 12.6	14°32.5	9.0'	17°55.1	1.9'	57.1'	
10	327°05.8	11.6	29°00.5	9.0'	17°53.2	2.0'	57.1'	
11	342°05.9	10.6	43°28.5	9.0'	17°51.2	2.1'	57.1'	
12	357°06.0	S06°09.7	57°56.5	8.9'	\$17°49.0	2.2'	57.2'	
13	12°06.2	08.7	72°24.4	8.9'	17°46.8	2.3'	57.2'	
14	27°06.3	07.7	86°52.2	8.9'	17°44.4	2.4'	57.3'	
15	42°06.4	.. 06.8	101°20.1	8.8'	17°41.9	2.5'	57.3'	
16	57°06.6	05.8	115°47.9	8.8'	17°39.4	2.6'	57.3'	
17	72°06.7	04.9	130°15.7	8.8'	17°36.7	2.7'	57.4'	
18	87°06.9	S06°03.9	144°43.4	8.7'	\$17°33.9	2.8'	57.4'	
19	102°07.0	02.9	159°11.1	8.7'	17°31.1	2.9'	57.5'	
20	117°07.1	02.0	173°38.8	8.7'	17°28.1	3.0'	57.5'	
21	132°07.3	.. 01.0	188°06.5	8.6'	17°25.0	3.1'	57.5'	
22	147°07.4	06°00.0	202°34.1	8.6'	17°21.8	3.2'	57.6'	
23	162°07.6	05°59.1	217°01.7	8.6'	17°18.5	3.4'	57.6'	
	SD.=16.1	d=1.0			S.D.=15.6			

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer.Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Upper Lower hh:mm
04	11:42	11:36	12:12	08:00 20:26
05	11:29	11:22	12:11	08:53 21:21
06	11:15	11:08	12:11	09:48 22:16



SD.=16.1	d=1.0	S.D.=16.1
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## March 07, 08, 09 UT (Mon., Tue., Wed.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	165°08.6	199°13.8	\$14°36.2	286°42.1	\$18°58.9	355°08.6	N05°54.3	270°01.4	S21°00.2									Alpheratz	357°41.9	29°10.7			
1	180°11.1	214°13.2	35.2	301°43.6	59.1	10°11.3	54.5	285°03.8	00.2									Ankaa	353°14.3	-42°13.3			
2	195°13.5	229°12.6	34.3	316°45.1	59.3	25°14.1	54.6	300°06.2	00.2								Schedar	349°38.8	56°37.5				
3	210°16.0	244°12.0	.. 33.4	331°46.7	.. 59.6	40°16.8	.. 54.7	315°08.6	.. 00.2								Diphda	348°54.4	-17°54.1				
4	225°18.5	259°11.4	32.4	346°48.2	18°59.8	55°19.6	54.9	330°11.0	00.2								Achernar	335°26.0	-57°09.6				
5	240°20.9	274°10.9	31.5	1°49.7	19°00.0	70°22.4	55.0	345°13.3	00.2								Hamal	327°58.9	23°32.2				
6	255°23.4	289°10.3	\$14°30.5	16°51.3	\$19°00.2	85°25.1	N05°55.1	0°15.7	S21°00.2								Polaris	317°09.6	89°20.1				
7	270°25.8	304°09.7	29.6	31°52.8	00.4	100°27.9	55.3	15°18.1	00.2								Acamar	315°17.2	-40°14.8				
8	285°28.3	319°09.1	28.7	46°54.3	00.6	115°30.7	55.4	30°20.5	00.2								Menkar	314°13.3	4°08.9				
9	300°30.8	334°08.5	.. 27.7	61°55.9	.. 00.8	130°33.4	.. 55.5	45°22.9	.. 00.2								Mirfak	308°37.8	49°55.1				
10	315°33.2	349°08.0	26.8	76°57.4	01.0	145°36.2	55.7	60°25.3	00.3								Aldebaran	290°47.3	16°32.3				
11	330°35.7	4°07.4	25.8	91°58.9	01.3	160°39.0	55.8	75°27.6	00.3								Rigel	281°10.3	-8°11.4				
12	345°38.2	19°06.8	\$14°24.9	107°00.5	\$19°01.5	175°41.7	N05°55.9	90°30.0	S21°00.3								Capella	280°31.7	46°00.8				
13	0°40.6	34°06.2	23.9	122°02.0	01.7	190°44.5	56.0	105°32.4	00.3								Bellatrix	278°30.0	6°21.5				
14	15°43.1	49°05.6	23.0	137°03.5	01.9	205°47.3	56.2	120°34.8	00.3								Elnath	278°10.2	28°37.1				
15	30°45.6	64°05.1	.. 22.0	152°05.1	.. 02.1	220°50.0	.. 56.3	135°37.2	.. 00.3								Alnilam	275°44.5	-1°11.8				
16	45°48.0	79°04.5	21.1	167°06.6	02.3	235°52.8	56.4	150°39.6	00.3								Betelgeuse	270°59.2	7°24.3				
17	60°50.5	94°03.9	20.2	182°08.2	02.5	250°55.6	56.6	165°41.9	00.3								Canopus	263°55.1	-52°42.8				
18	75°53.0	109°03.3	\$14°19.2	197°09.7	\$19°02.7	265°58.3	N05°56.7	180°44.3	S21°00.3								Sirius	258°32.0	-16°44.7				
19	90°55.4	124°02.8	18.3	212°11.2	03.0	281°01.1	56.8	195°46.7	00.3								Adhara	255°10.9	-29°00.1				
20	105°57.9	139°02.2	17.3	227°12.8	03.2	296°03.8	57.0	210°49.1	00.3								Procyon	244°57.6	5°10.7				
21	121°00.3	154°01.6	.. 16.4	242°14.3	.. 03.4	311°06.6	.. 57.1	225°51.5	.. 00.3								Pollux	243°25.3	27°59.0				
22	136°02.8	169°01.0	15.4	257°15.8	03.6	326°09.4	57.2	240°53.9	00.3								Avior	234°16.7	-59°34.1				
23	151°05.3	184°00.5	14.5	272°17.4	03.8	341°12.1	57.3	255°56.3	00.3								Suhail	222°50.7	-43°30.2				
Mer.pass.:12:57				v-0.6 d0.9 m-3.8				v1.5 d-0.2 m0.1				v2.8 d0.1 m-2.3				v2.4 d-0.0 m0.5							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	166°07.7	198°59.9	\$14°13.5	287°18.9	\$19°04.0	356°14.9	N05°57.5	270°58.6	S21°00.3								Denebola	182°31.5	14°28.8				
1	181°10.2	213°59.3	12.5	302°20.5	04.2	11°17.7	57.6	286°01.0	00.3								Gienah	175°50.1	-17°38.0				
2	196°12.7	228°58.7	11.6	317°22.0	04.4	26°20.4	57.7	301°03.4	00.3								Acrux	173°06.4	-63°11.3				
3	211°15.1	243°58.2	.. 10.6	332°23.6	.. 04.6	41°23.2	.. 57.9	316°05.8	.. 00.3								Gacrux	171°58.2	-57°12.2				
4	226°17.6	258°57.6	09.7	347°25.1	04.8	56°26.0	58.0	331°08.2	00.3								Alioth	166°18.7	55°52.2				
5	241°20.1	273°57.0	08.7	2°26.7	05.1	71°28.7	58.1	346°10.6	00.3								Spica	158°29.0	-11°14.8				
6	256°22.5	288°56.5	\$14°07.8	17°28.2	\$19°05.3	86°31.5	N05°58.3	1°13.0	S21°00.3								Alkaid	152°57.1	49°13.8				
7	271°25.0	303°55.9	06.8	32°29.7	05.5	101°34.3	58.4	16°15.4	00.3								Hadar	148°44.7	-60°26.8				
8	286°27.5	318°55.3	05.9	47°31.3	05.7	116°37.0	58.5	31°17.7	00.3								Menkent	148°05.1	-36°26.8				
9	301°29.9	333°54.7	.. 04.9	62°32.8	.. 05.9	131°39.8	.. 58.6	46°20.1	.. 00.3								Arcturus	145°53.8	19°05.8				
10	316°32.4	348°54.2	03.9	77°34.4	06.1	146°42.6	58.8	61°22.5	00.3								Rigel Kent.	139°48.7	-60°53.8				
11	331°34.8	3°53.6	03.0	92°35.9	06.3	161°45.3	58.9	76°24.9	00.3								Kochab	137°19.6	74°05.2				
12	346°37.3	18°53.0	\$14°02.0	107°37.5	\$19°06.5	176°48.1	N05°59.0	91°27.3	S21°00.3								Zuben ubi	137°03.2	-16°06.4				
13	1°39.8	33°52.5	01.1	122°39.0	06.7	191°50.9	59.2	106°29.7	00.3								Alphecca	126°09.3	26°39.5				
14	16°42.2	48°51.9	14°00.1	137°40.6	06.9	206°53.6	59.3	121°32.1	00.3								Antares	112°23.9	-26°27.8				
15	31°44.7	63°51.3	13°59.1	152°42.1	.. 07.1	221°56.4	.. 59.4	136°34.5	.. 00.3								Atria	107°24.0	-69°02.9				
16	46°47.2	78°50.8	58.2	167°43.7	07.4	236°59.2	59.5	151°36.9	00.3								Sabik	102°10.4	-15°44.5				
17	61°49.6	93°50.2	57.2	182°45.2	07.6	252°01.9	59.7	166°39.2	00.3								Shaula	96°19.4	-37°06.6				
18	76°52.1	108°49.6	\$13°56.2	197°46.8	\$19°07.8	267°04.7	N05°59.8	181°41.6	S21°00.3								Rasalhague	96°04.8	12°32.9				
19	91°54.6	123°49.1	55.3	212°48.3	08.0	282°07.4	05°59.9	196°44.0	00.3								Eltanin	90°45.4	51°29.1				
20	106°57.0	138°48.5	54.3	227°49.9	08.2	297°10.2	06°00.1	211°46.4	00.3								Kaus Aust.	83°41.5	-34°22.3				
21	121°59.5	153°48.0	.. 53.3	242°51.4	.. 08.4	312°13.0	.. 00.2	226°48.8	.. 00.3								Vega	80°37.8	38°47.8				
22	137°01.9	168°47.4	52.4	257°53.0	08.6	327°15.7	00.3	241°51.2	00.3								Nunki	75°56.2	-26°16.4				
23	152°04.4	183°46.8	51.4	272°54.6	08.8	342°18.5	00.5	256°53.6	00.3								Altair	62°06.6	8°54.7				
Mer.pass.:12:53				v-0.6 d1.0 m-3.8				v1.5 d-0.2 m0.1				v2.8 d0.1 m-2.3				v2.4 d-0.0 m0.5							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	167°06.9	198°46.3	\$13°50.4	287°56.1	\$19°09.0	357°21.3	N06°00.6	271°56.0	S21°00.3									Mar 07 Mon	SHA	Mer.pass			
1	182°09.3	213°45.7	49.5	302°57.7	09.2	12°24.0	00.7	286°58.4	00.3								Venus	34°05.2	10:43				
2	197°11.8	228°45.1	48.5	317°59.2	09.4	27°26.8	00.8	302°00.8	00.4								Mars	121°33.5	04:53				
3	212°14.3	243°44.6	.. 47.5	333°00.8	.. 09.6	42°29.6	.. 01.0	317°03.1	.. 00.4								Jupiter	190°00.0	00:19				
4	227°16.7	258°44.0	46.6	348°02.3	09.8	57°32.3	01.1	332°05.5	00.4								Saturn	104°52.8	05:59				
5	242°19.2	273°43.5	45.6	3°03.9	10.0	72°35.1	01.2	347°07.9	00.4														
6	257°21.7	288°42.9	\$13°44.6	18°05.5	\$19°10.2	87°37.9	N06°01.4	2°10.3	S21°00.4								Mar 08 Tue	SHA	Mer.pass				
7	272°24.1	303°42.3	43.6	33°07.0	1																		

DUT1 = UT1-UTC = -0.0324 sec ΔT = TT-UT1 = +68.2164 sec

2016 March 07 to Mar. 09 UT

h		Sun			Moon		
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	177°14.7	S05°11.5	205°09.1	7.8'	S12°30.7	8.3'	59.5'
1	192°14.8	10.6	219°35.8	7.8'	12°22.4	8.3'	59.5'
2	207°15.0	09.6	234°02.6	7.8'	12°14.0	8.4'	59.5'
3	222°15.1	.. 08.6	248°29.4	7.8'	12°05.5	8.5'	59.6'
4	237°15.2	07.6	262°56.2	7.8'	11°57.0	8.6'	59.6'
5	252°15.4	06.7	277°22.9	7.8'	11°48.3	8.7'	59.6'
6	267°15.5	S05°05.7	291°49.7	7.8'	S11°39.6	8.8'	59.7'
7	282°15.7	04.7	306°16.4	7.8'	11°30.8	8.9'	59.7'
8	297°15.8	03.7	320°43.2	7.7'	11°21.9	8.9'	59.7'
9	312°16.0	.. 02.8	335°09.9	7.7'	11°12.9	9.0'	59.8'
10	327°16.1	01.8	349°36.7	7.7'	11°03.8	9.1'	59.8'
11	342°16.3	05°00.8	4°03.4	7.7'	10°54.7	9.2'	59.8'
12	357°16.5	S04°59.8	18°30.1	7.7'	S10°45.5	9.3'	59.9'
13	12°16.6	58.9	32°56.9	7.7'	10°36.2	9.3'	59.9'
14	27°16.8	57.9	47°23.6	7.7'	10°26.8	9.4'	59.9'
15	42°16.9	.. 56.9	61°50.3	7.7'	10°17.4	9.5'	60.0'
16	57°17.1	55.9	76°17.1	7.7'	10°07.8	9.6'	60.0'
17	72°17.2	55.0	90°43.8	7.7'	09°58.2	9.6'	60.0'
18	87°17.4	S04°54.0	105°10.5	7.7'	S09°48.6	9.7'	60.0'
19	102°17.5	53.0	119°37.2	7.7'	09°38.8	9.8'	60.1'
20	117°17.7	52.0	134°04.0	7.7'	09°29.0	9.9'	60.1'
21	132°17.8	.. 51.1	148°30.7	7.7'	09°19.1	9.9'	60.1'
22	147°18.0	50.1	162°57.4	7.7'	09°09.1	10.0'	60.2'
23	162°18.1	49.1	177°24.1	7.7'	08°59.1	10.1'	60.2'
	SD.=16.1	d=1.0			S.D.=16.3		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	177°18.3	S04°48.1	191°50.8	7.7'	S08°49.0	10.1'	60.2'
1	192°18.4	47.2	206°17.6	7.7'	08°38.9	10.2'	60.2'
2	207°18.6	46.2	220°44.3	7.7'	08°28.7	10.3'	60.3'
3	222°18.7	.. 45.2	235°11.0	7.7'	08°18.4	10.3'	60.3'
4	237°18.9	44.2	249°37.7	7.7'	08°08.0	10.4'	60.3'
5	252°19.0	43.3	264°04.4	7.7'	07°57.6	10.4'	60.3'
6	267°19.2	S04°42.3	278°31.2	7.7'	S07°47.1	10.5'	60.4'
7	282°19.3	41.3	292°57.9	7.7'	07°36.6	10.6'	60.4'
8	297°19.5	40.3	307°24.6	7.7'	07°26.0	10.6'	60.4'
9	312°19.7	.. 39.3	321°51.3	7.7'	07°15.4	10.7'	60.4'
10	327°19.8	38.4	336°18.0	7.7'	07°04.7	10.7'	60.5'
11	342°20.0	37.4	350°44.7	7.7'	06°53.9	10.8'	60.5'
12	357°20.1	S04°36.4	5°11.4	7.7'	S06°43.1	10.8'	60.5'
13	12°20.3	35.4	19°38.2	7.7'	06°32.3	10.9'	60.5'
14	27°20.4	34.5	34°04.9	7.7'	06°21.4	10.9'	60.5'
15	42°20.6	.. 33.5	48°31.6	7.7'	06°10.4	11.0'	60.6'
16	57°20.7	32.5	62°58.3	7.7'	05°59.4	11.0'	60.6'
17	72°20.9	31.5	77°25.0	7.7'	05°48.4	11.1'	60.6'
18	87°21.0	S04°30.6	91°51.7	7.7'	S05°37.3	11.1'	60.6'
19	102°21.2	29.6	106°18.5	7.7'	05°26.2	11.2'	60.6'
20	117°21.4	28.6	120°45.2	7.7'	05°15.0	11.2'	60.7'
21	132°21.5	.. 27.6	135°11.9	7.7'	05°03.8	11.2'	60.7'
22	147°21.7	26.6	149°38.6	7.7'	04°52.5	11.3'	60.7'
23	162°21.8	25.7	164°05.3	7.7'	04°41.2	11.3'	60.7'
	SD.=16.1	d=1.0			S.D.=16.5		

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	177°22.0	S04°24.7	178°32.0	7.7'	S04°29.9	11.3'	60.7'
1	192°22.1	23.7	192°58.7	7.7'	04°18.5	11.4'	60.7'
2	207°22.3	22.7	207°25.5	7.7'	04°07.1	11.4'	60.8'
3	222°22.5	.. 21.7	221°52.2	7.7'	03°55.7	11.4'	60.8'
4	237°22.6	20.8	236°18.9	7.7'	03°44.3	11.5'	60.8'
5	252°22.8	19.8	250°45.6	7.7'	03°32.8	11.5'	60.8'
6	267°22.9	S04°18.8	265°12.3	7.7'	S03°21.2	11.5'	60.8'
7	282°23.1	17.8	279°39.0	7.7'	03°09.7	11.6'	60.8'
8	297°23.2	16.9	294°05.7	7.7'	02°58.1	11.6'	60.8'
9	312°23.4	.. 15.9	308°32.4	7.7'	02°46.5	11.6'	60.9'
10	327°23.6	14.9	322°59.1	7.7'	02°34.9	11.6'	60.9'
11	342°23.7	13.9	337°25.8	7.7'	02°23.3	11.6'	60.9'
12	357°23.9	S04°12.9	351°52.5	7.7'	S02°11.6	11.7'	60.9'
13	12°24.0	12.0	6°19.2	7.7'	01°59.9	11.7'	60.9'
14	27°24.2	11.0	20°45.9	7.7'	01°48.3	11.7'	60.9'
15	42°24.3	.. 10.0	35°12.6	7.7'	01°36.5	11.7'	60.9'
16	57°24.5	09.0	49°39.3	7.7'	01°24.8	11.7'	60.9'
17	72°24.7	08.0	64°06.0	7.7'	01°13.1	11.7'	60.9'
18	87°24.8	S04°07.1	78°32.7	7.7'	S01°01.4	11.7'	60.9'
19	102°25.0	06.1	92°59.4	7.7'	00°49.6	11.8'	60.9'
20	117°25.1	05.1	107°26.0	7.7'	00°37.8	11.8'	60.9'
21	132°25.3	.. 04.1	121°52.7	7.7'	00°26.1	11.8'	61.0'
22	147°25.5	03.1	136°19.4	7.7'	00°14.3	11.8'	61.0'
23	162°25.6	02.2	150°46.1	7.7'	00°02.5	11.8'	61.0'
	SD.=16.1	d=1.0			S.D.=16.6		

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

Day	Sun			Moon		
	Eqn.of Time	00 <sup>h</sup>	12 <sup>h</sup>	Mer.	Mer.Pass.	Age
	mm:ss	mm:ss	hh:mm	Upper	Lower	28-0
07	11:01	10:54	12:11	10:43	23:11	
08	10:47	10:40	12:11	11:38	—	
09	10:32	10:25	12:10	12:34	00:06	

## March 10, 11, 12 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	168°06.0	198°32.9	\$13°27.0	288°33.6	\$19°13.9	358°27.6	N06°03.7	272°53.4	S21°00.4	Alpheratz	357°41.9	29°10.7					
1	183°08.5	213°32.3	26.0	303°35.2	14.1	13°30.4	03.8	287°55.8	00.4	Ankaa	353°14.3	-42°13.3					
2	198°10.9	228°31.8	25.0	318°36.8	14.3	28°33.2	04.0	302°58.2	00.4	Schedar	349°38.8	56°37.5					
3	213°13.4	243°31.2	24.0	333°38.4	14.5	43°35.9	04.1	318°00.6	00.4	Diphda	348°54.4	-17°54.1					
4	228°15.9	258°30.7	23.0	348°39.9	14.7	58°38.7	04.2	333°03.0	00.4	Achernar	335°26.0	-57°09.6					
5	243°18.3	273°30.1	22.1	3°41.5	14.9	73°41.5	04.3	348°05.4	00.4	Hamal	327°58.9	23°32.2					
6	258°20.8	288°29.6	\$13°21.1	18°43.1	\$19°15.1	88°44.2	N06°04.5	3°07.8	S21°00.4	Polaris	317°10.8	89°20.1					
7	273°23.3	303°29.0	20.1	33°44.7	15.3	103°47.0	04.6	18°10.2	00.4	Acamar	315°17.2	-40°14.8					
8	288°25.7	318°28.5	19.1	48°46.2	15.5	118°49.8	04.7	33°12.6	00.4	Menkar	314°13.3	4°08.9					
9	303°28.2	333°27.9	18.1	63°47.8	15.7	133°52.5	04.9	48°15.0	00.4	Mirfak	308°37.9	49°55.1					
10	318°30.7	348°27.4	17.1	78°49.4	15.9	148°55.3	05.0	63°17.4	00.4	Aldebaran	290°47.3	16°32.3					
11	333°33.1	3°26.9	16.1	93°51.0	16.1	163°58.1	05.1	78°19.8	00.4	Rigel	281°10.3	-8°11.4					
12	348°35.6	18°26.3	\$13°15.1	108°52.5	\$19°16.3	179°00.8	N06°05.2	93°22.2	S21°00.4	Capella	280°31.7	46°00.8					
13	3°38.0	33°25.8	14.1	123°54.1	16.5	194°03.6	05.4	108°24.6	00.4	Bellatrix	278°30.0	6°21.5					
14	18°40.5	48°25.2	13.1	138°55.7	16.7	209°06.4	05.5	123°27.0	00.4	El Nath	278°10.3	28°37.1					
15	33°43.0	63°24.7	12.2	153°57.3	16.9	224°09.1	05.6	138°29.3	00.4	Alnilam	275°44.5	-1°11.9					
16	48°45.4	78°24.1	11.2	168°58.9	17.1	239°11.9	05.8	153°31.7	00.4	Betelgeuse	270°59.2	7°24.3					
17	63°47.9	93°23.6	10.2	184°00.4	17.3	254°14.7	05.9	168°34.1	00.4	Canopus	263°55.2	-52°42.8					
18	78°50.4	108°23.0	\$13°09.2	199°02.0	\$19°17.5	269°17.4	N06°06.0	183°36.5	S21°00.4	Sirius	258°32.0	-16°44.7					
19	93°52.8	123°22.5	08.2	214°03.6	17.7	284°20.2	06.1	198°38.9	00.4	Adhara	255°10.9	-29°00.1					
20	108°55.3	138°22.0	07.2	229°05.2	17.9	299°22.9	06.3	213°41.3	00.4	Procyon	244°57.6	5°10.7					
21	123°57.8	153°21.4	06.2	244°06.8	18.1	314°25.7	06.4	228°43.7	00.4	Pollux	243°25.3	27°59.0					
22	139°00.2	168°20.9	05.2	259°08.4	18.3	329°28.5	06.5	243°46.1	00.4	Avior	234°16.7	-59°34.1					
23	154°02.7	183°20.3	04.2	274°09.9	18.5	344°31.2	06.7	258°48.5	00.4	Suhail	222°50.7	-43°30.2					
Mer.pass.:12:46			v-0.6 d1.0 m-3.8	v1.6 d-0.2 m0.1	v2.8 d0.1 m-2.3	v2.4 d-0.0 m0.5	Miaplacidus			221°38.4	-69°47.3						
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.0	-8°44.0	
0	169°05.1	198°19.8	\$13°03.2	289°11.5	\$19°18.7	359°34.0	N06°06.8	273°50.9	S21°00.4	Regulus	207°41.3	11°53.1					
1	184°07.6	213°19.2	02.2	304°13.1	18.9	14°36.8	06.9	288°53.3	00.4	Dubhe	193°48.9	61°39.7					
2	199°10.1	228°18.7	01.2	319°14.7	19.1	29°39.5	07.1	303°55.7	00.4	Denebola	182°31.5	14°28.8					
3	214°12.5	243°18.2	13°00.2	334°16.3	19.3	44°42.3	07.2	318°58.1	00.4	Gienah	175°50.0	-17°38.0					
4	229°15.0	258°17.6	12°59.2	349°17.9	19.5	59°45.1	07.3	334°00.5	00.4	Acrua	173°06.4	-63°11.3					
5	244°17.5	273°17.1	58.2	4°19.5	19.7	74°47.8	07.4	349°02.9	00.4	Gacrux	171°58.2	-57°12.2					
6	259°19.9	288°16.5	\$12°57.2	19°21.0	\$19°19.9	89°50.6	N06°07.6	4°05.3	S21°00.4	Alioth	166°18.7	55°52.2					
7	274°22.4	303°16.0	56.2	34°22.6	20.1	104°53.4	07.7	19°07.7	00.4	Spica	158°29.0	-11°14.8					
8	289°24.9	318°15.5	55.2	49°24.2	20.3	119°56.1	07.8	34°10.1	00.4	Alkaid	152°57.1	49°13.8					
9	304°27.3	333°14.9	54.2	64°25.8	20.5	134°58.9	08.0	49°12.5	00.4	Hadar	148°44.6	-60°26.8					
10	319°29.8	348°14.4	53.2	79°27.4	20.7	150°01.7	08.1	64°14.9	00.4	Menkent	148°05.0	-36°26.8					
11	334°32.3	3°13.9	52.1	94°29.0	20.9	165°04.4	08.2	79°17.3	00.4	Arcturus	145°53.8	19°05.8					
12	349°34.7	18°13.3	\$12°51.1	109°30.6	\$19°21.1	180°07.2	N06°08.3	94°19.7	S21°00.4	Rigel Kent.	139°48.6	-60°53.8					
13	4°37.2	33°12.8	50.1	124°32.2	21.3	195°09.9	08.5	109°22.1	00.4	Kochab	137°19.6	74°05.2					
14	19°39.6	48°12.2	49.1	139°33.8	21.5	210°12.7	08.6	124°24.5	00.4	Zuben' ubi	137°03.2	-16°06.4					
15	34°42.1	63°11.7	48.1	154°35.4	21.7	225°15.5	08.7	139°27.0	00.4	Alphecca	126°09.3	26°39.5					
16	49°44.6	78°11.2	47.1	169°37.0	21.9	240°18.2	08.9	154°29.4	00.4	Antares	112°23.9	-26°27.8					
17	64°47.0	93°10.6	46.1	184°38.6	22.1	255°21.0	09.0	169°31.8	00.4	Atria	107°24.0	-69°02.9					
18	79°49.5	108°10.1	\$12°45.1	199°40.2	\$19°22.3	270°23.8	N06°09.1	184°34.2	S21°00.4	Sabik	102°10.4	-15°44.5					
19	94°52.0	123°09.6	44.1	214°41.8	22.5	285°26.5	09.2	199°36.6	00.4	Rasalhague	96°04.8	12°32.9					
20	109°54.4	138°09.0	43.1	229°43.4	22.7	300°29.3	09.4	214°39.0	00.4	Eltanin	90°45.4	51°29.1					
21	124°56.9	153°08.5	42.1	244°45.0	22.8	315°32.1	09.5	229°41.4	00.4	Kaus Aust.	83°41.5	-34°22.3					
22	139°59.4	168°08.0	41.0	259°46.6	23.0	330°34.8	09.6	244°43.8	00.4	Vega	80°37.8	38°47.8					
23	155°01.8	183°07.4	40.0	274°48.2	23.2	345°37.6	09.8	259°46.2	00.5	Nunki	75°56.2	-26°16.4					
Mer.pass.:12:42			v-0.5 d1.0 m-3.8	v1.6 d-0.2 m0.1	v2.8 d0.1 m-2.3	v2.4 d-0.0 m0.5	Altair			Altair	62°06.6	8°54.7					
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°16.8	-56°40.7					
0	170°04.3	198°06.9	\$12°39.0	289°49.8	\$19°23.4	0°40.4	N06°09.9	274°48.6	Deneb	49°30.5	45°20.2						
1	185°06.7	213°06.4	38.0	304°51.4	23.6	15°43.1	10.0	289°51.0	00.5	Scheat	33°45.6	9°56.9					
2	200°09.2	228°05.9	37.0	319°53.0	23.8	30°45.9	10.1	304°53.4	00.5	Markab	15°21.9	-46°52.9					
3	215°11.7	243°05.3	36.0	334°54.6	24.0	45°48.7	10.3	319°55.8	00.5	Mar 10 Thu	15°22.3	-29°32.2					
4	230°14.1	258°04.8	34.9	349°56.2	24.2	60°51.4	10.4	334°58.2	00.5	Venus	30°26.9	10:46					
5	245°16.6	273°04.3	33.9	4°57.8	24.4	75°54.2	10.5	350°00.6	00.5	Mars	120°27.6	04:45					
6	260°19.1	288°03.7	\$12°32.9	19°59.4	\$19°24.6	90°56.9	N06°10.6	5°03.0	Jupiter	190°21.6	00:06						
7	275°21.5	303°03.2	31.9	35°01.0	24.8	105°59.7	10.8	20°05.4	00.5	Saturn	104°47.4	05:48					
8	290°24.0	318°02.7	30.9	50°02.6	25.0	121°02.5	10.9	35°07.8	00.5	Mar 11 Fri	13°51.9	28°10.1					
9	305°26.5	333°02.2	29.9	65°04.2	25.2	136°05.2	11.0	50°10.2	00.5	Venus	29°14.6	10:47					
10	320°28.9	348°01.6	28.8	80°05.8	25.4	151°08.0	11.2	65°12.6	00.5	Mars	120°06.4	04:43					
11	335°31.4	3°01.1	27.8	95°07.4	25.6	166°10.8	11.3	80°15.0	00.5	Jupiter	190°28.9	00:02					
12	350°33.9	18°00.6	\$12°26.8	110°09.0	\$19°25.8	181°13.5	N06°11.4	95°17.4	Saturn	104°45.8	05:44						
13	5°36.3	33°00.1	25.8	125°10.6	25.9	196°16.3	11.5	110°19.8	00.5	Mar 12 Sat	13°36.8	15°17.4					
14	20°38.8	47°59.5	24.8	140°12.2	26.1	211°19.1	11.7	125°22.3	00.5	Venus	28°02.6	10:48					
15	35°41.2	62°59.0	23.7	155°13.9	26.3	226°21.8	11.8	140°24.7	00.5	Mars	119°45.5	04:40					
16	50°43.7	77°58.5	22.7	170°15.5	26.5	241°24.6	11.9	155°27.1	00.5	Jupiter	190°36.1	23:53					
17	65°46.2	92°58.0	21.7	185°17.1	26.7	256°27.3	12.1	170°29.5	00.5	Saturn	104°44.3	05:40					
18	80°48.6	107°57.4	\$12°20.7	200°18.7	\$19°26.9	271°30.1	N06°12.2	185°31.9	Horizontal parallax	Venus:	0.1						
19	95°51.1	122°56.9	19.6	215°20.3	27.1	286°32.9	12.3	200°34.3	Mars:	0.2							
20	110°53.6	137°56.4	18.6	230°21.9	27.3	301°35.6	12.4	215°36.7	00.5	Mer.pass.	15°22.3	15°17.4					
21	125°5																

DUT1 = UT1-UTC = -0.0384 sec  $\Delta T$  = TT-UT1 = +68.2224 sec

2016 March 10 to Mar. 12 UT

h	Sun			Moon				
	Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°25.8	S04°01.2	165°12.7	7.7'	N00°09.2	11.8'	61.0'	
1	192°25.9	04°00.2	179°39.4	7.7'	00°21.0	11.8'	61.0'	
2	207°26.1	03°59.2	194°06.1	7.7'	00°32.8	11.8'	61.0'	
3	222°26.3	.. 58.2	208°32.7	7.7'	00°44.5	11.8'	61.0'	
4	237°26.4	57.3	222°59.4	7.6'	00°56.3	11.8'	61.0'	
5	252°26.6	56.3	237°26.0	7.6'	01°08.1	11.8'	61.0'	
6	267°26.7	S03°55.3	251°52.6	7.6'	N01°19.8	11.7'	61.0'	
7	282°26.9	54.3	266°19.3	7.6'	01°31.6	11.7'	61.0'	
8	297°27.1	53.3	280°45.9	7.6'	01°43.3	11.7'	61.0'	
9	312°27.2	.. 52.3	295°12.5	7.6'	01°55.0	11.7'	61.0'	
10	327°27.4	51.4	309°39.2	7.6'	02°06.7	11.7'	61.0'	
11	342°27.5	50.4	324°05.8	7.6'	02°18.4	11.7'	61.0'	
12	357°27.7	S03°49.4	338°32.4	7.6'	N02°30.1	11.7'	61.0'	
13	12°27.9	48.4	352°59.0	7.6'	02°41.7	11.6'	61.0'	
14	27°28.0	47.4	7°25.6	7.6'	02°53.4	11.6'	61.0'	
15	42°28.2	.. 46.5	21°52.2	7.6'	03°05.0	11.6'	61.0'	
16	57°28.4	45.5	36°18.7	7.6'	03°16.6	11.6'	61.0'	
17	72°28.5	44.5	50°45.3	7.6'	03°28.2	11.6'	61.0'	
18	87°28.7	S03°43.5	65°11.9	7.6'	N03°39.7	11.5'	60.9'	
19	102°28.8	42.5	79°38.5	7.6'	03°51.2	11.5'	60.9'	
20	117°29.0	41.5	94°05.0	7.6'	04°02.7	11.5'	60.9'	
21	132°29.2	.. 40.6	108°31.6	7.5'	04°14.2	11.4'	60.9'	
22	147°29.3	39.6	122°58.1	7.5'	04°25.6	11.4'	60.9'	
23	162°29.5	38.6	137°24.6	7.5'	04°37.0	11.4'	60.9'	
	SD.=16.1	d=1.0			S.D.=16.6			

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer.Pass.	Mer.	Pass.	Age
	00 <sup>h</sup>	12 <sup>h</sup>	mm:ss	Upper	Lower	1-3
10	10:17	10:09		12:10	13:29	01:01
11	10:01	09:53		12:10	14:25	01:57
12	09:46	09:37		12:10	15:21	02:53



SD.=16.1	d=1.0	S.D.=16.4
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### March 13, 14, 15 UT (Sun., Mon., Tue.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	171°03.4	197°54.3	\$12°14.5	290°28.4	\$19°28.1	1°46.7	N06°12.9	275°46.3	\$21°00.5	Alpheratz	357°41.9	29°10.7											
1	186°05.9	212°53.8	13.5	305°30.0	28.2	16°49.5	13.1	290°48.7	00.5	Ankaa	353°14.3	-42°13.3											
2	201°08.4	227°53.3	12.4	320°31.6	28.4	31°52.2	13.2	305°51.1	00.5	Schedar	349°38.8	56°37.5											
3	216°10.8	242°52.7	11.4	335°33.2	28.6	46°55.0	13.3	320°53.6	00.5	Diphda	348°54.4	-17°54.1											
4	231°13.3	257°52.2	10.4	350°34.8	28.8	61°57.8	13.5	335°56.0	00.5	Achernar	335°26.0	-57°09.6											
5	246°15.7	272°51.7	09.3	5°36.5	29.0	77°00.5	13.6	350°58.4	00.5	Hamal	327°58.9	23°32.2											
6	261°18.2	287°51.2	\$12°08.3	20°38.1	\$19°29.2	92°03.3	N06°13.7	6°00.8	\$21°00.5	Polaris	317°11.7	89°20.1											
7	276°20.7	302°50.7	07.3	35°39.7	29.4	107°06.0	13.8	21°03.2	00.5	Acamar	315°17.2	-40°14.8											
8	291°23.1	317°50.1	06.2	50°41.3	29.6	122°08.8	14.0	36°05.6	00.5	Menkar	314°13.3	4°08.9											
9	306°25.6	332°49.6	05.2	65°43.0	29.8	137°11.6	14.1	51°08.0	00.5	Mirfak	308°37.9	49°55.0											
10	321°28.1	347°49.1	04.2	80°44.6	30.0	152°14.3	14.2	66°10.4	00.5	Aldebaran	290°47.3	16°32.3											
11	336°30.5	2°48.6	03.1	95°46.2	30.1	167°17.1	14.3	81°12.8	00.5	Rigel	281°10.3	-8°11.4											
12	351°33.0	17°48.1	\$12°02.1	110°47.8	\$19°30.3	182°19.9	N06°14.5	96°15.2	\$21°00.5	Capella	280°31.7	46°00.8											
13	6°35.5	32°47.6	01.1	125°49.4	30.5	197°22.6	14.6	111°17.7	00.5	Bellatrix	278°30.0	6°21.5											
14	21°37.9	47°47.0	12°00.0	140°51.1	30.7	212°25.4	14.7	126°20.1	00.5	El Nath	278°10.3	28°37.1											
15	36°40.4	62°46.5	11°59.0	155°52.7	30.9	227°28.1	14.9	141°22.5	00.5	Alnilam	275°44.5	-1°11.9											
16	51°42.8	77°46.0	58.0	170°54.3	31.1	242°30.9	15.0	156°24.9	00.5	Betelgeuse	270°59.3	7°24.3											
17	66°45.3	92°45.5	56.9	185°56.0	31.3	257°33.7	15.1	171°27.3	00.5	Canopus	263°55.2	-52°42.8											
18	81°47.8	107°45.0	\$11°55.9	200°57.6	\$19°31.5	272°36.4	N06°15.2	186°29.7	\$21°00.5	Sirius	258°32.0	-16°44.7											
19	96°50.2	122°44.5	54.9	215°59.2	31.6	287°39.2	15.4	201°32.1	00.5	Adhara	255°10.9	-29°00.1											
20	111°52.7	137°44.0	53.8	231°00.8	31.8	302°42.0	15.5	216°34.5	00.5	Procyon	244°57.6	5°10.7											
21	126°55.2	152°43.4	52.8	246°02.5	32.0	317°44.7	15.6	231°36.9	00.5	Pollux	243°25.3	27°59.0											
22	141°57.6	167°42.9	51.7	261°04.1	32.2	332°47.5	15.7	246°39.4	00.5	Avior	234°16.8	-59°34.1											
23	157°00.1	182°42.4	50.7	276°05.7	32.4	347°50.3	15.9	261°41.8	00.5	Suhail	222°50.7	-43°30.2											
Mer.pass.:12:34				v-0.5 d1.0 m-3.8				v1.6 d-0.2 m0.0				v2.8 d0.1 m-2.3				v2.4 d-0.0 m0.4							
Mon				GHA				GHA				GHA				GHA							
0	172°02.6	197°41.9	\$11°49.6	291°07.4	\$19°32.6	2°53.0	N06°16.0	276°44.2	\$21°00.5	Denebola	182°31.5	14°28.8											
1	187°05.0	212°41.4	48.6	306°09.0	32.8	17°55.8	16.1	291°46.6	00.5	Gienah	175°50.0	-17°38.0											
2	202°07.5	227°40.9	47.6	321°10.6	33.0	32°58.5	16.3	306°49.0	00.5	Acrux	173°06.4	-63°11.3											
3	217°10.0	242°40.4	46.5	336°12.3	33.1	48°01.3	16.4	321°51.4	00.5	Gacrux	171°58.1	-57°12.2											
4	232°12.4	257°39.9	45.5	351°13.9	33.3	63°04.1	16.5	336°53.8	00.5	Alioth	166°18.6	55°52.2											
5	247°14.9	272°39.4	44.4	6°15.5	33.5	78°06.8	16.6	351°56.2	00.5	Spica	158°29.0	-11°14.8											
6	262°17.3	287°38.9	\$11°43.4	21°17.2	\$19°33.7	93°09.6	N06°16.8	6°58.7	\$21°00.5	Alkaid	152°57.1	49°13.8											
7	277°19.8	302°38.3	42.3	36°18.8	33.9	108°12.4	16.9	22°01.1	00.5	Hadar	148°44.6	-60°26.8											
8	292°22.3	317°37.8	41.3	51°20.4	34.1	123°15.1	17.0	37°03.5	00.5	Menkent	148°05.0	-36°26.8											
9	307°24.7	332°37.3	40.2	66°22.1	34.3	138°17.9	17.1	52°05.9	00.5	Arcturus	145°53.8	19°05.8											
10	322°27.2	347°36.8	39.2	81°23.7	34.4	153°20.6	17.3	67°08.3	00.5	Rigel Kent.	139°48.6	-60°53.8											
11	337°29.7	2°36.3	38.2	96°25.4	34.6	168°23.4	17.4	82°10.7	00.5	Kochab	137°19.5	74°05.2											
12	352°32.1	17°35.8	\$11°37.1	111°27.0	\$19°34.8	183°26.2	N06°17.5	97°13.1	\$21°00.5	Zuben ubi	137°03.1	-16°06.4											
13	7°34.6	32°35.3	36.1	126°28.6	35.0	198°28.9	17.6	112°15.6	00.5	Alphecca	126°09.3	26°39.5											
14	22°37.1	47°34.8	35.0	141°30.3	35.2	213°31.7	17.8	127°18.0	00.5	Antares	112°23.9	-26°27.8											
15	37°39.5	62°34.3	34.0	156°31.9	35.4	228°34.4	17.9	142°20.4	00.5	Atria	107°23.9	-69°02.9											
16	52°42.0	77°33.8	32.9	171°33.6	35.6	243°37.2	18.0	157°22.8	00.5	Sabik	102°10.4	-15°44.5											
17	67°44.5	92°33.3	31.9	186°35.2	35.7	258°40.0	18.1	172°25.2	00.5	Rasalhague	96°19.4	-37°06.6											
18	82°46.9	107°32.8	\$11°30.8	201°36.9	\$19°35.9	273°42.7	N06°18.3	187°27.6	\$21°00.5	Eltanin	90°45.3	51°29.1											
19	97°49.4	122°32.3	29.7	216°38.5	36.1	288°45.5	18.4	202°30.1	00.5	Kaus Aust.	83°41.4	-34°22.3											
20	112°51.8	137°31.8	28.7	231°40.1	36.3	303°48.3	18.5	217°32.5	00.5	Vega	80°37.8	38°47.8											
21	127°54.3	152°31.3	27.6	246°41.8	36.5	318°51.0	18.7	232°34.9	00.5	Nunki	75°56.2	-26°16.4											
22	142°56.8	167°30.8	26.6	261°43.4	36.7	333°53.8	18.8	247°37.3	00.5	Altair	62°06.6	8°54.7											
23	157°59.2	182°30.3	25.5	276°45.1	36.8	348°56.5	18.9	262°39.7	00.5	Peacock	53°16.8	-56°40.7											
Mer.pass.:12:30				v-0.5 d1.0 m-3.8				v1.6 d-0.2 m-0.0				v2.8 d0.1 m-2.3				v2.4 d0.0 m0.4							
Tue				GHA				GHA				GHA				GHA							
0	173°01.7	197°29.8	\$11°24.5	291°46.7	\$19°37.0	3°59.3	N06°19.0	277°42.1	\$21°00.5	Mar 13 Sun	26°50.9	10:49											
1	188°04.2	212°29.3	23.4	306°48.4	37.2	19°02.1	19.2	292°44.6	00.5	Venus	26°50.9	10:49											
2	203°06.6	227°28.8	22.4	321°50.0	37.4	34°04.8	19.3	307°47.0	00.5	Mars	119°25.0	04:38											
3	218°09.1	242°28.3	21.3	336°51.7	37.6	49°07.6	19.4	322°49.4	00.5	Jupiter	190°43.3	23:49											
4	233°11.6	257°27.8	20.3	351°53.3	37.8	64°10.3	19.5	337°51.8	00.5	Saturn	104°42.9	05:36											
5	248°14.0	272°27.3	19.2	6°55.0	37.9	79°13.1	19.7	352°54.2	00.5	Mar 14 Mon	25°39.4	10:50											
6	263°16.5	287°26.8	\$11°18.1	21°56.6	\$19°38.1	94°15.9	N06°19.8	7°56.6	\$21°00.5	Venus	25°04.8	04:35											

DUT1 = UT1-UTC = -0.0444 sec ΔT = TT-UT1 = +68.2284 sec

2016 March 13 to Mar. 15 UT

h	Sun			Moon			
Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	177°37.7	S02°50.4	124°54.6	7.1'	N12°48.4	8.2'	60.0'
1	192°37.8	49.4	139°20.8	7.1'	12°56.6	8.1'	60.0'
2	207°38.0	48.4	153°46.9	7.1'	13°04.7	8.0'	60.0'
3	222°38.2	47.4	168°13.1	7.1'	13°12.6	7.9'	59.9'
4	237°38.3	46.4	182°39.2	7.1'	13°20.5	7.8'	59.9'
5	252°38.5	45.5	197°05.3	7.1'	13°28.3	7.7'	59.9'
6	267°38.7	S02°44.5	211°31.5	7.1'	N13°36.0	7.6'	59.8'
7	282°38.8	43.5	225°57.6	7.1'	13°43.6	7.6'	59.8'
8	297°39.0	42.5	240°23.7	7.1'	13°51.1	7.5'	59.8'
9	312°39.2	41.5	254°49.8	7.1'	13°58.5	7.4'	59.8'
10	327°39.4	40.5	269°15.9	7.1'	14°05.8	7.3'	59.7'
11	342°39.5	39.5	283°42.1	7.1'	14°13.1	7.2'	59.7'
12	357°39.7	S02°38.6	298°08.2	7.1'	N14°20.2	7.1'	59.7'
13	12°39.9	37.6	312°34.3	7.1'	14°27.2	7.0'	59.6'
14	27°40.0	36.6	327°00.4	7.1'	14°34.1	6.9'	59.6'
15	42°40.2	35.6	341°26.5	7.1'	14°40.9	6.8'	59.6'
16	57°40.4	34.6	355°52.7	7.1'	14°47.6	6.7'	59.6'
17	72°40.6	33.6	10°18.8	7.1'	14°54.2	6.6'	59.5'
18	87°40.7	S02°32.6	24°44.9	7.1'	N15°00.7	6.5'	59.5'
19	102°40.9	31.7	39°11.0	7.1'	15°07.1	6.4'	59.5'
20	117°41.1	30.7	53°37.2	7.1'	15°13.4	6.2'	59.4'
21	132°41.3	29.7	68°03.3	7.1'	15°19.6	6.1'	59.4'
22	147°41.4	28.7	82°29.4	7.1'	15°25.7	6.0'	59.4'
23	162°41.6	27.7	96°55.6	7.1'	15°31.7	5.9'	59.3'
	SD.=16.1	d=1.0			S.D.=16.3		

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

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

Day	Sun		Moon	
	Eqn. of Time	Mer. Pass.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
13	09:29	09:21	12:09	03:49
14	09:13	09:05	12:09	04:45
15	08:56	08:48	12:09	05:41



SD.=16.1	d=1.0	S.D.=15.8
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## March 16, 17, 18 UT (Wed., Thu., Fri.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	174°00.8	197°17.8	\$10°59.0	292°26.5	\$19°41.4	5°05.6	N06°22.0	278°40.2	S21°00.4									Alpheratz	357°41.9	29°10.7			
1	189°03.3	212°17.4	57.9	307°28.2	41.6	20°08.3	22.2	293°42.6	00.4									Ankaa	353°14.3	-42°13.2			
2	204°05.8	227°16.9	56.9	322°29.8	41.7	35°11.1	22.3	308°45.1	00.4								Schedar	349°38.8	56°37.5				
3	219°08.2	242°16.4	· · 55.8	337°31.5	· · 41.9	50°13.8	· · 22.4	323°47.5	· · 00.4								Diphda	348°54.4	-17°54.1				
4	234°10.7	257°15.9	54.7	352°33.2	42.1	65°16.6	22.5	338°49.9	00.4								Achernar	335°26.0	-57°09.6				
5	249°13.2	272°15.4	53.7	7°34.8	42.3	80°19.4	22.7	353°52.3	00.4								Hamal	327°58.9	23°32.2				
6	264°15.6	287°14.9	\$10°52.6	22°36.5	\$19°42.4	95°22.1	N06°22.8	8°54.7	S21°00.4								Polaris	317°12.7	89°20.1				
7	279°18.1	302°14.4	51.5	37°38.2	42.6	110°24.9	22.9	23°57.2	00.4								Acamar	315°17.2	-40°14.8				
8	294°20.6	317°13.9	50.4	52°39.9	42.8	125°27.6	23.0	38°59.6	00.4								Menkar	314°13.3	4°08.9				
9	309°23.0	332°13.4	· · 49.4	67°41.5	· · 43.0	140°30.4	· · 23.2	54°02.0	· · 00.4								Mirfak	308°37.9	49°55.0				
10	324°25.5	347°12.9	48.3	82°43.2	43.2	155°33.2	23.3	69°04.4	00.4								Aldebaran	290°47.3	16°32.3				
11	339°27.9	2°12.5	47.2	97°44.9	43.3	170°35.9	23.4	84°06.9	00.4								Rigel	281°10.3	-8°11.4				
12	354°30.4	17°12.0	\$10°46.1	112°46.5	\$19°43.5	185°38.7	N06°23.5	99°09.3	S21°00.4								Capella	280°31.7	46°00.8				
13	9°32.9	32°11.5	45.1	127°48.2	43.7	200°41.4	23.7	114°11.7	00.4								Bellatrix	278°30.0	6°21.5				
14	24°35.3	47°11.0	44.0	142°49.9	43.9	215°44.2	23.8	129°14.1	00.4								Elnath	278°10.3	28°37.1				
15	39°37.8	62°10.5	· · 42.9	157°51.6	· · 44.0	230°47.0	· · 23.9	144°16.6	· · 00.4								Alnilam	275°44.5	-1°11.9				
16	54°40.3	77°10.0	41.8	172°53.3	44.2	245°49.7	24.0	159°19.0	00.4								Betelgeuse	270°59.3	7°24.3				
17	69°42.7	92°09.5	40.8	187°54.9	44.4	260°52.5	24.2	174°21.4	00.4								Canopus	263°55.2	-52°42.8				
18	84°45.2	107°09.1	\$10°39.7	202°56.6	\$19°44.6	275°55.2	N06°24.3	189°23.8	S21°00.4								Sirius	258°32.0	-16°44.7				
19	99°47.7	122°08.6	38.6	217°58.3	44.8	290°58.0	24.4	204°26.3	00.4								Adhara	255°10.9	-29°00.1				
20	114°50.1	137°08.1	37.5	233°00.0	44.9	306°00.8	24.5	219°28.7	00.4								Procyon	244°57.6	5°10.7				
21	129°52.6	152°07.6	· · 36.5	248°01.6	· · 45.1	321°03.5	· · 24.7	234°31.1	· · 00.4								Pollux	243°25.3	27°59.0				
22	144°55.1	167°07.1	35.4	263°03.3	45.3	336°06.3	24.8	249°33.5	00.4								Avior	234°16.8	-59°34.1				
23	159°57.5	182°06.6	34.3	278°05.0	45.5	351°09.0	24.9	264°36.0	00.4								Suhail	222°50.7	-43°30.2				
Mer.pass.:12:22				v-0.5 d1.1 m-3.8				v1.7 d-0.2 m-0.1				v2.8 d0.1 m-2.3				v2.4 d0.0 m0.4							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	175°00.0	197°06.2	\$10°33.2	293°06.7	\$19°45.6	6°11.8	N06°25.0	279°38.4	S21°00.4								Denebola	182°31.5	14°28.8				
1	190°02.4	212°05.7	32.1	308°08.4	45.8	21°14.5	25.2	294°40.8	00.4								Gienah	175°50.0	-17°38.0				
2	205°04.9	227°05.2	31.1	323°10.1	46.0	36°17.3	25.3	309°43.2	00.4								Acrux	173°06.4	-63°11.3				
3	220°07.4	242°04.7	· · 30.0	338°11.7	· · 46.2	51°20.1	· · 25.4	324°45.7	· · 00.4								Gacrux	171°58.1	-57°12.2				
4	235°09.8	257°04.2	28.9	353°13.4	46.3	66°22.8	25.5	339°48.1	00.4								Alioth	166°18.6	55°52.2				
5	250°12.3	272°03.7	27.8	8°15.1	46.5	81°25.6	25.6	354°50.5	00.4								Spica	158°29.0	-11°14.8				
6	265°14.8	287°03.3	\$10°26.7	23°16.8	\$19°46.7	96°28.3	N06°25.8	9°52.9	S21°00.4								Alkaid	152°57.1	49°13.8				
7	280°17.2	302°02.8	25.7	38°18.5	46.9	111°31.1	25.9	24°55.4	00.4								Hadar	148°44.6	-60°26.8				
8	295°19.7	317°02.3	24.6	53°20.2	47.0	126°33.9	26.0	39°57.8	00.4								Menkent	148°05.0	-36°26.9				
9	310°22.2	332°01.8	· · 23.5	68°21.9	· · 47.2	141°36.6	· · 26.1	55°00.2	· · 00.4								Arcturus	145°53.8	19°05.8				
10	325°24.6	347°01.3	22.4	83°23.6	47.4	156°39.4	26.3	70°02.7	00.4								Rigel Kent.	139°48.6	-60°53.8				
11	340°27.1	2°00.9	21.3	98°25.2	47.6	171°42.1	26.4	85°05.1	00.4								Kochab	137°19.5	74°05.2				
12	355°29.5	17°00.4	\$10°20.2	113°26.9	\$19°47.7	186°49.9	N06°26.5	100°07.5	S21°00.4								Zuben ubi	137°03.1	-16°06.5				
13	10°32.0	31°59.9	19.1	128°28.6	47.9	201°44.6	26.6	115°09.9	00.4								Alphecca	126°09.3	26°39.5				
14	25°34.5	46°59.4	18.1	143°30.3	48.1	216°50.4	26.8	130°12.4	00.4								Antares	112°23.8	-26°27.8				
15	40°36.9	61°59.0	· · 17.0	158°32.0	· · 48.3	231°53.2	· · 26.9	145°14.8	· · 00.4								Atria	107°23.8	-69°02.9				
16	55°39.4	76°58.5	15.9	173°33.7	48.4	246°55.9	27.0	160°17.2	00.4								Sabik	102°10.3	-15°44.5				
17	70°41.9	91°58.0	14.8	188°35.4	48.6	261°58.7	27.1	175°19.7	00.4								Rasalhague	96°04.7	12°32.9				
18	85°44.3	106°57.5	\$10°13.7	203°37.1	\$19°48.8	277°01.4	N06°27.3	190°22.1	S21°00.4								Eltanin	90°45.3	51°29.1				
19	100°46.8	121°57.0	12.6	218°38.8	48.9	292°04.2	27.4	205°24.5	00.4								Kaus Aust.	83°41.4	-34°22.3				
20	115°49.3	136°56.6	11.5	233°40.5	49.1	307°06.9	27.5	220°26.9	00.4								Vega	80°37.8	38°47.8				
21	130°51.7	151°56.1	· · 10.4	248°42.2	· · 49.3	322°09.7	· · 27.6	235°29.4	· · 00.4								Nunki	75°56.1	-26°16.4				
22	145°54.2	166°55.6	09.3	263°43.9	49.5	337°12.5	27.7	250°31.8	00.4								Altair	62°06.6	8°54.7				
23	160°56.7	181°55.1	08.3	278°45.6	49.6	352°15.2	27.9	265°34.2	00.4								Peacock	53°16.8	-56°40.7				
Mer.pass.:12:18				v-0.5 d1.1 m-3.8				v1.7 d-0.2 m-0.1				v2.8 d0.1 m-2.3				v2.4 d0.0 m0.4							
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	175°59.1	196°54.7	\$10°07.2	293°47.3	\$19°49.8	7°18.0	N06°28.0	280°36.7	S21°00.4								Mar 16 Wed	SHA	Mer.pass				
1	191°01.6	211°54.2	06.1	308°49.0	50.0	22°20.7	28.1	295°39.1	00.4								Venus	23°17.0	10:51				
2	206°04.0	226°53.7	05.0	323°50.7	50.2	37°23.5	28.2	310°41.5	00.4								Mars	118°25.7	04:30				
3	221°06.5	241°53.3	· · 03.9	338°52.4	· · 50.3	52°26.2	· · 28.4	325°44.0	· · 00.4								Jupiter	191°04.7	23:35				
4	236°09.0	256°52.8	02.8	353°54.1	50.5	67°29.0	28.5	340°46.4	00.4								Saturn	104°39.4	05:24				
5	251°11.4	271°52.3	01.7	8°55.8	50.7	82°31.8	28.6	355°48.8	00.4														
6	266°13.9	286°51.8	\$10°00.6	23°57.5	\$19°50.8	97°34.5	N06°28.7	10°51.2	S21°00.4								Mar 17 Thu	SHA	Mer.pass				
7	281°16.4	301°51.4	09°55.9</td																				

DUT1 = UT1-UTC = -0.0504 sec  $\Delta T$  = TT-UT1 = +68.2344 sec

2016 March 16 to Mar. 18 UT

h	Sun	Moon					
Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	177°50.2	S01°39.3	84°34.1	8.1'	N18°10.9	0.5'	57.8'
1	192°50.4	38.3	99°01.3	8.1'	18°11.4	0.4'	57.7'
2	207°50.5	37.3	113°28.4	8.2'	18°11.8	0.3'	57.7'
3	222°50.7	.. 36.4	127°55.6	8.2'	18°12.1	0.2'	57.7'
4	237°50.9	35.4	142°22.9	8.2'	18°12.3	0.1'	57.6'
5	252°51.1	34.4	156°50.1	8.3'	18°12.3	0.0'	57.6'
6	267°51.3	S01°33.4	171°17.4	8.3'	N18°12.3	-0.1'	57.6'
7	282°51.4	32.4	185°44.8	8.4'	18°12.1	-0.2'	57.5'
8	297°51.6	31.4	200°12.2	8.4'	18°11.9	-0.3'	57.5'
9	312°51.8	.. 30.4	214°39.6	8.4'	18°11.5	-0.4'	57.5'
10	327°52.0	29.4	229°07.0	8.5'	18°11.0	-0.5'	57.5'
11	342°52.1	28.5	243°34.5	8.5'	18°10.5	-0.6'	57.4'
12	357°52.3	S01°27.5	258°02.1	8.6'	N18°09.8	-0.7'	57.4'
13	12°52.5	26.5	272°29.7	8.6'	18°09.0	-0.8'	57.4'
14	27°52.7	25.5	286°57.3	8.6'	18°08.1	-0.9'	57.3'
15	42°52.9	.. 24.5	301°24.9	8.7'	18°07.1	-1.0'	57.3'
16	57°53.0	23.5	315°52.7	8.7'	18°06.0	-1.1'	57.3'
17	72°53.2	22.5	330°20.4	8.8'	18°04.8	-1.2'	57.2'
18	87°53.4	S01°21.5	344°48.2	8.8'	N18°03.5	-1.3'	57.2'
19	102°53.6	20.6	359°16.0	8.9'	18°02.1	-1.5'	57.2'
20	117°53.8	19.6	13°43.9	8.9'	18°00.6	-1.6'	57.2'
21	132°53.9	.. 18.6	28°11.8	9.0'	17°59.0	-1.7'	57.1'
22	147°54.1	17.6	42°39.8	9.0'	17°57.3	-1.8'	57.1'
23	162°54.3	16.6	57°07.8	9.0'	17°55.5	-1.9'	57.1'
	SD.=16.1	d=1.0			S.D.=15.6		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Mer. Pass.	Upper	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass	Pass	hh:mm	7-9 59-78%
16	08:39	08:31	12:09	19:03	06:36	
17	08:22	08:13	12:08	19:55	07:29	
18	08:05	07:56	12:08	20:45	08:21	

SD.=16.1	d=1.0	S.D.=15.3
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### March 19, 20, 21 UT (Sat., Sun., Mon.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sat	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	176°58.3	196°43.4	\$09°40.8	294°28.3	\$19°53.9		8°24.1	N06°30.9	281°35.0	\$21°00.3							Alpheratz	357°41.9	29°10.7				
1	192°00.7	211°42.9	39.7	309°30.0	54.1		23°26.9	31.0	296°37.5	00.3							Ankaa	353°14.3	-42°13.2				
2	207°03.2	226°42.5	38.6	324°31.7	54.2		38°29.6	31.2	311°39.9	00.3							Schedar	349°38.8	56°37.5				
3	222°05.6	241°42.0	· · 37.5	339°33.5	· · 54.4		53°32.4	· · 31.3	326°42.4	· · 00.3							Diphda	348°54.4	-17°54.1				
4	237°08.1	256°41.5	36.4	354°35.2	54.6		68°35.1	31.4	341°44.8	00.3							Achernar	335°26.0	-57°09.5				
5	252°10.6	271°41.1	35.3	9°36.9	54.7		83°37.9	31.5	356°47.2	00.3							Hamal	327°58.9	23°32.2				
6	267°13.0	286°40.6	\$09°34.2	24°38.6	\$19°54.9		98°40.6	N06°31.7	11°49.7	\$21°00.3							Polaris	317°13.7	89°20.1				
7	282°15.5	301°40.2	33.1	39°40.3	55.1		113°43.4	31.8	26°52.1	00.3							Acamar	315°17.3	-40°14.8				
8	297°18.0	316°39.7	32.0	54°42.1	55.2		128°46.1	31.9	41°54.5	00.3							Menkar	314°13.3	4°08.9				
9	312°20.4	331°39.2	· · 30.9	69°43.8	· · 55.4		143°48.9	· · 32.0	56°57.0	· · 00.3							Mirfak	308°37.9	49°55.0				
10	327°22.9	346°38.8	29.8	84°45.5	55.6		158°51.6	32.1	71°59.4	00.3							Aldebaran	290°47.3	16°32.3				
11	342°25.4	1°38.3	28.7	99°47.2	55.7		173°54.4	32.3	87°01.8	00.3							Rigel	281°10.3	-8°11.4				
12	357°27.8	16°37.8	\$09°27.6	114°49.0	\$19°55.9		188°57.2	N06°32.4	102°04.3	\$21°00.3							Capella	280°31.8	46°00.8				
13	12°30.3	31°37.4	26.5	129°50.7	56.1		203°59.9	32.5	117°06.7	00.3							Bellatrix	278°30.1	6°21.5				
14	27°32.8	46°36.9	25.3	144°52.4	56.2		219°02.7	32.6	132°09.2	00.3							Elnath	278°10.3	28°37.1				
15	42°35.2	61°36.5	· · 24.2	159°54.1	· · 56.4		234°05.4	· · 32.7	147°11.6	· · 00.3							Alnilam	275°44.5	-1°11.9				
16	57°37.7	76°36.0	23.1	174°55.9	56.6		249°08.2	32.9	162°14.0	00.3							Betelgeuse	270°59.3	7°24.3				
17	72°40.1	91°35.5	22.0	189°57.6	56.7		264°10.9	33.0	177°16.5	00.3							Canopus	263°55.3	-52°42.8				
18	87°42.6	106°35.1	\$09°20.9	204°59.3	\$19°56.9		279°13.7	N06°33.1	192°18.9	\$21°00.3							Sirius	258°32.0	-16°44.7				
19	102°45.1	121°34.6	19.8	220°01.1	57.1		294°16.4	33.2	207°21.3	00.3							Adhara	255°11.0	-29°00.1				
20	117°47.5	136°34.2	18.7	235°02.8	57.2		309°19.2	33.3	222°23.8	00.3							Procyon	244°57.7	5°10.7				
21	132°50.0	151°33.7	· · 17.6	250°04.5	· · 57.4		324°21.9	· · 33.5	237°26.2	· · 00.3							Pollux	243°25.3	27°59.0				
22	147°52.5	166°33.2	16.5	265°06.3	57.6		339°24.7	33.6	252°28.7	00.3							Avior	234°16.8	-59°34.1				
23	162°54.9	181°32.8	15.4	280°08.0	57.7		354°27.4	33.7	267°31.1	00.3							Suhail	222°50.7	-43°30.2				
Mer.pass.:12:10				v-0.5 d1.1 m-3.8				v1.7 d-0.2 m-0.2				v2.8 d0.1 m-2.3				v2.4 d0.0 m0.4							
Sun	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	177°57.4	196°32.3	\$09°14.2	295°09.7	\$19°57.9		9°30.2	N06°33.8	282°33.5	\$21°00.3							Denebola	182°31.5	14°28.8				
1	192°59.9	211°31.9	13.1	310°11.5	58.1		24°32.9	33.9	297°36.0	00.3							Gienah	175°50.0	-17°38.0				
2	208°02.3	226°31.4	12.0	325°13.2	58.2		39°35.7	34.1	312°38.4	00.3							Acrux	173°06.4	-63°11.3				
3	223°04.8	241°31.0	· · 10.9	340°15.0	· · 58.4		54°38.4	· · 34.2	327°40.9	· · 00.3							Gacrux	171°58.1	-57°12.2				
4	238°07.3	256°30.5	09.8	355°16.7	58.6		69°41.2	34.3	342°43.3	00.3							Alioth	166°18.6	55°52.2				
5	253°09.7	271°30.1	08.7	10°18.4	58.7		84°44.0	34.4	357°45.7	00.3							Spica	158°29.0	-11°14.8				
6	268°12.2	286°29.6	\$09°07.5	25°20.2	\$19°58.9		99°46.7	N06°34.6	12°48.2	\$21°00.3							Alkaid	152°57.1	49°13.8				
7	283°14.6	301°29.1	06.4	40°21.9	59.1		114°49.5	34.7	27°50.6	00.3							Hadar	148°44.6	-60°26.9				
8	298°17.1	316°28.7	05.3	55°23.7	59.2		129°52.2	34.8	42°53.1	00.3							Menkent	148°05.0	-36°26.9				
9	313°19.6	331°28.2	· · 04.2	70°25.4	· · 59.4		144°55.0	· · 34.9	57°55.5	· · 00.3							Arcturus	145°53.8	19°05.8				
10	328°22.0	346°27.8	03.1	85°27.1	59.6		159°57.7	35.0	72°57.9	00.3							Rigel Kent.	139°48.6	-60°53.8				
11	343°24.5	1°27.3	02.0	100°28.9	59.7		175°00.5	35.1	88°00.4	00.3							Kochab	137°19.4	74°05.2				
12	358°27.0	16°26.9	\$09°00.8	115°30.6	\$19°59.9		190°03.2	N06°35.3	103°02.8	\$21°00.2							Zuben ubi	137°03.1	-16°06.5				
13	13°29.4	31°26.4	08°59.7	130°32.4	20°00.0		205°06.0	35.4	118°05.3	00.2							Alphecca	126°09.2	26°39.5				
14	28°31.9	46°26.0	58.6	145°34.1	00.2		220°08.7	35.5	133°07.7	00.2							Antares	112°23.8	-26°27.9				
15	43°34.4	61°25.5	· · 57.5	160°35.9	· · 00.4		235°11.5	· · 35.6	148°10.2	· · 00.2							Atria	107°23.8	-69°02.9				
16	58°36.8	76°25.1	56.4	175°37.6	00.5		250°14.2	35.7	163°12.6	00.2							Sabik	102°10.3	-15°44.5				
17	73°39.3	91°24.6	55.2	190°39.4	00.7		265°17.0	35.9	178°15.0	00.2							Rasalhague	96°04.7	12°32.9				
18	88°41.7	106°24.2	\$08°54.1	205°41.1	\$20°00.9		280°19.7	N06°36.0	193°17.5	\$21°00.2							Eltanin	90°45.3	51°29.1				
19	103°44.2	121°23.7	53.0	220°42.9	01.0		295°22.5	36.1	208°19.9	00.2							Kaus Aust.	83°41.4	-34°22.3				
20	118°46.7	136°23.3	51.9	235°44.6	01.2		310°25.2	36.2	223°22.4	00.2							Vega	80°37.7	38°47.8				
21	133°49.1	151°22.8	· · 50.8	250°46.4	· · 01.3		325°28.0	· · 36.3	238°24.8	· · 00.2							Nunki	75°56.1	-26°16.4				
22	148°51.6	166°22.4	49.6	265°48.1	01.5		340°30.7	36.5	253°27.3	00.2							Altair	62°06.6	8°54.7				
23	163°54.1	181°21.9	48.5	280°49.9	01.7		355°33.5	36.6	268°29.7	00.2							Peacock	53°16.7	-56°40.7				
Mer.pass.:12:06				v-0.5 d1.1 m-3.8				v1.7 d-0.2 m-0.2				v2.8 d0.1 m-2.3				v2.4 d0.0 m0.4							
Mon	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	178°56.5	196°21.5	\$08°47.4	295°51.6	\$20°01.8		10°36.2	N06°36.7	283°32.1	\$21°00.2							Mar 19 Sat	SHA	Mer.pass				
1	193°59.0	211°21.0	46.3	310°53.4	02.0		25°39.0	36.8	298°34.6	00.2							Venus	19°45.1	10:53				
2	209°01.5	226°20.6	45.1	325°55.2	02.2		40°41.7	36.9	313°37.0	00.2							Mars	117°30.0	04:22				
3	224°03.9	241°20.1	· · 44.0	340°56.9	· · 02.3		55°44.5	· · 37.1	328°39.5	· · 00.2							Jupiter	191°25.8	23:22				
4	239°06.4	256°19.7	42.9	355°58.7	02.5		70°47.2	37.2	343°41.9	00.2							Saturn	104°36.8	05:13				
5	254°08.9	271°19.2	41.8	11°00.4	02.6		85°50.0	37.3	358°44.4	00.2													
6	269°11.3	286°18.8	\$08°40.6	26°02.2	\$20°02.8		100°52.7	N06°37.4	13°46.8	\$21°00.2						Mar 20 Sun	SHA	Mer.pass					
7	284°13.8	301°18.3	39.5	41°03.9	0																		

DUT1 = UT1-UTC = -0.0564 sec ΔT = TT-UT1 = +68.2404 sec

2016 March 19 to Mar. 21 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°03.2	S00°28.2	47°02.0	11.5'	N14°37.2	-6.0'	55.8'
1	193°03.4	27.2	61°32.6	11.6'	14°31.2	-6.1'	55.8'
2	208°03.6	26.2	76°03.2	11.7'	14°25.1	-6.1'	55.7'
3	223°03.8	25.2	90°33.9	11.7'	14°19.0	-6.2'	55.7'
4	238°04.0	24.2	105°04.6	11.8'	14°12.7	-6.3'	55.7'
5	253°04.1	23.2	119°35.4	11.8'	14°06.5	-6.3'	55.7'
6	268°04.3	S00°22.2	134°06.3	11.9'	N14°00.1	-6.4'	55.7'
7	283°04.5	21.3	148°37.1	11.9'	13°53.7	-6.4'	55.6'
8	298°04.7	20.3	163°08.1	12.0'	13°47.2	-6.5'	55.6'
9	313°04.9	19.3	177°39.1	12.0'	13°40.7	-6.6'	55.6'
10	328°05.1	18.3	192°10.1	12.1'	13°34.1	-6.6'	55.6'
11	343°05.2	17.3	206°41.2	12.1'	13°27.4	-6.7'	55.6'
12	358°05.4	S00°16.3	221°12.3	12.2'	N13°20.7	-6.8'	55.5'
13	13°05.6	15.3	235°43.5	12.2'	13°13.9	-6.8'	55.5'
14	28°05.8	14.3	250°14.7	12.3'	13°07.1	-6.9'	55.5'
15	43°06.0	13.3	264°46.0	12.3'	13°00.2	-6.9'	55.5'
16	58°06.2	12.4	279°17.3	12.4'	12°53.2	-7.0'	55.4'
17	73°06.4	11.4	293°48.7	12.4'	12°46.2	-7.0'	55.4'
18	88°06.5	S00°10.4	308°20.2	12.5'	N12°39.1	-7.1'	55.4'
19	103°06.7	09.4	322°51.6	12.5'	12°32.0	-7.2'	55.4'
20	118°06.9	08.4	337°23.2	12.6'	12°24.8	-7.2'	55.4'
21	133°07.1	07.4	351°54.7	12.6'	12°17.6	-7.3'	55.4'
22	148°07.3	06.4	6°26.4	12.6'	12°10.3	-7.3'	55.3'
23	163°07.5	05.4	20°58.0	12.7'	12°03.0	-7.4'	55.3'
	SD.=16.1	d=1.0			S.D.=15.1		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Mer. Pass.	Upper	Lower
	00 <sup>h</sup>	12 <sup>h</sup>	mm:ss	mm:ss	hh:mm	hh:mm
19	07:47	07:38		12:08	21:33	09:10
20	07:29	07:20		12:07	22:19	09:57
21	07:12	07:03		12:07	23:04	10:42

SD.=16.0	d=1.0	S.D.=14.9
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**March 22, 23, 24 UT (Tue., Wed., Thu.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Tue	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	179°55.7	196°10.8	S08°20.3	296°34.0	S20°05.7	11°42.2	N06°39.5	284°30.9	S21°00.1								Alpheratz	357°41.9	29°10.7				
1	194°58.1	211°10.3	19.2	311°35.8	05.8	26°44.9	39.7	299°33.3	00.1								Ankaa	353°14.3	-42°13.2				
2	210°00.6	226°09.9	18.0	326°37.5	06.0	41°47.7	39.8	314°35.7	00.1								Schedar	349°38.8	56°37.5				
3	225°03.1	241°09.4	16.9	341°39.3	06.1	56°50.4	39.9	329°38.2	00.1								Diphda	348°54.4	-17°54.1				
4	240°05.5	256°09.0	15.8	356°41.1	06.3	71°53.2	40.0	344°40.6	00.1								Achernar	335°26.0	-57°09.5				
5	255°08.0	271°08.6	14.6	11°42.9	06.5	86°55.9	40.1	359°43.1	00.1								Hamal	327°58.9	23°32.2				
6	270°10.5	286°08.1	S08°13.5	26°44.7	S20°06.6	101°58.7	N06°40.2	14°45.5	S21°00.1								Polaris	317°14.7	89°20.1				
7	285°12.9	301°07.7	12.4	41°46.4	06.8	117°01.4	40.4	29°48.0	00.1								Acamar	315°17.3	-40°14.8				
8	300°15.4	316°07.2	11.2	56°48.2	06.9	132°04.2	40.5	44°50.4	00.1								Menkar	314°13.3	4°08.9				
9	315°17.8	331°06.8	10.1	71°50.0	07.1	147°06.9	40.6	59°52.9	00.1								Mirfak	308°37.9	49°55.0				
10	330°20.3	346°06.4	09.0	86°51.8	07.3	162°09.7	40.7	74°55.3	00.1								Aldebaran	290°47.4	16°32.3				
11	345°22.8	1°05.9	07.8	101°53.6	07.4	177°12.4	40.8	89°57.8	00.1								Rigel	281°10.3	-8°11.4				
12	0°25.2	16°05.5	S08°06.7	116°55.3	S20°07.6	192°15.2	N06°40.9	105°00.2	S21°00.1								Capella	280°31.8	46°00.8				
13	15°27.7	31°05.0	05.5	131°57.1	07.7	207°17.9	41.1	120°02.7	00.1								Bellatrix	278°30.1	6°21.5				
14	30°30.2	46°04.6	04.4	146°58.9	07.9	222°20.6	41.2	135°05.1	00.1								El Nath	278°10.3	28°37.1				
15	45°32.6	61°04.2	03.3	162°00.7	08.0	237°23.4	41.3	150°07.6	00.1								Alnilam	275°44.5	-1°11.8				
16	60°35.1	76°03.7	02.1	177°02.5	08.2	252°26.1	41.4	165°10.0	00.1								Betelgeuse	270°59.3	7°24.3				
17	75°37.6	91°03.3	08°01.0	192°04.3	08.3	267°28.9	41.5	180°12.5	00.1								Canopus	263°55.3	-52°42.8				
18	90°40.0	106°02.9	S07°59.8	207°06.1	S20°08.5	282°31.6	N06°41.6	195°15.0	S21°00.1								Sirius	258°32.0	-16°44.7				
19	105°42.5	121°02.4	58.7	222°07.8	08.7	297°34.4	41.8	210°17.4	00.1								Adhara	255°11.0	-29°00.1				
20	120°44.9	136°02.0	57.6	237°09.6	08.8	312°37.1	41.9	225°19.9	00.1								Procyon	244°57.7	5°10.7				
21	135°47.4	151°01.6	56.4	252°11.4	09.0	327°39.9	42.0	240°22.3	00.1								Pollux	243°25.3	27°59.0				
22	150°49.9	166°01.1	55.3	267°13.2	09.1	342°42.6	42.1	255°24.8	00.1								Avior	234°16.9	-59°34.1				
23	165°52.3	181°00.7	54.1	282°15.0	09.3	357°45.4	42.2	270°27.2	00.1								Suhail	222°50.7	-43°30.3				
Mer.pass.:11:58				v-0.4 d1.1 m-3.8				v1.8 d-0.2 m-0.2				v2.7 d0.1 m-2.3				v2.4 d0.0 m0.4							
Wed				GHA				GHA				GHA				GHA				GHA			
0	180°54.8	196°00.3	S07°53.0	297°16.8	S20°09.4	12°48.1	N06°42.3	285°29.7	S21°00.1								Denebola	182°31.5	14°28.8				
1	195°57.3	210°59.8	51.9	312°18.6	09.6	27°50.8	42.5	300°32.1	00.1								Gienah	175°50.0	-17°38.0				
2	210°59.7	225°59.4	50.7	327°20.4	09.7	42°53.6	42.6	315°34.6	00.0								Acrux	173°06.4	-63°11.3				
3	226°02.2	240°59.0	49.6	342°22.2	09.9	57°56.3	42.7	330°37.0	00.0								Gacrux	171°58.1	-57°12.2				
4	241°04.7	255°58.5	48.4	357°24.0	10.1	72°59.1	42.8	345°39.5	00.0								Alioth	166°18.6	55°52.2				
5	256°07.1	270°58.1	47.3	12°25.8	10.2	88°01.8	42.9	0°41.9	00.0								Spica	158°29.0	-11°14.8				
6	271°09.6	285°57.7	S07°46.1	27°27.6	S20°10.4	103°04.6	N06°43.0	15°44.4	S21°00.0								Alkaid	152°57.1	49°13.9				
7	286°12.1	300°57.2	45.0	42°29.4	10.5	118°07.3	43.2	30°46.8	00.0								Hadar	148°44.5	-60°26.9				
8	301°14.5	315°56.8	43.8	57°31.2	10.7	133°10.1	43.3	45°49.3	00.0								Menkent	148°05.0	-36°26.9				
9	316°17.0	330°56.4	42.7	72°33.0	10.8	148°12.8	43.4	60°51.7	00.0								Arcturus	145°53.8	19°05.8				
10	331°19.4	345°55.9	41.6	87°34.8	11.0	163°15.5	43.5	75°54.2	00.0								Rigel Kent.	139°48.5	-60°53.9				
11	346°21.9	0°55.5	40.4	102°36.6	11.1	178°18.3	43.6	90°56.7	00.0								Kochab	137°19.4	74°05.2				
12	1°24.4	15°55.1	S07°39.3	117°38.4	S20°11.3	193°21.0	N06°43.7	105°59.1	S21°00.0								Zuben ubi	137°03.1	-16°06.5				
13	16°26.8	30°54.6	38.1	132°40.2	11.4	208°23.8	43.9	121°01.6	00.0								Alphecca	126°09.2	26°39.5				
14	31°29.3	45°54.2	37.0	147°42.0	11.6	223°26.5	44.0	136°04.0	00.0								Antares	112°23.8	-26°27.9				
15	46°31.8	60°53.8	35.8	162°43.8	11.7	238°29.3	44.1	151°06.5	00.0								Atria	107°23.7	-69°02.9				
16	61°34.2	75°53.3	34.7	177°45.6	11.9	253°32.0	44.2	166°08.9	00.0								Sabik	102°10.3	-15°44.5				
17	76°36.7	90°52.9	33.5	192°47.4	12.1	268°34.7	44.3	181°11.4	00.0								Rasalhague	96°04.7	-37°06.6				
18	91°39.2	105°52.5	S07°32.4	207°49.2	S20°12.2	283°37.5	N06°44.4	196°13.8	S21°00.0								Eltanin	90°45.2	51°29.1				
19	106°41.6	120°52.1	31.2	222°51.0	12.4	298°40.2	44.5	211°16.3	00.0								Kaus Aust.	83°41.4	-34°22.3				
20	121°44.1	135°51.6	30.1	237°52.9	12.5	313°43.0	44.7	226°18.8	00.0								Vega	80°37.7	38°47.8				
21	136°46.5	150°51.2	28.9	252°54.7	12.7	328°45.7	44.8	241°21.2	00.0								Nunki	75°56.1	-26°16.4				
22	151°49.0	165°50.8	27.8	267°56.5	12.8	343°48.5	44.9	256°23.7	00.0								Altair	62°06.5	8°54.7				
23	166°51.5	180°50.3	26.6	282°58.3	13.0	358°51.2	45.0	271°26.1	00.0								Peacock	53°16.7	-56°40.7				
Mer.pass.:11:54				v-0.4 d1.1 m-3.8				v1.8 d-0.2 m-0.3				v2.7 d0.1 m-2.3				v2.5 d0.0 m0.4							
Thu				GHA				GHA				GHA				GHA				GHA			
0	181°53.9	195°49.9	S07°25.5	298°00.1	S20°13.1	13°53.9	N06°45.1	286°28.6	S21°00.0								Fomalhaut	15°22.3	-29°32.2				
1	196°56.4	210°49.5	24.3	313°01.9	13.3	28°56.7	45.2	301°31.0	00.0								Scheat	13°51.9	28°10.1				
2	211°58.9	225°49.1	23.2	328°03.7	13.4	43°59.4	45.3	316°33.5	21°00.0								Markab	13°36.8	15°17.4				
3	227°01.3	240°48.6	22.0	343°05.6	13.6	59°02.2	45.5	331°36.0	20°59.9								Mar 22 Tue	SHA	Mer.pass				
4	242°03.8	255°48.2	20.9	358°07.4	13.7	74°04.9	45.6	346°38.4	59.9								Venus	16°15.1	10:56				
5	257°06.3	270°47.8	19.7	13°09.2	13.9	89°07.6	45.7	1°40.9	59.9								Mars	116°38.3	04:13				
6	272°08.7	285°47.3	S07°18.6</td																				

DUT1 = UT1-UTC = -0.0624 sec ΔT = TT-UT1 = +68.2464 sec

2016 March 22 to Mar. 24 UT

h	Sun			Moon				
	Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°16.6	N00°42.9	13°39.7	14.5'	N05°13.5	-9.1'	54.5'	
1	193°16.8	43.9	28°13.2	14.5'	05°04.4	-9.1'	54.5'	
2	208°17.0	44.9	42°46.7	14.6'	04°55.3	-9.1'	54.5'	
3	223°17.2	.. 45.9	57°20.3	14.6'	04°46.1	-9.1'	54.5'	
4	238°17.4	46.9	71°53.9	14.6'	04°37.0	-9.1'	54.5'	
5	253°17.6	47.9	86°27.5	14.6'	04°27.9	-9.2'	54.5'	
6	268°17.7	N00°48.8	101°01.2	14.7'	N04°18.7	-9.2'	54.5'	
7	283°17.9	49.8	115°34.8	14.7'	04°09.5	-9.2'	54.5'	
8	298°18.1	50.8	130°08.5	14.7'	04°00.3	-9.2'	54.4'	
9	313°18.3	.. 51.8	144°42.2	14.7'	03°51.1	-9.2'	54.4'	
10	328°18.5	52.8	159°16.0	14.7'	03°41.9	-9.2'	54.4'	
11	343°18.7	53.8	173°49.7	14.8'	03°32.6	-9.2'	54.4'	
12	358°18.9	N00°54.8	188°23.5	14.8'	N03°23.4	-9.3'	54.4'	
13	13°19.1	55.7	202°57.3	14.8'	03°14.1	-9.3'	54.4'	
14	28°19.2	56.7	217°31.1	14.8'	03°04.9	-9.3'	54.4'	
15	43°19.4	.. 57.7	232°04.9	14.8'	02°55.6	-9.3'	54.4'	
16	58°19.6	58.7	246°38.8	14.9'	02°46.3	-9.3'	54.4'	
17	73°19.8	00°59.7	261°12.6	14.9'	02°37.0	-9.3'	54.4'	
18	88°20.0	N01°00.7	275°46.5	14.9'	N02°27.7	-9.3'	54.3'	
19	103°20.2	01.6	290°20.4	14.9'	02°18.4	-9.3'	54.3'	
20	118°20.4	02.6	304°54.3	14.9'	02°09.1	-9.3'	54.3'	
21	133°20.6	.. 03.6	319°28.2	14.9'	01°59.8	-9.3'	54.3'	
22	148°20.8	04.6	334°02.2	15.0'	01°50.4	-9.3'	54.3'	
23	163°20.9	05.6	348°36.1	15.0'	01°41.1	-9.3'	54.3'	
	SD.=16.0	d=1.0			S.D.=14.8			

Wed	GHA			Dec			
	GHA	Dec	GHA	ν	Dec	d	HP
0	178°21.1	N01°06.6	3°10.1	15.0'	N01°31.8	-9.3'	54.3'
1	193°21.3	07.6	17°44.1	15.0'	01°22.4	-9.3'	54.3'
2	208°21.5	08.5	32°18.1	15.0'	01°13.1	-9.3'	54.3'
3	223°21.7	.. 09.5	46°52.1	15.0'	01°03.7	-9.3'	54.3'
4	238°21.9	10.5	61°26.1	15.0'	00°54.4	-9.3'	54.2'
5	253°22.1	11.5	76°00.2	15.0'	00°45.1	-9.3'	54.2'
6	268°22.3	N01°12.5	90°34.2	15.1'	N00°35.7	-9.3'	54.2'
7	283°22.5	13.5	105°08.3	15.1'	00°26.4	-9.3'	54.2'
8	298°22.6	14.5	119°42.3	15.1'	00°17.0	-9.3'	54.2'
9	313°22.8	.. 15.4	134°16.4	15.1'	N00°07.7	-9.3'	54.2'
10	328°23.0	16.4	148°50.5	15.1'	S00°01.7	-9.3'	54.2'
11	343°23.2	17.4	163°24.6	15.1'	00°11.0	-9.3'	54.2'
12	358°23.4	N01°18.4	177°58.7	15.1'	S00°20.3	-9.3'	54.2'
13	13°23.6	19.4	192°32.8	15.1'	00°29.7	-9.3'	54.2'
14	28°23.8	20.4	207°06.9	15.1'	00°39.0	-9.3'	54.2'
15	43°24.0	.. 21.3	221°41.0	15.1'	00°48.3	-9.3'	54.2'
16	58°24.2	22.3	236°15.2	15.1'	00°57.6	-9.3'	54.2'
17	73°24.3	23.3	250°49.3	15.1'	01°06.9	-9.3'	54.1'
18	88°24.5	N01°24.3	265°23.4	15.1'	S01°16.3	-9.3'	54.1'
19	103°24.7	25.3	279°57.6	15.1'	01°25.5	-9.3'	54.1'
20	118°24.9	26.3	294°31.7	15.1'	01°34.8	-9.3'	54.1'
21	133°25.1	.. 27.2	309°05.9	15.1'	01°44.1	-9.3'	54.1'
22	148°25.3	28.2	323°40.0	15.1'	01°53.4	-9.3'	54.1'
23	163°25.5	29.2	338°14.1	15.2'	02°02.6	-9.3'	54.1'
	SD.=16.0	d=1.0			S.D.=14.8		

Thu	GHA			Dec			
	GHA	Dec	GHA	ν	Dec	d	HP
0	178°25.7	N01°30.2	352°48.3	15.2'	S02°11.9	-9.2'	54.1'
1	193°25.9	31.2	7°22.5	15.2'	02°21.1	-9.2'	54.1'
2	208°26.0	32.2	21°56.6	15.2'	02°30.4	-9.2'	54.1'
3	223°26.2	.. 33.2	36°30.8	15.2'	02°39.6	-9.2'	54.1'
4	238°26.4	34.1	51°04.9	15.2'	02°48.8	-9.2'	54.1'
5	253°26.6	35.1	65°39.1	15.2'	02°58.0	-9.2'	54.1'
6	268°26.8	N01°36.1	80°13.2	15.1'	S03°07.1	-9.2'	54.1'
7	283°27.0	37.1	94°47.4	15.1'	03°16.3	-9.2'	54.1'
8	298°27.2	38.1	109°21.5	15.1'	03°25.4	-9.1'	54.1'
9	313°27.4	.. 39.1	123°55.6	15.1'	03°34.6	-9.1'	54.1'
10	328°27.6	40.0	138°29.8	15.1'	03°43.7	-9.1'	54.1'
11	343°27.8	41.0	153°03.9	15.1'	03°52.8	-9.1'	54.0'
12	358°27.9	N01°42.0	167°38.0	15.1'	S04°01.8	-9.1'	54.0'
13	13°28.1	43.0	182°12.2	15.1'	04°10.9	-9.1'	54.0'
14	28°28.3	44.0	196°46.3	15.1'	04°19.9	-9.0'	54.0'
15	43°28.5	.. 44.9	211°20.4	15.1'	04°29.0	-9.0'	54.0'
16	58°28.7	45.9	225°54.5	15.1'	04°38.0	-9.0'	54.0'
17	73°28.9	46.9	240°28.6	15.1'	04°46.9	-9.0'	54.0'
18	88°29.1	N01°47.9	255°02.7	15.1'	S04°55.9	-9.0'	54.0'
19	103°29.3	48.9	269°36.8	15.1'	05°04.9	-8.9'	54.0'
20	118°29.5	49.9	284°10.8	15.1'	05°13.8	-8.9'	54.0'
21	133°29.6	.. 50.8	298°44.9	15.1'	05°22.7	-8.9'	54.0'
22	148°29.8	51.8	313°19.0	15.1'	05°31.5	-8.9'	54.0'
23	163°30.0	52.8	327°53.0	15.0'	05°40.4	-8.8'	54.0'
	SD.=16.0	d=1.0			S.D.=14.7		

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	Mer.Pass.		Upper	Lower
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss		hh:mm	99-99%
22	06:54	06:45		12:07	11:25
23	06:35	06:26		12:06	12:08
24	06:17	06:08	</		

## March 25, 26, 27 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	182° 53.1	195° 39.7	S06° 57.7	298° 43.9	S20° 16.7	14° 59.7	N06° 47.8	287° 27.6	S20° 59.9	Alpheratz	357° 41.9	29° 10.6					
1	197° 55.5	210° 39.3	56.6	313° 45.7	16.9	30° 02.4	48.0	302° 30.1	59.9	Ankaa	353° 14.3	-42° 13.2					
2	212° 58.0	225° 38.9	55.4	328° 47.6	17.0	45° 05.2	48.1	317° 32.5	59.8	Schedar	349° 38.8	56° 37.5					
3	228° 00.5	240° 38.5	54.3	343° 49.4	17.2	60° 07.9	48.2	332° 35.0	59.8	Diphda	348° 54.4	-17° 54.1					
4	243° 02.9	255° 38.0	53.1	358° 51.2	17.3	75° 10.7	48.3	347° 37.5	59.8	Achernar	335° 26.0	-57° 09.5					
5	258° 05.4	270° 37.6	51.9	13° 53.1	17.5	90° 13.4	48.4	2° 39.9	59.8	Hamal	327° 58.9	23° 32.1					
6	273° 07.9	285° 37.2	S06° 50.8	28° 54.9	S20° 17.6	105° 16.1	N06° 48.5	17° 42.4	S20° 59.8	Polaris	317° 15.6	89° 20.0					
7	288° 10.3	300° 36.8	49.6	43° 56.8	17.8	120° 18.9	48.6	32° 44.9	59.8	Acamar	315° 17.3	-40° 14.8					
8	303° 12.8	315° 36.4	48.5	58° 58.6	17.9	135° 21.6	48.7	47° 47.3	59.8	Menkar	314° 13.3	4° 08.9					
9	318° 15.3	330° 35.9	47.3	74° 00.4	18.1	150° 24.3	48.9	62° 49.8	59.8	Mirfak	308° 38.0	49° 55.0					
10	333° 17.7	345° 35.5	46.1	89° 02.3	18.2	165° 27.1	49.0	77° 52.2	59.8	Aldebaran	290° 47.4	16° 32.3					
11	348° 20.2	0° 35.1	45.0	104° 04.1	18.4	180° 29.8	49.1	92° 54.7	59.8	Rigel	281° 10.4	-8° 11.4					
12	3° 22.6	15° 34.7	S06° 43.8	119° 06.0	S20° 18.5	195° 32.6	N06° 49.2	107° 57.2	S20° 59.8	Capella	280° 31.8	46° 00.7					
13	18° 25.1	30° 34.3	42.6	134° 07.8	18.6	210° 35.3	49.3	122° 59.6	59.8	Bellatrix	278° 30.1	6° 21.5					
14	33° 27.6	45° 33.9	41.5	149° 09.7	18.8	225° 38.0	49.4	138° 02.1	59.8	Elnath	278° 10.3	28° 37.1					
15	48° 30.0	60° 33.4	40.3	164° 11.5	18.9	240° 40.8	49.5	153° 04.6	59.8	Alnilam	275° 44.5	-1° 11.8					
16	63° 32.5	75° 33.0	39.2	179° 13.4	19.1	255° 43.5	49.6	168° 07.0	59.8	Betelgeuse	270° 59.3	7° 24.3					
17	78° 35.0	90° 32.6	38.0	194° 15.2	19.2	270° 46.2	49.8	183° 09.5	59.8	Canopus	263° 55.3	-52° 42.8					
18	93° 37.4	105° 32.2	S06° 36.8	209° 17.1	S20° 19.4	285° 49.0	N06° 49.9	198° 12.0	S20° 59.8	Sirius	258° 32.1	-16° 44.7					
19	108° 39.9	120° 31.8	35.7	224° 18.9	19.5	300° 51.7	50.0	213° 14.4	59.8	Adhara	255° 11.0	-29° 00.1					
20	123° 42.4	135° 31.4	34.5	239° 20.8	19.7	315° 54.4	50.1	228° 16.9	59.8	Procyon	244° 57.7	5° 10.7					
21	138° 44.8	150° 30.9	33.3	254° 22.6	19.8	330° 57.2	50.2	243° 19.4	59.8	Pollux	243° 25.4	27° 59.0					
22	153° 47.3	165° 30.5	32.2	269° 24.5	20.0	345° 59.9	50.3	258° 21.8	59.8	Avior	234° 16.9	-59° 34.1					
23	168° 49.8	180° 30.1	31.0	284° 26.3	20.1	1° 02.7	50.4	273° 24.3	59.7	Suhail	222° 50.7	-43° 30.3					
Mer.pass.:11:47			v-0.4 d1.2 m-3.8			v1.8 d-0.1 m-0.3			v2.7 d0.1 m-2.3			v2.5 d0.0 m0.4					
Sat			GHA			GHA			GHA			GHA					
0	183° 52.2	195° 29.7	S06° 29.8	299° 28.2	S20° 20.3	16° 05.4	N06° 50.5	288° 26.7	S20° 59.7	Denebola	182° 31.5	14° 28.8					
1	198° 54.7	210° 29.3	28.7	314° 30.0	20.4	31° 08.1	50.6	303° 29.2	59.7	Gienah	175° 50.0	-17° 38.0					
2	213° 57.1	225° 28.9	27.5	329° 31.9	20.5	46° 10.9	50.8	318° 31.7	59.7	Gacrux	173° 06.4	-63° 11.4					
3	228° 59.6	240° 28.5	26.3	344° 33.8	20.7	61° 13.6	50.9	333° 34.1	59.7	Gacrux	171° 58.1	-57° 12.3					
4	244° 02.1	255° 28.0	25.2	359° 35.6	20.8	76° 16.3	51.0	348° 36.6	59.7	Alioth	166° 18.6	55° 52.3					
5	259° 04.5	270° 27.6	24.0	14° 37.5	21.0	91° 19.1	51.1	3° 39.1	59.7	Spica	158° 29.0	-11° 14.8					
6	274° 07.0	285° 27.2	S06° 22.8	29° 39.3	S20° 21.1	106° 21.8	N06° 51.2	18° 41.5	S20° 59.7	Alkaid	152° 57.1	49° 13.9					
7	289° 09.5	300° 26.8	21.7	44° 41.2	21.3	121° 24.5	51.3	33° 44.0	59.7	Hadar	148° 44.5	-60° 26.9					
8	304° 11.9	315° 26.4	20.5	59° 43.1	21.4	136° 27.3	51.4	48° 46.5	59.7	Menkent	148° 05.0	-36° 26.9					
9	319° 14.4	330° 26.0	19.3	74° 44.9	21.6	151° 30.0	51.5	63° 49.0	59.7	Arcturus	145° 53.8	19° 05.8					
10	334° 16.9	345° 25.6	18.1	89° 46.8	21.7	166° 32.7	51.6	78° 51.4	59.7	Rigel Kent.	139° 48.5	-60° 53.9					
11	349° 19.3	0° 25.1	17.0	104° 48.7	21.9	181° 35.5	51.7	93° 53.9	59.7	Kochab	137° 19.3	74° 05.2					
12	4° 21.8	15° 24.7	S06° 15.8	119° 50.5	S20° 22.0	196° 38.2	N06° 51.9	108° 56.4	S20° 59.7	Zuben ubi	137° 03.1	-16° 06.5					
13	19° 24.2	30° 24.3	14.6	134° 52.4	22.1	211° 40.9	52.0	123° 58.8	59.7	Alphecca	126° 09.2	26° 39.6					
14	34° 26.7	45° 23.9	13.5	149° 54.3	22.3	226° 43.7	52.1	139° 01.3	59.7	Antares	112° 23.8	-26° 27.9					
15	49° 29.2	60° 23.5	12.3	164° 56.1	22.4	241° 46.4	52.2	154° 03.8	59.7	Atria	107° 23.7	-69° 02.9					
16	64° 31.6	75° 23.1	11.1	179° 58.0	22.6	256° 49.1	52.3	169° 06.2	59.7	Sabik	102° 10.3	-15° 44.5					
17	79° 34.1	90° 22.7	09.9	194° 59.9	22.7	271° 51.9	52.4	184° 08.7	59.7	Rasalhague	96° 04.7	12° 32.9					
18	94° 36.6	105° 22.3	S06° 08.8	210° 01.8	S20° 22.9	286° 54.6	N06° 52.5	199° 11.2	S20° 59.6	Eltanin	90° 45.2	51° 29.1					
19	109° 39.0	120° 21.9	07.6	225° 03.6	23.0	301° 57.3	52.6	214° 13.6	59.6	Kaus Aust.	83° 41.3	-34° 22.3					
20	124° 41.5	135° 21.4	06.4	240° 05.5	23.1	317° 00.1	52.7	229° 16.1	59.6	Vega	80° 37.7	38° 47.8					
21	139° 44.0	150° 21.0	05.3	255° 07.4	23.3	332° 02.8	52.8	244° 18.6	59.6	Nunki	75° 56.1	-26° 16.4					
22	154° 46.4	165° 20.6	04.1	270° 09.3	23.4	347° 05.5	53.0	259° 21.0	59.6	Altair	62° 06.5	8° 54.7					
23	169° 48.9	180° 20.2	02.9	285° 11.1	23.6	2° 08.3	53.1	274° 23.5	59.6	Peacock	53° 16.7	-56° 40.6					
Mer.pass.:11:43			v-0.4 d1.2 m-3.8			v1.9 d-0.1 m-0.3			v2.7 d0.1 m-2.3			v2.5 d0.0 m0.4					
Sun			GHA			GHA			GHA			GHA					
0	184° 51.4	195° 19.8	S06° 01.7	300° 13.0	S20° 23.7	17° 11.0	N06° 53.2	289° 26.0	S20° 59.6	Mar 25 Fri	12° 46.6	10:58					
1	199° 53.8	210° 19.4	06° 00.6	315° 14.9	23.9	32° 13.7	53.3	304° 28.5	59.6	Venus	115° 50.8	04:05					
2	214° 56.3	225° 19.0	05° 59.4	330° 16.8	24.0	47° 16.5	53.4	319° 30.9	59.6	Mars	192° 06.6	22:56					
3	229° 58.7	240° 18.6	58.2	345° 18.6	24.1	62° 19.2	53.5	334° 33.4	59.6	Jupiter	104° 34.5	04:49					
4	245° 01.2	255° 18.2	57.0	0° 20.5	24.3	77° 21.9	53.6	349° 35.9	59.6	Saturn	104° 34.5	04:49					
5	260° 03.7	270° 17.8	55.9	15° 22.4	24.4	92° 24.6	53.7	4° 38.3	59.6	Mar 26 Sat	11° 37.5	10:58					
6	275° 06.1	285° 17.4	S05° 54.7	30° 24.3	S20° 24.6	107° 27.4	N06° 53.8	19° 40.8	S20° 59.6	Venus	115° 36.0	04:02					
7	290° 08.6	300° 17.0	53.5	45° 26.2	24.7	122° 30.1	53.9	34° 43.3	59.6	Mars	192° 13.2	22:51					
8	305° 11.1	315° 16.5	52.3	60° 28.1	24.8	137° 32.8	54.0	49° 45.8	59.6	Jupiter	104° 34.5	04:45					
9	320° 13.5	330° 16.1	51.2	75° 29.9	25.0	152° 35.6	54.2	64° 48.2	59.6	Saturn	104° 34.5	04:45					
10	335° 16.0	345° 15.7	50.0	90° 31.8	25.1	167° 38.3	54.3	79° 50.7	59.6	Mar 27 Sun	10° 28.5	10:59					
11	350° 18.5	0° 15.3	48.8	105° 33.7	25.3	182° 41.0	54.4	94° 53.2	59.6	Venus	115° 21.7	03:59					
12	5° 20.9	15° 14.9	S05° 47.6	120° 35.6	S20° 25.4	197° 43.8	N06° 54.5	109° 55.6	S20° 59.6	Mars	192° 19.6	22:47					
13	20° 23.4	30° 14.5	46.4	135° 37.5	25.6	212° 46.5	54.6	124° 58.1	59.5	Jupiter	104° 34.6	04:41					
14	35° 25.9	45° 14.1	45.3	150° 39.4	25.7	227° 49.2	54.7	140° 00.6	59.5	Horizontal parallax							
15	50° 28.3	60° 13.7	44.1	165° 41.3	25.8	242° 52.0	54.8	155° 03.1	59.5	Venus:	0.1						

DUT1 = UT1-UTC = -0.0684 sec ΔT = TT-UT1 = +68.2524 sec

2016 March 25 to Mar. 27 UT

h		Sun		Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°30.2	N01°53.8	342°27.0	15.0'	S05°49.2	-8.8'	54.0'
1	193°30.4	54.8	357°01.1	15.0'	05°58.0	-8.8'	54.0'
2	208°30.6	55.8	11°35.1	15.0'	06°06.8	-8.8'	54.0'
3	223°30.8	.. 56.7	26°09.1	15.0'	06°15.5	-8.7'	54.0'
4	238°31.0	57.7	40°43.1	15.0'	06°24.2	-8.7'	54.0'
5	253°31.2	58.7	55°17.1	15.0'	06°32.9	-8.7'	54.0'
6	268°31.4	N01°59.7	69°51.0	15.0'	S06°41.6	-8.7'	54.0'
7	283°31.5	02°00.7	84°25.0	14.9'	06°50.2	-8.6'	54.0'
8	298°31.7	01.6	98°58.9	14.9'	06°58.9	-8.6'	54.0'
9	313°31.9	.. 02.6	113°32.8	14.9'	07°07.4	-8.6'	54.0'
10	328°32.1	03.6	128°06.7	14.9'	07°16.0	-8.5'	54.0'
11	343°32.3	04.6	142°40.6	14.9'	07°24.5	-8.5'	54.0'
12	358°32.5	N02°05.6	157°14.5	14.9'	S07°33.0	-8.5'	54.0'
13	13°32.7	06.5	171°48.3	14.8'	07°41.5	-8.4'	54.0'
14	28°32.9	07.5	186°22.2	14.8'	07°49.9	-8.4'	54.0'
15	43°33.1	.. 08.5	200°56.0	14.8'	07°58.3	-8.4'	54.0'
16	58°33.2	09.5	215°29.8	14.8'	08°06.6	-8.3'	54.0'
17	73°33.4	10.5	230°03.6	14.8'	08°15.0	-8.3'	54.0'
18	88°33.6	N02°11.5	244°37.4	14.8'	S08°23.2	-8.3'	54.0'
19	103°33.8	12.4	259°11.1	14.7'	08°31.5	-8.2'	54.0'
20	118°34.0	13.4	273°44.8	14.7'	08°39.7	-8.2'	54.0'
21	133°34.2	.. 14.4	288°18.6	14.7'	08°47.9	-8.2'	54.0'
22	148°34.4	15.4	302°52.2	14.7'	08°56.1	-8.1'	54.0'
23	163°34.6	16.4	317°25.9	14.7'	09°04.2	-8.1'	54.0'
	SD.=16.0	d=1.0			S.D.=14.7		

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

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

Day	Sun			Moon		
	Eqn. of Time	Mer. Pass.	Mer. Pass.	Upper	Lower	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	hh:mm	hh:mm	hh:mm	96-86%
25	05:59	05:50	12:06	01:12	13:34	
26	05:41	05:32	12:06	01:55	14:17	
27	05:23	05:14	12:05	02:39	15:02	

SD.=16.0	d=1.0	S.D.=14.8
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## March 28, 29, 30 UT (Mon., Tue., Wed.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	185°50.5	195°10.1	S05°33.5	300°58.4	S20°27.1	18°16.5	N06°55.8	290°25.3	S20°59.5	Alpheratz	357°41.9	29°10.6											
1	200°53.0	210°09.7	32.3	316°00.3	27.2	33°19.2	55.9	305°27.8	59.5	Ankaa	353°14.3	-42°13.2											
2	215°55.4	225°09.2	31.1	331°02.2	27.4	48°22.0	56.0	320°30.3	59.5	Schedar	349°38.8	56°37.5											
3	230°57.9	240°08.8	29.9	346°04.1	27.5	63°24.7	56.1	335°32.8	59.5	Diphda	348°54.4	-17°54.0											
4	246°00.3	255°08.4	28.7	1°06.0	27.6	78°27.4	56.2	350°35.2	59.5	Achernar	335°26.0	-57°09.5											
5	261°02.8	270°08.0	27.6	16°07.9	27.8	93°30.1	56.3	5°37.7	59.5	Hamal	327°58.9	23°32.1											
6	276°05.3	285°07.6	S05°26.4	31°09.8	S20°27.9	108°32.9	N06°56.4	20°40.2	S20°59.5	Polaris	317°16.3	89°20.0											
7	291°07.7	300°07.2	25.2	46°11.7	28.1	123°35.6	56.5	35°42.7	59.4	Acamar	315°17.3	-40°14.8											
8	306°10.2	315°06.8	24.0	61°13.6	28.2	138°38.3	56.6	50°45.1	59.4	Menkar	314°13.3	4°08.9											
9	321°12.7	330°06.4	22.8	76°15.5	28.3	153°41.1	56.7	65°47.6	59.4	Mirfak	308°38.0	49°55.0											
10	336°15.1	345°06.0	21.6	91°17.4	28.5	168°43.8	56.9	80°50.1	59.4	Aldebaran	290°47.4	16°32.2											
11	351°17.6	0°05.6	20.5	106°19.3	28.6	183°46.5	57.0	95°52.6	59.4	Rigel	281°10.4	-8°11.4											
12	6°20.1	15°05.2	S05°19.3	121°21.2	S20°28.8	198°49.2	N06°57.1	110°55.0	S20°59.4	Capella	280°31.8	46°00.7											
13	21°22.5	30°04.8	18.1	136°23.1	28.9	213°52.0	57.2	125°57.5	59.4	Bellatrix	278°30.1	6°21.5											
14	36°25.0	45°04.4	16.9	151°25.1	29.0	228°54.7	57.3	141°00.0	59.4	El Nath	278°10.4	28°37.1											
15	51°27.5	60°04.0	15.7	166°27.0	29.2	243°57.4	57.4	156°02.5	59.4	Alnilam	275°44.6	-1°11.9											
16	66°29.9	75°03.6	14.5	181°28.9	29.3	259°00.1	57.5	171°05.0	59.4	Betelgeuse	270°59.3	7°24.3											
17	81°32.4	90°03.2	13.3	196°30.8	29.4	274°02.9	57.6	186°07.4	59.4	Canopus	263°55.3	-52°42.8											
18	96°34.8	105°02.8	S05°12.2	211°32.7	S20°29.6	289°05.6	N06°57.7	201°09.9	S20°59.4	Sirius	258°32.1	-16°44.7											
19	111°37.3	120°02.4	11.0	226°34.6	29.7	304°08.3	57.8	216°12.4	59.4	Adhara	255°11.0	-29°00.1											
20	126°39.8	135°02.0	09.8	241°36.6	29.9	319°11.0	57.9	231°14.9	59.4	Procyon	244°57.7	5°10.7											
21	141°42.2	150°01.6	08.6	256°38.5	30.0	334°13.8	58.0	246°17.3	59.4	Pollux	243°25.4	27°59.0											
22	156°44.7	165°01.2	07.4	271°40.4	30.1	349°16.5	58.1	261°19.8	59.4	Avior	234°16.9	-59°34.1											
23	171°47.2	180°00.8	06.2	286°42.3	30.3	4°19.2	58.2	276°22.3	59.4	Suhail	222°50.8	-43°30.3											
Mer.pass.:11:35				v-0.4 d1.2 m-3.8				v1.9 d-0.1 m-0.4				v2.7 d0.1 m-2.3				v2.5 d0.0 m-0.4							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	186°49.6	195°00.4	S05°05.0	301°44.2	S20°30.4	19°21.9	N06°58.3	291°24.8	S20°59.3	Denebola	182°31.5	14°28.8											
1	201°52.1	210°00.0	03.9	316°46.2	30.5	34°24.7	58.4	306°27.3	59.3	Gienah	175°50.0	-17°38.0											
2	216°54.6	224°59.6	02.7	331°48.1	30.7	49°27.4	58.5	321°29.7	59.3	Acrux	173°06.4	-63°11.4											
3	231°57.0	239°59.2	01.5	346°50.0	30.8	64°30.1	58.7	336°32.2	59.3	Gacrux	171°58.1	-57°12.3											
4	246°59.5	254°58.8	05°00.3	1°51.9	30.9	79°32.8	58.8	351°34.7	59.3	Alioth	166°18.6	55°52.3											
5	262°02.0	269°58.4	04°59.1	16°53.9	31.1	94°35.6	58.9	6°37.2	59.3	Spica	158°29.0	-11°14.8											
6	277°04.4	284°58.0	S04°57.9	31°55.8	S20°31.2	109°38.3	N06°59.0	21°39.7	S20°59.3	Alkaid	152°57.0	49°13.9											
7	292°06.9	299°57.6	56.7	46°57.7	31.4	124°41.0	59.1	36°42.1	59.3	Hadar	148°44.5	-60°26.9											
8	307°09.3	314°57.2	55.5	61°59.7	31.5	139°43.7	59.2	51°44.6	59.3	Menkent	148°05.0	-36°26.9											
9	322°11.8	329°56.8	54.3	77°01.6	31.6	154°46.4	59.3	66°47.1	59.3	Arcturus	145°53.7	19°05.8											
10	337°14.3	344°56.5	53.2	92°03.5	31.8	169°49.2	59.4	81°49.6	59.3	Rigel Kent.	139°48.5	-60°53.9											
11	352°16.7	359°56.1	52.0	107°05.5	31.9	184°51.9	59.5	96°52.1	59.3	Kochab	137°19.3	74°05.3											
12	7°19.2	14°55.7	S04°50.8	122°07.4	S20°32.0	199°54.6	N06°59.6	111°54.6	S20°59.3	Zuben ubi	137°03.1	-16°06.5											
13	22°21.7	29°55.3	49.6	137°09.3	32.2	214°57.3	59.7	126°57.0	59.3	Alphecca	126°09.2	26°39.6											
14	37°24.1	44°54.9	48.4	152°11.3	32.3	230°00.1	59.8	141°59.5	59.3	Antares	112°23.8	-26°27.9											
15	52°26.6	59°54.5	47.2	167°13.2	32.4	245°02.8	06°59.9	157°02.0	59.3	Atria	107°23.6	-69°03.0											
16	67°29.1	74°54.1	46.0	182°15.1	32.6	260°05.5	07°00.0	172°04.5	59.2	Sabik	102°10.3	-15°44.5											
17	82°31.5	89°53.7	44.8	197°17.1	32.7	275°08.2	00.1	187°07.0	59.2	Rasalhague	96°04.6	12°32.9											
18	97°34.0	104°53.3	S04°43.6	212°19.0	S20°32.8	290°10.9	N07°00.2	202°09.4	S20°59.2	Eltanin	90°45.2	51°29.1											
19	112°36.4	119°52.9	42.4	227°21.0	33.0	305°13.7	00.3	217°11.9	59.2	Kaus Aust.	83°41.3	-34°22.3											
20	127°38.9	134°52.5	41.2	242°22.9	33.1	320°16.4	00.4	232°14.4	59.2	Vega	80°37.7	38°47.8											
21	142°41.4	149°52.1	40.1	257°24.8	33.2	335°19.1	00.5	247°16.9	59.2	Nunki	75°56.0	-26°16.4											
22	157°43.8	164°51.7	38.9	272°26.8	33.4	350°21.8	00.6	262°19.4	59.2	Altair	62°06.5	8°54.7											
23	172°46.3	179°51.3	37.7	287°28.7	33.5	5°24.6	00.7	277°21.9	59.2	Peacock	53°16.6	-56°40.6											
Mer.pass.:11:31				v-0.4 d1.2 m-3.8				v1.9 d-0.1 m-0.4				v2.7 d0.1 m-2.3				v2.5 d0.0 m-0.4							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	187°48.8	194°50.9	S04°36.5	302°30.7	S20°33.6	20°27.3	N07°00.8	292°24.3	S20°59.2	Mar 28 Mon	SHA	Mer.pass											
1	202°51.2	209°50.5	35.3	317°32.6	33.8	35°30.0	00.9	307°26.8	59.2	Venus	9°19.6	11:00											
2	217°53.7	224°50.1	34.1	332°34.6	33.9	50°32.7	01.1	322°29.3	59.2	Mars	115°07.9	03:56											
3	232°56.2	239°49.7	32.9	347°36.5	34.0	65°35.4	01.2	337°31.8	59.2	Jupiter	192°26.0	22:43											
4	247°58.6	254°49.3	31.7	2°38.5	34.2	80°38.2	01.3	352°34.3	59.2	Saturn	104°34.8	04:38											
5	263°01.1	269°48.9	30.5	17°40.4	34.3	95°40.9	01.4	7°36.8	59.2	Mar 29 Tue	SHA	Mer.pass											
6	278°03.6	284°48.6	S04°29.3	32°42.4	S20°34.4	110°43.6	N07°01.5	22°39.2	S20°59.2	Venus	8°10.8	11:00											
7	293°06.0	299°48.2	28.1	47°44.3	34.6	125°46.3	01.6	37°41.7	59.1	Mars	114°54.6	03:53											
8	308°08.5	314°47.8	26.9	62°46.3	34.7	140																	

DUT1 = UT1-UTC = -0.0744 sec ΔT = TT-UT1 = +68.2584 sec

2016 March 28 to Mar. 30 UT

h		Sun			Moon			
Mon		GHA	Dec	GHA	ν	Dec	d	HP
0	178°43.9	N03°04.3	310°22.5	13.2'	S14°45.0	-5.6'	54.3'	
1	193°44.1	05.3	324°54.7	13.2'	14°50.6	-5.5'	54.3'	
2	208°44.2	06.2	339°26.9	13.1'	14°56.1	-5.5'	54.3'	
3	223°44.4	.. 07.2	353°59.0	13.1'	15°01.6	-5.4'	54.3'	
4	238°44.6	08.2	8°31.0	13.1'	15°06.9	-5.3'	54.4'	
5	253°44.8	09.2	23°03.1	13.0'	15°12.3	-5.3'	54.4'	
6	268°45.0	N03°10.1	37°35.1	13.0'	S15°17.5	-5.2'	54.4'	
7	283°45.2	11.1	52°07.0	12.9'	15°22.7	-5.1'	54.4'	
8	298°45.4	12.1	66°39.0	12.9'	15°27.8	-5.1'	54.4'	
9	313°45.6	.. 13.1	81°10.8	12.9'	15°32.9	-5.0'	54.4'	
10	328°45.8	14.0	95°42.7	12.8'	15°37.8	-4.9'	54.4'	
11	343°45.9	15.0	110°14.5	12.8'	15°42.7	-4.9'	54.5'	
12	358°46.1	N03°16.0	124°46.3	12.8'	S15°47.6	-4.8'	54.5'	
13	13°46.3	17.0	139°18.0	12.7'	15°52.4	-4.7'	54.5'	
14	28°46.5	17.9	153°49.7	12.7'	15°57.1	-4.7'	54.5'	
15	43°46.7	.. 18.9	168°21.4	12.6'	16°01.7	-4.6'	54.5'	
16	58°46.9	19.9	182°53.0	12.6'	16°06.3	-4.5'	54.5'	
17	73°47.1	20.9	197°24.6	12.6'	16°10.7	-4.5'	54.5'	
18	88°47.3	N03°21.8	211°56.1	12.5'	S16°15.2	-4.4'	54.6'	
19	103°47.5	22.8	226°27.6	12.5'	16°19.5	-4.3'	54.6'	
20	118°47.6	23.8	240°59.1	12.4'	16°23.8	-4.2'	54.6'	
21	133°47.8	.. 24.7	255°30.5	12.4'	16°28.0	-4.2'	54.6'	
22	148°48.0	25.7	270°01.9	12.4'	16°32.1	-4.1'	54.6'	
23	163°48.2	26.7	284°33.2	12.3'	16°36.2	-4.0'	54.6'	
	SD.=16.0	d=1.0			S.D.=14.8			
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	178°48.4	N03°27.7	299°04.5	12.3'	S16°40.1	-3.9'	54.7'	
1	193°48.6	28.6	313°35.8	12.3'	16°44.0	-3.9'	54.7'	
2	208°48.8	29.6	328°07.0	12.2'	16°47.9	-3.8'	54.7'	
3	223°49.0	.. 30.6	342°38.2	12.2'	16°51.6	-3.7'	54.7'	
4	238°49.2	31.6	357°09.4	12.1'	16°55.3	-3.6'	54.7'	
5	253°49.3	32.5	11°40.5	12.1'	16°58.9	-3.6'	54.8'	
6	268°49.5	N03°33.5	26°11.6	12.1'	S17°02.4	-3.5'	54.8'	
7	283°49.7	34.5	40°42.6	12.0'	17°05.8	-3.4'	54.8'	
8	298°49.9	35.4	55°13.6	12.0'	17°09.2	-3.3'	54.8'	
9	313°50.1	.. 36.4	69°44.6	11.9'	17°12.5	-3.2'	54.8'	
10	328°50.3	37.4	84°15.5	11.9'	17°15.7	-3.2'	54.8'	
11	343°50.5	38.4	98°46.4	11.9'	17°18.8	-3.1'	54.9'	
12	358°50.7	N03°39.3	113°17.2	11.8'	S17°21.8	-3.0'	54.9'	
13	13°50.8	40.3	127°48.0	11.8'	17°24.8	-2.9'	54.9'	
14	28°51.0	41.3	142°18.8	11.7'	17°27.7	-2.8'	54.9'	
15	43°51.2	.. 42.3	156°49.5	11.7'	17°30.5	-2.8'	55.0'	
16	58°51.4	43.2	171°20.2	11.7'	17°33.2	-2.7'	55.0'	
17	73°51.6	44.2	185°50.8	11.6'	17°35.8	-2.6'	55.0'	
18	88°51.8	N03°45.2	200°21.4	11.6'	S17°38.3	-2.5'	55.0'	
19	103°52.0	46.1	214°52.0	11.6'	17°40.8	-2.4'	55.0'	
20	118°52.2	47.1	229°22.5	11.5'	17°43.2	-2.3'	55.1'	
21	133°52.3	.. 48.1	243°53.0	11.5'	17°45.5	-2.3'	55.1'	
22	148°52.5	49.0	258°23.5	11.4'	17°47.7	-2.2'	55.1'	
23	163°52.7	50.0	272°53.9	11.4'	17°49.8	-2.1'	55.1'	
	SD.=16.0	d=1.0			S.D.=15.0			
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	178°52.9	N03°51.0	287°24.3	11.4'	S17°51.9	-2.0'	55.2'	
1	193°53.1	52.0	301°54.6	11.3'	17°53.8	-1.9'	55.2'	
2	208°53.3	52.9	316°24.9	11.3'	17°55.7	-1.8'	55.2'	
3	223°53.5	.. 53.9	330°55.2	11.2'	17°57.5	-1.7'	55.2'	
4	238°53.7	54.9	345°25.4	11.2'	17°59.2	-1.7'	55.3'	
5	253°53.9	55.8	359°55.6	11.2'	18°00.8	-1.6'	55.3'	
6	268°54.0	N03°56.8	14°25.8	11.1'	S18°02.3	-1.5'	55.3'	
7	283°54.2	57.8	28°55.9	11.1'	18°03.7	-1.4'	55.3'	
8	298°54.4	58.7	43°26.0	11.1'	18°05.1	-1.3'	55.4'	
9	313°54.6	03°59.7	57°56.0	11.0'	18°06.3	-1.2'	55.4'	
10	328°54.8	04°00.7	72°26.0	11.0'	18°07.5	-1.1'	55.4'	
11	343°55.0	01.7	86°56.0	11.0'	18°08.6	-1.0'	55.4'	
12	358°55.2	N04°02.6	101°25.9	10.9'	S18°09.6	-0.9'	55.5'	
13	13°55.4	03.6	115°55.8	10.9'	18°10.5	-0.9'	55.5'	
14	28°55.5	04.6	130°25.7	10.8'	18°11.3	-0.8'	55.5'	
15	43°55.7	.. 05.5	144°55.5	10.8'	18°12.0	-0.7'	55.5'	
16	58°55.9	06.5	159°25.3	10.8'	18°12.6	-0.6'	55.6'	
17	73°56.1	07.5	173°55.0	10.7'	18°13.1	-0.5'	55.6'	
18	88°56.3	N04°08.4	188°24.8	10.7'	S18°13.6	-0.4'	55.6'	
19	103°56.5	09.4	202°54.5	10.7'	18°13.9	-0.3'	55.6'	
20	118°56.7	10.4	217°24.1	10.6'	18°14.2	-0.2'	55.7'	
21	133°56.8	.. 11.3	231°53.7	10.6'	18°14.3	-0.1'	55.7'	
22	148°57.0	12.3	246°23.3	10.6'	18°14.4	-0.0'	55.7'	
23	163°57.2	13.3	260°52.9	10.5'	18°14.4	0.1'	55.8'	
	SD.=16.0	d=1.0			S.D.=15.1			

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

Lat.	Mon	Moonrise		Monset	Moonset	
		Tue	Wed		Mon	Tue
N 72°	01:01	02:48	■	05:38	05:29	■
N 70°	00:27	01:53	03:11	06:13	06:24	06:47
68°	00:03	01:21	02:30	06:38	06:57	07:28
66°	--	00:57	02:02	06:58	07:21	07:56
64°	--	00:38	01:41	07:13	07:40	08:17
62°	--	00:23	01:24	07:26	07:56	08:35
60°	--	00:10	01:10	07:38	08:09	08:49
N 58°	23:59	--	00:58	07:47	08:20	09:01
56°	23:49	--	00:47	07:56	08:30	09:12
54°	23:41	--	00:38	08:03	08:39	09:21
52°	23:34	--	00:30	08:10	08:47	09:29
50°	23:27	--	00:22	08:16	08:54	09:37
45°						

## March 31, 01, 02 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	188°47.9	194°41.5	S04°07.8	303°17.7	S20°36.8	21°32.5	N07°03.3	293°24.0	S20°59.0	Alpheratz	357°41.9	29°10.6					
1	203°50.4	209°41.1	06.6	318°19.7	36.9	36°35.2	03.4	308°26.5	59.0	Ankaa	353°14.3	-42°13.2					
2	218°52.8	224°40.7	05.4	333°21.7	37.1	51°37.9	03.5	323°29.0	59.0	Schedar	349°38.8	56°37.4					
3	233°55.3	239°40.3	· · 04.2	348°23.6	· · 37.2	66°40.7	· · 03.6	338°31.5	· · 59.0	Diphda	348°54.4	-17°54.0					
4	248°57.8	254°40.0	03.0	3°25.6	37.3	81°43.4	03.7	353°34.0	59.0	Achernar	335°26.1	-57°09.5					
5	264°00.2	269°39.6	01.8	18°27.6	37.5	96°46.1	03.8	8°36.5	59.0	Hamal	327°58.9	23°32.1					
6	279°02.7	284°39.2	S04°00.6	33°29.6	S20°37.6	111°48.8	N07°03.9	23°38.9	S20°59.0	Polaris	317°16.9	89°20.0					
7	294°05.2	299°38.8	03°59.4	48°31.5	37.7	126°51.5	04.0	38°41.4	59.0	Acamar	315°17.3	-40°14.7					
8	309°07.6	314°38.4	58.2	63°33.5	37.8	141°54.2	04.1	53°43.9	59.0	Menkar	314°13.3	4°08.9					
9	324°10.1	329°38.0	· · 57.0	78°35.5	· · 38.0	156°56.9	· · 04.2	68°46.4	· · 59.0	Mirfak	308°38.0	49°55.0					
10	339°12.5	344°37.6	55.8	93°37.5	38.1	171°59.7	04.3	83°48.9	59.0	Aldebaran	290°47.4	16°32.2					
11	354°15.0	359°37.2	54.6	108°39.5	38.2	187°02.4	04.4	98°51.4	59.0	Rigel	281°10.4	-8°11.4					
12	9°17.5	14°36.8	S03°53.4	123°41.4	S20°38.4	202°05.1	N07°04.5	113°53.9	S20°59.0	Capella	280°31.8	46°00.7					
13	24°19.9	29°36.5	52.2	138°43.4	38.5	217°07.8	04.6	128°56.4	58.9	Bellatrix	278°30.1	6°21.5					
14	39°22.4	44°36.1	51.0	153°45.4	38.6	232°10.5	04.7	143°58.9	58.9	Elnath	278°10.4	28°37.1					
15	54°24.9	59°35.7	· · 49.8	168°47.4	· · 38.7	247°13.2	· · 04.8	159°01.4	· · 58.9	Alnilam	275°44.6	-1°11.8					
16	69°27.3	74°35.3	48.6	183°49.4	38.9	262°15.9	04.9	174°03.8	58.9	Betelgeuse	270°59.3	7°24.3					
17	84°29.8	89°34.9	47.4	198°51.4	39.0	277°18.7	05.0	189°06.3	58.9	Canopus	263°55.4	-52°42.8					
18	99°32.3	104°34.5	S03°46.2	213°53.4	S20°39.1	292°21.4	N07°05.1	204°08.8	S20°58.9	Sirius	258°32.1	-16°44.7					
19	114°34.7	119°34.1	45.0	228°55.3	39.3	307°24.1	05.2	219°11.3	58.9	Adhara	255°11.0	-29°00.1					
20	129°37.2	134°33.7	43.8	243°57.3	39.4	322°26.8	05.3	234°13.8	58.9	Procyon	244°57.7	5°10.7					
21	144°39.7	149°33.4	· · 42.6	258°59.3	· · 39.5	337°29.5	· · 05.4	249°16.3	· · 58.9	Pollux	243°25.4	27°59.0					
22	159°42.1	164°33.0	41.4	274°01.3	39.6	352°32.2	05.5	264°18.8	58.9	Avior	234°16.9	-59°34.1					
23	174°44.6	179°32.6	40.2	289°03.3	39.8	7°34.9	05.6	279°21.3	58.9	Suhail	222°50.8	-43°30.3					
Mer.pass.:11:23			v-0.4 d1.2 m-3.8	v2.0 d-0.1 m-0.5	v2.7 d0.1 m-2.3	v2.5 d0.0 m-0.3	Miaplacidus			v21°38.6	v-69°47.4						
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.0	-8°44.0	
0	189°47.0	194°32.2	S03°39.0	304°05.3	S20°39.9	22°37.6	N07°05.7	294°23.8	S20°58.9	Regulus	207°41.3	11°53.1					
1	204°49.5	209°31.8	37.8	319°07.3	40.0	37°40.4	05.8	309°26.3	58.9	Dubhe	193°49.0	61°39.8					
2	219°52.0	224°31.4	36.6	334°09.3	40.2	52°43.1	05.9	324°28.8	58.9	Denebola	182°31.5	14°28.8					
3	234°54.4	239°31.0	· · 35.3	349°11.3	· · 40.3	67°45.8	· · 06.0	339°31.3	· · 58.8	Gienah	175°50.0	-17°38.0					
4	249°56.9	254°30.7	34.1	4°13.3	40.4	82°48.5	06.1	354°33.7	58.8	Acrua	173°06.4	-63°11.4					
5	264°59.4	269°30.3	32.9	19°15.3	40.5	97°51.2	06.2	9°36.2	58.8	Gacrux	171°58.1	-57°12.3					
6	280°01.8	284°29.9	S03°31.7	34°17.3	S20°40.7	112°53.9	N07°06.3	24°38.7	S20°58.8	Alioth	166°18.6	55°52.3					
7	295°04.3	299°29.5	30.5	49°19.3	40.8	127°56.6	06.4	39°41.2	58.8	Spica	158°28.9	-11°14.8					
8	310°06.8	314°29.1	29.3	64°21.3	40.9	142°59.3	06.5	54°43.7	58.8	Alkaid	152°57.0	49°13.9					
9	325°09.2	329°28.7	· · 28.1	79°23.3	· · 41.0	158°02.0	· · 06.6	69°46.2	· · 58.8	Hadar	148°44.5	-60°26.9					
10	340°11.7	344°28.3	26.9	94°25.3	41.2	173°04.8	06.7	84°48.7	58.8	Menkent	148°04.9	-36°26.9					
11	355°14.2	359°28.0	25.7	109°27.3	41.3	188°07.5	06.8	99°51.2	58.8	Arcturus	145°53.7	19°05.8					
12	10°16.6	14°27.6	S03°24.5	124°29.3	S20°41.4	203°10.2	N07°06.9	114°53.7	S20°58.8	Rigel Kent.	139°48.5	-60°53.9					
13	25°19.1	29°27.2	23.3	139°31.3	41.5	218°12.9	07.0	129°56.2	58.8	Kochab	137°19.3	74°05.3					
14	40°21.5	44°26.8	22.1	154°33.4	41.7	233°15.6	07.1	144°58.7	58.8	Zuben' ubi	137°03.0	-16°06.5					
15	55°24.0	59°26.4	· · 20.9	169°35.4	· · 41.8	248°18.3	· · 07.2	160°01.2	· · 58.8	Alphecca	126°09.2	26°39.6					
16	70°26.5	74°26.0	19.7	184°37.4	41.9	263°21.0	07.3	175°03.7	58.7	Antares	112°23.7	-26°27.9					
17	85°28.9	89°25.7	18.5	199°39.4	42.0	278°23.7	07.4	190°06.2	58.7	Atria	107°23.6	-69°03.0					
18	100°31.4	104°25.3	S03°17.3	214°41.4	S20°42.2	293°26.4	N07°07.5	205°08.7	S20°58.7	Sabik	102°10.2	-15°44.5					
19	115°33.9	119°24.9	16.1	229°43.4	42.3	308°29.1	07.6	220°11.2	58.7	Shaula	96°19.2	-37°06.6					
20	130°36.3	134°24.5	14.9	244°45.4	42.4	323°31.8	07.7	235°13.7	58.7	Rasalhague	96°04.6	12°32.9					
21	145°38.8	149°24.1	· · 13.7	259°47.5	· · 42.5	338°34.5	· · 07.8	250°16.2	· · 58.7	Eltanin	90°45.2	51°29.1					
22	160°41.3	164°23.7	12.4	274°49.5	42.7	353°37.3	07.9	265°18.7	58.7	Kaus Aust.	83°41.3	-34°22.3					
23	175°43.7	179°23.4	11.2	289°51.5	42.8	8°40.0	08.0	280°21.2	58.7	Vega	80°37.6	38°47.8					
Mer.pass.:11:19			v-0.4 d1.2 m-3.8	v2.0 d-0.1 m-0.5	v2.7 d0.1 m-2.3	v2.5 d0.0 m-0.3	Nunki			v21°56.0	v-26°16.4						
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Fomalhaut	15°22.3	-29°32.2	
0	190°46.2	194°23.0	S03°10.0	304°53.5	S20°42.9	23°42.7	N07°08.1	295°23.7	S20°58.7	Scheat	13°51.8	28°10.1					
1	205°48.6	209°22.6	08.8	319°55.5	43.0	38°45.4	08.2	310°26.1	58.7	Markab	13°36.7	15°17.4					
2	220°51.1	224°22.2	07.6	334°57.6	43.2	53°48.1	08.3	325°28.6	58.7	Mar 31 Thu							
3	235°53.6	239°21.8	· · 06.4	349°59.6	· · 43.3	68°50.8	· · 08.4	340°31.1	· · 58.7	Venus	5°53.6	11:02					
4	250°56.0	254°21.5	05.2	5°01.6	43.4	83°53.5	08.5	355°33.6	58.7	Mars	114°29.8	03:46					
5	265°58.5	269°21.1	04.0	20°03.6	43.5	98°56.2	08.6	10°36.1	58.7	Jupiter	192°44.6	22:30					
6	281°01.0	284°20.7	S03°02.8	35°05.7	S20°43.7	113°58.9	N07°08.7	25°38.6	S20°58.6	Saturn	104°36.1	04:26					
7	296°03.4	299°20.3	01.6	50°07.7	43.8	129°01.6	08.8	40°41.1	58.6	Apr 01 Fri							
8	311°05.9	314°19.9	03°00.4	65°09.7	43.9	144°04.3	08.9	55°43.6	58.6	Venus	4°45.2	11:02					
9	326°08.4	329°19.5	02°59.2	80°11.8	· · 44.0	159°07.0	· · 08.9	70°46.1	· · 58.6	Mars	114°18.3	03:43					
10	341°10.8	344°19.2	57.9	95°13.8	44.2	174°09.7	09.0	85°48.6	58.6	Jupiter	192°50.6	22:25					
11	356°13.3	359°18.8	56.7	110°15.8	44.3	189°12.4	09.1	100°51.1	58.6	Saturn	104°36.7	04:22					
12	11°15.8	14°18.4	S02°55.5	125°17.9	S20°44.4	204°15.1	N07°09.2	115°53.6	S20°58.6	Apr 02 Sat							
13	26°18.2	29°18.0	54.3	140°19.9	44.5	219°17.8	09.3	130°56.1	58.6	Venus	3°36.8	11:03					
14	41°20.7	44°17.6	53.1	155°21.9	44.7	234°20.6	09.4	145°58.6	58.6	Mars	114°07.3	03:40					
15	56°23.1	59°17.3	· · 51.9	170°24.0	· · 44.8	249°23.3	· · 09.5	161°01.1	· · 58.6	Jupiter	192°56.5	22:21					
16	71°25.6	74°16.9	50.7	185°26.0	44.9	264°26.0	09.6	176°03.6	58.6	Saturn	104°37.5	04:18					
17	86°28.1	89°16.5	49.5	200°28.0	45.0	279°28.7	09.7	191°06.1	58.6	Horizontal parallax							
18	101°30.5	104°16.1	S02°48.3	215°30.1	S20°45.1	294°31.4	N07°09.8	206°08.6	S20°58.6	Venus:	0.1						
19	116°33.0	119°15.7	47.1	230°32.1	4												

DUT1 = UT1-UTC = -0.0804 sec    $\Delta T$  = TT-UT1 = +68.2644 sec

2016 March 31 to Apr. 02 UT

h	Sun			Moon				
	Thu	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°57.4	N04°14.2		275°22.4	10.5'	S18°14.3	0.2'	55.8'
1	193°57.6	15.2		289°51.9	10.5'	18°14.0	0.3'	55.8'
2	208°57.8	16.2		304°21.3	10.4'	18°13.7	0.4'	55.9'
3	223°58.0	..	17.1	318°50.7	10.4'	18°13.3	0.5'	55.9'
4	238°58.2	18.1		333°20.1	10.4'	18°12.8	0.5'	55.9'
5	253°58.3	19.1		347°49.5	10.3'	18°12.2	0.6'	55.9'
6	268°58.5	N04°20.0		2°18.8	10.3'	S18°11.6	0.7'	56.0'
7	283°58.7	21.0		16°48.1	10.3'	18°10.8	0.8'	56.0'
8	298°58.9	22.0		31°17.3	10.2'	18°09.9	0.9'	56.0'
9	313°59.1	..	22.9	45°46.6	10.2'	18°08.9	1.0'	56.1'
10	328°59.3	23.9		60°15.8	10.2'	18°07.8	1.1'	56.1'
11	343°59.5	24.9		74°44.9	10.2'	18°06.7	1.2'	56.1'
12	358°59.6	N04°25.8		89°14.1	10.1'	S18°05.4	1.3'	56.2'
13	13°59.8	26.8		103°43.2	10.1'	18°04.0	1.4'	56.2'
14	29°00.0	27.8		118°12.3	10.1'	18°02.6	1.5'	56.2'
15	44°00.2	..	28.7	132°41.3	10.0'	18°01.0	1.6'	56.3'
16	59°00.4	29.7		147°10.3	10.0'	17°59.4	1.7'	56.3'
17	74°00.6	30.7		161°39.3	10.0'	17°57.6	1.8'	56.3'
18	89°00.8	N04°31.6		176°08.3	9.9'	S17°55.8	1.9'	56.4'
19	104°00.9	32.6		190°37.2	9.9'	17°53.8	2.0'	56.4'
20	119°01.1	33.6		205°06.1	9.9'	17°51.8	2.1'	56.4'
21	134°01.3	..	34.5	219°35.0	9.9'	17°49.6	2.2'	56.5'
22	149°01.5	35.5		234°03.8	9.8'	17°47.4	2.3'	56.5'
23	164°01.7	36.5		248°32.7	9.8'	17°45.1	2.4'	56.5'
	SD.=16.0	d=1.0				S.D.=15.3		

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

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

S	EE:10	EE:10	:	17.21	15.05	15.55
Day	Sun			Moon		
	Eqn.of Time		Mer.	Mer.Pass.		Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	hh:mm	Upper hh:mm	Lower hh:mm	22-24 52-31%
31	04:10	04:01	12:04	05:50	18:16	
01	03:53	03:44	12:04	06:42	19:08	
02	03:35	03:26	12:03	07:34	20:01	

**April 03, 04, 05 UT (Sun., Mon., Tue.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	191°45.3	194°13.8	\$02°41.0	305°42.3	\$20°45.9	24°47.6	N07°10.4	296°23.6	\$20°58.5	Alpheratz	357°41.9	29°10.6											
1	206°47.8	209°13.5	39.8	320°44.4	46.0	39°50.3	10.5	311°26.1	58.5	Ankaa	353°14.3	-42°13.2											
2	221°50.3	224°13.1	38.6	335°46.4	46.1	54°53.0	10.6	326°28.6	58.5	Schedar	349°38.8	56°37.4											
3	236°52.7	239°12.7	· · 37.4	350°48.5	· · 46.2	69°55.7	· · 10.7	341°31.1	· · 58.5	Diphda	348°54.4	-17°54.0											
4	251°55.2	254°12.3	36.2	5°50.5	46.4	84°58.4	10.8	356°33.6	58.5	Achernar	335°26.1	-57°09.5											
5	266°57.6	269°11.9	34.9	20°52.6	46.5	100°01.1	10.9	11°36.1	58.5	Hamal	327°58.9	23°32.1											
6	282°00.1	284°11.6	\$02°33.7	35°54.6	\$20°46.6	115°03.8	N07°11.0	26°38.6	\$20°58.5	Polaris	317°17.6	89°20.0											
7	297°02.6	299°11.2	32.5	50°56.7	46.7	130°06.5	11.0	41°41.1	58.4	Acamar	315°17.3	-40°14.7											
8	312°05.0	314°10.8	31.3	65°58.8	46.8	145°09.2	11.1	56°43.6	58.4	Menkar	314°13.3	4°08.9											
9	327°07.5	329°10.4	· · 30.1	81°00.8	· · 47.0	160°11.9	· · 11.2	71°46.2	· · 58.4	Mirfak	308°38.0	49°55.0											
10	342°10.0	344°10.1	28.9	96°02.9	47.1	175°14.6	11.3	86°48.7	58.4	Aldebaran	290°47.4	16°32.2											
11	357°12.4	359°09.7	27.7	111°04.9	47.2	190°17.3	11.4	101°51.2	58.4	Rigel	281°10.4	-8°11.4											
12	12°14.9	14°09.3	\$02°26.5	126°07.0	\$20°47.3	205°20.0	N07°11.5	116°53.7	\$20°58.4	Capella	280°31.9	46°00.7											
13	27°17.4	29°08.9	25.2	141°09.1	47.4	220°22.7	11.6	131°56.2	58.4	Bellatrix	278°30.1	6°21.5											
14	42°19.8	44°08.5	24.0	156°11.1	47.6	235°25.4	11.7	146°58.7	58.4	El Nath	278°10.4	28°37.1											
15	57°22.3	59°08.2	· · 22.8	171°13.2	· · 47.7	250°28.1	· · 11.8	162°01.2	· · 58.4	Alnilam	275°44.6	-1°11.8											
16	72°24.7	74°07.8	21.6	186°15.2	47.8	265°30.8	11.9	177°03.7	58.4	Betelgeuse	270°59.4	7°24.3											
17	87°27.2	89°07.4	20.4	201°17.3	47.9	280°33.5	12.0	192°06.2	58.4	Canopus	263°55.4	-52°42.8											
18	102°29.7	104°07.0	\$02°19.2	216°19.4	\$20°48.0	295°36.2	N07°12.1	207°08.7	\$20°58.4	Sirius	258°32.1	-16°44.7											
19	117°32.1	119°06.7	18.0	231°21.4	48.2	310°38.9	12.2	222°11.2	58.4	Adhara	255°11.0	-29°00.1											
20	132°34.6	134°06.3	16.8	246°23.5	48.3	325°41.6	12.3	237°13.7	58.3	Procyon	244°57.7	5°10.7											
21	147°37.1	149°05.9	· · 15.5	261°25.6	· · 48.4	340°44.3	· · 12.4	252°16.2	· · 58.3	Pollux	243°25.4	27°59.1											
22	162°39.5	164°05.5	14.3	276°27.7	48.5	355°47.0	12.5	267°18.7	58.3	Avior	234°17.0	-59°34.2											
23	177°42.0	179°05.1	13.1	291°29.7	48.6	10°49.7	12.5	282°21.2	58.3	Suhail	222°50.8	-43°30.3											
Mer.pass.:11:11				v-0.4 d1.2 m-3.8				v2.0 d-0.1 m-0.6				v2.7 d0.1 m-2.3				v2.5 d0.0 m0.3							
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	192°44.5	194°04.8	\$02°11.9	306°31.8	\$20°48.8	25°52.4	N07°12.6	297°23.7	\$20°58.3	Denebola	182°31.5	14°28.8											
1	207°46.9	209°04.4	10.7	321°33.9	48.9	40°55.1	12.7	312°26.2	58.3	Gienah	175°50.0	-17°38.0											
2	222°49.4	224°04.0	09.5	336°35.9	49.0	55°57.8	12.8	327°28.7	58.3	Acru	173°06.4	-63°11.4											
3	237°51.9	239°03.6	· · 08.3	351°38.0	· · 49.1	71°00.5	· · 12.9	342°31.2	· · 58.3	Gacrux	171°58.1	-57°12.3											
4	252°54.3	254°03.3	07.0	6°40.1	49.2	86°03.2	13.0	357°33.7	58.3	Alioth	166°18.6	55°52.3											
5	267°56.8	269°02.9	05.8	21°42.2	49.4	101°05.9	13.1	12°36.2	58.3	Spica	158°28.9	-11°14.8											
6	282°59.2	284°02.5	\$02°04.6	36°44.3	\$20°49.5	116°08.6	N07°13.2	27°38.8	\$20°58.3	Alkaid	152°57.0	49°13.9											
7	298°01.7	299°02.1	03.4	51°46.3	49.6	131°11.3	13.3	42°41.3	58.3	Hadar	148°44.5	-60°26.9											
8	313°04.2	314°01.8	02.2	66°48.4	49.7	146°14.0	13.4	57°43.8	58.2	Menkent	148°04.9	-36°26.9											
9	328°06.6	329°01.4	02°01.0	81°50.5	· · 49.8	161°16.7	· · 13.5	72°46.3	· · 58.2	Arcturus	145°53.7	19°05.8											
10	343°09.1	344°01.0	01°59.7	96°52.6	49.9	176°19.4	13.6	87°48.8	58.2	Rigel Kent.	139°48.4	-60°53.9											
11	358°11.6	359°00.6	58.5	111°54.7	50.1	191°22.1	13.7	102°51.3	58.2	Kochab	137°19.2	74°05.3											
12	13°14.0	14°00.3	\$01°57.3	126°56.8	\$20°50.2	206°24.7	N07°13.7	117°53.8	\$20°58.2	Zuben' ubi	137°03.0	-16°06.5											
13	28°16.5	28°59.9	56.1	141°58.9	50.3	221°27.4	13.8	132°56.3	58.2	Alphecca	126°09.2	26°39.6											
14	43°19.0	43°59.5	54.9	157°00.9	50.4	236°30.1	13.9	147°58.8	58.2	Antares	112°23.7	-26°27.9											
15	58°21.4	58°59.1	· · 53.7	172°03.0	· · 50.5	251°32.8	· · 14.0	163°01.3	· · 58.2	Atria	107°23.5	-69°03.0											
16	73°23.9	73°58.8	52.4	187°05.1	50.7	266°35.5	14.1	178°03.8	58.2	Sabik	102°10.2	-15°44.5											
17	88°26.4	88°58.4	51.2	202°07.2	50.8	281°38.2	14.2	193°06.3	58.2	Shaula	96°19.2	-37°06.6											
18	103°28.8	103°58.0	\$01°50.0	217°09.3	\$20°50.9	296°40.9	N07°14.3	208°08.8	\$20°58.2	Rasalhague	96°04.6	12°32.9											
19	118°31.3	118°57.6	48.8	232°11.4	51.0	311°43.6	14.4	223°11.4	58.2	Eltanin	90°45.1	51°29.1											
20	133°33.7	133°57.3	47.6	247°13.5	51.1	326°46.3	14.5	238°13.9	58.1	Kaus Aust.	83°41.3	-34°22.3											
21	148°36.2	148°56.9	· · 46.4	262°15.6	· · 51.2	341°49.0	· · 14.6	253°16.4	· · 58.1	Vega	80°37.6	38°47.8											
22	163°38.7	163°56.5	45.1	277°17.7	51.4	356°51.7	14.7	268°18.9	58.1	Nunki	75°56.0	-26°16.4											
23	178°41.1	178°56.1	43.9	292°19.8	51.5	11°54.4	14.7	283°21.4	58.1	Altair	62°06.5	8°54.7											
Mer.pass.:11:07				v-0.4 d1.2 m-3.8				v2.1 d-0.1 m-0.6				v2.7 d0.1 m-2.3				v2.5 d0.0 m0.3							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	193°43.6	193°55.8	\$01°42.7	307°21.9	\$20°51.6	26°57.1	N07°14.8	298°23.9	\$20°58.1	Apr 03 Sun	2°28.5	11:03											
1	208°46.1	208°55.4	41.5	322°24.0	51.7	41°59.8	14.9	313°26.4	58.1	Venus	113°57.0	03:37											
2	223°48.5	223°55.0	40.3	337°26.1	51.8	57°02.5	15.0	328°28.9	58.1	Mars	193°02.3	22:17											
3	238°51.0	238°54.6	· · 39.1	352°28.2	· · 51.9	72°05.2	· · 15.1	343°31.4	· · 58.1	Jupiter	104°38.3	04:14											
4	253°53.5	253°54.3	37.8	7°30.3	52.0	87°07.8	15.2	358°33.9	58.1	Saturn	104°38.3	04:14											
5	268°55.9	268°53.9	36.6	22°32.4	52.2	102°10.5	15.3	13°36.5	58.1	Apr 04 Mon	1°20.3	11:04											
6	283°58.4	283°53.5	\$01°35.4	37°34.5	\$20°52.3	117°13.2	N07°15.4	28°39.0	\$20°58.1	Venus	113°47.3	03:33											
7	299°00.8	298°53.1	34.2	52°36.6	52.4	132°15.9	15.5	43°41.5	58.0	Mars	193°07.9	22:13											
8	314°03.3	313°52.8	33.0	67°38.7	52.5	147°18.6	15.6	58°44.0	58.0	Jupiter	104°39.3	04:10											
9	329°05.8	328°52.4	· · 31.8	82°40.8	· · 52.6	162°21.3	· · 15.6	73°46.5	· · 58.0	Saturn	104°40.3	04:06											
10	344°08.2	343°52.0	30.5	97°43.0	52.7	177°24.0	15.7	88°49.0	58.0	Apr 05 Tue	0°12.2	11:05											
11	359°10.7	358°51.6	29.3	112°45.1	52.9																		

DUT1 = UT1-UTC = -0.0859 sec ΔT = TT-UT1 = +68.2699 sec

2016 April 03 to Apr. 05 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	ν	Dec	d	HP
0	179°10.7	N05°23.5	237°38.0	8.8'	S13°49.8	7.2'	58.4'	
1	194°10.9	24.5	252°05.9	8.8'	13°42.6	7.2'	58.4'	
2	209°11.1	25.4	266°33.7	8.8'	13°35.3	7.3'	58.5'	
3	224°11.2	.. 26.4	281°01.5	8.8'	13°27.9	7.4'	58.5'	
4	239°11.4	27.3	295°29.3	8.8'	13°20.4	7.5'	58.6'	
5	254°11.6	28.3	309°57.0	8.8'	13°12.8	7.6'	58.6'	
6	269°11.8	N05°29.3	324°24.8	8.8'	S13°05.2	7.7'	58.6'	
7	284°12.0	30.2	338°52.5	8.7'	12°57.5	7.8'	58.7'	
8	299°12.2	31.2	353°20.3	8.7'	12°49.6	7.9'	58.7'	
9	314°12.3	.. 32.1	7°48.0	8.7'	12°41.7	8.0'	58.8'	
10	329°12.5	33.1	22°15.7	8.7'	12°33.7	8.0'	58.8'	
11	344°12.7	34.0	36°43.4	8.7'	12°25.6	8.1'	58.8'	
12	359°12.9	N05°35.0	51°11.1	8.7'	S12°17.4	8.2'	58.9'	
13	14°13.1	35.9	65°38.7	8.7'	12°09.2	8.3'	58.9'	
14	29°13.2	36.9	80°06.4	8.6'	12°00.8	8.4'	59.0'	
15	44°13.4	.. 37.9	94°34.0	8.6'	11°52.4	8.5'	59.0'	
16	59°13.6	38.8	109°01.7	8.6'	11°43.9	8.6'	59.0'	
17	74°13.8	39.8	123°29.3	8.6'	11°35.3	8.6'	59.1'	
18	89°14.0	N05°40.7	137°56.9	8.6'	S11°26.6	8.7'	59.1'	
19	104°14.2	41.7	152°24.5	8.6'	11°17.9	8.8'	59.2'	
20	119°14.3	42.6	166°52.1	8.6'	11°09.1	8.9'	59.2'	
21	134°14.5	.. 43.6	181°19.6	8.6'	11°00.1	9.0'	59.2'	
22	149°14.7	44.5	195°47.2	8.5'	10°51.1	9.0'	59.3'	
23	164°14.9	45.5	210°14.7	8.5'	10°42.1	9.1'	59.3'	
SD.=16.0		d=1.0				S.D.=16.0		
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Mon		GHA	Dec	GHA	ν	Dec	d	HP
0	179°15.1	N05°46.4	224°42.2	8.5'	S10°32.9	9.2'	59.4'	
1	194°15.2	47.4	239°09.7	8.5'	10°23.7	9.3'	59.4'	
2	209°15.4	48.3	253°37.2	8.5'	10°14.4	9.3'	59.4'	
3	224°15.6	.. 49.3	268°04.7	8.5'	10°05.0	9.4'	59.5'	
4	239°15.8	50.2	282°32.2	8.5'	09°55.6	9.5'	59.5'	
5	254°16.0	51.2	296°59.7	8.5'	09°46.1	9.6'	59.5'	
6	269°16.1	N05°52.1	311°27.1	8.4'	S09°36.5	9.6'	59.6'	
7	284°16.3	53.1	325°54.5	8.4'	09°26.8	9.7'	59.6'	
8	299°16.5	54.0	340°22.0	8.4'	09°17.0	9.8'	59.7'	
9	314°16.7	.. 55.0	354°49.4	8.4'	09°07.2	9.8'	59.7'	
10	329°16.9	56.0	9°16.8	8.4'	08°57.4	9.9'	59.7'	
11	344°17.0	56.9	23°44.1	8.4'	08°47.4	10.0'	59.8'	
12	359°17.2	N05°57.9	38°11.5	8.4'	S08°37.4	10.0'	59.8'	
13	14°17.4	58.8	52°38.9	8.3'	08°27.3	10.1'	59.8'	
14	29°17.6	05°59.8	67°06.2	8.3'	08°17.2	10.2'	59.9'	
15	44°17.8	06°00.7	81°33.5	8.3'	08°07.0	10.2'	59.9'	
16	59°17.9	01.7	96°00.8	8.3'	07°56.7	10.3'	59.9'	
17	74°18.1	02.6	110°28.1	8.3'	07°46.4	10.4'	60.0'	
18	89°18.3	N06°03.6	124°55.4	8.3'	S07°36.0	10.4'	60.0'	
19	104°18.5	04.5	139°22.7	8.3'	07°25.5	10.5'	60.0'	
20	119°18.6	05.5	153°49.9	8.2'	07°15.0	10.5'	60.1'	
21	134°18.8	.. 06.4	168°17.2	8.2'	07°04.4	10.6'	60.1'	
22	149°19.0	07.4	182°44.4	8.2'	06°53.8	10.7'	60.1'	
23	164°19.2	08.3	197°11.6	8.2'	06°43.1	10.7'	60.2'	
SD.=16.0		d=1.0				S.D.=16.3		
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Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	179°19.4	N06°09.2	211°38.8	8.2'	S06°32.4	10.8'	60.2'	
1	194°19.5	10.2	226°06.0	8.2'	06°21.6	10.8'	60.2'	
2	209°19.7	11.1	240°33.2	8.2'	06°10.7	10.9'	60.3'	
3	224°19.9	.. 12.1	255°00.3	8.1'	05°59.9	10.9'	60.3'	
4	239°20.1	13.0	269°27.4	8.1'	05°48.9	11.0'	60.3'	
5	254°20.3	14.0	283°54.6	8.1'	05°37.9	11.0'	60.4'	
6	269°20.4	N06°14.9	298°21.7	8.1'	S05°26.9	11.1'	60.4'	
7	284°20.6	15.9	312°48.7	8.1'	05°15.8	11.1'	60.4'	
8	299°20.8	16.8	327°15.8	8.1'	05°04.6	11.2'	60.5'	
9	314°21.0	.. 17.8	341°42.9	8.0'	04°53.5	11.2'	60.5'	
10	329°21.1	18.7	356°09.9	8.0'	04°42.2	11.2'	60.5'	
11	344°21.3	19.7	10°36.9	8.0'	04°31.0	11.3'	60.6'	
12	359°21.5	N06°20.6	25°03.9	8.0'	S04°19.7	11.3'	60.6'	
13	14°21.7	21.6	39°30.9	8.0'	04°08.3	11.4'	60.6'	
14	29°21.9	22.5	53°57.9	8.0'	03°57.0	11.4'	60.6'	
15	44°22.0	.. 23.5	68°24.8	7.9'	03°45.5	11.4'	60.7'	
16	59°22.2	24.4	82°51.7	7.9'	03°34.1	11.5'	60.7'	
17	74°22.4	25.3	97°18.6	7.9'	03°22.6	11.5'	60.7'	
18	89°22.6	N06°26.3	111°45.5	7.9'	S03°11.1	11.5'	60.7'	
19	104°22.7	27.2	126°12.4	7.9'	02°59.5	11.6'	60.8'	
20	119°22.9	28.2	140°39.3	7.8'	02°48.0	11.6'	60.8'	
21	134°23.1	.. 29.1	155°06.1	7.8'	02°36.4	11.6'	60.8'	
22	149°23.3	30.1	169°32.9	7.8'	02°24.7	11.6'	60.8'	
23	164°23.4	31.0	183°59.7	7.8'	02°13.1	11.7'	60.9'	
SD.=16.0		d=0.9				S.D.=16.5		
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Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	00:39	03:20	04:38	19:31	20:51	-:-
N 70°	01:51	03:39	04:47	19:21	20:30	22:23
68°	02:27	03:54	04:55	19:13	20:15	21:44
66°	02:51	04:06	05:01	19:07	20:02	21:19
64°	03:10	04:16	05:07	19:01	19:52	20:59
62°	03:25	04:25	05:11	18:56	19:43	20:44
60°	03:37	04:32	05:15	18:52	19:36	20:31
N 58°	03:47	04:38	05:19	18:48	19:29	20:20
56°	03:56	04:44	05:22	18:45	19:24	20:11
54°	04:04	04:48	05:25	18:42	19:19	20:03
52°	04:11	04:53	05:27	18:40	19:14	19:56
50°	04:17	04:57	05:30	18:37	19:10	19:50
48°	04:29	05:05	05:35	18:32	19:02	19:38
N 40°	04:39	05:11	05:39	18:28	18:55	19:28
35°	04:47	05:17	05:42	18:24	18:50	19:20
30°	04:53	05:21	05:45	18:21	18:45	19:13
20°	05:03	05:29	05:51	18:15	18:37	19:03
N 10°	05:10	05:34	05:55	18:10	18:32	18:56
0°	05:15	05:39	06:00	18:06	18:27	18:51
S 10°	05:18	05:43	06:04	18:02	18:23	18:47
20°	05:20	05:46	06:08	17:57	18:20	18:45
30°	05:21	05:49	06:13	17:53	18:17	18:44
35°	05:21	05:50	06:15	17:50	18:15	18:44
40°	05:20	05:51	06:18	17:47	18:14	18:45
45°	05:18	05:52	06:22	17:43	18:12	18:46
S 50°	05:16	05:54	06:26	17:39	18:11	18:49
52°	05:15	05:54	06:28	17:37	18:11	18:50
54°	05:13	05:54	06:30	17:35	18:10	18:51
56°	05:12	05:55	06:32	17:33	18:10	18:53
58°	05:10	05:55	06:34	17:30	18:09	18:55
S 60°	05:07	05:56	06:37	17:27	18:09	18:57
Lat.	Sun	Moonrise	Mon	Tue	Sun	Moonset
	Mon		Tue		Mon	Tue
N 72°	05:28	05:22	05:17	11:43	13:41	15:41
N 70°	05:03	05:07	05:09	12:06	13:55	15:46
68°	04:44	04:55	05:03	12:24	14:06	15:51
66°	04:29	04:45	04:57	12:39	14:14	15:54
64°	04:16	04:36	04:52	12:51	14:22	15:57
62°	04:05	04:29	04:48	13:00	14:28	16:00
60°	03:56	04:22	04:45	13:09	14:34	16:03
N 58°	03:48	04:16	04:42	13:16	14:39	16:05
56°	03:41	04:11	04:39	13:23	14:43	16:06
54°	03:35	04:07	04:36	13:29	14:47	16:08
52°	03:29	04:03	04:34	13:34	14:50	16:10
50°	03:24	03:59	04:32			

**April 06, 07, 08 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Week	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	194°42.7	193°46.8	S01°13.5	308°12.6	S20°54.3	28°01.6	N07°17.0	299°24.2	S20°57.9	Alpheratz	357°41.8	29°10.6					
1	209°45.2	208°46.4	12.2	323°14.8	54.5	43°04.3	17.1	314°26.7	57.9	Ankaa	353°14.3	-42°13.2					
2	224°47.7	223°46.0	11.0	338°16.9	54.6	58°07.0	17.2	329°29.2	57.9	Schedar	349°38.8	56°37.4					
3	239°50.1	238°45.7	09.8	353°19.0	54.7	73°09.7	17.2	344°31.7	57.9	Diphda	348°54.4	-17°54.0					
4	254°52.6	253°45.3	08.6	8°21.2	54.8	88°12.4	17.3	359°34.3	57.9	Achernar	335°26.1	-57°09.5					
5	269°55.1	268°44.9	07.4	23°23.3	54.9	103°15.1	17.4	14°36.8	57.9	Hamal	327°58.9	23°32.1					
6	284°57.5	283°44.6	S01°06.1	38°25.4	S20°55.0	118°17.8	N07°17.5	29°39.3	S20°57.8	Polaris	317°18.3	89°20.0					
7	300°00.0	298°44.2	04.9	53°27.6	55.1	133°20.5	17.6	44°41.8	57.8	Acamar	315°17.3	-40°14.7					
8	315°02.4	313°43.8	03.7	68°29.7	55.2	148°23.1	17.7	59°44.3	57.8	Menkar	314°13.4	4°08.9					
9	330°04.9	328°43.4	02.5	83°31.9	55.4	163°25.8	17.8	74°46.8	57.8	Mirfak	308°38.0	49°55.0					
10	345°07.4	343°43.1	01.3	98°34.0	55.5	178°28.5	17.8	89°49.3	57.8	Aldebaran	290°47.4	16°32.2					
11	0°09.8	358°42.7	01°00.0	113°36.1	55.6	193°31.2	17.9	104°51.9	57.8	Rigel	281°10.4	-8°11.4					
12	15°12.3	13°42.3	S00°58.8	128°38.3	S20°55.7	208°33.9	N07°18.0	119°54.4	S20°57.8	Capella	280°31.9	46°00.7					
13	30°14.8	28°42.0	57.6	143°40.4	55.8	223°36.6	18.1	134°56.9	57.8	Bellatrix	278°30.1	6°21.5					
14	45°17.2	43°41.6	56.4	158°42.6	55.9	238°39.2	18.2	149°59.4	57.8	El Nath	278°10.4	28°37.1					
15	60°19.7	58°41.2	55.2	173°44.7	56.0	253°41.9	18.3	165°01.9	57.8	Alnilam	275°44.6	-1°11.8					
16	75°22.2	73°40.8	53.9	188°46.9	56.1	268°44.6	18.4	180°04.4	57.8	Betelgeuse	270°59.4	7°24.3					
17	90°24.6	88°40.5	52.7	203°49.0	56.2	283°47.3	18.5	195°07.0	57.7	Canopus	263°55.4	-52°42.8					
18	105°27.1	103°40.1	S00°51.5	218°51.1	S20°56.4	298°50.0	N07°18.5	210°09.5	S20°57.7	Sirius	258°32.1	-16°44.7					
19	120°29.6	118°39.7	50.3	233°53.3	56.5	313°52.7	18.6	225°12.0	57.7	Adhara	255°11.1	-29°00.1					
20	135°32.0	133°39.4	49.1	248°55.5	56.6	328°55.4	18.7	240°14.5	57.7	Procyon	244°57.7	5°10.7					
21	150°34.5	148°39.0	47.8	263°57.6	56.7	343°58.0	18.8	255°17.0	57.7	Pollux	243°25.4	27°59.1					
22	165°36.9	163°38.6	46.6	278°59.8	56.8	359°00.7	18.9	270°19.6	57.7	Avior	234°17.0	-59°34.2					
23	180°39.4	178°38.2	45.4	294°01.9	56.9	14°03.4	19.0	285°22.1	57.7	Suhail	222°50.8	-43°30.3					
Mer.pass.:10:59			v-0.4 d1.2 m-3.8			v2.1 d-0.1 m-0.7			v2.7 d0.1 m-2.2			v2.5 d0.0 m0.3			Miaplacidus		
Thu			GHA			GHA			GHA			GHA			GHA		
0	195°41.9	193°37.9	S00°44.2	309°04.1	S20°57.0	29°06.1	N07°19.1	300°24.6	S20°57.7	Denebola	182°31.5	14°28.8					
1	210°44.3	208°37.5	43.0	324°06.2	57.1	44°08.8	19.1	315°27.1	57.7	Gienah	175°50.0	-17°38.0					
2	225°46.8	223°37.1	41.7	339°08.4	57.2	59°11.4	19.2	330°29.6	57.7	Acrua	173°06.4	-63°11.4					
3	240°49.3	238°36.8	40.5	354°10.5	57.4	74°14.1	19.3	345°32.1	57.6	Gacrux	171°58.1	-57°12.3					
4	255°51.7	253°36.4	39.3	9°12.7	57.5	89°16.8	19.4	0°34.7	57.6	Alioth	166°18.6	55°52.3					
5	270°54.2	268°36.0	38.1	24°14.9	57.6	104°19.5	19.5	15°37.2	57.6	Spica	158°28.9	-11°14.8					
6	285°56.7	283°35.6	S00°36.8	39°17.0	S20°57.7	119°22.2	N07°19.6	30°39.7	S20°57.6	Alkaid	152°57.0	49°13.9					
7	300°59.1	298°35.3	35.6	54°19.2	57.8	134°24.9	19.7	45°42.2	57.6	Hadar	148°44.5	-60°26.9					
8	316°01.6	313°34.9	34.4	69°21.4	57.9	149°27.5	19.7	60°44.7	57.6	Menkent	148°04.9	-36°26.9					
9	331°04.0	328°34.5	33.2	84°23.5	58.0	164°30.2	19.8	75°47.3	57.6	Arcturus	145°53.7	19°05.9					
10	346°06.5	343°34.2	32.0	99°25.7	58.1	179°32.9	19.9	90°49.8	57.6	Rigel Kent.	139°48.4	-60°53.9					
11	1°09.0	358°33.8	30.7	114°27.9	58.2	194°35.6	20.0	105°52.3	57.6	Kochab	137°19.2	74°05.3					
12	16°11.4	13°33.4	S00°29.5	129°30.0	S20°58.3	209°38.3	N07°20.1	120°54.8	S20°57.6	Zuben ubi	137°03.0	-16°06.5					
13	31°13.9	28°33.1	28.3	144°32.2	58.4	224°40.9	20.2	135°57.3	57.6	Alphecca	126°09.1	26°39.6					
14	46°16.4	43°32.7	27.1	159°34.4	58.6	239°43.6	20.2	150°59.9	57.5	Antares	112°23.7	-26°27.9					
15	61°18.8	58°32.3	25.8	174°36.6	58.7	254°46.3	20.3	166°02.4	57.5	Atria	107°23.5	-69°03.0					
16	76°21.3	73°31.9	24.6	189°38.7	58.8	269°49.0	20.4	181°04.9	57.5	Sabik	102°10.2	-15°44.5					
17	91°23.8	88°31.6	23.4	204°40.9	58.9	284°51.6	20.5	196°07.4	57.5	Shaula	96°19.2	-37°06.6					
18	106°26.2	103°31.2	S00°22.2	219°43.1	S20°59.0	299°54.3	N07°20.6	211°10.0	S20°57.5	Rasalhague	96°04.6	12°32.9					
19	121°28.7	118°30.8	21.0	234°45.3	59.1	314°57.0	20.7	226°12.5	57.5	Eltanin	90°45.1	51°29.1					
20	136°31.2	133°30.5	19.7	249°47.4	59.2	329°59.7	20.7	241°15.0	57.5	Kaus Aust.	83°41.2	-34°22.3					
21	151°33.6	148°30.1	18.5	264°49.6	59.3	345°02.4	20.8	256°17.5	57.5	Vega	80°37.6	38°47.8					
22	166°36.1	163°29.7	17.3	279°51.8	59.4	0°05.0	20.9	271°20.0	57.5	Nunki	75°56.0	-26°16.4					
23	181°38.5	178°29.4	16.1	294°54.0	59.5	15°07.7	21.0	286°22.6	57.5	Altair	62°06.4	8°54.7					
Mer.pass.:10:55			v-0.4 d1.2 m-3.8			v2.2 d-0.1 m-0.7			v2.7 d0.1 m-2.2			v2.5 d0.0 m0.3			Peacock		
Fri			GHA			GHA			GHA			GHA			GHA		
0	196°41.0	193°29.0	S00°14.8	309°56.2	S20°59.6	30°10.4	N07°21.1	301°25.1	S20°57.4	Apr 06 Wed	359°04.1	11:05					
1	211°43.5	208°28.6	13.6	324°58.4	59.7	45°13.1	21.2	316°27.6	57.4	Venus	113°29.9	03:27					
2	226°45.9	223°28.2	12.4	340°00.5	20°59.9	60°15.7	21.2	331°30.1	57.4	Mars	193°18.9	22:04					
3	241°48.4	238°27.9	11.2	355°02.7	21°00.0	75°18.4	21.3	346°32.7	57.4	Jupiter	104°41.5	04:02					
4	256°50.9	253°27.5	10.0	10°04.9	00.1	90°21.1	21.4	1°35.2	57.4	Saturn	104°41.5	04:02					
5	271°53.3	268°27.1	08.7	25°07.1	00.2	105°23.8	21.5	16°37.7	57.4	Apr 07 Thu	357°56.0	11:06					
6	286°55.8	283°26.8	S00°07.5	40°09.3	S21°00.3	120°26.5	N07°21.6	31°40.2	S20°57.4	Venus	113°15.2	03:20					
7	301°58.3	298°26.4	06.3	55°11.5	00.4	135°29.1	21.7	46°42.8	57.4	Mars	193°24.2	22:00					
8	317°00.7	313°26.0	05.1	70°13.7	00.5	150°31.8	21.7	61°45.3	57.4	Jupiter	104°42.7	03:58					
9	332°03.2	328°25.7	03.8	85°15.9	00.6	165°34.5	21.8	76°47.8	57.4	Saturn	104°44.1	03:54					
10	347°05.7	343°25.3	02.6	100°18.1	00.7	180°37.2	21.9	91°50.3	57.3	Apr 08 Fri	356°48.0	11:06					
11	2°08.1	358°24.9	01.4	115°20.3	00.8	195°39.8	22.0	106°52.9	57.3	Venus	113°15.2	03:20					
12	17°10.6	13°24.6	S00°00.2	130°22.5	S21°00.9	210°42.5	N07°22.1	121°55.4	S20°57.3	Mars	193°29.4	21:55					
13																	

DUT1 = UT1-UTC = -0.0911 sec ΔT = TT-UT1 = +68.2751 sec

2016 April 06 to Apr. 08 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	179°23.6	N06°32.0	198°26.5	7.8'	S02°01.4	11.7'	60.9'	
1	194°23.8	32.9	212°53.2	7.7'	01°49.7	11.7'	60.9'	
2	209°24.0	33.8	227°20.0	7.7'	01°38.0	11.7'	60.9'	
3	224°24.2	.. 34.8	241°46.7	7.7'	01°26.2	11.8'	61.0'	
4	239°24.3	35.7	256°13.4	7.7'	01°14.5	11.8'	61.0'	
5	254°24.5	36.7	270°40.1	7.7'	01°02.7	11.8'	61.0'	
6	269°24.7	N06°37.6	285°06.7	7.6'	S00°50.9	11.8'	61.0'	
7	284°24.9	38.6	299°33.4	7.6'	00°39.1	11.8'	61.0'	
8	299°25.0	39.5	314°00.0	7.6'	00°27.2	11.8'	61.1'	
9	314°25.2	.. 40.4	328°26.6	7.6'	00°15.4	11.8'	61.1'	
10	329°25.4	41.4	342°53.1	7.6'	S00°03.6	11.8'	61.1'	
11	344°25.6	42.3	357°19.7	7.5'	N00°08.3	11.9'	61.1'	
12	359°25.7	N06°43.3	11°46.2	7.5'	N00°20.1	11.9'	61.1'	
13	14°25.9	44.2	26°12.7	7.5'	00°32.0	11.9'	61.1'	
14	29°26.1	45.2	40°39.2	7.5'	00°43.9	11.9'	61.2'	
15	44°26.3	.. 46.1	55°05.6	7.4'	00°55.7	11.9'	61.2'	
16	59°26.4	47.0	69°32.0	7.4'	01°07.6	11.9'	61.2'	
17	74°26.6	48.0	83°58.5	7.4'	01°19.5	11.9'	61.2'	
18	89°26.8	N06°48.9	98°24.8	7.4'	N01°31.3	11.9'	61.2'	
19	104°27.0	49.9	112°51.2	7.3'	01°43.2	11.9'	61.2'	
20	119°27.1	50.8	127°17.5	7.3'	01°55.1	11.9'	61.2'	
21	134°27.3	.. 51.7	141°43.9	7.3'	02°06.9	11.8'	61.3'	
22	149°27.5	52.7	156°10.1	7.3'	02°18.7	11.8'	61.3'	
23	164°27.7	53.6	170°36.4	7.3'	02°30.6	11.8'	61.3'	
	SD.=16.0	d=0.9			S.D.=16.7			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°27.8	N06°54.6	185°02.7	7.2'	N02°42.4	11.8'	61.3'
1	194°28.0	55.5	199°28.9	7.2'	02°54.2	11.8'	61.3'
2	209°28.2	56.4	213°55.1	7.2'	03°06.0	11.8'	61.3'
3	224°28.3	.. 57.4	228°21.2	7.2'	03°17.7	11.8'	61.3'
4	239°28.5	58.3	242°47.4	7.1'	03°29.5	11.7'	61.3'
5	254°28.7	06°59.2	257°13.5	7.1'	03°41.2	11.7'	61.3'
6	269°28.9	N07°00.2	271°39.6	7.1'	N03°52.9	11.7'	61.3'
7	284°29.0	01.1	286°05.6	7.1'	04°04.6	11.7'	61.3'
8	299°29.2	02.1	300°31.7	7.0'	04°16.3	11.6'	61.4'
9	314°29.4	.. 03.0	314°57.7	7.0'	04°27.9	11.6'	61.4'
10	329°29.6	03.9	329°23.7	7.0'	04°39.5	11.6'	61.4'
11	344°29.7	04.9	343°49.7	7.0'	04°51.1	11.6'	61.4'
12	359°29.9	N07°05.8	358°15.6	6.9'	N05°02.6	11.5'	61.4'
13	14°30.1	06.7	12°41.5	6.9'	05°14.2	11.5'	61.4'
14	29°30.3	07.7	27°07.4	6.9'	05°25.6	11.5'	61.4'
15	44°30.4	.. 08.6	41°33.3	6.9'	05°37.1	11.4'	61.4'
16	59°30.6	09.6	55°59.1	6.8'	05°48.5	11.4'	61.4'
17	74°30.8	10.5	70°24.9	6.8'	05°59.9	11.3'	61.4'
18	89°30.9	N07°11.4	84°50.7	6.8'	N06°11.2	11.3'	61.4'
19	104°31.1	12.4	99°16.5	6.7'	06°22.5	11.3'	61.4'
20	119°31.3	13.3	113°42.2	6.7'	06°33.7	11.2'	61.4'
21	134°31.5	.. 14.2	128°07.9	6.7'	06°44.9	11.2'	61.4'
22	149°31.6	15.2	142°33.6	6.7'	06°56.1	11.1'	61.4'
23	164°31.8	16.1	156°59.3	6.6'	07°07.2	11.1'	61.4'
	SD.=16.0	d=0.9			S.D.=16.7		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°32.0	N07°17.0	171°24.9	6.6'	N07°18.2	11.0'	61.4'
1	194°32.1	18.0	185°50.5	6.6'	07°29.2	11.0'	61.4'
2	209°32.3	18.9	200°16.1	6.6'	07°40.2	10.9'	61.4'
3	224°32.5	.. 19.8	214°41.7	6.5'	07°51.1	10.9'	61.4'
4	239°32.7	20.8	229°07.2	6.5'	08°01.9	10.8'	61.3'
5	254°32.8	21.7	243°32.7	6.5'	08°12.7	10.8'	61.3'
6	269°33.0	N07°22.6	257°58.2	6.5'	N08°23.4	10.7'	61.3'
7	284°33.2	23.6	272°23.7	6.5'	08°34.1	10.6'	61.3'
8	299°33.3	24.5	286°49.1	6.4'	08°44.7	10.6'	61.3'
9	314°33.5	.. 25.4	301°14.5	6.4'	08°55.2	10.5'	61.3'
10	329°33.7	26.4	315°39.9	6.4'	09°05.7	10.4'	61.3'
11	344°33.9	27.3	330°05.3	6.4'	09°16.1	10.4'	61.3'
12	359°34.0	N07°28.2	344°30.6	6.3'	N09°26.4	10.3'	61.3'
13	14°34.2	29.2	358°56.0	6.3'	09°36.7	10.2'	61.3'
14	29°34.4	30.1	13°21.3	6.3'	09°46.9	10.2'	61.3'
15	44°34.5	.. 31.0	27°46.5	6.3'	09°57.1	10.1'	61.2'
16	59°34.7	32.0	42°11.8	6.2'	10°07.1	10.0'	61.2'
17	74°34.9	32.9	56°37.0	6.2'	10°17.1	9.9'	61.2'
18	89°35.0	N07°33.8	71°02.2	6.2'	N10°27.0	9.9'	61.2'
19	104°35.2	34.7	85°27.4	6.2'	10°36.8	9.8'	61.2'
20	119°35.4	35.7	99°52.6	6.2'	10°46.6	9.7'	61.2'
21	134°35.6	.. 36.6	114°17.8	6.1'	10°56.3	9.6'	61.2'
22	149°35.7	37.5	128°42.9	6.1'	11°05.9	9.6'	61.1'
23	164°35.9	38.5	143°08.0	6.1'	11°15.4	9.5'	61.1'
	SD.=16.0	d=0.9			S.D.=16.7		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°		02:59	04:22	19:46	21:10	
N 70°	01:18	03:22	04:33	19:34	20:46	22:59
68°	02:05	03:39	04:42	19:24	20:28	22:06
66°	02:34	03:53	04:50	19:17	20:14	21:35
64°	02:55	04:05	04:56	19:10	20:02	21:12
62°	03:12	04:14	05:01	19:04	19:52	20:55
60°	03:26	04:22	05:06	18:59	19:44	20:41
N 58°	03:37	04:29	05:10	18:55	19:37	20:29
56°	03:47	04:35	05:14	18:51	19:30	20:19
54°	03:56	04:41	05:17	18:48	19:25	20:10
52°	04:03	04:46	05:20	18:45	19:20	20:03
50°	04:10	04:50	05:23	18:42	19:15	19:56
48°	04:23	04:59	05:29	18:36	19:06	19:42
N 40°	04:34	05:06	05:34	18:31	18:58	19:31
35°	04:42	05:13	05:38	18:26	18:52	19:22
30°	04:49	05:18	05:42	18:23	18:47	19:15
20°	05:00	05:26	05:48	18:16	18:38	19:04
N 10°	05:08	05:33	05:54	18:10	18:32	18:56
0°	05:14	05:38	05:59	18:05	18:26	18:50
S 10°	05:18	05:43	06:04	18:00	18:21	18:46
20°	05:21	05:47	06:07	17:55	18:17	18:43
30°	05:23	05:50	06:14	17:49	18:13	18:41
35°	05:23	05:52	06:18	17:46	18:11	18:40
40°	05:23	05:54	06:21	17:42	18:09	18:40
45°	05:22	05:56	06:26	17:38	18:07	18:41
S 50°	05:21	05:58	06:31	17:33	18:05	18:42
52°	05:20	05:59	06:33	17:30	18:04	18:43
54°	05:19	06:00	06:35	17:28	18:03	18:44
56°	05:18	06:01	06:38	17:25	18:02	18:45
58°	05:16	06:02	06:41	17:22	18:01	18:46
S 60°	05:14	06:03	06:44	17:18	18:00	18:48
Day	Moonrise		Moonset			
Day	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer. Pass Upper hh:mm	Mer. Pass Lower hh:mm	Age 28-1 1-2%	
06	02:26	02:17	12:02	11:11	23:39	
07	02:09	02:00	12:02	12:07	—	
08	01:52	01:44	12:02	13:04	00:36	

**April 09, 10, 11 UT (Sat., Sun., Mon.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sat	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	197°40.1	193°20.1	N00°14.5	310°49.0	S21°02.2	31°14.6	N07°23.0	302°25.7	S20°57.2								Alpheratz	357°41.8	29°10.6				
1	212°42.6	208°19.8	15.7	325°51.2	02.3	46°17.2	23.1	317°28.2	57.2							Ankaa	353°14.3	-42°13.1					
2	227°45.1	223°19.4	17.0	340°53.4	02.4	61°19.9	23.2	332°30.7	57.2							Schedar	349°38.8	56°37.4					
3	242°47.5	238°19.0	18.2	355°55.6	02.5	76°22.6	23.3	347°33.3	57.2							Diphda	348°54.3	-17°54.0					
4	257°50.0	253°18.6	19.4	10°57.8	02.6	91°25.3	23.4	2°35.8	57.2							Achernar	335°26.1	-57°09.4					
5	272°52.5	268°18.3	20.6	26°00.1	02.7	106°27.9	23.4	17°38.3	57.2							Hamal	327°58.9	23°32.1					
6	287°54.9	283°17.9	N00°21.9	41°02.3	S21°02.8	121°30.6	N07°23.5	32°40.9	S20°57.1							Polaris	317°18.7	89°20.0					
7	302°57.4	298°17.5	23.1	56°04.5	02.9	136°33.3	23.6	47°43.4	57.1							Acamar	315°17.3	-40°14.7					
8	317°59.9	313°17.2	24.3	71°06.7	03.0	151°35.9	23.7	62°45.9	57.1							Menkar	314°13.4	4°08.9					
9	333°02.3	328°16.8	25.5	86°09.0	03.1	166°38.6	23.8	77°48.4	57.1							Mirfak	308°38.0	49°55.0					
10	348°04.8	343°16.4	26.8	101°11.2	03.2	181°41.3	23.8	92°51.0	57.1							Aldebaran	290°47.4	16°32.2					
11	3°07.3	358°16.1	28.0	116°13.4	03.3	196°43.9	23.9	107°53.5	57.1							Rigel	281°10.4	-8°11.3					
12	18°09.7	13°15.7	N00°29.2	131°15.6	S21°03.4	211°46.6	N07°24.0	122°56.0	S20°57.1							Capella	280°31.9	46°00.7					
13	33°12.2	28°15.3	30.4	146°17.9	03.5	226°49.3	24.1	137°58.6	57.1							Bellatrix	278°30.1	6°21.5					
14	48°14.6	43°15.0	31.6	161°20.1	03.7	241°51.9	24.2	153°01.1	57.1							Elnath	278°10.4	28°37.1					
15	63°17.1	58°14.6	32.9	176°22.3	03.8	256°54.6	24.2	168°03.6	57.1							Alnilam	275°44.6	-1°11.8					
16	78°19.6	73°14.2	34.1	191°24.6	03.9	271°57.3	24.3	183°06.1	57.0							Betelgeuse	270°59.4	7°24.3					
17	93°22.0	88°13.9	35.3	206°26.8	04.0	287°00.0	24.4	198°08.7	57.0							Canopus	263°55.4	-52°42.8					
18	108°24.5	103°13.5	N00°36.5	221°29.0	S21°04.1	302°02.6	N07°24.5	213°11.2	S20°57.0							Sirius	258°32.1	-16°44.7					
19	123°27.0	118°13.1	37.8	236°31.3	04.2	317°05.3	24.6	228°13.7	57.0							Adhara	255°11.1	-29°00.1					
20	138°29.4	133°12.7	39.0	251°33.5	04.3	332°08.0	24.6	243°16.3	57.0							Procyon	244°57.8	5°10.7					
21	153°31.9	148°12.4	40.2	266°35.7	04.4	347°10.6	24.7	258°18.8	57.0							Pollux	243°25.4	27°59.1					
22	168°34.4	163°12.0	41.4	281°38.0	04.5	2°13.3	24.8	273°21.3	57.0							Avior	234°17.0	-59°34.2					
23	183°36.8	178°11.6	42.7	296°40.2	04.6	17°16.0	24.9	288°23.9	57.0							Suhail	222°50.8	-43°30.3					
Mer.pass.:10:48				v-0.4 d1.2 m-3.8				v2.2 d-0.1 m-0.8				v2.7 d0.1 m-2.2				v2.5 d0.0 m0.3							
Sun	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	198°39.3	193°11.3	N00°43.9	311°42.5	S21°04.7	32°18.6	N07°24.9	303°26.4	S20°57.0							Denebola	182°31.5	14°28.8					
1	213°41.7	208°10.9	45.1	326°44.7	04.8	47°21.3	25.0	318°28.9	57.0							Gienah	175°50.0	-17°38.0					
2	228°44.2	223°10.5	46.3	341°47.0	04.9	62°23.9	25.1	333°31.4	56.9							Acrux	173°06.4	-63°11.4					
3	243°46.7	238°10.2	47.6	356°49.2	05.0	77°26.6	25.2	348°34.0	56.9							Gacrux	171°58.1	-57°12.3					
4	258°49.1	253°09.8	48.8	11°51.5	05.1	92°29.3	25.3	3°36.5	56.9							Alioth	166°18.6	55°52.3					
5	273°51.6	268°09.4	50.0	26°53.7	05.2	107°31.9	25.3	18°39.0	56.9							Spica	158°28.9	-11°14.8					
6	288°54.1	283°09.1	N00°51.2	41°56.0	S21°05.3	122°34.6	N07°25.4	33°41.6	S20°56.9							Alkaid	152°57.0	49°13.9					
7	303°56.5	298°08.7	52.5	56°58.2	05.4	137°37.3	25.5	48°44.1	56.9							Hadar	148°44.4	-60°27.0					
8	318°59.0	313°08.3	53.7	72°00.5	05.5	152°39.9	25.6	63°46.6	56.9							Menkent	148°04.9	-36°26.9					
9	334°01.5	328°08.0	54.9	87°02.7	05.6	167°42.6	25.6	78°49.2	56.9							Arcturus	145°53.7	19°05.9					
10	349°03.9	343°07.6	56.1	102°05.0	05.7	182°45.3	25.7	93°51.7	56.9							Rigel Kent.	139°48.4	-60°53.9					
11	4°06.4	358°07.2	57.3	117°07.2	05.8	197°47.9	25.8	108°54.2	56.8							Kochab	137°19.2	74°05.3					
12	19°08.9	13°06.8	N00°58.6	132°09.5	S21°05.9	212°50.6	N07°25.9	123°56.8	S20°56.8							Zuben' ubi	137°03.0	-16°06.5					
13	34°11.3	28°06.5	00°59.8	147°11.7	06.0	227°53.2	25.9	138°59.3	56.8							Alphecca	126°09.1	26°39.6					
14	49°13.8	43°06.1	01°01.0	162°14.0	06.1	242°55.9	26.0	154°01.8	56.8							Antares	112°23.7	-26°27.9					
15	64°16.2	58°05.7	02.2	177°16.3	06.2	257°58.6	26.1	169°04.4	56.8							Atria	107°23.4	-69°03.0					
16	79°18.7	73°05.4	03.5	192°18.5	06.3	273°01.2	26.2	184°06.9	56.8							Sabik	102°10.2	-15°44.5					
17	94°21.2	88°05.0	04.7	207°20.8	06.4	288°03.9	26.2	199°09.4	56.8							Shaula	96°19.2	-37°06.6					
18	109°23.6	103°04.6	N01°05.9	222°23.1	S21°06.5	303°06.6	N07°26.3	214°12.0	S20°56.8							Rasalhague	96°04.5	12°32.9					
19	124°26.1	118°04.3	07.1	237°25.3	06.6	318°09.2	26.4	229°14.5	56.8							Eltanin	90°45.1	51°29.1					
20	139°28.6	133°03.9	08.4	252°27.6	06.7	333°11.9	26.5	244°17.0	56.8							Kaus Aust.	83°41.2	-34°22.3					
21	154°31.0	148°03.5	09.6	267°29.9	06.8	348°14.5	26.6	259°19.6	56.7							Vega	80°37.6	38°47.8					
22	169°33.5	163°03.2	10.8	282°32.1	06.9	3°17.2	26.6	274°22.1	56.7							Nunki	75°55.9	-26°16.3					
23	184°36.0	178°02.8	12.0	297°34.4	07.0	18°19.9	26.7	289°24.6	56.7							Altair	62°06.4	8°54.7					
Mer.pass.:10:44				v-0.4 d1.2 m-3.8				v2.2 d-0.1 m-0.8				v2.7 d0.1 m-2.2				v2.5 d0.0 m0.3							
Mon	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	199°38.4	193°02.4	N01°13.3	312°36.7	S21°07.1	33°22.5	N07°26.8	304°27.2	S20°56.7								Apr 09 Sat	SHA	Mer.pass				
1	214°40.9	208°02.1	14.5	327°39.0	07.2	48°25.2	26.9	319°29.7	56.7							Venus	355°40.0	11:07					
2	229°43.4	223°01.7	15.7	342°41.2	07.3	63°27.8	26.9	334°32.3	56.7							Mars	113°08.8	03:16					
3	244°45.8	238°01.3	16.9	357°43.5	07.4	78°30.5	27.0	349°34.8	56.7							Jupiter	193°34.4	21:51					
4	259°48.3	253°01.0	18.2	12°45.8	07.5	93°33.2	27.1	4°37.3	56.7							Saturn	104°45.5	03:50					
5	274°50.7	268°00.6	19.4	27°48.1	07.6	108°35.8	27.2	19°39.9	56.7														
6	289°53.2	283°00.2	N01°20.6	42°50.4	S21°07.2	123°38.5	N07°27.2	34°42.4	S20°56.6								Apr 10 Sun	SHA	Mer.pass				
7	304°55.7	297°59.8	21.8	57°52.6	07.8	138°41.1	27.3	49°44.9	56.6							Venus	354°32.0	11:08					
8	319°58.1	312°59.5	23.0	72°54.9	07.9	153°43.8	27.4	64°47.5	56.6							Mars	113°03.2	03:13					
9	335°00.6	327°59.1	24.3</td																				

DUT1 = UT1-UTC = -0.0964 sec ΔT = TT-UT1 = +68.2804 sec

2016 April 09 to Apr. 11 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	179°36.1	N07°39.4	157°33.1	6.1'	N11°24.8	9.4'	61.1'
1	194°36.2	40.3	171°58.2	6.1'	11°34.2	9.3'	61.1'
2	209°36.4	41.2	186°23.2	6.1'	11°43.4	9.2'	61.1'
3	224°36.6	.. 42.2	200°48.3	6.0'	11°52.6	9.1'	61.1'
4	239°36.7	43.1	215°13.3	6.0'	12°01.7	9.0'	61.0'
5	254°36.9	44.0	229°38.3	6.0'	12°10.7	9.0'	61.0'
6	269°37.1	N07°45.0	244°03.3	6.0'	N12°19.6	8.9'	61.0'
7	284°37.2	45.9	258°28.3	6.0'	12°28.4	8.8'	61.0'
8	299°37.4	46.8	272°53.3	6.0'	12°37.1	8.7'	61.0'
9	314°37.6	.. 47.7	287°18.2	5.9'	12°45.8	8.6'	60.9'
10	329°37.8	48.7	301°43.1	5.9'	12°54.3	8.5'	60.9'
11	344°37.9	49.6	316°08.1	5.9'	13°02.7	8.4'	60.9'
12	359°38.1	N07°50.5	330°33.0	5.9'	N13°11.1	8.3'	60.9'
13	14°38.3	51.4	344°57.9	5.9'	13°19.3	8.2'	60.8'
14	29°38.4	52.4	359°22.7	5.9'	13°27.5	8.1'	60.8'
15	44°38.6	.. 53.3	13°47.6	5.9'	13°35.5	8.0'	60.8'
16	59°38.8	54.2	28°12.5	5.9'	13°43.4	7.9'	60.8'
17	74°38.9	55.1	42°37.3	5.9'	13°51.3	7.8'	60.8'
18	89°39.1	N07°56.1	57°02.2	5.8'	N13°59.0	7.7'	60.7'
19	104°39.3	57.0	71°27.0	5.8'	14°06.7	7.6'	60.7'
20	119°39.4	57.9	85°51.9	5.8'	14°14.2	7.5'	60.7'
21	134°39.6	.. 58.8	100°16.7	5.8'	14°21.6	7.4'	60.6'
22	149°39.8	07°59.8	114°41.5	5.8'	14°29.0	7.3'	60.6'
23	164°39.9	08°00.7	129°06.3	5.8'	14°36.2	7.2'	60.6'
	SD.=16.0	d=0.9			S.D.=16.6		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
09	01:36	01:28	12:01	2:4
10	01:20	01:12	12:01	2:4
11	01:04	00:56	12:01	2:4



SD.=15.9	d=0.9	S.D.=16.2
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**April 12, 13, 14 UT (Tue., Wed., Thu.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Tue	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	200°37.6	192°53.6	N01°42.6	313°31.6	S21°09.5	34°26.3	N07°28.6	305°28.1	S20°56.4								Alpheratz	357°41.8	29°10.6				
1	215°40.0	207°53.2	43.8	328°33.9	09.6	49°28.9	28.6	320°30.6	56.4								Ankaa	353°14.3	-42°13.1				
2	230°42.5	222°52.8	45.1	343°36.2	09.7	64°31.6	28.7	335°33.2	56.4								Schedar	349°38.8	56°37.4				
3	245°45.0	237°52.5	.. 46.3	358°38.5	.. 09.8	79°34.2	.. 28.8	350°35.7	.. 56.4								Diphda	348°54.3	-17°54.0				
4	260°47.4	252°52.1	47.5	13°40.8	09.9	94°36.9	28.8	5°38.2	56.4								Achernar	335°26.1	-57°09.4				
5	275°49.9	267°51.7	48.7	28°43.2	09.9	109°39.6	28.9	20°40.8	56.4								Hamal	327°58.9	23°32.1				
6	290°52.3	282°51.4	N01°50.0	43°45.5	S21°10.0	124°42.2	N07°29.0	35°43.3	S20°56.4								Polaris	317°19.0	89°20.0				
7	305°54.8	297°51.0	51.2	58°47.8	10.1	139°44.9	29.1	50°45.9	56.4								Acamar	315°17.3	-40°14.7				
8	320°57.3	312°50.6	52.4	73°50.1	10.2	154°47.5	29.1	65°48.4	56.4								Menkar	314°13.4	4°08.9				
9	335°59.7	327°50.3	.. 53.6	88°52.4	.. 10.3	169°50.2	.. 29.2	80°50.9	.. 56.3								Mirfak	308°38.0	49°55.0				
10	351°02.2	342°49.9	54.9	103°54.7	10.4	184°52.8	29.3	95°53.5	56.3								Aldebaran	290°47.4	16°32.2				
11	6°04.7	357°49.5	56.1	118°57.0	10.5	199°55.5	29.3	110°56.0	56.3								Rigel	281°10.4	-8°11.3				
12	21°07.1	12°49.1	N01°57.3	133°59.4	S21°10.6	214°58.1	N07°29.4	125°58.6	S20°56.3								Capella	280°31.9	46°00.7				
13	36°09.6	27°48.8	58.5	149°01.7	10.7	230°00.8	29.5	141°01.1	56.3								Bellatrix	278°30.2	6°21.5				
14	51°12.1	42°48.4	01°59.7	164°04.0	10.8	245°03.4	29.6	156°03.7	56.3								El Nath	278°10.4	28°37.1				
15	66°14.5	57°48.0	02°01.0	179°06.3	.. 10.9	260°06.1	.. 29.6	171°06.2	.. 56.3								Alnilam	275°44.6	-1°11.8				
16	81°17.0	72°47.7	02.2	194°08.7	11.0	275°08.7	29.7	186°08.7	56.3								Betelgeuse	270°59.4	7°24.3				
17	96°19.5	87°47.3	03.4	209°11.0	11.1	290°11.4	29.8	201°11.3	56.3								Canopus	263°55.5	-52°42.8				
18	111°21.9	102°46.9	N02°04.6	224°13.3	S21°11.2	305°14.0	N07°29.8	216°13.8	S20°56.2								Sirius	258°32.1	-16°44.7				
19	126°24.4	117°46.6	05.9	239°15.6	11.3	320°16.7	29.9	231°16.4	56.2								Adhara	255°11.1	-29°00.1				
20	141°26.8	132°46.2	07.1	254°18.0	11.4	335°19.3	30.0	246°18.9	56.2								Procyon	244°57.8	5°10.7				
21	156°29.3	147°45.8	.. 08.3	269°20.3	.. 11.5	350°22.0	.. 30.0	261°21.4	.. 56.2								Pollux	243°25.4	27°59.1				
22	171°31.8	162°45.4	09.5	284°22.6	11.6	5°24.6	30.1	276°24.0	56.2								Avior	234°17.1	-59°34.2				
23	186°34.2	177°45.1	10.7	299°25.0	11.7	20°27.3	30.2	291°26.5	56.2								Suhail	222°50.8	-43°30.3				
Mer.pass.:10:36				v-0.4 d1.2 m-3.8				v2.3 d-0.1 m-0.9				v2.7 d0.1 m-2.2				v2.5 d0.0 m0.3							
Wed	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	201°36.7	192°44.7	N02°12.0	314°27.3	S21°11.8	35°29.9	N07°30.3	306°29.1	S20°56.2								Denebola	182°31.5	14°28.8				
1	216°39.2	207°44.3	13.2	329°29.6	11.9	50°32.6	30.3	321°31.6	56.2								Gienah	175°50.0	-17°38.1				
2	231°41.6	222°44.0	14.4	344°32.0	11.9	65°35.2	30.4	336°34.2	56.2								Acrua	173°06.4	-63°11.5				
3	246°44.1	237°43.6	.. 15.6	359°34.3	.. 12.0	80°37.9	.. 30.5	351°36.7	.. 56.1								Gacrux	171°58.1	-57°12.4				
4	261°46.6	252°43.2	16.9	14°36.6	12.1	95°40.5	30.5	6°39.3	56.1								Alioth	166°18.6	55°52.3				
5	276°49.0	267°42.9	18.1	29°39.0	12.2	110°43.1	30.6	21°41.8	56.1								Spica	158°28.9	-11°14.8				
6	291°51.5	282°42.5	N02°19.3	44°41.3	S21°12.3	125°45.8	N07°30.7	36°44.3	S20°56.1								Alkaid	152°57.0	49°13.9				
7	306°54.0	297°42.1	20.5	59°43.7	12.4	140°48.4	30.7	51°46.9	56.1								Hadar	148°44.4	-60°27.0				
8	321°56.4	312°41.7	21.7	74°46.0	12.5	155°51.1	30.8	66°49.4	56.1								Menkent	148°04.9	-36°26.9				
9	336°58.9	327°41.4	.. 23.0	89°48.4	.. 12.6	170°53.7	.. 30.9	81°52.0	.. 56.1								Arcturus	145°53.7	19°05.9				
10	352°01.3	342°41.0	24.2	104°50.7	12.7	185°56.4	31.0	96°54.5	56.1								Rigel Kent.	139°48.4	-60°54.0				
11	7°03.8	357°40.6	25.4	119°53.0	12.8	200°59.0	31.0	111°57.1	56.1								Kochab	137°19.2	74°05.3				
12	22°06.3	12°40.3	N02°26.6	134°55.4	S21°12.9	216°01.7	N07°31.1	126°59.6	S20°56.0								Zuben' ubi	137°03.0	-16°06.5				
13	37°08.7	27°39.9	27.8	149°57.8	13.0	231°04.3	31.2	142°02.2	56.0								Alphecca	126°09.1	26°39.6				
14	52°11.2	42°39.5	29.1	165°00.1	13.1	246°07.0	31.2	157°04.7	56.0								Antares	112°23.7	-26°27.9				
15	67°13.7	57°39.2	.. 30.3	180°02.5	.. 13.2	261°09.6	.. 31.3	172°07.2	.. 56.0								Atria	107°23.4	-69°03.0				
16	82°16.1	72°38.8	31.5	195°04.8	13.3	276°12.2	31.4	187°09.8	56.0								Sabik	102°10.2	-15°44.5				
17	97°18.6	87°38.4	32.7	210°07.2	13.3	291°14.9	31.4	202°12.3	56.0								Shaula	96°19.1	-37°06.6				
18	112°21.1	102°38.0	N02°33.9	225°09.5	S21°13.4	306°17.5	N07°31.5	217°14.9	S20°56.0								Rasalhague	96°04.5	12°32.9				
19	127°23.5	117°37.7	35.2	240°11.9	13.5	321°20.2	31.6	232°17.4	56.0								Eltanin	90°45.0	51°29.1				
20	142°26.0	132°37.3	36.4	255°14.2	13.6	336°22.8	31.6	247°20.0	55.9								Kaus Aust.	83°41.2	-34°22.3				
21	157°28.5	147°36.9	.. 37.6	270°16.6	.. 13.7	351°25.5	.. 31.7	262°22.5	.. 55.9								Vega	80°37.5	38°47.8				
22	172°30.9	162°36.6	38.8	285°19.0	13.8	6°28.1	31.8	277°25.1	55.9								Nunki	75°55.9	-26°16.3				
23	187°33.4	177°36.2	40.1	300°21.3	13.9	21°30.7	31.8	292°27.6	55.9								Altair	62°06.4	8°54.7				
Mer.pass.:10:32				v-0.4 d1.2 m-3.8				v2.3 d-0.1 m-0.9				v2.6 d0.1 m-2.2				v2.5 d0.0 m0.3							
Thu	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	202°35.8	192°35.8	N02°41.3	315°23.7	S21°14.0	36°33.4	N07°31.9	307°30.2	S20°55.9								Apr 12 Tue	SHA	Mer.pass				
1	217°38.3	207°35.4	42.5	330°26.1	14.1	51°36.0	32.0	322°32.7	55.9								Venus	352°16.0	11:09				
2	232°40.8	222°35.1	43.7	345°28.4	14.2	66°38.7	32.0	337°35.3	55.9								Mars	112°54.1	03:05				
3	247°43.2	237°34.7	.. 44.9	0°30.8	.. 14.3	81°41.3	.. 32.1	352°37.8	.. 55.9								Jupiter	193°48.7	21:38				
4	262°45.7	252°34.3	46.2	15°33.2	14.4	96°44.0	32.2	7°40.4	55.9								Saturn	104°50.5	03:38				
6	292°50.6	282°33.6	N02°48.6	45°37.9	S21°14.5	126°49.2	N07°32.3	37°45.5	S20°55.8								Apr 13 Wed	SHA	Mer.pass				
7	307°53.1	297°33.2	49.8	60°40.3	14.6	141°51.9	32.4	52°48.0	55.8								Venus	351°08.0	11:09				
8	322°55.6	312°32.8	51.0	75°42.7	14.7	156°54.5</td																	

DUT1 = UT1-UTC = -0.1016 sec ΔT = TT-UT1 = +68.2856 sec

2016 April 12 to Apr. 14 UT

h		Sun		Moon			
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°47.9	N08°45.7	115°34.4	6.7'	N18°08.6	1.4'	58.9'
1	194°48.1	46.6	130°00.1	6.7'	18°10.0	1.3'	58.9'
2	209°48.3	47.5	144°25.9	6.8'	18°11.2	1.2'	58.8'
3	224°48.4	.. 48.4	158°51.6	6.8'	18°12.3	1.1'	58.8'
4	239°48.6	49.3	173°17.5	6.8'	18°13.3	1.0'	58.8'
5	254°48.7	50.2	187°43.3	6.9'	18°14.2	0.8'	58.7'
6	269°48.9	N08°51.1	202°09.3	6.9'	N18°15.0	0.7'	58.7'
7	284°49.1	52.0	216°35.2	7.0'	18°15.7	0.6'	58.6'
8	299°49.2	52.9	231°01.2	7.0'	18°16.2	0.5'	58.6'
9	314°49.4	.. 53.9	245°27.3	7.1'	18°16.6	0.4'	58.6'
10	329°49.5	54.8	259°53.4	7.1'	18°17.0	0.3'	58.5'
11	344°49.7	55.7	274°19.5	7.2'	18°17.2	0.1'	58.5'
12	359°49.9	N08°56.6	288°45.7	7.2'	N18°17.2	0.0'	58.4'
13	14°50.0	57.5	303°12.0	7.3'	18°17.2	-0.1'	58.4'
14	29°50.2	58.4	317°38.3	7.3'	18°17.1	-0.2'	58.4'
15	44°50.3	08°59.3	332°04.6	7.4'	18°16.8	-0.3'	58.3'
16	59°50.5	09°00.2	346°31.0	7.4'	18°16.4	-0.4'	58.3'
17	74°50.7	01.1	0°57.5	7.5'	18°16.0	-0.5'	58.3'
18	89°50.8	N09°02.0	15°24.0	7.5'	N18°15.4	-0.6'	58.2'
19	104°51.0	02.9	29°50.5	7.6'	18°14.7	-0.8'	58.2'
20	119°51.1	03.8	44°17.1	7.6'	18°13.8	-0.9'	58.1'
21	134°51.3	.. 04.7	58°43.8	7.7'	18°12.9	-1.0'	58.1'
22	149°51.5	05.6	73°10.5	7.7'	18°11.9	-1.1'	58.1'
23	164°51.6	06.6	87°37.3	7.8'	18°10.8	-1.2'	58.0'
		SD.=15.9	d=0.9	S.D.=15.9			
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°51.8	N09°07.5	102°04.1	7.9'	N18°09.5	-1.3'	58.0'
1	194°51.9	08.4	116°31.0	7.9'	18°08.1	-1.4'	57.9'
2	209°52.1	09.3	130°58.0	8.0'	18°06.7	-1.5'	57.9'
3	224°52.2	.. 10.2	145°25.0	8.0'	18°05.1	-1.6'	57.9'
4	239°52.4	11.1	159°52.0	8.1'	18°03.4	-1.7'	57.8'
5	254°52.6	12.0	174°19.2	8.2'	18°01.7	-1.8'	57.8'
6	269°52.7	N09°12.9	188°46.3	8.2'	N17°59.8	-1.9'	57.8'
7	284°52.9	13.8	203°13.6	8.3'	17°57.8	-2.0'	57.7'
8	299°53.0	14.7	217°40.9	8.3'	17°55.7	-2.1'	57.7'
9	314°53.2	.. 15.6	232°08.3	8.4'	17°53.5	-2.2'	57.6'
10	329°53.3	16.5	246°35.7	8.5'	17°51.2	-2.3'	57.6'
11	344°53.5	17.4	261°03.2	8.5'	17°48.8	-2.4'	57.6'
12	359°53.6	N09°18.3	275°30.7	8.6'	N17°46.3	-2.5'	57.5'
13	14°53.8	19.2	289°58.3	8.6'	17°43.7	-2.6'	57.5'
14	29°54.0	20.1	304°26.0	8.7'	17°41.0	-2.7'	57.5'
15	44°54.1	.. 21.0	318°53.7	8.8'	17°38.2	-2.8'	57.4'
16	59°54.3	21.9	333°21.5	8.8'	17°35.4	-2.9'	57.4'
17	74°54.4	22.8	347°49.4	8.9'	17°32.4	-3.0'	57.4'
18	89°54.6	N09°23.7	2°17.3	9.0'	N17°29.3	-3.1'	57.3'
19	104°54.7	24.6	16°45.3	9.0'	17°26.1	-3.2'	57.3'
20	119°54.9	25.5	31°13.4	9.1'	17°22.8	-3.3'	57.2'
21	134°55.0	.. 26.4	45°41.5	9.2'	17°19.5	-3.4'	57.2'
22	149°55.2	27.3	60°09.7	9.2'	17°16.0	-3.5'	57.2'
23	164°55.4	28.2	74°37.9	9.3'	17°12.5	-3.6'	57.1'
		SD.=15.9	d=0.9	S.D.=15.7			
Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°55.5	N09°29.1	89°06.3	9.3'	N17°08.8	-3.7'	57.1'
1	194°55.7	30.0	103°34.6	9.4'	17°05.1	-3.8'	57.1'
2	209°55.8	30.9	118°03.1	9.5'	17°01.3	-3.9'	57.0'
3	224°56.0	.. 31.8	132°31.6	9.5'	16°57.4	-4.0'	57.0'
4	239°56.1	32.7	147°00.2	9.6'	16°53.4	-4.0'	57.0'
5	254°56.3	33.6	161°28.8	9.7'	16°49.3	-4.1'	56.9'
6	269°56.4	N09°34.5	175°57.5	9.7'	N16°45.1	-4.2'	56.9'
7	284°56.6	35.4	190°26.3	9.8'	16°40.8	-4.3'	56.9'
8	299°56.7	36.3	204°55.1	9.9'	16°36.5	-4.4'	56.8'
9	314°56.9	.. 37.2	219°24.1	9.9'	16°32.1	-4.5'	56.8'
10	329°57.0	38.1	233°53.0	10.0'	16°27.6	-4.6'	56.8'
11	344°57.2	39.0	248°22.1	10.1'	16°23.0	-4.6'	56.7'
12	359°57.4	N09°39.9	262°51.2	10.1'	N16°18.3	-4.7'	56.7'
13	14°57.5	40.8	277°20.3	10.2'	16°13.5	-4.8'	56.7'
14	29°57.7	41.7	291°49.6	10.3'	16°08.7	-4.9'	56.6'
15	44°57.8	.. 42.6	306°18.9	10.3'	16°03.7	-5.0'	56.6'
16	59°58.0	43.5	320°48.2	10.4'	15°58.7	-5.0'	56.6'
17	74°58.1	44.3	335°17.7	10.5'	15°53.7	-5.1'	56.5'
18	89°58.3	N09°45.2	349°47.2	10.5'	N15°48.5	-5.2'	56.5'
19	104°58.4	46.1	4°16.7	10.6'	15°43.3	-5.3'	56.5'
20	119°58.6	47.0	18°46.4	10.7'	15°38.0	-5.3'	56.4'
21	134°58.7	.. 47.9	33°16.1	10.7'	15°32.6	-5.4'	56.4'
22	149°58.9	48.8	47°45.8	10.8'	15°27.1	-5.5'	56.4'
23	164°59.0	49.7	62°15.7	10.9'	15°21.6	-5.6'	56.3'
		SD.=15.9	d=0.9	S.D.=15.4			

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

**April 15, 16, 17 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	203°35.0	192°26.9	N03°10.5	316°20.9	S21°16.2	37°36.7	N07°33.5	308°31.4	S20°55.6					Alpheratz	357°41.8	
1	218°37.4	207°26.5	11.8	331°23.3	16.2	52°39.3	33.5	323°33.9	55.6					Ankaa	353°14.3	
2	233°39.9	222°26.1	13.0	346°25.7	16.3	67°42.0	33.6	338°36.5	55.6					Schedar	349°38.8	
3	248°42.4	237°25.8	14.2	1°28.1	16.4	82°44.6	33.7	353°39.0	55.6					Diphda	348°54.3	
4	263°44.8	252°25.4	15.4	16°30.5	16.5	97°47.3	33.7	8°41.6	55.6					Achernar	335°26.1	
5	278°47.3	267°25.0	16.6	31°32.9	16.6	112°49.9	33.8	23°44.1	55.6					Hamal	327°58.9	
6	293°49.8	282°24.7	N03°17.8	46°35.3	S21°16.7	127°52.5	N07°33.9	38°46.7	S20°55.5					Polaris	317°19.3	
7	308°52.2	297°24.3	19.1	61°37.7	16.8	142°55.2	33.9	53°49.2	55.5					Acamar	315°17.3	
8	323°54.7	312°23.9	20.3	76°40.1	16.9	157°57.8	34.0	68°51.8	55.5					Menkar	314°13.4	
9	338°57.2	327°23.5	21.5	91°42.5	17.0	173°00.4	34.1	83°54.3	55.5					Mirfak	308°38.0	
10	353°59.6	342°23.2	22.7	106°44.9	17.0	188°03.1	34.1	98°56.9	55.5					Aldebaran	290°47.4	
11	9°02.1	357°22.8	23.9	121°47.3	17.1	203°05.7	34.2	113°59.4	55.5					Rigel	281°10.4	
12	24°04.6	12°22.4	N03°25.1	136°49.7	S21°17.2	218°08.3	N07°34.2	129°02.0	S20°55.5					Capella	280°31.9	
13	39°07.0	27°22.0	26.4	151°52.1	17.3	233°11.0	34.3	144°04.5	55.5					Bellatrix	278°30.2	
14	54°09.5	42°21.7	27.6	166°54.5	17.4	248°13.6	34.4	159°07.1	55.4					Elnath	278°10.4	
15	69°11.9	57°21.3	28.8	181°57.0	17.5	263°16.2	34.4	174°09.6	55.4					Alnilam	275°44.6	
16	84°14.4	72°20.9	30.0	196°59.4	17.6	278°18.8	34.5	189°12.2	55.4					Betelgeuse	270°59.4	
17	99°16.9	87°20.5	31.2	212°01.8	17.7	293°21.5	34.6	204°14.8	55.4					Canopus	263°55.5	
18	114°19.3	102°20.2	N03°32.4	227°04.2	S21°17.7	308°24.1	N07°34.6	219°17.3	S20°55.4					Sirius	258°32.1	
19	129°21.8	117°19.8	33.7	242°06.6	17.8	323°26.7	34.7	234°19.9	55.4					Adhara	255°11.1	
20	144°24.3	132°19.4	34.9	257°09.1	17.9	338°29.4	34.7	249°22.4	55.4					Procyon	244°57.8	
21	159°26.7	147°19.0	36.1	272°11.5	18.0	353°32.0	34.8	264°25.0	55.4					Pollux	243°25.5	
22	174°29.2	162°18.7	37.3	287°13.9	18.1	8°34.6	34.9	279°27.5	55.3					Avior	234°17.1	
23	189°31.7	177°18.3	38.5	302°16.3	18.2	23°37.3	34.9	294°30.1	55.3					Suhail	222°50.9	
Mer.pass.:10:24			v-0.4 d1.2 m-3.8	v2.4 d-0.1 m-1.0		v2.6 d0.1 m-2.2		v2.6 d0.0 m-0.3								
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	204°34.1	192°17.9	N03°39.7	317°18.8	S21°18.3	38°39.9	N07°35.0	309°32.6	S20°55.3					Denebola	182°31.5	
1	219°36.6	207°17.5	41.0	332°21.2	18.4	53°42.5	35.1	324°35.2	55.3					Gienah	175°50.0	
2	234°39.0	222°17.2	42.2	347°23.6	18.4	68°45.1	35.1	339°37.7	55.3					Acrux	173°06.4	
3	249°41.5	237°16.8	43.4	2°26.1	18.5	83°47.8	35.2	354°40.3	55.3					Gacrux	171°58.1	
4	264°44.0	252°16.4	44.6	17°28.5	18.6	98°50.4	35.2	9°42.9	55.3					Alioth	166°18.6	
5	279°46.4	267°16.0	45.8	32°30.9	18.7	113°53.0	35.3	24°45.4	55.3					Spica	158°28.9	
6	294°48.9	282°15.7	N03°47.0	47°33.4	S21°18.8	128°55.7	N07°35.4	39°48.0	S20°55.2					Alkaid	152°57.0	
7	309°51.4	297°15.3	48.3	62°35.8	18.9	143°58.3	35.4	54°50.5	55.2					Hadar	148°44.4	
8	324°53.8	312°14.9	49.5	77°38.2	19.0	159°00.9	35.5	69°53.1	55.2					Menkent	148°04.9	
9	339°56.3	327°14.5	50.7	92°40.7	19.0	174°03.5	35.5	84°55.6	55.2					Arcturus	145°53.7	
10	354°58.8	342°14.2	51.9	107°43.1	19.1	189°06.2	35.6	99°58.2	55.2					Rigel Kent.	139°48.4	
11	10°01.2	357°13.8	53.1	122°45.6	19.2	204°08.8	35.7	115°00.8	55.2					Kochab	137°19.1	
12	25°03.7	12°13.4	N03°54.3	137°48.0	S21°19.3	219°11.4	N07°35.7	130°03.3	S20°55.2					Zuben' ubi	137°03.0	
13	40°06.2	27°13.0	55.5	152°50.5	19.4	234°14.0	35.8	145°05.9	55.2					Alphecca	126°09.1	
14	55°08.6	42°12.7	56.8	167°52.9	19.5	249°16.7	35.8	160°08.4	55.1					Antares	112°23.6	
15	70°11.1	57°12.3	58.0	182°55.4	19.5	264°19.3	35.9	175°11.0	55.1					Atria	107°23.3	
16	85°13.5	72°11.9	59.2	197°57.8	19.6	279°21.9	36.0	190°13.5	55.1					Sabik	102°10.1	
17	100°16.0	87°11.5	04°00.4	213°00.3	19.7	294°24.6	36.0	205°16.1	55.1					Rasalhague	96°04.5	
18	115°18.5	102°11.2	N04°01.6	228°02.7	S21°19.8	309°27.2	N07°36.1	220°18.7	S20°55.1					Eltanin	90°45.0	
19	130°20.9	117°10.8	02.8	243°05.2	19.9	324°29.8	36.1	235°21.2	55.1					Kaus Aust.	83°41.2	
20	145°23.4	132°10.4	04.0	258°07.6	20.0	339°32.4	36.2	250°23.8	55.1					Vega	80°37.5	
21	160°25.9	147°10.0	05.2	273°10.1	20.1	354°35.0	36.3	265°26.3	55.1					Nunki	75°55.9	
22	175°28.3	162°09.6	06.5	288°12.5	20.1	9°37.7	36.3	280°28.9	55.0					Altair	62°06.4	
23	190°30.8	177°09.3	07.7	303°15.0	20.2	24°40.3	36.4	295°31.5	55.0					Peacock	53°16.4	
Mer.pass.:10:20			v-0.4 d1.2 m-3.8	v2.4 d-0.1 m-1.0		v2.6 d0.1 m-2.2		v2.6 d0.0 m-0.3								
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	205°33.3	192°08.9	N04°08.9	318°17.5	S21°20.3	39°42.9	N07°36.4	310°34.0	S20°55.0					Almael	15°22.2	
1	220°35.7	207°08.5	10.1	333°19.9	20.4	54°45.5	36.5	325°36.6	55.0					Scheat	13°51.8	
2	235°38.2	222°08.1	11.3	348°22.4	20.5	69°48.2	36.6	340°39.1	55.0					Markab	13°36.7	
3	250°40.7	237°07.8	12.5	3°24.8	20.6	84°50.8	36.6	355°41.7	55.0					Apr 15 Fri		
4	265°43.1	252°07.4	13.7	18°27.3	20.6	99°53.4	36.7	10°44.2	55.0					Venus	348°51.9	
5	280°45.6	267°07.0	14.9	33°29.8	20.7	114°56.0	36.7	25°46.8	55.0					Mars	112°45.9	
6	295°48.0	282°06.6	N04°16.2	48°32.2	S21°20.8	129°58.7	N07°36.8	40°49.4	S20°54.9					Jupiter	194°01.7	
7	310°50.5	297°06.2	17.4	63°34.7	20.9	145°01.3	36.8	55°51.9	54.9					Saturn	104°56.4	
8	325°53.0	312°05.9	18.6	78°37.2	21.0	160°03.9	36.9	70°54.5	54.9					Apr 16 Sat		
9	340°55.4	327°05.5	19.8	93°39.7	21.1	175°06.5	37.0	85°57.0	54.9					Venus	347°43.8	
10	355°57.9	342°05.1	21.0	108°42.1	21.1	190°09.1	37.0	100°59.6	54.9					Mars	112°44.7	
11	11°00.4	357°04.7	22.2	123°44.6	21.2	205°11.8	37.1	116°02.2	54.9					Jupiter	194°05.8	
12	26°02.8	12°04.4	N04°23.4	138°47.1	S21°21.3	220°14.4	N07°37.1	131°04.7	S20°54.9					Saturn	104°58.5	
13	41°05.3	27°04.0	24.6	153°49.6	21.4	235°17.0	37.2	146°07.3	54.9					Apr 17 Sun		
14	56°07.8	42°03.6	25.8	168°52.0	21.5	250°19.6	37.2	161°09.9	54.8					Venus	346°35.6	
15	71°10.2	57°03.2	27.1	183°54.5	21.5	265°22.2	37.3	176°12.4	54.8					Mars	112°44.2	
16	86°12.7	72°02.8	28.3	198°57.0	21.6	280°24.8	37.4	191°15.0	54.8					Jupiter	194°09.7	
17	101°15.1	87°02.5	29.5	213°59.5	21.7	295°27.5	37.4	206°17.5	54.8					Saturn	105°00.8	
18	116°17.6	102°02.1	N04°30.7	229°02.0	S21°21.8	310°3										

DUT1 = UT1-UTC = -0.1069 sec  $\Delta T$  = TT-UT1 = +68.2909 sec

2016 April 15 to Apr. 17 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°59.2	N09°50.6	76°45.5	10.9'	N15°16.0	-5.6'	56.3'
1	194°59.3	51.5	91°15.5	11.0'	15°10.3	-5.7'	56.3'
2	209°59.5	52.4	105°45.5	11.0'	15°04.5	-5.8'	56.2'
3	224°59.6	.. 53.3	120°15.6	11.1'	14°58.7	-5.9'	56.2'
4	239°59.8	54.2	134°45.7	11.2'	14°52.8	-5.9'	56.2'
5	254°59.9	55.1	149°16.0	11.2'	14°46.9	-6.0'	56.1'
6	270°00.1	N09°55.9	163°46.2	11.3'	N14°40.8	-6.1'	56.1'
7	285°00.2	56.8	178°16.6	11.4'	14°34.7	-6.1'	56.1'
8	300°00.4	57.7	192°47.0	11.4'	14°28.6	-6.2'	56.1'
9	315°00.5	.. 58.6	207°17.4	11.5'	14°22.4	-6.3'	56.0'
10	330°00.7	09°59.5	221°47.9	11.6'	14°16.1	-6.3'	56.0'
11	345°00.8	10°00.4	236°18.5	11.6'	14°09.7	-6.4'	56.0'
12	0°01.0	N10°01.3	250°49.2	11.7'	N14°03.3	-6.5'	55.9'
13	15°01.1	02.2	265°19.9	11.7'	13°56.8	-6.5'	55.9'
14	30°01.3	03.1	279°50.6	11.8'	13°50.3	-6.6'	55.9'
15	45°01.4	.. 03.9	294°21.5	11.9'	13°43.6	-6.6'	55.8'
16	60°01.6	04.8	308°52.4	11.9'	13°37.0	-6.7'	55.8'
17	75°01.7	05.7	323°23.3	12.0'	13°30.2	-6.8'	55.8'
18	90°01.9	N10°06.6	337°54.3	12.0'	N13°23.5	-6.8'	55.8'
19	105°02.0	07.5	352°25.4	12.1'	13°16.6	-6.9'	55.7'
20	120°02.2	08.4	6°56.5	12.2'	13°09.7	-6.9'	55.7'
21	135°02.3	.. 09.3	21°27.7	12.2'	13°02.7	-7.0'	55.7'
22	150°02.5	10.2	35°58.9	12.3'	12°55.7	-7.0'	55.7'
23	165°02.6	11.0	50°30.2	12.3'	12°48.7	-7.1'	55.6'
	SD.=15.9	d=0.9			S.D.=15.2		

Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°02.8	N10°11.9	65°01.6	12.4'	N12°41.5	-7.2'	55.6'
1	195°02.9	12.8	79°33.0	12.4'	12°34.3	-7.2'	55.6'
2	210°03.0	13.7	94°04.5	12.5'	12°27.1	-7.3'	55.6'
3	225°03.2	.. 14.6	108°36.0	12.6'	12°19.8	-7.3'	55.5'
4	240°03.3	15.5	123°07.6	12.6'	12°12.5	-7.4'	55.5'
5	255°03.5	16.3	137°39.2	12.7'	12°05.1	-7.4'	55.5'
6	270°03.6	N10°17.2	152°10.9	12.7'	N11°57.6	-7.5'	55.5'
7	285°03.8	18.1	166°42.7	12.8'	11°50.2	-7.5'	55.4'
8	300°03.9	19.0	181°14.5	12.8'	11°42.6	-7.6'	55.4'
9	315°04.1	.. 19.9	195°46.3	12.9'	11°35.0	-7.6'	55.4'
10	330°04.2	20.8	210°18.2	12.9'	11°27.4	-7.7'	55.4'
11	345°04.4	21.6	224°50.2	13.0'	11°19.7	-7.7'	55.3'
12	0°04.5	N10°22.5	239°22.2	13.0'	N11°12.0	-7.8'	55.3'
13	15°04.7	23.4	253°54.2	13.1'	11°04.2	-7.8'	55.3'
14	30°04.8	24.3	268°26.4	13.1'	10°56.4	-7.8'	55.3'
15	45°04.9	.. 25.2	282°58.5	13.2'	10°48.5	-7.9'	55.2'
16	60°05.1	26.0	297°30.7	13.2'	10°40.6	-7.9'	55.2'
17	75°05.2	26.9	312°03.0	13.3'	10°32.7	-8.0'	55.2'
18	90°05.4	N10°27.8	326°35.3	13.3'	N10°24.7	-8.0'	55.2'
19	105°05.5	28.7	341°07.6	13.4'	10°16.7	-8.1'	55.1'
20	120°05.7	29.6	355°40.0	13.4'	10°08.6	-8.1'	55.1'
21	135°05.8	.. 30.4	10°12.5	13.5'	10°00.5	-8.1'	55.1'
22	150°06.0	31.3	24°45.0	13.5'	09°52.3	-8.2'	55.1'
23	165°06.1	32.2	39°17.5	13.6'	09°44.1	-8.2'	55.1'
	SD.=15.9	d=0.9			S.D.=15.1		

Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°06.2	N10°33.1	53°50.1	13.6'	N09°35.9	-8.2'	55.0'
1	195°06.4	34.0	68°22.7	13.7'	09°27.6	-8.3'	55.0'
2	210°06.5	34.8	82°55.4	13.7'	09°19.3	-8.3'	55.0'
3	225°06.7	.. 35.7	97°28.1	13.7'	09°11.0	-8.4'	55.0'
4	240°06.8	36.6	112°00.9	13.8'	09°02.6	-8.4'	55.0'
5	255°07.0	37.5	126°33.7	13.8'	08°54.2	-8.4'	54.9'
6	270°07.1	N10°38.3	141°06.5	13.9'	N08°45.8	-8.5'	54.9'
7	285°07.2	39.2	155°39.4	13.9'	08°37.3	-8.5'	54.9'
8	300°07.4	40.1	170°12.3	13.9'	08°28.8	-8.5'	54.9'
9	315°07.5	.. 41.0	184°45.3	14.0'	08°20.3	-8.6'	54.9'
10	330°07.7	41.8	199°18.3	14.0'	08°11.7	-8.6'	54.8'
11	345°07.8	42.7	213°51.4	14.1'	08°03.1	-8.6'	54.8'
12	0°08.0	N10°43.6	228°24.4	14.1'	N07°54.5	-8.6'	54.8'
13	15°08.1	44.5	242°57.6	14.1'	07°45.8	-8.7'	54.8'
14	30°08.2	45.3	257°30.7	14.2'	07°37.1	-8.7'	54.8'
15	45°08.4	.. 46.2	272°03.9	14.2'	07°28.4	-8.7'	54.8'
16	60°08.5	47.1	286°37.1	14.2'	07°19.7	-8.8'	54.7'
17	75°08.7	48.0	301°10.4	14.3'	07°10.9	-8.8'	54.7'
18	90°08.8	N10°48.8	315°43.7	14.3'	N07°02.1	-8.8'	54.7'
19	105°08.9	49.7	330°17.0	14.3'	06°53.3	-8.8'	54.7'
20	120°09.1	50.6	344°50.4	14.4'	06°44.4	-8.9'	54.7'
21	135°09.2	.. 51.4	359°23.8	14.4'	06°35.6	-8.9'	54.7'
22	150°09.4	52.3	13°57.2	14.4'	06°26.7	-8.9'	54.6'
23	165°09.5	53.2	28°30.7	14.5'	06°17.7	-8.9'	54.6'
	SD.=15.9	d=0.9			S.D.=14.9		

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

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

**April 18, 19, 20 UT (Mon., Tue., Wed.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	206°32.4	191°59.8	N04°37.9	319°16.9	S21°22.3	40°45.8	N07°37.8	311°35.5	S20°54.7								Alpheratz	357°41.8	29°10.6				
1	221°34.9	206°59.4	39.1	334°19.4	22.4	55°48.4	37.9	326°38.0	54.7								Ankaa	353°14.3	-42°13.1				
2	236°37.3	221°59.0	40.4	349°21.9	22.4	70°51.0	37.9	341°40.6	54.7								Schedar	349°38.8	56°37.4				
3	251°39.8	236°58.7	41.6	4°24.4	22.5	85°53.6	38.0	356°43.2	54.7								Diphda	348°54.3	-17°54.0				
4	266°42.3	251°58.3	42.8	19°26.9	22.6	100°56.3	38.0	11°45.7	54.7								Achernar	335°26.1	-57°09.4				
5	281°44.7	266°57.9	44.0	34°29.4	22.7	115°58.9	38.1	26°48.3	54.6								Hamal	327°58.9	23°32.1				
6	296°47.2	281°57.5	N04°45.2	49°31.9	S21°22.8	131°01.5	N07°38.1	41°50.9	S20°54.6								Polaris	317°19.7	89°19.9				
7	311°49.6	296°57.1	46.4	64°34.4	22.8	146°04.1	38.2	56°53.4	54.6								Acamar	315°17.4	-40°14.7				
8	326°52.1	311°56.8	47.6	79°36.9	22.9	161°06.7	38.3	71°56.0	54.6								Menkar	314°13.4	4°08.9				
9	341°54.6	326°56.4	48.8	94°39.4	23.0	176°09.3	38.3	86°58.6	54.6								Mirfak	308°38.0	49°54.9				
10	356°57.0	341°56.0	50.0	109°41.9	23.1	191°11.9	38.4	102°01.1	54.6								Aldebaran	290°47.5	16°32.2				
11	11°59.5	356°55.6	51.2	124°44.4	23.2	206°14.6	38.4	117°03.7	54.6								Rigel	281°10.4	-8°11.3				
12	27°02.0	11°55.2	N04°52.4	139°46.9	S21°23.2	221°17.2	N07°38.5	132°06.2	S20°54.6								Capella	280°31.9	46°00.7				
13	42°04.4	26°54.8	53.6	154°49.5	23.3	236°19.8	38.5	147°08.8	54.5								Bellatrix	278°30.2	6°21.6				
14	57°06.9	41°54.5	54.8	169°52.0	23.4	251°22.4	38.6	162°11.4	54.5								Elnath	278°10.4	28°37.1				
15	72°09.4	56°54.1	56.1	184°54.5	23.5	266°25.0	38.6	177°13.9	54.5								Alnilam	275°44.6	-1°11.8				
16	87°11.8	71°53.7	57.3	199°57.0	23.6	281°27.6	38.7	192°16.5	54.5								Betelgeuse	270°59.4	7°24.3				
17	102°14.3	86°53.3	58.5	214°59.5	23.6	296°30.2	38.7	207°19.1	54.5								Canopus	263°55.5	-52°42.7				
18	117°16.7	101°52.9	N04°59.7	230°02.0	S21°23.7	311°32.8	N07°38.8	222°21.6	S20°54.5								Sirius	258°32.2	-16°44.7				
19	132°19.2	116°52.5	05°00.9	245°04.5	23.8	326°35.5	38.9	237°24.2	54.5								Adhara	255°11.1	-29°00.1				
20	147°21.7	131°52.2	02.1	260°07.1	23.9	341°38.1	38.9	252°26.8	54.5								Procyon	244°57.8	5°10.7				
21	162°24.1	146°51.8	03.3	275°09.6	24.0	356°40.7	39.0	267°29.3	54.4								Pollux	243°25.5	27°59.1				
22	177°26.6	161°51.4	04.5	290°12.1	24.0	11°43.3	39.0	282°31.9	54.4								Avior	234°17.1	-59°34.2				
23	192°29.1	176°51.0	05.7	305°14.6	24.1	26°45.9	39.1	297°34.5	54.4								Suhail	222°50.9	-43°30.3				
Mer.pass.:10:12				v-0.4	d1.2	m-3.8	v2.5	d-0.1	m-1.1	v2.6	d0.1	m-2.2	v2.6	d0.0	m0.2	Miaplacidus							
Tue				GHA				GHA				GHA				GHA							
0	207°31.5	191°50.6	N05°06.9	320°17.2	S21°24.2	41°48.5	N07°39.1	312°37.0	S20°54.4								Denebola	182°31.5	14°28.8				
1	222°34.0	206°50.2	08.1	335°19.7	24.3	56°51.1	39.2	327°39.6	54.4								Gienah	175°50.0	-17°38.1				
2	237°36.5	221°49.9	09.3	350°22.2	24.3	71°53.7	39.2	342°42.2	54.4								Acrua	173°06.4	-63°11.5				
3	252°38.9	236°49.5	10.5	5°24.7	24.4	86°56.3	39.3	357°44.7	54.4								Gacrux	171°58.1	-57°12.4				
4	267°41.4	251°49.1	11.7	20°27.3	24.5	101°58.9	39.3	12°47.3	54.3								Alioth	166°18.6	55°52.4				
5	282°43.9	266°48.7	12.9	35°29.8	24.6	117°01.6	39.4	27°49.9	54.3								Spica	158°28.9	-11°14.8				
6	297°46.3	281°48.3	N05°14.1	50°32.3	S21°24.7	132°04.2	N07°39.4	42°52.4	S20°54.3								Alkaid	152°57.0	49°14.0				
7	312°48.8	296°47.9	15.3	65°34.9	24.7	147°06.8	39.5	57°55.0	54.3								Hadar	148°44.4	-60°27.0				
8	327°51.2	311°47.6	16.5	80°37.4	24.8	162°09.4	39.5	72°57.6	54.3								Menkent	148°04.9	-36°27.0				
9	342°53.7	326°47.2	17.7	95°40.0	24.9	177°12.0	39.6	88°00.1	54.3								Arcturus	145°53.7	19°05.9				
10	357°56.2	341°46.8	18.9	110°42.5	25.0	192°14.6	39.6	103°02.7	54.3								Rigel Kent.	139°48.4	-60°54.0				
11	12°58.6	356°46.4	20.2	125°45.0	25.0	207°17.2	39.7	118°05.3	54.3								Kochab	137°19.1	74°05.4				
12	28°01.1	11°46.0	N05°21.4	140°47.6	S21°25.1	222°19.8	N07°39.7	133°07.8	S20°54.2								Zuben' ubi	137°03.0	-16°06.5				
13	43°03.6	26°45.6	22.6	155°50.1	25.2	237°22.4	39.8	148°10.4	54.2								Alphecca	126°09.1	26°39.6				
14	58°06.0	41°45.2	23.8	170°52.7	25.3	252°25.0	39.9	163°13.0	54.2								Antares	112°23.6	-26°27.9				
15	73°08.5	56°44.9	25.0	185°55.2	25.3	267°27.6	39.9	178°15.6	54.2								Atria	107°23.3	-69°03.0				
16	88°11.0	71°44.5	26.2	200°57.8	25.4	282°30.2	40.0	193°18.1	54.2								Sabik	102°10.1	-15°44.5				
17	103°13.4	86°44.1	27.4	216°00.3	25.5	297°32.8	40.0	208°20.7	54.2								Shaula	96°19.1	-37°06.6				
18	118°15.9	101°43.7	N05°28.6	231°02.9	S21°25.6	312°35.4	N07°40.1	223°23.3	S20°54.2								Rasalhague	96°04.5	12°32.9				
19	133°18.3	116°43.3	29.8	246°05.4	25.7	327°38.0	40.1	238°25.8	54.1								Eltanin	90°45.0	51°29.1				
20	148°20.8	131°42.9	31.0	261°08.0	25.7	342°40.7	40.2	253°28.4	54.1								Kaus Aust.	83°41.1	-34°22.3				
21	163°23.3	146°42.5	32.2	276°10.5	25.8	357°43.3	40.2	268°31.0	54.1								Vega	80°37.5	38°47.8				
22	178°25.7	161°42.1	33.4	291°13.1	25.9	12°45.9	40.3	283°33.5	54.1								Nunki	75°55.9	-26°16.3				
23	193°28.2	176°41.8	34.6	306°15.6	26.0	27°48.5	40.3	298°36.1	54.1								Altair	62°06.4	8°54.7				
Mer.pass.:10:08				v-0.4	d1.2	m-3.8	v2.5	d-0.1	m-1.1	v2.6	d0.1	m-2.2	v2.6	d0.0	m0.2	Peacock							
Wed				GHA				GHA				GHA				GHA							
0	208°30.7	191°41.4	N05°35.8	321°18.2	S21°26.0	42°51.1	N07°40.4	313°38.7	S20°54.1								Fomalhaut	15°22.2	-29°32.1				
1	223°33.1	206°41.0	37.0	336°20.8	26.1	57°53.7	40.4	328°41.3	54.1								Scheat	13°51.7	28°10.1				
2	238°35.6	221°40.6	38.2	351°23.3	26.2	72°56.3	40.5	343°43.8	54.0								Markab	13°36.6	15°17.4				
3	253°38.1	236°40.2	39.4	6°25.9	26.3	87°58.9	40.5	358°46.4	54.0								Apr 18 Mon	SHA	Mer.pass				
4	268°40.5	251°39.8	40.6	21°28.4	26.3	103°01.5	40.6	13°49.0	54.0								Venus	345°27.4	11:12				
5	283°43.0	266°39.4	41.8	36°31.0	26.4	118°04.1	40.6	28°51.5	54.0							Mars	112°44.5	02:42					
6	298°45.5	281°39.0	N05°43.0	51°33.6	S21°26.5	133°06.7	N07°40.7	43°54.1	S20°54.0							Jupiter	194°13.4	21:13					
7	313°47.9	296°38.7	44.2	66°36.1	26.6	148°09.3	40.7																

DUT1 = UT1-UTC = -0.1121 sec ΔT = TT-UT1 = +68.2961 sec

2016 April 18 to Apr. 20 UT

h	Sun			Moon			
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°09.6	N10°54.1	43°04.2	14.5'	N06°08.8	-9.0'	54.6'
1	195°09.8	54.9	57°37.7	14.5'	05°59.8	-9.0'	54.6'
2	210°09.9	55.8	72°11.3	14.6'	05°50.9	-9.0'	54.6'
3	225°10.1	.. 56.7	86°44.8	14.6'	05°41.9	-9.0'	54.6'
4	240°10.2	57.5	101°18.5	14.6'	05°32.8	-9.0'	54.5'
5	255°10.3	58.4	115°52.1	14.7'	05°23.8	-9.1'	54.5'
6	270°10.5	N10°59.3	130°25.8	14.7'	N05°14.7	-9.1'	54.5'
7	285°10.6	11°00.1	144°59.5	14.7'	05°05.7	-9.1'	54.5'
8	300°10.8	01.0	159°33.2	14.7'	04°56.6	-9.1'	54.5'
9	315°10.9	.. 01.9	174°06.9	14.8'	04°47.4	-9.1'	54.5'
10	330°11.0	02.8	188°40.7	14.8'	04°38.3	-9.1'	54.5'
11	345°11.2	03.6	203°14.5	14.8'	04°29.2	-9.2'	54.4'
12	0°11.3	N11°04.5	217°48.3	14.8'	N04°20.0	-9.2'	54.4'
13	15°11.4	05.4	232°22.2	14.9'	04°10.8	-9.2'	54.4'
14	30°11.6	06.2	246°56.0	14.9'	04°01.6	-9.2'	54.4'
15	45°11.7	.. 07.1	261°29.9	14.9'	03°52.4	-9.2'	54.4'
16	60°11.9	07.9	276°03.8	14.9'	03°43.2	-9.2'	54.4'
17	75°12.0	08.8	290°37.7	14.9'	03°34.0	-9.2'	54.4'
18	90°12.1	N11°09.7	305°11.7	15.0'	N03°24.8	-9.2'	54.4'
19	105°12.3	10.5	319°45.7	15.0'	03°15.5	-9.3'	54.3'
20	120°12.4	11.4	334°19.6	15.0'	03°06.2	-9.3'	54.3'
21	135°12.5	.. 12.3	348°53.6	15.0'	02°57.0	-9.3'	54.3'
22	150°12.7	13.1	3°27.7	15.0'	02°47.7	-9.3'	54.3'
23	165°12.8	14.0	18°01.7	15.0'	02°38.4	-9.3'	54.3'
	SD.=15.9	d=0.9			S.D.=14.8		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°12.9	N11°14.9	32°35.8	15.1'	N02°29.1	-9.3'	54.3'
1	195°13.1	15.7	47°09.8	15.1'	02°19.8	-9.3'	54.3'
2	210°13.2	16.6	61°43.9	15.1'	02°10.5	-9.3'	54.3'
3	225°13.3	.. 17.4	76°18.0	15.1'	02°01.2	-9.3'	54.3'
4	240°13.5	18.3	90°52.1	15.1'	01°51.9	-9.3'	54.2'
5	255°13.6	19.2	105°26.3	15.1'	01°42.5	-9.3'	54.2'
6	270°13.8	N11°20.0	120°00.4	15.1'	N01°33.2	-9.3'	54.2'
7	285°13.9	20.9	134°34.6	15.2'	01°23.9	-9.3'	54.2'
8	300°14.0	21.8	149°08.7	15.2'	01°14.5	-9.3'	54.2'
9	315°14.2	.. 22.6	163°42.9	15.2'	01°05.2	-9.3'	54.2'
10	330°14.3	23.5	178°17.1	15.2'	00°55.8	-9.3'	54.2'
11	345°14.4	24.3	192°51.3	15.2'	00°46.5	-9.3'	54.2'
12	0°14.6	N11°25.2	207°25.5	15.2'	N00°37.2	-9.3'	54.2'
13	15°14.7	26.1	221°59.7	15.2'	00°27.8	-9.3'	54.2'
14	30°14.8	26.9	236°33.9	15.2'	00°18.5	-9.3'	54.2'
15	45°15.0	.. 27.8	251°08.2	15.2'	N00°09.1	-9.3'	54.1'
16	60°15.1	28.6	265°42.4	15.2'	S00°00.2	-9.3'	54.1'
17	75°15.2	29.5	280°16.6	15.2'	00°09.6	-9.3'	54.1'
18	90°15.4	N11°30.3	294°50.9	15.3'	S00°18.9	-9.3'	54.1'
19	105°15.5	31.2	309°25.2	15.3'	00°28.3	-9.3'	54.1'
20	120°15.6	32.1	323°59.4	15.3'	00°37.6	-9.3'	54.1'
21	135°15.7	.. 32.9	338°33.7	15.3'	00°46.9	-9.3'	54.1'
22	150°15.9	33.8	353°07.9	15.3'	00°56.2	-9.3'	54.1'
23	165°16.0	34.6	7°42.2	15.3'	01°05.6	-9.3'	54.1'
	SD.=15.9	d=0.9			S.D.=14.8		

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°16.1	N11°35.5	22°16.5	15.3'	S01°14.9	-9.3'	54.1'
1	195°16.3	36.3	36°50.8	15.3'	01°24.2	-9.3'	54.1'
2	210°16.4	37.2	51°25.0	15.3'	01°33.5	-9.3'	54.1'
3	225°16.5	.. 38.0	65°59.3	15.3'	01°42.8	-9.3'	54.1'
4	240°16.7	38.9	80°33.6	15.3'	01°52.1	-9.3'	54.1'
5	255°16.8	39.7	95°07.8	15.3'	02°01.3	-9.3'	54.0'
6	270°16.9	N11°40.6	109°42.1	15.3'	S02°10.6	-9.3'	54.0'
7	285°17.1	41.5	124°16.4	15.3'	02°19.9	-9.3'	54.0'
8	300°17.2	42.3	138°50.7	15.3'	02°29.1	-9.2'	54.0'
9	315°17.3	.. 43.2	153°24.9	15.3'	02°38.3	-9.2'	54.0'
10	330°17.4	44.0	167°59.2	15.3'	02°47.6	-9.2'	54.0'
11	345°17.6	44.9	182°33.5	15.3'	02°56.8	-9.2'	54.0'
12	0°17.7	N11°45.7	197°07.7	15.3'	S03°06.0	-9.2'	54.0'
13	15°17.8	46.6	211°42.0	15.2'	03°15.2	-9.2'	54.0'
14	30°18.0	47.4	226°16.2	15.2'	03°24.3	-9.2'	54.0'
15	45°18.1	.. 48.3	240°50.4	15.2'	03°33.5	-9.2'	54.0'
16	60°18.2	49.1	255°24.7	15.2'	03°42.6	-9.1'	54.0'
17	75°18.3	50.0	269°58.9	15.2'	03°51.8	-9.1'	54.0'
18	90°18.5	N11°50.8	284°33.1	15.2'	S04°00.9	-9.1'	54.0'
19	105°18.6	51.7	299°07.3	15.2'	04°10.0	-9.1'	54.0'
20	120°18.7	52.5	313°41.5	15.2'	04°19.1	-9.1'	54.0'
21	135°18.9	.. 53.4	328°15.7	15.2'	04°28.1	-9.1'	54.0'
22	150°19.0	54.2	342°49.9	15.2'	04°37.2	-9.0'	54.0'
23	165°19.1	55.0	357°24.1	15.2'	04°46.2	-9.0'	54.0'
	SD.=15.9	d=0.9			S.D.=14.7		

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> 00 <sup>m</sup> 00 <sup>s</sup>	12 <sup>h</sup>	Mer. Pass.	Age
	mm:ss	mm:ss	mm:ss	hh:mm	11-13 88-97%
18	00:39	00:45	11:59	21:46	09:24
19	00:52	00:58	11:59	22:28	10:07
20	01:05	01:11	11:59	23:11	10:49



**April 21, 22, 23 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	209°29.8	191°32.0	N06°04.5	322°20.0	S21°27.8	43°53.5	N07°41.5	314°40.4	S20°53.7	Alpheratz	357°41.8	29°10.6					
1	224°32.3	206°31.6	05.7	337°22.6	27.9	58°56.1	41.6	329°43.0	53.7	Ankaa	353°14.3	-42°13.1					
2	239°34.7	221°31.2	06.9	352°25.2	28.0	73°58.7	41.6	344°45.6	53.7	Schedar	349°38.7	56°37.4					
3	254°37.2	236°30.8	.. 08.1	7°27.8	.. 28.0	89°01.3	.. 41.7	359°48.1	.. 53.7	Diphda	348°54.3	-17°54.0					
4	269°39.7	251°30.4	09.3	22°30.4	28.1	104°03.9	41.7	14°50.7	53.7	Achernar	335°26.1	-57°09.4					
5	284°42.1	266°30.1	10.5	37°33.0	28.2	119°06.5	41.8	29°53.3	53.7	Hamal	327°58.9	23°32.1					
6	299°44.6	281°29.7	N06°11.7	52°35.6	S21°28.2	134°09.0	N07°41.8	44°55.9	S20°53.7	Polaris	317°19.9	89°19.9					
7	314°47.1	296°29.3	12.9	67°38.2	28.3	149°11.6	41.9	59°58.4	53.6	Acamar	315°17.4	-40°14.6					
8	329°49.5	311°28.9	14.1	82°40.8	28.4	164°14.2	41.9	75°01.0	53.6	Menkar	314°13.4	4°08.9					
9	344°52.0	326°28.5	.. 15.3	97°43.4	.. 28.5	179°16.8	.. 42.0	90°03.6	.. 53.6	Mirfak	308°38.0	49°54.9					
10	359°54.4	341°28.1	16.5	112°46.0	28.5	194°19.4	42.0	105°06.2	53.6	Aldebaran	290°47.5	16°32.2					
11	14°56.9	356°27.7	17.7	127°48.6	28.6	209°22.0	42.0	120°08.7	53.6	Rigel	281°10.5	-8°11.3					
12	29°59.4	11°27.3	N06°18.8	142°51.2	S21°28.7	224°24.6	N07°42.1	135°11.3	S20°53.6	Capella	280°31.9	46°00.7					
13	45°01.8	26°26.9	20.0	157°53.9	28.7	239°27.2	42.1	150°13.9	53.6	Bellatrix	278°30.2	6°21.6					
14	60°04.3	41°26.5	21.2	172°56.5	28.8	254°29.8	42.2	165°16.5	53.6	Elnath	278°10.5	28°37.0					
15	75°06.8	56°26.1	.. 22.4	187°59.1	.. 28.9	269°32.4	.. 42.2	180°19.0	.. 53.5	Alnilam	275°44.6	-1°11.8					
16	90°09.2	71°25.7	23.6	203°01.7	29.0	284°35.0	42.3	195°21.6	53.5	Betelgeuse	270°59.4	7°24.3					
17	105°11.7	86°25.3	24.8	218°04.3	29.0	299°37.6	42.3	210°24.2	53.5	Canopus	263°55.5	-52°42.7					
18	120°14.2	101°24.9	N06°26.0	233°06.9	S21°29.1	314°40.2	N07°42.4	225°26.8	S20°53.5	Sirius	258°32.2	-16°44.7					
19	135°16.6	116°24.5	27.2	248°09.5	29.2	329°42.8	42.4	240°29.4	53.5	Adhara	255°11.1	-29°00.1					
20	150°19.1	131°24.1	28.4	263°12.2	29.2	344°45.4	42.5	255°31.9	53.5	Procyon	244°57.8	5°10.7					
21	165°21.6	146°23.7	.. 29.6	278°14.8	.. 29.3	359°47.9	.. 42.5	270°34.5	.. 53.5	Pollux	243°25.5	27°59.1					
22	180°24.0	161°23.4	30.8	293°17.4	29.4	14°50.5	42.5	285°37.1	53.4	Avior	234°17.2	-59°34.2					
23	195°26.5	176°23.0	32.0	308°20.0	29.4	29°53.1	42.6	300°39.7	53.4	Suhail	222°50.9	-43°30.3					
Mer.pass.:10:00			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Alplacidus	221°38.9	-69°47.5					
Fri			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Alphard	217°54.1	-8°44.0					
Sat			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Regulus	207°41.4	11°53.1					
Sun			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Dubhe	193°49.1	61°39.9					
Mon			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Denebola	182°31.5	14°28.8					
Tue			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Gienah	175°50.0	-17°38.1					
Wed			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Acrux	173°06.4	-63°11.5					
Thu			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Gacrux	171°58.1	-57°12.4					
Fri			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Alioth	166°18.6	55°52.4					
Sat			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Spica	158°28.9	-11°14.8					
Sun			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Alkaid	152°57.0	49°14.0					
Mon			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Hadar	148°44.4	-60°27.0					
Tue			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Menkent	148°04.9	-36°27.0					
Wed			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Arcturus	145°53.7	19°05.9					
Thu			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Rigel Kent.	139°48.3	-60°54.0					
Fri			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Kochab	137°19.1	74°05.4					
Sat			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Zuben 'ubi	137°03.0	-16°06.5					
Sun			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Alphecca	126°09.1	26°39.6					
Mon			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Antares	112°23.6	-26°27.9					
Tue			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Atria	107°23.2	-69°03.0					
Wed			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Sabik	102°10.1	-15°44.5					
Thu			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Shaula	96°19.1	-37°06.6					
Fri			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Rasalhague	96°04.5	12°32.9					
Sat			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Eltanin	90°45.0	51°29.1					
Sun			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Kaus Aust.	83°41.1	-34°22.3					
Mon			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Vega	80°37.5	38°47.9					
Tue			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Nunki	75°55.8	-26°16.3					
Wed			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Altair	62°06.3	8°54.7					
Thu			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Peacock	53°16.3	-56°40.6					
Fri			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Deneb	49°30.2	45°20.1					
Sat			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Enif	33°45.4	9°56.9					
Sun			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Al Na'ir	27°41.6	-46°52.7					
Mon			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Fomalhaut	15°22.2	-29°32.1					
Tue			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Scheat	13°51.7	28°10.1					
Wed			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Markab	13°36.6	15°17.4					
Thu			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	Apr 21 Thu	SHA	Mer.pass					
Fri			v-0.4 d1.2 m-3.8	v2.6 d-0.1 m-1.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2	v2.6 d0.0 m-2.2</									

DUT1 = UT1-UTC = -0.1173 sec ΔT = TT-UT1 = +68.3013 sec

2016 April 21 to Apr. 23 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	180°19.2	N11°55.9		11°58.2	15.2'	S04°55.2	-9.0'	54.0'
1	195°19.4	56.7		26°32.4	15.1'	05°04.2	-9.0'	54.0'
2	210°19.5	57.6		41°06.5	15.1'	05°13.1	-9.0'	54.0'
3	225°19.6	.. 58.4		55°40.6	15.1'	05°22.1	-8.9'	54.0'
4	240°19.7	11°59.3		70°14.8	15.1'	05°31.0	-8.9'	54.0'
5	255°19.9	12°00.1		84°48.9	15.1'	05°39.9	-8.9'	54.0'
6	270°20.0	N12°01.0		99°23.0	15.1'	S05°48.8	-8.9'	54.0'
7	285°20.1	01.8		113°57.0	15.1'	05°57.6	-8.8'	54.0'
8	300°20.2	02.7		128°31.1	15.1'	06°06.4	-8.8'	54.0'
9	315°20.4	.. 03.5		143°05.1	15.0'	06°15.2	-8.8'	54.0'
10	330°20.5	04.3		157°39.2	15.0'	06°24.0	-8.8'	54.0'
11	345°20.6	05.2		172°13.2	15.0'	06°32.8	-8.7'	54.0'
12	0°20.7	N12°06.0		186°47.2	15.0'	S06°41.5	-8.7'	54.0'
13	15°20.9	06.9		201°21.1	15.0'	06°50.2	-8.7'	54.0'
14	30°21.0	07.7		215°55.1	15.0'	06°58.8	-8.7'	54.0'
15	45°21.1	.. 08.6		230°29.0	14.9'	07°07.5	-8.6'	54.0'
16	60°21.2	09.4		245°03.0	14.9'	07°16.1	-8.6'	54.0'
17	75°21.4	10.2		259°36.9	14.9'	07°24.7	-8.6'	54.0'
18	90°21.5	N12°11.1		274°10.8	14.9'	S07°33.2	-8.5'	54.0'
19	105°21.6	11.9		288°44.6	14.9'	07°41.8	-8.5'	54.0'
20	120°21.7	12.8		303°18.5	14.8'	07°50.2	-8.5'	54.0'
21	135°21.9	.. 13.6		317°52.3	14.8'	07°58.7	-8.4'	54.0'
22	150°22.0	14.4		332°26.1	14.8'	08°07.1	-8.4'	54.0'
23	165°22.1	15.3		346°59.9	14.8'	08°15.5	-8.4'	54.0'
	SD.=15.9	d=0.8				S.D.=14.7		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°22.2	N12°16.1	1°33.7	14.8'	S08°23.9	-8.3'	54.0'
1	195°22.3	17.0	16°07.4	14.7'	08°32.2	-8.3'	54.0'
2	210°22.5	17.8	30°41.1	14.7'	08°40.5	-8.3'	54.0'
3	225°22.6	.. 18.6	45°14.8	14.7'	08°48.8	-8.2'	54.0'
4	240°22.7	19.5	59°48.5	14.7'	08°57.0	-8.2'	54.0'
5	255°22.8	20.3	74°22.2	14.6'	09°05.2	-8.2'	54.0'
6	270°23.0	N12°21.1	88°55.8	14.6'	S09°13.3	-8.1'	54.0'
7	285°23.1	22.0	103°29.4	14.6'	09°21.4	-8.1'	54.0'
8	300°23.2	22.8	118°03.0	14.6'	09°29.5	-8.1'	54.0'
9	315°23.3	.. 23.7	132°36.5	14.5'	09°37.5	-8.0'	54.0'
10	330°23.4	24.5	147°10.1	14.5'	09°45.5	-8.0'	54.0'
11	345°23.6	25.3	161°43.6	14.5'	09°53.5	-7.9'	54.0'
12	0°23.7	N12°26.2	176°17.0	14.5'	S10°01.4	-7.9'	54.0'
13	15°23.8	27.0	190°50.5	14.4'	10°09.3	-7.9'	54.0'
14	30°23.9	27.8	205°23.9	14.4'	10°17.1	-7.8'	54.0'
15	45°24.0	.. 28.7	219°57.3	14.4'	10°24.9	-7.8'	54.0'
16	60°24.2	29.5	234°30.7	14.4'	10°32.7	-7.7'	54.0'
17	75°24.3	30.3	249°04.0	14.3'	10°40.4	-7.7'	54.0'
18	90°24.4	N12°31.2	263°37.3	14.3'	S10°48.0	-7.6'	54.0'
19	105°24.5	32.0	278°10.6	14.3'	10°55.7	-7.6'	54.0'
20	120°24.6	32.8	292°43.9	14.2'	11°03.2	-7.6'	54.0'
21	135°24.7	.. 33.7	307°17.1	14.2'	11°10.8	-7.5'	54.0'
22	150°24.9	34.5	321°50.3	14.2'	11°18.2	-7.5'	54.0'
23	165°25.0	35.3	336°23.5	14.2'	11°25.7	-7.4'	54.0'
	SD.=15.9	d=0.8			S.D.=14.7		

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°25.1	N12°36.1	350°56.6	14.1'	S11°33.1	-7.4'	54.0'
1	195°25.2	37.0	5°29.7	14.1'	11°40.4	-7.3'	54.0'
2	210°25.3	37.8	20°02.8	14.1'	11°47.7	-7.3'	54.0'
3	225°25.5	.. 38.6	34°35.8	14.0'	11°54.9	-7.2'	54.0'
4	240°25.6	39.5	49°08.8	14.0'	12°02.1	-7.2'	54.1'
5	255°25.7	40.3	63°41.8	14.0'	12°09.3	-7.1'	54.1'
6	270°25.8	N12°41.1	78°14.8	13.9'	S12°16.4	-7.1'	54.1'
7	285°25.9	41.9	92°47.7	13.9'	12°23.4	-7.0'	54.1'
8	300°26.0	42.8	107°20.6	13.9'	12°30.4	-7.0'	54.1'
9	315°26.1	.. 43.6	121°53.5	13.8'	12°37.3	-6.9'	54.1'
10	330°26.3	44.4	136°26.3	13.8'	12°44.2	-6.9'	54.1'
11	345°26.4	45.3	150°59.1	13.8'	12°51.1	-6.8'	54.1'
12	0°26.5	N12°46.1	165°31.8	13.7'	S12°57.8	-6.8'	54.1'
13	15°26.6	46.9	180°04.6	13.7'	13°04.6	-6.7'	54.1'
14	30°26.7	47.7	194°37.3	13.7'	13°11.2	-6.6'	54.1'
15	45°26.8	.. 48.6	209°09.9	13.6'	13°17.8	-6.6'	54.1'
16	60°27.0	49.4	223°42.5	13.6'	13°24.4	-6.5'	54.1'
17	75°27.1	50.2	238°15.1	13.6'	13°30.9	-6.5'	54.1'
18	90°27.2	N12°51.0	252°47.7	13.5'	S13°37.3	-6.4'	54.1'
19	105°27.3	51.8	267°20.2	13.5'	13°43.7	-6.4'	54.2'
20	120°27.4	52.7	281°52.7	13.5'	13°50.1	-6.3'	54.2'
21	135°27.5	.. 53.5	296°25.2	13.4'	13°56.3	-6.2'	54.2'
22	150°27.6	54.3	310°57.6	13.4'	14°02.5	-6.2'	54.2'
23	165°27.7	55.1	325°30.0	13.4'	14°08.7	-6.1'	54.2'
	SD.=15.9	d=0.8			S.D.=14.7		

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	Time		Mer. Pass.	Upper
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass	hh:mm	hh:mm
21	01:17	01:23	11:59	23:54	11:32
22	01:29	01:35	11:58	—	12:15
23	01:40	01:46	11:58	00:37	13:00

**April 24, 25, 26 UT (Sun., Mon., Tue.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	212°27.2	191°03.3	N07°30.0	325°30.4	S21°32.7	46°59.7	N07°44.6	317°46.1	S20°52.7					Alpheratz	357°41.8	
1	227°29.7	206°02.9	31.1	340°33.1	32.8	62°02.3	44.7	332°48.7	52.7					Ankaa	353°14.3	
2	242°32.1	221°02.5	32.3	355°35.8	32.9	77°04.9	44.7	347°51.3	52.7					Schedar	349°38.7	
3	257°34.6	236°02.1	.. 33.5	10°38.5	.. 32.9	92°07.4	.. 44.7	2°53.9	.. 52.7					Diphda	348°54.3	
4	272°37.1	251°01.6	34.7	25°41.2	33.0	107°10.0	44.8	17°56.5	52.7					Achernar	335°26.0	
5	287°39.5	266°01.2	35.8	40°43.9	33.0	122°12.6	44.8	32°59.1	52.6					Hamal	327°58.9	
6	302°42.0	281°00.8	N07°37.0	55°46.6	S21°33.1	137°15.2	N07°44.9	48°01.7	S20°52.6					Polaris	317°19.9	
7	317°44.5	296°00.4	38.2	70°49.3	33.2	152°17.7	44.9	63°04.2	52.6					Acamar	315°17.4	
8	332°46.9	311°00.0	39.4	85°52.0	33.2	167°20.3	44.9	78°06.8	52.6					Menkar	314°13.4	
9	347°49.4	325°59.6	.. 40.5	100°54.7	.. 33.3	182°22.9	.. 45.0	93°09.4	.. 52.6					Mirfak	308°38.0	
10	2°51.9	340°59.2	41.7	115°57.4	33.4	197°25.5	45.0	108°12.0	52.6					Aldebaran	290°47.5	
11	17°54.3	355°58.8	42.9	131°00.1	33.4	212°28.0	45.0	123°14.6	52.6					Rigel	281°10.5	
12	32°56.8	10°58.4	N07°44.1	146°02.8	S21°33.5	227°30.6	N07°45.1	138°17.2	S20°52.5					Capella	280°32.0	
13	47°59.3	25°58.0	45.2	161°05.5	33.5	242°33.2	45.1	153°19.8	52.5					Bellatrix	278°30.2	
14	63°01.7	40°57.6	46.4	176°08.2	33.6	257°35.8	45.1	168°22.3	52.5					Elnath	278°10.5	
15	78°04.2	55°57.1	.. 47.6	191°11.0	.. 33.7	272°38.3	.. 45.2	183°24.9	.. 52.5					Alnilam	275°44.7	
16	93°06.6	70°56.7	48.8	206°13.7	33.7	287°40.9	45.2	198°27.5	52.5					Betelgeuse	270°59.4	
17	108°09.1	85°56.3	49.9	221°16.4	33.8	302°43.5	45.3	213°30.1	52.5					Canopus	263°55.6	
18	123°11.6	100°55.9	N07°51.1	236°19.1	S21°33.9	317°46.1	N07°45.3	228°32.7	S20°52.4					Sirius	258°32.2	
19	138°14.0	115°55.5	52.3	251°21.8	33.9	332°48.6	45.3	243°35.3	52.4					Adhara	255°11.2	
20	153°16.5	130°55.1	53.4	266°24.6	34.0	347°51.2	45.4	258°37.9	52.4					Procyon	244°57.8	
21	168°19.0	145°54.7	.. 54.6	281°27.3	.. 34.0	2°53.8	.. 45.4	273°40.5	.. 52.4					Pollux	243°25.5	
22	183°21.4	160°54.3	55.8	296°30.0	34.1	17°56.3	45.4	288°43.0	52.4					Avior	234°17.2	
23	198°23.9	175°53.9	57.0	311°32.7	34.2	32°58.9	45.5	303°45.6	52.4					Suhail	222°50.9	
Mer.pass.:09:49			v-0.4 d1.2 m-3.8	v2.7 d-0.1 m-1.3	v2.6 d0.0 m-2.1					Miaplacidus	221°38.9					
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.1	
0	213°26.4	190°53.4	N07°58.1	326°35.5	S21°34.2	48°01.5	N07°45.5	318°48.2	S20°52.4					Regulus	207°41.4	
1	228°28.8	205°53.0	07°59.3	341°38.2	34.3	63°04.0	45.5	333°50.8	52.3					Dubhe	193°49.1	
2	243°31.3	220°52.6	08°00.5	356°40.9	34.3	78°06.6	45.6	348°53.4	52.3					Denebola	182°31.5	
3	258°33.8	235°52.2	.. 01.6	11°43.7	.. 34.4	93°09.2	.. 45.6	3°56.0	.. 52.3					Gienah	175°50.0	
4	273°36.2	250°51.8	02.8	26°46.4	34.5	108°11.8	45.7	18°58.6	52.3					Acrux	173°06.4	
5	288°38.7	265°51.4	04.0	41°49.1	34.5	123°14.3	45.7	34°01.2	52.3					Gacrux	171°58.1	
6	303°41.1	280°51.0	N08°05.1	56°51.9	S21°34.6	138°16.9	N07°45.7	49°03.7	S20°52.3					Alioth	166°18.6	
7	318°43.6	295°50.5	06.3	71°54.6	34.6	153°19.5	45.8	64°06.3	52.3					Spica	158°28.9	
8	333°46.1	310°50.1	07.5	86°57.3	34.7	168°22.0	45.8	79°08.9	52.2					Alkaid	152°57.0	
9	348°48.5	325°49.7	.. 08.7	102°00.1	.. 34.8	183°24.6	.. 45.8	94°11.5	.. 52.2					Hadar	148°44.4	
10	3°51.0	340°49.3	09.8	117°02.8	34.8	198°27.2	45.9	109°14.1	52.2					Menkent	148°04.9	
11	18°53.5	355°48.9	11.0	132°05.6	34.9	213°29.7	45.9	124°16.7	52.2					Arcturus	145°53.7	
12	33°55.9	10°48.5	N08°12.2	147°08.3	S21°34.9	228°32.3	N07°45.9	139°19.3	S20°52.2					Rigel Kent.	139°48.3	
13	48°58.4	25°48.1	13.3	162°11.1	35.0	243°34.9	46.0	154°21.9	52.2					Kochab	137°19.1	
14	64°00.9	40°47.6	14.5	177°13.8	35.1	258°37.4	46.0	169°24.5	52.1					Zuben' ubi	137°03.0	
15	79°03.3	55°47.2	.. 15.7	192°16.6	.. 35.1	273°40.0	.. 46.0	184°27.1	.. 52.1					Alphecca	126°09.1	
16	94°05.8	70°46.8	16.8	207°19.3	35.2	288°42.6	46.1	199°29.6	52.1					Antares	112°23.6	
17	109°08.2	85°46.4	18.0	222°22.1	35.2	303°45.1	46.1	214°32.2	52.1					Atria	107°23.2	
18	124°10.7	100°46.0	N08°19.1	237°24.8	S21°35.3	318°47.7	N07°46.1	229°34.8	S20°52.1					Sabik	102°10.1	
19	139°13.2	115°45.5	20.3	252°27.6	35.3	333°50.2	46.2	244°37.4	52.1					Shaula	96°19.0	
20	154°15.6	130°45.1	21.5	267°30.3	35.4	348°52.8	46.2	259°40.0	52.1					Rasalhague	96°04.5	
21	169°18.1	145°44.7	.. 22.6	282°33.1	.. 35.5	3°55.4	.. 46.2	274°42.6	.. 52.0					Eltanin	90°44.9	
22	184°20.6	160°44.3	23.8	297°35.8	35.5	18°57.9	46.3	289°45.2	52.0					Kaus Aust.	83°41.1	
23	199°23.0	175°43.9	25.0	312°38.6	35.6	34°00.5	46.3	304°47.8	52.0					Vega	80°37.5	
Mer.pass.:09:45			v-0.4 d1.2 m-3.8	v2.7 d-0.1 m-1.3	v2.6 d0.0 m-2.1					Nunki	75°55.8					
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Al Na'ir	27°41.6	
0	214°25.5	190°43.5	N08°26.1	327°41.4	S21°35.6	49°03.1	N07°46.3	319°50.4	S20°52.0					Fomalhaut	15°22.1	
1	229°28.0	205°43.0	27.3	342°44.1	35.7	64°05.6	46.4	334°53.0	52.0					Scheat	13°51.7	
2	244°30.4	220°42.6	28.5	357°46.9	35.8	79°08.2	46.4	349°55.6	52.0					Markab	13°36.6	
3	259°32.9	235°42.2	.. 29.6	12°49.7	.. 35.8	94°10.8	.. 46.4	4°58.1	.. 51.9					Apr 24 Sun	338°36.1	
4	274°35.4	250°41.8	30.8	27°52.4	35.9	109°13.3	46.5	20°00.7	51.9					Venus	11:16	
5	289°37.8	265°41.4	31.9	42°55.2	35.9	124°15.9	46.5	35°03.3	51.9					Mars	02:18	
6	304°40.3	280°40.9	N08°33.1	57°58.0	S21°36.0	139°18.4	N07°46.5	50°05.9	S20°51.9					Jupiter	194°32.5	
7	319°42.7	295°40.5	34.3	73°00.7	36.0	154°21.0	46.6	65°08.5	51.9					Saturn	20:48	
8	334°45.2	310°40.1	35.4	88°03.5	36.1	169°23.6	46.6	80°11.1	51.9					Apr 25 Mon	337°27.1	
9	349°47.7	325°39.7	.. 36.6	103°06.3	.. 36.1	184°26.1	.. 46.6	95°13.7	.. 51.9					Venus	11:17	
10	4°50.1	340°39.3	37.7	118°09.1	36.2	199°28.7	46.6	110°16.3	51.8					Mars	02:13	
11	19°52.6	355°38.8	38.9	133°11.8	36.3	214°31.2	46.7	125°18.9	51.8					Jupiter	194°35.1	
12	34°55.1	10°38.4	N08°40.1	148°14.6	S21°36.3	229°33.8	N07°46.7	140°21.5	S20°51.8					Saturn	20:44	
13	49°57.5	25°38.0	41.2	163°17.4	36.4	244°36.4	46.7	155°24.1	51.8					Apr 26 Tue	336°18.0	
14	65°00.0	40°37.6	42.4	178°20.2	36.4	259°38.9	46.8	170°26.7	51.8					Venus	11:17	
15	80°02.5	55°37.1	.. 43.5	193°23.0	.. 36.5	274°41.5	.. 46.8	185°29.3	.. 51.8					Mars	02:09	
16	95°04.9	70°36.7	44.7	208°25.8	36.5	289°44.0	46.8	200°31.9	51.7					Jupiter	194°37.6	
17	110°07.4	85°36.3	45.9	223°28.5	36.6	304°46.6	46.9	215°								

DUT1 = UT1-UTC = -0.1226 sec ΔT = TT-UT1 = +68.3066 sec

2016 April 24 to Apr. 26 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°27.9	N12°56.0	340°02.3	13.3'	\$14°14.8	-6.1'	54.2'
1	195°28.0	56.8	354°34.7	13.3'	14°20.8	-6.0'	54.2'
2	210°28.1	57.6	9°07.0	13.3'	14°26.8	-5.9'	54.2'
3	225°28.2	.. 58.4	23°39.2	13.2'	14°32.7	-5.9'	54.2'
4	240°28.3	12°59.2	38°11.4	13.2'	14°38.5	-5.8'	54.2'
5	255°28.4	13°00.1	52°43.6	13.2'	14°44.3	-5.7'	54.2'
6	270°28.5	N13°00.9	67°15.7	13.1'	\$14°50.0	-5.7'	54.2'
7	285°28.6	01.7	81°47.9	13.1'	14°55.6	-5.6'	54.3'
8	300°28.8	02.5	96°19.9	13.1'	15°01.2	-5.6'	54.3'
9	315°28.9	.. 03.3	110°52.0	13.0'	15°06.7	-5.5'	54.3'
10	330°29.0	04.2	125°24.0	13.0'	15°12.2	-5.4'	54.3'
11	345°29.1	05.0	139°55.9	12.9'	15°17.6	-5.4'	54.3'
12	0°29.2	N13°05.8	154°27.9	12.9'	\$15°22.9	-5.3'	54.3'
13	15°29.3	06.6	168°59.8	12.9'	15°28.2	-5.2'	54.3'
14	30°29.4	07.4	183°31.6	12.8'	15°33.3	-5.2'	54.3'
15	45°29.5	.. 08.2	198°03.4	12.8'	15°38.5	-5.1'	54.3'
16	60°29.6	09.1	212°35.2	12.8'	15°43.5	-5.0'	54.4'
17	75°29.7	09.9	227°07.0	12.7'	15°48.5	-4.9'	54.4'
18	90°29.8	N13°10.7	241°38.7	12.7'	\$15°53.4	-4.9'	54.4'
19	105°30.0	11.5	256°10.4	12.7'	15°58.2	-4.8'	54.4'
20	120°30.1	12.3	270°42.0	12.6'	16°03.0	-4.7'	54.4'
21	135°30.2	.. 13.1	285°13.7	12.6'	16°07.7	-4.7'	54.4'
22	150°30.3	13.9	299°45.2	12.6'	16°12.3	-4.6'	54.4'
23	165°30.4	14.8	314°16.8	12.5'	16°16.9	-4.5'	54.4'
		SD.=15.9	d=0.8	S.D.=14.8			
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°30.5	N13°15.6	328°48.3	12.5'	\$16°21.3	-4.4'	54.4'
1	195°30.6	16.4	343°19.7	12.5'	16°25.7	-4.4'	54.5'
2	210°30.7	17.2	357°51.2	12.4'	16°30.1	-4.3'	54.5'
3	225°30.8	.. 18.0	122°26.6	12.4'	16°34.3	-4.2'	54.5'
4	240°30.9	18.8	26°53.9	12.3'	16°38.5	-4.1'	54.5'
5	255°31.0	19.6	41°25.3	12.3'	16°42.6	-4.1'	54.5'
6	270°31.1	N13°20.4	55°56.6	12.3'	\$16°46.6	-4.0'	54.5'
7	285°31.2	21.2	70°27.8	12.2'	16°50.6	-3.9'	54.5'
8	300°31.3	22.1	84°59.1	12.2'	16°54.5	-3.8'	54.6'
9	315°31.5	.. 22.9	99°30.2	12.2'	16°58.3	-3.8'	54.6'
10	330°31.6	23.7	114°01.4	12.1'	17°02.0	-3.7'	54.6'
11	345°31.7	24.5	128°32.5	12.1'	17°05.6	-3.6'	54.6'
12	0°31.8	N13°25.3	143°03.6	12.1'	\$17°09.2	-3.5'	54.6'
13	15°31.9	26.1	157°34.7	12.0'	17°12.7	-3.4'	54.6'
14	30°32.0	26.9	172°05.7	12.0'	17°16.1	-3.4'	54.6'
15	45°32.1	.. 27.7	186°36.7	12.0'	17°19.4	-3.3'	54.7'
16	60°32.2	28.5	201°07.6	11.9'	17°22.7	-3.2'	54.7'
17	75°32.3	29.3	215°38.5	11.9'	17°25.8	-3.1'	54.7'
18	90°32.4	N13°30.1	230°09.4	11.9'	\$17°28.9	-3.0'	54.7'
19	105°32.5	30.9	244°40.3	11.8'	17°31.9	-3.0'	54.7'
20	120°32.6	31.7	259°11.1	11.8'	17°34.8	-2.9'	54.7'
21	135°32.7	.. 32.5	273°41.9	11.8'	17°37.7	-2.8'	54.7'
22	150°32.8	33.3	288°12.6	11.7'	17°40.4	-2.7'	54.8'
23	165°32.9	34.1	302°43.3	11.7'	17°43.1	-2.6'	54.8'
		SD.=15.9	d=0.8	S.D.=14.9			
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°33.0	N13°35.0	317°14.0	11.7'	\$17°45.7	-2.5'	54.8'
1	195°33.1	35.8	331°44.7	11.6'	17°48.2	-2.5'	54.8'
2	210°33.2	36.6	346°15.3	11.6'	17°50.6	-2.4'	54.8'
3	225°33.3	.. 37.4	0°45.9	11.6'	17°53.0	-2.3'	54.8'
4	240°33.4	38.2	15°16.5	11.5'	17°55.2	-2.2'	54.9'
5	255°33.5	39.0	29°47.0	11.5'	17°57.4	-2.1'	54.9'
6	270°33.6	N13°39.8	44°17.5	11.5'	\$17°59.5	-2.0'	54.9'
7	285°33.7	40.6	58°48.0	11.5'	18°01.5	-2.0'	54.9'
8	300°33.8	41.4	73°18.4	11.4'	18°03.4	-1.9'	54.9'
9	315°33.9	.. 42.2	87°48.8	11.4'	18°05.2	-1.8'	55.0'
10	330°34.0	43.0	102°19.2	11.4'	18°06.9	-1.7'	55.0'
11	345°34.1	43.8	116°49.6	11.3'	18°08.6	-1.6'	55.0'
12	0°34.2	N13°44.6	131°19.9	11.3'	\$18°10.1	-1.5'	55.0'
13	15°34.3	45.4	145°50.2	11.3'	18°11.6	-1.4'	55.0'
14	30°34.4	46.2	160°20.5	11.3'	18°13.0	-1.3'	55.1'
15	45°34.5	.. 47.0	174°50.7	11.2'	18°14.3	-1.3'	55.1'
16	60°34.6	47.8	189°20.9	11.2'	18°15.5	-1.2'	55.1'
17	75°34.7	48.5	203°51.1	11.2'	18°16.6	-1.1'	55.1'
18	90°34.8	N13°49.3	218°21.2	11.1'	\$18°17.6	-1.0'	55.1'
19	105°34.9	50.1	232°51.4	11.1'	18°18.6	-0.9'	55.2'
20	120°35.0	50.9	247°21.5	11.1'	18°19.4	-0.8'	55.2'
21	135°35.1	.. 51.7	261°51.5	11.1'	18°20.2	-0.7'	55.2'
22	150°35.2	52.5	276°21.6	11.0'	18°20.9	-0.6'	55.2'
23	165°35.3	53.3	290°51.6	11.0'	18°21.4	-0.5'	55.2'
		SD.=15.9	d=0.8	S.D.=15.0			

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

**April 27, 28, 29 UT (Wed., Thu., Fri.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Week	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	215°24.6	190°33.3	N08°53.9	328°48.1	S21°37.0	50°04.5	N07°47.1	320°52.6	S20°51.6	Alpheratz	357°41.8	29°10.6											
1	230°27.1	205°32.9	55.1	343°50.9	37.0	65°07.1	47.1	335°55.2	51.6	Ankaa	353°14.2	-42°13.0											
2	245°29.6	220°32.5	56.3	358°53.7	37.1	80°09.6	47.1	350°57.8	51.6	Schedar	349°38.7	56°37.3											
3	260°32.0	235°32.0	57.4	13°56.5	· ·	37.1	95°12.2	· ·	47.2	Diphda	348°54.3	-17°53.9											
4	275°34.5	250°31.6	58.6	28°59.3	37.2	110°14.7	47.2	21°03.0	51.6	Achernar	335°26.0	-57°09.3											
5	290°37.0	265°31.2	08°59.7	44°02.1	37.3	125°17.3	47.2	36°05.6	51.5	Hamal	327°58.9	23°32.1											
6	305°39.4	280°30.8	N09°00.9	59°04.9	S21°37.3	140°19.8	N07°47.3	51°08.2	S20°51.5	Polaris	317°19.8	89°19.9											
7	320°41.9	295°30.3	02.0	74°07.7	37.4	155°22.4	47.3	66°10.8	51.5	Acamar	315°17.4	-40°14.6											
8	335°44.4	310°29.9	03.2	89°10.5	37.4	170°24.9	47.3	81°13.4	51.5	Menkar	314°13.4	4°08.9											
9	350°46.8	325°29.5	· · 04.3	104°13.3	· ·	185°27.5	· · 47.3	96°16.0	· · 51.5	Mirfak	308°38.0	49°54.9											
10	5°49.3	340°29.0	05.5	119°16.1	37.5	200°30.0	47.4	111°18.6	51.5	Aldebaran	290°47.5	16°32.2											
11	20°51.7	355°28.6	06.6	134°18.9	37.6	215°32.6	47.4	126°21.2	51.5	Rigel	281°10.5	-8°11.3											
12	35°54.2	10°28.2	N09°07.8	149°21.8	S21°37.6	230°35.1	N07°47.4	141°23.8	S20°51.4	Capella	280°32.0	46°00.7											
13	50°56.7	25°27.8	08.9	164°24.6	37.7	245°37.7	47.5	156°26.4	51.4	Bellatrix	278°30.2	6°21.6											
14	65°59.1	40°27.3	10.1	179°27.4	37.7	260°40.3	47.5	171°29.0	51.4	El Nath	278°10.5	28°37.0											
15	81°01.6	55°26.9	· · 11.2	194°30.2	· · 37.8	275°42.8	· · 47.5	186°31.6	· · 51.4	Alnilam	275°44.7	-1°11.8											
16	96°04.1	70°26.5	12.4	209°33.0	37.8	290°45.4	47.5	201°34.2	51.4	Betelgeuse	270°59.4	7°24.3											
17	111°06.5	85°26.0	13.5	224°35.9	37.9	305°47.9	47.6	216°36.7	51.4	Canopus	263°55.6	-52°42.7											
18	126°09.0	100°25.6	N09°14.7	239°38.7	S21°37.9	320°50.5	N07°47.6	231°39.3	S20°51.3	Sirius	258°32.2	-16°44.7											
19	141°11.5	115°25.2	15.8	254°41.5	38.0	335°53.0	47.6	246°41.9	51.3	Adhara	255°11.2	-29°00.1											
20	156°13.9	130°24.7	17.0	269°44.3	38.0	350°55.6	47.6	261°44.5	51.3	Procyon	244°57.8	5°10.7											
21	171°16.4	145°24.3	· · 18.1	284°47.2	· · 38.1	5°58.1	· · 47.7	276°47.1	· · 51.3	Pollux	243°25.5	27°59.1											
22	186°18.8	160°23.9	19.3	299°50.0	38.1	21°00.7	47.7	291°49.7	51.3	Avior	234°17.2	-59°34.2											
23	201°21.3	175°23.4	20.4	314°52.8	38.2	36°03.2	47.7	306°52.3	51.3	Suhail	222°50.9	-43°30.3											
Mer.pass.:09:37				v-0.4 d1.2 m-3.8				v2.8 d-0.1 m-1.4				v2.6 d0.0 m-2.1				v2.6 d0.0 m0.2							
Thu	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec						
0	216°23.8	190°23.0	N09°21.6	329°55.6	S21°38.2	51°05.8	N07°47.8	321°54.9	S20°51.2	Denebola	182°31.5	14°28.8											
1	231°26.2	205°22.6	22.7	344°58.5	38.3	66°08.3	47.8	336°57.5	51.2	Gienah	175°50.0	-17°38.1											
2	246°28.7	220°22.1	23.9	0°01.3	38.3	81°10.9	47.8	352°00.1	51.2	Acrux	173°06.4	-63°11.5											
3	261°31.2	235°21.7	· · 25.0	15°04.1	· · 38.4	96°13.4	· · 47.8	7°02.7	· · 51.2	Gacrux	171°58.1	-57°12.4											
4	276°33.6	250°21.3	26.1	30°07.0	38.4	111°16.0	47.9	22°05.3	51.2	Alioth	166°18.6	55°52.4											
5	291°36.1	265°20.8	27.3	45°09.8	38.5	126°18.5	47.9	37°07.9	51.2	Spica	158°28.9	-11°14.8											
6	306°38.6	280°20.4	N09°28.4	60°12.7	S21°38.5	141°21.0	N07°47.9	52°10.5	S20°51.2	Alkaid	152°57.0	49°14.0											
7	321°41.0	295°20.0	29.6	75°15.5	38.6	156°23.6	47.9	67°13.1	51.1	Hadar	148°44.4	-60°27.1											
8	336°43.5	310°19.5	30.7	90°18.3	38.6	171°26.1	48.0	82°15.7	51.1	Menkent	148°04.9	-36°27.0											
9	351°46.0	325°19.1	· · 31.9	105°21.2	· · 38.7	186°28.7	· · 48.0	97°18.3	· · 51.1	Arcturus	145°53.7	19°05.9											
10	6°48.4	340°18.7	33.0	120°24.0	38.7	201°31.2	48.0	112°20.9	51.1	Rigel Kent.	139°48.3	-60°54.0											
11	21°50.9	355°18.2	34.2	135°26.9	38.8	216°33.8	48.0	127°23.5	51.1	Kochab	137°19.1	74°05.4											
12	36°53.3	10°17.8	N09°35.3	150°29.7	S21°38.8	231°36.3	N07°48.1	142°26.1	S20°51.2	Zuben ubi	137°02.9	-16°06.5											
13	51°55.8	25°17.4	36.4	165°32.6	38.9	246°38.9	48.1	157°28.7	51.0	Alphecca	126°09.1	26°39.6											
14	66°58.3	40°16.9	37.6	180°35.4	38.9	261°41.4	48.1	172°31.3	51.0	Antares	112°23.6	-26°27.9											
15	82°00.7	55°16.5	· · 38.7	195°38.3	· · 39.0	276°44.0	· · 48.1	187°33.9	· · 51.0	Atria	107°23.2	-69°03.0											
16	97°03.2	70°16.1	39.9	210°41.1	39.0	291°46.5	48.2	202°36.5	51.0	Sabik	102°10.1	-15°44.5											
17	112°05.7	85°15.6	41.0	225°44.0	39.1	306°49.1	48.2	217°39.1	51.0	Shaula	96°19.0	-37°06.6											
18	127°08.1	100°15.2	N09°42.1	240°46.8	S21°39.1	321°51.6	N07°48.2	232°41.7	S20°51.0	Rasalhague	96°04.4	12°33.0											
19	142°10.6	115°14.7	43.3	255°49.7	39.2	336°54.1	48.2	247°44.3	50.9	Eltanin	90°44.9	51°29.1											
20	157°13.1	130°14.3	44.4	270°52.6	39.2	351°56.7	48.3	262°46.9	50.9	Kaus Aust.	83°41.1	-34°22.3											
21	172°15.5	145°13.9	· · 45.6	285°55.4	· · 39.3	6°59.2	· · 48.3	277°49.5	· · 50.9	Vega	80°37.4	38°47.9											
22	187°18.0	160°13.4	46.7	300°58.3	39.3	22°01.8	48.3	292°52.1	50.9	Nunki	75°55.8	-26°16.3											
23	202°20.5	175°13.0	47.8	316°01.1	39.4	37°04.3	48.3	307°54.7	50.9	Altair	62°06.3	8°54.7											
Mer.pass.:09:33				v-0.4 d1.1 m-3.8				v2.8 d-0.1 m-1.4				v2.5 d0.0 m-2.1				v2.6 d0.0 m0.2							
Fri	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec						
0	217°22.9	190°12.5	N09°49.0	331°04.0	S21°39.4	52°06.9	N07°48.4	322°57.3	S20°50.9	Apr 27 Wed	335°08.7	Mer.pass											
1	232°25.4	205°12.1	50.1	346°06.9	39.5	67°09.4	48.4	337°59.9	50.9	Venus	113°23.5	02:04											
2	247°27.8	220°11.7	51.2	1°09.7	39.5	82°11.9	48.4	353°02.5	50.8	Mars	113°31.9	02:04											
3	262°30.3	235°11.2	· · 52.4	16°12.6	· · 39.6	97°14.5	· · 48.4	8°05.1	· · 50.8	Jupiter	194°39.9	20:36											
4	277°32.8	250°10.8	53.5	31°15.5	39.6	112°17.0	48.5	23°07.7	50.8	Saturn	105°28.0	02:36											
5	292°35.2	265°10.3	54.7	46°18.4	39.7	127°19.6	48.5	38°10.3	50.8	Apr 28 Thu	333°59.2	11:19											
6	307°37.7	280°09.9	N09°55.8	61°21.2	S21°39.7	142°22.1	N07°48.5	53°12.9	S20°50.8	Venus	113°31.9	02:00											
7	322°40.2	295°09.5	56.9	76°24.1	39.8	157°24.6	48.5	68°15.5	50.8	Mars	113°42.0	20:32											
8	337°42.6	310°09.0	58.1	91°27.0	39.8	172°27.2	48.5	83°18.1	50.7	Jupiter	194°42.												

DUT1 = UT1-UTC = -0.1278 sec ΔT = TT-UT1 = +68.3118 sec

2016 April 27 to Apr. 29 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	180°35.4	N13°54.1	305°21.6	11.0'	\$18°21.9	-0.4'	55.3'	
1	195°35.5	54.9	319°51.6	11.0'	18°22.3	-0.3'	55.3'	
2	210°35.6	55.7	334°21.5	10.9'	18°22.6	-0.3'	55.3'	
3	225°35.7	.. 56.5	348°51.4	10.9'	18°22.8	-0.2'	55.3'	
4	240°35.8	57.3	3°21.3	10.9'	18°23.0	-0.1'	55.3'	
5	255°35.9	58.1	17°51.2	10.9'	18°23.0	0.0'	55.4'	
6	270°36.0	N13°58.9	32°21.0	10.8'	\$18°22.9	0.1'	55.4'	
7	285°36.1	13°59.7	46°50.9	10.8'	18°22.8	0.2'	55.4'	
8	300°36.2	14°00.5	61°20.7	10.8'	18°22.5	0.3'	55.4'	
9	315°36.3	.. 01.2	75°50.5	10.8'	18°22.2	0.4'	55.5'	
10	330°36.4	02.0	90°20.2	10.7'	18°21.7	0.5'	55.5'	
11	345°36.4	02.8	104°49.9	10.7'	18°21.2	0.6'	55.5'	
12	0°36.5	N14°03.6	119°19.7	10.7'	\$18°20.6	0.7'	55.5'	
13	15°36.6	04.4	133°49.4	10.7'	18°19.9	0.8'	55.6'	
14	30°36.7	05.2	148°19.0	10.7'	18°19.0	0.9'	55.6'	
15	45°36.8	.. 06.0	162°48.7	10.6'	18°18.1	1.0'	55.6'	
16	60°36.9	06.8	177°18.3	10.6'	18°17.1	1.0'	55.6'	
17	75°37.0	07.5	191°47.9	10.6'	18°16.1	1.1'	55.6'	
18	90°37.1	N14°08.3	206°17.5	10.6'	\$18°14.9	1.2'	55.7'	
19	105°37.2	09.1	220°47.1	10.6'	18°13.6	1.3'	55.7'	
20	120°37.3	09.9	235°16.6	10.5'	18°12.2	1.4'	55.7'	
21	135°37.4	.. 10.7	249°46.2	10.5'	18°10.7	1.5'	55.7'	
22	150°37.5	11.5	264°15.7	10.5'	18°09.2	1.6'	55.8'	
23	165°37.6	12.3	278°45.2	10.5'	18°07.5	1.7'	55.8'	
	SD.=15.9	d=0.8			S.D.=15.1			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°37.7	N14°13.0	293°14.7	10.5'	\$18°05.8	1.8'	55.8'
1	195°37.7	13.8	307°44.1	10.5'	18°03.9	1.9'	55.9'
2	210°37.8	14.6	322°13.6	10.4'	18°02.0	2.0'	55.9'
3	225°37.9	.. 15.4	336°43.0	10.4'	17°59.9	2.1'	55.9'
4	240°38.0	16.2	351°12.4	10.4'	17°57.8	2.2'	55.9'
5	255°38.1	17.0	5°41.8	10.4'	17°55.6	2.3'	56.0'
6	270°38.2	N14°17.7	20°11.2	10.4'	\$17°53.2	2.4'	56.0'
7	285°38.3	18.5	34°40.5	10.4'	17°50.8	2.5'	56.0'
8	300°38.4	19.3	49°09.9	10.3'	17°48.3	2.6'	56.0'
9	315°38.5	.. 20.1	63°39.2	10.3'	17°45.7	2.7'	56.1'
10	330°38.6	20.9	78°08.5	10.3'	17°43.0	2.8'	56.1'
11	345°38.6	21.6	92°37.8	10.3'	17°40.2	2.8'	56.1'
12	0°38.7	N14°22.4	107°07.1	10.3'	\$17°37.3	2.9'	56.2'
13	15°38.8	23.2	121°36.4	10.3'	17°34.3	3.0'	56.2'
14	30°38.9	24.0	136°05.7	10.3'	17°31.2	3.1'	56.2'
15	45°39.0	.. 24.8	150°34.9	10.2'	17°28.0	3.2'	56.2'
16	60°39.1	25.5	165°04.2	10.2'	17°24.8	3.3'	56.3'
17	75°39.2	26.3	179°33.4	10.2'	17°21.4	3.4'	56.3'
18	90°39.3	N14°27.1	194°02.6	10.2'	\$17°17.9	3.5'	56.3'
19	105°39.3	27.9	208°31.8	10.2'	17°14.4	3.6'	56.4'
20	120°39.4	28.6	223°01.0	10.2'	17°10.7	3.7'	56.4'
21	135°39.5	.. 29.4	237°30.2	10.2'	17°07.0	3.8'	56.4'
22	150°39.6	30.2	251°59.3	10.2'	17°03.1	3.9'	56.4'
23	165°39.7	31.0	266°28.5	10.1'	16°59.2	4.0'	56.5'
	SD.=15.9	d=0.8			S.D.=15.3		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°39.8	N14°31.8	280°57.6	10.1'	\$16°55.1	4.1'	56.5'
1	195°39.9	32.5	295°26.8	10.1'	16°51.0	4.2'	56.5'
2	210°40.0	33.3	309°55.9	10.1'	16°46.8	4.3'	56.6'
3	225°40.0	.. 34.1	324°25.0	10.1'	16°42.5	4.4'	56.6'
4	240°40.1	34.8	338°54.1	10.1'	16°38.1	4.5'	56.6'
5	255°40.2	35.6	353°23.2	10.1'	16°33.6	4.5'	56.7'
6	270°40.3	N14°36.4	7°52.3	10.1'	\$16°29.0	4.6'	56.7'
7	285°40.4	37.2	22°21.3	10.1'	16°24.3	4.7'	56.7'
8	300°40.5	37.9	36°50.4	10.1'	16°19.5	4.8'	56.8'
9	315°40.5	.. 38.7	51°19.5	10.0'	16°14.6	4.9'	56.8'
10	330°40.6	39.5	65°48.5	10.0'	16°09.7	5.0'	56.8'
11	345°40.7	40.2	80°17.5	10.0'	16°04.6	5.1'	56.9'
12	0°40.8	N14°41.0	94°46.6	10.0'	\$15°59.5	5.2'	56.9'
13	15°40.9	41.8	109°15.6	10.0'	15°54.2	5.3'	56.9'
14	30°41.0	42.5	123°44.6	10.0'	15°48.9	5.4'	57.0'
15	45°41.0	.. 43.3	138°13.6	10.0'	15°43.5	5.5'	57.0'
16	60°41.1	44.1	152°42.6	10.0'	15°37.9	5.6'	57.0'
17	75°41.2	44.9	167°11.6	10.0'	15°32.3	5.7'	57.0'
18	90°41.3	N14°45.6	181°40.6	10.0'	\$15°26.6	5.7'	57.1'
19	105°41.4	46.4	196°09.5	10.0'	15°20.8	5.8'	57.1'
20	120°41.4	47.2	210°38.5	10.0'	15°15.0	5.9'	57.1'
21	135°41.5	.. 47.9	225°07.4	10.0'	15°09.0	6.0'	57.2'
22	150°41.6	48.7	239°36.4	9.9'	15°02.9	6.1'	57.2'
23	165°41.7	49.4	254°05.3	9.9'	14°56.8	6.2'	57.3'
	SD.=15.9	d=0.8			S.D.=15.5		

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

Lat.	Wed	Moonrise		Wed	Moonset	
		Thu	Fri		Thu	Fri
N 72°		03:56			03:56	07:07
N 70°	02:10	02:49	03:07	05:22	06:28	07:56
68°	01:25	02:08	02:36	06:07	07:08	08:26
66°	00:55	01:40	02:13	06:37	07:36	08:49
64°	00:33	01:19	01:54	06:59	07:57	09:07
62°	00:15	01:02	01:39	07:17	08:14	09:22
60°	00:00	00:47	01:27	07:32	08:28	09:34
N 58°	--	00:35	01:16	07:45	08:40	09:44
56°	--	00:25	0			

**April 30, 01, 02 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	218°22.1	190°01.9	N10°16.2	332°13.2	\$21°40.5	53°07.8	N07°48.9	323°59.8	\$20°50.5					Alpheratz	357°41.7	29°10.6
1	233°24.5	205°01.4	17.3	347°16.1	40.6	68°10.3	48.9	339°02.4	50.5					Ankaa	353°14.2	-42°13.0
2	248°27.0	220°01.0	18.4	2°19.0	40.6	83°12.9	48.9	354°05.0	50.4					Schedar	349°38.7	56°37.3
3	263°29.4	235°00.5	19.5	17°21.9	40.7	98°15.4	49.0	9°07.6	50.4					Diphda	348°54.3	-17°53.9
4	278°31.9	250°00.1	20.7	32°24.8	40.7	113°17.9	49.0	24°10.2	50.4					Achernar	335°26.0	-57°09.3
5	293°34.4	264°59.6	21.8	47°27.7	40.7	128°20.5	49.0	39°12.8	50.4					Hamal	327°58.9	23°32.1
6	308°36.8	279°59.2	N10°22.9	62°30.6	\$21°40.8	143°23.0	N07°49.0	54°15.4	\$20°50.4					Polaris	317°19.9	89°19.9
7	323°39.3	294°58.7	24.0	77°33.5	40.8	158°25.5	49.0	69°18.0	50.4					Acamar	315°17.4	-40°14.6
8	338°41.8	309°58.3	25.2	92°36.5	40.9	173°28.1	49.1	84°20.6	50.3					Menkar	314°13.4	4°08.9
9	353°44.2	324°57.8	26.3	107°39.4	40.9	188°30.6	49.1	99°23.2	50.3					Mirfak	308°38.0	49°54.9
10	8°46.7	339°57.4	27.4	122°42.3	41.0	203°33.1	49.1	114°25.9	50.3					Aldebaran	290°47.5	16°32.2
11	23°49.2	354°56.9	28.5	137°45.2	41.0	218°35.6	49.1	129°28.5	50.3					Rigel	281°10.5	-8°11.3
12	38°51.6	9°56.5	N10°29.7	152°48.1	\$21°41.0	233°38.2	N07°49.1	144°31.1	\$20°50.3					Capella	280°32.0	46°00.7
13	53°54.1	24°56.0	30.8	167°51.0	41.1	248°40.7	49.2	159°33.7	50.3					Bellatrix	278°30.2	6°21.6
14	68°56.6	39°55.6	31.9	182°53.9	41.1	263°43.2	49.2	174°36.3	50.2					Elnath	278°10.5	28°37.0
15	83°59.0	54°55.1	33.0	197°56.9	41.2	278°45.8	49.2	189°38.9	50.2					Ahnilam	275°44.7	-1°11.8
16	99°01.5	69°54.7	34.2	212°59.8	41.2	293°48.3	49.2	204°41.5	50.2					Betelgeuse	270°59.4	7°24.3
17	114°03.9	84°54.2	35.3	228°02.7	41.3	308°50.8	49.2	219°44.1	50.2					Canopus	263°55.6	-52°42.7
18	129°06.4	99°53.8	N10°36.4	243°05.6	\$21°41.3	323°53.4	N07°49.2	234°46.7	\$20°50.2					Sirius	258°32.2	-16°44.7
19	144°08.9	114°53.3	37.5	258°08.6	41.3	338°55.9	49.3	249°49.3	50.2					Adhara	255°11.2	-29°00.1
20	159°11.3	129°52.9	38.6	273°11.5	41.4	353°58.4	49.3	264°51.9	50.2					Procyon	244°57.8	5°10.7
21	174°13.8	144°52.4	39.8	288°14.4	41.4	9°01.0	49.3	279°54.5	50.1					Pollux	243°25.5	27°59.1
22	189°16.3	159°52.0	40.9	303°17.3	41.5	24°03.5	49.3	294°57.1	50.1					Avior	234°17.2	-59°34.2
23	204°18.7	174°51.5	42.0	318°20.3	41.5	39°06.0	49.3	309°59.7	50.1					Suhail	222°50.9	-43°30.3
Mer.pass.:09:25			v-0.4 d1.1 m-3.8	v2.9 d-0.0 m-1.5	v2.5 d0.0 m-2.1	v2.6 d0.0 m-0.2										
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars		
0	219°21.2	189°51.0	N10°43.1	333°23.2	\$21°41.5	54°08.5	N07°49.4	325°02.3	\$20°50.1					Denebola	182°31.5	14°28.8
1	234°23.7	204°50.6	44.2	348°26.1	41.6	69°11.1	49.4	340°05.0	50.1					Gienah	175°50.0	-17°38.1
2	249°26.1	219°50.1	45.3	3°29.1	41.6	84°13.6	49.4	355°07.6	50.1					Acrux	173°06.4	-63°11.5
3	264°28.6	234°49.7	46.5	18°32.0	41.7	99°16.1	49.4	10°10.2	50.0					Gacrux	171°58.1	-57°12.4
4	279°31.0	249°49.2	47.6	33°35.0	41.7	114°18.7	49.4	25°12.8	50.0					Alioth	166°18.6	55°52.4
5	294°33.5	264°48.8	48.7	48°37.9	41.7	129°21.2	49.4	40°15.4	50.0					Spica	158°28.9	-11°14.8
6	309°36.0	279°48.3	N10°49.8	63°40.8	\$21°41.8	144°23.7	N07°49.5	55°18.0	\$20°50.0					Alkaid	152°57.0	49°14.0
7	324°38.4	294°47.8	50.9	78°43.8	41.8	159°26.2	49.5	70°20.6	50.0					Hadar	148°44.4	-60°27.1
8	339°40.9	309°47.4	52.0	93°46.7	41.9	174°28.8	49.5	85°23.2	50.0					Menkent	148°04.9	-36°27.0
9	354°43.4	324°46.9	53.2	108°49.7	41.9	189°31.3	49.5	100°25.8	49.9					Arcturus	145°53.7	19°05.9
10	9°45.8	339°46.5	54.3	123°52.6	41.9	204°33.8	49.5	115°28.4	49.9					Rigel Kent.	139°48.3	-60°54.0
11	24°48.3	354°46.0	55.4	138°55.6	42.0	219°36.3	49.5	130°31.0	49.9					Kochab	137°19.1	74°05.4
12	39°50.8	9°45.5	N10°56.5	153°58.5	\$21°42.0	234°38.9	N07°49.6	145°33.6	\$20°49.9					Zuben' ubi	137°02.9	-16°06.5
13	54°53.2	24°45.1	56.7	169°01.5	42.0	249°41.4	49.6	160°36.3	49.9					Alphecca	126°09.0	26°39.7
14	69°55.7	39°44.6	58.7	184°04.4	42.1	264°43.9	49.6	175°38.9	49.9					Antares	112°23.5	-26°27.9
15	84°58.2	54°44.2	10°59.8	199°07.4	42.1	279°46.4	49.6	190°41.5	49.8					Atria	107°23.1	-69°03.1
16	100°00.6	69°43.7	11°00.9	214°10.3	42.2	294°49.0	49.6	205°44.1	49.8					Sabik	102°10.1	-15°44.5
17	115°03.1	84°43.2	02.1	229°13.3	42.2	309°51.5	49.6	220°46.7	49.8					Shaula	96°19.0	-37°06.7
18	130°05.5	99°42.8	N11°03.2	244°16.3	\$21°42.2	324°54.0	N07°49.7	235°49.3	\$20°49.8					Rasalhague	96°04.4	12°33.0
19	145°08.0	114°42.3	04.3	259°19.2	42.3	339°56.5	49.7	250°51.9	49.8					Eltanin	90°44.9	51°29.2
20	160°10.5	129°41.9	05.4	274°22.2	42.3	354°59.0	49.7	265°54.5	49.8					Kaus Aust.	83°41.0	-34°22.3
21	175°12.9	144°41.4	06.5	289°25.1	42.3	10°01.6	49.7	280°57.1	49.7					Vega	80°37.4	38°47.9
22	190°15.4	159°40.9	07.6	304°28.1	42.4	25°04.1	49.7	295°59.7	49.7					Nunki	75°55.8	-26°16.3
23	205°17.9	174°40.5	08.7	319°31.1	42.4	40°06.6	49.7	311°02.4	49.7					Altair	62°06.3	8°54.7
Mer.pass.:09:21			v-0.5 d1.1 m-3.8	v2.9 d-0.0 m-1.5	v2.5 d0.0 m-2.1	v2.6 d0.0 m-0.2										
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars		
0	220°20.3	189°40.0	N11°09.8	334°34.0	\$21°42.5	55°09.1	N07°49.7	326°05.0	\$20°49.7					Peacock	15°22.1	-29°32.1
1	235°22.8	204°39.5	10.9	349°37.0	42.5	70°11.7	49.8	341°07.6	49.7					Markab	13°51.7	28°10.1
2	250°25.3	219°39.1	12.0	4°40.0	42.5	85°14.2	49.8	356°10.2	49.7					Markab	13°36.6	15°17.4
3	265°27.7	234°38.6	13.1	19°42.9	42.6	100°16.7	49.8	11°12.8	49.6					Apr 30 Sat	15°21.7	-29°32.1
4	280°30.2	249°38.1	14.2	34°45.9	42.6	115°19.2	49.8	26°15.4	49.6					Venus	331°39.8	11:20
5	295°32.7	264°37.7	15.3	49°48.9	42.6	130°21.7	49.8	41°18.0	49.6					Mars	113°51.2	01:51
6	310°35.1	279°37.2	N11°16.5	64°51.9	\$21°42.7	145°24.3	N07°49.8	56°20.6	\$20°49.6					Jupiter	194°45.7	20:24
7	325°37.6	294°36.7	17.6	79°54.8	42.7	160°26.8	49.8	71°23.2	49.6					Saturn	105°37.7	02:24
8	340°40.0	309°36.3	18.7	94°57.8	42.7	175°29.3	49.9	86°25.9	49.6					May 01 Sun	15°51.7	-29°36.6
9	355°42.5	324°35.8	19.8	110°00.8	42.8	190°31.8	49.9	101°28.5	49.5					Venus	330°29.8	11:21
10	10°45.0	339°35.3	20.9	125°03.8	42.8	205°34.3	49.9	116°31.1	49.5					Mars	114°02.0	01:46
11	25°47.4	354°34.9	22.0	215°21.7	43.0	295°49.4	50.0	206°46.8	49.4					Jupiter	194°47.3	20:20
12	40°49.9	9°34.4	N11°23.1	155°09.7	\$21°42.9	235°39.4	N07°49.9	146°36.3	\$20°49.5					Saturn	105°41.2	02:19
13	55°52.4	24°33.														

DUT1 = UT1-UTC = -0.1331 sec ΔT = TT-UT1 = +68.3171 sec

2016 April 30 to May. 02 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°41.8	N14°50.2	268°34.3	9.9'	S14°50.5	6.3'	57.3'
1	195°41.9	51.0	283°03.2	9.9'	14°44.2	6.4'	57.3'
2	210°41.9	51.7	297°32.1	9.9'	14°37.8	6.5'	57.4'
3	225°42.0	.. 52.5	312°01.0	9.9'	14°31.3	6.5'	57.4'
4	240°42.1	53.3	326°29.9	9.9'	14°24.7	6.6'	57.4'
5	255°42.2	54.0	340°58.8	9.9'	14°18.0	6.7'	57.5'
6	270°42.2	N14°54.8	355°27.7	9.9'	S14°11.3	6.8'	57.5'
7	285°42.3	55.6	9°56.6	9.9'	14°04.4	6.9'	57.5'
8	300°42.4	56.3	24°25.5	9.9'	13°57.5	7.0'	57.6'
9	315°42.5	.. 57.1	38°54.3	9.9'	13°50.5	7.1'	57.6'
10	330°42.6	57.8	53°23.2	9.9'	13°43.4	7.1'	57.6'
11	345°42.6	58.6	67°52.0	9.8'	13°36.2	7.2'	57.7'
12	0°42.7	N14°59.4	82°20.9	9.8'	S13°28.9	7.3'	57.7'
13	15°42.8	15°00.1	96°49.7	9.8'	13°21.6	7.4'	57.7'
14	30°42.9	0.9	111°18.6	9.8'	13°14.1	7.5'	57.8'
15	45°42.9	.. 01.6	125°47.4	9.8'	13°06.6	7.6'	57.8'
16	60°43.0	0.24	140°16.2	9.8'	12°59.0	7.6'	57.8'
17	75°43.1	03.1	154°45.0	9.8'	12°51.3	7.7'	57.9'
18	90°43.2	N15°03.9	169°13.8	9.8'	S12°43.5	7.8'	57.9'
19	105°43.3	04.7	183°42.6	9.8'	12°35.7	7.9'	58.0'
20	120°43.3	05.4	198°11.4	9.8'	12°27.8	8.0'	58.0'
21	135°43.4	.. 06.2	212°40.1	9.8'	12°19.7	8.0'	58.0'
22	150°43.5	06.9	227°08.9	9.8'	12°11.7	8.1'	58.1'
23	165°43.6	07.7	241°37.7	9.8'	12°03.5	8.2'	58.1'
SD.=15.9		d=0.8	S.D.=15.7				
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Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°43.6	N15°08.4	256°06.4	9.7'	S11°55.2	8.3'	58.1'
1	195°43.7	09.2	270°35.1	9.7'	11°46.9	8.4'	58.2'
2	210°43.8	09.9	285°03.9	9.7'	11°38.5	8.4'	58.2'
3	225°43.8	.. 10.7	299°32.6	9.7'	11°30.1	8.5'	58.2'
4	240°43.9	11.4	314°01.3	9.7'	11°21.5	8.6'	58.3'
5	255°44.0	12.2	328°30.0	9.7'	11°12.9	8.7'	58.3'
6	270°44.1	N15°12.9	342°58.7	9.7'	S11°04.2	8.7'	58.4'
7	285°44.1	13.7	357°27.4	9.7'	10°55.4	8.8'	58.4'
8	300°44.2	14.5	11°56.1	9.7'	10°46.6	8.9'	58.4'
9	315°44.3	.. 15.2	26°24.7	9.7'	10°37.6	9.0'	58.5'
10	330°44.4	16.0	40°53.4	9.6'	10°28.6	9.0'	58.5'
11	345°44.4	16.7	55°22.0	9.6'	10°19.6	9.1'	58.5'
12	0°44.5	N15°17.4	69°50.7	9.6'	S10°10.4	9.2'	58.6'
13	15°44.6	18.2	84°19.3	9.6'	10°01.2	9.2'	58.6'
14	30°44.6	18.9	98°47.9	9.6'	09°52.0	9.3'	58.6'
15	45°44.7	.. 19.7	113°16.5	9.6'	09°42.6	9.4'	58.7'
16	60°44.8	20.4	127°45.1	9.6'	09°33.2	9.4'	58.7'
17	75°44.9	21.2	142°13.6	9.6'	09°23.7	9.5'	58.8'
18	90°44.9	N15°21.9	156°42.2	9.6'	S09°14.2	9.6'	58.8'
19	105°45.0	22.7	171°10.7	9.5'	09°04.6	9.6'	58.8'
20	120°45.1	23.4	185°39.3	9.5'	08°54.9	9.7'	58.9'
21	135°45.1	.. 24.2	200°07.8	9.5'	08°45.2	9.8'	58.9'
22	150°45.2	24.9	214°36.3	9.5'	08°35.4	9.8'	58.9'
23	165°45.3	25.7	229°04.8	9.5'	08°25.5	9.9'	59.0'
SD.=15.9		d=0.8	S.D.=16.0				
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Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°45.3	N15°26.4	243°33.3	9.5'	S08°15.6	10.0'	59.0'
1	195°45.4	27.1	258°01.7	9.5'	08°05.6	10.0'	59.0'
2	210°45.5	27.9	272°30.2	9.4'	07°55.6	10.1'	59.1'
3	225°45.5	.. 28.6	286°58.6	9.4'	07°45.5	10.1'	59.1'
4	240°45.6	29.4	301°27.0	9.4'	07°35.3	10.2'	59.2'
5	255°45.7	30.1	315°55.4	9.4'	07°25.1	10.2'	59.2'
6	270°45.7	N15°30.9	330°23.8	9.4'	S07°14.8	10.3'	59.2'
7	285°45.8	31.6	344°52.2	9.4'	07°04.5	10.4'	59.3'
8	300°45.9	32.3	359°20.5	9.3'	06°54.1	10.4'	59.3'
9	315°45.9	.. 33.1	13°48.8	9.3'	06°43.7	10.5'	59.3'
10	330°46.0	33.8	28°17.2	9.3'	06°33.2	10.5'	59.4'
11	345°46.1	34.6	42°45.4	9.3'	06°22.6	10.6'	59.4'
12	0°46.1	N15°35.3	57°13.7	9.3'	S06°12.0	10.6'	59.4'
13	15°46.2	36.0	71°42.0	9.2'	06°01.4	10.7'	59.5'
14	30°46.3	36.8	86°10.2	9.2'	05°50.7	10.7'	59.5'
15	45°46.3	.. 37.5	100°38.4	9.2'	05°40.0	10.8'	59.5'
16	60°46.4	38.2	115°06.6	9.2'	05°29.2	10.8'	59.6'
17	75°46.5	39.0	129°34.8	9.2'	05°18.3	10.9'	59.6'
18	90°46.5	N15°39.7	144°02.9	9.1'	S05°07.5	10.9'	59.6'
19	105°46.6	40.4	158°31.1	9.1'	04°56.5	10.9'	59.7'
20	120°46.7	41.2	172°59.2	9.1'	04°45.6	11.0'	59.7'
21	135°46.7	.. 41.9	187°27.3	9.1'	04°34.6	11.0'	59.7'
22	150°46.8	42.7	201°55.3	9.1'	04°23.5	11.1'	59.8'
23	165°46.8	43.4	216°23.4	9.0'	04°12.4	11.1'	59.8'
SD.=15.9		d=0.7	S.D.=16.2				

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

## May 03, 04, 05 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	221°19.5	189°28.7	N11°36.3	335°45.6	S21°43.3	56°09.6	N07°50.1	327°07.7	S20°49.3					Alpheratz	357°41.7	29°10.6
1	236°21.9	204°28.3	37.4	350°48.6	43.3	71°12.1	50.1	342°10.3	49.3					Ankaa	353°14.2	-42°13.0
2	251°24.4	219°27.8	38.5	5°51.6	43.4	86°14.6	50.1	357°12.9	49.2					Schedar	349°38.7	56°37.3
3	266°26.9	234°27.3	· · 39.6	20°54.6	· · 43.4	101°17.1	· · 50.1	12°15.5	· · 49.2					Diphda	348°54.3	-17°53.9
4	281°29.3	249°26.9	40.6	35°57.7	43.4	116°19.6	50.1	27°18.1	49.2					Achernar	335°26.0	-57°09.3
5	296°31.8	264°26.4	41.7	51°00.7	43.4	131°22.1	50.1	42°20.7	49.2					Hamal	327°58.9	23°32.1
6	311°34.3	279°25.9	N11°42.8	66°03.7	S21°43.5	146°24.6	N07°50.1	57°23.3	S20°49.2					Polaris	317°19.9	89°19.9
7	326°36.7	294°25.4	43.9	81°06.7	43.5	161°27.1	50.1	72°26.0	49.2					Acamar	315°17.4	-40°14.6
8	341°39.2	309°25.0	45.0	96°09.7	43.5	176°29.7	50.2	87°28.6	49.1					Menkar	314°13.4	4°08.9
9	356°41.6	324°24.5	· · 46.1	111°12.7	· · 43.6	191°32.2	· · 50.2	102°31.2	· · 49.1					Mirfak	308°38.0	49°54.9
10	11°44.1	339°24.0	47.2	126°15.7	43.6	206°34.7	50.2	117°33.8	49.1					Aldebaran	290°47.5	16°32.2
11	26°46.6	354°23.5	48.3	141°18.7	43.6	221°37.2	50.2	132°36.4	49.1					Rigel	281°10.5	-8°11.3
12	41°49.0	9°23.0	N11°49.4	156°21.7	S21°43.7	236°39.7	N07°50.2	147°39.0	S20°49.1					Capella	280°32.0	46°00.7
13	56°51.5	24°22.6	50.5	171°24.8	43.7	251°42.2	50.2	162°41.6	49.1					Bellatrix	278°30.2	6°21.6
14	71°54.0	39°22.1	51.6	186°27.8	43.7	266°44.7	50.2	177°44.3	49.0					Elnath	278°10.5	28°37.0
15	86°56.4	54°21.6	· · 52.7	201°30.8	· · 43.8	281°47.2	· · 50.2	192°46.9	· · 49.0					Ahnilam	275°44.7	-1°11.8
16	101°58.9	69°21.1	53.7	216°33.8	43.8	296°49.7	50.2	207°49.5	49.0					Betelgeuse	270°59.5	7°24.3
17	117°01.4	84°20.7	54.8	231°36.8	43.8	311°52.2	50.2	222°52.1	49.0					Canopus	263°55.6	-52°42.7
18	132°03.8	99°20.2	N11°55.9	246°39.9	S21°43.8	326°54.8	N07°50.3	237°54.7	S20°49.0					Sirius	258°32.2	-16°44.7
19	147°06.3	114°19.7	57.0	261°42.9	43.9	341°57.3	50.3	252°57.3	49.0					Adhara	255°11.2	-29°00.1
20	162°08.8	129°19.2	58.1	276°45.9	43.9	356°59.8	50.3	268°00.0	48.9					Procyon	244°57.9	5°10.7
21	177°11.2	144°18.7	11°59.2	291°48.9	· · 43.9	12°02.3	· · 50.3	283°02.6	· · 48.9					Pollux	243°25.5	27°59.1
22	192°13.7	159°18.3	12°00.3	306°52.0	44.0	27°04.8	50.3	298°05.2	48.9					Avior	234°17.3	-59°34.2
23	207°16.1	174°17.8	01.4	321°55.0	44.0	42°07.3	50.3	313°07.8	48.9					Suhail	222°51.0	-43°30.3
Mer.pass.:09:13			v-0.5 d1.1 m-3.8	v3.0 d-0.0 m-1.6			v2.5 d0.0 m-2.1			v2.6 d0.0 m0.2						
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	222°18.6	189°17.3	N12°02.4	336°58.0	S21°44.0	57°09.8	N07°50.3	328°10.4	S20°48.9					Denebola	182°31.5	14°28.8
1	237°21.1	204°16.8	03.5	352°01.1	44.1	72°12.3	50.3	343°13.0	48.9					Gienah	175°50.0	-17°38.1
2	252°23.5	219°16.3	04.6	7°04.1	44.1	87°14.8	50.3	358°15.7	48.8					Acrua	173°06.4	-63°11.5
3	267°26.0	234°15.8	· · 05.7	22°07.1	· · 44.1	102°17.3	· · 50.3	13°18.3	· · 48.8					Gacrux	171°58.1	-57°12.4
4	282°28.5	249°15.4	06.8	37°10.2	44.1	117°19.8	50.3	28°20.9	48.8					Alioth	166°18.6	55°52.4
5	297°30.9	264°14.9	07.9	52°13.2	44.2	132°22.3	50.4	43°23.5	48.8					Spica	158°28.9	-11°14.8
6	312°33.4	279°14.4	N12°08.9	67°16.3	S21°44.2	147°24.8	N07°50.4	58°26.1	S20°48.8					Alkaid	152°57.0	49°14.0
7	327°35.9	294°13.9	10.0	82°19.3	44.2	162°27.3	50.4	73°28.7	48.7					Hadar	148°44.4	-60°27.1
8	342°38.3	309°13.4	11.1	97°22.3	44.2	177°29.8	50.4	88°31.4	48.7					Menkent	148°04.9	-36°27.0
9	357°40.8	324°12.9	· · 12.2	112°25.4	· · 44.3	192°32.3	· · 50.4	103°34.0	· · 48.7					Arcturus	145°53.7	19°05.9
10	12°43.2	339°12.5	13.3	127°28.4	44.3	207°34.9	50.4	118°36.6	48.7					Rigel Kent.	139°48.3	-60°54.1
11	27°45.7	354°12.0	14.3	142°31.5	44.3	222°37.4	50.4	133°39.2	48.7					Kochab	137°19.1	74°05.4
12	42°48.2	9°11.5	N12°15.4	157°34.5	S21°44.4	237°39.9	N07°50.4	148°41.8	S20°48.7					Zuben' ubi	137°02.9	-16°06.5
13	57°50.6	24°11.0	16.5	172°37.6	44.4	252°42.4	50.4	163°44.4	48.6					Alphecca	126°09.0	26°39.7
14	72°53.1	39°10.5	17.6	187°40.6	44.4	267°44.9	50.4	178°47.1	48.6					Antares	112°23.5	-26°27.9
15	87°55.6	54°10.0	· · 18.7	202°43.7	· · 44.4	282°47.4	· · 50.4	193°49.7	· · 48.6					Atria	107°23.1	-69°03.1
16	102°58.0	69°09.5	19.7	217°46.7	44.5	297°49.9	50.4	208°52.3	48.6					Sabik	102°10.0	-15°44.5
17	118°00.5	84°09.0	20.8	232°49.8	44.5	312°52.4	50.4	223°54.9	48.6					Shaula	96°19.0	-37°06.7
18	133°03.0	99°08.6	N12°21.9	247°52.8	S21°44.5	327°54.9	N07°50.5	238°57.5	S20°48.6					Rasalhague	96°04.4	12°33.0
19	148°05.4	114°08.1	23.0	262°55.9	44.5	342°57.4	50.5	254°00.2	48.5					Eltanin	90°44.9	51°29.2
20	163°07.9	129°07.6	24.0	277°59.0	44.6	357°59.9	50.5	269°02.8	48.5					Kaus Aust.	83°41.0	-34°22.3
21	178°10.4	144°07.1	· · 25.1	293°02.0	· · 44.6	13°02.4	· · 50.5	284°05.4	· · 48.5					Vega	80°37.4	38°47.9
22	193°12.8	159°06.6	26.2	308°05.1	44.6	28°04.9	50.5	299°08.0	48.5					Nunki	75°55.7	-26°16.3
23	208°15.3	174°06.1	27.3	323°08.1	44.6	43°07.4	50.5	314°10.6	48.5					Altair	62°06.2	8°54.7
Mer.pass.:09:09			v-0.5 d1.1 m-3.8	v3.0 d-0.0 m-1.6			v2.5 d0.0 m-2.1			v2.6 d0.0 m0.2						
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	223°17.7	189°05.6	N12°28.3	338°11.2	S21°44.7	58°09.9	N07°50.5	329°13.3	S20°48.5					May 03 Tue	SHA	Mer.pass
1	238°20.2	204°05.1	29.4	353°14.3	44.7	73°12.4	50.5	344°15.9	48.4					Ankaa	328°09.3	11:22
2	253°22.7	219°04.6	30.5	8°17.3	44.7	88°14.9	50.5	359°18.5	48.4					Schedar	349°38.7	56°37.3
3	268°25.1	234°04.1	· · 31.6	23°20.4	· · 44.7	103°17.4	· · 50.5	14°21.1	· · 48.4					Diphda	348°54.3	-17°53.9
4	283°27.6	249°03.6	32.6	38°23.5	44.8	118°19.9	50.5	29°23.7	48.4					Achernar	335°26.0	-57°09.3
5	298°30.1	264°03.2	33.7	53°26.5	44.8	133°22.4	50.5	44°26.4	48.4					Hamal	327°58.9	23°32.1
6	313°32.5	279°02.7	N12°34.8	68°29.6	S21°44.8	148°24.9	N07°50.5	59°29.0	S20°48.3					Polaris	317°19.9	89°19.9
7	328°35.0	294°02.2	35.8	83°32.7	44.8	163°27.4	50.5	74°31.6	48.3					Elnath	317°10.5	28°37.0
8	343°37.5	309°01.7	36.9	98°35.8	44.8	178°29.9	50.5	89°34.2	48.3					Ahnilam	275°44.7	-1°11.8
9	358°39.9	324°01.2	· · 38.0	113°38.8	· · 44.9	193°32.4	· · 50.5	104°36.8	· · 48.3					Betelgeuse	270°59.5	7°24.3
10	13°42.4	339°00.7	39.0	128°41.9	44.9	208°34.9	50.5	119°39.5	48.3					Canopus	263°55.6	-52°42.7
11	28°44.8	354°00.2	40.1	143°45.0	44.9	223°37.4	50.5	134°42.1	48.3					Sirius	258°32.2	-16°44.7
12	43°47.3	8°59.7	N12°41.2	158°48.1	S21°44.9</td											

DUT1 = UT1-UTC = -0.1381 sec ΔT = TT-UT1 = +68.3221 sec

2016 May 03 to May. 05 UT

h		Sun			Moon										
Tue		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight	Sunrise	Sunset	Twilight	Civil	Naut.
									Naut.	Civil				Civil	Naut.
0	180°46.9	N15°44.1	230°51.4	9.0'	S04°01.3	11.1'	59.8'		N 72°	□	01:21	22:43	□	□	
1	195°47.0	44.8	245°19.4	9.0'	03°50.1	11.2'	59.9'		N 70°	□	02:10	21:48	□	□	
2	210°47.0	45.6	259°47.3	9.0'	03°38.9	11.2'	59.9'		68°	□	02:41	21:16	□	□	
3	225°47.1	.. 46.3	274°15.3	8.9'	03°27.7	11.3'	59.9'		66°	□	01:33	03:04	20:52	22:27	□
4	240°47.2	47.0	288°43.2	8.9'	03°16.4	11.3'	60.0'		64°	□	02:09	03:22	20:34	21:48	□
5	255°47.2	47.8	303°11.1	8.9'	03°05.1	11.3'	60.0'		62°	□	02:34	03:37	20:19	21:22	□
6	270°47.3	N15°48.5	317°39.0	8.8'	S02°53.8	11.3'	60.0'		60°	01:23	02:54	03:49	20:06	21:02	22:37
7	285°47.3	49.2	332°06.8	8.8'	02°42.5	11.4'	60.1'		N 58°	01:56	03:10	04:00	19:55	20:46	22:02
8	300°47.4	50.0	346°34.6	8.8'	02°31.1	11.4'	60.1'		56°	02:19	03:23	04:09	19:46	20:32	21:37
9	315°47.5	.. 50.7	1°02.4	8.8'	02°19.6	11.4'	60.1'		54°	02:37	03:35	04:17	19:38	20:20	21:18
10	330°47.5	51.4	15°30.1	8.7'	02°08.2	11.5'	60.2'		52°	02:53	03:45	04:24	19:30	20:10	21:03
11	345°47.6	52.2	29°57.9	8.7'	01°56.7	11.5'	60.2'		50°	03:05	03:53	04:31	19:24	20:01	20:50
12	0°47.6	N15°52.9	44°25.6	8.7'	S01°45.2	11.5'	60.2'		45°	03:31	04:12	04:45	19:10	19:43	20:24
13	15°47.7	53.6	58°53.2	8.7'	01°33.7	11.5'	60.2'		N 40°	03:50	04:26	04:56	18:58	19:28	20:04
14	30°47.8	54.3	73°20.9	8.6'	01°22.2	11.6'	60.3'		35°	04:06	04:39	05:06	18:48	19:15	19:48
15	45°47.8	.. 55.1	87°48.5	8.6'	01°10.6	11.6'	60.3'		30°	04:18	04:49	05:14	18:40	19:05	19:36
16	60°47.9	55.8	102°16.0	8.6'	00°59.0	11.6'	60.3'		20°	04:38	05:06	05:29	18:25	18:48	19:15
17	75°47.9	56.5	116°43.6	8.5'	00°47.4	11.6'	60.4'		N 10°	04:54	05:20	05:42	18:12	18:34	19:00
18	90°48.0	N15°57.2	131°11.1	8.5'	S00°35.8	11.6'	60.4'		0°	05:07	05:32	05:53	18:00	18:22	18:47
19	105°48.1	58.0	145°38.6	8.5'	00°24.2	11.6'	60.4'		S 10°	05:18	05:43	06:05	17:48	18:10	18:36
20	120°48.1	58.7	160°06.0	8.4'	00°12.5	11.7'	60.4'		20°	05:28	05:54	06:17	17:36	17:59	18:25
21	135°48.2	15°59.4	174°33.4	8.4'	S00°09.9	11.7'	60.5'		30°	05:38	06:06	06:31	17:22	17:47	18:15
22	150°48.2	16°00.1	189°00.8	8.4'	N00°10.8	11.7'	60.5'		35°	05:43	06:13	06:39	17:14	17:40	18:11
23	165°48.3	00.9	203°28.1	8.3'	00°22.5	11.7'	60.5'		40°	05:48	06:20	06:48	17:05	17:33	18:05
	SD.=15.9	d=0.7			S.D.=16.4				45°	05:53	06:28	06:59	16:54	17:25	18:00
Wed		GHA	Dec	GHA	ν	Dec	d	HP							
0	180°48.3	N16°01.6	217°55.5	8.3'	N00°34.2	11.7'	60.6'		S 50°	05:58	06:37	07:12	16:41	17:16	17:54
1	195°48.4	02.3	232°22.7	8.3'	00°45.9	11.7'	60.6'		52°	06:01	06:41	07:18	16:35	17:12	17:52
2	210°48.5	03.0	246°50.0	8.2'	00°57.6	11.7'	60.6'		54°	06:03	06:46	07:24	16:29	17:07	17:49
3	225°48.5	.. 03.7	261°17.2	8.2'	01°09.3	11.7'	60.6'		56°	06:06	06:51	07:31	16:21	17:02	17:46
4	240°48.6	04.5	275°44.4	8.2'	01°21.0	11.7'	60.7'		58°	06:09	06:56	07:40	16:13	16:56	17:44
5	255°48.6	05.2	290°11.5	8.1'	01°32.7	11.7'	60.7'		S 60°	06:12	07:02	07:49	16:04	16:50	17:40
6	270°48.7	N16°05.9	304°38.6	8.1'	N01°44.4	11.7'	60.7'								
7	285°48.7	06.6	319°05.7	8.0'	01°56.1	11.7'	60.7'								
8	300°48.8	07.3	333°32.7	8.0'	02°07.8	11.7'	60.7'								
9	315°48.8	.. 08.1	347°59.7	8.0'	02°19.5	11.7'	60.8'								
10	330°48.9	08.8	2°26.6	7.9'	02°31.2	11.7'	60.8'								
11	345°49.0	09.5	16°53.5	7.9'	02°42.9	11.7'	60.8'								
12	0°49.0	N16°10.2	31°20.4	7.9'	N02°54.6	11.7'	60.8'								
13	15°49.1	10.9	45°47.2	7.8'	03°06.3	11.7'	60.9'								
14	30°49.1	11.6	60°14.0	7.8'	03°18.0	11.7'	60.9'								
15	45°49.2	.. 12.3	74°40.8	7.7'	03°29.6	11.6'	60.9'								
16	60°49.2	13.1	89°07.5	7.7'	03°41.3	11.6'	60.9'								
17	75°49.3	13.8	103°34.2	7.7'	03°52.9	11.6'	60.9'								
18	90°49.3	N16°14.5	118°00.8	7.6'	N04°04.5	11.6'	61.0'								
19	105°49.4	15.2	132°27.4	7.6'	04°16.1	11.6'	61.0'								
20	120°49.4	15.9	146°53.9	7.5'	04°27.6	11.6'	61.0'								
21	135°49.5	.. 16.6	161°20.4	7.5'	04°39.2	11.5'	61.0'								
22	150°49.5	17.3	175°46.9	7.4'	04°50.7	11.5'	61.0'								
23	165°49.6	18.1	190°13.3	7.4'	05°02.2	11.5'	61.0'								
	SD.=15.8	d=0.7			S.D.=16.6										
Thu		GHA	Dec	GHA	ν	Dec	d	HP							
0	180°49.6	N16°18.8	204°39.7	7.4'	N05°13.7	11.5'	61.1'		S 50°	02:26	03:44	05:04	15:14	15:44	16:17
1	195°49.7	19.5	219°06.1	7.3'	05°25.1	11.4'	61.1'		20°	02:38	03:39	04:42	15:10	15:57	16:46
2	210°49.7	20.2	233°32.4	7.3'	05°36.5	11.4'	61.1'		30°	02:35	03:40	04:47	15:11	15:54	16:39
3	225°49.8	.. 20.9	247°58.6	7.2'	05°47.9	11.4'	61.1'		35°	02:33	03:41	04:50	15:12	15:52	16:35
4	240°49.8	21.6	262°24.9	7.2'	05°59.3	11.3'	61.1'		40°	02:31	03:42	04:54	15:12	15:50	16:30
5	255°49.9	22.3	276°51.0	7.2'	06°10.6	11.3'	61.1'		45°	02:28	03:43	04:58	15:13	15:47	16:24
6	270°49.9	N16°23.0	291°17.2	7.1'	N06°21.9	11.3'	61.1'		S 50°	02:26	03:44	05:04	15:14	15:44	16:17
7	285°50.0	23.7	305°43.3	7.1'	06°33.1	11.2'	61.1'		52°	02:24	03:44	05:06	15:14	15:43	16:14
8	300°50.0	24.4	320°09.3	7.0'	06°44.3	11.2'	61.2'		54°	02:23	03:45	05:09	15:14	15:42	16:11
9	315°50.1	.. 25.1	334°35.3	7.0'	06°55.5	11.1'	61.2'		56°	02:21	03:45	05:11	15:15	15:40	16:07
10	330°50.1	25.8	349°01.3	6.9'	07°06.6	11.1'	61.2'		58°	02:20	03:46	05:15	15:15	15:38	16:03
11	345°50.2	26.6	3°27.2	6.9'	07°17.7	11.1'	61.2'		S 60°	02:18	03:47	05:18	15:16	15:36	15:58
12	0°50.2	N16°27.3	17°53.1	6.9'	N07°28.7	11.0'	61.2'								
13	15°50.3	28.0	32°18.9	6.8'	07°39.7	11.0'	61.2'								
14	30°50.3	28.7	46°44.7	6.8'	07°50.7	10.9'	61.2'								
15	45°50.4	.. 29.4	61°10.4	6.7'	08°01.6	10.9'	61.2'								
16	60°50.4	30.1	75°36.1	6.7'	08°12.4	10.8'	61.2'								
17	75°50.5	30.8	90°01.8	6.6'	08°23.2	10.8'	61.2'								
18	90°50.5	N16°31.5	104°27.4	6.6'	N08°33.9	10.7'	61.2'								
19	105°50.5	32.2	118°53.0	6.6'	08°44.6	10.7'	61.2'								
20	120°50.6	32.9	133°18.5	6.5'	08°55.2	10.6'	61.3'								
21	135°50.6	.. 33.6	147°44.0	6.5'	09°05.8	10.5'	61.3'								
22	150°50.7	34.3	162°09.5	6.4'	09°16.3	10.5'	61.3'								
23	165°50.7	35.0	176°34.9	6.4'	09°26.7	10.4'	61.3'								

## May 06, 07, 08 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars			
Fri	GHA	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	GHA		GHA		
0	224°16.9	188°53.7	N12°53.9	339°25.1	S21°45.2	59°09.8	N07°50.6	330°16.1	S20°48.0							Alpheratz	357°41.7	29°10.6
1	239°19.3	203°53.2	55.0	354°28.2	45.2	74°12.3	50.6	345°18.8	48.0						Ankaa	353°14.2	-42°13.0	
2	254°21.8	218°52.7	56.1	9°31.3	45.2	89°14.8	50.6	0°21.4	48.0						Schedar	349°38.6	56°37.3	
3	269°24.3	233°52.2	· · 57.1	24°34.4	· · 45.3	104°17.3	· · 50.6	15°24.0	· · 48.0						Diphda	348°54.2	-17°53.9	
4	284°26.7	248°51.7	58.2	39°37.5	45.3	119°19.8	50.6	30°26.6	48.0						Achernar	335°26.0	-57°09.3	
5	299°29.2	263°51.2	12°59.2	54°40.6	45.3	134°22.2	50.6	45°29.3	47.9						Hamal	327°58.9	23°32.1	
6	314°31.7	278°50.7	N13°00.3	69°43.7	S21°45.3	149°24.7	N07°50.6	60°31.9	S20°47.9						Polaris	317°19.5	89°19.8	
7	329°34.1	293°50.2	01.4	84°46.8	45.3	164°27.2	50.6	75°34.5	47.9						Acamar	315°17.4	-40°14.6	
8	344°36.6	308°49.7	02.4	99°49.9	45.4	179°29.7	50.6	90°37.1	47.9						Menkar	314°13.4	4°09.0	
9	359°39.1	323°49.2	· · 03.5	114°53.0	· · 45.4	194°32.2	· · 50.6	105°39.8	· · 47.9						Mirfak	308°38.0	49°54.9	
10	14°41.5	338°48.7	04.5	129°56.1	45.4	209°34.7	50.6	120°42.4	47.9						Aldebaran	290°47.5	16°32.2	
11	29°44.0	353°48.2	05.6	144°59.3	45.4	224°37.2	50.6	135°45.0	47.8						Rigel	281°10.5	-8°11.3	
12	44°46.5	8°47.7	N13°06.6	160°02.4	S21°45.4	239°39.7	N07°50.6	150°47.6	S20°47.8						Capella	280°32.0	46°00.7	
13	59°48.9	23°47.2	07.7	175°05.5	45.4	254°42.2	50.6	165°50.2	47.8						Bellatrix	278°30.2	6°21.6	
14	74°51.4	38°46.7	08.7	190°08.6	45.5	269°44.7	50.6	180°52.9	47.8						El Nath	278°10.5	28°37.0	
15	89°53.8	53°46.2	· · 09.8	205°11.7	· · 45.5	284°47.1	· · 50.6	195°55.5	· · 47.8						Alnilam	275°44.7	-1°11.8	
16	104°56.3	68°45.6	10.8	220°14.8	45.5	299°49.6	50.6	210°58.1	47.7						Betelgeuse	270°59.5	7°24.3	
17	119°58.8	83°45.1	11.9	235°17.9	45.5	314°52.1	50.6	226°00.7	47.7						Canopus	263°55.7	-52°42.7	
18	135°01.2	98°44.6	N13°12.9	250°21.1	S21°45.5	329°54.6	N07°50.6	241°03.4	S20°47.7						Sirius	258°32.2	-16°44.7	
19	150°03.7	113°44.1	14.0	265°24.2	45.5	344°57.1	50.6	256°06.0	47.7						Adhara	255°11.2	-29°00.1	
20	165°06.2	128°43.6	15.0	280°27.3	45.6	359°59.6	50.6	271°08.6	47.7						Procyon	244°57.9	5°10.7	
21	180°08.6	143°43.1	· · 16.1	295°30.4	· · 45.6	15°02.1	· · 50.6	286°11.2	· · 47.7						Pollux	243°25.6	27°59.1	
22	195°11.1	158°42.6	17.1	310°33.5	45.6	30°04.6	50.6	301°13.9	47.6						Avior	234°17.3	-59°34.2	
23	210°13.6	173°42.1	18.2	325°36.7	45.6	45°07.0	50.6	316°16.5	47.6						Suhail	222°51.0	-43°30.3	
Mer.pass.:09:01			v-0.5 d1.1 m-3.8	v3.1 d-0.0 m-1.7			v2.5 d0.0 m-2.1			v2.6 d0.0 m0.1								
Sat	GHA	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	GHA		GHA		Dec
0	225°16.0	188°41.6	N13°19.2	340°39.8	S21°45.6	60°09.5	N07°50.6	331°19.1	S20°47.6						Denebola	182°31.5	14°28.8	
1	240°18.5	203°41.1	20.3	355°42.9	45.6	75°12.0	50.6	346°21.7	47.6						Gienah	175°50.0	-17°38.1	
2	255°20.9	218°40.6	21.3	10°46.0	45.7	90°14.5	50.6	1°24.4	47.6						Acrux	173°06.5	-63°11.6	
3	270°23.4	233°40.0	· · 22.4	25°49.2	· · 45.7	105°17.0	· · 50.6	16°27.0	· · 47.5						Gacrux	171°58.2	-57°12.5	
4	285°25.9	248°39.5	23.4	40°52.3	45.7	120°19.5	50.6	31°29.6	47.5						Alioth	166°18.6	55°52.5	
5	300°28.3	263°39.0	24.5	55°55.4	45.7	135°21.9	50.6	46°32.2	47.5						Spica	158°28.9	-11°14.8	
6	315°30.8	278°38.5	N13°25.5	70°58.6	S21°45.7	150°24.4	N07°50.6	61°34.9	S20°47.5						Alkaid	152°57.0	49°14.1	
7	330°33.3	293°38.0	26.6	86°01.7	45.7	165°26.9	50.6	76°37.5	47.5						Hadar	148°44.4	-60°27.1	
8	345°35.7	308°37.5	27.6	101°04.8	45.8	180°29.4	50.6	91°40.1	47.5						Menkent	148°04.9	-36°27.0	
9	0°38.2	323°37.0	· · 28.6	116°08.0	· · 45.8	195°31.9	· · 50.6	106°42.7	· · 47.4						Arcturus	145°53.7	19°05.9	
10	15°40.7	338°36.5	29.7	131°11.1	45.8	210°34.4	50.6	121°45.4	47.4						Rigel Kent.	139°48.3	-60°54.1	
11	30°43.1	353°35.9	30.7	146°14.2	45.8	225°36.8	50.6	136°48.0	47.4						Kochab	137°19.1	74°05.5	
12	45°45.6	8°35.4	N13°31.8	161°17.4	S21°45.8	240°39.3	N07°50.6	151°50.6	S20°47.4						Zuben' ubi	137°02.9	-16°06.5	
13	60°48.1	23°34.9	32.8	176°20.5	45.8	255°41.8	50.6	166°53.2	47.4						Alphecca	126°09.0	26°39.7	
14	75°50.5	38°34.4	33.8	191°23.7	45.8	270°44.3	50.6	181°55.9	47.4						Antares	112°23.5	-26°27.9	
15	90°53.0	53°33.9	· · 34.9	206°26.8	· · 45.9	285°46.8	· · 50.6	196°58.5	· · 47.3						Atria	107°23.1	-69°03.1	
16	105°55.4	68°33.4	35.9	221°29.9	45.9	300°49.3	50.6	212°01.1	47.3						Sabik	102°10.0	-15°44.5	
17	120°57.9	83°32.8	37.0	236°33.1	45.9	315°51.7	50.6	227°03.7	47.3						Shaula	96°18.9	-37°06.7	
18	136°00.4	98°32.3	N13°38.0	251°36.2	S21°45.9	330°54.2	N07°50.6	242°06.4	S20°47.3						Rasalhague	96°04.4	12°33.0	
19	151°02.8	113°31.8	39.0	266°39.4	45.9	345°56.7	50.6	257°09.0	47.3						Eltanin	90°44.8	51°29.2	
20	166°05.3	128°31.3	40.1	281°42.5	45.9	0°59.2	50.6	272°11.6	47.2						Kaus Aust.	83°41.0	-34°22.3	
21	181°07.8	143°30.8	· · 41.1	296°45.7	· · 45.9	16°01.6	· · 50.6	287°14.2	· · 47.2						Vega	80°37.4	38°47.9	
22	196°10.2	158°30.3	42.1	311°48.8	45.9	31°04.1	50.6	302°16.9	47.2						Nunki	75°55.7	-26°16.3	
23	211°12.7	173°29.7	43.2	326°52.0	46.0	46°06.6	50.6	317°19.5	47.2						Altair	62°06.2	8°54.7	
Mer.pass.:08:57			v-0.5 d1.0 m-3.8	v3.1 d-0.0 m-1.7			v2.5 d-0.0 m-2.1			v2.6 d0.0 m0.1								
Sun	GHA	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	GHA		GHA		Dec
0	226°15.2	188°29.2	N13°44.2	341°55.1	S21°46.0	61°09.1	N07°50.6	332°22.1	S20°47.2						May 06 Fri	SHA	Mer.pass	
1	241°17.6	203°28.7	45.2	356°58.3	46.0	76°11.6	50.6	347°24.8	47.2						Venus	324°36.8	11:25	
2	256°20.1	218°28.2	46.3	12°01.4	46.0	91°14.0	50.6	2°27.4	47.1						Mars	115°08.2	01:22	
3	271°22.6	233°27.6	· · 47.3	27°04.6	· · 46.0	106°16.5	· · 50.6	17°30.0	· · 47.1						Jupiter	194°52.9	20:00	
4	286°25.0	248°27.1	48.3	42°07.8	46.0	121°19.0	50.6	32°32.6	47.1						Saturn	105°59.3	01:59	
5	301°27.5	263°26.6	49.4	57°10.9	46.0	136°21.5	50.6	47°35.3	47.1									
6	316°29.9	278°26.1	N13°50.4	72°14.1	S21°46.0	151°24.0	N07°50.6	62°37.9	S20°47.1						May 07 Sat	SHA	Mer.pass	
7	331°32.4	293°25.6	51.4	87°17.2	46.0	166°26.4	50.6	77°40.5	47.0						Venus	323°25.6	11:26	
8	346°34.9	308°25.0	52.5	102°20.4	46.1	181°28.9	50.5	92°43.1	47.0						Mars	115°23.8	01:17	
9	1°37.3	323°24.5	· · 53.5	117°23.6	· · 46.1	196°31.4	· · 50.5	107°45.8	· · 47.0						Jupiter	194°53.5	19:56	
10	16°39.8	338°24.0	54.5	132°26.7	46.1	211°33.9	50.5	122°48.4	47.0						S			

DUT1 = UT1-UTC = -0.1431 sec ΔT = TT-UT1 = +68.3271 sec

2016 May 06 to May. 08 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°50.8	N16°35.7	191°00.2	6.3'	N09°37.1	10.3'	61.3'
1	195°50.8	36.4	205°25.5	6.3'	09°47.4	10.3'	61.3'
2	210°50.9	37.1	219°50.8	6.3'	09°57.7	10.2'	61.3'
3	225°50.9	.. 37.8	234°16.1	6.2'	10°07.9	10.1'	61.3'
4	240°51.0	38.5	248°41.3	6.2'	10°18.0	10.1'	61.3'
5	255°51.0	39.2	263°06.4	6.1'	10°28.0	10.0'	61.3'
6	270°51.0	N16°39.9	277°31.5	6.1'	N10°38.0	9.9'	61.3'
7	285°51.1	40.6	291°56.6	6.1'	10°47.9	9.9'	61.3'
8	300°51.1	41.3	306°21.7	6.0'	10°57.7	9.8'	61.3'
9	315°51.2	.. 42.0	320°46.7	6.0'	11°07.5	9.7'	61.3'
10	330°51.2	42.7	335°11.6	5.9'	11°17.1	9.6'	61.3'
11	345°51.3	43.3	349°36.5	5.9'	11°26.7	9.5'	61.3'
12	0°51.3	N16°44.0	4°01.4	5.9'	N11°36.2	9.5'	61.3'
13	15°51.3	44.7	18°26.3	5.8'	11°45.7	9.4'	61.2'
14	30°51.4	45.4	32°51.1	5.8'	11°55.0	9.3'	61.2'
15	45°51.4	.. 46.1	47°15.9	5.8'	12°04.3	9.2'	61.2'
16	60°51.5	46.8	61°40.6	5.7'	12°13.4	9.1'	61.2'
17	75°51.5	47.5	76°05.3	5.7'	12°22.5	9.0'	61.2'
18	90°51.5	N16°48.2	90°30.0	5.7'	N12°31.5	9.0'	61.2'
19	105°51.6	48.9	104°54.6	5.6'	12°40.4	8.9'	61.2'
20	120°51.6	49.6	119°19.2	5.6'	12°49.2	8.8'	61.2'
21	135°51.7	.. 50.3	133°43.8	5.6'	12°58.0	8.7'	61.2'
22	150°51.7	51.0	148°08.3	5.5'	13°06.6	8.6'	61.2'
23	165°51.7	51.6	162°32.8	5.5'	13°15.1	8.5'	61.2'
	SD.=15.8	d=0.7			S.D.=16.7		

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

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

Day	Sun		Moon		Age 0-2 0-4%
	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass. Upper hh:mm	Mer. Pass. Lower hh:mm	Mer.Pass. hh:mm	
06	03:23	03:25	11:57	11:43	-:-
07	03:27	03:29	11:57	12:42	00:13
08	03:31	03:32	11:56	13:42	01:12



Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°52.6	N17°08.7	162°37.7	5.0'	N16°14.4	5.8'	60.7'
1	195°52.7	09.4	177°01.7	5.0'	16°20.1	5.6'	60.7'
2	210°52.7	10.0	191°25.7	5.0'	16°25.7	5.5'	60.7'
3	225°52.7	.. 10.7	205°49.7	5.0'	16°31.1	5.4'	60.7'
4	240°52.8	11.4	220°13.7	5.0'	16°36.4	5.3'	60.6'
5	255°52.8	12.1	234°37.7	5.0'	16°41.7	5.1'	60.6'
6	270°52.8	N17°12.7	249°01.7	5.0'	N16°46.7	5.0'	60.6'
7	285°52.9	13.4	263°25.6	5.0'	16°51.7	4.9'	60.6'
8	300°52.9	14.1	277°49.6	5.0'	16°56.5	4.8'	60.5'
9	315°52.9	.. 14.8	292°13.6	5.0'	17°01.3	4.7'	60.5'
10	330°53.0	15.4	306°37.6	5.0'	17°05.9	4.5'	60.5'
11	345°53.0	16.1	321°01.6	5.0'	17°10.3	4.4'	60.5'
12	0°53.0	N17°16.8	335°25.6	5.0'	N17°14.7	4.3'	60.4'
13	15°53.0	17.4	349°49.7	5.0'	17°18.9	4.2'	60.4'
14	30°53.1	18.1	4°13.7	5.0'	17°23.0	4.0'	60.4'
15	45°53.1	.. 18.8	18°37.7	5.0'	17°26.9	3.9'	60.3'
16	60°53.1	19.4	33°01.8	5.1'	17°30.8	3.8'	60.3'
17	75°53.2	20.1	47°25.9	5.1'	17°34.5	3.6'	60.3'
18	90°53.2	N17°20.8	61°49.9	5.1'	N17°38.1	3.5'	60.2'
19	105°53.2	21.4	76°14.0	5.1'	17°41.5	3.4'	60.2'
20	120°53.3	22.1	90°38.2	5.1'	17°44.9	3.3'	60.2'
21	135°53.3	.. 22.8	105°02.3	5.1'	17°48.1	3.1'	60.2'
22	150°53.3	23.4	119°26.5	5.2'	17°51.1	3.0'	60.1'
23	165°53.3	24.1	133°50.6	5.2'	17°54.1	2.9'	60.1'
	SD.=15.8	d=0.7			S.D.=16.5		

## May 09, 10, 11 UT (Mon., Tue., Wed.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	227°14.3	188°16.6	N14°08.9	343°11.2	S21°46.2	62°08.5	N07°50.5	333°25.2	S20°46.7	Alpheratz	357°41.7	29°10.6					
1	242°16.8	203°16.1	09.9	358°14.4	46.2	77°10.9	50.5	348°27.8	46.7	Ankaa	353°14.2	-42°13.0					
2	257°19.2	218°15.5	10.9	13°17.5	46.2	92°13.4	50.5	3°30.5	46.7	Schedar	349°38.6	56°37.3					
3	272°21.7	233°15.0	.. 11.9	28°20.7	.. 46.2	107°15.9	.. 50.4	18°33.1	.. 46.7	Diphda	348°54.2	-17°53.9					
4	287°24.2	248°14.5	12.9	43°23.9	46.2	122°18.4	50.4	33°35.7	46.7	Achernar	335°26.0	-57°09.3					
5	302°26.6	263°13.9	13.9	58°27.1	46.2	137°20.8	50.4	48°38.4	46.6	Hamal	327°58.9	23°32.1					
6	317°29.1	278°13.4	N14°15.0	73°30.3	S21°46.2	152°23.3	N07°50.4	63°41.0	S20°46.6	Polaris	317°19.1	89°19.8					
7	332°31.5	293°12.9	16.0	88°33.5	46.2	167°25.8	50.4	78°43.6	46.6	Acamar	315°17.3	-40°14.6					
8	347°34.0	308°12.3	17.0	103°36.7	46.2	182°28.2	50.4	93°46.3	46.6	Menkar	314°13.3	4°09.0					
9	2°36.5	323°11.8	.. 18.0	118°39.9	.. 46.3	197°30.7	.. 50.4	108°48.9	.. 46.6	Mirfak	308°38.0	49°54.9					
10	17°38.9	338°11.3	19.0	133°43.1	46.3	212°33.2	50.4	123°51.5	46.5	Aldebaran	290°47.5	16°32.2					
11	32°41.4	353°10.7	20.0	148°46.2	46.3	227°35.6	50.4	138°54.1	46.5	Rigel	281°10.5	-8°11.3					
12	47°43.9	8°10.2	N14°21.0	163°49.4	S21°46.3	242°38.1	N07°50.4	153°56.8	S20°46.5	Capella	280°32.0	46°00.7					
13	62°46.3	23°09.7	22.1	178°52.6	46.3	257°40.6	50.4	168°59.4	46.5	Bellatrix	278°30.2	6°21.6					
14	77°48.8	38°09.1	23.1	193°55.8	46.3	272°43.0	50.4	184°02.0	46.5	Elnath	278°10.5	28°37.0					
15	92°51.3	53°08.6	.. 24.1	208°59.0	.. 46.3	287°45.5	.. 50.4	199°04.7	.. 46.5	Ahnilam	275°44.7	-1°11.8					
16	107°53.7	68°08.1	25.1	224°02.2	46.3	302°48.0	50.4	214°07.3	46.4	Betelgeuse	270°59.5	7°24.3					
17	122°56.2	83°07.5	26.1	239°05.4	46.3	317°50.4	50.3	229°09.9	46.4	Canopus	263°55.7	-52°42.7					
18	137°58.7	98°07.7	N14°27.1	254°08.6	S21°46.3	332°52.9	N07°50.3	244°12.6	S20°46.4	Sirius	258°32.2	-16°44.7					
19	153°01.1	113°06.4	28.1	269°11.8	46.3	347°55.4	50.3	259°15.2	46.4	Adhara	255°11.2	-29°00.1					
20	168°03.6	128°05.9	29.1	284°15.0	46.3	2°57.8	50.3	274°17.8	46.4	Procyon	244°57.9	5°10.7					
21	183°06.0	143°05.4	.. 30.1	299°18.2	.. 46.3	18°00.3	.. 50.3	289°20.5	.. 46.3	Pollux	243°25.6	27°59.1					
22	198°08.5	158°04.8	31.1	314°21.4	46.3	33°02.8	50.3	304°23.1	46.3	Avior	234°17.3	-59°34.2					
23	213°11.0	173°04.3	32.2	329°24.7	46.3	48°05.2	50.3	319°25.7	46.3	Suhail	222°51.0	-43°30.3					
Mer.pass.:08:50			v-0.5 d1.0 m-3.8	v3.2 d-0.0 m-1.8	v2.5 d-0.0 m-2.1	v2.6 d0.0 m0.1	Mer.pass.:08:46			Miplacidus	221°39.2	-69°47.5					
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.2	-8°44.0	
0	228°13.4	188°03.7	N14°33.2	344°27.9	S21°46.3	63°07.7	N07°50.3	334°28.3	S20°46.3	Regulus	207°41.4	11°53.1					
1	243°15.9	203°03.2	34.2	359°31.1	46.3	78°10.2	50.3	349°31.0	46.3	Dubhe	193°49.2	61°40.0					
2	258°18.4	218°02.7	35.2	14°34.3	46.3	93°12.6	50.3	4°33.6	46.3	Denebola	182°31.5	14°28.8					
3	273°20.8	233°02.1	.. 36.2	29°37.5	.. 46.3	108°15.1	.. 50.3	19°36.2	.. 46.2	Gienah	175°50.0	-17°38.1					
4	288°23.3	248°01.6	37.2	44°40.7	46.3	123°17.6	50.2	34°38.9	46.2	Acrux	173°06.5	-63°11.6					
5	303°25.8	263°01.0	38.2	59°43.9	46.3	138°20.0	50.2	49°41.5	46.2	Gacrux	171°58.2	-57°12.5					
6	318°28.2	278°00.5	N14°39.2	74°47.1	S21°46.3	153°22.5	N07°50.2	64°44.1	S20°46.2	Alioth	166°18.7	55°52.5					
7	333°30.7	293°00.0	40.2	89°50.4	46.3	168°24.9	50.2	79°46.8	46.2	Spica	158°28.9	-11°14.8					
8	348°33.2	307°59.4	41.2	104°53.6	46.3	183°27.4	50.2	94°49.4	46.1	Alkaid	152°57.0	49°14.1					
9	3°35.6	322°58.9	.. 42.2	119°56.8	.. 46.3	198°29.9	.. 50.2	109°52.0	.. 46.1	Hadar	148°44.4	-60°27.1					
10	18°38.1	337°58.3	43.2	135°00.0	46.3	213°32.3	50.2	124°54.7	46.1	Menkent	148°04.8	-36°27.0					
11	33°40.5	352°57.8	44.2	150°03.2	46.3	228°34.8	50.2	139°57.3	46.1	Arcturus	145°53.7	19°05.9					
12	48°43.0	7°57.2	N14°45.2	165°06.4	S21°46.3	243°37.2	N07°50.2	154°59.9	S20°46.1	Rigel Kent.	139°48.3	-60°54.1					
13	63°45.5	22°56.7	46.2	180°09.7	46.3	258°39.7	50.2	170°02.6	46.1	Kochab	137°19.1	74°05.5					
14	78°47.9	37°56.1	47.2	195°12.9	46.3	273°42.2	50.1	185°05.2	46.0	Zuben' ubi	137°02.9	-16°06.5					
15	93°50.4	52°55.6	.. 48.2	210°16.1	.. 46.3	288°44.6	.. 50.1	200°07.8	.. 46.0	Alphecca	126°09.0	26°39.7					
16	108°52.9	67°55.0	49.2	225°19.3	46.3	303°47.1	50.1	215°10.5	46.0	Antares	112°23.5	-26°27.9					
17	123°55.3	82°54.5	50.2	240°22.6	46.3	318°49.5	50.1	230°13.1	46.0	Atria	107°23.0	-69°03.1					
18	138°57.8	97°53.9	N14°51.1	255°25.8	S21°46.3	333°52.0	N07°50.1	245°15.7	S20°46.0	Sabik	102°10.0	-15°44.5					
19	154°00.3	112°53.4	52.1	270°29.0	46.3	348°54.5	50.1	260°18.4	45.9	Shaula	96°18.9	-37°06.7					
20	169°02.7	127°52.8	53.1	285°32.2	46.3	3°56.9	50.1	275°21.0	45.9	Rasalhague	96°04.4	12°33.0					
21	184°05.2	142°52.3	.. 54.1	300°35.5	.. 46.3	18°59.4	.. 50.1	290°23.6	.. 45.9	Eltanin	90°44.8	51°29.2					
22	199°07.7	157°51.7	55.1	315°38.7	46.3	34°01.8	50.0	305°26.3	45.9	Kaus Aust.	83°41.0	-34°22.3					
23	214°10.1	172°51.2	56.1	330°41.9	46.3	49°04.3	50.0	320°28.9	45.9	Vega	80°37.3	38°47.9					
Mer.pass.:08:46			v-0.5 d1.0 m-3.8	v3.2 d-0.0 m-1.8	v2.5 d-0.0 m-2.0	v2.6 d0.0 m0.1	Mer.pass.:08:42			Nunki	75°55.7	-26°16.3					
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Altair	62°06.2	8°54.7					
0	229°12.6	187°50.6	N14°57.1	345°45.2	S21°46.3	64°06.7	N07°50.0	335°31.5	S20°45.8	Peacock	53°16.1	-56°40.6					
1	244°15.0	202°50.1	58.1	0°48.4	46.3	79°09.2	50.0	350°34.2	45.8	Deneb	49°30.0	45°20.2					
2	259°17.5	217°49.5	14°59.1	15°51.6	46.3	94°11.7	50.0	5°36.8	45.8	Enif	33°45.2	9°57.0					
3	274°20.0	232°49.0	15°00.1	30°54.9	.. 46.3	109°14.1	.. 50.0	20°39.4	.. 45.8	Al Na'ir	27°41.5	-46°52.6					
4	289°22.4	247°48.4	01.1	45°58.1	46.3	124°16.6	50.0	35°42.1	45.8	Fomalhaut	15°22.0	-29°32.0					
5	304°24.9	262°47.9	02.0	61°01.4	46.3	139°19.0	50.0	50°44.7	45.8	Scheat	13°51.6	28°10.1					
6	319°27.4	277°47.3	N15°03.0	76°04.6	S21°46.3	154°21.5	N07°49.9	65°47.4	S20°45.7	Markab	13°36.5	15°17.5					
7	334°29.8	292°46.8	04.0	91°07.8	46.3	169°23.9	49.9	80°50.0	45.7	May 09 Mon	SHA	Mer.pass					
8	349°32.3	307°46.2	05.0	106°11.1	46.3	184°26.4	49.9	95°52.6	45.7	Venus	321°02.3	11:27					
9	4°34.8	322°45.7	.. 06.0	121°14.3	.. 46.3	199°28.8	.. 49.9	110°55.3	.. 45.7	Mars	115°56.9	01:07					
10	19°37.2	337°45.1	07.0	136°17.6	46.3	214°31.3	49.9	125°57.9	45.7	Jupiter	194°54.2	19:48					
11	34°39.7	352°44.6	08.0	151°20.8	46.3	229°33.8	49.9	141°00.5	45.6	Saturn	106°10.9	01:46					
12	49°42.2	7°44.0	N15°08.9	166°24.1	S21°46.3	244°36.2	N07°49.9	156°03.2	S20°45.6	May 10 Tue	SHA	Mer.pass					
13	64°44.6	22°43.4	09.9	181°27.3	46.3	259°38.7	49.9	171°05.8	45.6	Venus	319°50.3	11:28					
14	79°47.1	37°42.9	10.9	196°30.5	46.3	274°41.1	49.8	186°08.4	45.6	Mars	116°32.6	00:57					
15	94°49.5	52°42.3	.. 11.9	211°33.8	.. 46.3	289°43.6	.. 49.8	201°11.1	.. 45.6	Jupiter	194°54.2	19:40					
16	109°52.0	67°41.8	12.9	226°37.0	46.3	304°46.0	49.8	216°13.7	45.5	Saturn	106°19.0	01:38					
17	124°54.5	82°41.2	13.8	241°40.3	46.3	319°48.5	49.8	231°16.3	45.5	May 11 Wed	SHA	Mer.pass					
18	139°56.9	97°40.6	N15°14.8	256°43.5	S21°46.3	334°50.9	N07°49.8	246°19.0	S20°45.5	Venus	318°38.1	11:29					
19	154°59.4	112°40.1	15.8	271°46.8	46.3	349°53.4	49.8	261°21.6	45.5	Mars	116°32.6						

DUT1 = UT1-UTC = -0.1481 sec ΔT = TT-UT1 = +68.3321 sec

2016 May 09 to May. 11 UT

h	Sun			Moon			
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°53.4	N17°24.8	148°14.8	5.2'	N17°56.9	2.8'	60.1'
1	195°53.4	25.4	162°39.1	5.2'	17°59.6	2.6'	60.0'
2	210°53.4	26.1	177°03.3	5.3'	18°02.2	2.5'	60.0'
3	225°53.4	.. 26.8	191°27.6	5.3'	18°04.6	2.4'	60.0'
4	240°53.5	27.4	205°51.9	5.3'	18°06.9	2.2'	59.9'
5	255°53.5	28.1	220°16.2	5.4'	18°09.1	2.1'	59.9'
6	270°53.5	N17°28.7	234°40.6	5.4'	N18°11.1	2.0'	59.9'
7	285°53.5	29.4	249°05.0	5.4'	18°13.1	1.9'	59.8'
8	300°53.6	30.1	263°29.4	5.4'	18°14.9	1.7'	59.8'
9	315°53.6	.. 30.7	277°53.9	5.5'	18°16.5	1.6'	59.7'
10	330°53.6	31.4	292°18.4	5.5'	18°18.1	1.5'	59.7'
11	345°53.6	32.0	306°42.9	5.6'	18°19.5	1.4'	59.7'
12	0°53.7	N17°32.7	321°07.5	5.6'	N18°20.8	1.2'	59.6'
13	15°53.7	33.4	335°32.1	5.6'	18°22.0	1.1'	59.6'
14	30°53.7	34.0	349°56.8	5.7'	18°23.0	1.0'	59.6'
15	45°53.7	.. 34.7	4°21.5	5.7'	18°23.9	0.9'	59.5'
16	60°53.8	35.3	18°46.2	5.8'	18°24.7	0.7'	59.5'
17	75°53.8	36.0	33°11.0	5.8'	18°25.4	0.6'	59.5'
18	90°53.8	N17°36.6	47°35.9	5.9'	N18°25.9	0.5'	59.4'
19	105°53.8	37.3	62°00.7	5.9'	18°26.4	0.4'	59.4'
20	120°53.9	37.9	76°25.7	5.9'	18°26.6	0.2'	59.3'
21	135°53.9	.. 38.6	90°50.6	6.0'	18°26.8	0.1'	59.3'
22	150°53.9	39.2	105°15.7	6.0'	18°26.9	-0.0'	59.3'
23	165°53.9	39.9	119°40.7	6.1'	18°26.8	-0.1'	59.2'
	SD.=15.8	d=0.7			S.D.=16.3		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°53.9	N17°40.6	134°05.9	6.2'	N18°26.6	-0.3'	59.2'
1	195°54.0	41.2	148°31.0	6.2'	18°26.3	-0.4'	59.2'
2	210°54.0	41.9	162°56.3	6.3'	18°25.9	-0.5'	59.1'
3	225°54.0	.. 42.5	177°21.6	6.3'	18°25.3	-0.6'	59.1'
4	240°54.0	43.2	191°46.9	6.4'	18°24.6	-0.7'	59.0'
5	255°54.0	43.8	206°12.3	6.4'	18°23.9	-0.8'	59.0'
6	270°54.1	N17°44.5	220°37.8	6.5'	N18°22.9	-1.0'	59.0'
7	285°54.1	45.1	235°03.3	6.5'	18°21.9	-1.1'	58.9'
8	300°54.1	45.7	249°28.8	6.6'	18°20.8	-1.2'	58.9'
9	315°54.1	.. 46.4	263°54.5	6.7'	18°19.5	-1.3'	58.8'
10	330°54.1	47.0	278°20.2	6.7'	18°18.1	-1.4'	58.8'
11	345°54.2	47.7	292°45.9	6.8'	18°16.7	-1.5'	58.8'
12	0°54.2	N17°48.3	307°11.8	6.9'	N18°15.0	-1.7'	58.7'
13	15°54.2	49.0	321°37.6	6.9'	18°13.3	-1.8'	58.7'
14	30°54.2	49.6	336°03.6	7.0'	18°11.5	-1.9'	58.6'
15	45°54.2	.. 50.3	350°29.6	7.0'	18°09.6	-2.0'	58.6'
16	60°54.3	50.9	4°55.7	7.1'	18°07.5	-2.1'	58.6'
17	75°54.3	51.6	19°21.8	7.2'	18°05.3	-2.2'	58.5'
18	90°54.3	N17°52.2	33°48.1	7.2'	N18°03.1	-2.3'	58.5'
19	105°54.3	52.8	48°14.3	7.3'	18°00.7	-2.4'	58.4'
20	120°54.3	53.5	62°40.7	7.4'	17°58.2	-2.5'	58.4'
21	135°54.3	.. 54.1	77°07.1	7.5'	17°55.6	-2.6'	58.4'
22	150°54.4	54.8	91°33.6	7.5'	17°52.9	-2.8'	58.3'
23	165°54.4	55.4	106°00.2	7.6'	17°50.1	-2.9'	58.3'
	SD.=15.8	d=0.7			S.D.=16.0		

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°54.4	N17°56.0	120°26.8	7.7'	N17°47.2	-3.0'	58.2'
1	195°54.4	56.7	134°53.5	7.7'	17°44.2	-3.1'	58.2'
2	210°54.4	57.3	149°20.3	7.8'	17°41.0	-3.2'	58.2'
3	225°54.4	.. 58.0	163°47.1	7.9'	17°37.8	-3.3'	58.1'
4	240°54.4	58.6	178°14.0	8.0'	17°34.5	-3.4'	58.1'
5	255°54.5	59.2	192°41.0	8.0'	17°31.1	-3.5'	58.0'
6	270°54.5	N17°59.9	207°08.1	8.1'	N17°27.5	-3.6'	58.0'
7	285°54.5	18°00.5	221°35.2	8.2'	17°23.9	-3.7'	58.0'
8	300°54.5	01.1	236°02.5	8.3'	17°20.2	-3.8'	57.9'
9	315°54.5	.. 01.8	250°29.7	8.3'	17°16.4	-3.9'	57.9'
10	330°54.5	02.4	264°57.1	8.4'	17°12.5	-4.0'	57.8'
11	345°54.5	03.0	279°24.6	8.5'	17°08.5	-4.1'	57.8'
12	0°54.6	N18°03.7	293°52.1	8.6'	N17°04.4	-4.1'	57.8'
13	15°54.6	04.3	308°19.7	8.6'	17°00.2	-4.2'	57.7'
14	30°54.6	04.9	322°47.3	8.7'	16°55.9	-4.3'	57.7'
15	45°54.6	.. 05.6	337°15.1	8.8'	16°51.5	-4.4'	57.6'
16	60°54.6	06.2	351°42.9	8.9'	16°47.0	-4.5'	57.6'
17	75°54.6	06.8	6°10.8	8.9'	16°42.5	-4.6'	57.6'
18	90°54.6	N18°07.5	20°38.8	9.0'	N16°37.8	-4.7'	57.5'
19	105°54.6	08.1	35°06.8	9.1'	16°33.1	-4.8'	57.5'
20	120°54.6	08.7	49°34.9	9.2'	16°28.3	-4.9'	57.5'
21	135°54.7	.. 09.3	64°03.1	9.2'	16°23.3	-5.0'	57.4'
22	150°54.7	10.0	78°31.4	9.3'	16°18.3	-5.0'	57.4'
23	165°54.7	10.6	92°59.8	9.4'	16°13.3	-5.1'	57.3'
	SD.=15.8	d=0.6			S.D.=15.7		

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> 00 <sup>m</sup> 00 <sup>s</sup>	12 <sup>h</sup>	Mer. Pass.	Age
	mm:ss	mm:ss	mm:ss	hh:mm	3-5 11-28%
09	03:33	03:35	11:56	14:42	02:12
10	03:36	03:37	11:56	15:40	03:11
11	03:38	03:38	11:56	16:34	04:07



## May 12, 13, 14 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	230°11.7	187°37.3	N15°20.7	347°03.1	S21°46.2	65°05.6	N07°49.7	336°34.8	S20°45.4					Alpheratz	357°41.7	
1	245°14.2	202°36.7	21.7	2°06.3	46.2	80°08.1	49.7	351°37.4	45.4					Ankaa	353°14.1	
2	260°16.6	217°36.2	22.6	17°09.6	46.2	95°10.5	49.7	6°40.1	45.4					Schedar	349°38.6	
3	275°19.1	232°35.6	23.6	32°12.8	46.2	110°13.0	49.7	21°42.7	45.3					Diphda	348°54.2	
4	290°21.6	247°35.0	24.6	47°16.1	46.2	125°15.4	49.6	36°45.3	45.3					Achernar	335°26.0	
5	305°24.0	262°34.5	25.5	62°19.4	46.2	140°17.9	49.6	51°48.0	45.3					Hamal	327°58.9	
6	320°26.5	277°33.9	N15°26.5	77°22.6	S21°46.2	155°20.3	N07°49.6	66°50.6	S20°45.3					Polaris	317°18.7	
7	335°29.0	292°33.3	27.5	92°25.9	46.2	170°22.8	49.6	81°53.2	45.3					Acamar	315°17.3	
8	350°31.4	307°32.8	28.5	107°29.2	46.2	185°25.2	49.6	96°55.9	45.2					Menkar	314°13.3	
9	5°33.9	322°32.2	29.4	122°32.4	46.2	200°27.7	49.6	111°58.5	45.2					Mirfak	308°38.0	
10	20°36.4	337°31.6	30.4	137°35.7	46.2	215°30.1	49.5	127°01.2	45.2					Aldebaran	290°47.5	
11	35°38.8	352°31.1	31.4	152°39.0	46.2	230°32.6	49.5	142°03.8	45.2					Rigel	281°10.5	
12	50°41.3	7°30.5	N15°32.3	167°42.2	S21°46.2	245°35.0	N07°49.5	157°06.4	S20°45.2					Capella	280°32.0	
13	65°43.8	22°29.9	33.3	182°45.5	46.1	260°37.4	49.5	172°09.1	45.2					Bellatrix	278°30.2	
14	80°46.2	37°29.4	34.3	197°48.8	46.1	275°39.9	49.5	187°11.7	45.1					El Nath	278°10.5	
15	95°48.7	52°28.8	35.2	212°52.0	46.1	290°42.3	49.5	202°14.3	45.1					Alnilam	275°44.7	
16	110°51.1	67°28.2	36.2	227°55.3	46.1	305°44.8	49.4	217°17.0	45.1					Betelgeuse	270°59.5	
17	125°53.6	82°27.7	37.1	242°58.6	46.1	320°47.2	49.4	232°19.6	45.1					Canopus	263°55.7	
18	140°56.1	97°27.1	N15°38.1	258°01.9	S21°46.1	335°49.7	N07°49.4	247°22.3	S20°45.1					Sirius	258°32.2	
19	155°58.5	112°26.5	39.1	273°05.1	46.1	350°52.1	49.4	262°24.9	45.0					Adhara	255°11.2	
20	171°01.0	127°25.9	40.0	288°08.4	46.1	5°54.6	49.4	277°27.5	45.0					Procyon	244°57.9	
21	186°03.5	142°25.4	41.0	303°11.7	46.1	20°57.0	49.4	292°30.2	45.0					Pollux	243°25.6	
22	201°05.9	157°24.8	42.0	318°15.0	46.1	35°59.4	49.3	307°32.8	45.0					Avior	234°17.4	
23	216°08.4	172°24.2	42.9	333°18.2	46.1	51°01.9	49.3	322°35.5	45.0					Suhail	222°51.0	
Mer.pass.:08:38			v-0.6 d1.0 m-3.8	v3.3 d0.0 m-1.9		v2.4 d-0.0 m-2.0		v2.6 d0.0 m-0.1								
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars		
0	231°10.9	187°23.7	N15°43.9	348°21.5	S21°46.0	66°04.3	N07°49.3	337°38.1	S20°44.9					Denebola	182°31.5	
1	246°13.3	202°23.1	44.8	3°24.8	46.0	81°06.8	49.3	352°40.7	44.9					Gienah	175°50.1	
2	261°15.8	217°22.5	45.8	18°28.1	46.0	96°09.2	49.3	7°43.4	44.9					Acrua	173°06.5	
3	276°18.3	232°21.9	46.7	33°31.4	46.0	111°11.7	49.2	22°46.0	44.9					Gacrux	171°58.2	
4	291°20.7	247°21.4	47.7	48°34.6	46.0	126°14.1	49.2	37°48.6	44.9					Alioth	166°18.7	
5	306°23.2	262°20.8	48.7	63°37.9	46.0	141°16.5	49.2	52°51.3	44.9					Spica	158°28.9	
6	321°25.6	277°20.2	N15°49.6	78°41.2	S21°46.0	156°19.0	N07°49.2	67°53.9	S20°44.8					Alkaid	152°57.0	
7	336°28.1	292°19.6	50.6	93°44.5	46.0	171°21.4	49.2	82°56.6	44.8					Hadar	148°44.4	
8	351°30.6	307°19.1	51.5	108°47.8	46.0	186°23.9	49.2	97°59.2	44.8					Menkent	148°04.8	
9	6°33.0	322°18.5	52.5	123°51.1	45.9	201°26.3	49.1	113°01.8	44.8					Arcturus	145°53.7	
10	21°35.5	337°17.9	53.4	138°54.4	45.9	216°28.7	49.1	128°04.5	44.8					Rigel Kent.	139°48.3	
11	36°38.0	352°17.3	54.4	153°57.7	45.9	231°31.2	49.1	143°07.1	44.7					Kochab	137°19.1	
12	51°40.4	7°16.8	N15°55.3	169°00.9	S21°45.9	246°33.6	N07°49.1	158°09.8	S20°44.7					Zuben ubi	137°02.9	
13	66°42.9	22°16.2	56.3	184°04.2	45.9	261°36.1	49.1	173°12.4	44.7					Alphecca	126°09.0	
14	81°45.4	37°15.6	57.2	199°07.5	45.9	276°38.5	49.0	188°15.0	44.7					Antares	112°23.5	
15	96°47.8	52°15.0	58.2	214°10.8	45.9	291°40.9	49.0	203°17.7	44.7					Atria	107°23.0	
16	111°50.3	67°14.4	59.1	229°14.1	45.9	306°43.4	49.0	218°20.3	44.6					Sabik	102°10.0	
17	126°52.7	82°13.9	60.0	244°17.4	45.8	321°45.8	49.0	233°20.6	44.6					Shaula	96°18.9	
18	141°55.2	97°13.3	N16°01.0	259°20.7	S21°45.8	336°48.3	N07°49.0	248°25.6	S20°44.6					Rasalhague	96°04.4	
19	156°57.7	112°12.7	0.0	274°24.0	45.8	351°50.7	48.9	263°28.2	44.6					Eltanin	90°44.8	
20	172°00.1	127°12.1	0.9	289°27.3	45.8	6°53.1	48.9	278°30.9	44.6					Kaus Aust.	83°40.9	
21	187°02.6	142°11.5	0.8	304°30.6	45.8	21°55.6	48.9	293°33.5	44.5					Vega	80°37.3	
22	202°05.1	157°10.9	0.8	319°33.9	45.8	36°58.0	48.9	308°36.2	44.5					Nunki	75°55.7	
23	217°07.5	172°10.4	0.7	334°37.2	45.8	52°00.4	48.9	323°38.8	44.5					Altair	62°06.2	
Mer.pass.:08:34			v-0.6 d1.0 m-3.8	v3.3 d0.0 m-2.0		v2.4 d-0.0 m-2.0		v2.6 d0.0 m-0.1								
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Stars		
0	232°10.0	187°09.8	N16°06.7	349°40.5	S21°45.7	67°02.9	N07°48.8	338°41.4	S20°44.5					Fomalhaut	15°22.0	
1	247°12.5	202°09.2	07.6	4°43.8	45.7	82°05.3	48.8	353°44.1	44.5					Scheat	13°51.6	
2	262°14.9	217°08.6	08.6	19°47.1	45.7	97°07.7	48.8	8°46.7	44.5					Markab	13°36.5	
3	277°17.4	232°08.0	09.5	34°50.4	45.7	112°10.2	48.8	23°49.4	44.4					May 12 Thu		
4	292°19.9	247°07.4	10.4	49°53.7	45.7	127°12.6	48.7	38°52.0	44.4					Venus	317°25.6	
5	307°22.3	262°06.9	11.4	64°57.0	45.7	142°15.0	48.7	53°54.6	44.4					Mars	116°51.4	
6	322°24.8	277°06.3	N16°12.3	80°00.3	S21°45.6	157°17.5	N07°48.7	68°57.3	S20°44.4					Jupiter	194°53.9	
7	337°27.2	292°05.7	13.2	95°03.6	45.6	172°19.9	48.7	83°59.9	44.4					Saturn	106°23.1	
8	352°29.7	307°05.1	14.2	110°06.9	45.6	187°22.3	48.7	99°02.6	44.3					May 13 Fri		
9	7°32.2	322°04.5	15.1	125°10.2	45.6	202°24.8	48.6	114°05.2	44.3					Venus	316°12.8	
10	22°34.6	337°03.9	16.1	140°13.5	45.6	217°27.2	48.6	129°07.8	44.3					Mars	117°10.7	
11	37°37.1	352°03.3	17.0	155°16.9	45.6	232°29.6	48.6	144°10.5	44.3					Jupiter	194°53.5	
12	52°39.6	7°02.7	N16°17.9	170°20.2	S21°45.5	247°32.1	N07°48.6	159°13.1	S20°44.3					Saturn	106°27.2	
13	67°42.0	22°02.1	18.9	185°23.5	45.5	262°34.5	48.5	174°15.8	44.2					May 14 Sat		
14	82°44.5	37°01.6	19.8	200°26.8	45.5	277°36.9	48.5	189°18.4	44.2					Venus	314°59.8	
15	97°47.0	52°01.0	20.7	215°30.1	45.5	292°39.4	48.4	204°21.1	44.2					Mars	117°30.5	
16	112°49.4	67°00.4	21.6	230°33.4	45.5	307°41.8	48.5	219°23.7	44.2					Jupiter	194°52.9	
17	127°51.9	81°59.8	22.6	245°36.7	45.5	322°44.2	48.5	234°26.3	44.2					Saturn	106°31.4	
18	142°54.4	96°59.2	N16°													

DUT1 = UT1-UTC = -0.1531 sec ΔT = TT-UT1 = +68.3371 sec

2016 May 12 to May. 14 UT

h		Sun		Moon										
Thu		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight	Sunrise	Sunset	Twilight	
									Naut.	Civil			Civil	Naut.
0	180°54.7	N18°11.2		107°28.2	9.5'	N16°08.1	-5.2'	57.3'	N 72°	□	□	□	□	□
1	195°54.7	11.9		121°56.7	9.6'	16°02.9	-5.3'	57.3'	N 70°	□	□	01:01	23:03	□
2	210°54.7	12.5		136°25.3	9.6'	15°57.5	-5.4'	57.2'	68°	□	□	01:56	22:01	□
3	225°54.7	.. 13.1		150°54.0	9.7'	15°52.1	-5.4'	57.2'	66°	□	□	02:29	21:27	□
4	240°54.7	13.7		165°22.7	9.8'	15°46.6	-5.5'	57.1'	64°	□	01:19	02:52	21:03	22:39
5	255°54.7	14.4		179°51.6	9.9'	15°41.1	-5.6'	57.1'	62°	□	01:58	03:11	20:44	21:58
6	270°54.7	N18°15.0		194°20.5	9.9'	N15°35.4	-5.7'	57.1'	60°	□	02:24	03:26	20:28	21:31
7	285°54.8	15.6		208°49.4	10.0'	15°29.7	-5.8'	57.0'	N 58°	01:11	02:45	03:39	20:15	21:10
8	300°54.8	16.2		223°18.5	10.1'	15°23.9	-5.8'	57.0'	56°	01:47	03:01	03:50	20:04	20:53
9	315°54.8	.. 16.8		237°47.6	10.2'	15°18.0	-5.9'	57.0'	54°	02:11	03:15	04:00	19:54	20:39
10	330°54.8	17.5		252°16.8	10.2'	15°12.1	-6.0'	56.9'	52°	02:30	03:27	04:09	19:45	20:27
11	345°54.8	18.1		266°46.1	10.3'	15°06.1	-6.1'	56.9'	50°	02:46	03:37	04:17	19:37	20:16
12	0°54.8	N18°18.7		281°15.4	10.4'	N15°00.0	-6.1'	56.8'	45°	03:16	03:59	04:33	19:20	19:55
13	15°54.8	19.3		295°44.9	10.5'	14°53.8	-6.2'	56.8'	N 40°	03:38	04:16	04:46	19:07	19:37
14	30°54.8	19.9		310°14.4	10.5'	14°47.6	-6.3'	56.8'	35°	03:56	04:30	04:58	18:55	19:23
15	45°54.8	.. 20.6		324°44.0	10.6'	14°41.3	-6.3'	56.7'	30°	04:10	04:42	05:08	18:45	19:11
16	60°54.8	21.2		339°13.6	10.7'	14°34.9	-6.4'	56.7'	20°	04:33	05:01	05:25	18:28	19:20
17	75°54.8	21.8		353°43.3	10.8'	14°28.5	-6.5'	56.7'	N 10°	04:51	05:17	05:39	18:14	18:36
18	90°54.8	N18°22.4		8°13.2	10.8'	N14°22.0	-6.5'	56.6'	0°	05:06	05:31	05:53	18:00	18:22
19	105°54.8	23.0		22°43.0	10.9'	14°15.4	-6.6'	56.6'	S 10°	05:19	05:44	06:06	17:46	18:08
20	120°54.8	23.6		37°13.0	11.0'	14°08.8	-6.7'	56.6'	20°	05:31	05:57	06:21	17:32	17:55
21	135°54.8	.. 24.3		51°43.0	11.1'	14°02.1	-6.7'	56.5'	30°	05:43	06:11	06:37	17:16	17:41
22	150°54.8	24.9		66°13.1	11.1'	13°55.3	-6.8'	56.5'	35°	05:49	06:19	06:46	17:06	17:33
23	165°54.9	25.5		80°43.3	11.2'	13°48.5	-6.9'	56.5'	40°	05:55	06:28	06:57	16:55	17:24
	SD.=15.8	d=0.6				S.D.=15.5			45°	06:02	06:38	07:09	16:43	17:15
Fri		GHA	Dec	GHA	ν	Dec	d	HP	S 50°	06:10	06:49	07:25	16:28	17:03
0	180°54.9	N18°26.1		95°13.5	11.3'	N13°41.6	-6.9'	56.4'	52°	06:13	06:54	07:32	16:21	16:58
1	195°54.9	26.7		109°43.8	11.3'	13°34.7	-7.0'	56.4'	54°	06:16	07:00	07:39	16:13	16:52
2	210°54.9	27.3		124°14.2	11.4'	13°27.6	-7.0'	56.3'	56°	06:20	07:06	07:48	16:04	16:46
3	225°54.9	.. 27.9		138°44.7	11.5'	13°20.6	-7.1'	56.3'	58°	06:24	07:13	07:58	15:54	16:39
4	240°54.9	28.6		153°15.2	11.6'	13°13.5	-7.2'	56.3'	S 60°	06:29	07:21	08:10	15:42	16:31
5	255°54.9	29.2		167°45.8	11.6'	13°06.3	-7.2'	56.2'						17:23
6	270°54.9	N18°29.8		182°16.5	11.7'	N12°59.0	-7.3'	56.2'						
7	285°54.9	30.4		196°47.2	11.8'	12°51.7	-7.3'	56.2'						
8	300°54.9	31.0		211°18.0	11.8'	12°44.4	-7.4'	56.1'						
9	315°54.9	.. 31.6		225°48.9	11.9'	12°37.0	-7.4'	56.1'						
10	330°54.9	32.2		240°19.8	12.0'	12°29.5	-7.5'	56.1'						
11	345°54.9	32.8		254°50.8	12.0'	12°22.0	-7.5'	56.0'						
12	0°54.9	N18°33.4		269°21.9	12.1'	N12°14.5	-7.6'	56.0'						
13	15°54.9	34.0		283°53.0	12.2'	12°06.9	-7.6'	56.0'						
14	30°54.9	34.6		298°24.2	12.2'	11°59.2	-7.7'	56.0'						
15	45°54.9	.. 35.3		312°55.5	12.3'	11°51.5	-7.7'	55.9'						
16	60°54.9	35.9		327°26.8	12.4'	11°43.8	-7.8'	55.9'						
17	75°54.9	36.5		341°58.2	12.4'	11°35.9	-7.8'	55.9'						
18	90°54.9	N18°37.1		356°29.7	12.5'	N11°28.1	-7.9'	55.8'						
19	105°54.9	37.7		11°01.2	12.6'	11°20.2	-7.9'	55.8'						
20	120°54.9	38.3		25°32.8	12.6'	11°12.3	-8.0'	55.8'						
21	135°54.9	.. 38.9		40°04.5	12.7'	11°04.3	-8.0'	55.7'						
22	150°54.9	39.5		54°36.2	12.7'	10°56.3	-8.0'	55.7'						
23	165°54.9	40.1		69°07.9	12.8'	10°48.2	-8.1'	55.7'						
	SD.=15.8	d=0.6				S.D.=15.3								
Sat		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Moonrise		Moonset		
0	180°54.9	N18°40.7		83°39.8	12.9'	N10°40.1	-8.1'	55.7'	N 72°	07:15	09:05	10:48	02:57	02:50
1	195°54.9	41.3		98°11.6	12.9'	10°31.9	-8.2'	55.6'	N 70°	07:52	09:28	11:02	02:19	02:29
2	210°54.9	41.9		112°43.6	13.0'	10°23.7	-8.2'	55.6'	68°	08:18	09:46	11:14	01:52	02:16
3	225°54.9	.. 42.5		127°15.6	13.0'	10°15.5	-8.3'	55.6'	66°	08:38	10:01	11:23	01:32	01:52
4	240°54.9	43.1		141°47.6	13.1'	10°07.2	-8.3'	55.5'	64°	08:53	10:12	11:31	01:16	01:39
5	255°54.9	43.7		156°19.8	13.1'	09°58.9	-8.3'	55.5'	62°	09:07	10:22	11:38	01:02	01:49
6	270°54.9	N18°44.3		170°51.9	13.2'	N09°50.6	-8.4'	55.5'	60°	09:18	10:31	11:44	00:50	01:42
7	285°54.9	44.9		185°24.2	13.3'	09°42.2	-8.4'	55.5'	N 58°	09:27	10:38	11:49	00:40	01:36
8	300°54.9	45.5		199°56.4	13.3'	09°33.8	-8.4'	55.4'	56°	09:36	10:45	11:54	00:31	01:31
9	315°54.9	.. 46.1		214°28.8	13.4'	09°25.3	-8.5'	55.4'	54°	09:43	10:51	11:58	00:24	00:58
10	330°54.9	46.7		229°01.2	13.4'	09°16.8	-8.5'	55.4'	52°	09:50	10:56	12:02	00:17	00:52
11	345°54.9	47.2		243°33.6	13.5'	09°08.3	-8.5'	55.3'	50°	09:56	11:01	12:05	00:10	01:18
12	0°54.8	N18°47.8		258°06.1	13.5'	N08°59.7	-8.6'	55.3'	45°	10:09	11:11	12:12	---	00:36
13	15°54.8	48.4		272°38.6	13.6'	08°51.1	-8.6'	55.3'	S 10°	11:25	12:12	12:56	23:28	00:18
14	30°54.8	49.0		287°11.2	13.6'	08°42.5	-8.6'	55.3'	20°	11:37	12:22	13:03	23:17	00:09
15	45°54.8	.. 49.6		301°43.9	13.7'	08°33.9	-8.7'	55.2'	30°	11:51	12:33	13:11	23:04	00:00
16	60°54.8	50.2		316°16.6	13.7'	08°25.2	-8.7'	55.2'	35°	11:59	12:39	13:15	22:57	23:54
17	75°54.8	50.8		330°49.3	13.8'	08°16.5	-8.7'	55.2'	40°	12:08	12:46	13:20	22:48	23:48
18	90°54.8	N18°51.4		345°22.1	13.8'	N08°07.7	-8.8'	55.2'	45°	12:18	12:55	13:26	22:39	23:40
19	105°54.8	52.0		359°54.9	13.9'	07°58.9	-8.8'	55.1'	S 50°	12:31	13:05	13:33	22:27	23:32
20	120°54.8	52.6		14°27.8	13.9'	07°50.2	-8.8'	55.1'	52°	12:37	13:09	13:37	22:21	23:27
21	135°54.8	.. 53.2		29°00.8	13.9'	07°41.3	-8.8'	55.1'	54°	12:43	13:14	13:40	22:15	23:23
22	150°54.8	53.8		43°33.7	14.0'	07°32.5	-8.9'	55.1'	56°	12:51	13:20	13:44	22:08	23:18
23	165°54.8	54.3		58°06.7	14.0'	07°23.6	-8.9'	55.0'	58°	12:59	13:26	13:49	22:01	23:12
	SD.=15.8	d=0.6				S.D.=15.1			S 60°	13:08	13:33	13:54	21:52	23:06
Day										Sun			Moon	

## May 15, 16, 17 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	233°09.1	186°55.6	N16°29.1	350°59.9	S21°45.3	68°01.2	N07°48.3	339°44.8	S20°44.0	Alpheratz	357°41.6	29°10.6					
1	248°11.6	201°55.0	30.0	6°03.3	45.3	83°03.7	48.3	354°47.5	44.0	Ankaa	353°14.1	-42°13.0					
2	263°14.1	216°54.4	30.9	21°06.6	45.3	98°06.1	48.2	9°50.1	44.0	Schedar	349°38.6	56°37.3					
3	278°16.5	231°53.8	.. 31.8	36°09.9	.. 45.3	113°08.5	.. 48.2	24°52.8	.. 44.0	Diphda	348°54.2	-17°53.9					
4	293°19.0	246°53.2	32.8	51°13.2	45.3	128°11.0	48.2	39°55.4	44.0	Achernar	335°26.0	-57°09.2					
5	308°21.5	261°52.6	33.7	66°16.6	45.2	143°13.4	48.2	54°58.0	43.9	Hamal	327°58.8	23°32.1					
6	323°23.9	276°52.0	N16°34.6	81°19.9	S21°45.2	158°15.8	N07°48.1	70°00.7	S20°43.9	Polaris	317°18.4	89°19.8					
7	338°26.4	291°51.5	35.5	96°23.2	45.2	173°18.2	48.1	85°03.3	43.9	Acamar	315°17.3	-40°14.5					
8	353°28.8	306°50.9	36.4	111°26.5	45.2	188°20.7	48.1	100°06.0	43.9	Menkar	314°13.3	4°09.0					
9	8°31.3	321°50.3	.. 37.4	126°29.9	.. 45.1	203°23.1	.. 48.1	115°08.6	.. 43.9	Mirfak	308°38.0	49°54.9					
10	23°33.8	336°49.7	38.3	141°33.2	45.1	218°25.5	48.0	130°11.3	43.8	Aldebaran	290°47.5	16°32.2					
11	38°36.2	351°49.1	39.2	156°36.5	45.1	233°27.9	48.0	145°13.9	43.8	Rigel	281°10.5	-8°11.3					
12	53°38.7	6°48.5	N16°40.1	171°39.8	S21°45.1	248°30.4	N07°48.0	160°16.5	S20°43.8	Capella	280°32.0	46°00.7					
13	68°41.2	21°47.9	41.0	186°43.2	45.1	263°32.8	48.0	175°19.2	43.8	Bellatrix	278°30.2	6°21.6					
14	83°43.6	36°47.2	41.9	201°46.5	45.0	278°35.2	47.9	190°21.8	43.8	Elnath	278°10.5	28°37.0					
15	98°46.1	51°46.6	.. 42.9	216°49.8	.. 45.0	293°37.6	.. 47.9	205°24.5	.. 43.7	Ahnilam	275°44.7	-1°11.8					
16	113°48.6	66°46.0	43.8	231°53.2	45.0	308°40.1	47.9	220°27.1	43.7	Betelgeuse	270°59.5	7°24.3					
17	128°51.0	81°45.4	44.7	246°56.5	45.0	323°42.5	47.9	235°29.8	43.7	Canopus	263°55.7	-52°42.7					
18	143°53.5	96°44.8	N16°45.6	261°59.8	S21°45.0	338°44.9	N07°47.8	250°32.4	S20°43.7	Sirius	258°32.3	-16°44.7					
19	158°56.0	111°44.2	46.5	277°03.2	44.9	353°47.3	47.8	265°35.0	43.7	Adhara	255°11.2	-29°00.0					
20	173°58.4	126°43.6	47.4	292°06.5	44.9	8°49.8	47.8	280°37.7	43.6	Procyon	244°57.9	5°10.7					
21	189°00.9	141°43.0	.. 48.3	307°09.8	.. 44.9	23°52.2	.. 47.8	295°40.3	.. 43.6	Pollux	243°25.6	27°59.1					
22	204°03.3	156°42.4	49.2	322°13.2	44.9	38°54.6	47.7	310°43.0	43.6	Avior	234°17.4	-59°34.2					
23	219°05.8	171°41.8	50.1	337°16.5	44.8	53°57.0	47.7	325°45.6	43.6	Suhail	222°51.0	-43°30.3					
Mer.pass.:08:26			v-0.6 d0.9 m-3.8	v3.3 d0.0 m-2.0	v2.4 d-0.0 m-2.0	v2.6 d0.0 m-2.0	Mer.pass.:08:26			Miaplacidus	221°39.3	-69°47.5					
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.2	-8°44.0					
0	234°08.3	186°41.2	N16°51.0	352°19.8	S21°44.8	68°59.4	N07°47.7	340°48.3	S20°43.6	Regulus	207°41.4	11°53.1					
1	249°10.7	201°40.6	52.0	7°23.2	44.8	84°01.9	47.7	355°50.9	43.5	Dubhe	193°49.3	61°40.0					
2	264°13.2	216°40.0	52.9	22°26.5	44.8	99°04.3	47.6	10°53.6	43.5	Denebola	182°31.5	14°28.9					
3	279°15.7	231°39.4	.. 53.8	37°29.9	.. 44.7	114°06.7	.. 47.6	25°56.2	.. 43.5	Gienah	175°50.1	-17°38.1					
4	294°18.1	246°38.8	54.7	52°33.2	44.7	129°09.1	47.6	40°58.8	43.5	Acrux	173°06.5	-63°11.6					
5	309°20.6	261°38.2	55.6	67°36.5	44.7	144°11.5	47.6	56°01.5	43.5	Gacrux	171°58.2	-57°12.5					
6	324°23.1	276°37.6	N16°56.5	82°39.9	S21°44.7	159°14.0	N07°47.5	71°04.1	S20°43.4	Alioth	166°18.7	55°52.5					
7	339°25.5	291°37.0	57.4	97°43.2	44.6	174°16.4	47.5	86°06.8	43.4	Spica	158°28.9	-11°14.8					
8	354°28.0	306°36.3	58.3	112°46.6	44.6	189°18.8	47.5	101°09.4	43.4	Alkaid	152°57.0	49°14.1					
9	9°30.4	321°35.7	16°59.2	127°49.9	.. 44.6	204°21.2	.. 47.4	116°12.1	.. 43.4	Hadar	148°44.4	-60°27.1					
10	24°32.9	336°35.1	17°00.1	142°53.3	44.6	219°23.6	47.4	131°14.7	43.4	Menkent	148°04.8	-36°27.0					
11	39°35.4	351°34.5	01.0	157°56.6	44.5	234°26.1	47.4	146°17.4	43.4	Arcturus	145°53.7	19°05.9					
12	54°37.8	6°33.9	N17°01.9	172°59.9	S21°44.5	249°28.5	N07°47.4	161°20.0	S20°43.3	Rigel Kent.	139°48.3	-60°54.1					
13	69°40.3	21°33.3	02.8	188°03.3	44.5	264°30.9	47.3	176°22.6	43.3	Kochab	137°19.1	74°05.5					
14	84°42.8	36°32.7	03.7	203°06.6	44.5	279°33.3	47.3	191°25.3	43.3	Zuben 'ubi	137°02.9	-16°06.5					
15	99°45.2	51°32.1	.. 04.6	218°10.0	.. 44.4	294°35.7	.. 47.3	206°27.9	.. 43.3	Alphecca	126°09.0	26°39.7					
16	114°47.7	66°31.4	05.5	233°13.3	44.4	309°38.2	47.2	221°30.6	43.3	Antares	112°23.5	-26°27.9					
17	129°50.2	81°30.8	06.4	248°16.7	44.4	324°40.6	47.2	236°33.2	43.2	Atria	107°23.0	-69°03.1					
18	144°52.6	96°30.2	N17°07.3	263°20.0	S21°44.4	339°43.0	N07°47.2	251°35.9	S20°43.2	Sabik	102°10.0	-15°44.5					
19	159°55.1	111°29.6	08.1	278°23.4	44.3	354°45.4	47.2	266°38.5	43.2	Rasalhague	96°04.3	12°33.0					
20	174°57.6	126°29.0	09.0	293°26.7	44.3	9°47.8	47.1	281°41.2	43.2	Eltanin	90°44.8	51°29.2					
21	190°00.0	141°28.4	.. 09.9	308°30.1	.. 44.3	24°50.2	.. 47.1	296°43.8	.. 43.2	Kaus Aust.	83°40.9	-34°22.3					
22	205°02.5	156°27.8	10.8	323°33.4	44.3	39°52.6	47.1	311°46.5	43.1	Vega	80°37.3	38°47.9					
23	220°04.9	171°27.1	11.7	338°36.8	44.2	54°55.1	47.0	326°49.1	43.1	Nunki	75°55.7	-26°16.3					
Mer.pass.:08:22			v-0.6 d0.9 m-3.8	v3.3 d0.0 m-2.0	v2.4 d-0.0 m-2.0	v2.6 d0.0 m-2.0	Mer.pass.:08:22			Altair	62°06.2	8°54.8					
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°16.0	-56°40.6					
0	235°07.4	186°26.5	N17°12.6	353°40.1	S21°44.2	69°57.5	N07°47.0	341°51.8	S20°43.1	Deneb	49°30.0	45°20.2					
1	250°09.9	201°25.9	13.5	8°43.5	44.2	84°59.9	47.0	356°54.4	43.1	Enif	33°45.2	9°57.0					
2	265°12.3	216°25.3	14.4	23°46.9	44.1	100°02.3	47.0	11°57.0	43.1	Al Na'ir	27°41.4	-46°52.6					
3	280°14.8	231°24.7	.. 15.3	38°50.2	.. 44.1	115°04.7	.. 46.9	26°59.7	.. 43.0	Fomalhaut	15°22.0	-29°32.0					
4	295°17.3	246°24.0	16.1	53°53.6	44.1	130°07.1	46.9	42°02.3	43.0	Scheat	13°51.6	28°10.1					
5	310°19.7	261°23.4	17.0	68°56.9	44.1	145°09.5	46.9	57°05.0	43.0	Markab	13°36.5	15°17.5					
6	325°22.2	276°22.8	N17°17.9	84°00.3	S21°44.0	160°12.0	N07°46.8	72°07.6	S20°43.0	May 15 Sun	313°46.5	11:33					
7	340°24.7	291°22.2	18.8	99°03.6	44.0	175°14.4	46.8	87°10.3	43.0	Venus	313°32.9	11:34					
8	355°27.1	306°21.6	19.7	114°07.0	44.0	190°16.8	46.8	102°12.9	42.9	Mars	117°50.8	00:36					
9	10°29.6	321°20.9	.. 20.6	129°10.4	.. 43.9	205°19.2	.. 46.7	117°15.6	.. 42.9	Jupiter	194°52.1	19:25					
10	25°32.1	336°20.3	21.4	144°13.7	43.9	220°21.6	46.7	132°18.2	42.9	Saturn	106°35.7	01:21					
11	40°34.5	351°19.7	22.3	159°17.1	43.9	235°24.0	46.7	147°20.9	42.9	May 16 Mon	312°32.9	11:34					
12	55°37.0	6°19.1	N17°23.2	174°20.4	S21°43.8	250°26.4	N07°46.6	162°23.5	S20°42.9	Venus	312°11.6	00:31					
13	70°39.4	21°18.4	24.1	189°23.8	43.8	265°28.8	46.6	177°26.2	42.8	Mars	118°32.7	00:25					
14	85°41.9	36°17.8	25.0	204°27.2	43.8	280°31.3	46.6	192°28.8	42.8	Jupiter	194°51.2	19:17					
15	100°44.4	51°17.2	.. 25.8	219°30.5	.. 43.8	295°33.7	.. 46.6	207°31.4	.. 42.8	Saturn	106°40.0	01:12					
16	115°46.8	66°16.6	26.7	234°33.9	43.7	310°36.1	46.5	222°34.1	42.8	May 17 Tue	311°19.1	11:35					
17	130°49.3	81°15.9	27.6	249°37.2	43.7	325°38.5	46.5	237°36.7	42.8	Venus	311°19.1	11:35					
18	145°51.8	96°15.3	N17°28.5	264°40.6	S21°43.7	340°40.9	N07°46.5	252°39.4	S20°42.7	Mars	118°32.7	00:25					
19	160°54.2	111°14.7	29.3	279°44.0	43.6	355°43.3	46.4	267°42.0	42.7	Jupiter	194°50.1	19:17					
20	175°56.7																

DUT1 = UT1-UTC = -0.1581 sec ΔT = TT-UT1 = +68.3421 sec

2016 May 15 to May. 17 UT

h		Sun		Moon			
Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	180°54.8	N18°54.9	72°39.8	14.1'	N07°14.7	-8.9'	55.0'
1	195°54.8	55.5	87°12.9	14.1'	07°05.8	-8.9'	55.0'
2	210°54.8	56.1	101°46.0	14.2'	06°56.8	-9.0'	55.0'
3	225°54.8	.. 56.7	116°19.2	14.2'	06°47.8	-9.0'	55.0'
4	240°54.7	57.3	130°52.5	14.2'	06°38.8	-9.0'	54.9'
5	255°54.7	57.9	145°25.7	14.3'	06°29.8	-9.0'	54.9'
6	270°54.7	N18°58.4	159°59.0	14.3'	N06°20.8	-9.1'	54.9'
7	285°54.7	59.0	174°32.4	14.4'	06°11.7	-9.1'	54.9'
8	300°54.7	18°59.6	189°05.8	14.4'	06°02.6	-9.1'	54.9'
9	315°54.7	19°00.2	203°39.2	14.4'	05°53.5	-9.1'	54.8'
10	330°54.7	00.8	218°12.6	14.5'	05°44.4	-9.1'	54.8'
11	345°54.7	01.4	232°46.1	14.5'	05°35.3	-9.1'	54.8'
12	0°54.7	N19°01.9	247°19.6	14.5'	N05°26.1	-9.2'	54.8'
13	15°54.7	02.5	261°53.2	14.6'	05°17.0	-9.2'	54.8'
14	30°54.6	03.1	276°26.8	14.6'	05°07.8	-9.2'	54.7'
15	45°54.6	.. 03.7	291°00.4	14.6'	04°58.6	-9.2'	54.7'
16	60°54.6	04.3	305°34.1	14.7'	04°49.3	-9.2'	54.7'
17	75°54.6	04.8	320°07.7	14.7'	04°40.1	-9.2'	54.7'
18	90°54.6	N19°05.4	334°41.5	14.7'	N04°30.9	-9.3'	54.7'
19	105°54.6	06.0	349°15.2	14.8'	04°21.6	-9.3'	54.6'
20	120°54.6	06.6	3°49.0	14.8'	04°12.3	-9.3'	54.6'
21	135°54.6	.. 07.1	18°22.8	14.8'	04°03.0	-9.3'	54.6'
22	150°54.6	07.7	32°56.6	14.8'	03°53.7	-9.3'	54.6'
23	165°54.5	08.3	47°30.5	14.9'	03°44.4	-9.3'	54.6'
		SD.=15.8	d=0.6	S.D.=14.9			
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°54.5	N19°08.9	62°04.4	14.9'	N03°35.1	-9.3'	54.6'
1	195°54.5	09.4	76°38.3	14.9'	03°25.8	-9.3'	54.5'
2	210°54.5	10.0	91°12.2	14.9'	03°16.4	-9.3'	54.5'
3	225°54.5	.. 10.6	105°46.1	15.0'	03°07.1	-9.4'	54.5'
4	240°54.5	11.1	120°20.1	15.0'	02°57.7	-9.4'	54.5'
5	255°54.5	11.7	134°54.1	15.0'	02°48.4	-9.4'	54.5'
6	270°54.4	N19°12.3	149°28.1	15.0'	N02°39.0	-9.4'	54.5'
7	285°54.4	12.9	164°02.2	15.1'	02°29.6	-9.4'	54.4'
8	300°54.4	13.4	178°36.3	15.1'	02°20.2	-9.4'	54.4'
9	315°54.4	.. 14.0	193°10.3	15.1'	02°10.8	-9.4'	54.4'
10	330°54.4	14.6	207°44.4	15.1'	02°01.5	-9.4'	54.4'
11	345°54.4	15.1	222°18.6	15.1'	01°52.1	-9.4'	54.4'
12	0°54.4	N19°15.7	236°52.7	15.1'	N01°42.7	-9.4'	54.4'
13	15°54.3	16.3	251°26.8	15.2'	01°33.2	-9.4'	54.4'
14	30°54.3	16.8	266°01.0	15.2'	01°23.8	-9.4'	54.3'
15	45°54.3	.. 17.4	280°35.2	15.2'	01°14.4	-9.4'	54.3'
16	60°54.3	18.0	295°09.4	15.2'	01°05.0	-9.4'	54.3'
17	75°54.3	18.5	309°43.6	15.2'	00°55.6	-9.4'	54.3'
18	90°54.3	N19°19.1	324°17.8	15.2'	N00°46.2	-9.4'	54.3'
19	105°54.2	19.7	338°52.1	15.2'	00°36.8	-9.4'	54.3'
20	120°54.2	20.2	353°26.3	15.3'	00°27.4	-9.4'	54.3'
21	135°54.2	.. 20.8	8°00.6	15.3'	00°17.9	-9.4'	54.3'
22	150°54.2	21.3	22°34.8	15.3'	N00°08.5	-9.4'	54.3'
23	165°54.2	21.9	37°09.1	15.3'	00°00.9	-9.4'	54.2'
		SD.=15.8	d=0.6	S.D.=14.8			
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°54.1	N19°22.5	51°43.4	15.3'	S00°10.3	-9.4'	54.1'
1	195°54.1	23.0	66°17.7	15.3'	00°19.7	-9.4'	54.2'
2	210°54.1	23.6	80°52.0	15.3'	00°29.1	-9.4'	54.2'
3	225°54.1	.. 24.1	95°26.3	15.3'	00°38.5	-9.4'	54.2'
4	240°54.1	24.7	110°00.6	15.3'	00°47.9	-9.4'	54.2'
5	255°54.0	25.3	124°34.9	15.3'	00°57.2	-9.4'	54.2'
6	270°54.0	N19°25.8	139°09.3	15.3'	S01°06.6	-9.4'	54.2'
7	285°54.0	26.4	153°43.6	15.3'	01°16.0	-9.4'	54.2'
8	300°54.0	26.9	168°17.9	15.3'	01°25.4	-9.4'	54.2'
9	315°54.0	.. 27.5	182°52.3	15.3'	01°34.7	-9.4'	54.2'
10	330°53.9	28.0	197°26.6	15.3'	01°44.1	-9.3'	54.1'
11	345°53.9	28.6	212°00.9	15.3'	01°53.4	-9.3'	54.1'
12	0°53.9	N19°29.1	226°35.3	15.3'	S02°02.7	-9.3'	54.1'
13	15°53.9	29.7	241°09.6	15.3'	02°12.1	-9.3'	54.1'
14	30°53.9	30.2	255°44.0	15.3'	02°21.4	-9.3'	54.1'
15	45°53.8	.. 30.8	270°18.3	15.3'	02°30.7	-9.3'	54.1'
16	60°53.8	31.4	284°52.6	15.3'	02°40.0	-9.3'	54.1'
17	75°53.8	31.9	299°27.0	15.3'	02°49.2	-9.3'	54.1'
18	90°53.8	N19°32.5	314°01.3	15.3'	S02°58.5	-9.3'	54.1'
19	105°53.7	33.0	328°35.6	15.3'	03°07.7	-9.2'	54.1'
20	120°53.7	33.6	343°09.9	15.3'	03°17.0	-9.2'	54.1'
21	135°53.7	.. 34.1	357°44.2	15.3'	03°26.2	-9.2'	54.1'
22	150°53.7	34.6	12°18.6	15.3'	03°35.4	-9.2'	54.1'
23	165°53.7	35.2	26°52.9	15.3'	03°44.6	-9.2'	54.1'
		SD.=15.8	d=0.6	S.D.=14.8			

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

## May 18, 19, 20 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Week	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	236°06.5	186°11.5	N17°33.7	355°00.8	S21°43.5	70°55.3	N07°46.3	342°55.3	S20°42.6	Alpheratz	357°41.6	29°10.6					
1	251°09.0	201°10.9	34.6	10°04.2	43.4	85°57.8	46.2	357°57.9	42.6	Ankaa	353°14.1	-42°12.9					
2	266°11.5	216°10.3	35.4	25°07.5	43.4	101°00.2	46.2	13°00.6	42.6	Schedar	349°38.5	56°37.3					
3	281°13.9	231°09.7	.. 36.3	40°10.9	.. 43.4	116°02.6	.. 46.2	28°03.2	.. 42.6	Diphda	348°54.2	-17°53.9					
4	296°16.4	246°09.0	37.2	55°14.3	43.3	131°05.0	46.1	43°05.9	42.5	Achernar	335°25.9	-57°09.2					
5	311°18.9	261°08.4	38.0	70°17.7	43.3	146°07.4	46.1	58°08.5	42.5	Hamal	327°58.8	23°32.1					
6	326°21.3	276°07.8	N17°38.9	85°21.0	S21°43.3	161°09.8	N07°46.1	73°11.2	S20°42.5	Polaris	317°17.9	89°19.8					
7	341°23.8	291°07.1	39.8	100°24.4	43.2	176°12.2	46.0	88°13.8	42.5	Acamar	315°17.3	-40°14.5					
8	356°26.3	306°06.5	40.6	115°27.8	43.2	191°14.6	46.0	103°16.5	42.5	Menkar	314°13.3	4°09.0					
9	11°28.7	321°05.9	.. 41.5	130°31.1	.. 43.2	206°17.0	.. 46.0	118°19.1	.. 42.5	Mirfak	308°38.0	49°54.9					
10	26°31.2	336°05.2	42.4	145°34.5	43.1	221°19.4	45.9	133°21.7	42.4	Aldebaran	290°47.5	16°32.2					
11	41°33.7	351°04.6	43.2	160°37.9	43.1	236°21.8	45.9	148°24.4	42.4	Rigel	281°10.5	-8°11.3					
12	56°36.1	6°04.0	N17°44.1	175°41.3	S21°43.1	251°24.2	N07°45.9	163°27.0	S20°42.4	Capella	280°32.0	46°00.6					
13	71°38.6	21°03.3	45.0	190°44.6	43.0	266°26.6	45.8	178°29.7	42.4	Bellatrix	278°30.2	6°21.6					
14	86°41.0	36°02.7	45.8	205°48.0	43.0	281°29.0	45.8	193°32.3	42.4	Elnath	278°10.5	28°37.0					
15	101°43.5	51°02.1	.. 46.7	220°51.4	.. 43.0	296°31.4	.. 45.8	208°35.0	.. 42.3	Ahnilam	275°44.7	-1°11.8					
16	116°46.0	66°01.4	47.5	235°54.8	42.9	311°33.8	45.7	223°37.6	42.3	Betelgeuse	270°59.5	7°24.3					
17	131°48.4	81°00.8	48.4	250°58.1	42.9	326°36.2	45.7	238°40.3	42.3	Canopus	263°55.7	-52°42.7					
18	146°50.9	96°00.1	N17°49.2	266°01.5	S21°42.9	341°38.6	N07°45.7	253°42.9	S20°42.3	Sirius	258°32.3	-16°44.7					
19	161°53.4	110°59.5	50.1	281°04.9	42.8	356°41.0	45.6	268°45.6	42.3	Adhara	255°11.3	-29°00.0					
20	176°55.8	125°58.9	51.0	296°08.3	42.8	11°43.4	45.6	283°48.2	42.2	Procyon	244°57.9	5°10.7					
21	191°58.3	140°58.2	.. 51.8	311°11.7	.. 42.8	26°45.8	.. 45.6	298°50.9	.. 42.2	Pollux	243°25.6	27°59.1					
22	207°00.8	155°57.6	52.7	326°15.0	42.7	41°48.2	45.5	313°53.5	42.2	Avior	234°17.4	-59°34.2					
23	222°03.2	170°56.9	53.5	341°18.4	42.7	56°50.6	45.5	328°56.2	42.2	Suhail	222°51.1	-43°30.3					
Mer.pass.:08:14			v-0.6 d0.9 m-3.8	v3.4 d0.0 m-2.0	v2.4 d-0.0 m-2.0	v2.6 d0.0 m-2.0				Miaplacidus	221°39.3	-69°47.5					
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.2	-8°44.0					
0	237°05.7	185°56.3	N17°54.4	356°21.8	S21°42.7	71°53.0	N07°45.5	343°58.8	S20°42.2	Regulus	207°41.5	11°53.1					
1	252°08.2	200°55.7	55.2	11°25.2	42.6	86°55.5	45.4	359°01.5	42.1	Dubhe	193°49.3	61°40.0					
2	267°10.6	215°55.0	56.1	26°28.6	42.6	101°57.9	45.4	14°04.1	42.1	Denebola	182°31.5	14°28.9					
3	282°13.1	230°54.4	.. 56.9	41°31.9	.. 42.5	117°00.3	.. 45.3	29°06.8	.. 42.1	Gienah	175°50.1	-17°38.1					
4	297°15.5	245°53.7	57.8	56°35.3	42.5	132°02.7	45.3	44°09.4	42.1	Acrua	173°06.5	-63°11.6					
5	312°18.0	260°53.1	58.6	71°38.7	42.5	147°05.1	45.3	59°12.1	42.1	Gacrux	171°58.2	-57°12.5					
6	327°20.5	275°52.4	N17°59.5	86°42.1	S21°42.4	162°07.5	N07°45.2	74°14.7	S20°42.0	Alioth	166°18.7	55°52.5					
7	342°22.9	290°51.8	18°00.3	101°45.5	42.4	177°09.8	45.2	89°17.4	42.0	Spica	158°28.9	-11°14.8					
8	357°25.4	305°51.2	01.1	116°48.9	42.4	192°12.2	45.2	104°20.0	42.0	Alkaid	152°57.0	49°14.1					
9	12°27.9	320°50.5	.. 02.0	131°52.2	.. 42.3	207°14.6	.. 45.1	119°22.7	.. 42.0	Hadar	148°44.4	-60°27.1					
10	27°30.3	335°49.9	02.8	146°55.6	42.3	222°17.0	45.1	134°25.3	42.0	Menkent	148°04.8	-36°27.0					
11	42°32.8	350°49.2	03.7	161°59.0	42.2	237°19.4	45.1	149°28.0	41.9	Arcturus	145°53.7	19°06.0					
12	57°35.3	5°48.6	N18°04.5	177°02.4	S21°42.2	252°21.8	N07°45.0	164°30.6	S20°41.9	Rigel Kent.	139°48.3	-60°54.1					
13	72°37.7	20°47.9	05.4	192°05.8	42.2	267°24.2	45.0	179°33.3	41.9	Kochab	137°19.1	74°05.5					
14	87°40.2	35°47.3	06.2	207°09.2	42.1	282°26.6	44.9	194°35.9	41.9	Zuben' ubi	137°02.9	-16°06.5					
15	102°42.6	50°46.6	.. 07.0	222°12.6	.. 42.1	297°29.0	.. 44.9	209°38.6	.. 41.9	Alphecca	126°09.0	26°39.7					
16	117°45.1	65°46.0	07.9	237°15.9	42.0	312°31.4	44.9	224°41.2	41.8	Antares	112°23.5	-26°27.9					
17	132°47.6	80°45.3	08.7	252°19.3	42.0	327°33.8	44.8	239°43.9	41.8	Atria	107°22.9	-69°03.1					
18	147°50.0	95°44.7	N18°09.6	267°22.7	S21°42.0	342°36.2	N07°44.8	254°46.5	S20°41.8	Sabik	102°10.0	-15°44.5					
19	162°52.5	110°44.0	10.4	282°26.1	41.9	357°38.6	44.8	269°49.2	41.8	Rasalhague	96°04.3	12°33.0					
20	177°55.0	125°43.4	11.2	297°29.5	41.9	12°41.0	44.7	284°51.8	41.8	Eltanin	90°44.8	51°29.2					
21	192°57.4	140°42.7	.. 12.1	312°32.9	.. 41.9	27°43.4	.. 44.7	299°54.5	.. 41.7	Kaus Aust.	83°40.9	-34°22.3					
22	207°59.9	155°42.1	12.9	327°36.3	41.8	42°45.8	44.6	314°57.1	41.7	Vega	80°37.3	38°47.9					
23	223°02.4	170°41.4	13.7	342°39.7	41.8	57°48.2	44.6	329°59.8	41.7	Nunki	75°55.6	-26°16.3					
Mer.pass.:08:10			v-0.6 d0.9 m-3.8	v3.4 d0.0 m-2.0	v2.4 d-0.0 m-2.0	v2.6 d0.0 m-2.0				Altair	62°06.1	8°54.8					
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°16.0	-56°40.5					
0	238°04.8	185°40.8	N18°14.6	357°43.1	S21°41.7	72°50.6	N07°44.6	345°02.4	S20°41.7	Deneb	49°29.9	45°20.2					
1	253°07.3	200°40.1	15.4	12°46.5	41.7	87°53.0	44.5	0°05.1	41.7	Enif	33°45.2	9°57.0					
2	268°09.8	215°39.5	16.2	27°49.8	41.7	102°55.4	44.5	15°07.7	41.6	AI Na'ir	27°41.4	-46°52.6					
3	283°12.2	230°38.8	.. 17.0	42°53.2	.. 41.6	117°57.8	.. 44.5	30°10.4	.. 41.6	Fomalhaut	15°22.0	-29°32.0					
4	298°14.7	245°38.2	17.9	57°56.6	41.6	133°00.2	44.4	45°13.0	41.6	Scheat	13°51.5	28°10.1					
5	313°17.1	260°37.5	18.7	73°00.0	41.5	148°02.6	44.4	60°15.7	41.6	Markab	13°36.5	15°17.5					
6	328°19.6	275°36.9	N18°19.5	88°03.4	S21°41.5	163°04.9	N07°44.3	75°18.3	S20°41.6	May 18 Wed	15°22.0						
7	343°22.1	290°36.2	20.4	103°06.8	41.4	178°07.3	44.3	90°21.0	41.5	Venus	310°05.0	11:36					
8	358°24.5	305°35.5	21.2	118°10.2	41.4	193°09.7	44.3	105°23.6	41.5	Mars	318°54.3	00:20					
9	13°27.0	320°34.9	.. 22.0	133°13.6	.. 41.4	208°12.1	.. 44.2	120°26.3	.. 41.5	Jupiter	194°48.8	19:13					
10	28°29.5	335°34.2	22.8	148°17.0	41.3	223°14.5	44.2	135°28.9	41.5	Saturn	106°48.7	01:08					
11	43°31.9	350°33.6	23.7	163°20.4	41.3	238°16.9	44.1	150°31.6	41.5	May 19 Thu	308°50.6	11:37					
12	58°34.4	5°32.9	N18°24.5	178°23.8	S21°41.2	253°19.3	N07°44.1	165°34.2	S20°41.4	Venus	308°50.6	11:37					
13	73°36.9	20°32.3	25.3	193°27.2	41.2	268°21.7	44.1	180°36.9	41.4	Mars	319°16.1	00:14					
14	88°39.3	35°31.6	26.1	208°30.6	41.2	283°24.1	44.0	195°39.5	41.4	Jupiter	194°47.4	19:09					
15	103°41.8	50°30.9	.. 26.9	223°34.0	.. 41.1	298°26.5	.. 44.0	210°42.2	.. 41.4	Saturn	106°53.1	01:04					
16	118°44.3	65°30.3	27.8	238°37.4	41.1	313°28.9	43.9	225°44.8	41.4	May 20 Fri	307°36.0	11:38					
17	133°46.7	80°29.6	28.6	253°40.8	41.0	328°31.2	43.9	240°47.5	41.3	Venus	307°36.0	11:38					
18	148°49.2	95°29.0	N18°29.4	268°44.2	S21°41.0	343°33.6	N07°43.9	255°50.1	S20°41.3	Mars	319°38.2	00:09					
19	163°51.6	110°28.3	30.2	283°47.6	40.9	358°36.0	43.8	270°52.8	41.3	Jupiter	194°45.8						

DUT1 = UT1-UTC = -0.1631 sec ΔT = TT-UT1 = +68.3471 sec

2016 May 18 to May. 20 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	180°53.6	N19°35.7		41°27.2	15.3'	S03°53.8	-9.2'	54.1'
1	195°53.6	36.3		56°01.4	15.3'	04°03.0	-9.2'	54.1'
2	210°53.6	36.8		70°35.7	15.3'	04°12.1	-9.1'	54.0'
3	225°53.6	.. 37.4		85°10.0	15.3'	04°21.2	-9.1'	54.0'
4	240°53.5	37.9		99°44.3	15.3'	04°30.3	-9.1'	54.0'
5	255°53.5	38.5		114°18.5	15.2'	04°39.4	-9.1'	54.0'
6	270°53.5	N19°39.0		128°52.7	15.2'	S04°48.5	-9.1'	54.0'
7	285°53.4	39.5		143°27.0	15.2'	04°56.7	-9.0'	54.0'
8	300°53.4	40.1		158°01.2	15.2'	05°06.6	-9.0'	54.0'
9	315°53.4	.. 40.6		172°35.4	15.2'	05°15.6	-9.0'	54.0'
10	330°53.4	41.2		187°09.6	15.2'	05°24.6	-9.0'	54.0'
11	345°53.3	41.7		201°43.8	15.2'	05°33.6	-9.0'	54.0'
12	0°53.3	N19°42.3		216°17.9	15.2'	S05°42.5	-8.9'	54.0'
13	15°53.3	42.8		230°52.1	15.1'	05°51.5	-8.9'	54.0'
14	30°53.3	43.3		245°26.2	15.1'	06°00.4	-8.9'	54.0'
15	45°53.2	.. 43.9		260°00.3	15.1'	06°09.2	-8.9'	54.0'
16	60°53.2	44.4		274°34.4	15.1'	06°18.1	-8.8'	54.0'
17	75°53.2	44.9		289°08.5	15.1'	06°26.9	-8.8'	54.0'
18	90°53.1	N19°45.5		303°42.6	15.1'	S06°35.7	-8.8'	54.0'
19	105°53.1	46.0		318°16.6	15.0'	06°44.5	-8.8'	54.0'
20	120°53.1	46.5		332°50.7	15.0'	06°53.3	-8.7'	54.0'
21	135°53.1	.. 47.1		347°24.7	15.0'	07°02.0	-8.7'	54.0'
22	150°53.0	47.6		1°58.7	15.0'	07°10.7	-8.7'	54.0'
23	165°53.0	48.1		16°32.6	15.0'	07°19.4	-8.7'	54.0'
	SD.=15.8	d=0.5				S.D.=14.7		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
18	03:35	03:33	11:56	21:52 09:31
19	03:32	03:30	11:56	22:35 10:13
20	03:29	03:27	11:57	23:20 10:57



SD.=15.8	d=0.5	S.D.=14.8
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## May 21, 22, 23 UT (Sat., Sun., Mon.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	239°04.0	185°25.0	N18°34.3	359°04.6	S21°40.7	73°48.0	N07°43.6	346°06.1	S20°41.2					Alpheratz	357°41.6	
1	254°06.4	200°24.3	35.1	14°08.0	40.7	88°50.4	43.6	1°08.7	41.2					Ankaa	353°14.1	
2	269°08.9	215°23.6	35.9	29°11.4	40.6	103°52.7	43.5	16°11.4	41.2					Schedar	349°38.5	
3	284°11.4	230°23.0	.. 36.7	44°14.8	.. 40.6	118°55.1	.. 43.5	31°14.0	.. 41.1					Diphda	348°54.2	
4	299°13.8	245°22.3	37.5	59°18.2	40.5	133°57.5	43.5	46°16.7	41.1					Achernar	335°25.9	
5	314°16.3	260°21.6	38.3	74°21.6	40.5	148°59.9	43.4	61°19.3	41.1					Hamal	327°58.8	
6	329°18.7	275°21.0	N18°39.1	89°25.0	S21°40.4	164°02.3	N07°43.4	76°22.0	S20°41.1					Polaris	317°17.3	
7	344°21.2	290°20.3	39.9	104°28.4	40.4	179°04.7	43.3	91°24.6	41.1					Acamar	315°17.3	
8	359°23.7	305°19.6	40.7	119°31.8	40.4	194°07.1	43.3	106°27.3	41.0					Menkar	314°13.3	
9	14°26.1	320°19.0	.. 41.5	134°35.2	.. 40.3	209°09.4	.. 43.2	121°29.9	.. 41.0					Mirfak	308°38.0	
10	29°28.6	335°18.3	42.3	149°38.6	40.3	224°11.8	43.2	136°32.6	41.0					Aldebaran	290°47.5	
11	44°31.1	350°17.6	43.1	164°42.0	40.2	239°14.2	43.2	151°35.2	41.0					Rigel	281°10.5	
12	59°33.5	5°17.0	N18°43.9	179°45.4	S21°40.2	254°16.6	N07°43.1	166°37.9	S20°41.0					Capella	280°32.0	
13	74°36.0	20°16.3	44.7	194°48.8	40.1	269°19.0	43.1	181°40.5	40.9					Bellatrix	278°30.2	
14	89°38.5	35°15.6	45.5	209°52.2	40.1	284°21.4	43.0	196°43.2	40.9					Elnath	278°10.5	
15	104°40.9	50°15.0	.. 46.3	224°55.6	.. 40.0	299°23.7	.. 43.0	211°45.8	.. 40.9					Ahnilam	275°44.7	
16	119°43.4	65°14.3	47.1	239°59.0	40.0	314°26.1	42.9	226°48.5	40.9					Betelgeuse	270°59.5	
17	134°45.9	80°13.6	47.9	255°02.4	39.9	329°28.5	42.9	241°51.1	40.9					Canopus	263°55.7	
18	149°48.3	95°12.9	N18°48.7	270°05.8	S21°39.9	344°30.9	N07°42.9	256°53.8	S20°40.8					Sirius	258°32.3	
19	164°50.8	110°12.3	49.5	285°09.2	39.9	359°33.3	42.8	271°56.4	40.8					Adhara	255°11.3	
20	179°53.2	125°11.6	50.3	300°12.6	39.8	14°35.7	42.8	286°59.1	40.8					Procyon	244°57.9	
21	194°55.7	140°10.9	.. 51.1	315°16.0	.. 39.8	29°38.0	.. 42.7	302°01.8	.. 40.8					Pollux	243°25.6	
22	209°58.2	155°10.2	51.9	330°19.4	39.7	44°40.4	42.7	317°04.4	40.8					Avior	234°17.4	
23	225°00.6	170°09.6	52.7	345°22.8	39.7	59°42.8	42.6	332°07.1	40.7					Suhail	222°51.1	
Mer.pass.:08:02			v-0.7 d0.8 m-3.8	v3.4 d0.0 m-2.1			v2.4 d-0.0 m-2.0			v2.7 d0.0 m0.1						
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	240°03.1	185°08.9	N18°53.5	0°26.2	S21°39.6	74°45.2	N07°42.6	347°09.7	S20°40.7					Denebola	182°31.6	
1	255°05.6	200°08.2	54.3	15°29.7	39.6	89°47.6	42.6	2°12.4	40.7					Gienah	175°50.1	
2	270°08.0	215°07.5	55.1	30°33.1	39.5	104°49.9	42.5	17°15.0	40.7					Acrux	173°06.5	
3	285°10.5	230°06.9	.. 55.9	45°36.5	.. 39.5	119°52.3	.. 42.5	32°17.7	.. 40.7					Gacrux	171°58.2	
4	300°13.0	245°06.2	56.7	60°39.9	39.4	134°54.7	42.4	47°20.3	40.6					Alioth	166°18.7	
5	315°15.4	260°05.5	57.4	75°43.3	39.4	149°57.1	42.4	62°23.0	40.6					Spica	158°28.9	
6	330°17.9	275°04.8	N18°58.2	90°46.7	S21°39.3	164°59.5	N07°42.3	77°25.6	S20°40.6					Alkaid	152°57.0	
7	345°20.4	290°04.1	59.0	105°50.1	39.3	180°01.8	42.3	92°28.3	40.6					Hadar	148°44.4	
8	0°22.8	305°03.5	18°59.8	120°53.5	39.2	195°04.2	42.2	107°30.9	40.6					Menkent	148°04.8	
9	15°25.3	320°02.8	19°00.6	135°56.9	.. 39.2	210°06.6	.. 42.2	122°33.6	.. 40.5					Arcturus	145°53.7	
10	30°27.7	335°02.1	01.4	151°00.3	39.1	225°09.0	42.2	137°36.2	40.5					Rigel Kent.	139°48.3	
11	45°30.2	350°01.4	02.1	166°03.7	39.1	240°11.3	42.1	152°38.9	40.5					Kochab	137°19.2	
12	60°32.7	5°00.7	N19°02.9	181°07.1	S21°39.0	255°13.7	N07°42.1	167°41.6	S20°40.5					Zuben' ubi	137°02.9	
13	75°35.1	20°00.1	03.7	196°10.6	39.0	270°16.1	42.0	182°44.2	40.5					Alphecca	126°09.0	
14	90°37.6	34°59.4	04.5	211°14.0	38.9	285°18.5	42.0	197°46.9	40.4					Antares	112°23.5	
15	105°40.1	49°58.7	.. 05.3	226°17.4	.. 38.9	300°20.9	.. 41.9	212°49.5	.. 40.4					Atria	107°22.9	
16	120°42.5	64°58.0	06.0	241°20.8	38.8	315°23.2	41.9	227°52.2	40.4					Sabik	102°10.0	
17	135°45.0	79°57.3	06.8	256°24.2	38.8	330°25.6	41.8	242°54.8	40.4					Shaula	96°18.9	
18	150°47.5	94°56.6	N19°07.6	271°27.6	S21°38.7	345°28.0	N07°41.8	257°57.5	S20°40.4					Rasalhague	96°04.3	
19	165°49.9	109°56.0	08.4	286°31.0	38.7	0°30.4	41.8	273°00.1	40.3					Eltanin	90°44.7	
20	180°52.4	124°55.3	09.1	301°34.4	38.6	15°32.7	41.7	288°02.8	40.3					Kaus Aust.	83°40.9	
21	195°54.8	139°54.6	.. 09.9	316°37.8	.. 38.6	30°35.1	.. 41.7	303°05.4	.. 40.3					Vega	80°37.3	
22	210°57.3	154°53.9	10.7	331°41.3	38.5	45°37.5	41.6	318°08.1	40.3					Nunki	75°55.6	
23	225°59.8	169°53.2	11.5	346°44.7	38.5	60°39.9	41.6	333°10.7	40.3					Altair	62°06.1	
Mer.pass.:07:58			v-0.7 d0.8 m-3.8	v3.4 d0.0 m-2.1			v2.4 d-0.0 m-2.0			v2.7 d0.0 m0.0						
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	241°02.2	184°52.5	N19°12.2	1°48.1	S21°38.4	75°42.2	N07°41.5	348°13.4	S20°40.2					Fomalhaut	15°21.9	
1	256°04.7	199°51.8	13.0	16°51.5	38.4	90°44.6	41.5	3°16.1	40.2					Scheat	13°51.5	
2	271°07.2	214°51.2	13.8	31°54.9	38.3	105°47.0	41.4	18°18.7	40.2					Markab	13°36.4	
3	286°09.6	229°50.5	.. 14.5	46°58.3	.. 38.3	120°49.3	.. 41.4	33°21.4	.. 40.2					May 21 Sat		
4	301°12.1	244°49.8	15.3	62°01.7	38.2	135°51.7	41.3	48°24.0	40.2					SHA	306°21.0	
5	316°14.6	259°49.1	16.1	77°05.1	38.2	150°54.1	41.3	63°26.7	40.1					Mer.pass	11:39	
6	331°17.0	274°48.4	N19°16.8	92°08.5	S21°38.1	165°56.5	N07°41.2	78°29.3	S20°40.1					Venus	306°00.6	
7	346°19.5	289°47.7	17.6	107°12.0	38.1	180°58.8	41.2	93°32.0	40.1					Mars	00:04	
8	1°22.0	304°47.0	18.4	122°15.4	38.0	196°01.2	41.1	108°34.6	40.1					Jupiter	194°44.0	
9	16°24.4	319°46.3	19.1	137°18.8	.. 38.0	211°03.6	.. 41.1	123°37.3	.. 40.1					Saturn	190°02.1	
10	31°26.9	334°45.6	19.9	152°22.2	37.9	226°06.0	41.0	138°39.9	40.0					107°02.1	00:55	
11	46°29.3	349°44.9	20.6	167°25.6	37.8	241°08.3	41.0	153°42.6	40.0					May 22 Sun		
12	61°31.8	4°44.2	N19°21.4	182°29.0	S21°37.8	256°10.7	N07°41.0	168°45.3	S20°40.0					Venus	305°05.8	
13	76°34.3	19°43.6	22.2	197°32.4	37.7	271°13.1	40.9	183°47.9	40.0					Mars	11:40	
14	91°36.7	34°42.9	22.9	212°35.9	37.7	286°15.4	40.9	198°50.6	40.0					Jupiter	23:53	
15	106°39.2	49°42.2	.. 23.7	227°39.3	.. 37.6	301°17.8	.. 40.8	213°53.2	.. 39.9					Saturn	18:58	
16	121°41.7	64°41.5	24.4	242°42.7	37.6	316°20.2	40.8	228°55.9	39.9					107°06.6	00:51	
17	136°44.1	79														

DUT1 = UT1-UTC = -0.1681 sec ΔT = TT-UT1 = +68.3521 sec

2016 May 21 to May. 23 UT

h		Sun			Moon			Twilight					
Lat.	Naut.	Civil	Sunrise	Sunset	Civil	Naut.							
Sat	GHA	Dec	GHA	ν	Dec	d	HP						
0	180°51.3	N20°13.5	9°43.3	13.5'	\$13°37.6	-6.5'	54.2'						
1	195°51.2	14.0	24°15.7	13.4'	13°44.1	-6.5'	54.2'						
2	210°51.2	14.6	38°48.1	13.4'	13°50.6	-6.4'	54.2'						
3	225°51.1	.. 15.1	53°20.5	13.3'	13°57.0	-6.4'	54.3'						
4	240°51.1	15.6	67°52.8	13.3'	14°03.3	-6.3'	54.3'						
5	255°51.1	16.1	82°25.1	13.3'	14°09.6	-6.3'	54.3'						
6	270°51.0	N20°16.6	96°57.3	13.2'	\$14°15.8	-6.2'	54.3'						
7	285°51.0	17.1	111°29.5	13.2'	14°22.0	-6.1'	54.3'						
8	300°50.9	17.6	126°01.7	13.1'	14°28.1	-6.1'	54.3'						
9	315°50.9	.. 18.1	140°33.8	13.1'	14°34.1	-6.0'	54.3'						
10	330°50.8	18.6	155°05.9	13.1'	14°40.1	-5.9'	54.3'						
11	345°50.8	19.0	169°37.9	13.0'	14°46.0	-5.9'	54.3'						
12	0°50.8	N20°19.5	184°10.0	13.0'	\$14°51.9	-5.8'	54.3'						
13	15°50.7	20.0	198°41.9	13.0'	14°57.7	-5.8'	54.4'						
14	30°50.7	20.5	213°13.9	12.9'	15°03.4	-5.7'	54.4'						
15	45°50.6	.. 21.0	227°45.8	12.9'	15°09.0	-5.6'	54.4'						
16	60°50.6	21.5	242°17.6	12.8'	15°14.6	-5.6'	54.4'						
17	75°50.5	22.0	256°49.4	12.8'	15°20.2	-5.5'	54.4'						
18	90°50.5	N20°22.5	271°21.2	12.8'	\$15°25.6	-5.4'	54.4'						
19	105°50.4	23.0	285°52.9	12.7'	15°31.0	-5.4'	54.4'						
20	120°50.4	23.5	300°24.6	12.7'	15°36.3	-5.3'	54.4'						
21	135°50.4	.. 24.0	314°56.3	12.6'	15°41.6	-5.2'	54.4'						
22	150°50.3	24.5	329°27.9	12.6'	15°46.8	-5.1'	54.5'						
23	165°50.3	25.0	343°59.5	12.6'	15°51.9	-5.1'	54.5'						
	SD.=15.8	d=0.5			S.D.=14.8								
Sun	GHA	Dec	GHA	ν	Dec	d	HP						
0	180°50.2	N20°25.5	358°31.0	12.5'	\$15°56.9	-5.0'	54.5'						
1	195°50.2	25.9	13°02.5	12.5'	16°01.9	-4.9'	54.5'						
2	210°50.1	26.4	27°34.0	12.4'	16°06.8	-4.9'	54.5'						
3	225°50.1	.. 26.9	42°05.4	12.4'	16°11.6	-4.8'	54.5'						
4	240°50.0	27.4	56°36.8	12.4'	16°16.4	-4.7'	54.5'						
5	255°50.0	27.9	71°08.2	12.3'	16°21.1	-4.6'	54.5'						
6	270°49.9	N20°28.4	85°39.5	12.3'	\$16°25.7	-4.6'	54.5'						
7	285°49.9	28.9	100°10.8	12.3'	16°30.2	-4.5'	54.6'						
8	300°49.8	29.4	114°42.0	12.2'	16°34.7	-4.4'	54.6'						
9	315°49.8	.. 29.8	129°13.2	12.2'	16°39.0	-4.3'	54.6'						
10	330°49.7	30.3	143°44.4	12.1'	16°43.4	-4.3'	54.6'						
11	345°49.7	30.8	158°15.5	12.1'	16°47.6	-4.2'	54.6'						
12	0°49.6	N20°31.3	172°46.6	12.1'	\$16°51.7	-4.1'	54.6'						
13	15°49.6	31.8	187°17.6	12.0'	16°55.8	-4.0'	54.6'						
14	30°49.5	32.2	201°48.6	12.0'	16°59.8	-4.0'	54.7'						
15	45°49.5	.. 32.7	216°19.6	12.0'	17°03.7	-3.9'	54.7'						
16	60°49.4	33.2	230°50.5	11.9'	17°07.6	-3.8'	54.7'						
17	75°49.4	33.7	245°21.4	11.9'	17°11.3	-3.7'	54.7'						
18	90°49.3	N20°34.2	259°52.3	11.8'	\$17°15.0	-3.6'	54.7'						
19	105°49.3	34.6	274°23.1	11.8'	17°18.6	-3.6'	54.7'						
20	120°49.2	35.1	288°53.9	11.8'	17°22.2	-3.5'	54.7'						
21	135°49.2	.. 35.6	303°24.7	11.7'	17°25.6	-3.4'	54.7'						
22	150°49.1	36.1	317°55.4	11.7'	17°29.0	-3.3'	54.8'						
23	165°49.1	36.5	332°26.1	11.7'	17°32.2	-3.2'	54.8'						
	SD.=15.8	d=0.5			S.D.=14.9								
Mon	GHA	Dec	GHA	ν	Dec	d	HP						
0	180°49.0	N20°37.0	346°56.7	11.6'	\$17°35.4	-3.2'	54.8'						
1	195°49.0	37.5	1°27.3	11.6'	17°38.5	-3.1'	54.8'						
2	210°48.9	38.0	15°57.9	11.6'	17°41.6	-3.0'	54.8'						
3	225°48.9	.. 38.4	30°28.5	11.5'	17°44.5	-2.9'	54.8'						
4	240°48.8	38.9	44°59.0	11.5'	17°47.4	-2.8'	54.9'						
5	255°48.8	39.4	59°29.5	11.5'	17°50.2	-2.7'	54.9'						
6	270°48.7	N20°39.9	73°59.9	11.4'	\$17°52.9	-2.6'	54.9'						
7	285°48.7	40.3	88°30.3	11.4'	17°55.5	-2.6'	54.9'						
8	300°48.6	40.8	103°00.7	11.4'	17°58.0	-2.5'	54.9'						
9	315°48.6	.. 41.3	117°31.1	11.3'	18°00.4	-2.4'	54.9'						
10	330°48.5	41.7	132°01.4	11.3'	18°02.8	-2.3'	54.9'						
11	345°48.4	42.2	146°31.7	11.3'	18°05.0	-2.2'	55.0'						
12	0°48.4	N20°42.7	161°02.0	11.2'	\$18°07.2	-2.1'	55.0'						
13	15°48.3	43.1	175°32.2	11.2'	18°09.3	-2.0'	55.0'						
14	30°48.3	43.6	190°02.4	11.2'	18°11.3	-2.0'	55.0'						
15	45°48.2	.. 44.1	204°32.6	11.2'	18°13.2	-1.9'	55.0'						
16	60°48.2	44.5	219°02.7	11.1'	18°15.0	-1.8'	55.0'						
17	75°48.1	45.0	233°32.8	11.1'	18°16.7	-1.7'	55.1'						
18	90°48.1	N20°45.5	248°02.9	11.1'	\$18°18.4	-1.6'	55.1'						
19	105°48.0	45.9	262°33.0	11.0'	18°19.9	-1.5'	55.1'						
20	120°47.9	46.4	277°03.0	11.0'	18°21.4	-1.4'	55.1'						
21	135°47.9	.. 46.9	291°33.0	11.0'	18°22.8	-1.3'	55.1'						
22	150°47.8	47.3	306°03.0	11.0'	18°24.1	-1.2'	55.1'						
23	165°47.8	47.8	320°32.9	10.9'	18°25.3	-1.1'	55.2'						
	SD.=15.8	d=0.5			S.D.=15.0								

Day	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass. 12 <sup>h</sup> mm:ss	Moon Mer.Pass. Upper hh:mm	Moon Mer.Pass. Lower hh:mm	Age 15-17 100-97%
21	03:25	03:23	11:57	..	11:43
22	03:21	03:19	11:57	00:06	12:30
23	03:16	03:14	11:57	00:54	13:18

## May 24, 25, 26 UT (Tue., Wed., Thu.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	242°01.4	184°35.9	N19°30.4	3°10.0	S21°37.1	76°39.1	N07°40.4	349°17.1	S20°39.8					Alpheratz	357°41.6	
1	257°03.8	199°35.2	31.2	18°13.4	37.1	91°41.5	40.3	4°19.8	39.7					Ankaa	353°14.1	
2	272°06.3	214°34.5	31.9	33°16.8	37.0	106°43.9	40.3	19°22.4	39.7					Schedar	349°38.5	
3	287°08.8	229°33.8	.. 32.7	48°20.2	.. 37.0	121°46.2	.. 40.2	34°25.1	.. 39.7					Diphda	348°54.1	
4	302°11.2	244°33.1	33.4	63°23.7	36.9	136°48.6	40.2	49°27.7	39.7					Achernar	335°25.9	
5	317°13.7	259°32.4	34.2	78°27.1	36.9	151°51.0	40.1	64°30.4	39.7					Hamal	327°58.8	
6	332°16.2	274°31.7	N19°34.9	93°30.5	S21°36.8	166°53.3	N07°40.1	79°33.0	S20°39.6					Polaris	317°16.5	
7	347°18.6	289°31.0	35.7	108°33.9	36.8	181°55.7	40.0	94°35.7	39.6					Acamar	315°17.3	
8	2°21.1	304°30.3	36.4	123°37.3	36.7	196°58.0	40.0	109°38.4	39.6					Menkar	314°13.3	
9	17°23.6	319°29.6	.. 37.1	138°40.7	.. 36.7	212°00.4	.. 39.9	124°41.0	.. 39.6					Mirfak	308°38.0	
10	32°26.0	334°28.9	37.9	153°44.2	36.6	227°02.8	39.9	139°43.7	39.6					Aldebaran	290°47.5	
11	47°28.5	349°28.2	38.6	168°47.6	36.5	242°05.1	39.8	154°46.3	39.5					Rigel	281°10.5	
12	62°31.0	4°27.5	N19°39.4	183°51.0	S21°36.5	257°07.5	N07°39.8	169°49.0	S20°39.5					Capella	280°32.0	
13	77°33.4	19°26.8	40.1	198°54.4	36.4	272°09.9	39.7	184°51.6	39.5					Bellatrix	278°30.2	
14	92°35.9	34°26.1	40.8	213°57.8	36.4	287°12.2	39.7	199°54.3	39.5					Elnath	278°10.5	
15	107°38.3	49°25.3	.. 41.6	229°01.2	.. 36.3	302°14.6	.. 39.6	214°57.0	.. 39.5					Ahnilam	275°44.7	
16	122°40.8	64°24.6	42.3	244°04.7	36.3	317°17.0	39.6	229°59.6	39.4					Betelgeuse	270°59.5	
17	137°43.3	79°23.9	43.0	259°08.1	36.2	332°19.3	39.5	245°02.3	39.4					Canopus	263°55.7	
18	152°45.7	94°23.2	N19°43.8	274°11.5	S21°36.1	347°21.7	N07°39.5	260°04.9	S20°39.4					Sirius	258°32.3	
19	167°48.2	109°22.5	44.5	289°14.9	36.1	2°24.0	39.4	275°07.6	39.4					Adhara	255°11.3	
20	182°50.7	124°21.8	45.2	304°18.3	36.0	17°26.4	39.4	290°10.2	39.4					Procyon	244°57.9	
21	197°53.1	139°21.1	.. 46.0	319°21.7	.. 36.0	32°28.8	.. 39.3	305°12.9	.. 39.3					Pollux	243°25.6	
22	212°55.6	154°20.4	46.7	334°25.1	35.9	47°31.1	39.3	320°15.5	39.3					Avior	234°17.5	
23	227°58.1	169°19.7	47.4	349°28.6	35.9	62°33.5	39.2	335°18.2	39.3					Suhail	222°51.1	
Mer.pass.:07:51			v-0.7 d0.7 m-3.8	v3.4 d0.1 m-2.1		v2.4 d-0.0 m-1.9		v2.7 d0.0 m0.0								
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	243°00.5	184°19.0	N19°48.1	4°32.0	S21°35.8	77°35.9	N07°39.2	350°20.9	S20°39.3					Denebola	182°31.6	
1	258°03.0	199°18.3	48.9	19°35.4	35.7	92°38.2	39.1	5°23.5	39.3					Gienah	175°50.1	
2	273°05.5	214°17.6	49.6	34°38.8	35.7	107°40.6	39.0	20°26.2	39.2					Acrua	173°06.6	
3	288°07.9	229°16.8	.. 50.3	49°42.2	.. 35.6	122°42.9	.. 39.0	35°28.8	.. 39.2					Gacrux	171°58.2	
4	303°10.4	244°16.1	51.0	64°45.6	35.6	137°45.3	38.9	50°31.5	39.2					Alioth	166°18.7	
5	318°12.8	259°15.4	51.8	79°49.1	35.5	152°47.7	38.9	65°34.1	39.2					Spica	158°28.9	
6	333°15.3	274°14.7	N19°52.5	94°52.5	S21°35.4	167°50.0	N07°38.8	80°36.8	S20°39.2					Alkaid	152°57.0	
7	348°17.8	289°14.0	53.2	109°55.9	35.4	182°52.4	38.8	95°39.5	39.1					Hadar	148°44.4	
8	3°20.2	304°13.3	53.9	124°59.3	35.3	197°54.7	38.7	110°42.1	39.1					Menkent	148°04.8	
9	18°22.7	319°12.6	.. 54.7	140°02.7	.. 35.3	212°57.1	.. 38.7	125°44.8	.. 39.1					Arcturus	145°53.7	
10	33°25.2	334°11.8	55.4	155°06.1	35.2	227°59.4	38.6	140°47.4	39.1					Rigel Kent.	139°48.3	
11	48°27.6	349°11.1	56.1	170°09.6	35.2	243°01.8	38.6	155°50.1	39.1					Kochab	137°19.2	
12	63°30.1	4°10.4	N19°56.8	185°13.0	S21°35.1	258°04.2	N07°38.5	170°52.7	S20°39.0					Zuben' ubi	137°02.9	
13	78°32.6	19°09.7	57.5	200°16.4	35.0	273°06.5	38.5	185°55.4	39.0					Alphecca	126°09.0	
14	93°35.0	34°09.0	58.2	215°19.8	35.0	288°08.9	38.4	200°58.0	39.0					Antares	112°23.4	
15	108°37.5	49°08.3	.. 58.9	230°23.2	.. 34.9	303°11.2	.. 38.4	216°00.7	.. 39.0					Atria	107°22.9	
16	123°39.9	64°07.5	19°59.7	245°26.6	34.9	318°13.6	38.3	231°03.4	39.0					Sabik	102°09.9	
17	138°42.4	79°06.8	20°00.4	260°30.1	34.8	333°15.9	38.3	246°06.0	38.9					Shaula	96°18.8	
18	153°44.9	94°06.1	N20°01.1	275°33.5	S21°34.7	348°18.3	N07°38.2	261°08.7	S20°38.9					Rasalhague	96°04.3	
19	168°47.3	109°05.4	01.8	290°36.9	34.7	3°20.7	38.1	276°11.3	38.9					Eltanin	90°44.7	
20	183°49.8	124°04.7	02.5	305°40.3	34.6	18°23.0	38.1	291°14.0	38.9					Kaus Aust.	83°40.9	
21	198°52.3	139°03.9	.. 03.2	320°43.7	.. 34.6	33°25.4	.. 38.0	306°16.6	.. 38.9					Vega	80°37.3	
22	213°54.7	154°03.2	03.9	335°47.1	34.5	48°27.7	38.0	321°19.3	38.8					Nunki	75°55.6	
23	228°57.2	169°02.5	04.6	350°50.5	34.4	63°30.1	37.9	336°22.0	38.8					Altair	62°06.1	
Mer.pass.:07:47			v-0.7 d0.7 m-3.8	v3.4 d0.1 m-2.1		v2.4 d-0.1 m-1.9		v2.7 d0.0 m0.0								
Thu			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	243°59.7	184°01.8	N20°05.3	5°54.0	S21°34.4	78°32.4	N07°37.9	351°24.6	S20°38.8					Peacock	15°21.9	
1	259°02.1	199°01.1	06.0	20°57.4	34.3	93°34.8	37.8	6°27.3	38.8					Deneb	13°51.5	
2	274°04.6	214°00.3	06.7	36°00.8	34.3	108°37.1	37.8	21°29.9	38.8					Markab	13°36.4	
3	289°07.1	228°59.6	.. 07.4	51°04.2	.. 34.2	123°39.5	.. 37.7	36°32.6	.. 38.7					May 24 Tue	15°21.9	
4	304°09.5	243°58.9	08.1	66°07.6	34.1	138°41.8	37.7	51°35.2	38.7					Venus	302°34.5	
5	319°12.0	258°58.2	08.8	81°11.0	34.1	153°44.2	37.6	66°37.9	38.7					Mars	121°08.6	
6	334°14.4	273°57.4	N20°09.5	96°14.4	S21°34.0	168°46.5	N07°37.5	81°40.6	S20°38.7					Jupiter	194°37.7	
7	349°16.9	288°56.7	10.2	111°17.9	33.9	183°48.9	37.5	96°43.2	38.6					Saturn	107°15.7	
8	4°19.4	303°56.0	10.9	126°21.3	33.9	198°51.2	37.4	111°45.9	38.6					May 25 Wed	15°20.1	
9	19°21.8	318°55.3	.. 11.6	141°24.7	.. 33.8	213°53.6	.. 37.4	126°48.5	.. 38.6					Venus	301°18.5	
10	34°24.3	333°54.5	12.3	156°28.1	33.8	228°56.0	37.3	141°51.2	38.6					Mars	121°31.5	
11	49°26.8	348°53.8	13.0	171°31.5	33.7	243°58.3	37.3	156°53.8	38.6					Jupiter	194°35.3	
12	64°29.2	3°53.1	N20°13.7	186°34.9	S21°33.6	259°00.7	N07°37.2	171°56.5	S20°38.5					Saturn	107°20.3	
13	79°31.7	18°52.4	14.4	201°38.3	33.6	274°03.0	37.2	186°59.2	38.5					May 26 Thu	15°19.7	
14	94°34.2	33°51.6	15.1	216°41.8	33.5	289°05.4	37.1	202°01.8	38.5					Venus	300°02.1	
15	109°36.6	48°50.9	.. 15.8	231°45.2	.. 33.5	304°07.7	.. 37.0	217°04.5	.. 38.5					Mars	121°54.3	
16	124°39.1	63°50.2	16.5	246°48.6	33.4	319°10.1	37.0	232°07.1	38.5					Jupiter	194°32.8	
17	139°41.6	78°49.4	17.1	261°52.0	33.3	334°12.4	36.9	247°09.8	38.4							

DUT1 = UT1-UTC = -0.1731 sec ΔT = TT-UT1 = +68.3571 sec

2016 May 24 to May. 26 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	180°47.7	N20°48.2	335°02.8	10.9'	\$18°26.4	-1.1'	55.2'	
1	195°47.7	48.7	349°32.8	10.9'	18°27.4	-1.0'	55.2'	
2	210°47.6	49.2	4°02.6	10.9'	18°28.3	-0.9'	55.2'	
3	225°47.5	.. 49.6	18°32.5	10.8'	18°29.1	-0.8'	55.2'	
4	240°47.5	50.1	33°02.3	10.8'	18°29.8	-0.7'	55.2'	
5	255°47.4	50.5	47°32.1	10.8'	18°30.5	-0.6'	55.3'	
6	270°47.4	N20°51.0	62°01.9	10.8'	\$18°31.0	-0.5'	55.3'	
7	285°47.3	51.4	76°31.7	10.7'	18°31.5	-0.4'	55.3'	
8	300°47.3	51.9	91°01.4	10.7'	18°31.8	-0.3'	55.3'	
9	315°47.2	.. 52.3	105°31.1	10.7'	18°32.1	-0.2'	55.3'	
10	330°47.1	52.8	120°00.8	10.7'	18°32.3	-0.1'	55.4'	
11	345°47.1	53.3	134°30.5	10.7'	18°32.4	-0.0'	55.4'	
12	0°47.0	N20°53.7	149°00.1	10.6'	\$18°32.3	0.1'	55.4'	
13	15°47.0	54.2	163°29.8	10.6'	18°32.2	0.2'	55.4'	
14	30°46.9	54.6	177°59.4	10.6'	18°32.0	0.2'	55.4'	
15	45°46.8	.. 55.1	192°29.0	10.6'	18°31.7	0.3'	55.4'	
16	60°46.8	55.5	206°58.6	10.6'	18°31.3	0.4'	55.5'	
17	75°46.7	56.0	221°28.1	10.6'	18°30.9	0.5'	55.5'	
18	90°46.7	N20°56.4	235°57.7	10.5'	\$18°30.3	0.6'	55.5'	
19	105°46.6	56.9	250°27.2	10.5'	18°29.6	0.7'	55.5'	
20	120°46.5	57.3	264°56.7	10.5'	18°28.8	0.8'	55.5'	
21	135°46.5	.. 57.8	279°26.2	10.5'	18°28.0	0.9'	55.6'	
22	150°46.4	58.2	293°55.7	10.5'	18°27.0	1.0'	55.6'	
23	165°46.3	58.6	308°25.2	10.5'	18°25.9	1.1'	55.6'	
	SD.=15.8	d=0.5			S.D.=15.1			
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	180°46.3	N20°59.1	322°54.6	10.4'	\$18°24.8	1.2'	55.6'	
1	195°46.2	20°59.5	337°24.1	10.4'	18°23.5	1.3'	55.6'	
2	210°46.2	21°00.0	351°53.5	10.4'	18°22.2	1.4'	55.7'	
3	225°46.1	.. 00.4	6°22.9	10.4'	18°20.8	1.5'	55.7'	
4	240°46.0	00.9	20°52.3	10.4'	18°19.2	1.6'	55.7'	
5	255°46.0	01.3	35°21.7	10.4'	18°17.6	1.7'	55.7'	
6	270°45.9	N21°01.7	49°51.1	10.4'	\$18°15.9	1.8'	55.7'	
7	285°45.8	02.2	64°20.4	10.4'	18°14.0	1.9'	55.8'	
8	300°45.8	02.6	78°49.8	10.4'	18°12.1	2.0'	55.8'	
9	315°45.7	.. 03.1	93°19.2	10.3'	18°10.1	2.1'	55.8'	
10	330°45.6	03.5	107°48.5	10.3'	18°08.0	2.2'	55.8'	
11	345°45.6	03.9	122°17.8	10.3'	18°05.8	2.3'	55.9'	
12	0°45.5	N21°04.4	136°47.1	10.3'	\$18°03.5	2.3'	55.9'	
13	15°45.4	04.8	151°16.5	10.3'	18°01.1	2.4'	55.9'	
14	30°45.4	05.3	165°45.8	10.3'	17°58.6	2.5'	55.9'	
15	45°45.3	.. 05.7	180°15.1	10.3'	17°56.0	2.6'	55.9'	
16	60°45.2	06.1	194°44.4	10.3'	17°53.4	2.7'	56.0'	
17	75°45.2	06.6	209°13.6	10.3'	17°50.6	2.8'	56.0'	
18	90°45.1	N21°07.0	223°42.9	10.3'	\$17°47.7	2.9'	56.0'	
19	105°45.1	07.4	238°12.2	10.3'	17°44.7	3.0'	56.0'	
20	120°45.0	07.9	252°41.5	10.3'	17°41.7	3.1'	56.0'	
21	135°44.9	.. 08.3	267°10.7	10.3'	17°38.5	3.2'	56.1'	
22	150°44.8	08.7	281°40.0	10.3'	17°35.3	3.3'	56.1'	
23	165°44.8	09.1	296°09.3	10.3'	17°31.9	3.4'	56.1'	
	SD.=15.8	d=0.4			S.D.=15.2			
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	180°44.7	N21°09.6	310°38.5	10.3'	\$17°28.5	3.5'	56.1'	
1	195°44.6	10.0	325°07.8	10.2'	17°25.0	3.6'	56.2'	
2	210°44.6	10.4	339°37.0	10.2'	17°21.3	3.7'	56.2'	
3	225°44.5	.. 10.9	354°06.3	10.2'	17°17.6	3.8'	56.2'	
4	240°44.4	11.3	8°35.5	10.2'	17°13.8	3.9'	56.2'	
5	255°44.4	11.7	23°04.7	10.2'	17°09.9	4.0'	56.3'	
6	270°44.3	N21°12.1	37°34.0	10.2'	\$17°05.9	4.0'	56.3'	
7	285°44.2	12.6	52°03.2	10.2'	17°01.8	4.1'	56.3'	
8	300°44.2	13.0	66°32.5	10.2'	16°57.6	4.2'	56.3'	
9	315°44.1	.. 13.4	81°01.7	10.2'	16°53.3	4.3'	56.3'	
10	330°44.0	13.8	95°30.9	10.2'	16°49.0	4.4'	56.4'	
11	345°44.0	14.3	110°00.2	10.2'	16°44.5	4.5'	56.4'	
12	0°43.9	N21°14.7	124°29.4	10.2'	\$16°39.9	4.6'	56.4'	
13	15°43.8	15.1	138°58.7	10.2'	16°35.3	4.7'	56.4'	
14	30°43.7	15.5	153°27.9	10.2'	16°30.6	4.8'	56.5'	
15	45°43.7	.. 16.0	167°57.1	10.2'	16°25.7	4.9'	56.5'	
16	60°43.6	16.4	182°26.4	10.2'	16°20.8	5.0'	56.5'	
17	75°43.5	16.8	196°55.6	10.2'	16°15.8	5.1'	56.5'	
18	90°43.5	N21°17.2	211°24.9	10.2'	\$16°10.7	5.1'	56.6'	
19	105°43.4	17.6	225°54.1	10.3'	16°05.5	5.2'	56.6'	
20	120°43.3	18.0	240°23.4	10.3'	16°00.2	5.3'	56.6'	
21	135°43.2	.. 18.5	254°52.6	10.3'	15°54.9	5.4'	56.6'	
22	150°43.2	18.9	269°21.9	10.3'	15°49.4	5.5'	56.7'	
23	165°43.1	19.3	283°51.2	10.3'	15°43.9	5.6'	56.7'	
	SD.=15.8	d=0.4			S.D.=15.4			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°			00:28	23:48		
66°			01:40	22:17		
64°			02:16	21:41		
62°			01:02	21:15	22:57	
60°			01:46	20:55	22:11	
N 58°						
56°			02:14	20:39	21:42	
54°	00:56	02:36	03:30	20:25	21:20	23:03
52°	01:37	02:53	03:42	20:13	21:02	22:20
50°	02:03	03:08	03:52	20:02	20:47	21:53
48°	02:23	03:20	04:02	19:53	20:35	21:32
46°	03:00	03:46	04:21	19:33	20:09	20:55
N 40°						
38°	03:26	04:05	04:37	19:18	19:49	20:29
36°	03:46	04:21	04:50	19:04	19:33	20:08
34°	04:02	04:35	05:01	18:53	19:20	19:52
32°	04:28	04:57	05:21	18:33	18:57	19:26
N 10°						
0°	04:49	05:15	05:38	18:16	18:39	19:05
0°	05:05	05:31	05:53	18:01	18:23	18:48
S 10°						
0°	05:20	05:46	06:09	17:45	18:07	18:33
20°	05:35	06:02	06:25	17:28	17:52	18:19
30°	05:49	06:18	06:44	17:10	17:36	18:05
35°	05:56	06:27	06:55	16:59	17:26	17:57
40°	06:04	06:38	07:07	16:46	17:16	17:49
45°	06:13	06:49	07:22	16:32	17:04	17:41
S 50°						
52°	06:23	07:03	07:40	16:14	16:51	17:31
54°	06:27	07:09	07:48	16:05	16:44	17:27
56°	06:32	07:16	07:58	15:56	16:37	17:22
58°	06:37	07:24	08:08	15:45	16:30	17:17
S 60°	06:42	07:32	08:21	15:33	16:21	17:11
Lat.	Tue	Moonrise	Wed	Thu	Tue	Moonset
N 72°	■	■	02:23	■	■	04:33
N 70°	00:09	00:58	01:21	03:16	04:12	05:35
68°	--	00:13	00:45	04:02	04:57	06:10
66°	23:43	--	00:19	04:32	05:26	06:35
64°	23:21	--	00:00	04:55	05:48	06:55
62°	23:03	23:43	--	05:13	06:06	07:10
60°	22:48	23:30	--	05:28	06:21	07:24
N 58°	22:35	23:18	23:54	05:41	06:33	07:35
56°	22:25	23:08	23:45	05:52	06:44	07:45
54°	22:15	22:59	23:38	06:01	06:54	07:53
52°	22:06	22:51	23:31	06:10	07:02	08:01
50°	21:59	22:44	23:24	06:18	07:10	08:08
48°	21:42	22:29	23:11	06:34	07:26	08:23
N 40°	21:29	22:16	23:00	06:48	07:39	08:35
38°	21:17	22:05	22:50	06:59	07:51	08:46
36°	21:07	21:56	22:42	07:09	08:00	08:55
30°	20:50	21:40	22:28	07:26	08:17	09:10
N 10°	20:35	21:25	22:15	07:41	08:32	09:24
0°	20:21	21:12	22:03	07:55	08:46	09:37
S 10°	20:07	2				

## May 27, 28, 29 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars			
Fri	GHA	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	GHA		GHA		
0	244°58.8	183°44.3	N20°21.9	7°15.9	S21°32.9	79°28.8	N07°36.5	352°28.4	S20°38.3							Alpheratz	357°41.5	29°10.6
1	260°01.3	198°43.6	22.6	22°19.3	32.8	94°31.2	36.5	7°31.1	38.3						Ankaa	353°14.0	-42°12.9	
2	275°03.7	213°42.8	23.3	37°22.7	32.8	109°33.5	36.4	22°33.7	38.3						Schedar	349°38.4	56°37.3	
3	290°06.2	228°42.1	.. 24.0	52°26.1	.. 32.7	124°35.9	.. 36.4	37°36.4	.. 38.2						Diphda	348°54.1	-17°53.8	
4	305°08.7	243°41.4	24.7	67°29.5	32.6	139°38.2	36.3	52°39.0	38.2						Achernar	335°25.9	-57°09.2	
5	320°11.1	258°40.6	25.3	82°33.0	32.6	154°40.6	36.2	67°41.7	38.2						Hamal	327°58.8	23°32.1	
6	335°13.6	273°39.9	N20°26.0	97°36.4	S21°32.5	169°42.9	N07°36.2	82°44.4	S20°38.2						Polaris	317°15.9	89°19.7	
7	350°16.1	288°39.2	26.7	112°39.8	32.4	184°45.3	36.1	97°47.0	38.2						Acamar	315°17.3	-40°14.5	
8	5°18.5	303°38.4	27.4	127°43.2	32.4	199°47.6	36.1	112°49.7	38.1						Menkar	314°13.3	4°09.0	
9	20°21.0	318°37.7	.. 28.0	142°46.6	.. 32.3	214°50.0	.. 36.0	127°52.3	.. 38.1						Mirfak	308°37.9	49°54.8	
10	35°23.4	333°37.0	28.7	157°50.0	32.3	229°52.3	35.9	142°55.0	38.1						Aldebaran	290°47.4	16°32.3	
11	50°25.9	348°36.2	29.4	172°53.4	32.2	244°54.6	35.9	157°57.6	38.1						Rigel	281°10.5	-8°11.2	
12	65°28.4	3°35.5	N20°30.0	187°56.8	S21°32.1	259°57.0	N07°35.8	173°00.3	S20°38.1						Capella	280°32.0	46°00.6	
13	80°30.8	18°34.7	30.7	203°00.2	32.1	274°59.3	35.8	188°03.0	38.0						Bellatrix	278°30.2	6°21.6	
14	95°33.3	33°34.0	31.4	218°03.6	32.0	290°01.7	35.7	203°05.6	38.0						El Nath	278°10.5	28°37.0	
15	110°35.8	48°33.3	.. 32.1	233°07.1	.. 31.9	305°04.0	.. 35.7	218°08.3	.. 38.0						Alnilam	275°44.7	-1°11.8	
16	125°38.2	63°32.5	32.7	248°10.5	31.9	320°06.4	35.6	233°10.9	38.0						Betelgeuse	270°59.5	7°24.3	
17	140°40.7	78°31.8	33.4	263°13.9	31.8	335°08.7	35.5	248°13.6	38.0						Canopus	263°55.8	-52°42.6	
18	155°43.2	93°31.0	N20°34.0	278°17.3	S21°31.7	350°11.1	N07°35.5	263°16.3	S20°37.9						Sirius	258°32.3	-16°44.6	
19	170°45.6	108°30.3	34.7	293°20.7	31.7	5°13.4	35.4	278°18.9	37.9						Adhara	255°11.3	-29°00.0	
20	185°48.1	123°29.6	35.4	308°24.1	31.6	20°15.7	35.4	293°21.6	37.9						Procyon	244°57.9	5°10.7	
21	200°50.5	138°28.8	.. 36.0	323°27.5	.. 31.5	35°18.1	.. 35.3	308°24.2	.. 37.9						Pollux	243°25.6	27°59.1	
22	215°53.0	153°28.1	36.7	338°30.9	31.5	50°20.4	35.2	323°26.9	37.9						Avior	234°17.5	-59°34.1	
23	230°55.5	168°27.3	37.4	353°34.3	31.4	65°22.8	35.2	338°29.5	37.8						Suhail	222°51.1	-43°30.3	
Mer.pass.:07:39			v-0.7 d0.7 m-3.8			v3.4 d0.1 m-2.1			v2.3 d-0.1 m-1.9			v2.7 d0.0 m0.0			Miaplacidus			
Sat	GHA	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	GHA		GHA		Dec
0	245°57.9	183°26.6	N20°38.0	8°37.7	S21°31.3	80°25.1	N07°35.1	353°32.2	S20°37.8						Denebola	182°31.6	14°28.9	
1	261°00.4	198°25.8	38.7	23°41.1	31.3	95°27.4	35.1	8°34.9	37.8						Gienah	175°50.1	-17°38.1	
2	276°02.9	213°25.1	39.3	38°44.6	31.2	110°29.8	35.0	23°37.5	37.8						Acrux	173°06.6	-63°11.6	
3	291°05.3	228°24.3	.. 40.0	53°48.0	.. 31.1	125°32.1	.. 34.9	38°40.2	.. 37.8						Gacrux	171°58.2	-57°12.5	
4	306°07.8	243°23.6	40.6	68°51.4	31.1	140°34.5	34.9	53°42.8	37.7						Alioth	166°18.7	55°52.5	
5	321°10.3	258°22.9	41.3	83°54.8	31.0	155°36.8	34.8	68°45.5	37.7						Spica	158°28.9	-11°14.8	
6	336°12.7	273°22.1	N20°41.9	98°58.2	S21°30.9	170°39.1	N07°34.8	83°48.2	S20°37.7						Alkaid	152°57.1	49°14.1	
7	351°15.2	288°21.4	42.6	114°01.6	30.9	185°41.5	34.7	98°50.8	37.7						Hadar	148°44.4	-60°27.2	
8	6°17.7	303°20.6	43.2	129°05.0	30.8	200°43.8	34.6	113°53.5	37.7						Menkent	148°04.8	-36°27.0	
9	21°20.1	318°19.9	.. 43.9	144°08.4	.. 30.8	215°46.2	.. 34.6	128°56.1	.. 37.6						Arcturus	145°53.7	19°06.0	
10	36°22.6	333°19.1	44.5	159°11.8	30.7	230°48.5	34.5	143°58.8	37.6						Rigel Kent.	139°48.3	-60°54.1	
11	51°25.0	348°18.4	45.2	174°15.2	30.6	245°50.8	34.4	159°01.5	37.6						Kochab	137°19.2	74°05.6	
12	66°27.5	3°17.6	N20°45.8	189°18.6	S21°30.6	260°53.2	N07°34.4	174°04.1	S20°37.6						Zuben' ubi	137°02.9	-16°06.5	
13	81°30.0	18°16.9	46.5	204°22.0	30.5	275°55.5	34.3	189°06.8	37.6						Alphecca	126°09.0	26°39.8	
14	96°32.4	33°16.1	47.1	219°25.4	30.4	290°57.8	34.3	204°09.4	37.5						Antares	112°23.4	-26°27.9	
15	111°34.9	48°15.4	.. 47.8	234°28.8	.. 30.4	306°00.2	.. 34.2	219°12.1	.. 37.5						Atria	107°22.9	-69°03.2	
16	126°37.4	63°14.6	48.4	249°32.2	30.3	321°02.5	34.1	234°14.7	37.5						Sabik	102°09.9	-15°44.5	
17	141°39.8	78°13.9	49.1	264°35.6	30.2	336°04.9	34.1	249°17.4	37.5						Shaula	96°18.8	-37°06.7	
18	156°42.3	93°13.1	N20°49.7	279°39.0	S21°30.2	351°07.2	N07°34.0	264°20.1	S20°37.5						Rasalhague	96°04.3	12°33.0	
19	171°44.8	108°12.4	50.3	294°42.4	30.1	6°09.5	34.0	279°22.7	37.4						Eltanin	90°44.7	51°29.3	
20	186°47.2	123°11.6	51.0	309°45.8	30.0	21°11.9	33.9	294°25.4	37.4						Kaus Aust.	83°40.8	-34°22.3	
21	201°49.7	138°10.8	.. 51.6	324°49.2	.. 29.9	36°14.2	.. 33.8	309°28.0	.. 37.4						Vega	80°37.2	38°48.0	
22	216°52.2	153°10.1	52.3	339°52.6	29.9	51°16.5	33.8	324°30.7	37.4						Nunki	75°55.6	-26°16.3	
23	231°54.6	168°09.3	52.9	354°56.0	29.8	66°18.9	33.7	339°33.4	37.4						Altair	62°06.1	8°54.8	
Mer.pass.:07:35			v-0.7 d0.7 m-3.8			v3.4 d0.1 m-2.1			v2.3 d-0.1 m-1.9			v2.7 d0.0 m0.0			Peacock			
Sun	GHA	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	GHA		GHA		Dec
0	246°57.1	183°08.6	N20°53.5	9°59.4	S21°29.7	81°21.2	N07°33.6	354°36.0	S20°37.3						Fomalhaut	15°21.9	-29°32.0	
1	261°59.5	198°07.8	54.2	25°02.8	29.7	96°23.5	33.6	9°38.7	37.3						Scheat	13°51.5	28°10.1	
2	277°02.0	213°07.1	54.8	40°06.2	29.6	111°25.9	33.5	24°41.3	37.3						Markab	13°36.4	15°17.5	
3	292°04.5	228°06.3	.. 55.4	55°09.6	.. 29.5	126°28.2	.. 33.5	39°44.0	.. 37.3						<b>May 27 Fri</b>	<b>SHA</b>	<b>Mer.pass</b>	
4	307°06.9	243°05.6	56.1	70°13.0	29.5	141°30.5	33.4	54°46.7	37.3						Venus	298°45.5	11:46	
5	322°09.4	258°04.8	56.7	85°16.4	29.4	156°32.9	33.3	69°49.3	37.2						Mars	122°17.1	23:26	
6	337°11.9	273°04.0	57.3	100°19.8	S21°29.3	171°35.2	N07°33.3	84°52.0	S20°37.2						Jupiter	194°30.0	18:39	
7	352°14.3	288°03.3	57.9	115°23.2	29.3	186°37.5	33.2	99°54.6	37.2						Saturn	107°29.6	00:30	
8	7°16.8	303°02.5	58.6	130°26.6	29.2	201°39.9	33.1	114°57.3	37.2						<b>May 28 Sat</b>	<b>SHA</b>	<b>Mer.pass</b>	
9	22°19.3	318°01.8	.. 59.2	145°30.0	.. 29.1	216°42.2	.. 33.1	130°00.0	.. 37.2						Venus	297°28.6	11:47	
10	37°21.7	333°01.0	20°59.8	160°33.4	29.1	231°44.5	33.0	145°02.6	37.1						Mars			

DUT1 = UT1-UTC = -0.1781 sec ΔT = TT-UT1 = +68.3621 sec

2016 May 27 to May. 29 UT

h	Sun			Moon											
Fri	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight	Civil	Sunrise	Sunset	Twilight	Civil	Naut.
0	180°43.0	N21°19.7	298°20.4	10.3'	\$15°38.2	5.7'	56.7'	N 72°	□	□	□	□	□	□	□
1	195°43.0	20.1	312°49.7	10.3'	15°32.5	5.8'	56.7'	N 70°	□	□	□	□	□	□	□
2	210°42.9	20.5	327°19.0	10.3'	15°26.7	5.9'	56.8'	68°	□	□	□	□	□	□	□
3	225°42.8	.. 20.9	341°48.2	10.3'	15°20.8	5.9'	56.8'	66°	□	□	01:28	22:31	□	□	□
4	240°42.7	21.4	356°17.5	10.3'	15°14.8	6.0'	56.8'	64°	□	□	02:07	21:50	□	□	□
5	255°42.7	21.8	10°46.8	10.3'	15°08.7	6.1'	56.8'	62°	□	00:43	02:34	21:22	23:19	□	□
6	270°42.6	N21°22.2	25°16.1	10.3'	\$15°02.6	6.2'	56.9'	60°	□	01:37	02:55	21:01	22:20	□	□
7	285°42.5	22.6	39°45.4	10.3'	14°56.4	6.3'	56.9'	N 58°	□	02:08	03:12	20:44	21:49	□	□
8	300°42.4	23.0	54°14.7	10.3'	14°50.0	6.4'	56.9'	56°	00:39	02:30	03:26	20:29	21:26	23:22	□
9	315°42.4	.. 23.4	68°44.0	10.3'	14°43.6	6.5'	56.9'	54°	01:28	02:49	03:39	20:17	21:07	22:29	□
10	330°42.3	23.8	83°13.3	10.3'	14°37.1	6.5'	57.0'	52°	01:57	03:04	03:49	20:06	20:52	22:00	□
11	345°42.2	24.2	97°42.6	10.3'	14°30.6	6.6'	57.0'	50°	02:18	03:17	03:59	19:56	20:39	21:38	□
12	0°42.1	N21°24.6	112°11.9	10.3'	\$14°23.9	6.7'	57.0'	45°	02:56	03:43	04:19	19:36	20:12	20:59	□
13	15°42.1	25.0	126°41.2	10.3'	14°17.2	6.8'	57.1'	N 40°	03:23	04:03	04:35	19:20	19:52	20:32	□
14	30°42.0	25.4	141°10.5	10.3'	14°10.3	6.9'	57.1'	35°	03:44	04:20	04:49	19:06	19:35	20:11	□
15	45°41.9	.. 25.8	155°39.9	10.3'	14°03.4	6.9'	57.1'	30°	04:01	04:34	05:00	18:54	19:21	19:54	□
16	60°41.8	26.3	170°09.2	10.3'	13°56.4	7.0'	57.1'	20°	04:28	04:56	05:20	18:34	18:59	19:27	□
17	75°41.8	26.7	184°38.5	10.3'	13°49.4	7.1'	57.2'	N 10°	04:48	05:15	05:38	18:17	18:40	19:06	□
18	90°41.7	N21°27.1	199°07.9	10.3'	\$13°42.2	7.2'	57.2'	0°	05:06	05:31	05:54	18:01	18:23	18:49	□
19	105°41.6	27.5	213°37.2	10.3'	13°35.0	7.3'	57.2'	S 10°	05:21	05:47	06:10	17:45	18:07	18:34	□
20	120°41.5	27.9	228°06.6	10.3'	13°27.7	7.3'	57.2'	20°	05:36	06:03	06:26	17:28	17:52	18:19	□
21	135°41.4	.. 28.3	242°35.9	10.4'	13°20.3	7.4'	57.3'	30°	05:50	06:20	06:46	17:09	17:35	18:04	□
22	150°41.4	28.7	257°05.3	10.4'	13°12.8	7.5'	57.3'	35°	05:58	06:29	06:57	16:57	17:25	17:56	□
23	165°41.3	29.1	271°34.6	10.4'	13°05.3	7.6'	57.3'	40°	06:06	06:40	07:10	16:45	17:15	17:48	□
	SD.=15.8	d=0.4			S.D.=15.5			45°	06:15	06:52	07:25	16:30	17:02	17:39	□
Sat	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Moonrise	Sat	Sun	Fri	Sat	Sun	Moonset
0	180°41.2	N21°29.5	286°04.0	10.4'	\$12°57.7	7.7'	57.4'	S 50°	06:25	07:06	07:43	16:11	16:48	17:29	□
1	195°41.1	29.9	300°33.4	10.4'	12°50.0	7.7'	57.4'	52°	06:30	07:13	07:52	16:02	16:42	17:24	□
2	210°41.1	30.3	315°02.7	10.4'	12°42.2	7.8'	57.4'	54°	06:35	07:20	08:02	15:52	16:34	17:19	□
3	225°41.0	.. 30.7	329°32.1	10.4'	12°34.4	7.9'	57.4'	56°	06:40	07:28	08:13	15:41	16:27	17:14	□
4	240°40.9	31.1	344°01.5	10.4'	12°26.5	8.0'	57.5'	58°	06:46	07:37	08:26	15:29	16:18	17:08	□
5	255°40.8	31.5	358°30.8	10.4'	12°18.5	8.0'	57.5'	S 60°	06:52	07:47	08:40	15:14	16:08	17:02	□
6	270°40.7	N21°31.8	13°00.2	10.4'	\$12°10.4	8.1'	57.5'								
7	285°40.7	32.2	27°29.6	10.4'	12°02.2	8.2'	57.5'								
8	300°40.6	32.6	41°59.0	10.4'	11°54.0	8.2'	57.6'								
9	315°40.5	.. 33.0	56°28.4	10.4'	11°45.7	8.3'	57.6'								
10	330°40.4	33.4	70°57.8	10.4'	11°37.4	8.4'	57.6'								
11	345°40.3	33.8	85°27.2	10.4'	11°29.0	8.5'	57.7'								
12	0°40.3	N21°34.2	99°56.6	10.4'	\$11°20.5	8.5'	57.7'								
13	15°40.2	34.6	114°26.0	10.4'	11°11.9	8.6'	57.7'								
14	30°40.1	35.0	128°55.4	10.4'	11°03.3	8.7'	57.7'								
15	45°40.0	.. 35.4	143°24.8	10.4'	10°54.6	8.7'	57.8'								
16	60°39.9	35.8	157°54.2	10.4'	10°45.8	8.8'	57.8'								
17	75°39.9	36.2	172°23.6	10.4'	10°36.9	8.9'	57.8'								
18	90°39.8	N21°36.5	186°53.0	10.4'	\$10°28.0	8.9'	57.9'								
19	105°39.7	36.9	201°22.4	10.4'	10°19.1	9.0'	57.9'								
20	120°39.6	37.3	215°51.8	10.4'	10°10.0	9.1'	57.9'								
21	135°39.5	.. 37.7	230°21.2	10.4'	10°00.9	9.1'	57.9'								
22	150°39.5	38.1	244°50.6	10.4'	09°51.8	9.2'	58.0'								
23	165°39.4	38.5	259°20.0	10.4'	09°42.6	9.3'	58.0'								
	SD.=15.8	d=0.4			S.D.=15.7										
Sun	GHA	Dec	GHA	ν	Dec	d	HP	Day	Sun	Mer.	Moon	Mer. Pass.	Upper	Lower	Age
0	180°39.3	N21°38.9	273°49.4	10.4'	\$09°33.3	9.3'	58.0'	Eqn.of Time	00 <sup>h</sup>	12 <sup>h</sup>	Mer. Pass.	21-23	21-50%	71-50%	
1	195°39.2	39.2	288°18.8	10.4'	09°23.9	9.4'	58.1'	00:mm:ss	mm:ss	hh:mm	Upper				
2	210°39.1	39.6	302°48.2	10.4'	09°14.5	9.4'	58.1'	00:mm:ss	mm:ss	hh:mm	Lower				
3	225°39.0	.. 40.0	317°17.5	10.4'	09°05.1	9.5'	58.1'	00:mm:ss	mm:ss	hh:mm	hh:mm				
4	240°39.0	40.4	331°46.9	10.4'	08°55.5	9.6'	58.1'	00:mm:ss	mm:ss	hh:mm	hh:mm				
5	255°38.9	40.8	346°16.3	10.4'	08°45.9	9.6'	58.2'	00:mm:ss	mm:ss	hh:mm	hh:mm				
6	270°38.8	N21°41.1	0°45.7	10.4'	\$08°36.3	9.7'	58.2'	00:mm:ss	mm:ss	hh:mm	hh:mm				
7	285°38.7	41.5	15°15.1	10.4'	08°26.6	9.7'	58.2'	00:mm:ss	mm:ss	hh:mm	hh:mm				
8	300°38.6	41.9	29°44.4	10.4'	08°16.8	9.8'	58.3'	00:mm:ss	mm:ss	hh:mm	hh:mm				
9	315°38.5	.. 42.3	44°13.8	10.4'	08°07.0	9.8'	58.3'	00:mm:ss	mm:ss	hh:mm	hh:mm				
10	330°38.5	42.7	58°43.1	10.4'	07°57.2	9.9'	58.3'	00:mm:ss	mm:ss	hh:mm	hh:mm				
11	345°38.4	43.0	73°12.5	10.3'	07°47.3	9.9'	58.3'	00:mm:ss	mm:ss	hh:mm	hh:mm				
12	0°38.3	N21°43.4	87°41.8	10.3'	\$07°37.3	10.0'	58.4'	00:mm:ss	mm:ss	hh:mm	hh:mm				
13	15°38.2	43.8	102°11.2	10.3'	07°27.3	10.0'	58.4'	00:mm:ss	mm:ss	hh:mm	hh:mm				
14	30°38.1	44.2	116°40.5	10.3'	07°17.2	10.1'	58.4'	00:mm:ss	mm:ss	hh:mm	hh:mm				
15	45°38.0	.. 44.5	131°09.8	10.3'	07°07.1	10.1'	58.5'	00:mm:ss	mm:ss	hh:mm	hh:mm				
16	60°37.9	44.9	145°39.1	10.3'	06°56.9	10.2'	58.5'	00:mm:ss	mm:ss	hh:mm	hh:mm				
17	75°37.9	45.3	160°08.4	10.3'	06°46.7	10.2'	58.5'	00:mm:ss	mm:ss	hh:mm	hh:mm				
18	90°37.8	N21°45.6	174°37.7	10.3'	\$06°36.4	10.3'	58.6'	00:mm:ss	mm:ss	hh:mm	hh:mm				
19	105°37.7	46.0	189°07.0	10.3'	06°26.1	10.3'	58.6'	00:mm:ss	mm:ss	hh:mm	hh:mm				
20	120°37.6	46.4	203°36.3	10.3'	06°15.7	10.4'	58.6'	00:mm:ss	mm:ss	hh:mm	hh:mm				
21	135°37.5	.. 46.8	218°05.5	10.3'	06°05.3	10.4'	58.6'	00:mm:ss	mm:ss	hh:mm	hh:mm				
22	150°37.4	47.1	232°34.8	10.2'	05°54.9	10.5'	58.7'	00:mm:ss	mm:ss	hh:mm	hh:mm				
23	165°37.3	47.5	247°04.0	10.2'	05°44.4	10.5'	58.7'	00:mm:ss	mm:ss	hh:mm	hh:mm				
	SD.=15.8	d=0.4			S.D.=15.9			27	02:52	02:49	11:57	04:15	16:41		
								28	02:45	02:41	11:57	05:06	17:31		
								29	02:37	02:33	11:57	05:57	18:22</td		

## May 30, 31, 01 UT (Mon., Tue., Wed.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	247°56.2	182°50.3	N21°08.5	11°20.9	S21°28.1	82°17.2	N07°32.1	355°39.9	S20°36.8								Alpheratz	357°41.5	29°10.6				
1	262°58.7	197°49.6	09.1	26°24.3	28.0	97°19.5	32.0	10°42.5	36.8							Ankaa	353°14.0	-42°12.9					
2	278°01.1	212°48.8	09.7	41°27.7	28.0	112°21.8	32.0	25°45.2	36.8							Schedar	349°38.4	56°37.3					
3	293°03.6	227°48.0	10.3	56°31.1	27.9	127°24.1	31.9	40°47.8	36.8							Diphda	348°54.1	-17°53.8					
4	308°06.1	242°47.3	10.9	71°34.5	27.8	142°26.5	31.8	55°50.5	36.8							Achernar	335°25.8	-57°09.1					
5	323°08.5	257°46.5	11.5	86°37.9	27.8	157°28.8	31.8	70°53.1	36.7							Hamal	327°58.8	23°32.1					
6	338°11.0	272°45.7	N21°12.1	101°41.3	S21°27.7	172°31.1	N07°31.7	85°55.8	S20°36.7							Polaris	317°15.2	89°19.7					
7	353°13.5	287°44.9	12.7	116°44.7	27.6	187°33.4	31.6	100°58.5	36.7							Acamar	315°17.3	-40°14.4					
8	8°15.9	302°44.2	13.3	131°48.1	27.5	202°35.8	31.6	116°01.1	36.7							Menkar	314°13.3	4°09.0					
9	23°18.4	317°43.4	13.9	146°51.5	27.5	217°38.1	31.5	131°03.8	36.7							Mirfak	308°37.9	49°54.8					
10	38°20.9	332°42.6	14.5	161°54.8	27.4	232°40.4	31.4	146°06.4	36.6							Aldebaran	290°47.4	16°32.3					
11	53°23.3	347°41.9	15.1	176°58.2	27.3	247°42.7	31.4	161°09.1	36.6							Rigel	281°10.5	-8°11.2					
12	68°25.8	2°41.1	N21°15.7	192°01.6	S21°27.3	262°45.1	N07°31.3	176°11.8	S20°36.6							Capella	280°32.0	46°00.6					
13	83°28.3	17°40.3	16.3	207°05.0	27.2	277°47.4	31.2	191°14.4	36.6							Bellatrix	278°30.2	6°21.6					
14	98°30.7	32°39.5	16.9	222°08.4	27.1	292°49.7	31.2	206°17.1	36.6							Elnath	278°10.5	28°37.0					
15	113°33.2	47°38.8	17.5	237°11.8	27.1	307°52.0	31.1	221°19.8	36.5							Ahnilam	275°44.7	-1°11.8					
16	128°35.6	62°38.0	18.1	252°15.2	27.0	322°54.4	31.0	236°22.4	36.5							Betelgeuse	270°59.5	7°24.3					
17	143°38.1	77°37.2	18.7	267°18.5	26.9	337°56.7	31.0	251°25.1	36.5							Canopus	263°55.8	-52°42.6					
18	158°40.6	92°36.5	N21°19.3	282°21.9	S21°26.8	352°59.0	N07°30.9	266°27.7	S20°36.5							Sirius	258°32.3	-16°44.6					
19	173°43.0	107°35.7	19.9	297°25.3	26.8	8°01.3	30.8	281°30.4	36.5							Adhara	255°11.3	-29°00.0					
20	188°45.5	122°34.9	20.5	312°28.7	26.7	23°03.7	30.8	296°33.1	36.4							Procyon	244°57.9	5°10.8					
21	203°48.0	137°34.1	21.0	327°32.1	26.6	38°06.0	30.7	311°35.7	36.4							Pollux	243°25.6	27°59.1					
22	218°50.4	152°33.4	21.6	342°35.5	26.6	53°08.3	30.6	326°38.4	36.4							Avior	234°17.5	-59°34.1					
23	233°52.9	167°32.6	22.2	357°38.8	26.5	68°10.6	30.6	341°41.0	36.4							Suhail	222°51.1	-43°30.3					
Mer.pass.:07:27				v-0.8 d0.6 m-3.8				v3.4 d0.1 m-2.1				v2.3 d-0.1 m-1.9				v2.7 d0.0 m0.0							
Tue				GHA				GHA				GHA				GHA							
0	248°55.4	182°31.8	N21°22.8	12°42.2	S21°26.4	83°13.0	N07°30.5	356°43.7	S20°36.4							Denebola	182°31.6	14°28.9					
1	263°57.8	197°31.0	23.4	27°45.6	26.4	98°15.3	30.4	11°46.4	36.3							Gienah	175°50.1	-17°38.1					
2	279°00.3	212°30.3	24.0	42°49.0	26.3	113°17.6	30.4	26°49.0	36.3							Acrux	173°06.6	-63°11.6					
3	294°02.7	227°29.5	24.6	57°52.4	26.2	128°19.9	30.3	41°51.7	36.3							Gacrux	171°58.3	-57°12.5					
4	309°05.2	242°28.7	25.1	72°55.7	26.1	143°22.2	30.2	56°54.3	36.3							Alioth	166°18.8	55°52.5					
5	324°07.7	257°27.9	25.7	87°59.1	26.1	158°24.6	30.2	71°57.0	36.3							Spica	158°28.9	-11°14.8					
6	339°10.1	272°27.1	N21°26.3	103°02.5	S21°26.0	173°26.9	N07°30.1	86°59.7	S20°36.2							Alkaid	152°57.1	49°14.2					
7	354°12.6	287°26.4	26.9	118°05.9	25.9	188°29.2	30.0	102°02.3	36.2							Hadar	148°44.4	-60°27.2					
8	9°15.1	302°25.6	27.5	133°09.3	25.9	203°31.5	30.0	117°05.0	36.2							Menkent	148°04.9	-36°27.1					
9	24°17.5	317°24.8	28.0	148°12.6	25.8	218°33.8	29.9	132°07.6	36.2							Arcturus	145°53.7	19°06.0					
10	39°20.0	332°24.0	28.6	163°16.0	25.7	233°36.2	29.8	147°10.3	36.2							Rigel Kent.	139°48.3	-60°54.2					
11	54°22.5	347°23.2	29.2	178°19.4	25.6	248°38.5	29.7	162°13.0	36.1							Kochab	137°19.2	74°05.6					
12	69°24.9	2°22.5	N21°29.8	193°22.8	S21°25.6	263°40.8	N07°29.7	177°15.6	S20°36.1							Zuben' ubi	137°02.9	-16°06.5					
13	84°27.4	17°21.7	30.3	208°26.1	25.5	278°43.1	29.6	192°18.3	36.1							Alphecca	126°09.0	26°39.8					
14	99°29.9	32°20.9	30.9	223°29.5	25.4	293°45.4	29.5	207°20.9	36.1							Antares	112°23.4	-26°27.9					
15	114°32.3	47°20.1	31.5	238°32.9	25.4	308°47.7	29.5	222°23.6	36.1							Atria	107°22.8	-69°03.2					
16	129°34.8	62°19.3	32.0	253°36.2	25.3	323°50.1	29.4	237°26.3	36.0							Sabik	102°09.9	-15°44.5					
17	144°37.2	77°18.5	32.6	268°39.6	25.2	338°52.4	29.3	252°28.9	36.0							Shaula	96°18.8	-37°06.7					
18	159°39.7	92°17.8	N21°33.2	283°43.0	S21°25.1	353°54.7	N07°29.3	267°31.6	S20°36.0							Rasalhague	96°04.3	12°33.1					
19	174°42.2	107°17.0	33.7	298°46.4	25.1	8°57.0	29.2	282°34.2	36.0							Eltanin	90°44.7	51°29.3					
20	189°44.6	122°16.2	34.3	313°49.7	25.0	23°59.3	29.1	297°36.9	36.0							Kaus Aust.	83°40.8	-34°22.3					
21	204°47.1	137°15.4	34.9	328°53.1	24.9	39°01.6	29.1	312°39.6	35.9							Vega	80°37.2	38°48.0					
22	219°49.6	152°14.6	35.4	343°56.5	24.9	54°04.0	29.0	327°42.2	35.9							Nunki	75°55.6	-26°16.3					
23	234°52.0	167°13.8	36.0	358°59.8	24.8	69°06.3	28.9	342°44.9	35.9							Altair	62°06.1	8°54.8					
Mer.pass.:07:23				v-0.8 d0.6 m-3.8				v3.4 d0.1 m-2.1				v2.3 d-0.1 m-1.9				v2.7 d0.0 m0.0							
Wed				GHA				GHA				GHA				GHA							
0	249°54.5	182°13.0	N21°36.6	14°03.2	S21°24.7	84°08.6	N07°28.8	357°47.5	S20°35.9							May 30 Mon	SHA	Mer.pass					
1	264°57.0	197°12.3	37.1	29°06.6	24.6	99°10.9	28.8	12°50.2	35.9							Venus	294°54.1	11:49					
2	279°59.4	212°11.5	37.7	44°09.9	24.6	114°13.2	28.7	27°52.9	35.8							Mars	123°24.7	23:09					
3	295°01.9	227°10.7	38.2	59°13.3	24.5	129°15.5	28.6	42°55.5	35.8							Jupiter	194°20.9	18:28					
4	310°04.3	242°09.9	38.8	74°16.7	24.4	144°17.9	28.6	57°58.2	35.8							Saturn	107°43.6	00:17					
5	325°06.8	257°09.1	39.4	89°20.0	24.4	159°20.2	28.5	73°00.8	35.8														
6	340°09.3	272°08.3	104°23.4	174°22.5	N07°28.4	88°03.5	S20°35.8									May 31 Tue	SHA	Mer.pass					
7	355°11.7	287°07.5	40.5	119°26.8	24.2	189°24.8	28.3	103°06.2	35.7							Venus	293°36.4	11:50					
8	10°14.2	302°06.7	41.0	134°30.1</																			

DUT1 = UT1-UTC = -0.1831 sec    $\Delta T$  = TT-UT1 = +68.3671 sec

2016 May 30 to Jun. 01 UT

Sun			Moon				
Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°37.2	N21°47.9	261°33.2	10.2'	\$05°33.8	10.6'	58.7'
1	195°37.2	48.2	276°02.4	10.2'	05°23.3	10.6'	58.8'
2	210°37.1	48.6	290°31.6	10.2'	05°12.6	10.6'	58.8'
3	225°37.0	.. 49.0	305°00.8	10.2'	05°02.0	10.7'	58.8'
4	240°36.9	49.3	319°30.0	10.2'	04°51.3	10.7'	58.8'
5	255°36.8	49.7	333°59.1	10.1'	04°40.6	10.8'	58.9'
6	270°36.7	N21°50.1	348°28.3	10.1'	\$04°29.8	10.8'	58.9'
7	285°36.6	50.4	2°57.4	10.1'	04°19.0	10.8'	58.9'
8	300°36.5	50.8	17°26.5	10.1'	04°08.1	10.9'	59.0'
9	315°36.5	.. 51.1	31°55.6	10.1'	03°57.2	10.9'	59.0'
10	330°36.4	51.5	46°24.6	10.1'	03°46.3	10.9'	59.0'
11	345°36.3	51.9	60°53.7	10.0'	03°35.4	11.0'	59.0'
12	0°36.2	N21°52.2	75°22.7	10.0'	\$03°24.4	11.0'	59.1'
13	15°36.1	52.6	89°51.7	10.0'	03°13.4	11.0'	59.1'
14	30°36.0	52.9	104°20.7	10.0'	03°02.4	11.0'	59.1'
15	45°35.9	.. 53.3	118°49.6	10.0'	02°51.3	11.1'	59.2'
16	60°35.8	53.7	133°18.6	9.9'	02°40.2	11.1'	59.2'
17	75°35.7	54.0	147°47.5	9.9'	02°29.1	11.1'	59.2'
18	90°35.6	N21°54.4	162°16.4	9.9'	\$02°18.0	11.2'	59.2'
19	105°35.5	54.7	176°45.3	9.9'	02°06.8	11.2'	59.3'
20	120°35.5	55.1	191°14.1	9.8'	01°55.6	11.2'	59.3'
21	135°35.4	.. 55.4	205°42.9	9.8'	01°44.4	11.2'	59.3'
22	150°35.3	55.8	220°11.7	9.8'	01°33.2	11.2'	59.3'
23	165°35.2	56.1	234°40.5	9.8'	01°21.9	11.3'	59.4'
	SD.=15.8	d=0.4			S.D.=16.1		

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

Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°35.1	N21°56.5	249°09.3	9.7'	S01°10.6	11.3'	59.4'
1	195°35.0	56.8	263°38.0	9.7'	00°59.4	11.3'	59.4'
2	210°34.9	57.2	278°06.7	9.7'	00°48.1	11.3'	59.5'
3	225°34.8	.. 57.5	292°35.3	9.6'	00°36.7	11.3'	59.5'
4	240°34.7	57.9	307°03.9	9.6'	00°25.4	11.3'	59.5'
5	255°34.6	58.2	321°32.5	9.6'	00°14.1	11.4'	59.5'
6	270°34.5	N21°58.6	336°01.1	9.6'	S00°02.7	11.4'	59.6'
7	285°34.4	58.9	350°29.7	9.5'	N00°08.7	11.4'	59.6'
8	300°34.3	59.3	4°58.2	9.5'	00°20.1	11.4'	59.6'
9	315°34.3	21°59.6	19°26.6	9.5'	00°31.4	11.4'	59.6'
10	330°34.2	22°00.0	33°55.1	9.4'	00°42.8	11.4'	59.7'
11	345°34.1	00.3	48°23.5	9.4'	00°54.2	11.4'	59.7'
12	0°34.0	N22°00.7	62°51.9	9.4'	N01°05.6	11.4'	59.7'
13	15°33.9	01.0	77°20.2	9.3'	01°17.1	11.4'	59.7'
14	30°33.8	01.4	91°48.5	9.3'	01°28.5	11.4'	59.8'
15	45°33.7	.. 01.7	106°16.8	9.3'	01°39.9	11.4'	59.8'
16	60°33.6	02.0	120°45.0	9.2'	01°51.3	11.4'	59.8'
17	75°33.5	02.4	135°13.2	9.2'	02°02.7	11.4'	59.8'
18	90°33.4	N22°02.7	149°41.4	9.1'	N02°14.1	11.4'	59.9'
19	105°33.3	03.1	164°09.5	9.1'	02°25.5	11.4'	59.9'
20	120°33.2	03.4	178°37.6	9.1'	02°36.9	11.4'	59.9'
21	135°33.1	.. 03.7	193°05.6	9.0'	02°48.3	11.4'	59.9'
22	150°33.0	04.1	207°33.6	9.0'	02°59.7	11.4'	59.9'
23	165°32.9	04.4	222°01.6	8.9'	03°11.1	11.4'	60.0'
	SD -15.8	d -0.4			SD -16.3		

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

Wed	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	180°32.8	N22°04.7	236°29.5	8.9'	N03°22.5	11.4'	60.0'
1	195°32.7	05.1	250°57.4	8.9'	03°33.8	11.4'	60.0'
2	210°32.6	05.4	265°25.2	8.8'	03°45.2	11.3'	60.0'
3	225°32.5	.. 05.8	279°53.0	8.8'	03°56.5	11.3'	60.1'
4	240°32.4	06.1	294°20.8	8.7'	04°07.8	11.3'	60.1'
5	255°32.3	06.4	308°48.5	8.7'	04°19.1	11.3'	60.1'
6	270°32.2	N22°06.8	323°16.2	8.6'	N04°30.4	11.3'	60.1'
7	285°32.2	07.1	337°43.8	8.6'	04°41.7	11.3'	60.1'
8	300°32.1	07.4	352°11.4	8.6'	04°52.9	11.2'	60.2'
9	315°32.0	.. 07.7	6°38.9	8.5'	05°04.2	11.2'	60.2'
10	330°31.9	08.1	21°06.4	8.5'	05°15.4	11.2'	60.2'
11	345°31.8	08.4	35°33.8	8.4'	05°26.6	11.2'	60.2'
12	0°31.7	N22°08.7	50°01.2	8.4'	N05°37.7	11.1'	60.2'
13	15°31.6	09.1	64°28.6	8.3'	05°48.8	11.1'	60.3'
14	30°31.5	09.4	78°55.9	8.3'	05°59.9	11.1'	60.3'
15	45°31.4	.. 09.7	93°23.1	8.2'	06°11.0	11.1'	60.3'
16	60°31.3	10.0	107°50.4	8.2'	06°22.0	11.0'	60.3'
17	75°31.2	10.4	122°17.5	8.1'	06°33.0	11.0'	60.3'
18	90°31.1	N22°10.7	136°44.6	8.1'	N06°44.0	11.0'	60.3'
19	105°31.0	11.0	151°11.7	8.0'	06°54.9	10.9'	60.4'
20	120°30.9	11.3	165°38.7	8.0'	07°05.8	10.9'	60.4'
21	135°30.8	.. 11.7	180°05.7	7.9'	07°16.7	10.8'	60.4'
22	150°30.7	12.0	194°32.6	7.9'	07°27.5	10.8'	60.4'
23	165°30.6	12.3	208°59.5	7.8'	07°38.3	10.8'	60.4'
	SD. <sub>w</sub> =15.8	d=0.3			S.D. <sub>w</sub> =16.4		

	01.21	02.13	03.22	03.11	14.01
Day	Sun		Moon		Age 24-26 39-18%
	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass 12 <sup>h</sup> mm:ss	Mer. Pass. Upper hh:mm	Mer. Pass. Lower hh:mm	
30	02:29	02:25	11:58	06:48	19:13
31	02:20	02:16	11:58	07:39	20:06
01	02:11	02:07	11:58	08:32	21:00

**June 02, 03, 04 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	250°53.6	181°54.0	N21°49.7	15°23.9	S21°23.0	85°04.1	N07°27.1	358°51.4	S20°35.4	Alpheratz	357°41.5	29°10.6					
1	265°56.1	196°53.2	50.2	30°27.2	22.9	100°06.4	27.0	13°54.1	35.4	Ankaa	353°14.0	-42°12.9					
2	280°58.6	211°52.4	50.8	45°30.6	22.8	115°08.7	27.0	28°56.7	35.3	Schedar	349°38.4	56°37.3					
3	296°01.0	226°51.6	.. 51.3	60°33.9	.. 22.8	130°11.0	.. 26.9	43°59.4	.. 35.3	Diphda	348°54.1	-17°53.8					
4	311°03.5	241°50.8	51.8	75°37.3	22.7	145°13.3	26.8	59°02.0	35.3	Achernar	335°25.8	-57°09.1					
5	326°06.0	256°50.0	52.4	90°40.6	22.6	160°15.6	26.7	74°04.7	35.3	Hamal	327°58.7	23°32.1					
6	341°08.4	271°49.2	N21°52.9	105°44.0	S21°22.6	175°17.9	N07°26.7	89°07.4	S20°35.3	Polaris	317°14.3	89°19.7					
7	356°10.9	286°48.4	53.4	120°47.3	22.5	190°20.2	26.6	104°10.0	35.2	Acamar	315°17.3	-40°14.4					
8	11°13.3	301°47.6	54.0	135°50.7	22.4	205°22.6	26.5	119°12.7	35.2	Menkar	314°13.3	4°09.0					
9	26°15.8	316°46.8	.. 54.5	150°54.0	.. 22.3	220°24.9	.. 26.5	134°15.3	.. 35.2	Mirfak	308°37.9	49°54.8					
10	41°18.3	331°46.0	55.0	165°57.4	22.3	235°27.2	26.4	149°18.0	35.2	Aldebaran	290°47.4	16°32.3					
11	56°20.7	346°45.2	55.5	181°00.7	22.2	250°29.5	26.3	164°20.7	35.2	Rigel	281°10.5	-8°11.2					
12	71°23.2	1°44.4	N21°56.1	196°04.0	S21°22.1	265°31.8	N07°26.2	179°23.3	S20°35.1	Capella	280°32.0	46°00.6					
13	86°25.7	16°43.6	56.6	211°07.4	22.0	280°34.1	26.2	194°26.0	35.1	Bellatrix	278°30.2	6°21.6					
14	101°28.1	31°42.8	57.1	226°10.7	22.0	295°36.4	26.1	209°28.7	35.1	Elnath	278°10.5	28°37.0					
15	116°30.6	46°42.0	.. 57.6	241°14.1	.. 21.9	310°38.7	.. 26.0	224°31.3	.. 35.1	Alnilam	275°44.7	-1°11.8					
16	131°33.1	61°41.2	58.1	256°17.4	21.8	325°41.0	25.9	239°34.0	35.1	Betelgeuse	270°59.5	7°24.3					
17	146°35.5	76°40.4	58.7	271°20.8	21.8	340°43.3	25.9	254°36.6	35.0	Canopus	263°55.8	-52°42.6					
18	161°38.0	91°39.6	N21°59.2	286°24.1	S21°21.7	355°45.6	N07°25.8	269°39.3	S20°35.0	Sirius	258°32.3	-16°44.6					
19	176°40.4	106°38.8	21°59.7	301°27.4	21.6	10°47.9	25.7	284°42.0	35.0	Adhara	255°11.3	-29°00.0					
20	191°42.9	121°38.0	22°00.2	316°30.8	21.5	25°50.2	25.6	299°44.6	35.0	Procyon	244°57.9	5°10.8					
21	206°45.4	136°37.2	.. 00.7	331°34.1	.. 21.5	40°52.5	.. 25.6	314°47.3	.. 35.0	Pollux	243°25.6	27°59.1					
22	221°47.8	151°36.4	01.2	346°37.5	21.4	55°54.8	25.5	329°49.9	34.9	Avior	234°17.5	-59°34.1					
23	236°50.3	166°35.6	01.7	1°40.8	21.3	70°57.1	25.4	344°52.6	34.9	Suhail	222°51.1	-43°30.3					
Mer.pass.:07:15			v-0.8 d0.5 m-3.8			v3.4 d0.1 m-2.1			v2.3 d-0.1 m-1.9			v2.7 d0.0 m0.0					
Fri			GHA			GHA			GHA			GHA					
0	251°52.8	181°34.8	N22°02.3	16°44.1	S21°21.2	85°59.4	N07°25.3	359°55.3	S20°34.9	Denebola	182°31.6	14°28.9					
1	266°55.2	196°34.0	02.8	31°47.5	21.2	101°01.7	25.2	14°57.9	34.9	Gienah	175°50.1	-17°38.1					
2	281°57.7	211°33.2	03.3	46°50.8	21.1	116°04.0	25.2	30°00.6	34.9	Acrux	173°06.6	-63°11.6					
3	297°00.2	226°32.4	.. 03.8	61°54.1	.. 21.0	131°06.3	.. 25.1	45°03.2	.. 34.8	Gacrux	171°58.3	-57°12.5					
4	312°02.6	241°31.6	04.3	76°57.5	21.0	146°08.6	25.0	60°05.9	34.8	Alioth	166°18.8	55°52.5					
5	327°05.1	256°30.8	04.8	92°00.8	20.9	161°10.9	24.9	75°08.6	34.8	Alkaid	152°57.1	-11°14.8					
6	342°07.6	271°29.9	N22°05.3	107°04.1	S21°20.8	176°13.2	N07°24.9	90°11.2	S20°34.8	Hadar	148°44.4	-60°27.2					
7	357°10.0	286°29.1	05.8	122°07.5	20.7	191°15.5	24.8	105°13.9	34.8	Menkent	148°04.9	-36°27.1					
8	12°12.5	301°28.3	06.3	137°10.8	20.7	206°17.8	24.7	120°16.5	34.7	Arcturus	145°53.7	19°06.0					
9	27°14.9	316°27.5	.. 06.8	152°14.1	.. 20.6	221°20.1	.. 24.6	135°19.2	.. 34.7	Rigel Kent.	139°48.3	-60°54.2					
10	42°17.4	331°26.7	07.3	167°17.5	20.5	236°22.4	24.6	150°21.9	34.7	Kochab	137°19.3	74°05.6					
11	57°19.9	346°25.9	07.8	182°20.8	20.5	251°24.7	24.5	165°24.5	34.7	Zuben 'ubi	137°02.9	-16°06.5					
12	72°22.3	1°25.1	N22°08.3	197°24.1	S21°20.4	266°27.0	N07°24.4	180°27.2	S20°34.7	Alphecca	126°09.0	26°39.8					
13	87°24.8	16°24.3	08.8	212°27.4	20.3	281°29.3	24.3	195°29.9	34.6	Antares	112°23.4	-26°27.9					
14	102°27.3	31°23.5	09.3	227°30.8	20.2	296°31.6	24.3	210°32.5	34.6	Atria	107°22.8	-69°03.2					
15	117°29.7	46°22.7	.. 09.8	242°34.1	.. 20.2	311°33.9	.. 24.2	225°35.2	.. 34.6	Sabik	102°09.9	-15°44.5					
16	132°32.2	61°21.8	10.3	257°37.4	20.1	326°36.2	24.1	240°37.8	34.6	Rasalhague	96°04.3	12°33.1					
17	147°34.7	76°21.0	10.8	272°40.7	20.0	341°38.5	24.0	255°40.5	34.6	Eltanin	90°44.7	51°29.3					
18	162°37.1	91°20.2	N22°11.3	287°44.1	S21°19.9	356°40.8	N07°23.9	270°43.2	S20°34.5	Kaus Aust.	83°40.8	-34°22.3					
19	177°39.6	106°19.4	11.7	302°47.4	19.9	11°43.1	23.9	285°45.8	34.5	Vega	80°37.2	38°48.0					
20	192°42.1	121°18.6	12.2	317°50.7	19.8	26°45.4	23.8	300°48.5	34.5	Nunki	75°55.5	-26°16.3					
21	207°44.5	136°17.8	.. 12.7	332°54.0	.. 19.7	41°47.7	.. 23.7	315°51.1	.. 34.5	Altair	62°06.0	8°54.8					
22	222°47.0	151°17.0	13.2	347°57.3	19.7	56°50.0	23.6	330°53.8	34.5	Peacock	53°15.8	-56°40.6					
23	237°49.4	166°16.1	13.7	3°00.7	19.6	71°52.3	23.6	345°56.5	34.4	Deneb	49°29.8	45°20.3					
Mer.pass.:07:11			v-0.8 d0.5 m-3.8			v3.3 d0.1 m-2.1			v2.3 d-0.1 m-1.9			v2.7 d0.0 m0.0					
Sat			GHA			GHA			GHA			GHA					
0	252°51.9	181°15.3	N22°14.2	18°04.0	S21°19.5	86°54.6	N07°23.5	0°59.1	S20°34.4	Jun 02 Thu	291°00.4	11:53					
1	267°54.4	196°14.5	14.7	33°07.3	19.4	101°56.9	23.4	16°01.8	34.4	Venus	291°00.4	11:53					
2	282°56.8	211°13.7	15.1	48°10.6	19.4	116°59.2	23.3	31°04.4	34.4	Mars	124°30.2	22:53					
3	297°59.3	226°12.9	.. 15.6	63°13.9	.. 19.3	132°01.5	.. 23.2	46°07.1	.. 34.4	Jupiter	194°10.5	18:17					
4	313°01.8	241°12.1	16.1	78°17.2	19.2	147°03.8	23.2	61°09.8	34.3	Saturn	107°57.8	00:05					
5	328°04.2	256°11.2	16.6	93°20.6	19.2	162°06.1	23.1	76°12.4	34.3	Jun 03 Fri							
6	343°06.7	271°10.4	N22°17.1	108°23.9	S21°19.1	177°08.4	N07°23.0	91°15.1	S20°34.3	Venus	289°42.0	11:54					
7	358°09.2	286°09.6	17.5	123°27.2	19.0	192°10.7	22.9	106°17.7	34.3	Mars	124°51.4	22:48					
8	13°11.6	301°08.8	18.0	138°30.5	18.9	207°13.0	22.8	121°20.4	34.3	Jupiter	194°06.7	18:13					
9	28°14.1	316°08.0	.. 18.5	153°33.8	.. 18.9	222°15.3	.. 22.8	136°23.1	.. 34.2	Saturn	108°02.5	00:00					
10	43°16.6	331°07.2	19.0	168°37.1	18.8	237°17.6	22.7	151°25.7	34.2	Jun 04 Sat							
11	58°19.0	346°06.3	19.4	183°40.4	18.7	252°19.9	22.6	166°28.4	34.2	Venus	288°23.4	11:56					
12	73°21.5	1°05.5	N22°19.9	198°43.7	S21°18.6	267°22.2	N07°22.5	181°31.0	S20°34.2	Mars	125°12.1	22:43					
13	88°23.9	16°04.7	20.4	213°47.0	18.6	282°24.5	22.4	196°33.7	34.2	Jupiter	194°02.7	18:10					
14	103°26.4	31°03.9	20.8	228°50.3	18.5	297°26.8	22.4	211°36.4	34.1	Saturn	108°07.2	23:52					
15	118°28.9	46°03.1	.. 21.3	243°53.6	.. 18.4	312°29.0	.. 22.3	226°39.0	.. 34.1	Horizontal parallax							
16	133°31.3	61°02.2	21.8	258°56.9	18.4	327°31.3	22.2	241°41.7	34.1	Venus	288°23.4	0.1					
17	148°33.8	76°01.4	22.2	274°00.3	18.3	342°33.6	22.1	256°44.4	34.1	Mars	125°12.1	0.3					
18	163°36.3	91°00.6	N22°22.7	289°03.6	S21°18.2	357°35.9</td											

DUT1 = UT1-UTC = -0.1873 sec ΔT = TT-UT1 = +68.3713 sec

2016 June 02 to Jun. 04 UT

		Sun		Moon			
Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°30.5	N22°12.6	223°26.3	7.8'	N07°49.0	10.7'	60.4'
1	195°30.4	12.9	237°53.0	7.7'	07°59.7	10.7'	60.5'
2	210°30.3	13.3	252°19.7	7.7'	08°10.4	10.6'	60.5'
3	225°30.2	.. 13.6	266°46.4	7.6'	08°21.0	10.6'	60.5'
4	240°30.1	13.9	281°13.0	7.6'	08°31.5	10.5'	60.5'
5	255°30.0	14.2	295°39.6	7.5'	08°42.1	10.5'	60.5'
6	270°29.9	N22°14.5	310°06.1	7.5'	N08°52.5	10.4'	60.5'
7	285°29.8	14.8	324°32.6	7.4'	09°02.9	10.4'	60.5'
8	300°29.7	15.2	338°59.0	7.4'	09°13.3	10.3'	60.5'
9	315°29.6	.. 15.5	353°25.3	7.3'	09°23.6	10.3'	60.6'
10	330°29.5	15.8	7°51.6	7.3'	09°33.8	10.2'	60.6'
11	345°29.3	16.1	22°17.9	7.2'	09°44.0	10.2'	60.6'
12	0°29.2	N22°16.4	36°44.1	7.2'	N09°54.1	10.1'	60.6'
13	15°29.1	16.7	51°10.2	7.1'	10°04.2	10.0'	60.6'
14	30°29.0	17.0	65°36.3	7.1'	10°14.2	10.0'	60.6'
15	45°28.9	.. 17.3	80°02.4	7.0'	10°24.1	9.9'	60.6'
16	60°28.8	17.6	94°28.4	7.0'	10°34.0	9.8'	60.6'
17	75°28.7	18.0	108°54.3	6.9'	10°43.8	9.8'	60.6'
18	90°28.6	N22°18.3	123°20.2	6.9'	N10°53.5	9.7'	60.6'
19	105°28.5	18.6	137°46.0	6.8'	11°03.2	9.6'	60.7'
20	120°28.4	18.9	152°11.8	6.8'	11°12.8	9.6'	60.7'
21	135°28.3	.. 19.2	166°37.6	6.7'	11°22.3	9.5'	60.7'
22	150°28.2	19.5	181°03.3	6.7'	11°31.8	9.4'	60.7'
23	165°28.1	19.8	195°28.9	6.6'	11°41.1	9.3'	60.7'
	SD.=15.8	d=0.3			S.D.=16.5		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°28.0	N22°20.1	209°54.5	6.6'	N11°50.5	9.3'	60.7'
1	195°27.9	20.4	224°20.0	6.5'	11°59.7	9.2'	60.7'
2	210°27.8	20.7	238°45.5	6.5'	12°08.8	9.1'	60.7'
3	225°27.7	.. 21.0	253°11.0	6.4'	12°17.9	9.0'	60.7'
4	240°27.6	21.3	267°36.3	6.4'	12°26.9	8.9'	60.7'
5	255°27.5	21.6	282°01.7	6.3'	12°35.8	8.9'	60.7'
6	270°27.4	N22°21.9	296°27.0	6.3'	N12°44.6	8.8'	60.7'
7	285°27.3	22.2	310°52.2	6.2'	12°53.3	8.7'	60.7'
8	300°27.2	22.5	325°17.4	6.2'	13°02.0	8.6'	60.7'
9	315°27.1	.. 22.8	339°42.6	6.1'	13°10.6	8.5'	60.7'
10	330°26.9	23.1	354°07.7	6.1'	13°19.0	8.4'	60.7'
11	345°26.8	23.4	8°32.7	6.0'	13°27.4	8.3'	60.7'
12	0°26.7	N22°23.7	22°57.8	6.0'	N13°35.7	8.2'	60.7'
13	15°26.6	24.0	37°22.7	5.9'	13°43.9	8.2'	60.7'
14	30°26.5	24.3	51°47.7	5.9'	13°52.0	8.1'	60.7'
15	45°26.4	.. 24.6	66°12.5	5.9'	14°00.0	8.0'	60.7'
16	60°26.3	24.9	80°37.4	5.8'	14°07.9	7.9'	60.7'
17	75°26.2	25.2	95°02.2	5.8'	14°15.8	7.8'	60.7'
18	90°26.1	N22°25.4	109°26.9	5.7'	N14°23.5	7.7'	60.7'
19	105°26.0	25.7	123°51.7	5.7'	14°31.1	7.6'	60.7'
20	120°25.9	26.0	138°16.3	5.7'	14°38.6	7.5'	60.7'
21	135°25.8	.. 26.3	152°41.0	5.6'	14°46.0	7.4'	60.7'
22	150°25.7	26.6	167°05.6	5.6'	14°53.3	7.3'	60.7'
23	165°25.6	26.9	181°30.1	5.5'	15°00.5	7.2'	60.7'
	SD.=15.8	d=0.3			S.D.=16.5		

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°25.4	N22°27.2	195°54.7	5.5'	N15°07.6	7.0'	60.7'
1	195°25.3	27.5	210°19.2	5.5'	15°14.6	6.9'	60.7'
2	210°25.2	27.8	224°43.6	5.4'	15°21.5	6.8'	60.7'
3	225°25.1	.. 28.0	239°08.0	5.4'	15°28.3	6.7'	60.6'
4	240°25.0	28.3	253°32.4	5.4'	15°35.0	6.6'	60.6'
5	255°24.9	28.6	267°56.8	5.3'	15°41.5	6.5'	60.6'
6	270°24.8	N22°28.9	282°21.1	5.3'	N15°48.0	6.4'	60.6'
7	285°24.7	29.2	296°45.4	5.3'	15°54.3	6.3'	60.6'
8	300°24.6	29.5	311°09.7	5.3'	16°00.6	6.2'	60.6'
9	315°24.5	.. 29.7	325°33.9	5.2'	16°06.7	6.1'	60.6'
10	330°24.4	30.0	339°58.1	5.2'	16°12.7	5.9'	60.6'
11	345°24.2	30.3	354°22.3	5.2'	16°18.5	5.8'	60.6'
12	0°24.1	N22°30.6	8°46.5	5.2'	N16°24.3	5.7'	60.6'
13	15°24.0	30.9	23°10.6	5.1'	16°29.9	5.6'	60.5'
14	30°23.9	31.1	37°34.8	5.1'	16°35.5	5.5'	60.5'
15	45°23.8	.. 31.4	51°58.9	5.1'	16°40.9	5.3'	60.5'
16	60°23.7	31.7	66°22.9	5.1'	16°46.2	5.2'	60.5'
17	75°23.6	32.0	80°47.0	5.1'	16°51.3	5.1'	60.5'
18	90°23.5	N22°32.2	95°11.0	5.0'	N16°56.4	5.0'	60.5'
19	105°23.4	32.5	109°35.1	5.0'	17°01.3	4.9'	60.5'
20	120°23.2	32.8	123°59.1	5.0'	17°06.1	4.7'	60.4'
21	135°23.1	.. 33.1	138°23.1	5.0'	17°10.8	4.6'	60.4'
22	150°23.0	33.3	152°47.1	5.0'	17°15.4	4.5'	60.4'
23	165°22.9	33.6	167°11.1	5.0'	17°19.8	4.4'	60.4'
	SD.=15.8	d=0.3			S.D.=16.5		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°						
64°						
62°						
60°						
N 58°						
56°						
54°						
52°						
50°						
48°						
N 40°						
35°						
30°						
20°						
N 10°						
0°						
S 10°						
20°						
30°						
35°						
40°						
S 50°						
52°						
54°						
56°						
58°						
S 60°						
Lat.	Thu	Fri	Sat	Thu	Fri	Sat
N 72°	01:28	01:22	01:15	18:10	20:19	22:37
N 70°	01:40	01:42	01:48	17:51	19:47	21:38
68°	01:49	01:58	02:12	17:37	19:23	21:04
66°	01:57	02:11	02:31	17:25	19:05	20:39
64°	02:04	02:22	02:47	17:15	18:50	20:20
62°	02:10	02:32	03:00	17:07	18:38	20:04
60°	02:15	02:40	03:11	17:00	18:28	19:51
N 58°	02:19	02:47	03:20	16:53	18:19	19:40
56°	02:23	02:53	03:29	16:48	18:11	19:30
54°	02:27	02:59	03:36	16:43	18:04	19:21
50°	02:30	03:04	03:43	16:38	17:58	19:13
45°	02:40	03:18	04:02	16:25	17:40	18:52
N 40°	02:45	03:27	04:13	16:18	17:30	18:39
35°	02:50	03:34	04:22	16:12	17:21	18:29
30°	02:54	03:40	04:31	16:06	17:13	18:20
20°	03:01	03:52	04:45	15:57	17:00	18:04
N 10°	03:08	04:01	04:57	15:48	16:49	17:50
0°	03:14	04:11	05:09	15:41	16:38	17:38
S 10°	03:20	04:20	05:21	15:33	16:28	17:25
20°	03:27	04:30	05:34	15:25	16:16	17:11
30°	03:35	04:42	05:49	15:15	16:03	16:56
35°	03:39	04:48	05:57	15:10	15:56	16:47
40°	03:44	04:56	06:07	15:04	15:47	16:36
45°	03:50	05:05	06:18	14:56	15:38	16:24
S 50°	03:57	05:16	06:32	14:48	15:26	16:09
52°	04:01	05:21	06:39	14:44	15:20	16:03
54°	04:04	05:26	06:46	14:40	15:14	15:55
56°	04:08	05:32	06:54	14:35	15:07	15:47
58°	04:13	05:39	07:03	14:30	15:00	15:37
S 60°	04:18	05:47	07:14	14:24	14:51	15:26
Day	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass 12 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Upper hh:mm	Lower hh:mm	Age 10-1%
02	02:02	0				

## June 05, 06, 07 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	253°51.0	180°55.7	N22°25.5	19°23.3	S21°17.8	87°49.7	N07°21.6	2°03.0	S20°33.9	Alpheratz	357°41.5	29°10.6					
1	268°53.5	195°54.8	25.9	34°26.6	17.7	102°52.0	21.5	17°05.6	33.9	Ankaa	353°14.0	-42°12.9					
2	283°56.0	210°54.0	26.4	49°29.9	17.6	117°54.3	21.4	32°08.3	33.9	Schedar	349°38.3	56°37.3					
3	298°58.4	225°53.2	.. 26.8	64°33.2	.. 17.6	132°56.5	.. 21.3	47°11.0	.. 33.9	Diphda	348°54.1	-17°53.8					
4	314°00.9	240°52.4	27.3	79°36.5	17.5	147°58.8	21.2	62°13.6	33.9	Achernar	335°25.8	-57°09.1					
5	329°03.4	255°51.5	27.7	94°39.8	17.4	163°01.1	21.2	77°16.3	33.8	Hamal	327°58.7	23°32.1					
6	344°05.8	270°50.7	N22°28.2	109°43.1	S21°17.4	178°03.4	N07°21.1	92°18.9	S20°33.8	Polaris	317°13.3	89°19.7					
7	359°08.3	285°49.9	28.6	124°46.4	17.3	193°05.7	21.0	107°21.6	33.8	Acamar	315°17.3	-40°14.4					
8	14°10.8	300°49.0	29.1	139°49.7	17.2	208°08.0	20.9	122°24.3	33.8	Menkar	314°13.2	4°09.0					
9	29°13.2	315°48.2	.. 29.5	154°53.0	.. 17.1	223°10.3	.. 20.8	137°26.9	.. 33.8	Mirfak	308°37.9	49°54.8					
10	44°15.7	330°47.4	30.0	169°56.3	17.1	238°12.6	20.7	152°29.6	33.7	Aldebaran	290°47.4	16°32.3					
11	59°18.2	345°46.6	30.4	184°59.6	17.0	253°14.9	20.7	167°32.2	33.7	Rigel	281°10.5	-8°11.2					
12	74°20.6	0°45.7	N22°30.9	200°02.8	S21°16.9	268°17.1	N07°20.6	182°34.9	S20°33.7	Capella	280°32.0	46°00.6					
13	89°23.1	15°44.9	31.3	215°06.1	16.9	283°19.4	20.5	197°37.6	33.7	Bellatrix	278°30.2	6°21.6					
14	104°25.5	30°44.1	31.8	230°09.4	16.8	298°21.7	20.4	212°40.2	33.7	Elnath	278°10.5	28°37.0					
15	119°28.0	45°43.2	.. 32.2	245°12.7	.. 16.7	313°24.0	.. 20.3	227°42.9	.. 33.6	Alnilam	275°44.7	-1°11.8					
16	134°30.5	60°42.4	32.6	260°16.0	16.6	328°26.3	20.3	242°45.5	33.6	Betelgeuse	270°59.5	7°24.3					
17	149°32.9	75°41.6	33.1	275°19.3	16.6	343°28.6	20.2	257°48.2	33.6	Canopus	263°55.8	-52°42.6					
18	164°35.4	90°40.8	N22°33.5	290°22.5	S21°16.5	358°30.9	N07°20.1	272°50.9	S20°33.6	Sirius	258°32.3	-16°44.6					
19	179°37.9	105°39.9	33.9	305°25.8	16.4	13°33.1	20.0	287°53.5	33.6	Adhara	255°11.3	-29°00.0					
20	194°40.3	120°39.1	34.4	320°29.1	16.4	28°35.4	19.9	302°56.2	33.5	Procyon	244°57.9	5°10.8					
21	209°42.8	135°38.3	.. 34.8	335°32.4	.. 16.3	43°37.7	.. 19.8	317°58.9	.. 33.5	Pollux	243°25.6	27°59.1					
22	224°45.3	150°37.4	35.3	350°35.7	16.2	58°40.0	19.8	333°01.5	33.5	Avior	234°17.6	-59°34.1					
23	239°47.7	165°36.6	35.7	5°38.9	16.2	73°42.3	19.7	348°04.2	33.5	Suhail	222°51.1	-43°30.3					
Mer.pass.:07:03			v-0.8 d0.5 m-3.8	v3.3 d0.1 m-2.1	v2.3 d-0.1 m-1.9	v2.7 d0.0 m0.0	Miaplacidus			Zuben' ubi	221°39.5	-69°47.5					
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.3	-8°44.0					
0	254°50.2	180°35.8	N22°36.1	20°42.2	S21°16.1	88°44.6	N07°19.6	3°06.8	S20°33.5	Regulus	207°41.5	11°53.2					
1	269°52.7	195°34.9	36.5	35°45.5	16.0	103°46.9	19.5	18°09.5	33.4	Dubhe	193°49.5	61°40.0					
2	284°55.1	210°34.1	37.0	50°48.7	15.9	118°49.1	19.4	33°12.2	33.4	Denebola	182°31.6	14°28.9					
3	299°57.6	225°33.3	.. 37.4	65°52.0	.. 15.9	133°51.4	.. 19.3	48°14.8	.. 33.4	Gienah	175°50.1	-17°38.1					
4	315°00.0	240°32.4	37.8	80°55.3	15.8	148°53.7	19.3	63°17.5	33.4	Acrux	173°06.6	-63°11.6					
5	330°02.5	255°31.6	38.3	95°58.6	15.7	163°56.0	19.2	78°20.1	33.4	Gacrux	171°58.3	-57°12.5					
6	345°05.0	270°30.8	N22°38.7	111°01.8	S21°15.7	178°58.3	N07°19.1	93°22.8	S20°33.3	Alioth	166°18.8	55°52.5					
7	0°07.4	285°29.9	39.1	126°05.1	15.6	194°00.6	19.0	108°25.5	33.3	Spica	158°28.9	-11°14.8					
8	15°09.9	300°29.1	39.5	141°08.4	15.5	209°02.8	18.9	123°28.1	33.3	Alkaid	152°57.1	49°14.2					
9	30°12.4	315°28.3	.. 39.9	156°11.6	.. 15.4	224°05.1	.. 18.8	138°30.8	.. 33.3	Hadar	148°44.4	-60°27.2					
10	45°14.8	330°27.4	40.4	171°14.9	15.4	239°07.4	18.8	153°33.4	33.3	Menkent	148°04.9	-36°27.1					
11	60°17.3	345°26.6	40.8	186°18.2	15.3	254°09.7	18.7	168°36.1	33.2	Arcturus	145°53.7	19°06.0					
12	75°19.8	0°25.8	N22°41.2	201°21.4	S21°15.2	269°12.0	N07°18.6	183°38.8	S20°33.2	Rigel Kent.	139°48.3	-60°54.2					
13	90°22.2	15°24.9	41.6	216°24.7	15.2	284°14.2	18.5	198°41.4	33.2	Kochab	137°19.3	74°05.6					
14	105°24.7	30°24.1	42.0	231°27.9	15.1	299°16.5	18.4	213°44.1	33.2	Zuben' ubi	137°02.9	-16°06.5					
15	120°27.2	45°23.3	.. 42.4	246°31.2	.. 15.0	314°18.8	.. 18.3	228°46.7	.. 33.2	Alphecca	126°09.0	26°39.8					
16	135°29.6	60°22.4	42.8	261°34.5	15.0	329°21.1	18.2	243°49.4	33.1	Antares	112°23.4	-26°27.9					
17	150°32.1	75°21.6	43.3	276°37.7	14.9	344°23.4	18.2	258°52.1	33.1	Atria	107°22.8	-69°03.2					
18	165°34.5	90°20.8	N22°43.7	291°41.0	S21°14.8	359°25.6	N07°18.1	273°54.7	S20°33.1	Sabik	102°09.9	-15°44.5					
19	180°37.0	105°20.0	44.1	306°44.2	14.8	14°27.9	18.0	288°57.4	33.1	Rasalhague	96°04.3	12°33.1					
20	195°39.5	120°19.2	44.4	321°47.5	14.7	29°30.2	17.9	304°00.0	33.1	Eltanin	90°44.7	51°29.3					
21	210°41.9	135°18.4	.. 44.7	336°50.7	.. 14.6	44°32.5	.. 17.8	319°02.7	.. 33.0	Kaus Aust.	83°40.8	-34°22.3					
22	225°44.4	150°17.1	44.8	351°54.0	14.5	59°34.8	17.7	334°05.4	33.0	Vega	80°37.2	38°48.0					
23	240°46.9	165°16.3	45.7	6°57.2	14.5	74°37.0	17.6	349°08.0	33.0	Nunki	75°55.5	-26°16.3					
Mer.pass.:07:00			v-0.8 d0.4 m-3.8	v3.3 d0.1 m-2.0	v2.3 d-0.1 m-1.9	v2.7 d0.0 m0.0	Altair			Altair	62°06.0	8°54.8					
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°15.8	-56°40.6					
0	255°49.3	180°15.5	N22°46.1	22°00.5	S21°14.4	89°39.3	N07°17.6	4°10.7	S20°33.0	Deneb	49°29.8	45°20.3					
1	270°51.8	195°14.7	46.5	37°03.7	14.3	104°41.6	17.5	19°13.3	33.0	Enif	33°45.0	9°57.0					
2	285°54.3	210°13.9	46.9	52°07.0	14.3	119°43.9	17.4	34°16.0	32.9	Al Na'ir	27°41.2	-46°52.6					
3	300°56.7	225°13.1	.. 47.3	67°10.2	.. 14.2	134°46.2	.. 17.3	49°18.7	.. 32.9	Fomalhaut	15°21.8	-29°31.9					
4	315°59.2	240°12.3	47.7	82°13.5	14.1	149°48.4	17.2	64°21.3	32.9	Scheat	13°51.4	28°10.2					
5	331°01.7	255°11.4	48.1	97°16.7	14.1	164°50.7	17.1	79°24.0	32.9	Markab	13°36.3	15°17.5					
6	346°04.1	270°10.6	N22°48.5	112°20.0	S21°14.0	179°53.0	N07°17.0	94°26.6	S20°32.9	Jun 05 Sun	287°04.6	11:57					
7	1°06.6	285°09.7	48.9	127°23.2	13.9	194°55.3	17.0	109°29.3	32.8	Venus	125°32.3	22:37					
8	16°09.0	300°08.9	49.3	142°26.5	13.9	209°57.5	16.9	124°32.0	32.8	Mars	193°58.6	18:06					
9	31°11.5	315°08.1	.. 49.7	157°29.7	.. 13.8	224°59.8	.. 16.8	139°34.6	.. 32.8	Jupiter	108°11.9	23:48					
10	46°14.0	330°07.2	50.1	172°32.9	13.7	240°02.1	16.7	154°37.3	32.8	Saturn	285°45.6	11:58					
11	61°16.4	345°06.4	50.5	187°36.2	13.7	255°04.4	16.6	169°39.9	32.8	Jun 06 Mon	280°52.0	22:32					
12	76°18.9	0°05.5	N22°50.9	202°39.4	S21°13.6	270°06.6	N07°16.5	184°42.6	S20°32.7	Venus	193°54.4	18:02					
13	91°21.4	15°04.7	51.3	217°42.7	13.5	285°08.9	16.4	199°45.3	32.7	Mars	108°16.6	23:43					
14	106°23.8	30°03.9	51.7	232°45.9	13.4	300°11.2	16.3	214°47.9	32.7	Jupiter	284°26.2	12:00					
15	121°26.3	45°03.0	.. 52.1	247°49.1	.. 13.4	315°13.5	.. 16.3	229°50.6	.. 32.7	Saturn	126°11.2	22:27					
16	136°28.8	60°02.2	52.4	262°52.4	13.3	330°15.7	16.2	244°53.2	32.7	Jun 07 Tue	193°50.0	17:59					
17	151°31.2	75°01.3	52.8	277°55.6	13.2	345°18.0	16.1	259°55.9	32.6	Venus	108°21.4	23:39					
18	166°33.7	90°00.5	N22°53.2	292°58.8	S21°13.2	0°20.3	N07°16.0	274°58.6	S20°32.6	Horizontal parallax	Venus:	0.1					
19	181°36.2	104°59.6	53.6	308°02.1	13.1	15°22.6	15.9	290°01.2	32.6	Mars	126°22.8	22:27					

DUT1 = UT1-UTC = -0.1899 sec ΔT = TT-UT1 = +68.3739 sec

2016 June 05 to Jun. 07 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	ν	Dec	d	HP
0	180°22.8	N22°33.9		181°35.0	5.0'	N17°24.1	4.2'	60.4'
1	195°22.7	34.2		195°59.0	5.0'	17°28.3	4.1'	60.4'
2	210°22.6	34.4		210°22.9	5.0'	17°32.3	4.0'	60.3'
3	225°22.5	.. 34.7		224°46.9	4.9'	17°36.3	3.9'	60.3'
4	240°22.4	35.0		239°10.8	4.9'	17°40.1	3.7'	60.3'
5	255°22.2	35.2		253°34.8	4.9'	17°43.8	3.6'	60.3'
6	270°22.1	N22°35.5		267°58.7	4.9'	N17°47.3	3.5'	60.3'
7	285°22.0	35.8		282°22.7	4.9'	17°50.7	3.4'	60.3'
8	300°21.9	36.0		296°46.6	4.9'	17°54.0	3.2'	60.2'
9	315°21.8	.. 36.3		311°10.6	5.0'	17°57.2	3.1'	60.2'
10	330°21.7	36.6		325°34.5	5.0'	18°00.2	3.0'	60.2'
11	345°21.6	36.8		339°58.5	5.0'	18°03.2	2.8'	60.2'
12	0°21.5	N22°37.1		354°22.4	5.0'	N18°05.9	2.7'	60.1'
13	15°21.3	37.3		8°46.4	5.0'	18°08.6	2.6'	60.1'
14	30°21.2	37.6		23°10.4	5.0'	18°11.1	2.5'	60.1'
15	45°21.1	.. 37.9		37°34.4	5.0'	18°13.5	2.3'	60.1'
16	60°21.0	38.1		51°58.4	5.0'	18°15.8	2.2'	60.1'
17	75°20.9	38.4		66°22.4	5.0'	18°17.9	2.1'	60.0'
18	90°20.8	N22°38.6		80°46.5	5.1'	N18°19.9	1.9'	60.0'
19	105°20.7	38.9		95°10.6	5.1'	18°21.8	1.8'	60.0'
20	120°20.5	39.2		109°34.6	5.1'	18°23.6	1.7'	60.0'
21	135°20.4	.. 39.4		123°58.7	5.1'	18°25.2	1.6'	59.9'
22	150°20.3	39.7		138°22.9	5.1'	18°26.7	1.4'	59.9'
23	165°20.2	39.9		152°47.0	5.2'	18°28.0	1.3'	59.9'
	SD.=15.8	d=0.3				S.D.=16.4		

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	180°20.1	N22°40.2	167°11.2	5.2'	N18°29.3	1.2'	59.8'
1	195°20.0	40.4	181°35.4	5.2'	18°30.4	1.0'	59.8'
2	210°19.8	40.7	195°59.6	5.2'	18°31.3	0.9'	59.8'
3	225°19.7	.. 40.9	210°23.9	5.3'	18°32.2	0.8'	59.8'
4	240°19.6	41.2	224°48.2	5.3'	18°32.9	0.7'	59.7'
5	255°19.5	41.4	239°12.5	5.3'	18°33.5	0.5'	59.7'
6	270°19.4	N22°41.7	253°36.9	5.4'	N18°34.0	0.4'	59.7'
7	285°19.3	42.0	268°01.2	5.4'	18°34.3	0.3'	59.7'
8	300°19.2	42.2	282°25.7	5.4'	18°34.5	0.1'	59.6'
9	315°19.0	.. 42.4	296°50.1	5.5'	18°34.6	0.0'	59.6'
10	330°18.9	42.7	311°14.6	5.5'	18°34.6	-0.1'	59.6'
11	345°18.8	42.9	325°39.2	5.6'	18°34.4	-0.2'	59.5'
12	0°18.7	N22°43.2	340°03.8	5.6'	N18°34.1	-0.4'	59.5'
13	15°18.6	43.4	354°28.4	5.7'	18°33.7	-0.5'	59.5'
14	30°18.5	43.7	8°53.1	5.7'	18°33.1	-0.6'	59.4'
15	45°18.3	.. 43.9	23°17.8	5.7'	18°32.5	-0.7'	59.4'
16	60°18.2	44.2	37°42.6	5.8'	18°31.7	-0.9'	59.4'
17	75°18.1	44.4	52°07.4	5.8'	18°30.7	-1.0'	59.3'
18	90°18.0	N22°44.7	66°32.3	5.9'	N18°29.7	-1.1'	59.3'
19	105°17.9	44.9	80°57.2	5.9'	18°28.5	-1.2'	59.3'
20	120°17.8	45.1	95°22.1	6.0'	18°27.3	-1.3'	59.2'
21	135°17.6	.. 45.4	109°47.2	6.0'	18°25.9	-1.5'	59.2'
22	150°17.5	45.6	124°12.2	6.1'	18°24.3	-1.6'	59.2'
23	165°17.4	45.9	138°37.4	6.2'	18°22.7	-1.7'	59.1'
	SD.=15.7	d=0.3			S.D.=16.2		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°17.3	N22°46.1	153°02.5	6.2'	N18°20.9	-1.8'	59.1'
1	195°17.2	46.3	167°27.8	6.3'	18°19.1	-1.9'	59.1'
2	210°17.0	46.6	181°53.1	6.3'	18°17.1	-2.1'	59.0'
3	225°16.9	.. 46.8	196°18.5	6.4'	18°15.0	-2.2'	59.0'
4	240°16.8	47.0	210°43.9	6.5'	18°12.7	-2.3'	59.0'
5	255°16.7	47.3	225°09.4	6.5'	18°10.4	-2.4'	58.9'
6	270°16.6	N22°47.5	239°34.9	6.6'	N18°07.9	-2.5'	58.9'
7	285°16.5	47.7	254°00.5	6.6'	18°05.4	-2.6'	58.9'
8	300°16.3	48.0	268°26.2	6.7'	18°02.7	-2.7'	58.8'
9	315°16.2	.. 48.2	282°51.9	6.8'	17°59.9	-2.9'	58.8'
10	330°16.1	48.4	297°17.7	6.8'	17°57.0	-3.0'	58.8'
11	345°16.0	48.7	311°43.6	6.9'	17°54.0	-3.1'	58.7'
12	0°15.9	N22°48.9	326°09.5	7.0'	N17°50.8	-3.2'	58.7'
13	15°15.7	49.1	340°35.5	7.0'	17°47.6	-3.3'	58.7'
14	30°15.6	49.4	355°01.6	7.1'	17°44.3	-3.4'	58.6'
15	45°15.5	.. 49.6	9°27.8	7.2'	17°40.8	-3.5'	58.6'
16	60°15.4	49.8	23°54.0	7.3'	17°37.3	-3.6'	58.6'
17	75°15.3	50.0	38°20.3	7.3'	17°33.6	-3.7'	58.5'
18	90°15.1	N22°50.3	52°46.6	7.4'	N17°29.8	-3.8'	58.5'
19	105°15.0	50.5	67°13.1	7.5'	17°26.0	-3.9'	58.4'
20	120°14.9	50.7	81°39.6	7.5'	17°22.0	-4.0'	58.4'
21	135°14.8	.. 50.9	96°06.1	7.6'	17°17.9	-4.1'	58.4'
22	150°14.7	51.2	110°32.8	7.7'	17°13.8	-4.2'	58.3'
23	165°14.5	51.4	124°59.5	7.8'	17°09.5	-4.3'	58.3'
	SD.=15.7	d=0.2			S.D.=16.0		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°						
64°						
62°						
60°						
N 58°						
56°						
54°						
52°						
50°						
48°						
46°						
N 40°						
38°						
36°						
34°						
30°						
28°						
N 10°						
0°						
S 10°						
20°						
30°						
35°						
40°						
S 50°						
52°						
54°						
56°						
58°						
S 60°						

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

## June 08, 09, 10 UT (Wed., Thu., Fri.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Week	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	256°48.5	179°55.4	N22°55.5	23°18.2	S21°12.8	90°33.9	N07°15.5	5°14.5	S20°32.5	Alpheratz	357°41.4	29°10.7											
1	271°50.9	194°54.5	55.9	38°21.4	12.7	105°36.2	15.4	20°17.2	32.5	Ankaa	353°13.9	-42°12.9											
2	286°53.4	209°53.7	56.2	53°24.6	12.6	120°38.5	15.3	35°19.8	32.5	Schedar	349°38.3	56°37.3											
3	301°55.9	224°52.8	.. 56.6	68°27.9	.. 12.6	135°40.7	.. 15.2	50°22.5	.. 32.4	Diphda	348°54.0	-17°53.8											
4	316°58.3	239°52.0	57.0	83°31.1	12.5	150°43.0	15.1	65°25.2	32.4	Achernar	335°25.8	-57°09.1											
5	332°00.8	254°51.2	57.3	98°34.3	12.4	165°45.3	15.0	80°27.8	32.4	Hamal	327°58.7	23°32.1											
6	347°03.3	269°50.3	N22°57.7	113°37.5	S21°12.4	180°47.6	N07°14.9	95°30.5	S20°32.4	Polaris	317°12.3	89°19.7											
7	2°05.7	284°49.5	58.1	128°40.7	12.3	195°49.8	14.9	110°33.1	32.4	Acamar	315°17.2	-40°14.4											
8	17°08.2	299°48.6	58.5	143°44.0	12.2	210°52.1	14.8	125°35.8	32.3	Menkar	314°13.2	4°09.0											
9	32°10.6	314°47.8	.. 58.8	158°47.2	.. 12.2	225°54.4	.. 14.7	140°38.5	.. 32.3	Mirfak	308°37.9	49°54.8											
10	47°13.1	329°46.9	59.2	173°50.4	12.1	240°56.6	14.6	155°41.1	32.3	Aldebaran	290°47.4	16°32.3											
11	62°15.6	344°46.0	59.6	188°53.6	12.0	255°58.9	14.5	170°43.8	32.3	Rigel	281°10.5	-8°11.2											
12	77°18.0	359°45.2	N22°59.9	203°56.8	S21°12.0	271°01.2	N07°14.4	185°46.4	S20°32.3	Capella	280°31.9	46°00.6											
13	92°20.5	14°44.3	23°00.3	219°00.0	11.9	286°03.5	14.3	200°49.1	32.2	Bellatrix	278°30.2	6°21.6											
14	107°23.0	29°43.5	00.6	234°03.2	11.8	301°05.7	14.2	215°51.8	32.2	Elnath	278°10.5	28°37.0											
15	122°25.4	44°42.6	.. 01.0	249°06.4	.. 11.8	316°08.0	.. 14.1	230°54.4	.. 32.2	Alnilam	275°44.7	-1°11.7											
16	137°27.9	59°41.8	01.4	264°09.6	11.7	331°10.3	14.0	245°57.1	32.2	Betelgeuse	270°59.5	7°24.4											
17	152°30.4	74°40.9	01.7	279°12.9	11.6	346°12.5	14.0	260°59.7	32.2	Canopus	263°55.8	-52°42.6											
18	167°32.8	89°40.1	N23°02.1	294°16.1	S21°11.6	1°14.8	N07°13.9	276°02.4	S20°32.1	Sirius	258°32.3	-16°44.6											
19	182°35.3	104°39.2	02.4	309°19.3	11.5	16°17.1	13.8	291°05.1	32.1	Adhara	255°11.3	-29°00.0											
20	197°37.8	119°38.4	02.8	324°22.5	11.5	31°19.3	13.7	306°07.7	32.1	Procyon	244°57.9	5°10.8											
21	212°40.2	134°37.5	.. 03.1	339°25.7	.. 11.4	46°21.6	.. 13.6	321°10.4	.. 32.1	Pollux	243°25.6	27°59.1											
22	227°42.7	149°36.7	03.5	354°28.9	11.3	61°23.9	13.5	336°13.0	32.1	Avior	234°17.6	-59°34.1											
23	242°45.1	164°35.8	03.8	9°32.1	11.3	76°26.1	13.4	351°15.7	32.0	Suhail	222°51.2	-43°30.3											
Mer.pass.:06:52				v-0.8 d0.4 m-3.8				v3.2 d0.1 m-2.0				v2.3 d-0.1 m-1.9				v2.7 d0.0 m0.0							
Thu				GHA				GHA				GHA				GHA							
0	257°47.6	179°35.0	N23°04.2	24°35.3	S21°11.2	91°28.4	N07°13.3	6°18.4	S20°32.0	Denebola	182°31.6	14°28.9											
1	272°50.1	194°34.1	04.5	39°38.5	11.1	106°30.7	13.2	21°21.0	32.0	Gienah	175°50.1	-17°38.1											
2	287°52.5	209°33.2	04.9	54°41.7	11.1	121°32.9	13.1	36°23.7	32.0	Gacrux	173°06.7	-63°11.7											
3	302°55.0	224°32.4	.. 05.2	69°44.9	.. 11.0	136°35.2	.. 13.0	51°26.3	.. 32.0	Alioth	171°58.3	-57°12.5											
4	317°57.5	239°31.5	05.6	84°48.0	10.9	151°37.5	13.0	66°29.0	31.9	Spica	166°18.8	55°52.6											
5	332°59.9	254°30.7	05.9	99°51.2	10.9	166°39.7	12.9	81°31.6	31.9	Alkaid	152°57.1	-11°14.8											
6	348°02.4	269°29.8	N23°06.2	114°54.4	S21°10.8	181°42.0	N07°12.8	96°34.3	S20°31.9	Hadar	152°44.4	-60°27.2											
7	3°04.9	284°29.0	06.6	129°57.6	10.7	196°44.3	12.7	111°37.0	31.9	Menkent	148°04.9	-36°27.1											
8	18°07.3	299°28.1	06.9	145°00.8	10.7	211°46.5	12.6	126°39.6	31.9	Arcturus	145°53.7	19°06.0											
9	33°09.8	314°27.3	.. 07.3	160°04.0	.. 10.6	226°48.8	.. 12.5	141°42.3	.. 31.8	Rigel Kent.	139°48.3	-60°54.2											
10	48°12.3	329°26.4	07.6	175°07.2	10.6	241°51.1	12.4	156°44.9	31.8	Kochab	137°19.3	74°05.6											
11	63°14.7	344°25.5	07.9	190°10.4	10.5	256°53.3	12.3	171°47.6	31.8	Zuben' ubi	137°02.9	-16°06.5											
12	78°17.2	359°24.7	N23°08.3	205°13.6	S21°10.4	271°55.6	N07°12.2	186°50.3	S20°31.8	Alphecca	126°09.0	26°39.8											
13	93°19.6	14°23.8	08.6	220°16.7	10.4	286°57.8	12.1	201°52.9	31.8	Antares	112°23.4	-26°27.9											
14	108°22.1	29°23.0	08.9	235°19.9	10.3	302°00.1	12.0	216°55.6	31.7	Atria	107°22.8	-69°03.2											
15	123°24.6	44°22.1	.. 09.3	250°23.1	.. 10.2	317°02.4	.. 12.0	231°58.2	.. 31.7	Sabik	102°09.9	-15°44.5											
16	138°27.0	59°21.2	09.6	265°26.3	10.2	332°04.6	11.9	247°00.9	31.7	Rasalhague	96°04.2	12°33.1											
17	153°29.5	74°20.4	09.9	280°29.5	10.1	347°06.9	11.8	262°03.6	31.7	Eltanin	90°44.7	51°29.4											
18	168°32.0	89°19.5	N23°10.3	295°32.6	S21°10.0	2°09.2	N07°11.7	277°06.2	S20°31.7	Kaus Aust.	83°40.8	-34°22.3											
19	183°34.4	104°18.7	10.6	310°35.8	10.0	17°11.4	11.6	292°08.9	31.6	Vega	80°37.2	38°48.1											
20	198°36.9	119°17.8	10.9	325°39.0	09.9	32°13.7	11.5	307°11.5	31.6	Nunki	75°55.5	-26°16.3											
21	213°39.4	134°16.9	.. 11.2	340°42.2	.. 09.9	47°15.9	.. 11.4	322°14.2	.. 31.6	Altair	62°06.0	8°54.8											
22	228°41.8	149°16.1	11.6	355°45.3	09.8	62°18.2	11.3	337°16.8	31.6	Peacock	53°15.8	-56°40.6											
23	243°44.3	164°15.2	11.9	10°48.5	09.7	77°20.5	11.2	352°19.5	31.6	Deneb	49°29.7	45°20.3											
Mer.pass.:06:48				v-0.9 d0.3 m-3.8				v3.2 d0.1 m-1.9				v2.3 d-0.1 m-1.9				v2.7 d0.0 m0.0							
Fri				GHA				GHA				GHA				GHA							
0	258°46.8	179°14.4	N23°12.2	25°51.7	S21°09.7	92°22.7	N07°11.1	7°22.2	S20°31.6	Jun 08 Wed	SHA	Mer.pass											
1	273°49.2	194°13.5	12.5	40°54.8	09.6	107°25.0	11.0	22°24.8	31.5	Venus	283°06.9	12:01											
2	288°51.7	209°12.6	12.8	55°58.0	09.6	122°27.3	10.9	37°27.5	31.5	Mars	126°29.7	22:22											
3	303°54.1	224°11.8	.. 13.2	71°01.2	.. 09.5	137°29.5	.. 10.8	52°30.1	.. 31.5	Jupiter	193°45.5	17:55											
4	318°56.6	239°10.9	13.5	86°04.3	09.4	152°31.8	10.7	67°32.8	31.5	Saturn	108°26.1	23:35											
5	333°59.1	254°10.0	13.8	101°07.5	09.4	167°34.0	10.6	82°35.5	31.5	Jun 09 Thu				SHA									
6	349°01.5	269°09.2	N23°14.1	116°10.7	S21°09.3	182°36.3	N07°10.6	97°38.1	S20°31.4	Venus	281°47.3	12:02											
7	4°04.0	284°08.3	14.4	131°13.8	09.2	197°38.5	10.5	112°40.8	31.4	Mars	126°47.7	22:17											
8	19°06.5	299°07.5	14.7	146°17.0	09.2	212°40.8	10.4	127°43.4	31.4	Jupiter	193°40.8	17:51											
9	34°08.9	314°06.6	.. 15.0	161°20.1	.. 09.1	227°43.1	.. 10.3	142°46.1	.. 31.4	Saturn	108°30.7	23:31											
10	49°11.4	329°05.7	15.4	176°23.3	09.1	242°45.3	10.2	157°48.7	31.4	Jun 10 Fri				SHA									
11	64°13.9	344°04.9	15.7	191°26.5	09.0	257°47.6	10.1	172°51.4	31.3	Venus	280°27.6	12:04											
12	79°16.3	359°04.0	N23°16.0	206°29.6	S21°08.9	272°49.8	N07°10.0	187°54.1	S20°31.3	Mars	127°04.9	22:12											
13	94°18.8	14°03.1	16.3	221°32.8	08.9	287°52.1	09.9	202°56.7	31.3	Jupiter	193°36.0	17:48											
14	109°21.2	29°02.3	16.6	236°35.9	08.8	302°54.4	09.8	217°59.4	31.3	Saturn	108°35.4	23:26											
15	124°23.7	44°01.4	.. 16.9	251°39.1	.. 08.8	317°56.6	.. 09.7	233°02.0	.. 31.3	Horizontal parallax				Mer.pass									

DUT1 = UT1-UTC = -0.1925 sec ΔT = TT-UT1 = +68.3765 sec

2016 June 08 to Jun. 10 UT

h	Sun			Moon			
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	180°14.4	N22°51.6	139°26.3	7.8'	N17°05.1	-4.4'	58.3'
1	195°14.3	51.8	153°53.2	7.9'	17°00.6	-4.5'	58.2'
2	210°14.2	52.0	168°20.2	8.0'	16°56.1	-4.6'	58.2'
3	225°14.1	.. 52.3	182°47.2	8.1'	16°51.4	-4.7'	58.2'
4	240°13.9	52.5	197°14.3	8.1'	16°46.7	-4.8'	58.1'
5	255°13.8	52.7	211°41.5	8.2'	16°41.8	-4.9'	58.1'
6	270°13.7	N22°52.9	226°08.7	8.3'	N16°36.9	-5.0'	58.0'
7	285°13.6	53.1	240°36.1	8.4'	16°31.9	-5.1'	58.0'
8	300°13.4	53.3	255°03.5	8.5'	16°26.7	-5.2'	58.0'
9	315°13.3	.. 53.6	269°31.0	8.5'	16°21.5	-5.3'	57.9'
10	330°13.2	53.8	283°58.6	8.6'	16°16.2	-5.3'	57.9'
11	345°13.1	54.0	298°26.2	8.7'	16°10.8	-5.4'	57.9'
12	0°13.0	N22°54.2	312°54.0	8.8'	N16°05.4	-5.5'	57.8'
13	15°12.8	54.4	327°21.8	8.9'	15°59.8	-5.6'	57.8'
14	30°12.7	54.6	341°49.7	8.9'	15°54.2	-5.7'	57.7'
15	45°12.6	.. 54.8	356°17.7	9.0'	15°48.4	-5.8'	57.7'
16	60°12.5	55.0	10°45.7	9.1'	15°42.6	-5.8'	57.7'
17	75°12.3	55.3	25°13.8	9.2'	15°36.8	-5.9'	57.6'
18	90°12.2	N22°55.5	39°42.1	9.3'	N15°30.8	-6.0'	57.6'
19	105°12.1	55.7	54°10.4	9.3'	15°24.7	-6.1'	57.6'
20	120°12.0	55.9	68°38.7	9.4'	15°18.6	-6.2'	57.5'
21	135°11.9	.. 56.1	83°07.2	9.5'	15°12.4	-6.2'	57.5'
22	150°11.7	56.3	97°35.7	9.6'	15°06.1	-6.3'	57.4'
23	165°11.6	56.5	112°04.3	9.7'	14°59.8	-6.4'	57.4'
	SD.=15.7	d=0.2		S.D.=15.8			

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Pass.	Mer. Pass.	Upper	Lower
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	hh:mm	hh:mm	Age 3-5 15-32%
08	00:58	00:52	11:59	15:15	02:48	
09	00:46	00:40	11:59	16:07	03:41	
10	00:34	00:28	12:00	16:55	04:31	

SD.=15.7	d=0.2	S.D.=15.3
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**June 11, 12, 13 UT (Sat., Sun., Mon.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	259°45.9	178°53.6	N23°19.6	27°07.4	S21°08.2	93°16.9	N07°08.9	8°26.0	S20°31.1	Alpheratz	357°41.4
1	274°48.4	193°52.7	19.9	42°10.5	08.2	108°19.2	08.8	23°28.6	31.1	Ankaa	353°13.9
2	289°50.8	208°51.9	20.1	57°13.7	08.1	123°21.4	08.7	38°31.3	31.0	Schedar	349°38.3
3	304°53.3	223°51.0	.. 20.4	72°16.8	.. 08.0	138°23.7	.. 08.6	53°33.9	.. 31.0	Diphda	348°54.0
4	319°55.7	238°50.1	20.7	87°19.9	08.0	153°25.9	08.5	68°36.6	31.0	Achernar	335°25.7
5	334°58.2	253°49.3	21.0	102°23.1	07.9	168°28.2	08.4	83°39.3	31.0	Hamal	327°58.7
6	350°00.7	268°48.4	N23°21.3	117°26.2	S21°07.9	183°30.4	N07°08.3	98°41.9	S20°31.0	Polaris	317°11.4
7	5°03.1	283°47.5	21.6	132°29.3	07.8	198°32.7	08.2	113°44.6	30.9	Acamar	315°17.2
8	20°05.6	298°46.7	21.9	147°32.5	07.8	213°35.0	08.1	128°47.2	30.9	Menkar	314°13.2
9	35°08.1	313°45.8	.. 22.1	162°35.6	.. 07.7	228°37.2	.. 08.0	143°49.9	.. 30.9	Mirfak	308°37.8
10	50°10.5	328°44.9	22.4	177°38.7	07.6	243°39.5	07.9	158°52.5	30.9	Aldebaran	290°47.4
11	65°13.0	343°44.0	22.7	192°41.8	07.6	258°41.7	07.8	173°55.2	30.9	Rigel	281°10.5
12	80°15.5	358°43.2	N23°23.0	207°45.0	S21°07.5	273°44.0	N07°07.7	188°57.9	S20°30.9	Capella	280°31.9
13	95°17.9	13°42.3	23.3	222°48.1	07.5	288°46.2	07.6	204°05.5	30.8	Bellatrix	278°30.2
14	110°20.4	28°41.4	23.5	237°51.2	07.4	303°48.5	07.5	219°03.2	30.8	Elnath	278°10.5
15	125°22.9	43°40.6	.. 23.8	252°54.3	.. 07.4	318°50.7	.. 07.4	234°05.8	.. 30.8	Alnilam	275°44.7
16	140°25.3	58°39.7	24.1	267°57.5	07.3	333°53.0	07.3	249°08.5	30.8	Betelgeuse	270°59.5
17	155°27.8	73°38.8	24.4	283°00.6	07.2	348°55.2	07.2	264°11.1	30.8	Canopus	263°55.8
18	170°30.2	88°38.0	N23°24.6	298°03.7	S21°07.2	3°57.5	N07°07.1	279°13.8	S20°30.7	Sirius	258°32.3
19	185°32.7	103°37.1	24.9	313°06.8	07.1	189°59.7	07.0	294°16.5	30.7	Adhara	255°11.3
20	200°35.2	118°36.2	25.2	328°09.9	07.1	34°02.0	06.9	309°19.1	30.7	Procyon	244°57.9
21	215°37.6	133°35.3	.. 25.4	343°13.0	.. 07.0	49°04.2	.. 06.8	324°21.8	.. 30.7	Pollux	243°25.6
22	230°40.1	148°34.5	25.7	358°16.1	07.0	64°06.5	06.7	339°24.4	30.7	Avior	234°17.6
23	245°42.6	163°33.6	26.0	13°19.3	06.9	79°08.7	06.6	354°27.1	30.6	Suhail	222°51.2
Mer.pass.:06:40		v-0.9 d0.3 m-3.8		v3.1 d0.1 m-1.9		v2.3 d-0.1 m-1.8		v2.7 d0.0 m0.0		Miaplacidus	
Sun		GHA		GHA		GHA		GHA		GHA	
0	260°45.0	178°32.7	N23°26.2	28°22.4	S21°06.9	94°11.0	N07°06.5	9°29.7	S20°30.6	Denebola	182°31.6
1	275°47.5	193°31.8	26.5	43°25.5	06.8	109°13.2	06.4	24°32.4	30.6	Gienah	175°50.1
2	290°50.0	208°31.0	26.8	58°28.6	06.7	124°15.5	06.3	39°35.1	30.6	Acrux	173°06.7
3	305°52.4	223°30.1	.. 27.0	73°31.7	.. 06.7	139°17.7	.. 06.2	54°37.7	.. 30.6	Gacrux	171°58.3
4	320°54.9	238°29.2	27.3	88°34.8	06.6	154°20.0	06.1	69°40.4	30.5	Alioth	166°18.8
5	335°57.3	253°28.4	27.5	103°37.9	06.6	169°22.2	06.0	84°43.0	30.5	Spica	158°28.9
6	350°59.8	268°27.5	N23°27.8	118°41.0	S21°06.5	184°24.5	N07°05.9	99°45.7	S20°30.5	Alkaid	152°57.1
7	6°02.3	283°26.6	28.1	133°44.1	06.5	199°26.7	05.8	114°48.3	30.5	Hadar	148°44.4
8	21°04.7	298°25.7	28.3	148°47.2	06.4	214°29.0	05.7	129°51.0	30.5	Menkent	148°04.9
9	36°07.2	313°24.9	.. 28.6	163°50.3	.. 06.4	229°31.2	.. 05.6	144°53.7	.. 30.4	Arcturus	145°53.7
10	51°09.7	328°24.0	28.8	178°53.4	06.3	244°33.5	05.6	159°56.3	30.4	Rigel Kent.	139°48.3
11	66°12.1	343°23.1	29.1	193°56.5	06.3	259°35.7	05.5	174°59.0	30.4	Kochab	137°19.4
12	81°14.6	358°22.2	N23°29.3	208°59.6	S21°06.2	274°37.9	N07°05.4	190°01.6	S20°30.4	Zuben'ubi	137°02.9
13	96°17.1	13°21.4	29.6	224°02.7	06.1	289°40.2	05.3	205°04.3	30.4	Alphecca	126°09.0
14	111°19.5	28°20.5	29.8	239°05.8	06.1	304°42.4	05.2	220°06.9	30.4	Antares	112°23.4
15	126°22.0	43°19.6	.. 30.1	254°08.9	.. 06.0	319°44.7	.. 05.1	235°09.6	.. 30.3	Atria	107°22.8
16	141°24.5	58°18.7	30.3	269°12.0	06.0	334°46.9	05.0	250°12.2	30.3	Sabik	102°09.9
17	156°26.9	73°17.8	30.6	284°15.0	05.9	349°49.2	04.9	265°14.9	30.3	Rasalhague	96°04.2
18	171°29.4	88°17.0	N23°30.8	299°18.1	S21°05.9	4°51.4	N07°04.8	280°17.6	S20°30.3	Eltanin	90°44.7
19	186°31.8	103°16.1	31.0	314°21.2	05.8	19°53.7	04.7	295°20.2	30.3	Kaus Aust.	83°40.8
20	201°34.3	118°15.2	31.3	329°24.3	05.8	34°55.9	04.6	310°22.9	30.2	Vega	80°37.2
21	216°36.8	133°14.3	.. 31.5	344°27.4	.. 05.7	49°58.2	.. 04.5	325°25.5	.. 30.2	Nunki	75°55.5
22	231°39.2	148°13.5	31.8	359°30.5	05.7	65°00.4	04.4	340°28.2	30.2	Altair	62°06.0
23	246°41.7	163°12.6	32.0	14°33.5	05.6	80°02.6	04.3	355°30.8	30.2	Peacock	53°15.7
Mer.pass.:06:36		v-0.9 d0.3 m-3.8		v3.1 d0.1 m-1.9		v2.2 d-0.1 m-1.8		v2.7 d0.0 m0.0		Deneb	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Mer.pass
0	261°44.2	178°11.7	N23°32.2	29°36.6	S21°05.6	95°04.9	N07°04.2	10°33.5	S20°30.2	Jun 11 Sat	SHA
1	276°46.6	193°10.8	32.5	44°39.7	05.5	110°07.1	04.1	25°36.2	30.1	Venus	279°07.7
2	291°49.1	208°09.9	32.7	59°42.8	05.5	125°09.4	04.0	40°38.8	30.1	Mars	127°21.5
3	306°51.6	223°09.1	.. 32.9	74°45.8	.. 05.4	140°11.6	.. 03.9	55°41.5	.. 30.1	Jupiter	193°31.0
4	321°54.0	238°08.2	33.2	89°48.9	05.4	155°13.9	03.8	70°44.1	30.1	Saturn	108°40.1
5	336°56.5	253°07.3	33.4	104°52.0	05.3	170°16.1	03.7	85°46.8	30.1	Jun 12 Sun	SHA
6	351°59.0	268°06.4	N23°33.6	119°55.1	S21°05.3	185°18.3	N07°03.6	100°49.4	S20°30.0	Venus	277°47.7
7	7°01.4	283°05.6	33.8	134°58.1	05.2	200°20.6	03.5	115°52.1	30.0	Mars	127°37.3
8	22°03.9	298°04.7	34.1	150°01.2	05.2	215°22.8	03.4	130°54.7	30.0	Jupiter	193°25.9
9	37°06.3	313°03.8	.. 34.3	165°04.3	.. 05.1	230°25.1	.. 03.3	145°57.4	.. 30.0	Saturn	108°44.7
10	52°08.8	328°02.9	34.5	180°07.3	05.1	245°27.3	03.2	161°00.1	30.0	Jun 13 Mon	SHA
11	67°11.3	343°02.0	34.7	195°10.4	05.0	260°29.6	03.1	176°02.7	30.0	Venus	276°27.5
12	82°13.7	358°01.2	N23°35.0	210°13.5	S21°05.0	275°31.8	N07°02.9	191°05.4	S20°29.9	Mars	127°52.5
13	97°16.2	13°00.3	35.2	225°16.5	04.9	290°34.0	02.8	206°08.0	29.9	Jupiter	193°20.7
14	112°18.7	27°59.4	35.4	240°19.6	04.9	305°36.3	02.7	221°10.7	29.9	Saturn	108°49.3
15	127°21.1	42°58.5	.. 35.6	255°22.6	.. 04.8	320°38.5	.. 02.6	236°13.3	.. 29.9	Horizontal parallax	
16	142°23.6	57°57.6	35.8	270°25.7	04.8	335°40.8	02.5	251°16.0	29.9	Venus:	0.1
17	157°26.1	72°56.8	36.1	285°28.7	04.7	350°43.0	02.4	266°18.6	29.8	Mars:	0.3
18	172°28.5	87°55.9	N23°36.3	300°31.8	S21°04.7	5°45.2	N07°02.3	281°21.3	S20°29.8	Mer.pass.:06:32	Mer.pass
19	187°31.0	102°55.0	36.5	315°34.9	04.6	20°47.5	02.2	296°24.0	29.8	Alpheratz	357°41.4
20	202°33.4	117°54.1	36.7	330°37.9	04.6	35°49.7	02.1	311°26.6	29.8	Ankaa	353°13.9
21	217°35.9	132°53.2	.. 36.9	345°41.0	.. 04.5	50°52.0	.. 02.0	326°29.3	.. 29.8	Schedar	349°38.3
22	232°38.4	147°52.3	37.1	0°44.0	04.5	65°54.2	01.9	341°31.9	29.7	Diphda	348°54.0
23	247°40.8	162°51.5	37.3	15°47.1	04.4	80°56.4	01.8	356°34.6	29.7	Achernar	335°25.7
Mer.pass.:06:32		v-0.9 d0.2 m-3.8		v3.1 d0.1 m-1.9		v2.2 d-0.1 m-1.8		v2.7 d0.0 m0.0		Stars	

DUT1 = UT1-UTC = -0.1951 sec ΔT = TT-UT1 = +68.3791 sec

2016 June 11 to Jun. 13 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°05.5	N23°05.7	102°58.2	13.1'	N08°36.6	-8.9'	55.7'
1	195°05.3	05.9	117°30.3	13.2'	08°27.7	-8.9'	55.7'
2	210°05.2	06.0	132°02.5	13.2'	08°18.8	-8.9'	55.7'
3	225°05.1	.. 06.2	146°34.8	13.3'	08°09.9	-9.0'	55.7'
4	240°05.0	06.4	161°07.1	13.4'	08°00.9	-9.0'	55.6'
5	255°04.8	06.5	175°39.5	13.4'	07°51.9	-9.0'	55.6'
6	270°04.7	N23°06.7	190°11.9	13.5'	N07°42.8	-9.0'	55.6'
7	285°04.6	06.9	204°44.4	13.5'	07°33.8	-9.1'	55.5'
8	300°04.4	07.0	219°17.0	13.6'	07°24.7	-9.1'	55.5'
9	315°04.3	.. 07.2	233°49.6	13.6'	07°15.6	-9.1'	55.5'
10	330°04.2	07.4	248°22.2	13.7'	07°06.5	-9.1'	55.5'
11	345°04.1	07.5	262°54.9	13.7'	06°57.3	-9.2'	55.4'
12	0°03.9	N23°07.7	277°27.6	13.8'	N06°48.1	-9.2'	55.4'
13	15°03.8	07.9	292°00.4	13.8'	06°38.9	-9.2'	55.4'
14	30°03.7	08.0	306°33.2	13.9'	06°29.7	-9.2'	55.3'
15	45°03.5	.. 08.2	321°06.1	13.9'	06°20.5	-9.2'	55.3'
16	60°03.4	08.3	335°39.1	13.9'	06°11.2	-9.3'	55.3'
17	75°03.3	08.5	350°12.0	14.0'	06°01.9	-9.3'	55.3'
18	90°03.2	N23°08.7	4°45.0	14.0'	N05°52.7	-9.3'	55.2'
19	105°03.0	08.8	19°18.1	14.1'	05°43.3	-9.3'	55.2'
20	120°02.9	09.0	33°51.2	14.1'	05°34.0	-9.3'	55.2'
21	135°02.8	.. 09.1	48°24.4	14.2'	05°24.7	-9.3'	55.2'
22	150°02.6	09.3	62°57.5	14.2'	05°15.3	-9.4'	55.1'
23	165°02.5	09.4	77°30.8	14.2'	05°06.0	-9.4'	55.1'
	SD.=15.7	d=0.2			S.D.=15.1		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Mer. Pass.	Upper	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	Pass	hh:mm	6-8
11	00:22	00:16	12:00	17:40	05:18	
12	00:10	00:03	12:00	18:24	06:02	
13	00:03	00:09	12:00	19:07	06:46	

SD.=15.7	d=0.1	S.D.=14.8
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## June 14, 15, 16 UT (Tue., Wed., Thu.)

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	262°43.3	177°50.6	N23°37.5	30°50.1	S21°04.4	95°58.7	N07°01.7	11°37.2	S20°29.7	Alpheratz	357°41.4
1	277°45.8	192°49.7	37.7	45°53.1	04.3	111°00.9	01.6	26°39.9	29.7	Ankaa	353°13.9
2	292°48.2	207°48.8	37.9	60°56.2	04.3	126°03.1	01.5	41°42.5	29.7	Schedar	349°38.2
3	307°50.7	222°47.9	.. 38.1	75°59.2	.. 04.2	141°05.4	.. 01.4	56°45.2	.. 29.6	Diphda	348°54.0
4	322°53.2	237°47.1	38.4	91°02.3	04.2	156°07.6	01.3	71°47.9	29.6	Achernar	335°25.7
5	337°55.6	252°46.2	38.6	106°05.3	04.1	171°09.9	01.2	86°50.5	29.6	Hamal	327°58.7
6	352°58.1	267°45.3	N23°38.8	121°08.3	S21°04.1	186°12.1	N07°01.1	101°53.2	S20°29.6	Polaris	317°10.4
7	8°00.6	282°44.4	39.0	136°11.4	04.1	201°14.3	01.0	116°55.8	29.6	Acamar	315°17.2
8	23°03.0	297°43.5	39.1	151°14.4	04.0	216°16.6	00.9	131°58.5	29.6	Menkar	314°13.2
9	38°05.5	312°42.6	.. 39.3	166°17.4	.. 04.0	231°18.8	.. 00.8	147°01.1	.. 29.5	Mirfak	308°37.8
10	53°07.9	327°41.7	39.5	181°20.5	03.9	246°21.0	00.7	162°03.8	29.5	Aldebaran	290°47.4
11	68°10.4	342°40.9	39.7	196°23.5	03.9	261°23.3	00.6	177°06.4	29.5	Rigel	281°10.5
12	83°12.9	357°40.0	N23°39.9	211°26.5	S21°03.8	276°25.5	N07°00.5	192°09.1	S20°29.5	Capella	280°31.9
13	98°15.3	12°39.1	40.1	226°29.6	03.8	291°27.7	00.4	207°11.7	29.5	Bellatrix	278°30.2
14	113°17.8	27°38.2	40.3	241°32.6	03.7	306°30.0	00.3	222°14.4	29.4	Elnath	278°10.5
15	128°20.3	42°37.3	.. 40.5	256°35.6	.. 03.7	321°32.2	.. 00.2	237°17.1	.. 29.4	Alnilam	275°44.7
16	143°22.7	57°36.4	40.7	271°38.6	03.7	336°34.5	00.1	252°19.7	29.4	Betelgeuse	270°59.5
17	158°25.2	72°35.6	40.9	286°41.7	03.6	351°36.7	07°00.0	267°22.4	29.4	Canopus	263°55.8
18	173°27.7	87°34.7	N23°41.1	301°44.7	S21°03.6	6°38.9	N06°59.9	282°25.0	S20°29.4	Sirius	258°32.3
19	188°30.1	102°33.8	41.2	316°47.7	03.5	21°41.2	59.8	297°27.7	29.3	Adhara	255°11.3
20	203°32.6	117°32.9	41.4	331°50.7	03.5	36°43.4	59.7	312°30.3	29.3	Procyon	244°57.9
21	218°35.0	132°32.0	.. 41.6	346°53.7	.. 03.4	51°45.6	.. 59.6	327°33.0	.. 29.3	Pollux	243°25.6
22	233°37.5	147°31.1	41.8	1°56.8	03.4	66°47.9	59.4	342°35.6	29.3	Avior	234°17.6
23	248°40.0	162°30.2	42.0	16°59.8	03.3	81°50.1	59.3	357°38.3	29.3	Suhail	222°51.2
Mer.pass.:06:28		v-0.9 d0.2 m-3.8		v3.0 d0.0 m-1.8		v2.2 d-0.1 m-1.8		v2.7 d0.0 m0.0		Miaplacidus	
Wed		GHA		GHA		Dec		GHA		Dec	
0	263°42.4	177°29.4	N23°42.1	32°02.8	S21°03.3	96°52.3	N06°59.2	12°40.9	S20°29.3	Denebola	183°49.5
1	278°44.9	192°28.5	42.3	47°05.8	03.3	111°54.6	59.1	27°43.6	29.2	Gienah	182°31.6
2	293°47.4	207°27.6	42.5	62°08.8	03.2	126°56.8	59.0	42°46.2	29.2	Acrux	175°50.1
3	308°49.8	222°26.7	.. 42.7	77°11.8	.. 03.2	141°59.0	.. 58.9	57°48.9	.. 29.2	Gacrux	173°06.7
4	323°52.3	237°25.8	42.8	92°14.8	03.1	157°01.2	58.8	72°51.6	29.2	Alioth	171°58.4
5	338°54.8	252°24.9	43.0	107°17.8	03.1	172°03.5	58.7	87°54.2	29.2	Alkaid	166°44.7
6	353°57.2	267°24.0	N23°43.2	122°20.8	S21°03.0	187°05.7	N06°58.6	102°56.9	S20°29.1	Hadar	155°57.1
7	8°59.7	282°23.2	43.4	137°23.8	03.0	202°07.9	58.5	117°59.5	29.1	Menkent	148°44.5
8	24°02.2	297°22.3	43.5	152°26.8	03.0	217°10.2	58.4	133°02.2	29.1	Arcturus	148°04.9
9	39°04.6	312°21.4	.. 43.7	167°29.8	.. 02.9	232°12.4	.. 58.3	148°04.8	.. 29.1	Rigel Kent.	145°53.7
10	54°07.1	327°20.5	43.9	182°32.8	02.9	247°14.6	58.2	163°07.5	29.1	Kochab	139°48.4
11	69°09.5	342°19.6	44.0	197°35.8	02.8	262°16.9	58.1	178°10.1	29.0	Zuben' ubi	137°02.9
12	84°12.0	357°18.7	N23°44.2	212°38.8	S21°02.8	277°19.1	N06°58.0	193°12.8	S20°29.0	Alphecca	126°09.0
13	99°14.5	12°17.8	44.4	227°41.8	02.8	292°21.3	57.9	208°15.4	29.0	Antares	112°23.4
14	114°16.9	27°16.9	44.5	242°44.8	02.7	307°23.6	57.8	223°18.1	29.0	Atria	107°22.8
15	129°19.4	42°16.0	.. 44.7	257°47.8	.. 02.7	322°25.8	.. 57.7	238°20.7	.. 29.0	Sabik	90°09.9
16	144°21.9	57°15.2	44.8	272°50.8	02.6	337°28.0	57.6	253°23.4	29.0	Shaula	80°45.5
17	159°24.3	72°14.3	45.0	287°53.8	02.6	352°30.2	57.4	268°26.1	28.9	Rasalhague	70°04.2
18	174°26.8	87°13.4	N23°45.1	302°56.8	S21°02.6	7°32.5	N06°57.3	283°28.7	S20°28.9	Eltanin	60°27.2
19	189°29.3	102°12.5	45.3	317°59.8	02.5	22°34.7	57.2	298°31.4	28.9	Kaus Aust.	53°40.7
20	204°31.7	117°11.6	45.5	333°02.8	02.5	37°36.9	57.1	313°34.0	28.9	Vega	43°32.2
21	219°34.2	132°10.7	.. 45.6	348°05.7	.. 02.4	52°39.2	.. 57.0	328°36.7	.. 28.9	Nunki	33°09.2
22	234°36.7	147°09.8	45.8	3°08.7	02.4	67°41.4	56.9	343°39.3	28.8	Altair	22°51.3
23	249°39.1	162°08.9	45.9	18°11.7	02.4	82°43.6	56.8	358°42.0	28.8	Peacock	11°51.3
Mer.pass.:06:24		v-0.9 d0.2 m-3.8		v3.0 d0.0 m-1.8		v2.2 d-0.1 m-1.8		v2.7 d0.0 m0.0		Deneb	
Thu		GHA		GHA		Dec		GHA		Dec	
0	264°41.6	177°08.1	N23°46.1	33°14.7	S21°02.3	97°45.8	N06°56.7	13°44.6	S20°28.8	Menkent	148°04.9
1	279°44.0	192°07.2	46.2	48°17.7	02.3	112°48.1	56.6	28°47.3	28.8	Arcturus	145°53.7
2	294°46.5	207°06.3	46.4	63°20.6	02.3	127°50.3	56.5	43°49.9	28.8	Rigel Kent.	139°48.4
3	309°49.0	222°05.4	.. 46.5	78°23.6	.. 02.2	142°52.5	.. 56.4	58°52.6	.. 28.7	Kochab	137°19.4
4	324°51.4	237°04.5	46.6	93°26.6	02.2	157°54.7	56.3	73°55.2	28.7	Zuben' ubi	137°02.9
5	339°53.9	252°03.6	46.8	108°29.6	02.1	172°57.0	56.2	88°57.9	28.7	Alphecca	126°09.0
6	354°56.4	267°02.7	N23°46.9	123°32.5	S21°02.1	187°59.2	N06°56.1	104°00.5	S20°28.7	Antares	112°23.4
7	9°58.8	282°01.8	47.1	138°35.5	02.1	203°01.4	55.9	119°03.2	28.7	Atria	107°22.8
8	25°01.3	297°00.9	47.2	153°38.5	02.0	218°03.7	55.8	134°05.8	28.7	Sabik	90°09.9
9	40°03.8	312°00.0	.. 47.3	168°41.4	.. 02.0	233°05.9	.. 55.7	149°08.5	.. 28.6	Shaula	80°45.5
10	55°06.2	326°59.2	47.5	183°44.4	02.0	248°08.1	55.6	164°11.1	28.6	Rasalhague	70°04.2
11	70°08.7	341°58.3	47.6	198°47.4	01.9	263°10.3	55.5	179°13.8	28.6	Eltanin	60°27.2
12	85°11.1	356°57.4	N23°47.8	213°50.3	S21°01.9	278°12.6	N06°55.4	194°16.4	S20°28.6	Kaus Aust.	53°40.7
13	100°13.6	11°56.5	47.9	228°53.3	01.8	293°14.8	55.3	209°19.1	28.6	Vega	43°32.2
14	115°16.1	26°55.6	48.0	243°56.2	01.8	308°17.0	55.2	224°21.8	28.5	Nunki	33°09.2
15	130°18.5	41°54.7	.. 48.2	258°59.2	.. 01.8	323°19.2	.. 55.1	239°24.4	.. 28.5	Altair	22°51.3
16	145°21.0	56°53.8	48.3	274°02.2	01.7	338°21.4	55.0	254°27.1	28.5	Peacock	11°51.3
17	160°23.5	71°52.9	48.4	289°05.1	01.7	353°23.7	54.9	269°29.7	28.5	Deneb	80°45.5
18	175°25.9	86°52.0	N23°48.5	304°08.1	S21°01.7	8°25.9	N06°54.8	284°32.4	S20°28.5	Enif	70°04.2
19	190°28.4	101°51.1	48.7	319°11.0	01.6	23°28.1	54.7	299°35.0	28.5	Al Na'ir	57°51.3
20	205°30.9	116°50.2	48.8	334°14.0	01.6	38°30.3	54.5	314°37.7	28.4	Fomalhaut	47°51.3
21	220°33.3	131°49.3	.. 48.9	349°16.9	.. 01.6	53°32.6	.. 54.4	329°40.3	.. 28.4	Scheat	37°51.3
22	235°35.8	146°48.5	49.0	4°19.9	01.5	68°34.8	54.3	344°43.0	28.4	Markab	27°51.3
23	250°38.3	161°47.6	49.2	19°22.8	01.5	83°37.0	54.2	359°45.6	28.4	Jun 14 Tue	
Mer.pass.:06:20		v-0.9 d0.1 m-3.8		v3.0 d0.0 m-1.8		v2.2 d-0.1 m-1.8		v2.7 d0.0 m0.0			

DUT1 = UT1-UTC = -0.1977 sec ΔT = TT-UT1 = +68.3817 sec

2016 June 14 to Jun. 16 UT

h	Sun			Moon											
Tue	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight		Sunrise	Sunset	Twilight		
								Naut.	Civil			Civil	Naut.		
0	179°56.1	N23°16.1	71°12.2	15.3'	S02°38.5	-9.4'	54.3'	N 72°	□	□	□	□	□	□	
1	194°56.0	16.3	85°46.4	15.3'	02°47.8	-9.3'	54.3'	N 70°	□	□	□	□	□	□	
2	209°55.9	16.4	100°20.7	15.3'	02°57.2	-9.3'	54.3'	68°	□	□	□	□	□	□	
3	224°55.7	.. 16.5	114°54.9	15.3'	03°06.5	-9.3'	54.3'	66°	□	□	□	□	□	□	
4	239°55.6	16.6	129°29.2	15.3'	03°15.8	-9.3'	54.3'	64°	□	□	01:33	22:29	□	□	
5	254°55.5	16.7	144°03.4	15.3'	03°25.1	-9.3'	54.3'	62°	□	□	02:10	21:51	□	□	
6	269°55.3	N23°16.8	158°37.7	15.3'	S03°34.4	-9.3'	54.2'	60°	□	00:53	02:36	21:25	23:10	□	
7	284°55.2	17.0	173°11.9	15.2'	03°43.6	-9.3'	54.2'	N 58°	□	01:41	02:56	21:05	22:20	□	
8	299°55.1	17.1	187°46.2	15.2'	03°52.9	-9.2'	54.2'	56°	□	02:11	03:13	20:48	21:51	□	
9	314°54.9	.. 17.2	202°20.4	15.2'	04°02.1	-9.2'	54.2'	54°	□	00:48	02:33	03:27	20:34	21:29	23:14
10	329°54.8	17.3	216°54.7	15.2'	04°11.3	-9.2'	54.2'	52°	□	01:33	02:51	03:39	20:22	21:11	22:29
11	344°54.7	17.4	231°28.9	15.2'	04°20.5	-9.2'	54.2'	50°	□	02:01	03:06	03:50	20:11	20:56	22:01
12	359°54.5	N23°17.5	246°03.1	15.2'	S04°29.7	-9.2'	54.2'	45°	□	02:46	03:35	04:13	19:49	20:26	21:16
13	14°54.4	17.6	260°37.3	15.2'	04°38.8	-9.1'	54.2'	N 40°	03:16	03:58	04:31	19:31	20:03	20:45	
14	29°54.3	17.7	275°11.6	15.2'	04°48.0	-9.1'	54.2'	35°	03:39	04:16	04:46	19:16	19:45	20:22	
15	44°54.1	.. 17.8	289°45.8	15.2'	04°57.1	-9.1'	54.2'	30°	03:58	04:31	04:59	19:03	19:30	20:03	
16	59°54.0	18.0	304°20.0	15.2'	05°06.2	-9.1'	54.2'	20°	04:27	04:56	05:21	18:41	19:05	19:34	
17	74°53.9	18.1	318°54.1	15.2'	05°15.2	-9.1'	54.2'	N 10°	04:49	05:16	05:39	18:22	18:45	19:12	
18	89°53.7	N23°18.2	333°28.3	15.2'	S05°24.3	-9.0'	54.2'	0°	05:08	05:34	05:57	18:04	18:27	18:53	
19	104°53.6	18.3	348°02.5	15.2'	05°33.3	-9.0'	54.2'	S 10°	05:25	05:51	06:14	17:47	18:10	18:36	
20	119°53.5	18.4	2°36.6	15.1'	05°42.3	-9.0'	54.2'	20°	05:41	06:09	06:33	17:28	17:52	18:20	
21	134°53.3	.. 18.5	17°10.8	15.1'	05°51.3	-9.0'	54.2'	30°	05:58	06:28	06:54	17:07	17:34	18:03	
22	149°53.2	18.6	31°44.9	15.1'	06°00.2	-8.9'	54.2'	35°	06:06	06:38	07:06	16:55	17:23	17:55	
23	164°53.1	18.7	46°19.0	15.1'	06°09.2	-8.9'	54.1'	40°	06:16	06:50	07:20	16:41	17:11	17:45	
	SD.=15.7	d=0.1			S.D.=14.8			45°	06:26	07:03	07:37	16:24	16:58	17:35	
Wed	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Moonrise		Moonset				
								Tue	Wed	Thu	Tue	Wed	Thu		
0	179°52.9	N23°18.8	60°53.1	15.1'	S06°18.1	-8.9'	54.1'	N 72°	14:43	16:18	17:56	00:41	00:36	00:30	
1	194°52.8	18.9	75°27.2	15.1'	06°27.0	-8.9'	54.1'	N 70°	14:36	16:04	17:34	00:45	00:45		
2	209°52.7	19.0	90°01.3	15.1'	06°35.8	-8.8'	54.1'	68°	14:30	15:53	17:17	00:48	00:52	00:57	
3	224°52.5	.. 19.1	104°35.3	15.0'	06°44.6	-8.8'	54.1'	66°	14:25	15:44	17:03	00:51	00:58	01:07	
4	239°52.4	19.2	119°09.3	15.0'	06°53.4	-8.8'	54.1'	64°	14:21	15:36	16:52	00:53	01:04	01:16	
5	254°52.3	19.3	133°43.4	15.0'	07°02.2	-8.8'	54.1'	62°	14:17	15:30	16:42	00:55	01:08	01:23	
6	269°52.1	N23°19.4	148°17.4	15.0'	S07°10.9	-8.7'	54.1'	60°	14:14	15:24	16:34	00:57	01:12	01:30	
7	284°52.0	19.5	162°51.3	15.0'	07°19.6	-8.7'	54.1'	N 58°	14:11	15:19	16:27	00:58	01:16	01:35	
8	299°51.9	19.6	177°25.3	15.0'	07°28.3	-8.7'	54.1'	56°	14:09	15:15	16:20	01:00	01:19	01:40	
9	314°51.7	.. 19.7	191°59.2	14.9'	07°37.0	-8.6'	54.1'	54°	14:07	15:11	16:15	01:01	01:22	01:45	
10	329°51.6	19.8	206°33.2	14.9'	07°45.6	-8.6'	54.1'	52°	14:05	15:07	16:10	01:02	01:25	01:49	
11	344°51.5	19.9	221°07.1	14.9'	07°54.2	-8.6'	54.1'	50°	14:03	15:04	16:05	01:03	01:27	01:53	
12	359°51.3	N23°20.0	235°40.9	14.9'	S08°02.8	-8.5'	54.1'	45°	13:59	14:57	15:55	01:05	01:32	02:01	
13	14°51.2	20.1	250°14.8	14.8'	08°11.3	-8.5'	54.1'	N 40°	13:56	14:51	15:47	01:07	01:37	02:08	
14	29°51.1	20.2	264°48.6	14.8'	08°19.8	-8.5'	54.1'	35°	13:53	14:46	15:40	01:09	01:40	02:13	
15	44°50.9	.. 20.2	279°22.4	14.8'	08°28.2	-8.4'	54.1'	30°	13:50	14:42	15:34	01:10	01:44	02:19	
16	59°50.8	20.3	293°56.2	14.8'	08°36.7	-8.4'	54.1'	20°	13:46	14:34	15:23	01:13	01:50	02:27	
17	74°50.7	20.4	308°30.0	14.7'	08°45.1	-8.4'	54.1'	N 10°	13:42	14:28	15:14	01:15	01:55	02:35	
18	89°50.5	N23°20.5	323°03.7	14.7'	S08°53.4	-8.3'	54.1'	0°	13:39	14:22	15:06	01:17	02:00	02:43	
19	104°50.4	20.6	337°37.4	14.7'	09°01.7	-8.3'	54.1'	S 10°	13:36	14:16	14:57	01:19	02:04	02:50	
20	119°50.3	20.7	352°11.1	14.7'	09°10.0	-8.3'	54.1'	20°	13:32	14:09	14:48	01:21	02:09	02:58	
21	134°50.1	.. 20.8	6°44.8	14.6'	09°18.3	-8.2'	54.1'	30°	13:28	14:02	14:37	01:24	02:15	03:07	
22	149°50.0	20.9	21°18.4	14.6'	09°26.5	-8.2'	54.1'	35°	13:25	13:58	14:31	01:25	02:19	03:12	
23	164°49.9	21.0	35°52.0	14.6'	09°34.7	-8.2'	54.1'	40°	13:23	13:53	14:25	01:27	02:23	03:18	
	SD.=15.7	d=0.1			S.D.=14.8			45°	13:20	13:47	14:17	01:29	02:27	03:25	
Thu	GHA	Dec	GHA	ν	Dec	d	HP	Day	Sun		Moon				
								Eqn. of Time	Mer.	Mer.	Mer. Pass.	Age			
0	179°49.7	N23°21.0	50°25.6	14.6'	S09°42.8	-8.1'	54.1'		00 <sup>h</sup>	00:22	12:00	19:49	07:28		
1	194°49.6	21.1	64°59.1	14.5'	09°50.9	-8.1'	54.1'		00 <sup>h</sup>	00:35	12:01	20:32	08:11		
2	209°49.5	21.2	79°32.6	14.5'	09°59.0	-8.0'	54.2'		00 <sup>h</sup>	00:47	12:01	21:16	08:54		
3	224°49.3	.. 21.3	94°06.1	14.5'	10°07.0	-8.0'	54.2'		mm:ss	mm:ss	hh:mm	hh:mm	hh:mm		
4	239°49.2	21.4	108°39.6	14.4'	10°15.0	-8.0'	54.2'		14:16	14:57	14:57	01:31	02:32	03:33	
5	254°49.1	21.5	123°13.0	14.4'	10°22.9	-7.9'	54.2'		14:30	15:15	15:15	01:32	02:35	03:37	
6	269°48.9	N23°21.5	137°46.4	14.4'	S10°30.8	-7.9'	54.2'		14:43	15:38	15:58	01:33	02:38	03:42	
7	284°48.8	21.6	152°19.8	14.3'	10°38.7	-7.8'	54.2'		14:56	15:46	15:40	01:34	02:41	03:46	
8	299°48.7	21.7	166°53.1	14.3'	10°46.5	-7.8'	54.2'		15:10	15:57	15:53	01:34	02:44	03:52	
9	314°48.5	.. 21.8	181°26.4	14.3'	10°54.3	-7.8'	54.2'		15:24	16:05	16:05	01:35	02:50	03:58	
10	329°48.4	21.9	195°59.7	14.2'	11°02.0	-7.7'	54.2'		15:38	16:10	16:10	01:36	02:54	04:00	
11	344°48.3	21.9	210°32.9	14.2'	11°09.7	-7.7'	54.2'		15:52	16:15	16:15	01:37	02:57	04:06	
12	359°48.1	N23°22.0	225°06.1	14.2'	S11°17.3	-7.6'	54.2'		16:06	16:32	13:41	01:37	02:48	03:58	
13	14°48.0	22.1	239°39.2	14.1'	11°24.9	-7.6'	54.2'								
14	29°47.9	22.2	254°12.4	14.1'	11°32.5	-7.5'	54.2'								
15	44°47.7	.. 22.2	268°45.5	14.1'	11°40.0	-7.5'	54.2'								
16	59°47.6	22.3	283°18.5	14.0'	11°47.4	-7.4'	54.2'								
17	74°47.5	22.4	297°51.5	14.0'	11°54.8	-7.4'	54.2'								
18	89°47.3	N23°22.5	312°24.5	14.0'	S12°02.2	-7.3'	54.2'		</td						

## June 17, 18, 19 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	265°40.7	176°46.7	N23°49.3	34°25.8	S21°01.5	98°39.2	N06°54.1	14°48.3	S20°28.4					Alpheratz	357°41.4	
1	280°43.2	191°45.8	49.4	49°28.7	01.4	113°41.5	54.0	29°50.9	28.3					Ankaa	353°13.9	
2	295°45.6	206°44.9	49.5	64°31.6	01.4	128°43.7	53.9	44°53.6	28.3					Schedar	349°38.2	
3	310°48.1	221°44.0	49.6	79°34.6	01.4	143°45.9	53.8	59°56.2	28.3					Diphda	348°54.0	
4	325°50.6	236°43.1	49.7	94°37.5	01.3	158°48.1	53.7	74°58.9	28.3					Achernar	335°25.7	
5	340°53.0	251°42.2	49.9	109°40.5	01.3	173°50.3	53.6	90°01.5	28.3					Hamal	327°58.6	
6	355°55.5	266°41.3	N23°50.0	124°43.4	S21°01.3	188°52.6	N06°53.4	105°04.2	S20°28.3					Polaris	317°09.2	
7	10°58.0	281°40.4	50.1	139°46.3	01.2	203°54.8	53.3	120°06.8	28.2					Acamar	315°17.2	
8	26°00.4	296°39.5	50.2	154°49.3	01.2	218°57.0	53.2	135°09.5	28.2					Menkar	314°13.2	
9	41°02.9	311°38.6	50.3	169°52.2	01.2	233°59.2	53.1	150°12.1	28.2					Mirfak	308°37.8	
10	56°05.4	326°37.7	50.4	184°55.1	01.2	249°01.4	53.0	165°14.8	28.2					Aldebaran	290°47.4	
11	71°07.8	341°36.9	50.5	199°58.1	01.1	264°03.7	52.9	180°17.4	28.2					Rigel	281°10.5	
12	86°10.3	356°36.0	N23°50.6	215°01.0	S21°01.1	279°05.9	N06°52.8	195°20.1	S20°28.1					Capella	280°31.9	
13	101°12.8	11°35.1	50.7	230°03.9	01.1	294°08.1	52.7	210°22.7	28.1					Bellatrix	278°30.2	
14	116°15.2	26°34.2	50.8	245°06.8	01.0	309°10.3	52.6	225°25.4	28.1					Elnath	278°10.4	
15	131°17.7	41°33.3	50.9	260°09.8	01.0	324°12.5	52.5	240°28.0	28.1					Alnilam	275°44.7	
16	146°20.1	56°32.4	51.0	275°12.7	01.0	339°14.8	52.3	255°30.7	28.1					Betelgeuse	270°59.5	
17	161°22.6	71°31.5	51.1	290°15.6	00.9	354°17.0	52.2	270°33.3	28.0					Canopus	263°55.8	
18	176°25.1	86°30.6	N23°51.2	305°18.5	S21°00.9	9°19.2	N06°52.1	285°36.0	S20°28.0					Sirius	258°32.3	
19	191°27.5	101°29.7	51.3	320°21.4	00.9	24°21.4	52.0	300°38.6	28.0					Adhara	255°11.3	
20	206°30.0	116°28.8	51.4	335°24.4	00.9	39°23.6	51.9	315°41.3	28.0					Procyon	244°57.9	
21	221°32.5	131°27.9	51.5	350°27.3	00.8	54°25.8	51.8	330°43.9	28.0					Pollux	243°25.6	
22	236°34.9	146°27.0	51.6	5°30.2	00.8	69°28.1	51.7	345°46.6	28.0					Avior	234°17.6	
23	251°37.4	161°26.1	51.7	20°33.1	00.8	84°30.3	51.6	0°49.2	27.9					Suhail	222°51.2	
Mer.pass.:06:16			v-0.9 d0.1 m-3.8			v2.9 d0.0 m-1.8			v2.2 d-0.1 m-1.8			v2.7 d0.0 m0.1				
Sat			GHA			GHA			GHA			GHA				
0	266°39.9	176°25.2	N23°51.8	35°36.0	S21°00.7	99°32.5	N06°51.5	15°51.9	S20°27.9					Denebola	182°31.6	
1	281°42.3	191°24.3	51.9	50°38.9	00.7	114°34.7	51.3	30°54.5	27.9					Gienah	175°50.2	
2	296°44.8	206°23.4	52.0	65°41.8	00.7	129°36.9	51.2	45°57.2	27.9					Acrux	173°06.7	
3	311°47.3	221°22.6	52.0	80°44.7	00.7	144°39.1	51.1	60°59.8	27.9					Gacrux	171°58.4	
4	326°49.7	236°21.7	52.1	95°47.6	00.6	159°41.4	51.0	76°02.5	27.8					Alioth	166°18.9	
5	341°52.2	251°20.8	52.2	110°50.5	00.6	174°43.6	50.9	91°05.1	27.8					Spica	158°29.0	
6	356°54.6	266°19.9	N23°52.3	125°53.4	S21°00.6	189°45.8	N06°50.8	106°07.8	S20°27.8					Alkaid	152°57.1	
7	11°57.1	281°19.0	52.4	140°56.3	00.6	204°48.0	50.7	121°10.4	27.8					Hadar	148°44.5	
8	26°59.6	296°18.1	52.5	155°59.2	00.5	219°50.2	50.6	136°13.1	27.8					Menkent	148°04.9	
9	42°02.0	311°17.2	52.5	171°02.1	00.5	234°52.4	50.5	151°15.7	27.8					Arcturus	145°53.7	
10	57°04.5	326°16.3	52.6	186°05.0	00.5	249°54.7	50.3	166°18.4	27.7					Rigel Kent.	139°48.4	
11	72°07.0	341°15.4	52.7	201°07.9	00.4	264°56.9	50.2	181°21.0	27.7					Kochab	137°19.4	
12	87°09.4	356°14.5	N23°52.8	216°10.8	S21°00.4	279°59.1	N06°50.1	196°23.7	S20°27.7					Zuben 'ubi	137°02.9	
13	102°11.9	11°13.6	52.9	231°13.7	00.4	295°01.3	50.0	211°26.3	27.7					Alphecca	126°09.0	
14	117°14.4	26°12.7	52.9	246°16.6	00.4	310°03.5	49.9	226°29.0	27.7					Antares	112°23.4	
15	132°16.8	41°11.8	53.0	261°19.5	00.3	325°05.7	49.8	241°31.6	27.7					Atria	107°22.8	
16	147°19.3	56°10.9	53.1	276°22.4	00.3	340°07.9	49.7	256°34.3	27.6					Sabik	102°09.9	
17	162°21.7	71°10.0	53.1	291°25.3	00.3	355°10.1	49.6	271°36.9	27.6					Rasalhague	96°04.2	
18	177°24.2	86°09.1	N23°53.2	306°28.1	S21°00.3	10°12.4	N06°49.4	286°39.6	S20°27.6					Eltanin	90°44.7	
19	192°26.7	101°08.2	53.3	321°31.0	00.3	25°14.6	49.3	301°42.2	27.6					Kaus Aust.	83°40.7	
20	207°29.1	116°07.3	53.3	336°33.9	00.2	40°16.8	49.2	316°44.9	27.6					Vega	80°37.2	
21	222°31.6	131°06.4	53.4	351°36.8	00.2	55°19.0	49.1	331°47.5	27.5					Nunki	75°55.5	
22	237°34.1	146°05.5	53.5	6°39.7	00.2	70°21.2	49.0	346°50.2	27.5					Altair	62°06.0	
23	252°36.5	161°04.7	53.5	21°42.5	00.2	85°23.4	48.9	1°52.8	27.5					Peacock	53°15.7	
Mer.pass.:06:12			v-0.9 d0.1 m-3.8			v2.9 d0.0 m-1.7			v2.2 d-0.1 m-1.8			v2.6 d0.0 m0.1				
Sun			GHA			GHA			GHA			GHA				
0	267°39.0	176°03.8	N23°53.6	36°45.4	S21°00.1	100°25.6	N06°48.8	16°55.5	S20°27.5					Jun 17 Fri	SHA	Mer.pass
1	282°41.5	191°02.9	53.7	51°48.3	00.1	115°27.8	48.6	31°58.1	27.5					Venus	271°06.0	12:14
2	297°43.9	206°02.0	53.7	66°51.2	00.1	130°30.1	48.5	47°00.8	27.5					Mars	128°45.0	21:38
3	312°46.4	221°01.1	53.8	81°54.0	00.1	145°32.3	48.4	62°03.4	27.4					Jupiter	192°58.5	17:23
4	327°48.9	236°00.2	53.8	96°56.9	00.0	160°34.5	48.3	77°06.1	27.4					Saturn	109°07.6	22:57
5	342°51.3	250°59.3	53.9	111°59.8	00.0	175°36.7	48.2	92°08.7	27.4							
6	357°53.8	265°58.4	N23°53.9	127°02.6	S21°00.0	190°38.9	N06°48.1	107°11.4	S20°27.4					Jun 18 Sat	SHA	Mer.pass
7	12°56.2	280°57.5	54.0	142°05.5	00.0	205°41.1	48.0	122°14.0	27.4					Venus	269°45.4	12:15
8	27°58.7	295°56.6	54.0	157°08.4	00.0	220°43.3	47.8	137°16.7	27.3					Mars	128°56.1	21:33
9	43°01.2	310°55.7	54.1	172°11.2	00.0	235°45.5	47.7	152°19.3	27.3					Jupiter	192°52.6	17:19
10	58°03.6	325°54.8	54.1	187°14.1	00.0	250°47.7	47.6	167°22.0	27.3					Saturn	109°12.0	22:53
11	73°06.1	340°53.9	54.2	202°16.9	00.0	265°49.9	47.5	182°24.6	27.3							
12	88°08.6	355°53.0	N23°54.2	217°19.8	S20°59.9	280°52.2	N06°47.4	197°27.2	S20°27.3					Jun 19 Sun	SHA	Mer.pass
13	103°11.0	10°52.1	54.3	232°22.7	59.9	295°54.4	47.3	212°29.9	27.3					Venus	268°24.8	12:16
14	118°13.5	25°51.2	54.3	247°25.5	59.8	310°56.6	47.2	227°32.5	27.2					Mars	129°06.4	21:29
15	133°16.0	40°50.3	54.4	262°28.4	59.8	325°58.8	47.0	242°35.2	27.2					Jupiter	192°46.6</	

DUT1 = UT1-UTC = -0.2003 sec ΔT = TT-UT1 = +68.3843 sec

2016 June 17 to Jun. 19 UT

h		Sun		Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°46.5	N23°22.9	39°41.6	13.7'	\$12°45.3	-7.0'	54.3'
1	194°46.4	22.9	54°14.3	13.7'	12°52.3	-7.0'	54.3'
2	209°46.2	23.0	68°47.0	13.7'	12°59.2	-6.9'	54.3'
3	224°46.1	.. 23.1	83°19.7	13.6'	13°06.1	-6.9'	54.3'
4	239°46.0	23.1	97°52.3	13.6'	13°13.0	-6.8'	54.3'
5	254°45.8	23.2	112°24.8	13.5'	13°19.8	-6.8'	54.3'
6	269°45.7	N23°23.3	126°57.3	13.5'	\$13°26.5	-6.7'	54.3'
7	284°45.6	23.3	141°29.8	13.5'	13°33.2	-6.7'	54.3'
8	299°45.4	23.4	156°02.2	13.4'	13°39.8	-6.6'	54.4'
9	314°45.3	.. 23.5	170°34.6	13.4'	13°46.4	-6.5'	54.4'
10	329°45.2	23.5	185°07.0	13.3'	13°52.9	-6.5'	54.4'
11	344°45.0	23.6	199°39.3	13.3'	13°59.3	-6.4'	54.4'
12	359°44.9	N23°23.6	214°11.6	13.2'	\$14°05.7	-6.4'	54.4'
13	14°44.8	23.7	228°43.8	13.2'	14°12.1	-6.3'	54.4'
14	29°44.6	23.8	243°16.0	13.2'	14°18.3	-6.2'	54.4'
15	44°44.5	.. 23.8	257°48.1	13.1'	14°24.5	-6.2'	54.4'
16	59°44.4	23.9	272°20.2	13.1'	14°30.7	-6.1'	54.4'
17	74°44.2	23.9	286°52.3	13.0'	14°36.8	-6.1'	54.5'
18	89°44.1	N23°24.0	301°24.3	13.0'	\$14°42.8	-6.0'	54.5'
19	104°44.0	24.0	315°56.3	13.0'	14°48.8	-5.9'	54.5'
20	119°43.8	24.1	330°28.2	12.9'	14°54.7	-5.9'	54.5'
21	134°43.7	.. 24.1	345°00.1	12.9'	15°00.5	-5.8'	54.5'
22	149°43.6	24.2	359°31.9	12.8'	15°06.3	-5.7'	54.5'
23	164°43.4	24.2	14°03.7	12.8'	15°12.0	-5.7'	54.5'
	SD.=15.7	d=0.1			S.D.=14.8		

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

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	Mer.Pass.		Mer.Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm	12-14 92-99%
17	00:54	01:00	12:01	22:02	09:39
18	01:07	01:13	12:01	22:49	10:25
19	01:20	01:26	12:01	23:39	11:14

SD.=15.7	d=0.0	S.D.=15.0
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## June 20, 21, 22 UT (Mon., Tue., Wed.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	268°38.1	175°42.3	N23°54.7	37°54.0	S20°59.7	101°18.6	N06°46.0	17°59.0	S20°27.1								Alpheratz	357°41.3	29°10.7				
1	283°40.6	190°41.4		54.7	52°56.8	59.7	116°20.9	45.9	33°01.7							Ankaa	353°13.8	-42°12.8					
2	298°43.1	205°40.5		54.7	67°59.6	59.6	131°23.1	45.8	48°04.3							Schedar	349°38.2	56°37.3					
3	313°45.5	220°39.6		· · 54.8	83°02.5	· · 59.6	146°25.3	· · 45.7	63°07.0							Diphda	348°53.9	-17°53.7					
4	328°48.0	235°38.7		54.8	98°05.3	59.6	161°27.5	45.5	78°09.6							Achernar	335°25.6	-57°09.0					
5	343°50.5	250°37.8		54.8	113°08.1	59.6	176°29.7	45.4	93°12.3							Hamal	327°58.6	23°32.2					
6	358°52.9	265°36.9	N23°54.9	128°11.0	S20°59.6	191°31.9	N06°45.3	108°14.9	S20°27.0							Polaris	317°08.0	89°19.7					
7	13°55.4	280°36.0		54.9	143°13.8	59.6	206°34.1	45.2	123°17.5							Acamar	315°17.2	-40°14.3					
8	28°57.9	295°35.1		54.9	158°16.6	59.5	221°36.3	45.1	138°20.2							Menkar	314°13.2	4°09.1					
9	44°00.3	310°34.2		· · 54.9	173°19.5	· · 59.5	236°38.5	· · 45.0	153°22.8							Mirfak	308°37.8	49°54.8					
10	59°02.8	325°33.3		54.9	188°22.3	59.5	251°40.7	44.8	168°25.5							Aldebaran	290°47.4	16°32.3					
11	74°05.2	340°32.4		55.0	203°25.1	59.5	266°42.9	44.7	183°28.1							Rigel	281°10.4	-8°11.2					
12	89°07.7	355°31.5	N23°55.0	218°27.9	S20°59.5	281°45.1	N06°44.6	198°30.8	S20°26.9							Capella	280°31.9	46°00.6					
13	104°10.2	10°30.6		55.0	233°30.7	59.5	296°47.3	44.5	213°33.4							Bellatrix	278°30.2	6°21.6					
14	119°12.6	25°29.7		55.0	248°33.6	59.5	311°49.5	44.4	228°36.1							Elnath	278°10.4	28°37.0					
15	134°15.1	40°28.8		· · 55.0	263°36.4	· · 59.4	326°51.7	· · 44.3	243°38.7							Alnilam	275°44.6	-1°11.7					
16	149°17.6	55°27.9		55.0	278°39.2	59.4	341°53.9	44.1	258°41.4							Betelgeuse	270°59.4	7°24.4					
17	164°20.0	70°27.0		55.0	293°42.0	59.4	356°56.1	44.0	273°44.0							Canopus	263°55.8	-52°42.5					
18	179°22.5	85°26.1	N23°55.0	308°44.8	S20°59.4	11°58.3	N06°43.9	288°46.7	S20°26.9							Sirius	258°32.3	-16°44.6					
19	194°25.0	100°25.2		55.1	323°47.6	59.4	27°00.5	43.8	303°49.3							Adhara	255°11.3	-28°59.9					
20	209°27.4	115°24.3		55.1	338°50.4	59.4	42°02.7	43.7	318°51.9							Procyon	244°57.9	5°10.8					
21	224°29.9	130°23.4		· · 55.1	353°53.3	· · 59.4	57°04.9	· · 43.6	333°54.6							Pollux	243°25.6	27°59.0					
22	239°32.4	145°22.5		55.1	8°56.1	59.4	72°07.1	43.4	348°57.2							Avior	234°17.6	-59°34.1					
23	254°34.8	160°21.6		55.1	23°58.9	59.3	87°09.3	43.3	3°59.9							Suhail	222°51.2	-43°30.2					
Mer.pass.:06:04				v-0.9 d0.0 m-3.8				v2.8 d0.0 m-1.7				v2.2 d-0.1 m-1.8				v2.6 d0.0 m0.1							
Tue	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	269°37.3	175°20.7	N23°55.1	39°01.7	S20°59.3	102°11.5	N06°43.2	19°02.5	S20°26.6							Denebola	182°31.6	14°28.9					
1	284°39.7	190°19.8		55.1	54°04.5	59.3	117°13.7	43.1	34°05.2							Gienah	175°50.2	-17°38.1					
2	299°42.2	205°18.9		55.1	69°07.3	59.3	132°15.9	43.0	49°07.8							Acrux	173°06.8	-63°11.7					
3	314°44.7	220°18.0		· · 55.1	84°10.1	· · 59.3	147°18.1	· · 42.9	64°10.5							Gacrux	171°58.4	-57°12.5					
4	329°47.1	235°17.1		55.1	99°12.9	59.3	162°20.3	42.7	79°13.1							Alioth	166°18.9	55°52.6					
5	344°49.6	250°16.2		55.1	114°15.7	59.3	177°22.5	42.6	94°15.8							Spica	158°29.0	-11°14.8					
6	359°52.1	265°15.3	N23°55.1	129°18.5	S20°59.3	192°24.7	N06°42.5	109°18.4	S20°26.5							Alkaid	152°57.2	49°14.2					
7	14°54.5	280°14.5		55.1	144°21.3	59.3	207°26.9	42.4	124°21.0							Hadar	148°44.5	-60°27.2					
8	29°57.0	295°13.6		55.1	159°24.0	59.3	222°29.1	42.3	139°23.7							Menkent	148°04.9	-36°27.1					
9	44°59.5	310°12.7		· · 55.0	174°26.8	· · 59.2	237°31.3	· · 42.1	154°26.3							Arcturus	145°53.7	19°06.0					
10	60°01.9	325°11.8		55.0	189°29.6	59.2	252°33.5	42.0	169°29.0							Rigel Kent.	139°48.4	-60°54.2					
11	75°04.4	340°10.9		55.0	204°32.4	59.2	267°35.7	41.9	184°31.6							Kochab	137°19.5	74°05.7					
12	90°06.8	355°10.0	N23°55.0	219°35.2	S20°59.2	282°37.9	N06°41.8	199°34.3	S20°26.4							Zuben' ubi	137°02.9	-16°06.5					
13	105°09.3	10°09.1		55.0	234°38.0	59.2	297°40.1	41.7	214°36.9							Alphecca	126°09.0	26°39.8					
14	120°11.8	25°08.2		55.0	249°40.8	59.2	312°42.3	41.5	229°39.6							Antares	112°23.4	-26°27.9					
15	135°14.2	40°07.3		· · 55.0	264°43.5	· · 59.2	327°44.5	· · 41.4	244°42.2							Atria	107°22.8	-69°03.3					
16	150°16.7	55°06.4		54.9	279°46.3	59.2	342°46.7	41.3	259°44.8							Sabik	102°09.9	-15°44.5					
17	165°19.2	70°05.5		54.9	294°49.1	59.2	357°48.9	41.2	274°47.5							Shaula	96°18.7	-37°06.7					
18	180°21.6	85°04.6	N23°54.9	309°51.9	S20°59.2	12°51.1	N06°41.1	289°50.1	S20°26.3							Rasalhague	96°04.2	12°33.1					
19	195°24.1	100°03.7		54.9	324°54.7	59.2	27°53.3	40.9	304°52.8							Eltanin	90°44.7	51°29.4					
20	210°26.6	115°02.8		54.9	339°57.4	59.2	42°55.5	40.8	319°55.4							Kaus Aust.	83°40.7	-34°22.3					
21	225°29.0	130°01.9		· · 54.8	355°00.2	· · 59.2	57°57.7	· · 40.7	334°58.1							Vega	80°37.1	38°48.1					
22	240°31.5	145°01.0		54.8	10°03.0	59.2	72°59.9	40.6	350°00.7							Nunki	75°55.4	-26°16.3					
23	255°34.0	160°00.1		54.8	25°05.7	59.2	88°02.1	40.5	5°03.4							Altair	62°05.9	8°54.9					
Mer.pass.:06:01				v-0.9 d0.0 m-3.8				v2.8 d0.0 m-1.7				v2.2 d-0.1 m-1.8				v2.6 d0.0 m0.1							
Wed	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	270°36.4	174°59.2	N23°54.8	40°08.5	S20°59.1	103°04.3	N06°40.4	20°06.0	S20°26.2							Jun 20 Mon	SHA	Mer.pass					
1	285°38.9	189°58.3		54.7	55°11.3	59.1	118°06.5	40.2	35°08.6							Venus	267°04.1	12:18					
2	300°41.3	204°57.4		54.7	70°14.0	59.1	133°08.7	40.1	50°11.3							Mars	129°15.8	21:24					
3	315°43.8	219°56.5		· · 54.7	85°16.8	· · 59.1	148°10.9	· · 40.0	65°13.9							Jupiter	192°40.5	17:12					
4	330°46.3	234°55.6		54.6	100°19.6	59.1	163°13.1	39.9	80°16.6							Saturn	109°20.9	22:44					
5	345°48.7	249°54.7		54.6	115°22.3	59.1	178°15.3	39.8	95°19.2														
6	0°51.2	264°53.8	N23°54.6	130°25.1	S20°59.1	193°17.5	N06°39.6	110°21.9	S20°26.1							Jun 21 Tue	SHA	Mer.pass					
7	15°53.7	279°52.9		54.5	145°27.8	59.1	208°19.7	39.5	125°24.5							Venus	265°43.4	12:19					
8	30°56.1	294°52.0		54.5	160°30.6	59.1	223°21.9	39.4	140°27.1							Mars	129°24.4	21:20					
9	45°58.6	309°51.1		· · 54.5	175°33.4	· · 59.1	238°24.1	· · 39.3	155°29.8							Jupiter	192°34.3	17:09					
10	61°01.1	324°50.2	</																				

DUT1 = UT1-UTC = -0.2029 sec ΔT = TT-UT1 = +68.3869 sec

2016 June 20 to Jun. 22 UT

h	Sun			Moon			
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°36.8	N23°25.9	5°09.8	10.8'	S18°19.6	-1.8'	55.3'
1	194°36.7	25.9	19°39.5	10.7'	18°21.4	-1.7'	55.3'
2	209°36.5	25.9	34°09.3	10.7'	18°23.0	-1.6'	55.3'
3	224°36.4	.. 25.9	48°39.0	10.7'	18°24.6	-1.5'	55.4'
4	239°36.3	26.0	63°08.6	10.6'	18°26.0	-1.4'	55.4'
5	254°36.1	26.0	77°38.3	10.6'	18°27.4	-1.3'	55.4'
6	269°36.0	N23°26.0	92°07.9	10.6'	S18°28.7	-1.2'	55.4'
7	284°35.9	26.0	106°37.4	10.6'	18°29.8	-1.1'	55.4'
8	299°35.7	26.0	121°07.0	10.5'	18°30.9	-1.0'	55.4'
9	314°35.6	.. 26.0	135°36.5	10.5'	18°31.9	-0.9'	55.5'
10	329°35.5	26.0	150°06.0	10.5'	18°32.8	-0.9'	55.5'
11	344°35.3	26.0	164°35.4	10.4'	18°33.6	-0.8'	55.5'
12	359°35.2	N23°26.0	179°04.8	10.4'	S18°34.3	-0.7'	55.5'
13	14°35.0	26.0	193°34.2	10.4'	18°34.9	-0.6'	55.5'
14	29°34.9	26.1	208°03.6	10.4'	18°35.5	-0.5'	55.6'
15	44°34.8	.. 26.1	222°33.0	10.3'	18°35.9	-0.4'	55.6'
16	59°34.6	26.1	237°02.3	10.3'	18°36.2	-0.3'	55.6'
17	74°34.5	26.1	251°31.6	10.3'	18°36.4	-0.2'	55.6'
18	89°34.4	N23°26.1	266°00.9	10.3'	S18°36.6	-0.1'	55.6'
19	104°34.2	26.1	280°30.1	10.2'	18°36.6	0.0'	55.7'
20	119°34.1	26.1	294°59.3	10.2'	18°36.6	0.1'	55.7'
21	134°34.0	.. 26.1	309°28.5	10.2'	18°36.4	0.2'	55.7'
22	149°33.8	26.1	323°57.7	10.2'	18°36.1	0.3'	55.7'
23	164°33.7	26.1	338°26.9	10.2'	18°35.8	0.4'	55.7'
	SD.=15.7	d=0.0			S.D.=15.1		
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°33.6	N23°26.1	352°56.0	10.1'	S18°35.4	0.5'	55.8'
1	194°33.4	26.1	7°25.2	10.1'	18°34.8	0.6'	55.8'
2	209°33.3	.. 26.1	21°54.3	10.1'	18°34.2	0.7'	55.8'
3	224°33.2	26.1	36°23.3	10.1'	18°33.4	0.8'	55.8'
4	239°33.0	26.1	50°52.4	10.1'	18°32.6	0.9'	55.8'
5	254°32.9	26.1	65°21.5	10.0'	18°31.7	1.0'	55.9'
6	269°32.8	N23°26.1	79°50.5	10.0'	S18°30.6	1.1'	55.9'
7	284°32.6	26.1	94°19.5	10.0'	18°29.5	1.2'	55.9'
8	299°32.5	26.0	108°48.5	10.0'	18°28.3	1.3'	55.9'
9	314°32.3	.. 26.0	123°17.5	10.0'	18°26.9	1.4'	55.9'
10	329°32.2	26.0	137°46.5	10.0'	18°25.5	1.5'	56.0'
11	344°32.1	26.0	152°15.4	9.9'	18°24.0	1.6'	56.0'
12	359°31.9	N23°26.0	166°44.3	9.9'	S18°22.4	1.7'	56.0'
13	14°31.8	26.0	181°13.3	9.9'	18°20.6	1.8'	56.0'
14	29°31.7	26.0	195°42.2	9.9'	18°18.8	1.9'	56.0'
15	44°31.5	.. 26.0	210°11.1	9.9'	18°16.9	2.0'	56.1'
16	59°31.4	26.0	224°40.0	9.9'	18°14.9	2.1'	56.1'
17	74°31.3	26.0	239°08.9	9.9'	18°12.8	2.2'	56.1'
18	89°31.1	N23°25.9	253°37.8	9.9'	S18°10.5	2.3'	56.1'
19	104°31.0	25.9	268°06.6	9.9'	18°08.2	2.4'	56.1'
20	119°30.9	25.9	282°35.5	9.9'	18°05.8	2.5'	56.2'
21	134°30.7	.. 25.9	297°04.3	9.8'	18°03.3	2.6'	56.2'
22	149°30.6	25.9	311°33.2	9.8'	18°00.7	2.7'	56.2'
23	164°30.5	25.9	326°02.0	9.8'	17°58.0	2.8'	56.2'
	SD.=15.7	d=0.0			S.D.=15.3		
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°30.3	N23°25.8	340°30.9	9.8'	S17°55.2	2.9'	56.2'
1	194°30.2	25.8	354°59.7	9.8'	17°52.3	3.0'	56.3'
2	209°30.1	25.8	9°28.5	9.8'	17°49.3	3.0'	56.3'
3	224°29.9	.. 25.8	23°57.3	9.8'	17°46.2	3.1'	56.3'
4	239°29.8	25.8	38°26.2	9.8'	17°43.0	3.2'	56.3'
5	254°29.7	25.7	52°55.0	9.8'	17°39.7	3.3'	56.3'
6	269°29.5	N23°25.7	67°23.8	9.8'	S17°36.3	3.4'	56.4'
7	284°29.4	25.7	81°52.6	9.8'	17°32.8	3.5'	56.4'
8	299°29.3	25.7	96°21.4	9.8'	17°29.2	3.6'	56.4'
9	314°29.1	.. 25.7	110°50.2	9.8'	17°25.5	3.7'	56.4'
10	329°29.0	25.6	125°19.0	9.8'	17°21.8	3.8'	56.5'
11	344°28.9	25.6	139°47.8	9.8'	17°17.9	3.9'	56.5'
12	359°28.7	N23°25.6	154°16.6	9.8'	S17°13.9	4.0'	56.5'
13	14°28.6	25.5	168°45.4	9.8'	17°09.9	4.1'	56.5'
14	29°28.5	25.5	183°14.3	9.8'	17°05.7	4.2'	56.5'
15	44°28.3	.. 25.5	197°43.1	9.8'	17°01.4	4.3'	56.6'
16	59°28.2	25.5	212°11.9	9.8'	16°57.1	4.4'	56.6'
17	74°28.0	25.4	226°40.7	9.8'	16°52.7	4.5'	56.6'
18	89°27.9	N23°25.4	241°09.5	9.8'	S16°48.1	4.6'	56.6'
19	104°27.8	25.4	255°38.4	9.8'	16°43.5	4.7'	56.6'
20	119°27.6	25.3	270°07.2	9.8'	16°38.8	4.8'	56.7'
21	134°27.5	.. 25.3	284°36.0	9.8'	16°33.9	4.9'	56.7'
22	149°27.4	25.3	299°04.9	9.8'	16°29.0	5.0'	56.7'
23	164°27.2	25.2	313°33.7	9.9'	16°24.0	5.0'	56.7'
	SD.=15.7	d=0.0			S.D.=15.4		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	[■]	[■]	[■]	[■]	[■]	[■]
N 70°	[■]	[■]	[■]	[■]	[■]	[■]
68°	[■]	[■]	[■]	[■]	[■]	[■]
66°	[■]	[■]	[■]	[■]	[■]	[■]
64°	[■]	[■]	01:31	22:32	[■]	[■]
62°	[■]	[■]	02:09	21:54	[■]	[■]
60°	[■]	00:49	02:36	21:28	23:14	[■]
N 58°	[■]	01:41	02:56	21:07	22:23	[■]
56°	[■]	02:11	03:13	20:50	21:53	[■]
54°	00:45	02:33	03:28	20:36	21:31	23:18
52°	01:32	02:51	03:40	20:24	21:13	22:31
50°	02:00	03:06	03:51	20:13	20:58	22:03
48°	02:46	03:36	04:13	19:50	20:28	21:18
N 40°	03:17	03:59	04:31	19:32	20:05	20:47
35°	03:40	04:17	04:46	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°	04:50	05:18	05:41	18:23	18:46	19:13
0°	05:09	05:36	05:58	18:06	18:28	18:54
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	08:33	15:30	16:18	17:07
58°	07:04	07:56	08:48	15:15	16:08	17:00
S 60°	07:11	08:08	09:06	14:58	15:56	16:53

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

## June 23, 24, 25 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	271°35.6	174°37.7	N23°53.7	41°14.5	S20°59.1	103°57.0	N06°37.4	21°09.4	S20°25.8					Alpheratz	357°41.3	29°10.7	
1	286°38.0	189°36.8	53.7	56°17.2	59.1	118°59.2	37.3	36°12.1	25.8					Ankaa	353°13.8	-42°12.8	
2	301°40.5	204°35.9	53.6	71°19.9	59.1	134°01.3	37.2	51°14.7	25.8					Schedar	349°38.1	56°37.3	
3	316°43.0	219°35.0	· · 53.6	86°22.7	· · 59.1	149°03.5	· · 37.1	66°17.3	· · 25.8					Diphda	348°53.9	-17°53.7	
4	331°45.4	234°34.1	53.5	101°25.4	59.1	164°05.7	37.0	81°20.0	25.8					Achernar	335°25.6	-57°09.0	
5	346°47.9	249°33.2	53.4	116°28.1	59.1	179°07.9	36.8	96°22.6	25.7					Hamal	327°58.6	23°32.2	
6	1°50.3	264°32.3	N23°53.4	131°30.8	S20°59.1	194°10.1	N06°36.7	111°25.3	S20°25.7					Polaris	317°06.8	89°19.6	
7	16°52.8	279°31.4	53.3	146°33.6	59.1	209°12.3	36.6	126°27.9	25.7					Acamar	315°17.1	-40°14.3	
8	31°55.3	294°30.5	53.2	161°36.3	59.1	224°14.5	36.5	141°30.6	25.7					Menkar	314°13.1	4°09.1	
9	46°57.7	309°29.6	· · 53.2	176°39.0	· · 59.1	239°16.7	· · 36.3	156°33.2	· · 25.7					Mirfak	308°37.7	49°54.8	
10	62°00.2	324°28.7	53.1	191°41.7	59.1	254°18.9	36.2	171°35.8	25.7					Aldebaran	290°47.3	16°32.3	
11	77°02.7	339°27.8	53.0	206°44.4	59.1	269°21.1	36.1	186°38.5	25.6					Rigel	281°10.4	-8°11.2	
12	92°05.1	354°27.0	N23°53.0	221°47.1	S20°59.1	284°23.2	N06°36.0	201°41.1	S20°25.6					Capella	280°31.9	46°00.6	
13	107°07.6	9°26.1	52.9	236°49.9	59.1	299°25.4	35.9	216°43.8	25.6					Bellatrix	278°30.2	6°21.6	
14	122°10.1	24°25.2	52.8	251°52.6	59.1	314°27.6	35.7	231°46.4	25.6					Elnath	278°10.4	28°37.0	
15	137°12.5	39°24.3	· · 52.7	266°55.3	· · 59.2	329°29.8	· · 35.6	246°49.0	· · 25.6					Alnilam	275°44.6	-1°11.7	
16	152°15.0	54°23.4	52.7	281°58.0	59.2	344°32.0	35.5	261°51.7	25.6					Betelgeuse	270°59.4	7°24.4	
17	167°17.4	69°22.5	52.6	297°00.7	59.2	359°34.2	35.4	276°54.3	25.5					Canopus	263°55.8	-52°42.5	
18	182°19.9	84°21.6	N23°52.5	312°03.4	S20°59.2	14°36.4	N06°35.2	291°57.0	S20°25.5					Sirius	258°32.3	-16°44.5	
19	197°22.4	99°20.7	52.4	327°06.1	59.2	298°38.6	35.1	306°59.6	25.5					Adhara	255°11.3	-28°59.9	
20	212°24.8	114°19.8	52.3	342°08.8	59.2	44°40.7	35.0	322°02.2	25.5					Procyon	244°57.9	5°10.8	
21	227°27.3	129°18.9	· · 52.3	357°11.5	· · 59.2	59°42.9	· · 34.9	337°04.9	· · 25.5					Pollux	243°25.6	27°59.0	
22	242°29.8	144°18.0	52.2	12°14.2	59.2	74°45.1	34.7	352°07.5	25.5					Avior	234°17.7	-59°34.0	
23	257°32.2	159°17.1	52.1	27°16.9	59.2	89°47.3	34.6	7°10.2	25.4					Suhail	222°51.2	-43°30.2	
Mer.pass.:05:53			v-0.9 d-0.1 m-3.8			v2.7 d-0.0 m-1.6			v2.2 d-0.1 m-1.8			v2.6 d0.0 m0.1					
Fri			GHA			GHA			GHA			GHA			GHA		
0	272°34.7	174°16.2	N23°52.0	42°19.6	S20°59.2	104°49.5	N06°34.5	22°12.8	S20°25.4					Denebola	182°31.6	14°28.9	
1	287°37.2	189°15.3	51.9	57°22.3	59.2	119°51.7	34.4	37°15.4	25.4					Gienah	175°50.2	-17°38.1	
2	302°39.6	204°14.4	51.8	72°25.0	59.2	134°53.9	34.2	52°18.1	25.4					Acrux	173°06.8	-63°11.7	
3	317°42.1	219°13.5	· · 51.7	87°27.7	· · 59.2	149°56.1	· · 34.1	67°20.7	· · 25.4					Gacrux	171°58.4	-57°12.5	
4	332°44.6	234°12.6	51.6	102°30.4	59.2	164°58.2	34.0	82°23.4	25.4					Alioth	166°18.9	55°52.6	
5	347°47.0	249°11.7	51.5	117°33.0	59.3	180°00.4	33.9	97°26.0	25.3					Spica	158°29.0	-11°14.8	
6	2°49.5	264°10.9	N23°51.4	132°35.7	S20°59.3	195°02.6	N06°33.7	112°28.6	S20°25.3					Alkaid	152°57.2	49°14.2	
7	17°51.9	279°10.0	51.4	147°38.4	59.3	210°04.8	33.6	127°31.3	25.3					Hadar	148°44.5	-60°27.3	
8	32°54.4	294°09.1	51.3	162°41.1	59.3	225°07.0	33.5	142°33.9	25.3					Menkent	148°04.9	-36°27.1	
9	47°56.9	309°08.2	· · 51.2	177°43.8	· · 59.3	240°09.2	· · 33.4	157°36.6	· · 25.3					Arcturus	145°53.7	19°06.0	
10	62°59.3	324°07.3	51.1	192°46.5	59.3	255°11.3	33.3	172°39.2	25.3					Rigel Kent.	139°48.4	-60°54.2	
11	78°01.8	339°06.4	51.0	207°49.1	59.3	270°13.5	33.1	187°41.8	25.2					Kochab	137°19.5	74°05.7	
12	93°04.3	354°05.5	N23°50.9	222°51.8	S20°59.3	285°15.7	N06°33.0	202°44.5	S20°25.2					Zuben 'ubi	137°02.9	-16°06.5	
13	108°06.7	9°04.6	50.8	237°54.5	59.3	300°17.9	32.9	217°47.1	25.2					Alphecca	126°09.0	26°39.8	
14	123°09.2	24°03.7	50.7	252°57.2	59.3	315°20.1	32.8	232°49.8	25.2					Antares	112°23.4	-26°27.9	
15	138°11.7	39°02.8	· · 50.5	267°59.8	· · 59.4	330°22.3	· · 32.6	247°52.4	· · 25.2					Atria	107°22.8	-69°03.3	
16	153°14.1	54°01.9	50.4	283°02.5	59.4	345°24.4	32.5	262°55.0	25.2					Sabik	102°09.9	-15°44.5	
17	168°16.6	69°01.0	50.3	298°05.2	59.4	0°26.6	32.4	277°57.7	25.1					Rasalhague	96°04.2	12°33.1	
18	183°19.1	84°00.1	N23°50.2	313°07.9	S20°59.4	15°28.8	N06°32.2	293°00.3	S20°25.1					Eltanin	90°44.7	51°29.4	
19	198°21.5	98°59.2	50.1	328°10.5	59.4	30°31.0	32.1	308°02.9	25.1					Kaus Aust.	83°40.7	-34°22.3	
20	213°24.0	113°58.3	50.0	343°13.2	59.4	45°33.2	32.0	323°05.6	25.1					Vega	80°37.1	38°48.1	
21	228°26.4	128°57.5	· · 49.9	358°15.8	· · 59.4	60°35.4	· · 31.9	338°08.2	· · 25.1					Nunki	75°55.4	-26°16.3	
22	243°28.9	143°56.6	49.8	13°18.5	59.4	75°37.5	31.7	353°10.9	25.1					Altair	62°05.9	8°54.9	
23	258°31.4	158°55.7	49.7	28°21.2	59.5	90°39.7	31.6	8°13.5	25.0					Peacock	53°15.6	-56°40.6	
Mer.pass.:05:49			v-0.9 d-0.1 m-3.8			v2.7 d-0.0 m-1.6			v2.2 d-0.1 m-1.8			v2.6 d0.0 m0.1					
Sat			GHA			GHA			GHA			GHA					
0	273°33.8	173°54.8	N23°49.5	43°23.8	S20°59.5	105°41.9	N06°31.5	23°16.1	S20°25.0					Jun 23 Thu	SHA	Mer.pass	
1	288°36.3	188°53.9	49.4	58°26.5	59.5	120°44.1	31.4	38°18.8	25.0					Venus	263°02.1	12:22	
2	303°38.8	203°53.0	49.3	73°29.1	59.5	135°46.3	31.2	53°21.4	25.0					Mars	129°38.9	21:11	
3	318°41.2	218°52.1	· · 49.2	88°31.8	· · 59.5	150°48.5	· · 31.1	68°24.0	· · 25.0					Jupiter	192°21.4	17:02	
4	333°43.7	233°51.2	49.1	103°34.5	59.5	165°50.6	31.0	83°26.7	25.0					Saturn	109°33.9	22:31	
5	348°46.2	248°50.3	48.9	118°37.1	59.5	180°52.8	30.9	98°29.3	25.0								
6	3°48.6	263°49.4	N23°48.8	133°39.8	S20°59.6	195°55.0	N06°30.7	113°32.0	S20°24.9					Jun 24 Fri	SHA	Mer.pass	
7	18°51.1	278°48.5	48.7	148°42.4	59.6	210°57.2	30.6	128°34.6	24.9					Venus	261°41.5	12:24	
8	33°53.6	293°47.6	48.6	163°45.0	59.6	225°59.4	30.5	143°37.2	24.9					Mars	129°44.9	21:07	
9	48°56.0	308°46.8	· · 48.4	178°47.7	· · 59.6	241°01.5	· · 30.4	158°39.9	· · 24.9					Jupiter	192°14.8	16:58	
10	63°58.5	323°45.9	48.3	193°50.3	59.6	256°03.7	30.2	173°42.5	24.9					Saturn	109°38.1	22:27	
11	79°00.9																

DUT1 = UT1-UTC = -0.2055 sec ΔT = TT-UT1 = +68.3895 sec

2016 June 23 to Jun. 25 UT

	Sun			Moon			
Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°27.1	N23°25.2	328°02.6	9.9'	S16°18.9	5.1'	56.7'
1	194°27.0	25.2	342°31.4	9.9'	16°13.7	5.2'	56.8'
2	209°26.8	25.1	357°00.3	9.9'	16°08.5	5.3'	56.8'
3	224°26.7	.. 25.1	11°29.2	9.9'	16°03.1	5.4'	56.8'
4	239°26.6	25.1	25°58.1	9.9'	15°57.6	5.5'	56.8'
5	254°26.4	25.0	40°27.0	9.9'	15°52.1	5.6'	56.9'
6	269°26.3	N23°25.0	54°55.9	9.9'	S15°46.4	5.7'	56.9'
7	284°26.2	24.9	69°24.8	9.9'	15°40.7	5.8'	56.9'
8	299°26.0	24.9	83°53.7	9.9'	15°34.9	5.9'	56.9'
9	314°25.9	.. 24.9	98°22.6	9.9'	15°29.0	5.9'	56.9'
10	329°25.8	24.8	112°51.6	9.9'	15°23.0	6.0'	57.0'
11	344°25.6	24.8	127°20.5	10.0'	15°16.9	6.1'	57.0'
12	359°25.5	N23°24.7	141°49.5	10.0'	S15°10.8	6.2'	57.0'
13	14°25.4	24.7	156°18.5	10.0'	15°04.5	6.3'	57.0'
14	29°25.2	24.6	170°47.4	10.0'	14°58.2	6.4'	57.0'
15	44°25.1	.. 24.6	185°16.4	10.0'	14°51.7	6.5'	57.1'
16	59°25.0	24.5	199°45.4	10.0'	14°45.2	6.6'	57.1'
17	74°24.8	24.5	214°14.4	10.0'	14°38.6	6.6'	57.1'
18	89°24.7	N23°24.4	228°43.5	10.0'	S14°32.0	6.7'	57.1'
19	104°24.6	24.4	243°12.5	10.0'	14°25.2	6.8'	57.1'
20	119°24.4	24.3	257°41.6	10.1'	14°18.3	6.9'	57.2'
21	134°24.3	.. 24.3	272°10.6	10.1'	14°11.4	7.0'	57.2'
22	149°24.2	24.2	286°39.7	10.1'	14°04.4	7.0'	57.2'
23	164°24.0	24.2	301°08.8	10.1'	13°57.3	7.1'	57.2'
	SD.=15.7	d=-0.0			S.D.=15.5		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Mer. Pass.	Upper	Age
	00 <sup>h</sup>	12 <sup>h</sup>	mm:ss	mm:ss	hh:mm	hh:mm
23	02:12	02:18		12:02	02:12	14:38
24	02:24	02:31		12:03	03:04	15:29
25	02:37	02:43		12:03	03:55	16:20

SD.=15.7	d=-0.1	S.D.=15.8
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## June 26, 27, 28 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	274°33.0	173°33.4	N23°46.4	44°27.2	S20°59.9	106°34.2	N06°28.4	24°19.4	S20°24.6	Alpheratz	357°41.3	29°10.7					
1	289°35.4	188°32.5	46.2	59°29.8	59.9	121°36.4	28.3	39°22.1	24.6	Ankaa	353°13.8	-42°12.8					
2	304°37.9	203°31.6	46.1	74°32.4	59.9	136°38.6	28.2	54°24.7	24.6	Schedar	349°38.1	56°37.3					
3	319°40.4	218°30.7	• 46.0	89°35.1	20°59.9	151°40.7	• 28.1	69°27.3	• 24.6	Diphda	348°53.9	-17°53.7					
4	334°42.8	233°29.8	45.8	104°37.7	21°00.0	166°42.9	27.9	84°30.0	24.6	Achernar	335°25.6	-57°09.0					
5	349°45.3	248°29.0	45.6	119°40.3	00.0	181°45.1	27.8	99°32.6	24.6	Hamal	327°58.6	23°32.2					
6	4°47.8	263°28.1	N23°45.5	134°42.9	S21°00.0	196°47.3	N06°27.7	114°35.2	S20°24.6	Polaris	317°05.8	89°19.6					
7	19°50.2	278°27.2	45.3	149°45.5	00.0	211°49.4	27.5	129°37.9	24.5	Acamar	315°17.1	-40°14.3					
8	34°52.7	293°26.3	45.2	164°48.1	00.0	226°51.6	27.4	144°40.5	24.5	Menkar	314°13.1	4°09.1					
9	49°55.2	308°25.4	• 45.0	179°50.7	• 00.1	241°53.8	• 27.3	159°43.1	• 24.5	Mirfak	308°37.7	49°54.8					
10	64°57.6	323°24.5	44.9	194°53.3	00.1	256°56.0	27.2	174°45.8	24.5	Aldebaran	290°47.3	16°32.3					
11	80°00.1	338°23.6	44.7	209°55.9	00.1	271°58.1	27.0	189°48.4	24.5	Rigel	281°10.4	-8°11.2					
12	95°02.5	353°22.7	N23°44.6	224°58.5	S21°00.1	287°00.3	N06°26.9	204°51.0	S20°24.5	Capella	280°31.9	46°00.6					
13	110°05.0	8°21.8	44.4	240°01.2	00.2	302°02.5	26.8	219°53.7	24.4	Bellatrix	278°30.1	6°21.6					
14	125°07.5	23°21.0	44.2	255°03.8	00.2	317°04.7	26.6	234°56.3	24.4	El Nath	278°10.4	28°37.0					
15	140°09.9	38°20.1	• 44.1	270°06.4	• 00.2	332°06.8	• 26.5	249°59.0	• 24.4	Alnilam	275°44.6	-1°11.7					
16	155°12.4	53°19.2	43.9	285°09.0	00.2	347°09.0	26.4	265°01.6	24.4	Betelgeuse	270°59.4	7°24.4					
17	170°14.9	68°18.3	43.7	300°11.5	00.3	2°11.2	26.3	280°04.2	24.4	Canopus	263°55.8	-52°42.5					
18	185°17.3	83°17.4	N23°43.6	315°14.1	S21°00.3	17°13.4	N06°26.1	295°06.9	S20°24.4	Sirius	258°32.3	-16°44.5					
19	200°19.8	98°16.5	43.4	330°16.7	00.3	32°15.5	26.0	310°09.5	24.3	Adhara	255°11.3	-28°59.9					
20	215°22.3	113°15.6	43.2	345°19.3	00.3	47°17.7	25.9	325°12.1	24.3	Procyon	244°57.9	5°10.8					
21	230°24.7	128°14.7	• 43.1	0°21.9	• 00.4	62°19.9	• 25.7	340°14.8	• 24.3	Pollux	243°25.6	27°59.0					
22	245°27.2	143°13.9	42.9	15°24.5	00.4	77°22.1	25.6	355°17.4	24.3	Avior	234°17.7	-59°34.0					
23	260°29.6	158°13.0	42.7	30°27.1	00.4	92°24.2	25.5	10°20.0	24.3	Suhail	222°51.2	-43°30.2					
Mer.pass.:05:41			v-0.9 d-0.1 m-3.8	v2.6 d-0.0 m-1.6	v2.2 d-0.1 m-1.8	v2.6 d0.0 m0.1	Miaplacidus			v2.1	v-0.9	d-0.2 m-3.8	v2.6 d-0.0 m-1.5	v2.2 d-0.1 m-1.7	v2.6 d0.0 m0.1		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	275°32.1	173°12.1	N23°42.5	45°29.7	S21°00.4	107°26.4	N06°25.3	25°22.7	S20°24.3	Denebola	183°31.7	14°28.9					
1	290°34.6	188°11.2	42.4	60°32.3	00.5	122°28.6	25.2	40°25.3	24.3	Gienah	175°50.2	-17°38.1					
2	305°37.0	203°10.3	42.2	75°34.9	00.5	137°30.7	25.1	55°27.9	24.2	Acrux	173°06.8	-63°11.7					
3	320°39.5	218°09.4	• 42.0	90°37.4	• 00.5	152°32.9	• 25.0	70°30.6	• 24.2	Gacrux	171°58.4	-57°12.5					
4	335°42.0	233°08.5	41.8	105°40.0	00.5	167°35.1	24.8	85°33.2	24.2	Alioth	166°18.9	55°52.6					
5	350°44.4	248°07.7	41.6	120°42.6	00.6	182°37.3	24.7	100°35.8	24.2	Spica	158°29.0	-11°14.8					
6	5°46.9	263°06.8	N23°41.5	135°45.2	S21°00.6	197°39.4	N06°24.6	115°38.5	S20°24.2	Alkaid	152°57.2	49°14.2					
7	20°49.4	278°05.9	41.3	150°47.7	00.6	212°41.6	24.4	130°41.1	24.2	Hadar	148°44.5	-60°27.3					
8	35°51.8	293°05.0	41.1	165°50.3	00.7	227°43.8	24.3	145°43.7	24.1	Menkent	148°04.9	-36°27.1					
9	50°54.3	308°04.1	• 40.9	180°52.9	• 00.7	242°45.9	• 24.2	160°46.4	• 24.1	Arcturus	145°53.7	19°06.1					
10	65°56.8	323°03.2	40.7	195°55.5	00.7	257°48.1	24.0	175°49.0	24.1	Rigel Kent.	139°48.4	-60°54.2					
11	80°59.2	338°02.3	40.5	210°58.0	00.8	272°50.3	23.9	190°51.6	24.1	Kochab	137°19.6	74°05.7					
12	96°01.7	353°01.5	N23°40.3	226°00.6	S21°00.8	287°52.4	N06°23.8	205°54.3	S20°24.1	Zuben' ubi	137°02.9	-16°06.5					
13	111°04.1	8°00.6	40.1	241°03.2	00.8	302°54.6	23.6	220°56.9	24.1	Alphecca	126°09.0	26°39.9					
14	126°06.6	22°59.7	40.0	256°05.7	00.8	317°56.8	23.5	235°59.5	24.1	Antares	112°23.4	-26°27.9					
15	141°09.1	37°58.8	• 39.8	271°08.3	• 00.9	332°59.0	• 23.4	251°02.2	• 24.0	Atria	107°22.8	-69°03.3					
16	156°11.5	52°57.9	39.6	286°10.9	00.9	348°01.1	23.3	266°04.8	24.0	Sabik	102°09.9	-15°44.5					
17	171°14.0	67°57.0	39.4	301°13.4	00.9	3°03.3	23.1	281°07.4	24.0	Rasalhague	96°04.2	12°33.1					
18	186°16.5	82°56.2	N23°39.2	316°16.0	S21°01.0	18°05.5	N06°23.0	296°10.1	S20°24.0	Eltanin	90°44.7	51°29.4					
19	201°18.9	97°55.3	39.0	331°18.5	01.0	33°07.6	22.9	311°12.7	24.0	Kaus Aust.	83°40.7	-34°22.3					
20	216°21.4	112°54.4	38.8	346°21.1	01.0	48°09.8	22.7	326°15.3	24.0	Vega	80°37.1	38°48.1					
21	231°23.9	127°53.5	• 38.6	1°23.7	• 01.1	63°12.0	• 22.6	341°17.9	• 23.9	Nunki	75°55.4	-26°16.3					
22	246°26.3	142°52.6	38.4	16°26.2	01.1	78°14.1	22.5	356°20.6	23.9	Altair	62°05.9	8°54.9					
23	261°28.8	157°51.7	38.2	31°28.8	01.1	93°16.3	22.3	11°23.2	23.9	Peacock	53°15.6	-56°40.6					
Mer.pass.:05:37			v-0.9 d-0.2 m-3.8	v2.6 d-0.0 m-1.5	v2.2 d-0.1 m-1.7	v2.6 d0.0 m0.1	Deneb			v2.1	v-0.9	d-0.2 m-3.8	v2.6 d-0.0 m-1.5	v2.2 d-0.1 m-1.7	v2.6 d0.0 m0.1		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	276°31.3	172°50.9	N23°38.0	46°31.3	S21°01.2	108°18.5	N06°22.2	26°25.8	S20°23.9	Jun 26 Sun	15°21.6	-29°31.9					
1	291°33.7	187°50.0	37.8	61°33.9	01.2	123°20.6	22.1	41°28.5	23.9	Venus	259°00.4	12:27					
2	306°36.2	202°49.1	37.6	76°36.4	01.2	138°22.8	21.9	56°31.1	23.9	Mars	129°54.2	20:59					
3	321°38.6	217°48.2	• 37.4	91°38.9	• 01.3	153°25.0	• 21.8	71°33.7	• 23.9	Jupiter	192°01.2	16:51					
4	336°41.1	232°47.3	37.1	106°41.5	01.3	168°27.1	21.7	86°36.4	23.8	Saturn	109°46.4	22:19					
5	351°43.6	247°46.5	36.9	121°44.0	01.3	183°29.3	21.5	101°39.0	23.8	Jun 27 Mon							
6	6°46.0	262°45.6	N23°36.7	136°46.6	S21°01.4	198°31.5	N06°21.4	116°41.6	S20°23.8	Venus	257°40.0	12:28					
7	21°48.5	277°44.7	36.5	151°49.1	01.4	213°33.6	21.3	131°44.3	23.8	Mars	129°57.6	20:54					
8	36°51.0	292°43.8	36.3	166°51.7	01.4	228°35.8	21.1	146°46.9	23.8	Jupiter	191°54.3	16:48					
9	51°53.4	307°42.9	• 36.1	181°54.2	• 01.5	243°38.0	• 21.0	161°49.5	• 23.8	Saturn	109°50.5	22:15					
10	66°55.9	322°42.0	35.9	196°56.7	01.5	258°40.1	20.9	176°52.2	23.7	Jun 28 Tue							
11	81°58.4	337°41.2	35.6	211°59.3	01.5	273°42.3	20.7	191°54.8	23.7	Venus	256°19.6	12:29					
12	97°00.8	352°40.3	N23°35.4	227°01.8	S21°01.6	288°44.5	N06°20.6	206°57.4	S20°23.7	Mars	130°00.1	20:50					
13	112°03.3	7°39.4	35.2	242°04.3	01.6	303°46.6	20.5	222°00.0	23.7	Jupiter	191°47.2	16:44					
14	127°05.7	22°38.5	35.0	257°06.8	01.7	318°48.8	20.3	237°02.7	23.7	Saturn	109°54.6	22:10					
15	142°08.2	37°37.6	• 34.8	272°09.4	• 01.7	333°51.0	• 20.2	252°05.3	• 23.7	Horizontal parallax							
16	157°10.7	52°36.8	34.5	287°11.9	01.7	348°53.1	20.1	267°07.9	23.7	Venus:	0.1						
17	172°13.1	67°35.9	34.3	302°14.4	01.8	3°55.3	19.9	282°10.6	23.6	Mars:	0.3						
18	187°15.6	82°35.0	N23°34.1	317°16.9	S21°01.8	18°57.4	N06°19.8	297°13.2	S20°23.6	Mer.pass.:05:33							
19	202°18.1	97°34.1	33.9	332°19.5</													

DUT1 = UT1-UTC = -0.2081 sec ΔT = TT-UT1 = +68.3921 sec

2016 June 26 to Jun. 28 UT

h	Sun			Moon			
Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	179°17.6	N23°20.8	291°07.9	10.6'	S06°45.2	10.2'	58.2'
1	194°17.5	20.7	305°37.5	10.6'	06°35.0	10.2'	58.3'
2	209°17.3	20.6	320°07.0	10.6'	06°24.7	10.3'	58.3'
3	224°17.2	.. 20.5	334°36.6	10.6'	06°14.4	10.3'	58.3'
4	239°17.1	20.4	349°06.2	10.6'	06°04.0	10.4'	58.3'
5	254°16.9	20.3	3°35.7	10.6'	05°53.7	10.4'	58.3'
6	269°16.8	N23°20.3	18°05.3	10.6'	S05°43.2	10.4'	58.4'
7	284°16.7	20.2	32°34.9	10.6'	05°32.8	10.5'	58.4'
8	299°16.5	20.1	47°04.4	10.6'	05°22.3	10.5'	58.4'
9	314°16.4	.. 20.0	61°34.0	10.6'	05°11.7	10.6'	58.4'
10	329°16.3	19.9	76°03.5	10.6'	05°01.1	10.6'	58.4'
11	344°16.1	19.8	90°33.1	10.6'	04°50.5	10.6'	58.5'
12	359°16.0	N23°19.7	105°02.7	10.6'	S04°39.9	10.7'	58.5'
13	14°15.9	19.6	119°32.2	10.5'	04°29.2	10.7'	58.5'
14	29°15.8	19.5	134°01.7	10.5'	04°18.5	10.7'	58.5'
15	44°15.6	.. 19.4	148°31.3	10.5'	04°07.8	10.8'	58.5'
16	59°15.5	19.3	163°00.8	10.5'	03°57.0	10.8'	58.6'
17	74°15.4	19.2	177°30.3	10.5'	03°46.2	10.8'	58.6'
18	89°15.2	N23°19.1	191°59.9	10.5'	S03°35.4	10.8'	58.6'
19	104°15.1	19.0	206°29.4	10.5'	03°24.5	10.9'	58.6'
20	119°15.0	18.9	220°58.9	10.5'	03°13.7	10.9'	58.6'
21	134°14.9	.. 18.8	235°28.4	10.5'	03°02.8	10.9'	58.7'
22	149°14.7	18.7	249°57.9	10.5'	02°51.9	10.9'	58.7'
23	164°14.6	18.6	264°27.3	10.5'	02°40.9	11.0'	58.7'
	SD.=15.7	d=-0.1			S.D.=15.9		

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°14.5	N23°18.5	278°56.8	10.5'	S02°30.0	11.0'	58.7'
1	194°14.3	18.4	293°26.3	10.4'	02°19.0	11.0'	58.7'
2	209°14.2	18.3	307°55.7	10.4'	02°08.0	11.0'	58.8'
3	224°14.1	.. 18.2	322°25.1	10.4'	01°56.9	11.0'	58.8'
4	239°13.9	18.1	336°54.6	10.4'	01°45.9	11.0'	58.8'
5	254°13.8	18.0	351°24.0	10.4'	01°34.8	11.1'	58.8'
6	269°13.7	N23°17.9	5°53.4	10.4'	S01°23.8	11.1'	58.8'
7	284°13.6	17.8	20°22.7	10.4'	01°12.7	11.1'	58.8'
8	299°13.4	17.6	34°52.1	10.4'	01°01.6	11.1'	58.9'
9	314°13.3	.. 17.5	49°21.4	10.3'	00°50.5	11.1'	58.9'
10	329°13.2	17.4	63°50.8	10.3'	00°39.3	11.1'	58.9'
11	344°13.0	17.3	78°20.1	10.3'	00°28.2	11.1'	58.9'
12	359°12.9	N23°17.2	92°49.4	10.3'	S00°17.1	11.1'	58.9'
13	14°12.8	17.1	107°18.6	10.3'	S00°05.9	11.2'	59.0'
14	29°12.7	17.0	121°47.9	10.2'	N00°05.2	11.2'	59.0'
15	44°12.5	.. 16.9	136°17.1	10.2'	00°16.4	11.2'	59.0'
16	59°12.4	16.7	150°46.3	10.2'	00°27.6	11.2'	59.0'
17	74°12.3	16.6	165°15.5	10.2'	00°38.8	11.2'	59.0'
18	89°12.1	N23°16.5	179°44.7	10.2'	N00°49.9	11.2'	59.0'
19	104°12.0	16.4	194°13.8	10.1'	01°01.1	11.2'	59.1'
20	119°11.9	16.3	208°42.9	10.1'	01°12.3	11.2'	59.1'
21	134°11.8	.. 16.2	223°12.0	10.1'	01°23.5	11.2'	59.1'
22	149°11.6	16.0	237°41.1	10.1'	01°34.7	11.2'	59.1'
23	164°11.5	15.9	252°10.2	10.0'	01°45.8	11.2'	59.1'
	SD.=15.7	d=-0.1			S.D.=16.1		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	179°11.4	N23°15.8	266°39.2	10.0'	N01°57.0	11.2'	59.1'
1	194°11.3	15.7	281°08.2	10.0'	02°08.2	11.2'	59.2'
2	209°11.1	15.6	295°37.1	10.0'	02°19.3	11.2'	59.2'
3	224°11.0	.. 15.4	310°06.1	9.9'	02°30.5	11.2'	59.2'
4	239°10.9	15.3	324°35.0	9.9'	02°41.6	11.1'	59.2'
5	254°10.7	15.2	339°03.9	9.9'	02°52.8	11.1'	59.2'
6	269°10.6	N23°15.1	353°32.7	9.8'	N03°03.9	11.1'	59.2'
7	284°10.5	14.9	8°01.5	9.8'	03°15.0	11.1'	59.3'
8	299°10.4	14.8	22°30.3	9.8'	03°26.1	11.1'	59.3'
9	314°10.2	.. 14.7	36°59.1	9.7'	03°37.2	11.1'	59.3'
10	329°10.1	14.6	51°27.8	9.7'	03°48.3	11.1'	59.3'
11	344°10.0	14.4	65°56.5	9.7'	03°59.3	11.1'	59.3'
12	359°09.9	N23°14.3	80°25.2	9.6'	N04°10.4	11.0'	59.3'
13	14°09.7	14.2	94°53.8	9.6'	04°21.4	11.0'	59.4'
14	29°09.6	14.0	109°22.4	9.6'	04°32.4	11.0'	59.4'
15	44°09.5	.. 13.9	123°50.9	9.5'	04°43.4	11.0'	59.4'
16	59°09.4	13.8	138°19.5	9.5'	04°54.4	11.0'	59.4'
17	74°09.2	13.6	152°47.9	9.5'	05°05.3	10.9'	59.4'
18	89°09.1	N23°13.5	167°16.4	9.4'	N05°16.2	10.9'	59.4'
19	104°09.0	13.4	181°44.8	9.4'	05°27.1	10.9'	59.4'
20	119°08.8	13.2	196°13.2	9.4'	05°38.0	10.9'	59.5'
21	134°08.7	.. 13.1	210°41.5	9.3'	05°48.8	10.8'	59.5'
22	149°08.6	13.0	225°09.8	9.3'	05°59.6	10.8'	59.5'
23	164°08.5	12.8	239°38.0	9.2'	06°10.4	10.8'	59.5'
	SD.=15.7	d=-0.1			S.D.=16.2		

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

## June 29, 30, 01 UT (Wed., Thu., Fri.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Week	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	277°30.4	172°29.7	N23°32.7	47°32.1	S21°02.0	109°10.4	N06°19.0	27°29.0	S20°23.5	Alpheratz	357°41.3	29°10.7					
1	292°32.9	187°28.9	32.5	62°34.6	02.1	124°12.6	18.9	42°31.6	23.5	Ankaa	353°13.7	-42°12.8					
2	307°35.3	202°28.0	32.2	77°37.1	02.1	139°14.8	18.7	57°34.2	23.5	Schedar	349°38.1	56°37.3					
3	322°37.8	217°27.1	.. 32.0	92°39.6	.. 02.2	154°16.9	.. 18.6	72°36.9	.. 23.5	Diphda	348°53.9	-17°53.7					
4	337°40.2	232°26.2	31.8	107°42.1	02.2	169°19.1	18.5	87°39.5	23.5	Achernar	335°25.5	-57°09.0					
5	352°42.7	247°25.3	31.5	122°44.6	02.2	184°21.2	18.3	102°42.1	23.5	Hamal	327°58.5	23°32.2					
6	7°45.2	262°24.5	N23°31.3	137°47.1	S21°02.3	199°23.4	N06°18.2	117°44.7	S20°23.4	Polaris	317°04.5	89°19.6					
7	22°47.6	277°23.6	31.0	152°49.6	02.3	214°25.6	18.1	132°47.4	23.4	Acamar	315°17.1	-40°14.3					
8	37°50.1	292°22.7	30.8	167°52.1	02.4	229°27.7	17.9	147°50.0	23.4	Menkar	314°13.1	4°09.1					
9	52°52.6	307°21.8	.. 30.6	182°54.6	.. 02.4	244°29.9	.. 17.8	162°52.6	.. 23.4	Mirfak	308°37.7	49°54.8					
10	67°55.0	322°21.0	30.3	197°57.1	02.4	259°32.0	17.7	177°55.3	23.4	Aldebaran	290°47.3	16°32.3					
11	82°57.5	337°20.1	30.1	212°59.6	02.5	274°34.2	17.5	192°57.9	23.4	Rigel	281°10.4	-8°11.1					
12	98°00.0	352°19.2	N23°29.8	228°02.1	S21°02.5	289°36.4	N06°17.4	208°00.5	S20°23.4	Capella	280°31.9	46°00.6					
13	113°02.4	7°18.3	29.6	243°04.6	02.6	304°38.5	17.3	223°03.1	23.3	Bellatrix	278°30.1	6°21.7					
14	128°04.9	22°17.5	29.3	258°07.1	02.6	319°40.7	17.1	238°05.8	23.3	Elnath	278°10.4	28°37.0					
15	143°07.4	37°16.6	.. 29.1	273°09.6	.. 02.7	334°42.8	.. 17.0	253°08.4	.. 23.3	Alnilam	275°44.6	-1°11.7					
16	158°09.8	52°15.7	28.8	288°12.1	02.7	349°45.0	16.9	268°11.0	23.3	Betelgeuse	270°59.4	7°24.4					
17	173°12.3	67°14.8	28.6	303°14.6	02.8	4°47.2	16.7	283°13.7	23.3	Canopus	263°55.8	-52°42.4					
18	188°14.7	82°14.0	N23°28.3	318°17.0	S21°02.8	19°49.3	N06°16.6	298°16.3	S20°23.4	Sirius	258°32.3	-16°44.5					
19	203°17.2	97°13.1	28.0	333°19.5	02.8	34°51.5	16.5	313°18.9	23.3	Adhara	255°11.3	-28°59.9					
20	218°19.7	112°12.2	27.8	348°22.0	02.9	49°53.6	16.3	328°21.5	23.2	Procyon	244°57.9	5°10.8					
21	233°22.1	127°11.3	.. 27.5	3°24.5	.. 02.9	64°55.8	.. 16.2	343°24.2	.. 23.2	Pollux	243°25.6	27°59.0					
22	248°24.6	142°10.5	27.3	18°27.0	03.0	79°58.0	16.0	358°26.8	23.2	Avior	234°17.7	-59°34.0					
23	263°27.1	157°09.6	27.0	33°29.5	03.0	95°00.1	15.9	13°29.4	23.2	Suhail	222°51.2	-43°30.2					
Mer.pass.:05:29			v-0.9 d-0.2 m-3.8			v2.5 d-0.0 m-1.5			v2.2 d-0.1 m-1.7			v2.6 d0.0 m0.1					
Thu			GHA			GHA			GHA			GHA					
0	278°29.5	172°08.7	N23°26.7	48°31.9	S21°03.1	110°02.3	N06°15.8	28°32.0	S20°23.2	Denebola	183°31.7	14°28.9					
1	293°32.0	187°07.8	26.5	63°34.4	03.1	125°04.4	15.6	43°34.7	23.2	Gienah	175°50.2	-17°38.0					
2	308°34.5	202°07.0	26.2	78°36.9	03.2	140°06.6	15.5	58°37.3	23.2	Acrux	173°06.9	-63°11.7					
3	323°36.9	217°06.1	.. 25.9	93°39.4	.. 03.2	155°08.8	.. 15.4	73°39.9	.. 23.1	Gacrux	171°58.5	-57°12.5					
4	338°39.4	232°05.2	25.7	108°41.8	03.3	170°10.9	15.2	88°42.6	23.1	Alioth	166°19.0	55°52.6					
5	353°41.8	247°04.4	25.4	123°44.3	03.3	185°13.1	15.1	103°45.2	23.1	Spica	158°29.0	-11°14.8					
6	8°44.3	262°03.5	N23°25.1	138°46.8	S21°03.4	200°15.2	N06°15.0	118°47.8	S20°23.1	Alkaid	152°57.2	49°14.2					
7	23°46.8	277°02.6	24.9	153°49.2	03.4	215°17.4	14.8	133°50.4	23.1	Hadar	148°44.6	-60°27.3					
8	38°49.2	292°01.7	24.6	168°51.7	03.5	230°19.5	14.7	148°53.1	23.1	Menkent	148°04.9	-36°27.1					
9	53°51.7	307°00.9	.. 24.3	183°54.2	.. 03.5	245°21.7	.. 14.5	163°55.7	.. 23.1	Arcturus	145°53.7	19°06.1					
10	68°54.2	322°00.0	24.1	198°56.6	03.6	260°23.9	14.4	178°58.3	23.0	Rigel Kent.	139°48.4	-60°54.2					
11	83°56.6	336°59.1	23.8	213°59.1	03.6	275°26.0	14.3	194°00.9	23.0	Kochab	137°19.6	74°05.7					
12	98°59.1	351°58.3	N23°25.5	229°01.5	S21°03.7	290°28.2	N06°14.1	209°03.6	S20°23.0	Zuben' ubi	137°02.9	-16°06.5					
13	114°01.6	6°57.4	23.2	244°04.0	03.7	305°30.3	14.0	224°06.2	23.0	Alphecca	126°09.0	26°39.9					
14	129°04.0	21°56.5	22.9	259°06.5	03.8	320°32.5	13.9	239°08.8	23.0	Antares	112°23.4	-26°27.9					
15	144°06.5	36°55.6	.. 22.7	274°08.9	.. 03.8	335°34.6	.. 13.7	254°11.4	.. 23.0	Atria	107°22.8	-69°03.3					
16	159°09.0	51°54.8	22.4	289°11.4	03.9	350°36.8	13.6	269°14.1	23.0	Sabik	102°09.9	-15°44.5					
17	174°11.4	66°53.9	22.1	304°13.8	03.9	5°38.9	13.4	284°16.7	22.9	Rasalhague	96°04.2	12°33.1					
18	189°13.9	81°53.0	N23°21.8	319°16.3	S21°04.0	20°41.1	N06°13.3	299°19.3	S20°22.9	Eltanin	90°44.7	51°29.5					
19	204°16.3	96°52.2	21.5	334°18.7	04.0	35°43.2	13.2	314°21.9	22.9	Kaus Aust.	83°40.7	-34°22.4					
20	219°18.8	111°51.3	21.2	349°21.2	04.1	50°45.4	13.0	329°24.6	22.9	Vega	80°37.1	38°48.2					
21	234°21.3	126°50.4	.. 21.0	4°23.6	.. 04.1	65°47.6	.. 12.9	344°27.2	.. 22.9	Nunki	75°55.4	-26°16.3					
22	249°23.7	141°49.6	20.7	19°26.1	04.2	80°49.7	12.8	359°29.8	22.9	Altair	62°05.9	8°54.9					
23	264°26.2	156°48.7	20.4	34°28.5	04.2	95°51.9	12.6	14°32.4	22.9	Peacock	53°15.6	-56°40.6					
Mer.pass.:05:25			v-0.9 d-0.3 m-3.8			v2.5 d-0.0 m-1.5			v2.2 d-0.1 m-1.7			v2.6 d0.0 m0.1					
Fri			GHA			GHA			GHA			GHA					
0	279°28.7	171°47.8	N23°20.1	49°30.9	S21°04.3	110°54.0	N06°12.5	29°35.1	S20°22.8	Jun 29 Wed	SHA	Mer.pass					
1	294°31.1	186°47.0	19.8	64°33.4	04.3	125°56.2	12.3	44°37.7	22.8	Venus	254°59.3	12:31					
2	309°33.6	201°46.1	19.5	79°35.8	04.4	140°58.3	12.2	59°40.3	22.8	Mars	130°01.7	20:46					
3	324°36.1	216°45.2	.. 19.2	94°38.3	.. 04.4	156°00.5	.. 12.1	74°42.9	.. 22.8	Jupiter	191°40.0	16:41					
4	339°38.5	231°44.4	18.9	109°40.7	04.5	171°02.6	11.9	89°45.6	22.8	Saturn	109°58.6	22:06					
5	354°41.0	246°43.5	18.6	124°43.1	04.5	186°04.8	11.8	104°48.2	22.8	Jun 30 Thu							
6	9°43.5	261°42.6	N23°18.3	139°45.6	S21°04.6	201°06.9	N06°11.7	119°50.8	S20°22.8	Venus	253°39.2	12:32					
7	24°45.9	276°41.8	18.0	154°48.0	04.6	216°09.1	11.5	134°53.4	22.7	Mars	130°02.4	20:42					
8	39°48.4	291°40.9	17.7	169°50.4	04.7	231°11.2	11.4	149°56.1	22.7	Jupiter	191°32.8	16:37					
9	54°50.8	306°40.0	.. 17.4	184°52.8	.. 04.8	246°13.4	.. 11.2	164°58.7	.. 22.7	Saturn	110°02.5	22:02					
10	69°53.3	321°39.2	17.1	199°55.3	04.8	261°15.5	11.1	180°01.3	22.7	Jul 01 Fri							
11	84°55.8	336°38.3	16.8	214°57.7	04.9	276°17.7	11.0	195°03.9	22.7	Venus	252°19.2	12:34					
12	99°58.2	351°37.4	N23°16.5	230°00.1	S21°04.9	291°19.9	N06°10.8	210°06.5	S20°22.7	Mars	130°02.3	20:39					
13	115°00.7	6°36.6	16.2	245°02.5	05.0	306°22.0	10.7	225°09.2	22.7	Jupiter	191°25.4	16:34					
14	130°03.2	21°35.7	15.9	260°05.0	05.0	321°24.2	10.5	240°11.8	22.6	Saturn	110°06.4	21:58					
15	145°05.6	36°34.8	.. 15.6	275°07.4	.. 05.1	336°26.3	.. 10.4	255°14.4	.. 22.6	Horizontal parallax							
16	160°08.1	51°34.0	15.3	290°09.8	05.2	351°28.5	10.3	270°17.0	22.6	Venus:	0.1						
17	175°10.6	66°33.1	15.0	305°12.2	05.2	6°30.6	10.1	285°19.7	22.6	Mars:	0.3						
18	190°13.0	81°32.3	N23°14.6	320°14.6	S21°05.3	21°32.8	N06°10.0	300°22.3	S20								

DUT1 = UT1-UTC = -0.2107 sec ΔT = TT-UT1 = +68.3947 sec

2016 June 29 to Jul. 01 UT

		Sun			Moon		
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°08.3	N23°12.7	254°06.3	9.2'	N06°21.2	10.7'	59.5'
1	194°08.2	12.6	268°34.4	9.2'	06°31.9	10.7'	59.5'
2	209°08.1	12.4	283°02.6	9.1'	06°42.6	10.7'	59.5'
3	224°08.0	12.3	297°30.7	9.1'	06°53.2	10.6'	59.5'
4	239°07.8	12.1	311°58.7	9.0'	07°03.8	10.6'	59.6'
5	254°07.7	12.0	326°26.7	9.0'	07°14.4	10.6'	59.6'
6	269°07.6	N23°11.8	340°54.7	8.9'	N07°24.9	10.5'	59.6'
7	284°07.5	11.7	355°22.6	8.9'	07°35.4	10.5'	59.6'
8	299°07.3	11.6	9°50.5	8.9'	07°45.9	10.4'	59.6'
9	314°07.2	11.4	24°18.3	8.8'	07°56.3	10.4'	59.6'
10	329°07.1	11.3	38°46.1	8.8'	08°06.7	10.4'	59.6'
11	344°07.0	11.1	53°13.8	8.7'	08°17.0	10.3'	59.6'
12	359°06.8	N23°11.0	67°41.5	8.7'	N08°27.3	10.3'	59.7'
13	14°06.7	10.8	82°09.2	8.6'	08°37.5	10.2'	59.7'
14	29°06.6	10.7	96°36.8	8.6'	08°47.7	10.2'	59.7'
15	44°06.5	10.5	111°04.4	8.5'	08°57.9	10.1'	59.7'
16	59°06.3	10.4	125°31.9	8.5'	09°07.9	10.1'	59.7'
17	74°06.2	10.2	139°59.3	8.4'	09°18.0	10.0'	59.7'
18	89°06.1	N23°10.1	154°26.8	8.4'	N09°28.0	10.0'	59.7'
19	104°06.0	09.9	168°54.1	8.3'	09°37.9	9.9'	59.7'
20	119°05.9	09.8	183°21.5	8.3'	09°47.8	9.8'	59.7'
21	134°05.7	09.6	197°48.7	8.3'	09°57.6	9.8'	59.7'
22	149°05.6	09.5	212°16.0	8.2'	10°07.4	9.7'	59.8'
23	164°05.5	09.3	226°43.2	8.2'	10°17.1	9.7'	59.8'
	SD.=15.7	d=-0.1			S.D.=16.3		

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°05.4	N23°09.2	241°10.3	8.1'	N10°26.7	9.6'	59.8'
1	194°05.2	09.0	255°37.4	8.1'	10°36.3	9.5'	59.8'
2	209°05.1	08.9	270°04.4	8.0'	10°45.8	9.5'	59.8'
3	224°05.0	08.7	284°31.4	8.0'	10°55.2	9.4'	59.8'
4	239°04.9	08.5	298°58.3	7.9'	11°04.6	9.4'	59.8'
5	254°04.7	08.4	313°25.2	7.9'	11°14.0	9.3'	59.8'
6	269°04.6	N23°08.2	327°52.1	7.8'	N11°23.2	9.2'	59.8'
7	284°04.5	08.1	342°18.9	7.8'	11°32.4	9.2'	59.8'
8	299°04.4	07.9	356°45.6	7.7'	11°41.5	9.1'	59.8'
9	314°04.3	07.8	11°12.3	7.7'	11°50.6	9.0'	59.8'
10	329°04.1	07.6	25°38.9	7.6'	11°59.5	8.9'	59.8'
11	344°04.0	07.4	40°05.5	7.6'	12°08.4	8.9'	59.9'
12	359°03.9	N23°07.3	54°32.1	7.5'	N12°17.3	8.8'	59.9'
13	14°03.8	07.1	68°58.6	7.5'	12°26.0	8.7'	59.9'
14	29°03.6	06.9	83°25.0	7.4'	12°34.7	8.6'	59.9'
15	44°03.5	06.8	97°51.4	7.4'	12°43.3	8.6'	59.9'
16	59°03.4	06.6	112°17.8	7.3'	12°51.8	8.5'	59.9'
17	74°03.3	06.4	126°44.1	7.3'	13°00.2	8.4'	59.9'
18	89°03.2	N23°06.3	141°10.3	7.2'	N13°08.6	8.3'	59.9'
19	104°03.0	06.1	155°36.5	7.2'	13°16.9	8.2'	59.9'
20	119°02.9	05.9	170°02.7	7.1'	13°25.1	8.1'	59.9'
21	134°02.8	05.8	184°28.8	7.1'	13°33.2	8.1'	59.9'
22	149°02.7	05.6	198°54.9	7.0'	13°41.2	8.0'	59.9'
23	164°02.5	05.4	213°20.9	7.0'	13°49.1	7.9'	59.9'
	SD.=15.7	d=-0.2			S.D.=16.3		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	179°02.4	N23°05.3	227°46.9	6.9'	N13°56.9	7.8'	59.9'
1	194°02.3	05.1	242°12.8	6.9'	14°04.7	7.7'	59.9'
2	209°02.2	04.9	256°38.7	6.9'	14°12.4	7.6'	59.9'
3	224°02.1	04.7	271°04.5	6.8'	14°19.9	7.5'	59.9'
4	239°01.9	04.6	285°30.3	6.8'	14°27.4	7.4'	59.9'
5	254°01.8	04.4	299°56.0	6.7'	14°34.8	7.3'	59.9'
6	269°01.7	N23°04.2	314°21.7	6.7'	N14°42.1	7.2'	59.9'
7	284°01.6	04.0	328°47.4	6.6'	14°49.3	7.1'	59.9'
8	299°01.5	03.9	343°13.0	6.6'	14°56.4	7.0'	59.9'
9	314°01.3	03.7	357°38.6	6.6'	15°03.4	6.9'	59.9'
10	329°01.2	03.5	12°04.1	6.5'	15°10.3	6.8'	59.9'
11	344°01.1	03.3	26°29.6	6.5'	15°17.1	6.7'	59.9'
12	359°01.0	N23°03.1	40°55.1	6.4'	N15°23.8	6.6'	59.9'
13	14°00.9	03.0	55°20.5	6.4'	15°30.4	6.5'	59.9'
14	29°00.7	02.8	69°45.8	6.4'	15°36.9	6.4'	59.9'
15	44°00.6	02.6	84°11.2	6.3'	15°43.2	6.3'	59.9'
16	59°00.5	02.4	98°36.5	6.3'	15°49.5	6.2'	59.9'
17	74°00.4	02.2	113°01.7	6.2'	15°55.7	6.1'	59.9'
18	89°00.3	N23°02.0	127°26.9	6.2'	N16°01.8	6.0'	59.9'
19	104°00.1	01.9	141°52.1	6.2'	16°07.8	5.9'	59.9'
20	119°00.0	01.7	156°17.3	6.1'	16°13.6	5.8'	59.9'
21	133°59.9	01.5	170°42.4	6.1'	16°19.4	5.7'	59.9'
22	148°59.8	01.3	185°07.5	6.1'	16°25.0	5.6'	59.9'
23	163°59.7	01.1	199°32.5	6.0'	16°30.5	5.5'	59.9'
	SD.=15.7	d=-0.2			S.D.=16.3		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°						
64°						
62°						
60°						
N 58°						
56°						
54°						
52°						
50°						
48°						
46°						
N 40°						
35°						
30°						
20°						
N 10°						
0°						
S 50°						
52°						
54°						
56°						
58°						
S 60°						
Lat.	Wed	Moonrise	Thu	Fri	Wed	Moonset
N 72°	23:40	23:33	23:23		15:32	17:34
N 70°	23:56	23:59	--:		15:18	17:09
68°	00:01	00:09	00:19		15:06	16:50
66°	00:07	00:19	00:36		14:57	16:35
64°	00:12	00:28	00:49		14:49	16:22
62°	00:17	00:36	01:00		14:42	16:12
60°	00:21	00:43	01:10		14:37	16:03
N 58°	00:24	00:49	01:18		14:31	15:55
56°	00:27	00:54	01:26		14:27	15:48
54°	00:30	00:59	01:32		14:23	15:42
52°	00:32	01:03	01:38		14:19	15:37
50°	00:35	01:07	01:44		14:16	15:32
48°	00:40	01:16	01:56		14:09	15:21
N 40°	00:44	01:23	02:05		14:03	15:12
35°	00:48	01:29	02:14		13:58	15:04
30°	00:51	01:34	02:21		13:53	14:58
20°	00:57	01:44	02:34		13:45	14:46
N 10°	01:02	01:52	02:46		13:38	14:35
0°	01:07	02:00	02:56		13:32	14:27
S 10°	01:11	02:08	03:07		13:25	14:17
20°	01:17	02:17	03:19		13:19	14:07
30°	01:23	02:27	03:32		13:11	13:56
35°	01:26	02:33	03:39		13:06	13:49
40°	01:30	02:39	03:48		13:01	13:42
45°	01:35	02:47	03:59		12:55	13:33
S 50°	01:40	02:56	04:11		12:48	13:23
52°	01:43	03:00	04:17		12:45	13:18
54°	01:45	03:05	04:23		12:42	13:13
56°	01:49	03:10	04:31		12:38	13:07
58°	01:52	03:16	04:39		12:34	13:00
S 60°	01:56	03:23	04:48		12:29	12:53
Day	Sun		Moon			
	Eqn. of Time	Mer. Pass.	Mer. Pass.	Mer. Pass.	Upper	Lower
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	hh:mm	hh:mm	hh:mm	hh:mm
29	03:27	03:33	12:04	07:19	19:46	
30	03:39	03:44	12:04	08:13	20:41	
01	03:50	03:56	12:04	09:10	21:39	

**July 02, 03, 04 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	280°27.8	171°27.1	N23°12.7	50°29.1	S21°05.6	111°45.7	N06°09.2	30°38.0	S20°22.5	Alpheratz	357°41.2	29°10.7				
1	295°30.3	186°26.2	12.4	65°31.5	05.7	126°47.8	09.0	45°40.6	22.5	Ankaa	353°13.7	-42°12.8				
2	310°32.7	201°25.4	12.1	80°33.9	05.7	141°50.0	08.9	60°43.3	22.5	Schedar	349°38.0	56°37.3				
3	325°35.2	216°24.5	.. 11.8	95°36.3	.. 05.8	156°52.1	.. 08.7	75°45.9	.. 22.5	Diphda	348°53.9	-17°53.7				
4	340°37.7	231°23.6	11.5	110°38.7	05.9	171°54.2	08.6	90°48.5	22.4	Achernar	335°25.5	-57°09.0				
5	355°40.1	246°22.8	11.1	125°41.1	05.9	186°56.4	08.5	105°51.1	22.4	Hamal	327°58.5	23°32.2				
6	10°42.6	261°21.9	N23°10.8	140°43.5	S21°06.0	201°58.5	N06°08.3	120°53.7	S20°22.4	Polaris	317°03.0	89°19.6				
7	25°45.1	276°21.1	10.5	155°45.9	06.0	217°00.7	08.2	135°56.4	22.4	Acamar	315°17.1	-40°14.3				
8	40°47.5	291°20.2	10.1	170°48.3	06.1	232°02.8	08.0	150°59.0	22.4	Menkar	314°13.1	4°09.1				
9	55°50.0	306°19.3	.. 09.8	185°50.7	.. 06.2	247°05.0	.. 07.9	166°01.6	.. 22.4	Mirfak	308°37.7	49°54.8				
10	70°52.4	321°18.5	09.5	200°53.0	06.2	262°07.1	07.8	181°04.2	22.4	Aldebaran	290°47.3	16°32.3				
11	85°54.9	336°17.6	09.1	215°55.4	06.3	277°09.3	07.6	196°06.8	22.4	Rigel	281°10.4	-8°11.1				
12	100°57.4	351°16.8	N23°08.8	230°57.8	S21°06.4	292°11.4	N06°07.5	211°09.5	S20°22.3	Capella	280°31.8	46°00.6				
13	115°59.8	6°15.9	08.5	246°00.2	06.4	307°13.6	07.3	226°12.1	22.3	Bellatrix	278°30.1	6°21.7				
14	131°02.3	21°15.0	08.1	261°02.6	06.5	322°15.7	07.2	241°14.7	22.3	Elnath	278°10.4	28°37.0				
15	146°04.8	36°14.2	.. 07.8	276°05.0	.. 06.6	337°17.9	.. 07.1	256°17.3	.. 22.3	Alnilam	275°44.6	-1°11.7				
16	161°07.2	51°13.3	07.5	291°07.4	06.6	352°20.0	06.9	271°19.9	22.3	Betelgeuse	270°59.4	7°24.4				
17	176°09.7	66°12.5	07.1	306°09.7	06.7	7°22.2	06.8	286°22.6	22.3	Canopus	263°55.8	-52°42.4				
18	191°12.2	81°11.6	N23°06.8	321°12.1	S21°06.7	22°24.3	N06°06.6	301°25.2	S20°22.3	Sirius	258°32.3	-16°44.5				
19	206°14.6	96°10.8	06.4	336°14.5	06.8	37°26.5	06.5	316°27.8	22.2	Adhara	255°11.3	-28°59.9				
20	221°17.1	111°09.9	06.1	351°16.9	06.9	52°28.6	06.3	331°30.4	22.2	Procyon	244°57.9	5°10.8				
21	236°19.6	126°09.0	.. 05.8	6°19.2	.. 06.9	67°30.7	.. 06.2	346°33.0	.. 22.2	Pollux	243°25.6	27°59.0				
22	251°22.0	141°08.2	05.4	21°21.6	07.0	82°32.9	06.1	1°35.7	22.2	Avior	234°17.7	-59°34.0				
23	266°24.5	156°07.3	05.1	36°24.0	07.1	97°35.0	05.9	16°38.3	22.2	Suhail	222°51.2	-43°30.2				
Mer.pass.:05:17			v-0.9 d-0.3 m-3.8			v2.4 d-0.1 m-1.4			v2.1 d-0.1 m-1.7			v2.6 d0.0 m0.1				
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	281°26.9	171°06.5	N23°04.7	51°26.4	S21°07.1	112°37.2	N06°05.8	31°40.9	S20°22.2	Denebola	182°31.7	14°28.9				
1	296°29.4	186°05.6	04.4	66°28.7	07.2	127°39.3	05.6	46°43.5	22.2	Gienah	175°50.2	-17°38.0				
2	311°31.9	201°04.8	04.0	81°31.1	07.3	142°41.5	05.5	61°46.1	22.2	Acrux	173°06.9	-63°11.7				
3	326°34.3	216°03.9	.. 03.7	96°33.5	.. 07.3	157°43.6	.. 05.4	76°48.8	.. 22.1	Gacrux	171°58.5	-57°12.5				
4	341°36.8	231°03.1	03.3	111°35.8	07.4	172°45.8	05.2	91°51.4	22.1	Alioth	166°19.0	55°52.6				
5	356°39.3	246°02.2	03.0	126°38.2	07.5	187°47.9	05.1	106°54.0	22.1	Alkaid	152°57.2	49°14.2				
6	11°41.7	261°01.4	N23°02.6	141°40.5	S21°07.5	202°50.0	N06°04.9	121°56.6	S20°22.1	Hadar	148°44.6	-60°27.3				
7	26°44.2	276°00.5	02.2	156°42.9	07.6	217°52.2	04.8	136°59.2	22.1	Menkent	148°04.9	-36°27.1				
8	41°46.7	290°59.7	01.9	171°45.3	07.7	232°54.3	04.6	152°01.9	22.1	Arcturus	145°53.7	19°06.1				
9	56°49.1	305°58.8	.. 01.5	186°47.6	.. 07.7	247°56.5	.. 04.5	167°04.5	.. 22.1	Rigel Kent.	139°48.5	-60°54.2				
10	71°51.6	320°57.9	01.2	201°50.0	07.8	262°58.6	04.4	182°07.1	22.0	Kochab	137°19.7	74°05.7				
11	86°54.1	335°57.1	00.8	216°52.3	07.9	278°08.8	04.2	197°09.7	22.0	Zuben' ubi	137°02.9	-16°06.5				
12	101°56.5	350°56.2	N23°00.4	231°54.7	S21°08.0	293°02.9	N06°04.1	212°12.3	S20°22.0	Alphecca	126°09.0	26°39.9				
13	116°59.0	5°55.4	23°00.1	246°57.0	08.0	308°05.0	03.9	227°14.9	22.0	Antares	112°23.4	-26°27.9				
14	132°01.4	20°54.5	22°59.7	261°59.4	08.1	323°07.2	03.8	242°17.6	22.0	Atria	107°22.8	-69°03.3				
15	147°03.9	35°53.7	.. 59.3	277°01.7	.. 08.2	338°09.3	.. 03.6	257°20.2	.. 22.0	Sabik	102°09.8	-15°44.5				
16	162°06.4	50°52.8	59.0	292°04.1	08.2	353°11.5	03.5	272°22.8	22.0	Rasalhague	96°04.2	12°33.2				
17	177°08.8	65°52.0	58.6	307°06.4	08.3	8°13.6	03.4	287°04.4	22.0	Eltanin	90°44.7	51°29.5				
18	192°11.3	80°51.1	N22°58.2	322°08.7	S21°08.4	23°15.8	N06°03.2	302°28.0	S20°21.9	Kaus Aust.	83°40.7	-34°22.4				
19	207°13.8	95°50.3	57.9	337°11.1	08.5	38°17.9	03.1	317°30.6	21.9	Vega	80°37.1	38°48.2				
20	222°16.2	110°49.4	57.5	352°13.4	08.5	53°20.0	02.9	332°33.3	21.9	Nunki	75°55.4	-26°16.3				
21	237°18.7	125°48.6	.. 57.1	7°15.8	.. 08.6	68°22.2	.. 02.8	347°35.9	.. 21.9	Altair	62°05.9	8°54.9				
22	252°21.2	140°47.7	56.8	22°18.1	08.7	83°24.3	02.6	2°38.5	21.9	Peacock	53°15.5	-56°40.6				
23	267°23.6	155°46.9	56.4	37°20.4	08.7	98°26.5	02.5	17°41.1	21.9	Deneb	49°29.6	45°20.4				
Mer.pass.:05:13			v-0.9 d-0.3 m-3.8			v2.4 d-0.1 m-1.4			v2.1 d-0.1 m-1.7			v2.6 d0.0 m0.1				
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	282°26.1	170°46.1	N22°56.0	52°22.8	S21°08.8	113°28.6	N06°02.4	32°43.7	S20°21.9	Al Na'ir	15°21.6	-46°52.6				
1	297°28.6	185°45.2	55.6	67°25.1	08.9	128°30.7	02.2	47°46.3	21.8	Fomalhaut	13°51.2	-29°31.9				
2	312°31.0	200°44.4	55.2	82°27.4	09.0	143°32.9	02.1	62°49.0	21.8	Scheat	13°36.1	28°10.3				
3	327°33.5	215°43.5	.. 54.9	97°29.8	.. 09.0	158°35.0	.. 01.9	77°51.6	.. 21.8	Markab	13°36.1	15°17.6				
4	342°35.9	230°42.7	54.5	112°32.1	09.1	173°37.2	01.8	92°54.2	21.8	<b>Jul 02 Sat</b>			<b>Mer.pass</b>			
5	357°38.4	245°41.8	54.1	127°34.4	09.2	188°39.3	01.6	107°56.8	21.8	Venus	250°59.3	12:35				
6	12°40.9	260°41.0	N22°53.7	142°36.7	S21°09.3	203°41.4	N06°01.5	122°59.4	S20°21.8	Mars	130°01.3	20:35				
7	27°43.3	275°40.1	53.3	157°39.1	09.3	218°43.6	01.4	138°02.0	21.8	Jupiter	191°17.8	16:31				
8	42°45.8	290°39.3	53.0	172°41.4	09.4	233°45.7	01.2	153°04.7	21.8	Saturn	110°10.2	21:54				
9	57°48.3	305°38.4	.. 52.6	187°43.7	.. 09.5	248°47.9	.. 01.1	168°07.3	.. 21.7	<b>Jul 03 Sun</b>			<b>Mer.pass</b>			
10	72°50.7	320°37.6	52.2	202°46.0	09.6	263°50.0	00.9	183°09.9	21.7	Venus	249°39.5	12:36				
11	87°53.2	335°36.7	51.8	217°48.3	09.6	278°52.1	00.8	198°12.5	21.7	Mars	129°59.4	20:31				
12	102°55.7	350°35.9	N22°51.4	232°50.7	S21°09.7	293°54.3	N06°00.6	213°15.1	S20°21.7	Jupiter	191°10.2	16:27				
13	117°58.1	5°35.1	51.0	247°53.0	09.8	308°56.4	00.5	228°17.7	21.7	Saturn	110°14.0	21:49				
14	133°00.6	20°34.2	50.6	262°55.3	09.9	323°58.6	00.3	243°20.4	21.7	<b>Jul 04 Mon</b>			<b>Mer.pass</b>			
15	148°03.1	35°33.4	.. 50.2	277°57.6	.. 09.9	339°00.7	.. 00.2	258°23.0	.. 21.7	Venus	248°20.0	12:38				
16	163°05.5	50°32.5	49.8	292°59.9	10.0	354°02.8	06°00.1	273°25.6	21.7	Mars	129°56.7	20:27				
17	178°08.0	65°31.7	49.4	308°02.2	10.1	9°05.0	05°59.9	288°28.2	21.6	Jupiter	191°02.5	16:24				
18	193°10.4	80°30.8	N22°49.0	323°04.5	S21°10.2	24°07.1	N05°59.8	303°30.8								

DUT1 = UT1-UTC = -0.2128 sec ΔT = TT-UT1 = +68.3968 sec

2016 July 02 to Jul. 04 UT

h		Sun			Moon			
Sat		GHA	Dec	GHA	ν	Dec	d	HP
0	178°59.6	N23°00.9	213°57.6	6.0'	N16°36.0	5.4'	59.9'	
1	193°59.4	00.7	228°22.5	6.0'	16°41.3	5.3'	59.9'	
2	208°59.3	00.5	242°47.5	5.9'	16°46.5	5.1'	59.8'	
3	223°59.2	.. 00.4	257°12.4	5.9'	16°51.5	5.0'	59.8'	
4	238°59.1	00.2	271°37.4	5.9'	16°56.5	4.9'	59.8'	
5	253°59.0	23°00.0	286°02.2	5.9'	17°01.4	4.8'	59.8'	
6	268°58.8	N22°59.8	300°27.1	5.8'	N17°06.1	4.7'	59.8'	
7	283°58.7	59.6	314°51.9	5.8'	17°10.7	4.6'	59.8'	
8	298°58.6	59.4	329°16.7	5.8'	17°15.2	4.4'	59.8'	
9	313°58.5	.. 59.2	343°41.5	5.8'	17°19.6	4.3'	59.8'	
10	328°58.4	59.0	358°06.3	5.8'	17°23.9	4.2'	59.8'	
11	343°58.3	58.8	12°31.0	5.7'	17°28.0	4.1'	59.8'	
12	358°58.1	N22°58.6	26°55.8	5.7'	N17°32.0	4.0'	59.8'	
13	13°58.0	58.4	41°20.5	5.7'	17°36.0	3.8'	59.8'	
14	28°57.9	58.2	55°45.2	5.7'	17°39.7	3.7'	59.7'	
15	43°57.8	.. 58.0	70°09.8	5.7'	17°43.4	3.6'	59.7'	
16	58°57.7	57.8	84°34.5	5.7'	17°47.0	3.5'	59.7'	
17	73°57.6	57.6	98°59.1	5.6'	17°50.4	3.4'	59.7'	
18	88°57.4	N22°57.4	113°23.8	5.6'	N17°53.7	3.2'	59.7'	
19	103°57.3	57.2	127°48.4	5.6'	17°56.9	3.1'	59.7'	
20	118°57.2	57.0	142°13.0	5.6'	17°59.9	3.0'	59.7'	
21	133°57.1	.. 56.8	156°37.7	5.6'	18°02.9	2.9'	59.7'	
22	148°57.0	56.6	171°02.3	5.6'	18°05.7	2.7'	59.7'	
23	163°56.9	56.4	185°26.9	5.6'	18°08.4	2.6'	59.6'	
	SD.=15.7	d=-0.2			S.D.=16.3			
	SD.=15.7	d=-0.2			S.D.=16.2			
	SD.=15.7	d=-0.2			S.D.=16.2			
	SD.=15.7	d=-0.2			S.D.=16.1			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°			00:38	23:25		
64°			01:46	22:21		
62°			02:20	21:47		
60°		01:09	02:45	21:23	22:57	
N 58°						
56°						
54°	01:04	02:41	03:34	20:34	21:27	23:03
52°	01:43	02:58	03:46	20:22	21:10	22:24
50°	02:09	03:13	03:57	20:12	20:55	21:59
48°	02:53	03:41	04:19	19:50	20:27	21:16
N 40°	03:22	04:03	04:36	19:32	20:05	20:46
35°	03:45	04:21	04:51	19:18	19:47	20:24
30°	04:03	04:36	05:03	19:05	19:32	20:05
20°	04:31	05:00	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	18:30	18:57
S 10°	05:29	05:55	06:18	17:51	18:14	18:40
20°	05:44	06:12	06:36	17:33	17:57	18:24
30°	06:00	06:30	06:57	17:12	17:38	18:08
35°	06:09	06:41	07:09	17:00	17:28	18:00
40°	06:18	06:52	07:22	16:46	17:17	17:51
45°	06:28	07:05	07:39	16:30	17:04	17:41
S 50°	06:39	07:21	07:59	16:10	16:48	17:29
52°	06:44	07:28	08:08	16:00	16:41	17:24
54°	06:50	07:36	08:19	15:50	16:33	17:19
56°	06:56	07:45	08:31	15:38	16:24	17:13
58°	07:02	07:54	08:45	15:23	16:14	17:07
S 60°	07:09	08:06	09:02	15:07	16:03	16:59
Lat.	Sat	Moonrise	Sun	Mon	Sat	Moonset
		Sun			Sun	Mon
N 72°	22:49		-:-		22:20	
N 70°	00:08	00:28	01:15	20:42	21:58	22:35
68°	00:37	01:08	02:00	20:02	21:13	21:58
66°	00:59	01:36	02:29	19:35	20:43	21:31
64°	01:17	01:57	02:52	19:14	20:21	21:11
62°	01:32	02:14	03:10	18:57	20:03	20:54
60°	01:44	02:28	03:24	18:43	19:48	20:40
N 58°	01:55	02:41	03:37	18:31	19:36	20:28
56°	02:04	02:51	03:48	18:20	19:25	20:18
54°	02:12	03:01	03:58	18:11	19:15	20:09
52°	02:20	03:09	04:06	18:03	19:07	20:01
50°	02:27	03:17	04:14	17:56	18:59	19:53
45°	02:41	03:33	04:30	17:40	18:42	19:38
N 40°	02:53	03:46	04:44	17:27	18:29	19:25
35°	03:03	03:57	04:55	17:16	18:17	19:14
30°	03:12	04:07	05:05	17:06	18:07	19:04
20°	03:28	04:24	05:22	16:50	17:50	18:47
N 10°	03:41	04:39	05:37	16:35	17:35	18:33
0°	03:54	04:53	05:51	16:22	17:21	18:19
S 10°	04:07	05:07	06:05	16:08	17:07	18:05
20°	04:21	05:22	06:20	15:54	16:51	17:50
30°	04:36	05:39	06:38	15:37	16:34	17:33
35°	04:46	05:49	06:48	15:28	16:24	17:24
40°	04:56	06:00	06:59	15:17	16:12	17:12
45°	05:09	06:14	07:13	15:04	15:59	16:59
S 50°	05:24	06:31	07:29	14:48	15:42	16:43
52°	05:31	06:38	07:37	14:41	15:34	16:35
54°	05:39	06:47	07:46	14:33	15:25	16:27
56°	05:47	06:57	07:55	14:24	15:16	16:17
58°	05:57	07:08	08:06	14:13	15:05	16:06
S 60°	06:09	07:21	08:19	14:02	14:52	15:54
Day	Sun		Moon			
	Eqn.of Time 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer. Pass Upper hh:mm	Mer. Pass Lower hh:mm	Age 27-0 5-0%
02	04:02	04:07	12:04	10:08	22:37	
03	04:13	04:18	12:04	11:07	23:36	
04	04:24	04:29	12:04	12:05	--:-	

**July 05, 06, 07 UT (Tue., Wed., Thu.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	283°25.2	170°25.8	N22°46.6	53°18.3	S21°10.6	114°19.9	N05°58.9	33°46.5	S20°21.6	Alpheratz	357°41.2	29°10.7				
1	298°27.7	185°25.0	46.2	68°20.6	10.7	129°22.1	58.8	48°49.1	21.5	Ankaa	353°13.7	-42°12.8				
2	313°30.2	200°24.1	45.8	83°22.9	10.8	144°24.2	58.6	63°51.7	21.5	Schedar	349°38.0	56°37.3				
3	328°32.6	215°23.3	.. 45.4	98°25.2	.. 10.9	159°26.3	.. 58.5	78°54.3	.. 21.5	Diphda	348°53.8	-17°53.7				
4	343°35.1	230°22.4	45.0	113°27.5	11.0	174°28.5	58.3	93°56.9	21.5	Achernar	335°25.5	-57°09.0				
5	358°37.6	245°21.6	44.6	128°29.8	11.0	189°30.6	58.2	108°59.6	21.5	Hamal	327°58.5	23°32.2				
6	13°40.0	260°20.8	N22°44.2	143°32.1	S21°11.1	204°32.7	N05°58.0	124°02.2	S20°21.5	Polaris	317°01.6	89°19.6				
7	28°42.5	275°19.9	43.8	158°34.4	11.2	219°34.9	57.9	139°04.8	21.5	Acamar	315°17.1	-40°14.3				
8	43°44.9	290°19.1	43.3	173°36.7	11.3	234°37.0	57.7	154°07.4	21.5	Menkar	314°13.1	4°09.1				
9	58°47.4	305°18.3	.. 42.9	188°39.0	.. 11.4	249°39.1	.. 57.6	169°10.0	.. 21.4	Mirfak	308°37.6	49°54.8				
10	73°49.9	320°17.4	42.5	203°41.2	11.5	264°41.3	57.4	184°12.6	21.4	Aldebaran	290°47.3	16°32.3				
11	88°52.3	335°16.6	42.1	218°43.5	11.5	279°43.4	57.3	199°15.2	21.4	Rigel	281°10.4	-8°11.1				
12	103°54.8	350°15.7	N22°41.7	233°45.8	S21°11.6	294°45.5	N05°57.2	214°17.8	S20°21.4	Capella	280°31.8	46°00.5				
13	118°57.3	5°14.9	41.3	248°48.1	11.7	309°47.7	57.0	229°20.5	21.4	Bellatrix	278°30.1	6°21.7				
14	133°59.7	20°14.1	40.8	263°50.4	11.8	324°49.8	56.9	244°23.1	21.4	Elnath	278°10.4	28°37.0				
15	149°02.2	35°13.2	.. 40.4	278°52.6	.. 11.9	339°51.9	.. 56.7	259°25.7	.. 21.4	Alnilam	275°44.6	-1°11.7				
16	164°04.7	50°12.4	40.0	293°54.9	12.0	354°54.1	56.6	274°28.3	21.4	Betelgeuse	270°59.4	7°24.4				
17	179°07.1	65°11.6	39.6	308°57.2	12.0	9°56.2	56.4	289°30.9	21.3	Canopus	263°55.8	-52°42.4				
18	194°09.6	80°10.7	N22°39.1	323°59.5	S21°12.1	24°58.3	N05°56.3	304°33.5	S20°21.3	Sirius	258°32.2	-16°44.5				
19	209°12.0	95°09.9	38.7	339°01.7	12.2	40°00.5	56.1	319°36.1	21.3	Adhara	255°11.3	-28°59.8				
20	224°14.5	110°09.1	38.3	354°04.0	12.3	55°02.6	56.0	334°38.7	21.3	Procyon	244°57.9	5°10.8				
21	239°17.0	125°08.2	.. 37.9	9°06.3	.. 12.4	70°04.7	.. 55.8	349°41.4	.. 21.3	Pollux	243°25.6	27°59.0				
22	254°19.4	140°07.4	37.4	24°08.5	12.5	85°06.9	55.7	4°44.0	21.3	Avior	234°17.7	-59°34.0				
23	269°21.9	155°06.6	37.0	39°10.8	12.6	100°09.0	55.5	19°46.6	21.3	Suhail	222°51.2	-43°30.2				
Mer.pass.:05:05			v-0.8 d-0.4 m-3.8			v2.3 d-0.1 m-1.4			v2.1 d-0.1 m-1.7			v2.6 d0.0 m0.2				
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	284°24.4	170°05.7	N22°36.6	54°13.1	S21°12.6	115°11.1	N05°55.4	34°49.2	S20°21.3	Denebola	182°31.7	14°28.9				
1	299°26.8	185°04.9	36.1	69°15.3	12.7	130°13.3	55.2	49°51.8	21.2	Gienah	175°50.2	-17°38.0				
2	314°29.3	200°04.1	35.7	84°17.6	12.8	145°15.4	55.1	64°54.4	21.2	Acrux	173°06.9	-63°11.7				
3	329°31.8	215°03.2	.. 35.3	99°19.8	.. 12.9	160°17.5	.. 55.0	79°57.0	.. 21.2	Gacrux	171°58.5	-57°12.5				
4	344°34.2	230°02.4	34.8	114°22.1	13.0	175°19.7	54.8	94°59.6	21.2	Alioth	166°19.0	55°52.6				
5	359°36.7	245°01.6	34.4	129°24.3	13.1	190°21.8	54.7	110°02.2	21.2	Alkaid	152°57.2	-11°14.8				
6	14°39.2	260°00.8	N22°34.0	144°26.6	S21°13.2	205°23.9	N05°54.5	125°04.9	S20°21.2	Hadar	148°44.6	-60°27.3				
7	29°41.6	274°59.9	33.5	159°28.9	13.2	220°26.1	54.4	140°07.5	21.2	Menkent	148°04.9	-36°27.1				
8	44°44.1	289°59.1	33.1	174°31.1	13.3	235°28.2	54.2	155°10.1	21.2	Arcturus	145°53.7	19°06.1				
9	59°46.5	304°58.3	.. 32.6	189°33.4	.. 13.4	250°30.3	.. 54.1	170°12.7	.. 21.1	Rigel Kent.	139°48.5	-60°54.3				
10	74°49.0	319°57.4	32.2	204°35.6	13.5	265°32.4	53.9	185°15.3	21.1	Kochab	137°19.7	74°05.7				
11	89°51.5	334°56.6	31.7	219°37.8	13.6	280°34.6	53.8	200°17.9	21.1	Zuben' ubi	137°02.9	-16°06.5				
12	104°53.9	349°55.8	N22°31.3	234°40.1	S21°13.7	295°36.7	N05°53.6	215°20.5	S20°21.1	Alphecca	126°09.0	26°39.9				
13	119°56.4	4°55.0	30.9	249°42.3	13.8	310°38.8	53.5	230°23.1	21.1	Antares	112°23.4	-26°27.9				
14	134°58.9	19°54.1	30.4	264°44.6	13.9	325°41.0	53.3	245°25.7	21.1	Atria	107°22.8	-69°03.3				
15	150°01.3	34°53.3	.. 30.0	279°46.8	.. 14.0	340°43.1	.. 53.2	260°28.3	.. 21.1	Sabik	102°09.8	-15°44.5				
16	165°03.8	49°52.5	29.5	294°49.1	14.1	355°45.2	53.0	275°30.9	21.1	Rasalhague	96°04.2	12°33.2				
17	180°06.3	64°51.6	29.1	309°51.3	14.1	10°47.4	52.9	290°33.6	21.1	Eltanin	90°44.7	51°29.5				
18	195°08.7	79°50.8	N22°28.6	324°53.5	S21°14.2	25°49.5	N05°52.7	305°36.2	S20°21.0	Kaus Aust.	83°40.7	-34°22.4				
19	210°11.2	94°50.0	28.1	339°55.8	14.3	40°51.6	52.6	320°38.8	21.0	Vega	80°37.1	38°48.2				
20	225°13.7	109°49.2	27.7	354°58.0	14.4	55°53.7	52.4	335°41.4	21.0	Nunki	75°55.4	-26°16.3				
21	240°16.1	124°48.3	.. 27.2	10°00.2	.. 14.5	70°55.9	.. 52.3	350°44.0	.. 21.0	Altair	62°05.9	8°54.9				
22	255°18.6	139°47.5	26.8	25°02.5	14.6	85°58.0	52.1	5°46.6	21.0	Peacock	53°15.5	-56°40.6				
23	270°21.0	154°46.7	26.3	40°04.7	14.7	101°00.1	52.0	20°49.2	21.0	Deneb	49°29.6	45°20.4				
Mer.pass.:05:02			v-0.8 d-0.4 m-3.8			v2.3 d-0.1 m-1.3			v2.1 d-0.1 m-1.7			v2.6 d0.0 m0.2				
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	285°23.5	169°45.9	N22°25.9	55°06.9	S21°14.8	116°02.3	N05°51.8	35°51.8	S20°21.0	Fomalhaut	15°21.6	-29°31.9				
1	300°26.0	184°45.1	25.4	70°09.2	14.9	131°04.4	51.7	50°54.4	21.0	Scheat	13°51.1	28°10.3				
2	315°28.4	199°44.2	24.9	85°11.4	15.0	146°06.5	51.5	65°57.0	20.9	Markab	13°36.1	15°17.6				
3	330°30.9	214°43.4	.. 24.5	100°13.6	.. 15.1	161°08.6	.. 51.4	80°59.6	.. 20.9	<b>Jul 05 Tue SHA Mer.pass</b>						
4	345°33.4	229°42.6	24.0	115°15.8	15.2	176°10.8	51.2	96°02.2	20.9	Venus	247°00.6	12:39				
5	0°35.8	244°41.8	23.5	130°18.0	15.3	191°12.9	51.1	111°04.8	20.9	Mars	129°53.1	20:24				
6	15°38.3	259°40.9	N22°23.1	145°20.3	S21°15.3	206°15.0	N05°51.0	126°07.5	S20°20.9	Jupiter	190°54.7	16:20				
7	30°40.8	274°40.1	22.6	160°22.5	15.4	221°17.1	50.8	141°10.1	20.9	Saturn	110°21.3	21:41				
8	45°43.2	289°39.3	22.1	175°24.7	15.5	236°19.3	50.7	156°12.7	20.9	<b>Jul 06 Wed SHA Mer.pass</b>						
9	60°45.7	304°38.5	.. 21.7	190°26.9	.. 15.6	251°21.4	.. 50.5	171°15.3	.. 20.9	Venus	245°41.4	12:40				
10	75°48.2	319°37.7	21.2	205°29.1	15.7	266°23.5	50.4	186°17.9	20.9	Mars	129°48.7	20:20				
11	90°50.6	334°36.8	20.7	220°31.3	15.8	281°25.7	50.2	201°20.5	20.8	Jupiter	190°46.8	16:17				
12	105°53.1	349°36.0	N22°20.3	235°33.6	S21°15.9	296°27.8	N05°50.1	216°23.1	S20°20.8	Saturn	110°24.8	21:37				
13	120°55.5	4°35.2	19.8	250°35.8	16.0	311°29.9	49.9	231°25.7	20.8	<b>Jul 07 Thu SHA Mer.pass</b>						
14	135°58.0	19°34.4	19.3	265°38.0	16.1	326°32.0	49.8	246°28.3	20.8	Venus	244°22.4	12:42				
15	151°00.5	34°33.6	.. 18.8	280°40.2	.. 16.2	341°34.2	.. 49.6	261°30.9	.. 20.8	Mars	129°43.4	20:17				
16	166°02.9	49°32.8	18.4	295°42.4	16.3	356°36.3	49.5	276°33.5	20.8	Jupiter	190°38.7	16:14				
17	181°05.4	64°31.9	17.9	310°44.6	16.4	11°38.4	49.3	291°36.1	20.8	Saturn	110°28.3	21:33				
18	196°07.9	79°31.1	N22°17.4	325°46.8	S21°16.5	26°40.5	N05°49.2	306°38.7	S20°20.8	<b>Horizontal parallax</b>						
1																

DUT1 = UT1-UTC = -0.2141 sec ΔT = TT-UT1 = +68.3981 sec

2016 July 05 to Jul. 07 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	178°51.4	N22°45.6	171°53.9	7.0'	N17°48.7	-3.3'	58.6'	
1	193°51.3	45.3	186°19.9	7.0'	17°45.3	-3.4'	58.6'	
2	208°51.2	45.1	200°46.0	7.1'	17°41.9	-3.5'	58.6'	
3	223°51.0	.. 44.8	215°12.1	7.2'	17°38.3	-3.6'	58.5'	
4	238°50.9	44.6	229°38.3	7.2'	17°34.6	-3.7'	58.5'	
5	253°50.8	44.3	244°04.6	7.3'	17°30.8	-3.8'	58.5'	
6	268°50.7	N22°44.1	258°30.9	7.3'	N17°26.9	-3.9'	58.5'	
7	283°50.6	43.9	272°57.3	7.4'	17°22.9	-4.0'	58.4'	
8	298°50.5	43.6	287°23.7	7.5'	17°18.8	-4.2'	58.4'	
9	313°50.4	.. 43.4	301°50.2	7.5'	17°14.6	-4.3'	58.4'	
10	328°50.3	43.1	316°16.8	7.6'	17°10.3	-4.4'	58.3'	
11	343°50.2	42.9	330°43.4	7.7'	17°05.9	-4.5'	58.3'	
12	358°50.1	N22°42.6	345°10.1	7.7'	N17°01.4	-4.6'	58.3'	
13	13°50.0	42.4	359°36.9	7.8'	16°56.8	-4.7'	58.3'	
14	28°49.9	42.1	14°03.7	7.9'	16°52.1	-4.7'	58.2'	
15	43°49.8	.. 41.9	28°30.6	7.9'	16°47.3	-4.8'	58.2'	
16	58°49.7	41.6	42°57.5	8.0'	16°42.4	-4.9'	58.2'	
17	73°49.5	41.4	57°24.6	8.1'	16°37.4	-5.0'	58.1'	
18	88°49.4	N22°41.1	71°51.7	8.1'	N16°32.4	-5.1'	58.1'	
19	103°49.3	40.9	86°18.8	8.2'	16°27.2	-5.2'	58.1'	
20	118°49.2	40.6	100°46.1	8.3'	16°21.9	-5.3'	58.0'	
21	133°49.1	.. 40.4	115°13.4	8.3'	16°16.5	-5.4'	58.0'	
22	148°49.0	40.1	129°40.8	8.4'	16°11.1	-5.5'	58.0'	
23	163°48.9	39.9	144°08.2	8.5'	16°05.6	-5.6'	57.9'	
	SD.=15.7	d=-0.2		S.D.=15.9				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	178°48.8	N22°39.6	158°35.8	8.6'	N15°59.9	-5.7'	57.9'	
1	193°48.7	39.4	173°03.3	8.6'	15°54.2	-5.8'	57.9'	
2	208°48.6	39.1	187°31.0	8.7'	15°48.4	-5.8'	57.9'	
3	223°48.5	.. 38.9	201°58.8	8.8'	15°42.5	-5.9'	57.8'	
4	238°48.4	38.6	216°26.6	8.8'	15°36.6	-6.0'	57.8'	
5	253°48.3	38.3	230°54.5	8.9'	15°30.5	-6.1'	57.8'	
6	268°48.2	N22°38.1	245°22.4	9.0'	N15°24.4	-6.2'	57.7'	
7	283°48.1	37.8	259°50.4	9.1'	15°18.1	-6.3'	57.7'	
8	298°48.0	37.6	274°18.6	9.1'	15°11.9	-6.3'	57.7'	
9	313°47.9	.. 37.3	288°46.7	9.2'	15°05.5	-6.4'	57.6'	
10	328°47.8	37.0	303°15.0	9.3'	14°59.0	-6.5'	57.6'	
11	343°47.7	36.8	317°43.3	9.4'	14°52.5	-6.6'	57.6'	
12	358°47.6	N22°36.5	332°11.7	9.4'	N14°45.9	-6.6'	57.5'	
13	13°47.5	36.3	346°40.2	9.5'	14°39.2	-6.7'	57.5'	
14	28°47.4	36.0	1°08.7	9.6'	14°32.4	-6.8'	57.5'	
15	43°47.3	.. 35.7	15°37.4	9.7'	14°25.6	-6.9'	57.4'	
16	58°47.2	35.5	30°06.1	9.7'	14°18.7	-6.9'	57.4'	
17	73°47.1	35.2	44°34.8	9.8'	14°11.7	-7.0'	57.4'	
18	88°46.9	N22°34.9	59°03.7	9.9'	N14°04.7	-7.1'	57.4'	
19	103°46.8	34.7	73°32.6	10.0'	13°57.6	-7.1'	57.3'	
20	118°46.7	34.4	88°01.6	10.0'	13°50.4	-7.2'	57.3'	
21	133°46.6	.. 34.1	102°30.7	10.1'	13°43.2	-7.3'	57.3'	
22	148°46.5	33.9	116°59.8	10.2'	13°35.9	-7.3'	57.2'	
23	163°46.4	33.6	131°29.0	10.3'	13°28.5	-7.4'	57.2'	
	SD.=15.7	d=-0.3		S.D.=15.7				
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	178°46.3	N22°33.3	145°58.3	10.3'	N13°21.0	-7.5'	57.2'	
1	193°46.2	33.0	160°27.7	10.4'	13°13.5	-7.5'	57.1'	
2	208°46.1	32.8	174°57.1	10.5'	13°06.0	-7.6'	57.1'	
3	223°46.0	.. 32.5	189°26.6	10.5'	12°58.4	-7.7'	57.1'	
4	238°45.9	32.2	203°56.2	10.6'	12°50.7	-7.7'	57.0'	
5	253°45.8	32.0	218°25.9	10.7'	12°42.9	-7.8'	57.0'	
6	268°45.7	N22°31.7	232°55.6	10.8'	N12°35.1	-7.8'	57.0'	
7	283°45.6	31.4	247°25.4	10.8'	12°27.3	-7.9'	56.9'	
8	298°45.5	31.1	261°55.3	10.9'	12°19.4	-7.9'	56.9'	
9	313°45.4	.. 30.9	276°25.2	11.0'	12°11.4	-8.0'	56.9'	
10	328°45.3	30.6	290°55.3	11.1'	12°03.4	-8.0'	56.8'	
11	343°45.2	30.3	305°25.3	11.1'	11°55.3	-8.1'	56.8'	
12	358°45.1	N22°30.0	319°55.5	11.2'	N11°47.2	-8.1'	56.8'	
13	13°45.0	29.7	334°25.7	11.3'	11°39.0	-8.2'	56.7'	
14	28°44.9	29.5	348°56.0	11.3'	11°30.8	-8.2'	56.7'	
15	43°44.8	.. 29.2	3°26.4	11.4'	11°22.5	-8.3'	56.7'	
16	58°44.7	28.9	17°56.8	11.5'	11°14.2	-8.3'	56.6'	
17	73°44.6	28.6	32°27.3	11.5'	11°05.9	-8.4'	56.6'	
18	88°44.6	N22°28.3	46°57.9	11.6'	N10°57.4	-8.4'	56.6'	
19	103°44.5	28.0	61°28.6	11.7'	10°49.0	-8.5'	56.6'	
20	118°44.4	27.8	75°59.3	11.7'	10°40.5	-8.5'	56.5'	
21	133°44.3	.. 27.5	90°30.0	11.8'	10°31.9	-8.6'	56.5'	
22	148°44.2	27.2	105°00.9	11.9'	10°23.4	-8.6'	56.5'	
23	163°44.1	26.9	119°31.8	11.9'	10°14.7	-8.6'	56.4'	
	SD.=15.7	d=-0.3		S.D.=15.5				

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°			00:55	23:10		
64°			01:53	22:15		
62°			02:25	21:43		
60°		01:18	02:49	21:20	22:49	
N 58°						
56°						
54°	01:57	03:08	21:01	22:11		
52°	02:24	03:24	20:45	21:45		
50°	01:12	02:44	20:32	21:24	22:56	
48°	01:48	03:01	20:20	21:08	22:20	
46°	02:13	03:15	20:10	21:04	21:56	
44°	02:55	03:44	20:25	21:14		
N 40°						
38°	03:24	04:05	19:32	20:04	20:45	
36°	03:47	04:23	19:17	19:47	20:23	
34°	04:05	04:38	19:05	19:32	20:05	
32°	04:33	05:02	18:44	19:08	19:37	
N 10°						
0°	04:54	05:21	18:25	18:48	19:15	
5°	05:13	05:39	18:01	18:31	18:57	
S 10°						
5°	05:29	05:55	17:52	18:14	18:41	
3°	05:45	06:12	17:34	17:58	18:25	
1°	06:00	06:30	17:14	17:40	18:09	
-2°	06:09	06:40	17:02	17:30	18:01	
-4°	06:18	06:51	16:48	17:18	17:52	
-6°	06:27	07:04	16:32	17:06	17:42	
S 50°						
52°	06:38	07:20	16:12	16:50	17:31	
54°	06:43	07:27	16:03	16:43	17:26	
56°	06:49	07:34	15:52	16:36	17:21	
58°	06:55	07:43	15:41	16:27	17:15	
S 60°						
59°	07:01	07:54	15:48	16:57	17:50	
57°	07:16	08:06	15:53	16:46	17:41	
55°	07:32	08:20	15:34	16:34	17:32	
53°	07:41	08:28	15:10	16:26	17:26	
51°	07:52	08:37	15:17	16:18	17:20	
49°	08:04	08:48	15:26	16:08	17:12	
S 50°						
52°	08:19	09:01	15:48	16:56	17:40	
54°	08:26	09:07	15:41	16:50	17:49	
56°	08:34	09:13	15:34	16:44	17:55	
58°	08:43	09:21	15:25	16:37	17:50	
S 60°						
59°	09:04	09:38	15:04	16:21	17:38	
Day	Sun		Moon		Age	
	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer. Pass Upper hh:mm	Mer. Pass Lower hh:mm	Age 1-3 2-11%	
05	04:35	04:40	12:05	13:02	00:34	
06	04:45	04:50	12:05	13:55	01:29	
07	04:55	04:59	12:05	14:46	02:21	

**July 08, 09, 10 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	286°22.6	169°26.2	N22°14.5	56°00.0	S21°17.1	116°53.3	N05°48.3	36°54.4	S20°20.7	Alpheratz	357°41.2	29°10.7				
1	301°25.1	184°25.4	14.0	71°02.2	17.2	131°55.4	48.1	51°57.0	20.7	Ankaa	353°13.6	-42°12.8				
2	316°27.6	199°24.6	13.5	86°04.4	17.3	146°57.5	48.0	66°59.6	20.7	Schedar	349°37.9	56°37.4				
3	331°30.0	214°23.8	13.0	101°06.5	17.4	161°59.6	48.0	82°02.2	20.7	Diphda	348°53.8	-17°53.7				
4	346°32.5	229°23.0	12.5	116°08.7	17.5	177°01.8	47.7	97°04.8	20.7	Achernar	335°25.4	-57°09.0				
5	1°35.0	244°22.2	12.1	131°10.9	17.6	192°03.9	47.5	112°07.4	20.6	Hamal	327°58.5	23°32.2				
6	16°37.4	259°21.4	N22°11.6	146°13.1	S21°17.7	207°06.0	N05°47.4	127°10.0	S20°20.6	Polaris	317°00.4	89°19.6				
7	31°39.9	274°20.5	11.1	161°15.3	17.8	222°08.1	47.2	142°12.6	20.6	Acamar	315°17.0	-40°14.3				
8	46°42.4	289°19.7	10.6	176°17.5	17.9	237°10.3	47.0	157°15.2	20.6	Menkar	314°13.0	4°09.1				
9	61°44.8	304°18.9	10.1	191°19.7	18.0	252°12.4	46.9	172°17.8	20.6	Mirfak	308°37.6	49°54.8				
10	76°47.3	319°18.1	09.6	206°21.8	18.1	267°14.5	46.7	187°20.4	20.6	Aldebaran	290°47.3	16°32.3				
11	91°49.8	334°17.3	09.1	221°24.0	18.2	282°16.6	46.6	202°23.0	20.6	Rigel	281°10.4	-8°11.1				
12	106°52.2	349°16.5	N22°08.6	236°26.2	S21°18.3	297°18.7	N05°46.4	217°25.6	S20°20.6	Capella	280°31.8	46°00.5				
13	121°54.7	4°15.7	08.1	251°28.4	18.4	312°20.9	46.3	232°28.2	20.6	Bellatrix	278°30.1	6°21.7				
14	136°57.1	19°14.9	07.6	266°30.5	18.5	327°23.0	46.1	247°30.8	20.5	Elnath	278°10.3	28°37.0				
15	151°59.6	34°14.1	07.1	281°32.7	18.6	342°25.1	46.0	262°33.4	20.5	Alnilam	275°44.6	-1°11.7				
16	167°02.1	49°13.3	06.6	296°34.9	18.7	357°27.2	45.8	277°36.0	20.5	Betelgeuse	270°59.4	7°24.4				
17	182°04.5	64°12.4	06.1	311°37.1	18.8	12°29.4	45.7	292°38.6	20.5	Canopus	263°55.8	-52°42.4				
18	197°07.0	79°11.6	N22°05.6	326°39.2	S21°18.9	27°31.5	N05°45.5	307°41.2	S20°20.5	Sirius	258°32.2	-16°44.5				
19	212°09.5	94°10.8	05.0	341°41.4	19.0	42°33.6	45.4	322°43.8	20.5	Adhara	255°11.3	-28°59.8				
20	227°11.9	109°10.0	04.5	356°43.6	19.1	57°35.7	45.2	337°46.4	20.5	Procyon	244°57.9	5°10.8				
21	242°14.4	124°09.2	04.0	11°45.7	19.2	72°37.8	45.1	352°49.0	20.5	Pollux	243°25.6	27°59.0				
22	257°16.9	139°08.4	03.5	26°47.9	19.3	87°40.0	44.9	7°51.6	20.5	Avior	234°17.7	-59°34.0				
23	272°19.3	154°07.6	03.0	41°50.0	19.4	102°42.1	44.8	22°54.2	20.4	Suhail	222°51.3	-43°30.2				
Mer.pass.:04:54			v-0.8 d-0.5 m-3.8			v2.2 d-0.1 m-1.3			v2.1 d-0.2 m-1.7			v2.6 d0.0 m0.2				
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	287°21.8	169°06.8	N22°02.5	56°52.2	S21°19.5	117°44.2	N05°44.6	37°56.8	S20°20.4	Denebola	182°31.7	14°28.9				
1	302°24.3	184°06.0	02.0	71°54.4	19.6	132°46.3	44.5	52°59.4	20.4	Gienah	175°50.2	-17°38.0				
2	317°26.7	199°05.2	01.5	86°56.5	19.8	147°48.4	44.3	68°02.0	20.4	Acrux	173°06.9	-63°11.7				
3	332°29.2	214°04.4	00.9	101°58.7	19.9	162°50.6	44.2	83°04.6	20.4	Gacrux	171°58.5	-57°12.5				
4	347°31.6	229°03.6	00.4	117°00.8	20.0	177°52.7	44.0	98°07.3	20.4	Alioth	166°19.0	55°52.6				
5	2°34.1	244°02.8	19.9	132°03.0	20.1	192°54.8	43.9	113°09.9	20.4	Alkaid	152°57.3	49°14.2				
6	17°36.6	259°02.0	N21°59.4	147°05.1	S21°20.2	207°56.9	N05°43.7	128°12.5	S20°20.4	Hadar	148°44.6	-60°27.3				
7	32°39.0	274°01.2	58.9	162°07.3	20.3	222°59.0	43.6	143°15.1	20.4	Menkent	148°05.0	-36°27.1				
8	47°41.5	289°00.4	58.3	177°09.4	20.4	238°01.1	43.4	158°17.7	20.3	Arcturus	145°53.8	19°06.1				
9	62°44.0	303°59.6	57.8	192°11.6	20.5	253°03.3	43.3	173°20.3	20.3	Rigel Kent.	139°48.5	-60°54.3				
10	77°46.4	318°58.8	57.3	207°13.7	20.6	268°05.4	43.1	188°22.9	20.3	Kochab	137°19.8	74°05.7				
11	92°48.9	333°58.0	56.8	222°15.9	20.7	283°07.5	42.9	203°25.5	20.3	Zuben' ubi	137°02.9	-16°06.5				
12	107°51.4	348°57.2	N21°56.2	237°18.0	S21°20.8	298°09.6	N05°42.8	218°28.1	S20°20.3	Alphecca	126°09.0	26°39.9				
13	122°53.8	3°56.4	55.7	252°20.1	20.9	313°11.7	42.6	233°30.7	20.3	Antares	112°23.4	-26°27.9				
14	137°56.3	18°55.6	55.2	267°22.3	21.0	328°13.9	42.5	248°33.3	20.3	Atria	107°22.8	-69°03.3				
15	152°58.7	33°54.8	54.7	282°24.4	21.1	343°16.0	42.3	263°35.9	20.3	Sabik	102°09.8	-15°44.5				
16	168°01.2	48°54.0	54.1	297°26.6	21.3	358°18.1	42.2	278°38.5	20.3	Rasalhague	96°04.2	12°33.2				
17	183°03.7	63°53.2	53.6	312°28.7	21.4	13°20.2	42.0	293°41.1	20.3	Eltanin	90°44.7	51°29.5				
18	198°06.1	78°52.4	N21°53.1	327°30.8	S21°21.5	28°22.3	N05°41.9	308°43.7	S20°20.2	Kaus Aust.	83°40.7	-34°22.4				
19	213°08.6	93°51.6	52.5	342°33.0	21.6	43°24.4	41.7	323°46.3	20.2	Vega	80°37.1	38°48.2				
20	228°11.1	108°50.8	52.0	357°35.1	21.7	58°26.6	41.6	338°48.9	20.2	Nunki	75°55.4	-26°16.3				
21	243°13.5	123°50.0	51.5	12°37.2	21.8	73°28.7	41.4	353°51.5	20.2	Altair	62°05.9	8°54.9				
22	258°16.0	138°49.2	50.9	27°39.4	21.9	88°30.8	41.3	8°54.1	20.2	Peacock	53°15.5	-56°40.6				
23	273°18.5	153°48.4	50.4	42°41.5	22.0	103°32.9	41.1	23°56.7	20.2	Deneb	49°29.6	45°20.4				
Mer.pass.:04:50			v-0.8 d-0.5 m-3.8			v2.2 d-0.1 m-1.3			v2.1 d-0.2 m-1.7			v2.6 d0.0 m0.2				
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	288°20.9	168°47.6	N21°49.8	57°43.6	S21°22.1	118°35.0	N05°41.0	38°59.2	S20°20.2	Al Na'ir	15°21.5	-46°52.6				
1	303°23.4	183°46.8	49.3	72°45.7	22.3	133°37.1	40.8	54°01.8	20.2	Fomalhaut	13°51.1	28°10.3				
2	318°25.9	198°46.0	48.8	87°47.9	22.4	148°39.3	40.6	69°04.4	20.2	Scheat	13°36.1	15°17.6				
3	333°28.3	213°45.2	48.2	102°50.0	22.5	163°41.4	40.5	84°07.0	20.1	Markab	13°21.7					
4	348°30.8	228°44.4	47.7	117°52.1	22.6	178°43.5	40.3	99°09.6	20.1	<b>Jul 08 Fri</b>	<b>SHA</b>	<b>Mer.pass</b>				
5	3°33.2	243°43.7	47.1	132°54.2	22.7	193°45.6	40.2	114°12.2	20.1	Venus	243°03.6	12:43				
6	18°35.7	258°42.9	N21°46.6	147°56.3	S21°22.8	208°47.8	N05°40.0	129°14.8	S20°20.1	Mars	129°37.3	20:13				
7	33°38.2	273°42.1	46.0	162°58.5	22.9	223°49.8	39.9	144°17.4	20.1	Jupiter	190°30.6	16:10				
8	48°40.6	288°41.3	45.5	178°00.6	23.0	238°51.9	39.7	159°20.0	20.1	Saturn	110°31.7	21:29				
9	63°43.1	303°40.5	44.9	193°02.7	23.2	253°54.1	39.6	174°22.6	20.1	<b>Jul 09 Sat</b>	<b>SHA</b>	<b>Mer.pass</b>				
10	78°45.6	318°39.7	44.4	208°04.8	23.3	268°56.2	39.4	189°25.2	20.1	Venus	241°45.0	12:44				
11	93°48.0	333°38.9	43.8	223°06.9	23.4	283°58.3	39.3	204°27.8	20.1	Mars	129°30.4	20:10				
12	108°50.5	348°38.1	N21°43.3	238°09.0	S21°23.5	299°00.4	N05°39.1	219°30.4	S20°20.1	Jupiter	190°22.4	16:07				
13	123°53.0	3°37.3	42.7	253°11.1	23.6	314°02.5	38.9	234°33.0	20.0	Saturn	110°35.1	21:25				
14	138°55.4	18°36.5	42.2	268°13.2	23.7	329°04.6	38.8	249°35.6	20.0	<b>Jul 10 Sun</b>	<b>SHA</b>	<b>Mer.pass</b>				
15	153°57.9	33°35.8	41.6	283°15.3	23.8	344°06.7	38.6	264°38.2	20.0	Venus	240°26.7	12:46				
16	169°00.3	48°35.0	41.1	298°17.4	24.0	359°08.9	38.5	279°40.8	20.0	Mars	129°22.7	20:06				
17	184°02.8	63°34.2	40.5	313°19.5	24.1	14°11.0	38.3	294°43.4	20.0	Jupiter	190°14.1	16:03				
18	199°05.3	78°33.4	N21°39.9	328°21.6	S21°24.2	29°13.1	N05°38.2	309°46.0	S20°20.0	Saturn	110°38.3	21:20				
19	214°07.7	93°32.6	39.4	343°23.7	24.3	44°15.2	38.0	324°48.6	20.0	<b>Horizontal parallax</b>						
20	229°10.2	108°31.8														

DUT1 = UT1-UTC = -0.2153 sec    $\Delta T$  = TT-UT1 = +68.3993 sec

2016 July 08 to Jul. 10 UT

<b>h</b>	<b>Sun</b>		<b>Moon</b>				
<b>Fri</b>	<b>GHA</b>	<b>Dec</b>	<b>GHA</b>	$\nu$	<b>Dec</b>	<b>d</b>	<b>HP</b>
0	178°44.0	N22°26.6	134°02.8	12.0'	N10°06.1	-8.7'	56.4'
1	193°43.9	26.3	148°33.8	12.1'	09°57.4	-8.7'	56.4'
2	208°43.8	26.0	163°04.9	12.1'	09°48.6	-8.8'	56.3'
3	223°43.7	.. 25.8	177°36.1	12.2'	09°39.8	-8.8'	56.3'
4	238°43.6	25.5	192°07.3	12.3'	09°31.0	-8.8'	56.3'
5	253°43.5	25.2	206°38.6	12.3'	09°22.2	-8.9'	56.2'
6	268°43.4	N22°24.9	221°10.0	12.4'	N09°13.3	-8.9'	56.2'
7	283°43.3	24.6	235°41.4	12.4'	09°04.4	-8.9'	56.2'
8	298°43.2	24.3	250°12.9	12.5'	08°55.4	-9.0'	56.2'
9	313°43.1	.. 24.0	264°44.4	12.6'	08°46.4	-9.0'	56.1'
10	328°43.0	23.7	279°16.0	12.6'	08°37.4	-9.0'	56.1'
11	343°42.9	23.4	293°47.7	12.7'	08°28.3	-9.1'	56.1'
12	358°42.8	N22°23.1	308°19.4	12.7'	N08°19.3	-9.1'	56.0'
13	13°42.7	22.8	322°51.2	12.8'	08°10.2	-9.1'	56.0'
14	28°42.6	22.5	337°23.0	12.9'	08°01.0	-9.2'	56.0'
15	43°42.5	.. 22.2	351°54.9	12.9'	07°51.9	-9.2'	56.0'
16	58°42.4	21.9	6°26.8	13.0'	07°42.7	-9.2'	55.9'
17	73°42.4	21.6	20°58.8	13.0'	07°33.4	-9.2'	55.9'
18	88°42.3	N22°21.3	35°30.9	13.1'	N07°24.2	-9.3'	55.9'
19	103°42.2	21.0	50°03.0	13.1'	07°14.9	-9.3'	55.8'
20	118°42.1	20.7	64°35.2	13.2'	07°05.7	-9.3'	55.8'
21	133°42.0	.. 20.4	79°07.4	13.2'	06°56.3	-9.3'	55.8'
22	148°41.9	20.1	93°39.7	13.3'	06°47.0	-9.3'	55.8'
23	163°41.8	19.8	108°12.0	13.3'	06°37.7	-9.4'	55.7'
	SD.=15.7	d=-0.3			S.D.=15.3		

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

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

	10:23	10:45	10:59	20:51	22:00	23:20
Day	Sun		Moon			Age 4-6 18-36%
	Eqn.of 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer.Pass. Upper hh:mm	Mer.Pass. Lower hh:mm	
08	05:04	05:09	12:05	15:33	03:10	
09	05:13	05:18	12:05	16:19	03:56	
10	05:22	05:26	12:05	17:02	04:41	

**July 11, 12, 13 UT (Mon., Tue., Wed.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	289°20.1	168°28.7	N21°36.6	58°34.2	S21°24.9	119°25.8	N05°37.2	40°01.6	S20°19.9					Alpheratz	357°41.2	
1	304°22.5	183°27.9	36.0	73°36.3	25.0	134°27.9	37.1	55°04.2	19.9					Ankaa	353°13.6	
2	319°25.0	198°27.1	35.4	88°38.4	25.1	149°30.0	36.9	70°06.8	19.9					Schedar	349°37.9	
3	334°27.5	213°26.3	.. 34.9	103°40.5	.. 25.2	164°32.1	.. 36.8	85°09.4	.. 19.9					Diphda	348°53.8	
4	349°29.9	228°25.5	34.3	118°42.6	25.4	179°34.2	36.6	100°12.0	19.9					Achernar	335°25.4	
5	4°32.4	243°24.8	33.7	133°44.7	25.5	194°36.3	36.5	115°14.6	19.9					Hamal	327°58.5	
6	19°34.8	258°24.0	N21°33.1	148°46.8	S21°25.6	209°38.4	N05°36.3	130°17.1	S20°19.9					Polaris	316°59.1	
7	34°37.3	273°23.2	32.6	163°48.8	25.7	224°40.5	36.2	145°19.7	19.9					Acamar	315°17.0	
8	49°39.8	288°22.4	32.0	178°50.9	25.8	239°42.6	36.0	160°22.3	19.9					Menkar	314°13.0	
9	64°42.2	303°21.6	.. 31.4	193°53.0	.. 26.0	254°44.8	.. 35.8	175°24.9	.. 19.8					Mirfak	308°37.6	
10	79°44.7	318°20.9	30.8	208°55.1	26.1	269°46.9	35.7	190°27.5	19.8					Aldebaran	290°47.2	
11	94°47.2	333°20.1	30.3	223°57.2	26.2	284°49.0	35.5	205°30.1	19.8					Rigel	281°10.4	
12	109°49.6	348°19.3	N21°29.7	238°59.2	S21°26.3	299°51.1	N05°35.4	220°32.7	S20°19.8					Capella	280°31.8	
13	124°52.1	3°18.5	29.1	254°01.3	26.4	314°53.2	35.2	235°35.3	19.8					Bellatrix	278°30.1	
14	139°54.6	18°17.7	28.5	269°03.4	26.6	329°55.3	35.1	250°37.9	19.8					Elnath	278°10.3	
15	154°57.0	33°17.0	.. 27.9	284°05.5	.. 26.7	344°57.4	.. 34.9	265°40.5	.. 19.8					Alnilam	275°44.6	
16	169°59.5	48°16.2	27.4	299°07.5	26.8	359°59.5	34.7	280°43.1	19.8					Betelgeuse	270°59.4	
17	185°02.0	63°15.4	26.8	314°09.6	26.9	15°01.6	34.6	295°45.7	19.8					Canopus	263°55.8	
18	200°04.4	78°14.6	N21°26.2	329°11.7	S21°27.0	30°03.7	N05°34.4	310°48.3	S20°19.8					Sirius	258°32.2	
19	215°06.9	93°13.9	25.6	344°13.7	27.2	45°05.9	34.3	325°50.9	19.7					Adhara	255°11.3	
20	230°09.3	108°13.1	25.0	359°15.8	27.3	60°08.0	34.1	340°53.5	19.7					Procyon	244°57.9	
21	245°11.8	123°12.3	.. 24.4	14°17.9	.. 27.4	75°10.1	.. 34.0	355°56.1	.. 19.7					Pollux	243°25.6	
22	260°14.3	138°11.5	23.8	29°19.9	27.5	90°12.2	33.8	10°58.6	19.7					Avior	234°17.7	
23	275°16.7	153°10.8	23.2	44°22.0	27.7	105°14.3	33.7	26°01.2	19.7					Suhail	222°51.3	
Mer.pass.:04:42			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Miaplacidus	221°39.9	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Alphard	217°54.3	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Regulus	207°41.6	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Dubhe	193°49.7	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Denebola	182°31.7	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Gienah	175°50.2	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Acrux	173°07.0	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Gacrux	171°58.6	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Alioth	166°19.0	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Spica	158°29.0	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Alkaid	152°57.3	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Hadar	148°44.6	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Menkent	148°05.0	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Arcturus	145°53.8	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Rigel Kent.	139°48.5	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Kochab	137°19.8	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Zuben' ubi	137°03.0	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Alphecca	126°09.1	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Antares	112°23.4	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Atria	107°22.8	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Sabik	102°09.9	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Shaula	96°18.7	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Rasalhague	96°04.2	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Eltanin	90°44.7	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Kaus Aust.	83°40.7	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Vega	80°37.1	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Nunki	75°55.4	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Altair	62°05.9	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Peacock	53°15.5	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Deneb	49°29.6	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Enif	33°44.8	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Al Na'ir	27°40.9	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Fomalhaut	15°21.5	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Scheat	13°51.1	
Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Markab	13°36.0	
Jul 11 Mon			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Jul 11 Mon	SHA	Mer.pass
Jul 11 Mon			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Venus	239°08.6	12:47
Jul 11 Mon			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Mars	129°14.2	20:03
Jul 11 Mon			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Jupiter	190°05.7	16:00
Jul 11 Mon			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Saturn	110°41.5	21:16
Jul 12 Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Jul 12 Tue	SHA	Mer.pass
Jul 12 Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Venus	237°50.8	12:48
Jul 12 Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v2.1 d-0.2 m-1.7	v2.6 d0.0 m0.2								Mars	129°04.9	20:00
Jul 12 Tue			v-0.8 d-0.6 m-3.8	v2.1 d-0.1 m-1.2	v											

DUT1 = UT1-UTC = -0.2166 sec ΔT = TT-UT1 = +68.4006 sec

2016 July 11 to Jul. 13 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	ν	Dec	d	HP
0	178°37.5	N22°04.2	101°23.7	15.0'	S01°11.8	-9.5'	54.6'	
1	193°37.4	03.9	115°57.7	15.0'	01°21.3	-9.5'	54.6'	
2	208°37.3	03.5	130°31.6	15.0'	01°30.8	-9.5'	54.6'	
3	223°37.2	.. 03.2	145°05.6	15.0'	01°40.3	-9.5'	54.6'	
4	238°37.2	02.9	159°39.6	15.0'	01°49.9	-9.5'	54.6'	
5	253°37.1	02.5	174°13.6	15.0'	01°59.3	-9.5'	54.6'	
6	268°37.0	N22°02.2	188°47.6	15.0'	S02°08.8	-9.5'	54.6'	
7	283°36.9	01.8	203°21.7	15.0'	02°18.3	-9.5'	54.5'	
8	298°36.8	01.5	217°55.7	15.0'	02°27.7	-9.4'	54.5'	
9	313°36.8	.. 01.2	232°29.7	15.0'	02°37.2	-9.4'	54.5'	
10	328°36.7	00.8	247°03.8	15.1'	02°46.6	-9.4'	54.5'	
11	343°36.6	00.5	261°37.8	15.1'	02°56.0	-9.4'	54.5'	
12	358°36.5	N22°00.1	276°11.9	15.1'	S03°05.4	-9.4'	54.5'	
13	13°36.4	21°59.8	290°46.0	15.1'	03°14.8	-9.4'	54.5'	
14	28°36.4	59.4	305°20.0	15.1'	03°24.1	-9.3'	54.5'	
15	43°36.3	.. 59.1	319°54.1	15.1'	03°33.4	-9.3'	54.4'	
16	58°36.2	58.8	334°28.2	15.1'	03°42.8	-9.3'	54.4'	
17	73°36.1	58.4	349°02.3	15.1'	03°52.1	-9.3'	54.4'	
18	88°36.0	N21°58.1	3°36.3	15.1'	S04°01.3	-9.3'	54.4'	
19	103°36.0	57.7	18°10.4	15.1'	04°10.6	-9.2'	54.4'	
20	118°35.9	57.4	32°44.5	15.1'	04°19.8	-9.2'	54.4'	
21	133°35.8	.. 57.0	47°18.6	15.1'	04°29.0	-9.2'	54.4'	
22	148°35.7	56.7	61°52.6	15.1'	04°38.2	-9.2'	54.4'	
23	163°35.6	56.3	76°26.7	15.1'	04°47.4	-9.2'	54.4'	
	SD.=15.7	d=-0.3			S.D.=14.8			
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	178°35.6	N21°56.0	91°00.8	15.1'	S04°56.6	-9.1'	54.4'	
1	193°35.5	55.6	105°34.9	15.1'	05°05.7	-9.1'	54.3'	
2	208°35.4	55.3	120°08.9	15.1'	05°14.8	-9.1'	54.3'	
3	223°35.3	.. 54.9	134°43.0	15.1'	05°23.9	-9.1'	54.3'	
4	238°35.3	54.6	149°17.0	15.0'	05°32.9	-9.0'	54.3'	
5	253°35.2	54.2	163°51.1	15.0'	05°41.9	-9.0'	54.3'	
6	268°35.1	N21°53.9	178°25.1	15.0'	S05°50.9	-9.0'	54.3'	
7	283°35.0	53.5	192°59.1	15.0'	05°59.9	-9.0'	54.3'	
8	298°34.9	53.1	207°33.2	15.0'	06°08.9	-8.9'	54.3'	
9	313°34.9	.. 52.8	222°07.2	15.0'	06°17.8	-8.9'	54.3'	
10	328°34.8	52.4	236°41.2	15.0'	06°26.7	-8.9'	54.3'	
11	343°34.7	52.1	251°15.2	15.0'	06°35.6	-8.9'	54.3'	
12	358°34.6	N21°51.7	265°49.1	15.0'	S06°44.4	-8.8'	54.3'	
13	13°34.6	51.4	280°23.1	15.0'	06°53.2	-8.8'	54.3'	
14	28°34.5	51.0	294°57.1	14.9'	07°02.0	-8.8'	54.3'	
15	43°34.4	.. 50.6	309°31.0	14.9'	07°10.7	-8.7'	54.3'	
16	58°34.3	50.3	324°04.9	14.9'	07°19.5	-8.7'	54.3'	
17	73°34.3	49.9	338°38.8	14.9'	07°28.1	-8.7'	54.2'	
18	88°34.2	N21°49.5	353°12.7	14.9'	S07°36.8	-8.6'	54.2'	
19	103°34.1	49.2	7°46.6	14.9'	07°45.4	-8.6'	54.2'	
20	118°34.0	48.8	22°20.5	14.9'	07°54.0	-8.6'	54.2'	
21	133°34.0	.. 48.5	36°54.3	14.8'	08°02.6	-8.5'	54.2'	
22	148°33.9	48.1	51°28.1	14.8'	08°11.1	-8.5'	54.2'	
23	163°33.8	47.7	66°01.9	14.8'	08°19.6	-8.5'	54.2'	
	SD.=15.7	d=-0.4			S.D.=14.8			
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	178°33.8	N21°47.4	80°35.7	14.8'	S08°28.1	-8.4'	54.2'	
1	193°33.7	47.0	95°09.5	14.8'	08°36.5	-8.4'	54.2'	
2	208°33.6	46.6	109°43.2	14.7'	08°44.9	-8.4'	54.2'	
3	223°33.5	.. 46.3	124°17.0	14.7'	08°53.2	-8.3'	54.2'	
4	238°33.5	45.9	138°50.7	14.7'	09°01.5	-8.3'	54.2'	
5	253°33.4	45.5	153°24.3	14.7'	09°09.8	-8.3'	54.2'	
6	268°33.3	N21°45.2	167°58.0	14.6'	S09°18.1	-8.2'	54.2'	
7	283°33.3	44.8	182°31.6	14.6'	09°26.3	-8.2'	54.2'	
8	298°33.2	44.4	197°05.2	14.6'	09°34.4	-8.1'	54.2'	
9	313°33.1	.. 44.0	211°38.8	14.6'	09°42.5	-8.1'	54.2'	
10	328°33.0	43.7	226°12.4	14.5'	09°50.6	-8.1'	54.2'	
11	343°33.0	43.3	240°45.9	14.5'	09°58.7	-8.0'	54.2'	
12	358°32.9	N21°42.9	255°19.4	14.5'	S10°06.7	-8.0'	54.2'	
13	13°32.8	42.5	269°52.9	14.5'	10°14.6	-7.9'	54.2'	
14	28°32.8	42.2	284°26.3	14.4'	10°22.6	-7.9'	54.2'	
15	43°32.7	.. 41.8	298°59.8	14.4'	10°30.4	-7.9'	54.2'	
16	58°32.6	41.4	313°33.2	14.4'	10°38.3	-7.8'	54.2'	
17	73°32.6	41.0	328°06.5	14.3'	10°46.1	-7.8'	54.2'	
18	88°32.5	N21°40.7	342°39.8	14.3'	S10°53.8	-7.7'	54.2'	
19	103°32.4	40.3	357°13.1	14.3'	11°01.5	-7.7'	54.3'	
20	118°32.3	39.9	11°46.4	14.3'	11°09.2	-7.6'	54.3'	
21	133°32.3	.. 39.5	26°19.7	14.2'	11°16.8	-7.6'	54.3'	
22	148°32.2	39.1	40°52.9	14.2'	11°24.4	-7.5'	54.3'	
23	163°32.1	38.8	55°26.0	14.2'	11°31.9	-7.5'	54.3'	
	SD.=15.7	d=-0.4			S.D.=14.8			

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°			01:24	22:44		
64°			02:08	22:01		
62°		00:23	02:37	21:33	23:36	
60°		01:37	02:59	21:11	22:32	
N 58°						
56°	02:10	03:16	20:54	22:00		
54°	00:21	02:34	20:39	21:36	23:39	
52°	01:29	02:53	20:44	21:17	22:40	
50°	02:00	03:09	20:55	21:06	22:10	
48°	02:22	03:22	20:45	20:06	20:48	21:48
46°	03:02	03:49	19:46	20:22	21:09	
N 40°						
35°	03:29	04:10	19:29	20:01	20:41	
30°	04:51	04:27	19:55	19:44	20:20	
20°	04:35	05:04	18:43	19:07	19:36	
N 10°						
0°	04:56	05:23	18:26	18:48	19:15	
5°	05:14	05:40	18:09	18:32	18:57	
S 10°						
20°	05:30	05:56	17:53	18:16	18:42	
30°	05:45	06:12	17:36	18:00	18:27	
40°	06:00	06:29	17:16	17:42	18:12	
50°	06:07	06:39	17:05	17:33	18:04	
55°	06:16	06:50	16:52	17:22	17:56	
60°	06:25	07:02	16:37	17:10	17:46	
S 50°						
52°	06:40	07:23	16:09	16:49		
54°	06:45	07:30	15:59	16:41		
56°	06:51	07:39	15:48	16:33		
58°	06:57	07:48	15:35	16:24		
S 60°						
55°	07:03	07:58	15:20	16:14		
Lat.	Mon	Tue	Wed	Mon	Tue	Wed
N 72°	12:16	13:50	15:26	22:53	22:48	22:41
N 70°	12:11	13:39	15:08	23:00	23:00	23:01
68°	12:07	13:31	14:54	23:05	23:10	23:16
66°	12:04	13:24	14:43	23:10	23:18	23:28
64°	12:02	13:18	14:33	23:14	23:25	23:39
62°	11:59	13:12	14:25	23:17	23:31	23:48
60°	11:57	13:08	14:18	23:20	23:37	23:55
N 58°	11:56	13:04	14:12	23:23	23:42	23:42
56°	11:54	13:00	14:06	23:25	23:46	23:46
54°	11:53	12:57	14:01	23:28	23:50	23:50
52°	11:51	12:54	13:57	23:29	23:53	23:53
50°	11:50	12:52	13:53	23:31	23:56	23:56
48°	11:48	12:46	13:44	23:35	00:03	00:03
N 40°	11:46	12:42	13:37	23:38	00:09	00:09
35°	11:44	12:38	13:31	23:41	00:14	00:14
30°	11:42	12:34	13:26	23:44	00:18	00:18
20°	11:39	12:28	13:16	23:48	00:25	00:25
N 10°	11:37	12:23	13:08	23:52	00:32	00:32
0°	11:35	12:18	13:01	23:55	00:38	00:38
S 10°	11:33	12:13	12:53	23:59	00:45	00:45
20°	11:30	12:07	12:45	00:03	00:51	00:51
30°						

**July 14, 15, 16 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	292°17.5	167°33.4	N20°53.0	61°01.4	S21°34.0	121°57.4	N05°25.9	43°08.1	S20°19.3					Alpheratz	357°41.2	
1	307°19.9	182°32.6	52.4	76°03.4	34.1	136°59.5	25.7	58°10.7	19.3					Ankaa	353°13.6	
2	322°22.4	197°31.9	51.7	91°05.4	34.2	152°01.6	25.6	73°13.3	19.3					Schedar	349°37.9	
3	337°24.9	212°31.1	· · 51.1	106°07.4	· · 34.4	167°03.7	· · 25.4	88°15.9	· · 19.2					Diphda	348°53.8	
4	352°27.3	227°30.4	50.4	121°09.4	34.5	182°05.8	25.2	103°18.4	19.2					Achernar	335°25.4	
5	7°29.8	242°29.6	49.8	136°11.4	34.6	197°07.9	25.1	118°21.0	19.2					Hamal	327°58.4	
6	22°32.3	257°28.9	N20°49.1	151°13.4	S21°34.8	212°10.0	N05°24.9	133°23.6	S20°19.2					Polaris	316°57.6	
7	37°34.7	272°28.1	48.5	166°15.3	34.9	227°12.1	24.8	148°26.2	19.2					Acamar	315°17.0	
8	52°37.2	287°27.4	47.8	181°17.3	35.0	242°14.2	24.6	163°28.8	19.2					Menkar	314°13.0	
9	67°39.7	302°26.6	· · 47.2	196°19.3	· · 35.2	257°16.3	· · 24.4	178°31.4	· · 19.2					Mirfak	308°37.5	
10	82°42.1	317°25.9	46.5	211°21.3	35.3	272°18.4	24.3	193°33.9	19.2					Aldebaran	290°47.2	
11	97°44.6	332°25.1	45.9	226°23.3	35.5	287°20.5	24.1	208°36.5	19.2					Rigel	281°10.3	
12	112°47.0	347°24.4	N20°45.2	241°25.3	S21°35.6	302°22.6	N05°24.0	223°39.1	S20°19.2					Capella	280°31.8	
13	127°49.5	2°23.6	44.6	256°27.2	35.7	317°24.7	23.8	238°41.7	19.2					Bellatrix	278°30.1	
14	142°52.0	17°22.9	43.9	271°29.2	35.9	332°26.8	23.6	253°44.3	19.2					Elnath	278°10.3	
15	157°54.4	32°22.2	· · 43.3	286°31.2	· · 36.0	347°28.9	· · 23.5	268°46.9	· · 19.2					Alnilam	275°44.5	
16	172°56.9	47°21.4	42.6	301°33.2	36.1	2°31.0	23.3	283°49.4	19.1					Betelgeuse	270°59.4	
17	187°59.4	62°20.7	41.9	316°35.1	36.3	17°33.1	23.1	298°52.0	19.1					Canopus	263°55.7	
18	203°01.8	77°19.9	N20°41.3	331°37.1	S21°36.4	32°35.2	N05°23.0	313°54.6	S20°19.1					Sirius	258°32.2	
19	218°04.3	92°19.2	40.6	346°39.1	36.6	47°37.3	22.8	328°57.2	19.1					Adhara	255°11.3	
20	233°06.8	107°18.4	40.0	1°41.1	36.7	62°39.4	22.7	343°59.8	19.1					Procyon	244°57.9	
21	248°09.2	122°17.7	· · 39.3	16°43.0	· · 36.8	77°41.5	· · 22.5	359°02.4	· · 19.1					Pollux	243°25.6	
22	263°11.7	137°17.0	38.6	31°45.0	37.0	92°43.6	22.3	14°04.9	19.1					Avior	234°17.7	
23	278°14.2	152°16.2	38.0	46°47.0	37.1	107°45.7	22.2	29°07.5	19.1					Suhail	222°51.3	
Mer.pass.:04:30			v-0.8 d-0.6 m-3.8			v2.0 d-0.1 m-1.2			v2.1 d-0.2 m-1.7			v2.6 d0.0 m0.2				
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	293°16.6	167°15.5	N20°37.3	61°48.9	S21°37.3	122°47.8	N05°22.0	44°10.1	S20°19.1					Denebola	182°31.7	
1	308°19.1	182°14.7	36.6	76°50.9	37.4	137°49.9	21.9	59°12.7	19.1					Gienah	175°50.2	
2	323°21.5	197°14.0	36.0	91°52.9	37.5	152°52.0	21.7	74°15.3	19.1					Acrux	173°07.0	
3	338°24.0	212°13.3	· · 35.3	106°54.8	· · 37.7	167°54.1	· · 21.5	89°17.9	· · 19.1					Gacrux	171°58.6	
4	353°26.5	227°12.5	34.6	121°56.8	37.8	182°56.2	21.4	104°20.4	19.0					Alioth	166°19.1	
5	8°28.9	242°11.8	34.0	136°58.7	38.0	197°58.3	21.2	119°23.0	19.0					Spica	158°29.0	
6	23°31.4	257°11.0	N20°33.3	152°00.7	S21°38.1	213°00.4	N05°21.0	134°25.6	S20°19.0					Alkaid	152°57.3	
7	38°33.9	272°10.3	32.6	167°02.7	38.2	228°02.5	20.9	149°28.2	19.0					Hadar	148°44.7	
8	53°36.3	287°09.6	31.9	182°04.6	38.4	243°04.6	20.7	164°30.8	19.0					Menkent	148°05.0	
9	68°38.8	302°08.8	· · 31.3	197°06.6	· · 38.5	258°06.6	· · 20.6	179°33.3	· · 19.0					Arcturus	145°53.8	
10	83°41.3	317°08.1	30.6	212°08.5	38.7	273°08.7	20.4	194°35.9	19.0					Rigel Kent.	139°48.5	
11	98°43.7	332°07.4	29.9	227°10.5	38.8	288°10.8	20.2	209°38.5	19.0					Kochab	137°19.9	
12	113°46.2	347°06.6	N20°29.2	242°12.4	S21°39.0	303°12.9	N05°20.1	224°41.1	S20°19.0					Zuben' ubi	137°03.0	
13	128°48.6	2°05.9	28.5	257°14.4	39.1	318°15.0	19.9	239°43.7	19.0					Alphecca	126°09.1	
14	143°51.1	17°05.2	27.9	272°16.3	39.2	333°17.1	19.7	254°46.2	19.0					Antares	112°23.4	
15	158°53.6	32°04.4	· · 27.2	287°18.3	· · 39.4	348°19.2	· · 19.6	269°48.8	· · 19.0					Atria	107°22.8	
16	173°56.0	47°03.7	26.5	302°20.2	39.5	3°21.3	19.4	284°51.4	19.0					Sabik	102°09.9	
17	188°58.5	62°03.0	25.8	317°22.2	39.7	18°23.4	19.3	299°54.0	18.9					Rasalhague	96°04.2	
18	204°01.0	77°02.2	N20°25.1	332°24.1	S21°39.8	33°25.5	N05°19.1	314°56.6	S20°18.9					Eltanin	90°44.7	
19	219°03.4	92°01.5	24.4	347°26.0	40.0	48°27.6	18.9	329°59.1	18.9					Kaus Aust.	83°40.7	
20	234°05.9	107°00.8	23.8	2°28.0	40.1	63°29.7	18.8	345°01.7	18.9					Vega	80°37.1	
21	249°08.4	122°00.0	· · 23.1	17°29.9	· · 40.2	78°31.8	· · 18.6	0°04.3	· · 18.9					Nunki	75°55.4	
22	264°10.8	136°59.3	22.4	32°31.9	40.4	93°33.9	18.4	15°06.9	18.9					Altair	62°05.9	
23	279°13.3	151°58.6	21.7	47°33.8	40.5	108°36.0	18.3	30°09.5	18.9					Peacock	53°15.5	
Mer.pass.:04:26			v-0.7 d-0.7 m-3.8			v2.0 d-0.1 m-1.1			v2.1 d-0.2 m-1.7			v2.6 d0.0 m0.2				
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	294°15.8	166°57.9	N20°21.0	62°35.7	S21°40.7	123°38.1	N05°18.1	45°12.0	S20°18.9					Fomalhaut	15°21.5	
1	309°18.2	181°57.1	20.3	77°37.7	40.8	138°40.2	18.0	60°14.6	18.9					Scheat	13°51.1	
2	324°20.7	196°56.4	19.6	92°39.6	41.0	153°42.3	17.8	75°17.2	18.9					Markab	13°36.0	
3	339°23.1	211°55.7	· · 18.9	107°41.5	· · 41.1	168°44.3	· · 17.6	90°19.8	· · 18.9					Jul 14 Thu	15°21.5	
4	354°25.6	226°54.9	18.2	122°43.5	41.3	183°46.4	17.5	105°22.4	18.9					SHA	235°15.9	
5	9°28.1	241°54.2	17.5	137°45.4	41.4	198°48.5	17.3	120°24.9	18.9					Mer.pass	12:50	
6	24°30.5	256°53.5	N20°16.8	152°47.3	S21°41.6	213°50.6	N05°17.1	135°27.5	S20°18.9					Venus	233°58.9	
7	39°33.0	271°52.8	16.1	167°49.2	41.7	228°52.7	17.0	150°30.1	18.8					Mars	128°43.9	
8	54°35.5	286°52.0	15.4	182°51.2	41.8	243°54.8	16.8	165°32.7	18.8					Jupiter	189°39.9	
9	69°37.9	301°51.3	· · 14.7	197°53.1	· · 42.0	258°56.9	· · 16.6	180°35.2	· · 18.8					Saturn	110°50.6	
10	84°40.4	316°50.6	14.0	212°55.0	42.1	273°59.0	16.5	195°37.8	18.8					Jul 15 Fri	21:04	
11	99°42.9	331°49.9	13.3	227°56.9	42.3	289°01.1	16.3	210°40.4	18.8					SHA	233°32.3	
12	114°45.3	346°49.1	N20°12.6	242°58.9	S21°42.4	304°03.2	N05°16.2	225°43.0	S20°18.8					Mer.pass	19:53	
13	129°47.8	1°48.4	11.9	258°00.8	42.6	319°05.3	16.0	240°45.5	18.8					Venus	233°32.3	
14	144°50.3	16°47.7	11.2	273°02.7	42.7	334°07.4	15.8	255°48.1	18.8					Mars	128°32.3	
15	159°52.7	31°47.0	· · 10.5	288°04.6	· · 42.9	349°09.5	· · 15.7	270°50.7	· · 18.8					Jupiter	189°31.2	
16	174°55.2	46°46.3	09.8	303°06.5	43.0	4°11.5	15.5	285°53.3	18.8					Saturn	110°53.5	
17	189°57.6	61°45.5	09.1	3												

DUT1 = UT1-UTC = -0.2179 sec ΔT = TT-UT1 = +68.4019 sec

2016 July 14 to Jul. 16 UT

h		Sun		Moon				
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	178°32.1	N21°38.4		69°59.2	14.1'	\$11°39.4	-7.5'	54.3'
1	193°32.0	38.0		84°32.3	14.1'	11°46.8	-7.4'	54.3'
2	208°31.9	37.6		99°05.4	14.1'	11°54.2	-7.4'	54.3'
3	223°31.9	.. 37.2		113°38.4	14.0'	12°01.5	-7.3'	54.3'
4	238°31.8	36.8		128°11.4	14.0'	12°08.8	-7.3'	54.3'
5	253°31.7	36.5		142°44.4	13.9'	12°16.0	-7.2'	54.3'
6	268°31.7	N21°36.1		157°17.3	13.9'	\$12°23.2	-7.2'	54.3'
7	283°31.6	35.7		171°50.2	13.9'	12°30.3	-7.1'	54.3'
8	298°31.5	35.3		186°23.1	13.8'	12°37.4	-7.1'	54.3'
9	313°31.5	.. 34.9		200°55.9	13.8'	12°44.4	-7.0'	54.3'
10	328°31.4	34.5		215°28.7	13.8'	12°51.4	-6.9'	54.3'
11	343°31.3	34.1		230°01.4	13.7'	12°58.3	-6.9'	54.4'
12	358°31.3	N21°33.8		244°34.1	13.7'	\$13°05.2	-6.8'	54.4'
13	13°31.2	33.4		259°06.8	13.6'	13°12.0	-6.8'	54.4'
14	28°31.1	33.0		273°39.4	13.6'	13°18.8	-6.7'	54.4'
15	43°31.1	.. 32.6		288°12.0	13.6'	13°25.5	-6.7'	54.4'
16	58°31.0	32.2		302°44.5	13.5'	13°32.1	-6.6'	54.4'
17	73°31.0	31.8		317°17.1	13.5'	13°38.7	-6.6'	54.4'
18	88°30.9	N21°31.4		331°49.5	13.4'	\$13°45.3	-6.5'	54.4'
19	103°30.8	31.0		346°22.0	13.4'	13°51.7	-6.4'	54.4'
20	118°30.8	30.6		0°54.3	13.4'	13°58.2	-6.4'	54.4'
21	133°30.7	.. 30.2		15°26.7	13.3'	14°04.5	-6.3'	54.4'
22	148°30.6	29.8		29°59.0	13.3'	14°10.8	-6.3'	54.5'
23	163°30.6	29.4		44°31.2	13.2'	14°17.1	-6.2'	54.5'
	SD.=15.7	d=-0.4				S.D.=14.8		
Fri		GHA	Dec	GHA	ν	Dec	d	HP
0	178°30.5	N21°29.0		59°03.5	13.2'	\$14°23.2	-6.2'	54.5'
1	193°30.5	28.6		73°35.6	13.2'	14°29.4	-6.1'	54.5'
2	208°30.4	28.2		88°07.8	13.1'	14°35.4	-6.0'	54.5'
3	223°30.3	.. 27.8		102°39.8	13.1'	14°41.4	-6.0'	54.5'
4	238°30.3	27.4		117°11.9	13.0'	14°47.4	-5.9'	54.5'
5	253°30.2	27.0		131°43.9	13.0'	14°53.2	-5.8'	54.5'
6	268°30.1	N21°26.6		146°15.8	12.9'	\$14°59.0	-5.8'	54.6'
7	283°30.1	26.2		160°47.8	12.9'	15°04.8	-5.7'	54.6'
8	298°30.0	25.8		175°19.6	12.8'	15°10.5	-5.6'	54.6'
9	313°30.0	.. 25.4		189°51.4	12.8'	15°16.1	-5.6'	54.6'
10	328°29.9	25.0		204°23.2	12.8'	15°21.6	-5.5'	54.6'
11	343°29.8	24.6		218°55.0	12.7'	15°27.1	-5.4'	54.6'
12	358°29.8	N21°24.2		233°26.6	12.7'	\$15°32.5	-5.4'	54.6'
13	13°29.7	23.8		247°58.3	12.6'	15°37.9	-5.3'	54.7'
14	28°29.7	23.4		262°29.9	12.6'	15°43.1	-5.2'	54.7'
15	43°29.6	.. 23.0		277°01.4	12.5'	15°48.3	-5.2'	54.7'
16	58°29.5	22.6		291°32.9	12.5'	15°53.5	-5.1'	54.7'
17	73°29.5	22.2		306°04.4	12.4'	15°58.6	-5.0'	54.7'
18	88°29.4	N21°21.8		320°35.8	12.4'	\$16°03.6	-5.0'	54.7'
19	103°29.4	21.4		335°07.2	12.3'	16°08.5	-4.9'	54.7'
20	118°29.3	21.0		349°38.5	12.3'	16°13.3	-4.8'	54.8'
21	133°29.3	.. 20.5		4°09.7	12.2'	16°18.1	-4.7'	54.8'
22	148°29.2	20.1		18°41.0	12.2'	16°22.8	-4.7'	54.8'
23	163°29.1	19.7		33°12.1	12.2'	16°27.5	-4.6'	54.8'
	SD.=15.7	d=-0.4				S.D.=14.9		
Sat		GHA	Dec	GHA	ν	Dec	d	HP
0	178°29.1	N21°19.3		47°43.3	12.1'	\$16°32.0	-4.5'	54.8'
1	193°29.0	18.9		62°14.4	12.1'	16°36.5	-4.5'	54.8'
2	208°29.0	18.5		76°45.4	12.0'	16°40.9	-4.4'	54.9'
3	223°28.9	.. 18.1		91°16.4	12.0'	16°45.3	-4.3'	54.9'
4	238°28.9	17.7		105°47.3	11.9'	16°49.5	-4.2'	54.9'
5	253°28.8	17.2		120°18.2	11.9'	16°53.7	-4.1'	54.9'
6	268°28.8	N21°16.8		134°49.1	11.8'	\$16°57.8	-4.1'	54.9'
7	283°28.7	16.4		149°19.9	11.8'	17°01.9	-4.0'	55.0'
8	298°28.6	16.0		163°50.7	11.7'	17°05.8	-3.9'	55.0'
9	313°28.6	.. 15.6		178°21.4	11.7'	17°09.7	-3.8'	55.0'
10	328°28.5	15.2		192°52.1	11.6'	17°13.5	-3.8'	55.0'
11	343°28.5	14.7		207°22.7	11.6'	17°17.2	-3.7'	55.0'
12	358°28.4	N21°14.3		221°53.3	11.6'	\$17°20.8	-3.6'	55.0'
13	13°28.4	13.9		236°23.8	11.5'	17°24.4	-3.5'	55.1'
14	28°28.3	13.5		250°54.3	11.5'	17°27.8	-3.4'	55.1'
15	43°28.3	.. 13.1		265°24.7	11.4'	17°31.2	-3.3'	55.1'
16	58°28.2	12.6		279°55.1	11.4'	17°34.5	-3.3'	55.1'
17	73°28.2	12.2		294°25.5	11.3'	17°37.7	-3.2'	55.1'
18	88°28.1	N21°11.8		308°55.8	11.3'	\$17°40.9	-3.1'	55.2'
19	103°28.1	11.4		323°26.0	11.2'	17°43.9	-3.0'	55.2'
20	118°28.0	10.9		337°56.3	11.2'	17°46.9	-2.9'	55.2'
21	133°27.9	.. 10.5		352°26.4	11.2'	17°49.8	-2.8'	55.2'
22	148°27.9	10.1		6°56.6	11.1'	17°52.6	-2.8'	55.2'
23	163°27.8	09.7		21°26.7	11.1'	17°55.3	-2.7'	55.3'
	SD.=15.7	d=-0.4				S.D.=15.0		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°			01:37	22:31		
64°			02:17	21:53		
62°		00:53	02:44	21:27	23:13	
60°		01:46	03:04	21:06	22:23	
N 58°						
56°		02:17	03:21	20:50	21:53	
54°	00:48	02:40	03:35	20:36	21:31	23:18
52°	01:37	02:58	03:48	20:23	21:13	22:32
50°	02:06	03:13	03:58	20:13	20:58	22:04
48°	02:27	03:26	04:08	20:03	20:45	21:44
46°	03:05	03:52	04:28	19:44	20:19	21:06
N 40°						
35°	03:32	04:12	04:44	19:28	19:59	20:39
30°	04:29	04:49	04:58	19:14	19:43	20:18
20°	04:36	05:05	05:29	18:43	19:07	19:35
N 10°						
0°	04:57	05:24	05:46	18:25	18:48	19:15
0°	05:14	05:40	06:02	18:10	18:32	18:58
S 10°						
0°	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	18:13
35°	06:07	06:38	07:05	17:07	17:35	18:06
40°	06:15	06:48	07:18	16:54	17:24	17:58
45°	06:24	07:00	07:33	16:39	17:12	17:49
S 50°						
52°	06:34	07:14	07:51	16:21	16:58	17:39
54°	06:38	07:21	08:00	16:12	16:52	17:34
56°	06:43	07:28	08:10	16:03	16:45	17:30
58°	06:48	07:36	08:21	15:52	16:37	17:24
S 60°						
60°	07:00	07:54	08:48	15:25	16:18	17:13
Day	Sun		Mer.	Moon		Age
	Eqn.of Time 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss		Mer. Pass. Upper hh:mm	Moon Pass. Lower hh:mm	
14	05:52	05:55	12:06	19:56	07:34	
15	05:58	06:01	12:06	20:43	08:19	
16	06:04	06:06	12:06	21:31	09:07	

## July 17, 18, 19 UT (Sun., Mon., Tue.)

Aries				Venus				Mars				Jupiter				Saturn				Stars	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	295°14.9	166°40.5	N20°04.1	63°21.8	S21°44.2	124°28.3	N05°14.2	46°13.9	S20°18.7									Alpheratz	357°41.1	29°10.8	
1	310°17.4	181°39.8	03.4	78°23.7	44.4	139°30.4	14.0	61°16.5	18.7								Ankaa	353°13.6	-42°12.8		
2	325°19.8	196°39.1	02.7	93°25.6	44.5	154°32.5	13.8	76°19.0	18.7								Schedar	349°37.8	56°37.4		
3	340°22.3	211°38.4	02.0	108°27.5	44.5	169°34.5	13.7	91°21.6	18.7								Diphda	348°53.7	-17°53.7		
4	355°24.8	226°37.7	01.3	123°29.4	44.8	184°36.6	13.5	106°24.2	18.7								Achernar	335°25.3	-57°09.0		
5	10°27.2	241°36.9	20°00.5	138°31.3	45.0	199°38.7	13.4	121°26.8	18.7								Hamal	327°58.4	23°32.2		
6	25°29.7	256°36.2	N19°59.8	153°33.2	S21°45.1	214°40.8	N05°13.2	136°29.3	S20°18.7								Polaris	316°56.1	89°19.6		
7	40°32.1	271°35.5	59.1	168°35.1	45.3	229°42.9	13.0	151°31.9	18.7								Acamar	315°17.0	-40°14.2		
8	55°34.6	286°34.8	58.4	183°37.0	45.4	244°45.0	12.9	166°34.5	18.7								Menkar	314°13.0	4°09.1		
9	70°37.1	301°34.1	00.7	198°38.9	45.6	259°47.1	12.7	181°37.1	18.7								Mirfak	308°37.5	49°54.8		
10	85°39.5	316°33.4	56.9	213°40.8	45.7	274°49.2	12.5	196°39.6	18.7								Aldebaran	290°47.2	16°32.3		
11	100°42.0	331°32.7	56.2	228°42.7	45.9	289°51.3	12.4	211°42.2	18.6								Rigel	281°10.3	-8°11.1		
12	115°44.5	346°32.0	N19°55.5	243°44.6	S21°46.0	304°53.3	N05°12.2	226°44.8	S20°18.6								Capella	280°31.7	46°00.5		
13	130°46.9	1°31.2	54.7	258°46.5	46.2	319°55.4	12.0	241°47.3	18.6								Bellatrix	278°30.0	6°21.7		
14	145°49.4	16°30.5	54.0	273°48.3	46.3	334°57.5	11.9	256°49.9	18.6								Elnath	278°10.3	28°37.0		
15	160°51.9	31°29.8	00.3	53.3	288°50.2	46.5	349°59.6	11.7	271°52.5	18.6							Alnilam	275°44.5	-1°11.6		
16	175°54.3	46°29.1	52.6	303°52.1	46.6	5°01.7	11.5	286°55.1	18.6								Betelgeuse	270°59.3	7°24.4		
17	190°56.8	61°28.4	51.8	318°54.0	46.8	20°03.8	11.4	301°57.6	18.6								Canopus	263°55.7	-52°42.3		
18	205°59.3	76°27.7	N19°51.1	333°55.9	S21°46.9	35°05.9	N05°11.2	317°00.2	S20°18.6								Sirius	258°32.2	-16°44.5		
19	221°01.7	91°27.0	50.4	348°57.8	47.1	50°08.0	11.0	332°02.8	18.6								Adhara	255°11.2	-28°59.8		
20	236°04.2	106°26.3	49.6	3°59.7	47.3	65°10.0	10.9	347°05.4	18.6								Procyon	244°57.9	5°10.8		
21	251°06.6	121°25.6	00.8	48.9	19°01.5	00.7	80°12.1	10.7	2°07.9	18.6							Pollux	243°25.6	27°59.0		
22	266°09.1	136°24.9	48.1	34°03.4	47.6	95°14.2	10.5	17°10.5	18.6								Avior	234°17.7	-59°33.9		
23	281°11.6	151°24.2	47.4	49°05.3	47.7	110°16.3	10.4	32°13.1	18.6								Suhail	222°51.3	-43°30.1		
Mer.pass.:04:18				v-0.7 d-0.7 m-3.8				v1.9 d-0.2 m-1.1				v2.1 d-0.2 m-1.6				v2.6 d0.0 m0.2					
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	296°14.0	166°23.5	N19°46.7	64°07.2	S21°47.9	125°18.4	N05°10.2	47°15.6	S20°18.6									Denebola	182°31.7	14°28.9	
1	311°16.5	181°22.8	45.9	79°09.0	48.0	140°20.5	10.0	62°18.2	18.6								Gienah	175°50.2	-17°38.0		
2	326°19.0	196°22.1	45.2	94°10.9	48.2	155°22.6	09.9	77°20.8	18.6								Acrux	173°07.0	-63°11.6		
3	341°21.4	211°21.4	00.4	44.5	109°12.8	00.3	170°24.7	09.7	92°23.4	18.5							Gacrux	171°58.6	-57°12.5		
4	356°23.9	226°20.6	43.7	124°14.7	48.5	185°26.7	09.5	107°25.9	18.5								Alioth	166°19.1	55°52.6		
5	11°26.4	241°19.9	43.0	139°16.5	48.6	200°28.8	09.4	122°28.5	18.5								Spica	158°29.0	-11°14.8		
6	26°28.8	256°19.2	N19°42.2	154°18.4	S21°48.8	215°30.9	N05°09.2	137°31.1	S20°18.5								Alkaid	152°57.3	49°14.2		
7	41°31.3	271°18.5	41.5	169°20.3	49.0	230°33.0	09.0	152°33.6	18.5								Hadar	148°44.7	-60°27.3		
8	56°33.7	286°17.8	40.7	184°22.1	49.1	245°35.1	08.9	167°36.2	18.5								Menkent	148°05.0	-36°27.1		
9	71°36.2	301°17.1	00.8	40.0	199°24.0	00.7	260°37.2	08.7	182°38.8	18.5							Arcturus	145°53.8	19°06.1		
10	86°38.7	316°16.4	39.2	214°25.9	49.4	275°39.3	08.5	197°41.4	18.5								Rigel Kent.	139°48.6	-60°54.3		
11	101°41.1	331°15.7	38.5	229°27.7	49.6	290°41.3	08.4	212°43.9	18.5								Kochab	137°19.9	74°05.7		
12	116°43.6	346°15.0	N19°37.7	244°29.6	S21°49.7	305°43.4	N05°08.2	227°46.5	S20°18.5								Zuben' ubi	137°03.0	-16°06.5		
13	131°46.1	1°14.3	37.0	259°31.4	49.9	320°45.5	08.0	242°49.1	18.5								Alphecca	126°09.1	26°39.9		
14	146°48.5	16°13.7	36.2	274°33.3	50.1	335°47.6	07.9	257°51.6	18.5								Antares	112°23.4	-26°27.9		
15	161°51.0	31°13.0	00.3	35.5	289°35.2	00.2	350°49.7	07.7	272°54.2	18.5							Atria	107°22.8	-69°03.4		
16	176°53.5	46°12.3	34.7	304°37.0	50.4	5°51.8	07.5	287°56.8	18.5								Sabik	102°09.9	-15°44.5		
17	191°55.9	61°11.6	34.0	319°38.9	50.5	20°53.8	07.4	302°59.3	18.5								Rasalhague	96°04.2	12°33.2		
18	206°58.4	76°10.9	N19°33.2	334°40.7	S21°50.7	35°55.9	N05°07.2	318°01.9	S20°18.5								Eltanin	90°44.7	51°29.6		
19	222°00.9	91°10.2	32.5	349°42.6	50.8	50°58.0	07.0	333°04.5	18.4								Kaus Aust.	83°40.7	-34°22.4		
20	237°03.3	106°09.5	31.7	4°44.4	51.0	66°00.1	06.9	348°07.0	18.4								Vega	80°37.1	38°48.2		
21	252°05.8	121°08.8	00.8	31.0	19°46.3	01.2	81°02.2	06.7	3°09.6	18.4							Nunki	75°55.4	-26°16.3		
22	267°08.2	136°08.1	30.2	34°48.1	51.3	96°04.3	06.5	18°12.2	18.4								Altair	62°05.9	8°55.0		
23	282°10.7	151°07.4	29.4	49°50.0	51.5	111°06.3	06.4	33°14.8	18.4								Peacock	53°15.4	-56°40.6		
Mer.pass.:04:14				v-0.7 d-0.7 m-3.8				v1.9 d-0.2 m-1.1				v2.1 d-0.2 m-1.6				v2.6 d0.0 m0.2					
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	297°13.2	166°06.7	N19°28.7	64°51.8	S21°51.6	126°08.4	N05°06.2	48°17.3	S20°18.4									Fomalhaut	15°21.5	-29°31.9	
1	312°15.6	181°06.0	27.9	79°53.7	51.8	141°10.5	06.0	63°19.9	18.4								Scheat	13°51.1	28°10.3		
2	327°18.1	196°05.3	27.1	94°55.5	52.0	156°12.6	05.9	78°22.5	18.4								Markab	13°36.0	15°17.7		
3	342°20.6	211°04.6	00.3	26.4	109°57.3	00.2	52.1	171°14.7	05.7	93°25.0	18.4										
4	357°23.0	226°03.9	25.6	124°59.2	52.3	186°16.8	05.5	108°27.6	18.4												
5	12°25.5	241°03.2	24.9	140°01.0	52.4	201°18.8	05.4	123°30.2	18.4												
6	27°28.0	256°02.6	N19°24.1	155°02.9	S21°52.6	216°20.9	N05°05.2	138°32.7	S20°18.4												
7	42°30.4	271°01.9	23.3	170°04.7	52.8	231°23.0	05.0	153°35.3	18.4												

DUT1 = UT1-UTC = -0.2191 sec ΔT = TT-UT1 = +68.4031 sec

2016 July 17 to Jul. 19 UT

h		Sun			Moon			Twilight						
Sun	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Naut.	Civil	Sunrise	Sunset	Civil	Naut.
0	178°27.8	N21°09.2	35°56.7	11.0'	\$17°57.9	-2.6'	55.3'	N 72°						
1	193°27.7	08.8	50°26.7	11.0'	18°00.4	-2.5'	55.3'	N 70°						
2	208°27.7	08.4	64°56.7	10.9'	18°02.9	-2.4'	55.3'	68°						
3	223°27.6	.. 08.0	79°26.6	10.9'	18°05.2	-2.3'	55.4'	66°			00:38	23:22		
4	238°27.6	07.5	93°56.4	10.9'	18°07.5	-2.2'	55.4'	64°			01:50	22:19		
5	253°27.5	07.1	108°26.3	10.8'	18°09.7	-2.1'	55.4'	62°			02:26	21:45		
6	268°27.5	N21°06.7	122°56.1	10.8'	\$18°11.8	-2.0'	55.4'	60°			01:12	02:51	21:20	22:56
7	283°27.4	06.2	137°25.8	10.7'	18°13.8	-2.0'	55.4'	N 58°			01:56	03:10	21:01	22:14
8	298°27.4	05.8	151°55.5	10.7'	18°15.7	-1.9'	55.5'	56°			02:24	03:26	20:45	21:46
9	313°27.3	.. 05.4	166°25.2	10.7'	18°17.5	-1.8'	55.5'	54°	01:06	02:46	03:40	20:31	21:25	23:02
10	328°27.3	04.9	180°54.8	10.6'	18°19.2	-1.7'	55.5'	52°	01:46	03:03	03:52	20:20	21:08	22:24
11	343°27.2	04.5	195°24.4	10.6'	18°20.9	-1.6'	55.5'	50°	02:13	03:17	04:02	20:09	20:54	21:58
12	358°27.2	N21°04.1	209°54.0	10.5'	\$18°22.4	-1.5'	55.5'	45°	02:33	03:30	04:11	20:00	20:42	21:38
13	13°27.2	03.6	224°23.5	10.5'	18°23.8	-1.4'	55.6'	N 40°	03:09	03:55	04:31	19:41	20:17	21:02
14	28°27.1	03.2	238°53.0	10.5'	18°25.2	-1.3'	55.6'	35°	03:35	04:15	04:46	19:26	19:57	20:36
15	43°27.1	.. 02.8	253°22.4	10.4'	18°26.5	-1.2'	55.6'	30°	03:56	04:31	05:00	19:13	19:41	20:16
16	58°27.0	02.3	267°51.8	10.4'	18°27.6	-1.1'	55.6'	20°	04:12	04:44	05:11	19:01	19:28	20:00
17	73°27.0	01.9	282°21.2	10.3'	18°28.7	-1.0'	55.7'	N 10°	04:38	05:06	05:30	18:42	19:06	19:34
18	88°26.9	N21°01.4	296°50.5	10.3'	\$18°29.7	-0.9'	55.7'	0°	04:58	05:25	05:47	18:25	18:48	19:14
19	103°26.9	01.0	311°19.8	10.3'	18°30.6	-0.8'	55.7'	S 10°	05:15	05:41	06:03	18:10	18:32	18:58
20	118°26.8	00.6	325°49.1	10.2'	18°31.4	-0.7'	55.7'	20°	05:30	05:56	06:18	17:54	18:17	18:43
21	133°26.8	21°00.1	340°18.3	10.2'	18°32.1	-0.6'	55.8'	30°	05:44	06:11	06:34	17:38	18:02	18:29
22	148°26.7	20°59.7	354°47.5	10.2'	18°32.7	-0.5'	55.8'	35°	05:58	06:27	06:53	17:20	17:45	18:15
23	163°26.7	59.2	9°16.6	10.1'	18°33.2	-0.5'	55.8'	40°	06:05	06:36	07:04	17:09	17:36	18:07
	SD.=15.7	d=-0.4			S.D.=15.1			45°	06:22	06:58	07:31	16:42	17:26	18:00
	SD.=15.7	d=-0.4			S.D.=15.1			S 50°	06:31	07:12	07:49	16:24	17:01	17:42
	SD.=15.7	d=-0.4			S.D.=15.3			52°	06:36	07:18	07:57	16:16	16:55	17:37
	SD.=15.7	d=-0.4			S.D.=15.3			54°	06:40	07:25	08:06	16:07	16:48	17:33
	SD.=15.7	d=-0.4			S.D.=15.3			56°	06:45	07:32	08:17	15:56	16:41	17:28
	SD.=15.7	d=-0.4			S.D.=15.3			58°	06:51	07:41	08:29	15:44	16:32	17:23
	SD.=15.7	d=-0.4			S.D.=15.3			S 60°	06:56	07:50	08:43	15:30	16:23	17:17
Tue	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Sun	Moonrise	Sun	Moonset	Sun	Moonset
0	178°26.6	N20°58.8	23°45.7	10.1'	\$18°33.6	-0.4'	55.8'	N 72°	■■■	22:49	■■■	—:-	—:-	—:-
1	193°26.6	58.4	38°14.8	10.1'	18°33.9	-0.3'	55.8'	N 70°	20:50	21:35	21:54	23:52	—:-	00:55
2	208°26.5	57.9	52°43.9	10.0'	18°34.1	-0.2'	55.9'	68°	20:03	20:51	21:21	00:01	00:39	01:39
3	223°26.5	.. 57.5	67°12.9	10.0'	18°34.2	-0.1'	55.9'	66°	19:33	20:22	20:56	00:28	01:10	02:08
4	238°26.5	57.0	81°41.9	10.0'	18°34.2	0.0'	55.9'	64°	19:10	19:59	20:37	00:49	01:33	02:30
5	253°26.4	56.6	96°10.9	10.0'	18°34.1	0.1'	55.9'	62°	18:52	19:42	20:21	01:06	01:51	02:47
6	268°26.4	N20°56.1	110°39.8	9.9'	\$18°33.9	0.2'	56.0'	60°	18:37	19:27	20:08	01:21	02:06	03:02
7	283°26.3	55.7	125°08.7	9.9'	18°33.7	0.3'	56.0'	N 58°	18:24	19:14	19:57	01:33	02:19	03:14
8	298°26.3	55.2	139°37.6	9.9'	18°33.3	0.4'	56.0'	56°	18:13	19:04	19:47	01:43	02:30	03:25
9	313°26.2	.. 54.8	154°06.5	9.8'	18°32.8	0.5'	56.0'	54°	18:03	18:54	19:38	01:53	02:39	03:35
10	328°26.2	54.4	168°35.3	9.8'	18°32.2	0.6'	56.1'	52°	17:55	18:45	19:31	02:01	02:48	03:43
11	343°26.2	53.9	183°04.1	9.8'	18°31.5	0.7'	56.1'	50°	17:47	18:38	19:24	02:08	02:56	03:51
12	358°26.1	N20°53.5	197°32.9	9.8'	\$18°30.8	0.8'	56.1'	45°	17:30	18:21	19:08	02:24	03:12	04:07
13	13°26.1	53.0	212°01.6	9.7'	18°29.9	0.9'	56.1'	N 40°	17:17	18:08	18:56	02:37	03:26	04:20
14	28°26.0	52.6	226°30.3	9.7'	18°28.9	1.0'	56.2'	35°	17:05	17:57	18:45	02:48	03:37	04:31
15	43°26.0	.. 52.1	240°59.0	9.7'	18°27.8	1.1'	56.2'	30°	16:55	17:47	18:36	02:58	03:47	04:41
16	58°25.9	51.7	255°27.7	9.7'	18°26.7	1.2'	56.2'	20°	16:38	17:30	18:20	03:15	04:05	04:58
17	73°25.9	51.2	269°56.3	9.6'	18°25.4	1.3'	56.2'	N 10°	16:23	17:15	18:06	03:30	04:20	05:12
18	88°25.9	N20°50.7	284°25.0	9.6'	\$18°24.0	1.4'	56.3'	0°	16:09	17:01	17:53	03:43	04:34	05:26
19	103°25.8	50.3	298°53.6	9.6'	18°22.5	1.5'	56.3'	S 10°	15:55	16:47	17:40	03:57	04:48	05:39
20	118°25.8	49.8	313°22.2	9.6'	18°20.9	1.6'	56.3'	20°	15:40	16:32	17:26	04:12	05:03	05:54
21	133°25.7	.. 49.4	327°50.7	9.6'	18°19.3	1.7'	56.3'	30°	15:23	16:15	17:10	04:28	05:20	06:11
22	148°25.7	48.9	342°19.3	9.5'	18°17.5	1.8'	56.4'	35°	15:14	16:05	17:01	04:38	05:30	06:20
23	163°25.7	48.5	356°47.8	9.5'	18°15.6	1.9'	56.4'	40°	15:02	15:54	16:50	04:49	05:42	06:31
	SD.=15.7	d=-0.4			S.D.=15.3			45°	14:49	15:40	16:38	05:02	05:55	06:44
	SD.=15.7	d=-0.4			S.D.=15.3			S 50°	14:33	15:24	16:22	05:18	06:11	07:00
	SD.=15.7	d=-0.4			S.D.=15.3			52°	14:25	15:16	16:15	05:26	06:19	07:07
	SD.=15.7	d=-0.4			S.D.=15.3			54°	14:17	15:08	16:07	05:34	06:28	07:15
	SD.=15.7	d=-0.4			S.D.=15.3			56°	14:07	14:58	15:58	05:43	06:37	07:24
	SD.=15.7	d=-0.4			S.D.=15.3			58°	13:57	14:47	15:48	05:54	06:48	07:34
	SD.=15.7	d=-0.4			S.D.=15.3			S 60°	13:44	14:35	15:37	06:06	07:01	07:46
Day					Eqn.of Time					Moon				
					00 <sup>h</sup>	00:mm:ss	Mer. Pass.			Mer.				
					12 <sup>h</sup>	mm:ss	Pass			Upper				
							hh:mm			Lower				
							hh:mm			hh:mm				
17					06:09	06:11				12:06				
18					06:13	06:16				22:22				
19					06:18	06:19				12:06				
										—:-				
										11:39				

**July 20, 21, 22 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	298°12.3	165°50.2	N19°10.1	65°35.8	S21°55.5	126°58.4	N05°02.2	49°18.9	S20°18.3					Alpheratz	357°41.1	
1	313°14.8	180°49.6	09.3	80°37.6	55.7	142°00.5	02.0	64°21.5	18.3					Ankaa	353°13.5	
2	328°17.2	195°48.9	08.6	95°39.4	55.8	157°02.5	01.8	79°24.0	18.3					Schedar	349°37.8	
3	343°19.7	210°48.2	.. 07.8	110°41.2	.. 56.0	172°04.6	.. 01.6	94°26.6	.. 18.3					Diphda	348°53.7	
4	358°22.2	225°47.5	07.0	125°43.0	56.2	187°06.7	01.5	109°29.2	18.3					Achernar	335°25.3	
5	13°24.6	240°46.8	06.2	140°44.9	56.3	202°08.8	01.3	124°31.7	18.3					Hamal	327°58.4	
6	28°27.1	255°46.2	N19°05.4	155°46.7	S21°56.5	217°10.9	N05°01.1	139°34.3	S20°18.3					Polaris	316°54.6	
7	43°29.6	270°45.5	04.6	170°48.5	56.7	232°12.9	01.0	154°36.9	18.3					Acamar	315°16.9	
8	58°32.0	285°44.8	03.8	185°50.3	56.8	247°15.0	00.8	169°39.4	18.2					Menkar	314°12.9	
9	73°34.5	300°44.1	.. 03.0	200°52.1	.. 57.0	262°17.1	.. 00.6	184°42.0	.. 18.2					Mirfak	308°37.5	
10	88°37.0	315°43.5	02.2	215°53.9	57.2	277°19.2	00.5	199°44.5	18.2					Aldebaran	290°47.2	
11	103°39.4	330°42.8	01.4	230°55.7	57.3	292°21.3	00.3	214°47.1	18.2					Rigel	281°10.3	
12	118°41.9	345°42.1	N19°00.7	245°57.5	S21°57.5	307°23.3	N05°00.1	229°49.7	S20°18.2					Capella	280°31.7	
13	133°44.3	0°41.4	18°59.9	260°59.3	57.7	322°25.4	04°59.9	244°52.2	18.2					Bellatrix	278°30.0	
14	148°46.8	15°40.8	59.1	276°01.1	57.8	337°27.5	59.8	259°54.8	18.2					Elnath	278°10.3	
15	163°49.3	30°40.1	.. 58.3	291°02.9	.. 58.0	352°29.6	.. 59.6	274°57.4	.. 18.2					Alnilam	275°44.5	
16	178°51.7	45°39.4	57.5	306°04.7	58.2	7°31.7	59.4	289°59.9	18.2					Betelgeuse	270°59.3	
17	193°54.2	60°38.7	56.7	321°06.5	58.3	22°33.7	59.3	305°02.5	18.2					Canopus	263°55.7	
18	208°56.7	75°38.1	N18°55.9	336°08.3	S21°58.5	37°35.8	N04°59.1	320°05.0	S20°18.2					Sirius	258°32.2	
19	223°59.1	90°37.4	55.1	351°10.1	58.7	52°37.9	58.9	335°07.6	18.2					Adhara	255°11.2	
20	239°01.6	105°36.7	54.3	6°11.9	58.8	67°40.0	58.8	350°10.2	18.2					Procyon	244°57.9	
21	254°04.1	120°36.1	.. 53.5	21°13.7	.. 59.0	82°42.0	.. 58.6	5°12.7	.. 18.2					Pollux	243°25.6	
22	269°06.5	135°35.4	52.7	36°15.5	59.2	97°44.1	58.4	20°15.3	18.2					Avior	234°17.7	
23	284°09.0	150°34.7	51.9	51°17.3	59.3	112°46.2	58.2	35°17.8	18.2					Suhail	222°51.3	
Mer.pass.:04:07			v-0.7 d-0.8 m-3.8			v1.8 d-0.2 m-1.0			v2.1 d-0.2 m-1.6			v2.6 d0.0 m0.3				
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	299°11.5	165°34.1	N18°51.0	66°19.1	S21°59.5	127°48.3	N04°58.1	50°20.4	S20°18.2					Denebola	182°31.7	
1	314°13.9	180°33.4	50.2	81°20.9	59.7	142°50.3	57.9	65°23.0	18.2					Gienah	175°50.2	
2	329°16.4	195°32.7	49.4	96°22.6	21°59.8	157°52.4	57.7	80°25.5	18.2					Acrux	173°07.0	
3	344°18.8	210°32.1	.. 48.6	111°24.4	22°00.0	172°54.5	.. 57.6	95°28.1	.. 18.2					Gacrux	171°58.6	
4	359°21.3	225°31.4	47.8	126°26.2	00.2	187°56.6	57.4	110°30.6	18.1					Alioth	166°19.1	
5	14°23.8	240°30.7	47.0	141°28.0	00.3	202°58.7	57.2	125°33.2	18.1					Spica	158°29.1	
6	29°26.2	255°30.1	N18°46.2	156°29.8	S22°00.5	218°00.7	N04°57.1	140°35.8	S20°18.1					Alkaid	152°57.3	
7	44°28.7	270°29.4	45.4	171°31.6	00.7	233°02.8	56.9	155°38.3	18.1					Hadar	148°44.7	
8	59°31.2	285°28.7	44.6	186°33.3	00.8	248°04.9	56.7	170°40.9	18.1					Menkent	148°05.0	
9	74°33.6	300°28.1	.. 43.8	201°35.1	.. 01.0	263°07.0	.. 56.5	185°43.4	.. 18.1					Arcturus	145°53.8	
10	89°36.1	315°27.4	42.9	216°36.9	01.2	278°09.0	56.4	200°46.0	18.1					Rigel Kent.	139°48.6	
11	104°38.6	330°26.7	42.1	231°38.7	01.3	293°11.1	56.2	215°48.6	18.1					Kochab	137°20.0	
12	119°41.0	345°26.1	N18°41.3	246°40.5	S22°01.5	308°13.2	N04°56.0	230°51.1	S20°18.1					Zuben' ubi	137°03.0	
13	134°43.5	0°25.4	40.5	261°42.2	01.7	323°15.3	55.9	245°53.7	18.1					Alphecca	126°09.1	
14	149°46.0	15°24.8	39.7	276°44.0	01.9	338°17.3	55.7	260°56.2	18.1					Antares	112°23.4	
15	164°48.4	30°24.1	.. 38.9	291°45.8	.. 02.0	353°19.4	.. 55.5	275°58.8	.. 18.1					Atria	107°22.9	
16	179°50.9	45°23.4	38.0	306°47.6	02.2	8°21.5	55.3	291°01.4	18.1					Sabik	102°09.9	
17	194°53.3	60°22.8	37.2	321°49.3	02.4	23°23.6	55.2	306°03.9	18.1					Rasalhague	96°04.2	
18	209°55.8	75°22.1	N18°36.4	336°51.1	S22°02.5	38°25.6	N04°55.0	321°06.5	S20°18.1					Eltanin	90°44.7	
19	224°58.3	90°21.5	35.6	351°52.9	02.7	53°27.7	54.8	336°09.0	18.1					Kaus Aust.	83°40.7	
20	240°00.7	105°20.8	34.7	6°54.6	02.9	68°29.8	54.7	351°11.6	18.1					Vega	80°37.1	
21	255°03.2	120°20.2	.. 33.9	21°56.4	.. 03.1	83°31.8	.. 54.5	6°14.1	.. 18.1					Nunki	75°55.4	
22	270°05.7	135°19.5	33.1	36°58.2	03.2	98°33.9	54.3	21°16.7	18.1					Altair	62°05.8	
23	285°08.1	150°18.8	32.3	51°59.9	03.4	113°36.0	54.1	36°19.3	18.1					Peacock	53°15.4	
Mer.pass.:04:03			v-0.7 d-0.8 m-3.8			v1.8 d-0.2 m-1.0			v2.1 d-0.2 m-1.6			v2.6 d0.0 m0.3				
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	300°10.6	165°18.2	N18°31.4	67°01.7	S22°03.6	128°38.1	N04°54.0	51°21.8	S20°18.1					Fomalhaut	15°21.5	
1	315°13.1	180°17.5	30.6	82°03.4	03.7	143°40.1	53.8	66°24.4	18.1					Scheat	13°51.0	
2	330°15.5	195°16.9	29.8	97°05.2	03.9	158°42.2	53.6	81°26.9	18.1					Markab	13°36.0	
3	345°18.0	210°16.2	.. 29.0	112°07.0	.. 04.1	173°44.3	.. 53.4	96°29.5	.. 18.0					Jul 20 Wed	15°06.6	
4	0°20.4	225°15.6	28.1	127°08.7	04.3	188°46.4	53.3	111°32.0	18.0					Venus	227°37.9	
5	15°22.9	240°14.9	27.3	142°10.5	04.4	203°48.4	53.1	126°34.6	18.0					Mars	127°23.5	
6	30°25.4	255°14.3	N18°26.5	157°12.2	S22°04.6	218°50.5	N04°52.9	141°37.2	S20°18.0					Jupiter	188°46.1	
7	45°27.8	270°13.6	25.6	172°14.0	04.8	233°52.6	52.8	156°39.7	18.0					Saturn	111°06.6	
8	60°30.3	285°13.0	24.8	187°15.7	04.9	248°54.7	52.6	171°42.3	18.0					Jul 21 Thu	12:59:11	
9	75°32.8	300°12.3	.. 24.0	202°17.5	.. 05.1	263°56.7	.. 52.4	186°44.8	.. 18.0					Venus	226°22.6	
10	90°35.2	315°11.7	23.1	217°19.2	05.3	278°58.8	52.2	201°47.4	18.0					Mars	127°07.6	
11	105°37.7	330°11.0	22.3	232°21.0	05.5	294°09.9	52.1	216°49.9	18.0					Jupiter	188°36.8	
12	120°40.2	345°10.4	N18°21.4	247°22.7	S22°05.6	309°02.9	N04°51.9	231°52.5	S20°18.0					Saturn	111°09.0	
13	135°42.6	0°09.7	20.6	262°24.5	05.8	324°05.0	51.7	246°55.0	18.0					Jul 22 Fri	20:39	
14	150°45.1	15°09.1	19.8	277°26.2	06.0	339°07.1	51.6	261°57.6	18.0					Venus	225°07.6	
15	165°47.6	30°08.4	.. 18.9	292°28.0	.. 06.2	354°09.2	.. 51.4	277°00.2	.. 18.0					Mars	126°51.1	
16	180°50.0	45°07.8	18.1	307°29.7	06.3	9°11.2	51.2	292°02.7	18.0					Jupiter	188°27.5	
17	195°52.5	60°07.1	17.2	322°31.5	06.5	24°										

DUT1 = UT1-UTC = -0.2204 sec ΔT = TT-UT1 = +68.4044 sec

2016 July 20 to Jul. 22 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	178°24.7	N20°36.9	358°36.9	9.3'	S16°55.7	4.4'	57.0'	
1	193°24.7	36.4	13°05.1	9.3'	16°51.2	4.5'	57.0'	
2	208°24.7	35.9	27°33.4	9.3'	16°46.6	4.6'	57.0'	
3	223°24.6	.. 35.5	42°01.7	9.3'	16°41.9	4.7'	57.1'	
4	238°24.6	35.0	56°29.9	9.3'	16°37.1	4.8'	57.1'	
5	253°24.6	34.5	70°58.2	9.3'	16°32.3	4.9'	57.1'	
6	268°24.5	N20°34.0	85°26.5	9.3'	S16°27.3	5.0'	57.1'	
7	283°24.5	33.6	95°44.8	9.3'	16°22.2	5.1'	57.2'	
8	298°24.5	33.1	114°23.0	9.3'	16°17.0	5.2'	57.2'	
9	313°24.4	.. 32.6	128°51.3	9.3'	16°11.8	5.3'	57.2'	
10	328°24.4	32.1	143°19.6	9.3'	16°06.4	5.4'	57.2'	
11	343°24.4	31.7	157°47.9	9.3'	16°01.0	5.5'	57.3'	
12	358°24.3	N20°31.2	172°16.2	9.3'	S15°55.4	5.6'	57.3'	
13	13°24.3	30.7	186°44.5	9.3'	15°49.8	5.7'	57.3'	
14	28°24.3	30.2	201°12.7	9.3'	15°44.0	5.8'	57.3'	
15	43°24.3	.. 29.7	215°41.1	9.3'	15°38.2	5.9'	57.4'	
16	58°24.2	29.3	230°09.4	9.3'	15°32.3	6.0'	57.4'	
17	73°24.2	28.8	244°37.7	9.3'	15°26.3	6.1'	57.4'	
18	88°24.2	N20°28.3	259°06.0	9.3'	S15°20.2	6.2'	57.4'	
19	103°24.1	27.8	273°34.3	9.3'	15°14.0	6.2'	57.4'	
20	118°24.1	27.3	288°02.7	9.3'	15°07.7	6.3'	57.5'	
21	133°24.1	.. 26.8	302°31.0	9.3'	15°01.3	6.4'	57.5'	
22	148°24.0	26.4	316°59.4	9.4'	14°54.8	6.5'	57.5'	
23	163°24.0	25.9	331°27.7	9.4'	14°48.3	6.6'	57.5'	
	SD.=15.7	d=-0.5			S.D.=15.6			

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

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

Day	Sun		Moon		Age
	Eqn.of Time	Mer. Pass.	Mer. Pass.	Upper Lower	
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	hh:mm	hh:mm	16-18 100-93%
20	06:21	06:23	12:06	00:06	12:32
21	06:24	06:25	12:06	00:58	13:24
22	06:26	06:27	12:06	01:50	14:16

SD.=15.7	d=-0.5	S.D.=15.9
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**July 23, 24, 25 UT (Sat., Sun., Mon.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	301°09.7	165°02.6	N18°11.3	67°43.6	S22°07.7	129°27.8	N04°49.8	52°23.1	S20°18.0	Alpheratz	357°41.1
1	316°12.2	180°02.0	10.5	82°45.4	07.9	144°29.9	49.6	67°25.7	18.0	Ankaa	353°13.5
2	331°14.7	195°01.3	09.6	97°47.1	08.1	159°31.9	49.5	82°28.2	18.0	Schedar	349°37.8
3	346°17.1	210°00.7	.. 08.8	112°48.8	.. 08.3	174°34.0	.. 49.3	97°30.8	.. 18.0	Diphda	348°53.7
4	1°19.6	225°00.0	07.9	127°50.6	08.4	189°36.1	49.1	112°33.4	18.0	Achernar	335°25.3
5	16°22.1	239°59.4	07.1	142°52.3	08.6	204°38.1	49.0	127°35.9	18.0	Hamal	327°58.4
6	31°24.5	254°58.8	N18°06.2	157°54.0	S22°08.8	219°40.2	N04°48.8	142°38.5	S20°17.9	Polaris	316°53.3
7	46°27.0	269°58.1	05.4	172°55.8	09.0	234°42.3	48.6	157°41.0	17.9	Acamar	315°16.9
8	61°29.4	284°57.5	04.5	187°57.5	09.1	249°44.4	48.4	172°43.6	17.9	Menkar	314°12.9
9	76°31.9	299°56.8	.. 03.7	202°59.2	.. 09.3	264°46.4	.. 48.3	187°46.1	.. 17.9	Mirfak	308°37.4
10	91°34.4	314°56.2	02.8	218°00.9	09.5	279°48.5	48.1	202°48.7	17.9	Aldebaran	290°47.2
11	106°36.8	329°55.6	01.9	233°02.7	09.7	294°50.6	47.9	217°51.2	17.9	Rigel	281°10.3
12	121°39.3	344°54.9	N18°01.1	248°04.4	S22°09.8	309°52.6	N04°47.7	232°53.8	S20°17.9	Capella	280°31.7
13	136°41.8	359°54.3	18°00.2	263°06.1	10.0	324°54.7	47.6	247°56.3	17.9	Bellatrix	278°30.0
14	151°44.2	14°53.7	17°59.4	278°07.8	10.2	339°56.8	47.4	262°58.9	17.9	Elnath	278°10.2
15	166°46.7	29°53.0	.. 58.5	293°09.5	.. 10.4	354°58.8	.. 47.2	278°01.4	.. 17.9	Alnilam	275°44.5
16	181°49.2	44°52.4	57.6	308°11.3	10.6	10°00.9	47.0	293°04.0	17.9	Betelgeuse	270°59.3
17	196°51.6	59°51.8	56.8	323°13.0	10.7	25°03.0	46.9	308°06.5	17.9	Canopus	263°55.7
18	211°54.1	74°51.1	N17°55.9	338°14.7	S22°10.9	40°05.0	N04°46.7	323°09.1	S20°17.9	Sirius	258°32.2
19	226°55.6	89°50.5	55.0	353°16.4	11.1	55°07.1	46.5	338°11.6	17.9	Adhara	255°11.2
20	241°59.0	104°49.9	54.2	8°18.1	11.3	70°09.2	46.3	353°14.2	17.9	Procyon	244°57.9
21	257°01.5	119°49.2	.. 53.3	23°19.8	.. 11.4	85°11.2	.. 46.2	8°16.7	.. 17.9	Pollux	243°25.6
22	272°03.9	134°48.6	52.4	38°21.5	11.6	100°13.3	46.0	23°19.3	17.9	Avior	234°17.7
23	287°06.4	149°48.0	51.6	53°23.3	11.8	115°15.4	45.8	38°21.8	17.9	Suhail	222°51.3
Mer.pass.:03:55		v-0.6 d-0.8 m-3.8		v1.7 d-0.2 m-1.0		v2.1 d-0.2 m-1.6		v2.6 d0.0 m0.3		Miaplacidus	
Sun		GHA		GHA		Dec		GHA		Dec	
0	302°08.9	164°47.3	N17°50.7	68°25.0	S22°12.0	130°17.4	N04°45.6	53°24.4	S20°17.9	Denebola	183°31.7
1	317°11.3	179°46.7	49.8	83°26.7	12.2	145°19.5	45.5	68°26.9	17.9	Gienah	175°50.3
2	332°13.8	194°46.1	49.0	98°28.4	12.3	160°21.6	45.3	83°29.5	17.9	Acrux	173°07.1
3	347°16.3	209°45.4	.. 48.1	113°30.1	.. 12.5	175°23.6	.. 45.1	98°32.0	.. 17.9	Gacrux	171°58.6
4	2°18.7	224°44.8	47.2	128°31.8	12.7	190°25.7	44.9	113°34.6	17.9	Alioth	166°19.1
5	17°21.2	239°44.2	46.4	143°33.5	12.9	205°27.8	44.8	128°37.1	17.9	Spica	158°29.1
6	32°23.7	254°43.6	N17°45.5	158°35.2	S22°13.1	220°29.8	N04°44.6	143°39.7	S20°17.9	Alkaid	152°57.4
7	47°26.1	269°42.9	44.6	173°36.9	13.2	235°31.9	44.4	158°42.2	17.9	Hadar	148°44.7
8	62°28.6	284°42.3	43.7	188°38.6	13.4	250°34.0	44.2	173°44.8	17.9	Menkent	148°05.0
9	77°31.0	299°41.7	.. 42.9	203°40.3	.. 13.6	265°36.0	.. 44.1	188°47.3	.. 17.9	Arcturus	145°53.8
10	92°33.5	314°41.0	42.0	218°42.0	13.8	280°38.1	43.9	203°49.9	17.9	Rigel Kent.	139°48.6
11	107°36.0	329°40.4	41.1	233°43.7	14.0	295°40.2	43.7	218°52.4	17.9	Kochab	137°20.0
12	122°38.4	344°39.8	N17°40.2	248°45.4	S22°14.1	310°42.2	N04°43.5	233°55.0	S20°17.9	Zuben' ubi	137°03.0
13	137°40.9	359°39.2	39.3	263°47.1	14.3	325°44.3	43.4	248°57.5	17.9	Alphecca	126°09.1
14	152°43.4	14°38.5	38.5	278°48.8	14.5	340°46.4	43.2	264°00.1	17.8	Antares	112°23.4
15	167°45.8	29°37.9	.. 37.6	293°50.5	.. 14.7	355°48.4	.. 43.0	279°02.6	.. 17.8	Atria	107°22.9
16	182°48.3	44°37.3	36.7	308°52.2	14.9	10°50.5	42.8	294°05.1	17.8	Sabik	102°09.9
17	197°50.8	59°36.7	35.8	323°53.8	15.0	25°52.6	42.7	309°07.7	17.8	Rasalhague	96°04.2
18	212°53.2	74°36.1	N17°34.9	338°55.5	S22°15.2	40°54.6	N04°42.5	324°10.2	S20°17.8	Eltanin	90°44.7
19	227°55.7	89°35.4	34.0	353°57.2	15.4	55°56.7	42.3	339°12.8	17.8	Kaus Aust.	83°40.7
20	242°58.2	104°34.8	33.2	8°58.9	15.6	70°58.8	42.1	354°15.3	17.8	Vega	80°37.1
21	258°00.6	119°34.2	.. 32.3	24°00.6	.. 15.8	86°00.8	.. 42.0	9°17.9	.. 17.8	Nunki	75°55.4
22	273°03.1	134°33.6	31.4	39°02.3	15.9	101°02.9	41.8	24°20.4	17.8	Altair	62°05.8
23	288°05.5	149°33.0	30.5	54°04.0	16.1	116°05.0	41.6	39°23.0	17.8	Peacock	53°15.4
Mer.pass.:03:51		v-0.6 d-0.9 m-3.8		v1.7 d-0.2 m-0.9		v2.1 d-0.2 m-1.6		v2.5 d0.0 m0.3		Deneb	
Mon		GHA		GHA		Dec		GHA		Dec	
0	303°08.0	164°32.3	N17°29.6	69°05.6	S22°16.3	131°07.0	N04°41.4	54°25.5	S20°17.8	Fomalhaut	15°21.4
1	318°10.5	179°31.7	28.7	84°07.3	16.5	146°09.1	41.3	69°28.1	17.8	Scheat	13°51.0
2	333°12.9	194°31.1	27.8	99°09.0	16.7	161°11.1	41.1	84°30.6	17.8	Markab	13°36.0
3	348°15.4	209°30.5	.. 26.9	114°10.7	.. 16.9	176°13.2	.. 40.9	99°33.2	.. 17.8	Jul 23 Sat	Jul 23 Sat
4	3°17.9	224°29.9	26.0	129°12.4	17.0	191°15.3	40.7	114°35.7	17.8	Venus	223°52.9
5	18°20.3	239°29.3	25.1	144°14.0	17.2	206°17.3	40.6	129°38.2	17.8	Mars	126°33.9
6	33°22.8	254°28.6	N17°24.2	159°15.7	S22°17.4	221°19.4	N04°40.4	144°40.8	S20°17.8	Jupiter	188°18.1
7	48°25.3	269°28.0	23.4	174°17.4	17.6	236°21.5	40.2	159°43.3	17.8	Saturn	111°13.4
8	63°27.7	284°27.4	22.5	189°19.1	17.8	251°23.5	40.0	174°45.9	17.8	Jul 24 Sun	Jul 24 Sun
9	78°30.2	299°26.8	.. 21.6	204°20.7	.. 18.0	266°25.6	.. 39.9	189°48.4	.. 17.8	Venus	222°38.5
10	93°32.6	314°26.2	20.7	219°22.4	18.1	281°27.7	39.7	204°51.0	17.8	Mars	126°16.1
11	108°35.1	329°25.6	19.8	234°24.1	18.3	296°29.7	39.5	219°53.5	17.8	Jupiter	188°08.6
12	123°37.6	344°25.0	N17°18.9	249°25.7	S22°18.5	311°31.8	N04°39.3	234°56.1	S20°17.8	Saturn	111°15.5
13	138°40.0	359°24.3	18.0	264°27.4	18.7	326°33.8	39.1	249°58.6	17.8	Jul 25 Mon	Jul 25 Mon
14	153°42.5	14°23.7	17.1	279°29.1	18.9	341°35.9	39.0	265°01.1	17.8	Venus	221°24.3
15	168°45.0	29°23.1	.. 16.2	294°30.7	.. 19.1	356°38.0	.. 38.8	280°03.7	.. 17.8	Mars	125°57.6
16	183°47.4	44°22.5	15.3	309°32.4	19.2	11°40.0	38.6	295°06.2	17.8	Jupiter	187°59.0
17	198°49.9	59°21.9	14.4	324°34.1	19.4	26°42.1	38.4	310°08.8	17.8	Saturn	111°17.5
18	213°52.4	74°21.3	N17°13.5	339°35.7	S22°19.6	41°44.2	N04°38.3	325°11.3	S20°17.8	Horizontal parallax	
19	228°54.8	89°20.7	12.5	354°37.4	19.8	56°46.2	38.1	340°13.9	17.8	Venus:	0.1
20	243°57.3	104°20.1	11.6	9°39.1	20.0	71°48.3	37.9	355°16.4	17.8	Mars:	0.2
21	258°59.8	119°19.5	.. 10.7	24°40.7	.. 20.2	86°50.3	.. 37.7	10°18.9	.. 17.8	Jul 25 Mon	Jul 25 Mon
22	274°02.2	134°18.9	09.8	39°42.4	20.4	101°52.4	37.6	25°21.5	17.8	Venus	221°24.3
23	289°04.7	149°18.3	08.9	54°44.0	20.5	116°54.5	37.4	40°24.0	17.8	Mars	125°57.6
Mer.pass.:03:47		v-0.6 d-0.9 m-3.8		v1.7 d-0.2 m-0.9		v2.1 d-0.2 m-1.6		v2.5 d0.0 m0.3		Stars	

DUT1 = UT1-UTC = -0.2216 sec ΔT = TT-UT1 = +68.4056 sec

2016 July 23 to Jul. 25 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.9	N20°01.4	320°52.7	10.0'	S07°52.9	10.0'	58.5'
1	193°22.9	00.9	335°21.7	10.0'	07°42.8	10.1'	58.5'
2	208°22.9	20°00.4	349°50.7	10.0'	07°32.7	10.1'	58.5'
3	223°22.9	19°59.9	4°19.7	10.0'	07°22.6	10.2'	58.5'
4	238°22.9	59.3	18°48.8	10.0'	07°12.4	10.2'	58.5'
5	253°22.9	58.8	33°17.8	10.0'	07°02.1	10.3'	58.6'
6	268°22.8	N19°58.3	47°46.9	10.1'	S06°51.8	10.3'	58.6'
7	283°22.8	57.8	62°15.9	10.1'	06°41.5	10.3'	58.6'
8	298°22.8	57.3	76°45.0	10.1'	06°31.1	10.4'	58.6'
9	313°22.8	.. 56.8	91°14.1	10.1'	06°20.7	10.4'	58.6'
10	328°22.8	56.2	105°43.2	10.1'	06°10.3	10.5'	58.6'
11	343°22.8	55.7	120°12.3	10.1'	05°59.8	10.5'	58.6'
12	358°22.8	N19°55.2	134°41.4	10.1'	S05°49.3	10.5'	58.7'
13	13°22.7	54.7	149°10.5	10.1'	05°38.7	10.6'	58.7'
14	28°22.7	54.1	163°39.6	10.1'	05°28.1	10.6'	58.7'
15	43°22.7	.. 53.6	178°08.7	10.1'	05°17.5	10.7'	58.7'
16	58°22.7	53.1	192°37.9	10.1'	05°06.8	10.7'	58.7'
17	73°22.7	52.6	207°07.0	10.1'	04°56.1	10.7'	58.7'
18	88°22.7	N19°52.1	221°36.1	10.1'	S04°45.4	10.7'	58.7'
19	103°22.7	51.5	236°05.3	10.2'	04°34.6	10.8'	58.7'
20	118°22.7	51.0	250°34.4	10.2'	04°23.8	10.8'	58.8'
21	133°22.6	.. 50.5	265°03.6	10.2'	04°13.0	10.8'	58.8'
22	148°22.6	50.0	279°32.8	10.2'	04°02.1	10.9'	58.8'
23	163°22.6	49.4	294°01.9	10.2'	03°51.3	10.9'	58.8'
	SD.=15.7	d=-0.5			S.D.=16.0		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
23	06:28	06:29	12:06	15:08
24	06:30	06:30	12:06	15:59
25	06:30	06:30	12:07	16:50



SD.=15.7	d=-0.5	S.D.=16.1
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**July 26, 27, 28 UT (Tue., Wed., Thu.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	304°07.1	164°17.7	N17°08.0	69°45.7	S22°20.7	131°56.5	N04°37.2	55°26.6	S20°17.8	Alpheratz	357°41.1	29°10.8					
1	319°09.6	179°17.0	07.1	84°47.3	20.9	146°58.6	37.0	70°29.1	17.8	Ankaa	353°13.5	-42°12.7					
2	334°12.1	194°16.4	06.2	99°49.0	21.1	162°00.6	36.8	85°31.6	17.8	Schedar	349°37.7	56°37.4					
3	349°14.5	209°15.8	.. 05.3	114°50.7	.. 21.1	177°02.7	.. 36.7	100°34.2	.. 17.8	Diphda	348°53.7	-17°53.6					
4	4°17.0	224°15.2	04.4	129°52.3	21.5	192°04.8	36.5	115°36.7	17.8	Achernar	335°25.2	-57°09.0					
5	19°19.5	239°14.6	03.5	144°54.0	21.6	207°06.8	36.3	130°39.3	17.8	Hamal	327°58.3	23°32.2					
6	34°21.9	254°14.0	N17°02.5	159°55.6	S22°21.8	222°08.9	N04°36.1	145°41.8	S20°17.8	Polaris	316°51.9	89°19.6					
7	49°24.4	269°13.4	01.6	174°57.3	22.0	237°10.9	36.0	160°44.4	17.8	Acamar	315°16.9	-40°14.2					
8	64°26.9	284°12.8	17°00.7	189°58.9	22.2	252°13.0	35.8	175°46.9	17.8	Menkar	314°12.9	4°09.2					
9	79°29.3	299°12.2	16°59.8	205°00.6	.. 22.4	267°15.1	.. 35.6	190°49.4	.. 17.8	Mirfak	308°37.4	49°54.8					
10	94°31.8	314°11.6	58.9	220°02.2	22.6	282°17.1	35.4	205°52.0	17.7	Aldebaran	290°47.1	16°32.3					
11	109°34.2	329°11.0	58.0	235°03.8	22.8	297°19.2	35.2	220°54.5	17.7	Rigel	281°10.3	-8°11.1					
12	124°36.7	344°10.4	N16°57.0	250°05.5	S22°23.0	312°21.2	N04°35.1	235°57.1	S20°17.7	Capella	280°31.7	46°00.5					
13	139°39.2	359°09.8	56.1	265°07.1	23.1	327°23.3	34.9	250°59.6	17.7	Bellatrix	278°30.0	6°21.7					
14	154°41.6	14°09.2	55.2	280°08.8	23.3	342°25.4	34.7	266°02.1	17.7	Elnath	278°10.2	28°37.0					
15	169°44.1	29°08.6	.. 54.3	295°10.4	.. 23.5	357°27.4	.. 34.5	281°04.7	.. 17.7	Alnilam	275°44.5	-1°11.6					
16	184°46.6	44°08.0	53.4	310°12.1	23.7	12°29.5	34.4	296°07.2	17.7	Betelgeuse	270°59.3	7°24.4					
17	199°49.0	59°07.4	52.4	325°13.7	23.9	27°31.5	34.2	311°09.8	17.7	Canopus	263°55.7	-52°42.3					
18	214°51.5	74°06.8	N16°51.5	340°15.3	S22°24.1	42°33.6	N04°34.0	326°12.3	S20°17.7	Sirius	258°32.2	-16°44.4					
19	229°54.0	89°06.2	50.6	355°17.0	24.3	57°35.7	33.8	341°14.8	17.7	Adhara	255°11.2	-28°59.8					
20	244°56.4	104°05.6	49.7	10°18.6	24.4	72°37.7	33.6	356°17.4	17.7	Procyon	244°57.9	5°10.8					
21	259°58.9	119°05.0	.. 48.7	25°20.2	.. 24.6	87°39.8	.. 33.5	11°19.9	.. 17.7	Pollux	243°25.6	27°59.0					
22	275°01.4	134°04.4	47.8	40°21.9	24.8	102°41.8	33.3	26°22.4	17.7	Avior	234°17.7	-59°33.9					
23	290°03.8	149°03.9	46.9	55°23.5	25.0	117°43.9	33.1	41°25.0	17.7	Suhail	222°51.3	-43°30.1					
Mer.pass.:03:43			v-0.6 d-0.9 m-3.8			v1.7 d-0.2 m-0.9			v2.1 d-0.2 m-1.6			v2.5 d0.0 m0.3					
Wed			GHA			GHA			GHA			GHA					
0	305°06.3	164°03.3	N16°46.0	70°25.1	S22°25.2	132°45.9	N04°32.9	56°27.5	S20°17.7	Denebola	182°31.7	14°28.9					
1	320°08.7	179°02.7	45.0	85°26.8	25.4	147°48.0	32.8	71°30.1	17.7	Gienah	175°50.3	-17°38.0					
2	335°11.2	194°02.1	44.1	100°28.4	25.6	162°50.1	32.6	86°32.6	17.7	Acrux	173°07.1	-63°11.6					
3	350°13.7	209°01.5	.. 43.2	115°30.0	.. 25.8	177°52.1	.. 32.4	101°35.1	.. 17.7	Gacrux	171°58.7	-57°12.5					
4	5°16.1	224°00.9	42.2	130°31.6	26.0	192°54.2	32.2	116°37.7	17.7	Alioth	166°19.2	55°52.6					
5	20°18.6	239°00.3	41.3	145°33.3	26.1	207°56.2	32.0	131°40.2	17.7	Spica	158°29.1	-11°14.7					
6	35°21.1	253°59.7	N16°40.4	160°34.9	S22°26.3	222°58.3	N04°31.9	146°42.7	S20°17.7	Alkaid	152°57.4	49°14.2					
7	50°23.5	268°59.1	39.4	175°36.5	26.5	238°00.4	31.7	161°45.3	17.7	Hadar	148°44.8	-60°27.3					
8	65°26.0	283°58.5	38.5	190°38.1	26.7	253°02.4	31.5	176°47.8	17.7	Menkent	148°05.0	-36°27.1					
9	80°28.5	298°57.9	.. 37.6	205°39.8	.. 26.9	268°04.5	.. 31.3	191°50.4	.. 17.7	Arcturus	145°53.8	19°06.1					
10	95°30.9	313°57.4	36.6	220°41.4	27.1	283°06.5	31.1	206°52.9	17.7	Rigel Kent.	139°48.7	-60°54.3					
11	110°33.4	328°56.8	35.7	235°43.0	27.3	298°08.6	31.0	221°55.4	17.7	Kochab	137°20.1	74°05.7					
12	125°35.9	343°56.2	N16°34.8	250°44.6	S22°27.5	313°10.6	N04°30.8	236°58.0	S20°17.7	Zuben' ubi	137°03.0	-16°06.5					
13	140°38.3	358°55.6	33.8	265°46.2	27.7	328°12.7	30.6	252°00.5	17.7	Alphecca	126°09.1	26°39.9					
14	155°40.8	13°55.0	32.9	280°47.8	27.8	343°14.7	30.4	267°03.0	17.7	Antares	112°23.4	-26°27.9					
15	170°43.2	28°54.4	.. 31.9	295°49.5	.. 28.0	358°16.8	.. 30.2	282°05.6	.. 17.7	Atria	107°22.9	-69°03.4					
16	185°45.7	43°53.8	31.0	310°51.1	28.2	13°18.9	30.1	297°08.1	17.7	Sabik	102°09.9	-15°44.5					
17	200°48.2	58°53.2	30.1	325°52.7	28.4	28°20.9	29.9	312°10.6	17.7	Rasalhague	96°04.2	12°33.2					
18	215°50.6	73°52.7	N16°29.1	340°54.3	S22°28.6	43°23.0	N04°29.7	327°13.2	S20°17.7	Eltanin	90°44.7	51°29.6					
19	230°53.1	88°52.1	28.2	355°55.9	28.8	58°25.0	29.5	342°15.7	17.7	Kaus Aust.	83°40.7	-34°22.4					
20	245°55.6	103°51.5	27.2	10°57.5	29.0	73°27.1	29.4	357°18.2	17.7	Vega	80°37.1	38°48.3					
21	260°58.0	118°50.9	.. 26.3	25°59.1	.. 29.2	88°29.1	.. 29.2	12°20.8	.. 17.7	Nunki	75°55.4	-26°16.3					
22	276°00.5	133°50.3	25.3	41°00.7	29.4	103°31.2	29.0	27°23.3	17.7	Altair	62°05.8	8°55.0					
23	291°03.0	148°49.7	24.4	56°02.3	29.6	118°33.2	28.8	42°25.8	17.7	Peacock	53°15.4	-56°40.7					
Mer.pass.:03:39			v-0.6 d-0.9 m-3.8			v1.6 d-0.2 m-0.9			v2.1 d-0.2 m-1.6			v2.5 d0.0 m0.3					
Thu			GHA			GHA			GHA			GHA					
0	306°05.4	163°49.2	N16°23.4	71°03.9	S22°29.7	133°35.3	N04°28.6	57°28.4	S20°17.7	Al Na'ir	27°40.7	-46°52.6					
1	321°07.9	178°48.6	22.5	86°05.6	29.9	148°37.4	28.5	72°30.9	17.7	Fomalhaut	15°21.4	-29°31.9					
2	336°10.3	193°48.0	21.5	101°07.2	30.1	163°39.4	28.3	87°33.5	17.7	Scheat	13°51.0	28°10.4					
3	351°12.8	208°47.4	.. 20.6	116°08.8	.. 30.3	178°41.5	.. 28.1	102°36.0	.. 17.7	Markab	13°36.0	15°17.7					
4	6°15.3	223°46.8	19.6	131°10.4	30.5	193°43.5	27.9	117°38.5	17.7	<b>Jul 26 Tue SHA Mer.pass</b>							
5	21°17.7	238°46.3	18.7	146°12.0	30.7	208°45.6	27.7	132°41.1	17.7	Venus	220°10.5	13:03					
6	36°20.2	253°45.7	N16°17.7	161°13.6	S22°30.9	223°47.6	N04°27.6	147°43.6	S20°17.7	Mars	125°38.5	19:19					
7	51°22.7	268°45.1	16.8	176°15.2	31.1	238°49.7	27.4	162°46.1	17.7	Jupiter	187°49.4	15:10					
8	66°25.1	283°44.5	15.8	191°16.8	31.3	253°51.7	27.2	177°48.6	17.7	Saturn	111°19.4	20:15					
9	81°27.6	298°44.0	.. 14.9	206°18.3	.. 31.5	268°53.8	.. 27.0	192°51.2	.. 17.7	<b>Jul 27 Wed SHA Mer.pass</b>							
10	96°30.1	313°43.4	13.9	221°19.9	31.7	283°55.8	26.8	207°53.7	17.7	Venus	218°57.0	13:04					
11	111°32.5	328°42.8	13.0	236°21.5	31.8	298°57.9	26.7	222°56.2	17.7	Mars	125°18.8	19:16					
12	126°35.0	343°42.2	N16°12.0	251°23.1	S22°32.0	314°00.0	N04°26.5	237°58.8	S20°17.7	Jupiter	187°39.7	15:07					
13	141°37.5	358°41.6	11.1	266°24.7	32.2	329°02.0	26.3	253°01.3	17.7	Saturn	111°21.2	20:11					
14	156°39.9	13°41.1	10.1	281°26.3	32.4	344°04.1	26.1	268°03.8	17.7	<b>Jul 28 Thu SHA Mer.pass</b>							
15	171°42.4	28°40.5	.. 09.1	296°27.9	.. 32.6	359°06.1	.. 25.9	283°06.4	.. 17.7	Venus	217°43.7	13:05					
16	186°44.8	43°39.9	08.2	311°29.5	32.8	14°08.2	25.7	298°08.9	17.7	Mars	124°58.5	19:14					
17	201°47.3	58°39.4	07.2	326°31.1	33.0	29°10.2	25.6	313°11.4	17.7	Jupiter	187°29.9	15:04					
18	216°49.8	73°38.8															

DUT1 = UT1-UTC = -0.2229 sec ΔT = TT-UT1 = +68.4069 sec

2016 July 26 to Jul. 28 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.4	N19°22.9	283°43.8	9.6'	N05°11.2	10.8'	59.2'	
1	193°22.4	22.4	298°12.4	9.6'	05°22.0	10.8'	59.2'	
2	208°22.4	21.8	312°41.0	9.6'	05°32.8	10.8'	59.2'	
3	223°22.4	.. 21.2	327°09.6	9.6'	05°43.6	10.7'	59.2'	
4	238°22.4	20.7	341°38.2	9.5'	05°54.3	10.7'	59.2'	
5	253°22.4	20.1	356°06.7	9.5'	06°04.9	10.7'	59.2'	
6	268°22.4	N19°19.6	10°35.2	9.5'	N06°15.6	10.6'	59.3'	
7	283°22.4	19.0	25°03.7	9.5'	06°26.2	10.6'	59.3'	
8	298°22.4	18.5	39°32.1	9.4'	06°36.8	10.6'	59.3'	
9	313°22.4	.. 17.9	54°00.6	9.4'	06°47.3	10.5'	59.3'	
10	328°22.4	17.3	68°29.0	9.4'	06°57.8	10.5'	59.3'	
11	343°22.4	16.8	82°57.3	9.4'	07°08.3	10.4'	59.3'	
12	358°22.4	N19°16.2	97°25.7	9.3'	N07°18.7	10.4'	59.3'	
13	13°22.4	15.7	111°54.0	9.3'	07°29.0	10.4'	59.3'	
14	28°22.5	15.1	126°22.3	9.3'	07°39.4	10.3'	59.3'	
15	43°22.5	.. 14.5	140°50.5	9.2'	07°49.7	10.3'	59.3'	
16	58°22.5	14.0	155°18.7	9.2'	07°59.9	10.2'	59.3'	
17	73°22.5	13.4	169°46.9	9.2'	08°10.1	10.2'	59.3'	
18	88°22.5	N19°12.8	184°15.1	9.1'	N08°20.2	10.1'	59.3'	
19	103°22.5	12.3	198°43.2	9.1'	08°30.3	10.1'	59.3'	
20	118°22.5	11.7	213°11.3	9.1'	08°40.4	10.0'	59.3'	
21	133°22.5	.. 11.1	227°39.3	9.0'	08°50.4	10.0'	59.3'	
22	148°22.5	10.6	242°07.3	9.0'	09°00.3	9.9'	59.3'	
23	163°22.5	10.0	256°35.3	9.0'	09°10.2	9.9'	59.3'	
	SD.=15.7	d=-0.6			S.D.=16.2			
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.5	N19°09.4	271°03.3	8.9'	N09°20.1	9.8'	59.3'	
1	193°22.5	08.9	285°31.2	8.9'	09°29.9	9.8'	59.3'	
2	208°22.5	08.3	299°59.1	8.9'	09°39.6	9.7'	59.3'	
3	223°22.5	.. 07.7	314°26.9	8.8'	09°49.3	9.6'	59.3'	
4	238°22.6	07.2	328°54.7	8.8'	09°58.9	9.6'	59.3'	
5	253°22.6	06.6	343°22.5	8.8'	10°08.4	9.5'	59.3'	
6	268°22.6	N19°06.0	357°50.3	8.7'	N10°17.9	9.5'	59.3'	
7	283°22.6	05.4	12°18.0	8.7'	10°27.4	9.4'	59.3'	
8	298°22.6	04.9	26°45.6	8.7'	10°36.8	9.3'	59.3'	
9	313°22.6	.. 04.3	41°13.3	8.6'	10°46.1	9.3'	59.3'	
10	328°22.6	03.7	55°40.9	8.6'	10°55.3	9.2'	59.3'	
11	343°22.6	03.2	70°08.4	8.5'	11°04.5	9.1'	59.3'	
12	358°22.6	N19°02.6	84°35.9	8.5'	N11°13.6	9.1'	59.3'	
13	13°22.6	02.0	99°03.4	8.5'	11°22.6	9.0'	59.3'	
14	28°22.7	01.4	113°30.9	8.4'	11°31.6	8.9'	59.3'	
15	43°22.7	.. 00.8	127°58.3	8.4'	11°40.5	8.9'	59.3'	
16	58°22.7	19°00.3	142°25.7	8.4'	11°49.4	8.8'	59.3'	
17	73°22.7	18°59.7	156°53.0	8.3'	11°58.1	8.7'	59.3'	
18	88°22.7	N18°59.1	171°20.3	8.3'	N12°06.8	8.7'	59.3'	
19	103°22.7	58.5	185°47.6	8.2'	12°15.4	8.6'	59.3'	
20	118°22.7	58.0	200°14.8	8.2'	12°24.0	8.5'	59.3'	
21	133°22.7	.. 57.4	214°42.0	8.2'	12°32.4	8.4'	59.3'	
22	148°22.7	56.8	229°09.1	8.1'	12°40.8	8.3'	59.3'	
23	163°22.8	56.2	243°36.2	8.1'	12°49.1	8.3'	59.3'	
	SD.=15.7	d=-0.6			S.D.=16.2			
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	178°22.8	N18°55.6	258°03.3	8.1'	N12°57.4	8.2'	59.3'	
1	193°22.8	55.1	272°30.3	8.0'	13°05.5	8.1'	59.3'	
2	208°22.8	54.5	286°57.3	8.0'	13°13.6	8.0'	59.3'	
3	223°22.8	.. 53.9	301°24.3	7.9'	13°21.6	7.9'	59.3'	
4	238°22.8	53.3	315°51.2	7.9'	13°29.5	7.9'	59.3'	
5	253°22.8	52.7	330°18.1	7.9'	13°37.3	7.8'	59.3'	
6	268°22.9	N18°52.1	344°44.9	7.8'	N13°45.0	7.7'	59.3'	
7	283°22.9	51.6	359°11.7	7.8'	13°52.7	7.6'	59.3'	
8	298°22.9	51.0	13°38.5	7.8'	14°00.3	7.5'	59.3'	
9	313°22.9	.. 50.4	28°05.2	7.7'	14°07.7	7.4'	59.3'	
10	328°22.9	49.8	42°31.9	7.7'	14°15.1	7.3'	59.3'	
11	343°22.9	49.2	56°58.6	7.6'	14°22.4	7.3'	59.3'	
12	358°23.0	N18°48.6	71°25.2	7.6'	N14°29.6	7.2'	59.3'	
13	13°23.0	48.0	85°51.8	7.6'	14°36.8	7.1'	59.3'	
14	28°23.0	47.4	100°18.4	7.5'	14°43.8	7.0'	59.3'	
15	43°23.0	.. 46.9	114°44.9	7.5'	14°50.7	6.9'	59.3'	
16	58°23.0	46.3	129°11.4	7.5'	14°57.6	6.8'	59.3'	
17	73°23.0	45.7	143°37.8	7.4'	15°04.3	6.7'	59.2'	
18	88°23.1	N18°45.1	158°04.3	7.4'	N15°11.0	6.6'	59.2'	
19	103°23.1	44.5	172°30.6	7.4'	15°17.5	6.5'	59.2'	
20	118°23.1	43.9	186°57.0	7.3'	15°24.0	6.4'	59.2'	
21	133°23.1	.. 43.3	201°23.3	7.3'	15°30.3	6.3'	59.2'	
22	148°23.1	42.7	215°49.6	7.3'	15°36.6	6.2'	59.2'	
23	163°23.2	42.1	230°15.8	7.2'	15°42.7	6.1'	59.2'	
	SD.=15.7	d=-0.6			S.D.=16.2			

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

**July 29, 30, 31 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	307°04.6	163°35.4	N16°00.5	71°42.2	S22°34.3	134°24.6	N04°24.3	58°29.1	S20°17.7					Alpheratz	357°41.0	29°10.8	
1	322°07.0	178°34.8	15°59.5	86°43.7	34.5	149°26.6	24.1	73°31.7	17.7					Ankaa	353°13.5	-42°12.7	
2	337°09.5	193°34.2	58.6	101°45.3	34.7	164°28.7	23.9	88°34.2	17.7					Schedar	349°37.7	56°37.4	
3	352°12.0	208°33.6	· · 57.6	116°46.9	· · 34.9	179°30.7	· · 23.8	103°36.7	· · 17.7					Diphda	348°53.6	-17°53.6	
4	7°14.4	223°33.1	56.6	131°48.5	35.1	194°32.8	23.6	118°39.3	17.7					Achernar	335°25.2	-57°08.9	
5	22°16.9	238°32.5	55.6	146°50.0	35.3	209°34.9	23.4	133°41.8	17.7					Hamal	327°58.3	23°32.3	
6	37°19.3	253°31.9	N15°54.7	161°51.6	S22°35.5	224°36.9	N04°23.2	148°44.3	S20°17.7					Polaris	316°50.3	89°19.6	
7	52°21.8	268°31.4	53.7	176°53.2	35.7	239°39.0	23.0	163°46.9	17.7					Acamar	315°16.9	-40°14.2	
8	67°24.3	283°30.8	52.7	191°54.8	35.9	254°41.0	22.9	178°49.4	17.7					Menkar	314°12.9	4°09.2	
9	82°26.7	298°30.3	· · 51.8	206°56.3	· · 36.1	269°43.1	· · 22.7	193°51.9	· · 17.7					Mirfak	308°37.4	49°54.8	
10	97°29.2	313°29.7	50.8	221°57.9	36.3	284°45.1	22.5	208°54.4	17.7					Aldebaran	290°47.1	16°32.3	
11	112°31.7	328°29.1	49.8	236°59.5	36.5	299°47.2	22.3	223°57.0	17.7					Rigel	281°10.2	-8°11.1	
12	127°34.1	343°28.6	N15°48.8	252°01.0	S22°36.7	314°49.2	N04°22.1	238°59.5	S20°17.7					Capella	280°31.6	46°00.5	
13	142°36.6	358°28.0	47.9	267°02.6	36.9	329°51.3	21.9	254°02.0	17.7					Bellatrix	278°30.0	6°21.7	
14	157°39.1	13°27.4	46.9	282°04.2	37.1	344°53.3	21.8	269°04.6	17.7					Elnath	278°10.2	28°37.0	
15	172°41.5	28°26.9	· · 45.9	297°05.7	· · 37.3	359°55.4	· · 21.6	284°07.1	· · 17.7					Alnilam	275°44.5	-1°11.6	
16	187°44.0	43°26.3	44.9	312°07.3	37.4	14°57.4	21.4	299°09.6	17.7					Betelgeuse	270°59.3	7°24.4	
17	202°46.5	58°25.8	44.0	327°08.9	37.6	29°59.5	21.2	314°12.1	17.7					Canopus	263°55.7	-52°42.3	
18	217°48.9	73°25.2	N15°43.0	342°10.4	S22°37.8	45°01.5	N04°21.0	329°14.7	S20°17.7					Sirius	258°32.2	-16°44.4	
19	232°51.4	88°24.6	42.0	357°12.0	38.0	60°03.6	20.9	344°17.2	17.7					Adhara	255°11.2	-28°59.7	
20	247°53.8	103°24.1	41.0	12°13.6	38.2	75°05.6	20.7	359°19.7	17.7					Procyon	244°57.9	5°10.8	
21	262°56.3	118°23.5	· · 40.0	27°15.1	· · 38.4	90°07.7	· · 20.5	14°22.2	· · 17.7					Pollux	243°25.5	27°59.0	
22	277°58.8	133°23.0	39.1	42°16.7	38.6	105°09.7	20.3	29°24.8	17.7					Avior	234°17.7	-59°33.9	
23	293°01.2	148°22.4	38.1	57°18.2	38.8	120°11.8	20.1	44°27.3	17.7					Suhail	222°51.3	-43°30.1	
Mer.pass.:03:31			v-0.6 d-1.0 m-3.8			v1.6 d-0.2 m-0.8			v2.1 d-0.2 m-1.6			v2.5 d0.0 m0.3					
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	308°03.7	163°21.8	N15°37.1	72°19.8	S22°39.0	135°13.8	N04°19.9	59°29.8	S20°17.7					Denebola	182°31.7	14°28.9	
1	323°06.2	178°21.3	36.1	87°21.3	39.2	150°15.9	19.8	74°32.3	17.7					Gienah	175°50.3	-17°38.0	
2	338°08.6	193°20.7	35.1	102°22.9	39.4	165°17.9	19.6	89°34.9	17.7					Acrux	173°07.1	-63°11.6	
3	353°11.1	208°20.2	· · 34.1	117°24.4	· · 39.6	180°20.0	· · 19.4	104°37.4	· · 17.7					Gacrux	171°58.7	-57°12.5	
4	8°13.6	223°19.6	33.2	132°26.0	39.8	195°22.0	19.2	119°39.9	17.7					Alioth	166°19.2	55°52.6	
5	23°16.0	238°19.1	32.2	147°27.5	40.0	210°24.1	19.0	134°42.4	17.7					Spica	158°29.1	-11°14.7	
6	38°18.5	253°18.5	N15°31.2	162°29.1	S22°40.2	225°26.1	N04°18.8	149°45.0	S20°17.7					Alkaid	152°57.4	49°14.2	
7	53°21.0	268°17.9	30.2	177°30.6	40.4	240°28.2	18.7	164°47.5	17.7					Hadar	148°44.8	-60°27.3	
8	68°23.4	283°17.4	29.2	192°32.2	40.6	255°30.2	18.5	179°50.0	17.7					Menkent	148°05.0	-36°27.1	
9	83°25.9	298°16.8	· · 28.2	207°33.7	· · 40.8	270°32.2	· · 18.3	194°52.5	· · 17.7					Arcturus	145°53.8	19°06.1	
10	98°28.3	313°16.3	27.2	222°35.3	41.0	285°34.3	18.1	209°55.1	17.7					Rigel Kent.	139°48.7	-60°54.3	
11	113°30.8	328°15.7	26.2	237°36.8	41.2	300°36.3	17.9	224°57.6	17.7					Kochab	137°20.2	74°05.7	
12	128°33.3	343°15.2	N15°25.2	252°38.4	S22°41.4	315°38.4	N04°17.7	240°00.1	S20°17.7					Zuben' ubi	137°03.0	-16°06.5	
13	143°35.7	358°14.6	24.2	267°39.9	41.6	330°40.4	17.6	255°02.6						Alphecca	126°09.1	26°39.9	
14	158°38.2	13°14.1	23.3	282°41.5	41.8	345°42.5	17.4	270°05.2						Antares	112°23.4	-26°27.9	
15	173°40.7	28°13.5	· · 22.3	297°43.0	· · 42.0	0°44.5	· · 17.2	285°07.7	· · 17.7					Atria	107°22.9	-69°03.4	
16	188°43.1	43°13.0	21.3	312°44.5	42.1	15°46.6	17.0	300°10.2	17.7					Sabik	102°09.9	-15°44.5	
17	203°45.6	58°12.4	20.3	327°46.1	42.3	30°48.6	16.8	315°12.7	17.7					Rasalhague	96°04.2	12°33.2	
18	218°48.1	73°11.9	N15°19.3	342°47.6	S22°42.5	45°50.7	N04°16.6	330°15.3	S20°17.7					Eltanin	90°44.7	51°29.6	
19	233°50.5	88°11.3	18.3	357°49.1	42.7	60°52.7	16.5	345°17.8	17.7					Kaus Aust.	83°40.7	-34°22.4	
20	248°53.0	103°10.8	17.3	12°50.7	42.9	75°54.8	16.3	0°20.3	17.7					Vega	80°37.1	38°48.3	
21	263°55.4	118°10.2	· · 16.3	27°52.2	· · 43.1	90°56.8	· · 16.1	15°22.8	· · 17.7					Nunki	75°55.4	-26°16.3	
22	278°57.9	133°09.7	15.3	42°53.8	43.3	105°58.9	15.9	30°25.3	17.7					Altair	62°05.8	8°55.0	
23	294°00.4	148°09.2	14.3	57°55.3	43.5	121°00.9	15.7	45°27.9	17.7					Peacock	53°15.4	-56°40.7	
Mer.pass.:03:27			v-0.6 d-1.0 m-3.8			v1.6 d-0.2 m-0.8			v2.0 d-0.2 m-1.6			v2.5 d-0.0 m0.3					
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	309°02.8	163°08.6	N15°13.3	72°56.8	S22°43.7	136°03.0	N04°15.5	60°30.4	S20°17.7					Fomalhaut	15°21.4	-29°31.9	
1	324°05.3	178°08.1	12.3	87°58.3	43.9	151°05.0	15.4	75°32.9	17.7					Scheat	13°51.0	28°10.4	
2	339°07.8	193°07.5	11.3	102°59.9	44.1	166°07.1	15.2	90°35.4	17.7					Markab	13°35.9	15°17.7	
3	354°10.2	208°07.0	· · 10.3	118°01.4	· · 44.3	181°09.1	· · 15.0	105°38.0	· · 17.7					Jul 29 Fri	SHA	Mer.pass	
4	9°12.7	223°06.4	09.3	133°02.9	44.5	196°11.1	14.8	120°40.5	17.7					Venus	216°30.8	13:06	
5	24°15.2	238°05.9	08.3	148°04.5	44.7	211°13.2	14.6	135°43.0	17.7					Mars	124°37.6	19:11	
6	39°17.6	253°05.3	N15°07.3	163°06.0	S22°44.9	226°15.2	N04°14.4	150°45.5	S20°17.7					Jupiter	187°20.0	15:00	
7	54°20.1	268°04.8	06.3	178°07.5	45.1	241°17.3	14.3	165°48.0	17.7					Saturn	111°24.6	20:03	
8	69°22.6	283°04.3	05.3	193°09.0	45.3	256°19.3	14.1	180°50.6	17.7					Jul 30 Sat	SHA	Mer.pass	
9	84°25.0	298°03.7	· · 04.2	208°10.6	· · 45.5	271°21.4	· · 13.9	195°53.1	· · 17.7					Venus	215°18.1	13:07	
10	99°27.5	313°03.2	03.2	223°12.1	45.7	286°23.4	13.7	210°55.6	17.7					Mars	124°16.1	19:09	
11	114°29.9	328°02.6	02.2	238°13.6	45.9	301°25.5	13.5	225°58.1	17.7					Jupiter	187°10.1	14:57	
12	129°32.4	343°02.1	N15°01.2	253°15.1	S22°46.1	316°27.5	N04°13.3	241									

DUT1 = UT1-UTC = -0.2241 sec ΔT = TT-UT1 = +68.4081 sec

2016 July 29 to Jul. 31 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.2	N18°41.5	244°42.1	7.2'	N15°48.8	6.0'	59.2'
1	193°23.2	40.9	259°08.2	7.2'	15°54.8	5.9'	59.2'
2	208°23.2	40.3	273°34.4	7.1'	16°00.6	5.8'	59.2'
3	223°23.2	.. 39.7	288°00.5	7.1'	16°06.4	5.7'	59.2'
4	238°23.3	39.1	302°26.6	7.1'	16°12.0	5.6'	59.2'
5	253°23.3	38.6	316°52.7	7.1'	16°17.6	5.5'	59.2'
6	268°23.3	N18°38.0	331°18.7	7.0'	N16°23.0	5.4'	59.2'
7	283°23.3	37.4	345°44.8	7.0'	16°28.4	5.3'	59.2'
8	298°23.3	36.8	0°10.8	7.0'	16°33.6	5.2'	59.2'
9	313°23.4	.. 36.2	14°36.7	6.9'	16°38.7	5.1'	59.2'
10	328°23.4	35.6	29°02.7	6.9'	16°43.8	5.0'	59.1'
11	343°23.4	35.0	43°28.6	6.9'	16°48.7	4.9'	59.1'
12	358°23.4	N18°34.4	57°54.5	6.9'	N16°53.5	4.7'	59.1'
13	13°23.5	33.8	72°20.3	6.9'	16°58.2	4.6'	59.1'
14	28°23.5	33.2	86°46.2	6.8'	17°02.7	4.5'	59.1'
15	43°23.5	.. 32.6	101°12.0	6.8'	17°07.2	4.4'	59.1'
16	58°23.5	32.0	115°37.8	6.8'	17°11.6	4.3'	59.1'
17	73°23.6	31.3	130°03.6	6.8'	17°15.8	4.2'	59.1'
18	88°23.6	N18°30.7	144°29.3	6.7'	N17°20.0	4.1'	59.1'
19	103°23.6	30.1	158°55.0	6.7'	17°24.0	4.0'	59.1'
20	118°23.6	29.5	173°20.8	6.7'	17°27.9	3.9'	59.1'
21	133°23.7	.. 28.9	187°46.5	6.7'	17°31.7	3.7'	59.1'
22	148°23.7	28.3	202°12.2	6.7'	17°35.4	3.6'	59.0'
23	163°23.7	27.7	216°37.8	6.7'	17°39.0	3.5'	59.0'
	SD.=15.7	d=-0.6			S.D.=16.1		

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	178°23.7	N18°27.1	231°03.5	6.7'	N17°42.4	3.4'	59.0'
1	193°23.8	26.5	245°29.1	6.6'	17°45.8	3.3'	59.0'
2	208°23.8	25.9	259°54.8	6.6'	17°49.0	3.2'	59.0'
3	223°23.8	.. 25.3	274°20.4	6.6'	17°52.1	3.1'	59.0'
4	238°23.8	24.7	288°46.0	6.6'	17°55.1	2.9'	59.0'
5	253°23.9	24.1	303°11.6	6.6'	17°58.0	2.8'	59.0'
6	268°23.9	N18°23.5	317°37.2	6.6'	N18°00.8	2.7'	59.0'
7	283°23.9	22.9	332°02.8	6.6'	18°03.4	2.6'	58.9'
8	298°23.9	22.2	346°28.4	6.6'	18°06.0	2.5'	58.9'
9	313°24.0	.. 21.6	0°53.9	6.6'	18°08.4	2.4'	58.9'
10	328°24.0	21.0	15°19.5	6.6'	18°10.7	2.2'	58.9'
11	343°24.0	20.4	29°45.1	6.6'	18°12.8	2.1'	58.9'
12	358°24.1	N18°19.8	44°10.6	6.6'	N18°14.9	2.0'	58.9'
13	13°24.1	19.2	58°36.2	6.6'	18°16.8	1.9'	58.9'
14	28°24.1	18.6	73°01.7	6.6'	18°18.7	1.8'	58.9'
15	43°24.1	.. 17.9	87°27.3	6.6'	18°20.4	1.6'	58.9'
16	58°24.2	17.3	101°52.9	6.6'	18°22.0	1.5'	58.8'
17	73°24.2	16.7	116°18.4	6.6'	18°23.4	1.4'	58.8'
18	88°24.2	N18°16.1	130°44.0	6.6'	N18°24.8	1.3'	58.8'
19	103°24.3	15.5	145°09.6	6.6'	18°26.0	1.2'	58.8'
20	118°24.3	14.9	159°35.1	6.6'	18°27.1	1.1'	58.8'
21	133°24.3	.. 14.3	174°00.7	6.6'	18°28.1	0.9'	58.8'
22	148°24.4	13.6	188°26.3	6.6'	18°29.0	0.8'	58.8'
23	163°24.4	13.0	202°51.9	6.6'	18°29.7	0.7'	58.7'
	SD.=15.7	d=-0.6			S.D.=16.1		

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	178°24.4	N18°12.4	217°17.5	6.6'	N18°30.4	0.6'	58.7'
1	193°24.5	11.8	231°43.1	6.6'	18°30.9	0.5'	58.7'
2	208°24.5	11.2	246°08.8	6.6'	18°31.3	0.3'	58.7'
3	223°24.5	.. 10.5	260°34.4	6.7'	18°31.5	0.2'	58.7'
4	238°24.6	09.9	275°00.1	6.7'	18°31.7	0.1'	58.7'
5	253°24.6	09.3	289°25.8	6.7'	18°31.7	-0.0'	58.7'
6	268°24.6	N18°08.7	303°51.5	6.7'	N18°31.7	-0.1'	58.6'
7	283°24.7	08.0	318°17.2	6.7'	18°31.5	-0.3'	58.6'
8	298°24.7	07.4	332°42.9	6.7'	18°31.2	-0.4'	58.6'
9	313°24.7	.. 06.8	347°08.7	6.8'	18°30.7	-0.5'	58.6'
10	328°24.8	06.2	1°34.4	6.8'	18°30.2	-0.6'	58.6'
11	343°24.8	05.5	16°00.2	6.8'	18°29.5	-0.7'	58.6'
12	358°24.8	N18°04.9	30°26.1	6.8'	N18°28.7	-0.8'	58.5'
13	13°24.9	04.3	44°51.9	6.9'	18°27.8	-1.0'	58.5'
14	28°24.9	03.7	59°17.8	6.9'	18°26.8	-1.1'	58.5'
15	43°24.9	.. 03.0	73°43.7	6.9'	18°25.7	-1.2'	58.5'
16	58°25.0	02.4	88°09.6	6.9'	18°24.4	-1.3'	58.5'
17	73°25.0	01.8	102°35.5	7.0'	18°23.1	-1.4'	58.5'
18	88°25.0	N18°01.2	117°01.5	7.0'	N18°21.6	-1.5'	58.4'
19	103°25.1	18°00.5	131°27.5	7.0'	18°20.0	-1.7'	58.4'
20	118°25.1	17°59.9	145°53.6	7.1'	18°18.3	-1.8'	58.4'
21	133°25.2	.. 59.3	160°19.7	7.1'	18°16.5	-1.9'	58.4'
22	148°25.2	58.6	174°45.8	7.1'	18°14.5	-2.0'	58.4'
23	163°25.2	58.0	189°11.9	7.2'	18°12.5	-2.1'	58.4'
	SD.=15.7	d=-0.6			S.D.=16.0		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°						
N 70°						
68°						
66°						
64°						
62°						
60°						
N 58°	01:21	02:55	03:50	20:22	21:16	22:46
56°	01:57	03:12	04:01	20:11	20:59	22:13
54°	02:21	03:26	04:11	20:01	20:46	21:49
52°	02:41	03:37	04:19	19:53	20:34	21:30
50°	02:56	03:48	04:27	19:45	20:24	21:15
48°	03:26	04:09	04:43	19:29	20:03	20:45
N 40°	03:49	04:26	04:57	19:15	19:46	20:23
35°	04:06	04:40	05:08	19:04	19:32	20:06
30°	04:21	04:52	05:18	18:54	19:20	19:52
20°	04:43	05:11	05:35	18:38	19:01	19:29
N 10°	05:01	05:27	05:49	18:23	18:46	19:12
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°	05:41	06:07	06:30	17:43	18:06	18:32
30°	05:52	06:21	06:47	17:27	17:52	18:21
35°	05:58	06:29	06:56	17:17	17:44	18:15
40°	06:05	06:37	07:06	17:07	17:36	18:08
45°	06:12	06:47	07:19	16:54	17:26	18:02
S 50°	06:19	06:58	07:34	16:40	17:15	17:54
52°	06:22	07:03	07:41	16:33	17:10	17:51
54°	06:26	07:09	07:49	16:25	17:04	17:48
56°	06:30	07:15	07:57	16:16	16:58	17:44
58°	06:34	07:22	08:07	16:06	16:51	17:40
S 60°	06:38	07:30	08:18	15:55	16:44	17:36
Day	Sun		Moon		Moon	
	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass 12 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer.Pass. Upper hh:mm	Mer.Pass. Lower hh:mm	Age 25-27 22-7%
29	06:27	06:26	12:06	07:59	20:28	
30	06:25	06:24	12:06	08:56	21:25	
31	06:22	06:21	12:06	09:53	22:22	

**August 01, 02, 03 UT (Mon., Tue., Wed.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	310°02.0	162°55.7	N14°49.1	73°33.3	S22°48.5	136°52.0	N04°11.1	61°30.9	S20°17.7	Alpheratz	357°41.0	29°10.8					
1	325°04.4	177°55.1	48.0	88°34.8	48.7	151°54.1	10.9	76°33.4	17.7	Ankaa	353°13.4	-42°12.7					
2	340°06.9	192°54.6	47.0	103°36.3	48.9	166°56.1	10.8	91°35.9	17.7	Schedar	349°37.7	56°37.4					
3	355°09.4	207°54.1	.. 46.0	118°37.8	.. 49.1	181°58.2	.. 10.6	106°38.4	.. 17.7	Diphda	348°53.6	-17°53.6					
4	10°11.8	222°53.5	45.0	133°39.3	49.3	197°00.2	10.4	121°40.9	17.7	Achernar	335°25.2	-57°08.9					
5	25°14.3	237°53.0	44.0	148°40.8	49.5	212°02.3	10.2	136°43.5	17.7	Hamal	327°58.3	23°32.3					
6	40°16.8	252°52.5	N14°42.9	163°42.3	S22°49.7	227°04.3	N04°10.0	151°46.0	S20°17.7	Polaris	316°48.7	89°19.6					
7	55°19.2	267°51.9	41.9	178°43.8	49.9	242°06.3	09.8	166°48.5	17.8	Acamar	315°16.8	-40°14.2					
8	70°21.1	282°51.4	40.9	193°45.3	50.1	257°08.4	09.7	181°51.0	17.8	Menkar	314°12.9	4°09.2					
9	85°24.2	297°50.9	.. 39.9	208°46.8	.. 50.3	272°10.4	.. 09.5	196°53.5	.. 17.8	Mirfak	308°37.3	49°54.8					
10	100°26.6	312°50.3	38.9	223°48.3	50.5	287°12.5	09.3	211°56.0	17.8	Aldebaran	290°47.1	16°32.3					
11	115°29.1	327°49.8	37.8	238°49.8	50.7	302°14.5	09.1	226°58.6	17.8	Rigel	281°10.2	-8°11.0					
12	130°31.6	342°49.3	N14°36.8	253°51.3	S22°50.9	317°16.6	N04°08.9	242°01.1	S20°17.8	Capella	280°31.6	46°00.5					
13	145°34.0	357°48.8	35.8	268°52.8	51.1	332°18.6	08.7	257°03.6	17.8	Bellatrix	278°29.9	6°21.7					
14	160°36.5	12°48.2	34.8	283°54.3	51.3	347°20.6	08.5	272°06.1	17.8	El Nath	278°10.2	28°37.0					
15	175°38.9	27°47.7	.. 33.7	298°55.8	.. 51.5	2°22.7	.. 08.4	287°08.6	.. 17.8	Alnilam	275°44.4	-1°11.6					
16	190°41.4	42°47.2	32.7	313°57.2	51.7	17°24.7	08.2	302°11.1	17.8	Betelgeuse	270°59.3	7°24.4					
17	205°43.9	57°46.7	31.7	328°58.7	51.9	32°26.8	08.0	317°13.6	17.8	Canopus	263°55.6	-52°42.3					
18	220°46.3	72°46.1	N14°30.6	344°00.2	S22°52.1	47°28.8	N04°07.8	332°16.2	S20°17.8	Sirius	258°32.1	-16°44.4					
19	235°48.8	87°45.6	29.6	359°01.7	52.3	62°30.9	07.6	347°18.7	17.8	Adhara	255°11.2	-28°59.7					
20	250°51.3	102°45.1	28.6	14°03.2	52.5	77°32.9	07.4	2°21.2	17.8	Procyon	244°57.8	5°10.8					
21	265°53.7	117°44.6	.. 27.5	29°04.7	.. 52.7	92°34.9	.. 07.2	17°23.7	.. 17.8	Pollux	243°25.5	27°59.0					
22	280°56.2	132°44.0	26.5	44°06.2	52.9	107°37.0	07.1	32°26.2	17.8	Avior	234°17.7	-59°33.8					
23	295°58.7	147°43.5	25.5	59°07.7	53.1	122°39.0	06.9	47°28.7	17.8	Suhail	222°51.3	-43°30.1					
Mer.pass.:03:19			v-0.5 d-1.0 m-3.8	v1.5 d-0.2 m-0.8	v2.0 d-0.2 m-1.6	v2.5 d-0.0 m-0.3	Miaplacidus			Zuben ubi	221°40.0	-69°47.2					
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.3	-8°43.9	
0	311°01.1	162°43.0	N14°24.5	74°09.1	S22°53.3	137°41.1	N04°06.7	62°31.2	S20°17.8	Regulus	207°41.6	11°53.2					
1	326°03.6	177°42.5	23.4	89°10.6	53.5	152°43.1	06.5	77°33.8	17.8	Dubhe	193°49.8	61°39.9					
2	341°06.0	192°41.9	22.4	104°12.1	53.7	167°45.1	06.3	92°36.3	17.8	Denebola	182°31.7	14°28.9					
3	356°08.5	207°41.4	.. 21.3	119°13.6	.. 53.9	182°47.2	.. 06.1	107°38.8	.. 17.8	Gienah	175°50.3	-17°38.0					
4	11°11.0	222°40.9	20.3	134°15.1	54.1	197°49.2	05.9	122°41.3	17.8	Acrux	173°07.1	-63°11.6					
5	26°13.4	237°40.4	19.3	149°16.5	54.3	212°51.3	05.8	137°43.8	17.8	Gacrux	171°58.7	-57°12.5					
6	41°15.9	252°39.9	N14°18.2	164°18.0	S22°54.5	227°53.3	N04°05.6	152°46.3	S20°17.8	Alioth	166°19.2	55°52.6					
7	56°18.4	267°39.3	17.2	179°19.5	54.7	242°55.3	05.4	167°48.8	17.8	Spica	158°29.1	-11°14.7					
8	71°20.8	282°38.8	16.2	194°21.0	54.9	257°57.4	05.2	182°51.4	17.8	Alkaid	152°57.4	49°14.2					
9	86°23.3	297°38.3	.. 15.1	209°22.5	.. 55.1	272°59.4	.. 05.0	197°53.9	.. 17.8	Hadar	148°44.8	-60°27.3					
10	101°25.8	312°37.8	14.1	224°23.9	55.3	288°01.5	04.8	212°56.4	17.8	Menkent	148°05.1	-36°27.1					
11	116°28.2	327°37.3	13.0	239°25.4	55.5	303°03.5	04.6	227°58.9	17.8	Arcturus	145°53.8	19°06.1					
12	131°30.7	342°36.8	N14°12.0	254°26.9	S22°55.7	318°05.5	N04°04.5	243°01.4	S20°17.8	Rigel Kent.	139°48.7	-60°54.3					
13	146°33.2	357°36.2	11.0	269°28.3	55.9	333°07.6	04.3	258°03.9	17.8	Kochab	137°20.2	74°05.7					
14	161°35.6	12°35.7	09.9	284°29.8	56.1	348°09.6	04.1	273°06.4	17.8	Zuben ubi	137°03.0	-16°06.5					
15	176°38.1	27°35.2	.. 08.9	299°31.3	.. 56.3	3°11.7	.. 03.9	288°08.9	.. 17.8	Alphecca	126°09.1	26°39.9					
16	191°40.5	42°34.7	07.8	314°32.7	56.5	18°13.7	03.7	303°11.4	17.8	Antares	112°23.4	-26°27.9					
17	206°43.0	57°34.2	06.8	329°34.2	56.7	33°15.7	03.5	318°14.0	17.8	Atria	107°23.0	-69°03.4					
18	221°45.5	72°33.7	N14°05.7	344°35.7	S22°56.9	48°17.8	N04°03.3	333°16.5	S20°17.8	Sabik	102°09.9	-15°44.5					
19	236°47.9	87°33.2	04.7	359°37.1	57.1	63°19.8	03.1	348°19.0	17.8	Rasalhague	96°18.7	-37°06.8					
20	251°50.4	102°32.6	03.6	14°38.6	57.3	78°21.9	03.0	3°21.5	17.8	Eltanin	90°44.7	51°29.6					
21	266°52.9	117°32.1	.. 02.6	29°40.1	.. 57.5	93°23.9	.. 02.8	18°24.0	.. 17.8	Kaus Aust.	83°40.7	-34°22.4					
22	281°55.3	132°31.6	01.5	44°41.5	57.7	108°25.9	02.6	33°26.5	17.8	Vega	80°37.1	38°48.3					
23	296°57.8	147°31.1	00.5	59°43.0	57.9	123°28.0	02.4	48°29.0	17.8	Nunki	75°55.4	-26°16.3					
Mer.pass.:03:15			v-0.5 d-1.0 m-3.8	v1.5 d-0.2 m-0.8	v2.0 d-0.2 m-1.6	v2.5 d-0.0 m-0.3	Altair			Altair	62°05.8	8°55.0					
Wed			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°15.4	-56°40.7					
0	312°00.3	162°30.6	N13°59.5	74°44.5	S22°58.1	138°30.0	N04°02.2	63°31.5	Deneb	49°29.5	45°20.6						
1	327°02.7	177°30.1	58.4	89°45.9	58.3	153°32.1	02.0	78°34.0	17.8	Scheat	33°44.7	9°57.2					
2	342°05.2	192°29.6	57.4	104°47.4	58.5	168°34.1	01.8	93°36.5	17.8	Markab	15°21.4	-29°31.9					
3	357°07.7	207°29.1	.. 56.3	119°48.8	.. 58.7	183°36.1	.. 01.7	108°39.1	.. 17.9	Aug 01 Mon	13°51.0	28°10.4					
4	12°10.1	222°28.6	55.2	134°50.3	58.9	198°38.2	01.5	123°41.6	17.9	Venus	212°53.7	13:09					
5	27°12.6	237°28.1	54.2	149°51.7	59.1	213°40.2	01.3	138°44.1	17.9	Mars	123°31.3	19:04					
6	42°15.0	252°27.5	N13°53.1	164°53.2	S22°59.3	228°42.2	N04°01.1	153°46.6	Jupiter	186°50.1	14:51						
7	57°17.5	267°27.0	52.1	179°54.7	59.5	243°44.3	00.9	168°49.1	17.9	Saturn	111°28.9	19:51					
8	72°20.0	282°26.5	51.0	194°56.1	22°59.7	258°46.3	00.7	183°51.6	17.9	Aug 02 Tue	13°35.9	15°17.7					
9	87°22.4	297°26.0	.. 50.0	209°57.6	23°00.0	273°48.4	.. 00.5	198°54.1	.. 17.9	Venus	211°41.9	13:10					
10	102°24.9	312°25.5	48.9	224°59.0	00.2	288°50.4	00.3	213°56.6	17.9	Mars	123°08.0	19:02					
11	117°27.4	327°25.0	47.9	240°00.5	00.4	303°52.4	00.2	228°59.1	17.9	Jupiter	186°39.9	14:47					
12	132°29.8	342°24.5	N13°46.8	255°01.9	S23°00.6	318°54.5	N04°00.0	244°01.6	Saturn	111°30.1	19:47						
13	147°32.3	357°24.0	45.8	270°03.4	00.8	333°56.5	03°59.8	259°04.1	17.9	Aug 03 Wed	210°30.3	13:10					
14	162°34.8	12°23.5	44.7	285°04.8	01.0	348°58.5	59.6	274°06.6	17.9	Venus	212°44.2	18:59					
15	177°37.2	27°23.0	.. 43.6	300°06.2	.. 01.2	4°00.6	.. 59.4	289°09.1	.. 17.9	Mars	122°31.3	19:45					
16	192°39.7	42°22.5	42.6	315°07.7	01.4	19°02.6	59.2	304°11.7	17.9	Jupiter	186°29.8	14:44					
17	207°42.2	57°22.0	41.5	330°09.1	01.6	34°04.7	59.0	319°14.2	17.9	Saturn	111°31.3	19:43					
18	222°44.6	72°21.5	N13°40.5	345°10.6	S23°01.8	49°06.7	N03°58.8	334°16.7	Horizontal parallax	210°30.3	0.1						
19	237°47.1	87°21.0	39.4	0°12.0	02.0	64°08.7	58.7	349°19.2	Mars:	212°44.2	0.2						
20</td																	

DUT1 = UT1-UTC = -0.2254 sec ΔT = TT-UT1 = +68.4094 sec

2016 August 01 to Aug. 03 UT

h	Sun			Moon			
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	178°25.3	N17°57.4	203°38.1	7.2'	N18°10.3	-2.2'	58.3'
1	193°25.3	56.7	218°04.3	7.2'	18°08.1	-2.3'	58.3'
2	208°25.3	56.1	232°30.6	7.3'	18°05.7	-2.4'	58.3'
3	223°25.4	.. 55.5	246°56.9	7.3'	18°03.2	-2.5'	58.3'
4	238°25.4	54.8	261°23.2	7.4'	18°00.6	-2.7'	58.3'
5	253°25.5	54.2	275°49.6	7.4'	17°57.9	-2.8'	58.2'
6	268°25.5	N17°53.6	290°16.0	7.4'	N17°55.0	-2.9'	58.2'
7	283°25.5	52.9	304°42.4	7.5'	17°52.1	-3.0'	58.2'
8	298°25.6	52.3	319°08.9	7.5'	17°49.1	-3.1'	58.2'
9	313°25.6	.. 51.7	333°35.5	7.6'	17°45.9	-3.2'	58.2'
10	328°25.7	51.0	348°02.1	7.6'	17°42.7	-3.3'	58.1'
11	343°25.7	50.4	2°28.7	7.7'	17°39.3	-3.4'	58.1'
12	358°25.8	N17°49.8	16°55.4	7.7'	N17°35.8	-3.5'	58.1'
13	13°25.8	49.1	31°22.1	7.7'	17°32.3	-3.6'	58.1'
14	28°25.8	48.5	45°48.9	7.8'	17°28.6	-3.7'	58.1'
15	43°25.9	.. 47.8	60°15.7	7.8'	17°24.8	-3.8'	58.0'
16	58°25.9	47.2	74°42.6	7.9'	17°20.9	-3.9'	58.0'
17	73°26.0	46.6	89°09.5	7.9'	17°17.0	-4.0'	58.0'
18	88°26.0	N17°45.9	103°36.5	8.0'	N17°12.9	-4.1'	58.0'
19	103°26.0	45.3	118°03.5	8.0'	17°08.7	-4.2'	57.9'
20	118°26.1	44.6	132°30.6	8.1'	17°04.4	-4.3'	57.9'
21	133°26.1	.. 44.0	146°57.7	8.2'	17°00.0	-4.4'	57.9'
22	148°26.2	43.4	161°24.9	8.2'	16°55.6	-4.5'	57.9'
23	163°26.2	42.7	175°52.1	8.3'	16°51.0	-4.6'	57.9'
	SD.=15.7	d=-0.6			S.D.=15.8		
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	178°26.3	N17°42.1	190°19.4	8.3'	N16°46.3	-4.7'	57.8'
1	193°26.3	41.4	204°46.7	8.4'	16°41.5	-4.8'	57.8'
2	208°26.4	40.8	219°14.1	8.4'	16°36.7	-4.9'	57.8'
3	223°26.4	.. 40.1	233°41.6	8.5'	16°31.7	-5.0'	57.8'
4	238°26.4	39.5	248°09.1	8.5'	16°26.7	-5.1'	57.7'
5	253°26.5	38.8	262°36.7	8.6'	16°21.5	-5.2'	57.7'
6	268°26.5	N17°38.2	277°04.3	8.7'	N16°16.3	-5.3'	57.7'
7	283°26.6	37.5	291°32.0	8.7'	16°11.0	-5.4'	57.7'
8	298°26.6	36.9	305°59.7	8.8'	16°05.6	-5.5'	57.7'
9	313°26.7	.. 36.3	320°27.6	8.8'	16°00.1	-5.5'	57.6'
10	328°26.7	35.6	334°55.4	8.9'	15°54.5	-5.6'	57.6'
11	343°26.8	35.0	349°23.3	9.0'	15°48.8	-5.7'	57.6'
12	358°26.8	N17°34.3	3°51.3	9.0'	N15°43.1	-5.8'	57.6'
13	13°26.9	33.7	18°19.4	9.1'	15°37.2	-5.9'	57.5'
14	28°26.9	33.0	32°47.5	9.1'	15°31.3	-6.0'	57.5'
15	43°27.0	.. 32.4	47°15.7	9.2'	15°25.3	-6.1'	57.5'
16	58°27.0	31.7	61°43.9	9.3'	15°19.2	-6.1'	57.5'
17	73°27.1	31.1	76°12.2	9.3'	15°13.0	-6.2'	57.4'
18	88°27.1	N17°30.4	90°40.5	9.4'	N15°06.7	-6.3'	57.4'
19	103°27.2	29.7	105°09.0	9.4'	15°00.4	-6.4'	57.4'
20	118°27.2	29.1	119°37.4	9.5'	14°54.0	-6.5'	57.4'
21	133°27.3	.. 28.4	134°06.0	9.6'	14°47.5	-6.5'	57.3'
22	148°27.3	27.8	148°34.6	9.6'	14°40.9	-6.6'	57.3'
23	163°27.4	27.1	163°03.3	9.7'	14°34.3	-6.7'	57.3'
	SD.=15.7	d=-0.6			S.D.=15.7		
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	178°27.4	N17°26.5	177°32.0	9.8'	N14°27.6	-6.8'	57.3'
1	193°27.5	25.8	192°00.8	9.8'	14°20.8	-6.8'	57.2'
2	208°27.5	25.2	206°29.6	9.9'	14°13.9	-6.9'	57.2'
3	223°27.6	.. 24.5	220°58.6	10.0'	14°07.0	-7.0'	57.2'
4	238°27.6	23.8	235°27.6	10.0'	13°59.9	-7.0'	57.2'
5	253°27.7	23.2	249°56.6	10.1'	13°52.9	-7.1'	57.1'
6	268°27.7	N17°22.5	264°25.7	10.1'	N13°45.7	-7.2'	57.1'
7	283°27.8	21.9	278°54.9	10.2'	13°38.5	-7.2'	57.1'
8	298°27.8	21.2	293°24.1	10.3'	13°31.2	-7.3'	57.1'
9	313°27.9	.. 20.5	307°53.5	10.3'	13°23.9	-7.4'	57.0'
10	328°27.9	19.9	322°22.8	10.4'	13°16.5	-7.4'	57.0'
11	343°28.0	19.2	336°52.3	10.5'	13°09.0	-7.5'	57.0'
12	358°28.0	N17°18.6	351°21.8	10.5'	N13°01.4	-7.6'	57.0'
13	13°28.1	17.9	5°51.3	10.6'	12°53.8	-7.6'	56.9'
14	28°28.2	17.2	20°21.0	10.7'	12°46.2	-7.7'	56.9'
15	43°28.2	.. 16.6	34°50.6	10.7'	12°38.5	-7.8'	56.9'
16	58°28.3	15.9	49°20.4	10.8'	12°30.7	-7.8'	56.9'
17	73°28.3	15.3	63°50.2	10.8'	12°22.8	-7.9'	56.8'
18	88°28.4	N17°14.6	78°20.1	10.9'	N12°14.9	-7.9'	56.8'
19	103°28.4	13.9	92°50.0	11.0'	12°07.0	-8.0'	56.8'
20	118°28.5	13.3	107°20.0	11.0'	11°59.0	-8.0'	56.8'
21	133°28.5	.. 12.6	121°50.1	11.1'	11°50.9	-8.1'	56.7'
22	148°28.6	11.9	136°20.3	11.2'	11°42.8	-8.1'	56.7'
23	163°28.7	11.3	150°50.4	11.2'	11°34.6	-8.2'	56.7'
	SD.=15.8	d=-0.7			S.D.=15.5		

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

## August 04, 05, 06 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	312°59.4	162°18.5	N13°34.1	75°19.2	S23°03.0	139°18.9	N03°57.7	64°31.7	S20°17.9	Alpheratz	357°41.0	29°10.8					
1	328°01.9	177°18.0	33.0	90°20.7	03.2	154°20.9	57.5	79°34.2	17.9	Ankaa	353°13.4	-42°12.7					
2	343°04.3	192°17.5	32.0	105°22.1	03.4	169°23.0	57.3	94°36.7	17.9	Schedar	349°37.6	56°37.5					
3	358°06.8	207°17.0	30.9	120°23.5	03.6	184°25.0	57.1	109°39.2	17.9	Diphda	348°53.6	-17°53.6					
4	13°09.3	222°16.5	29.8	135°25.0	03.8	199°27.1	57.0	124°41.7	17.9	Achernar	335°25.1	-57°08.9					
5	28°11.7	237°16.0	28.7	150°26.4	04.0	214°29.1	56.8	139°44.2	17.9	Hamal	327°58.3	23°32.3					
6	43°14.2	252°15.5	N13°27.7	165°27.8	S23°04.2	229°31.1	N03°56.6	154°46.7	S20°17.9	Polaris	316°47.4	89°19.6					
7	58°16.6	267°15.0	26.6	180°29.3	04.4	244°33.2	56.4	169°49.2	17.9	Acamar	315°16.8	-40°14.2					
8	73°19.1	282°14.5	25.5	195°30.7	04.6	259°35.2	56.2	184°51.7	17.9	Menkar	314°12.8	4°09.2					
9	88°21.6	297°14.0	24.5	210°32.1	04.8	274°37.2	56.0	199°54.2	17.9	Mirfak	308°37.3	49°54.8					
10	103°24.0	312°13.5	23.4	225°33.5	05.0	289°39.3	55.8	214°56.8	18.0	Aldebaran	290°47.1	16°32.3					
11	118°26.5	327°13.0	22.3	240°35.0	05.2	304°41.3	55.6	229°59.3	18.0	Rigel	281°10.2	-8°11.0					
12	133°29.0	342°12.5	N13°21.3	255°36.4	S23°05.4	319°43.3	N03°55.5	245°01.8	S20°18.0	Capella	280°31.6	46°00.5					
13	148°31.4	357°12.0	20.2	270°37.8	05.6	334°45.4	55.3	260°40.3	18.0	Bellatrix	278°29.9	6°21.7					
14	163°33.9	12°11.5	19.1	285°39.2	05.9	349°47.4	55.1	275°06.8	18.0	El Nath	278°10.2	28°37.0					
15	178°36.4	27°11.0	18.0	300°40.7	06.1	4°49.4	54.9	290°09.3	18.0	Alnilam	275°44.4	-1°11.6					
16	193°38.8	42°10.6	17.0	315°42.1	06.3	19°51.5	54.7	305°11.8	18.0	Betelgeuse	270°59.2	7°24.4					
17	208°41.3	57°10.1	15.9	330°43.5	06.5	34°53.5	54.5	320°14.3	18.0	Canopus	263°55.6	-52°42.3					
18	223°43.8	72°09.6	N13°14.8	345°44.9	S23°06.7	49°55.5	N03°54.3	335°16.8	S20°18.0	Sirius	258°32.1	-16°44.4					
19	238°46.2	87°09.1	13.7	0°46.3	06.9	64°57.6	54.1	350°19.3	18.0	Adhara	255°11.2	-28°59.7					
20	253°48.7	102°08.6	12.7	15°47.8	07.1	79°59.6	53.9	5°21.8	18.0	Procyon	244°57.8	5°10.8					
21	268°51.1	117°08.1	11.6	30°49.2	07.3	95°01.6	53.8	20°24.3	18.0	Pollux	243°25.5	27°59.0					
22	283°53.6	132°07.6	10.5	45°50.6	07.5	110°03.7	53.6	35°26.8	18.0	Avior	234°17.7	-59°33.8					
23	298°56.1	147°07.1	09.4	60°52.0	07.7	125°05.7	53.4	50°29.3	18.0	Suhail	222°51.3	-43°30.0					
Mer.pass.:03:08			v-0.5 d-1.1 m-3.8			v1.4 d-0.2 m-0.7			v2.0 d-0.2 m-1.6			v2.5 d-0.0 m0.3					
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	313°58.5	162°06.6	N13°08.4	75°53.4	S23°07.9	140°07.7	N03°53.2	65°31.8	S20°18.0	Denebola	182°31.8	14°28.9					
1	329°01.0	177°06.1	07.3	90°54.8	08.1	155°09.8	53.0	80°34.3	18.0	Gienah	175°50.3	-17°38.0					
2	344°03.5	192°05.7	06.2	105°56.3	08.3	170°11.8	52.8	95°36.8	18.0	Acrux	173°07.2	-63°11.6					
3	359°05.9	207°05.2	05.1	120°57.7	08.5	185°13.8	52.6	110°39.3	18.0	Gacrux	171°58.7	-57°12.5					
4	14°08.4	222°04.7	04.0	135°59.1	08.7	200°15.9	52.4	125°41.8	18.0	Alioth	166°19.2	55°52.5					
5	29°10.9	237°04.2	02.9	151°00.5	08.9	215°17.9	52.2	140°44.3	18.0	Spica	158°29.1	-11°14.7					
6	44°13.3	252°03.7	N13°01.9	166°01.9	S23°09.1	230°19.9	N03°52.1	155°46.8	S20°18.0	Alkaid	152°57.4	49°14.2					
7	59°15.8	267°03.2	13.0	181°03.3	09.3	245°22.0	51.9	170°49.3	18.0	Hadar	148°44.8	-60°27.3					
8	74°18.2	282°02.7	12.9	196°04.7	09.5	260°24.0	51.7	185°51.8	18.0	Menkent	148°05.1	-36°27.1					
9	89°20.7	297°02.3	11.6	211°06.1	09.7	275°26.0	51.5	200°54.3	18.0	Arcturus	145°53.9	19°06.1					
10	104°23.2	312°01.8	5.5	226°07.5	09.9	290°28.1	51.3	215°56.8	18.0	Rigel Kent.	139°48.7	-60°54.3					
11	119°25.6	327°01.3	5.4	241°08.9	10.2	305°30.1	51.1	230°59.3	18.1	Kochab	137°20.3	74°05.7					
12	134°28.1	342°00.8	N12°55.4	256°10.3	S23°10.4	320°32.1	N03°50.9	246°01.8	S20°18.1	Zuben ubi	137°03.0	-16°06.5					
13	149°30.6	357°00.3	54.3	271°11.7	10.6	335°34.2	50.7	261°04.3	18.1	Alphecca	126°09.1	26°39.9					
14	164°33.0	11°59.8	53.2	286°13.1	10.8	350°36.2	50.5	276°06.8	18.1	Antares	112°23.5	-26°27.9					
15	179°35.5	26°59.4	52.1	301°14.5	11.0	5°38.2	50.3	291°09.3	18.1	Atria	107°23.0	-69°03.4					
16	194°38.0	41°58.9	51.0	316°15.9	11.2	20°40.3	50.2	306°11.8	18.1	Sabik	102°09.9	-15°44.5					
17	209°40.4	56°58.4	49.9	331°17.3	11.4	35°42.3	50.0	321°14.3	18.1	Shaula	96°18.7	-37°06.8					
18	224°42.9	71°57.9	N12°48.8	346°18.7	S23°11.6	50°44.3	N03°49.8	336°16.8	S20°18.1	Rasalhague	96°04.3	12°33.2					
19	239°45.4	86°57.4	47.7	1°20.1	11.8	65°46.4	49.6	351°19.3	18.1	Eltanin	90°44.8	51°29.6					
20	254°47.8	101°57.0	46.6	16°21.5	12.0	80°48.4	49.4	6°21.8	18.1	Kaus Aust.	83°40.7	-34°22.4					
21	269°50.3	116°56.5	45.6	31°22.9	12.2	95°50.4	49.2	21°24.3	18.1	Vega	80°37.1	38°48.3					
22	284°52.7	131°56.0	44.5	46°24.3	12.4	110°52.5	49.0	36°26.8	18.1	Nunki	75°55.4	-26°16.3					
23	299°55.2	146°55.5	43.4	61°25.7	12.6	125°54.5	48.8	51°29.3	18.1	Altair	62°05.8	8°55.0					
Mer.pass.:03:04			v-0.5 d-1.1 m-3.8			v1.4 d-0.2 m-0.7			v2.0 d-0.2 m-1.6			v2.5 d-0.0 m0.3					
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	314°57.7	161°55.0	N12°42.3	76°27.1	S23°12.8	140°56.5	N03°48.6	66°31.8	S20°18.1	Peacock	209°19.1	13:11					
1	330°00.1	176°54.6	41.2	91°28.5	13.0	155°58.5	48.4	81°34.3	18.1	Deneb	122°19.8	18:57					
2	345°02.6	191°54.1	40.1	106°29.9	13.2	171°00.6	48.3	96°36.8	18.1	Jupiter	186°19.5	14:41					
3	0°05.1	206°53.6	39.0	121°31.3	13.4	186°02.6	48.1	111°39.3	18.1	Saturn	111°32.3	19:39					
4	15°07.5	221°53.1	37.9	136°32.7	13.6	201°04.6	47.9	126°41.7	18.1	Aug 04 Thu	SHA	Mer.pass					
5	30°10.0	236°52.7	36.8	151°34.1	13.8	216°06.7	47.7	141°44.2	18.1	Venus	208°19.1	13:12					
6	45°12.5	251°52.2	N12°35.7	166°35.4	S23°14.0	231°08.7	N03°47.5	156°46.7	S20°18.1	Mars	121°54.9	18:55					
7	60°14.9	266°51.7	34.6	181°36.8	14.3	246°10.7	47.3	171°49.2	18.1	Jupiter	186°09.2	14:38					
8	75°17.4	281°51.2	33.5	196°38.2	14.5	261°12.8	47.1	186°51.7	18.1	Saturn	111°33.2	19:35					
9	90°19.9	296°50.8	32.4	211°39.6	14.7	276°14.8	46.9	201°54.2	18.2	Aug 05 Fri	SHA	Mer.pass					
10	105°22.3	311°50.3	31.3	226°41.0	14.9	291°16.8	46.7	216°56.7	18.2	Venus	208°08.1	13:12					
11	120°24.8	326°49.8	30.2	241°42.4	15.1	306°18.9	46.5	231°59.2	18.2	Mars	121°54.9	18:55					
12	135°27.2	341°49.3	N12°29.1	256°43.7	S23°15.3	321°20.9	N03°46.4	247°01.7	S20°18.2	Jupiter	186°09.2	14:38					
13	150°29.7	356°48.9	28.0	271°45.1	15.5	336°22.9	46.2	262°04.2	18.2	Saturn	111°33.2	19:35					
14	165°32.2	11°48.4	26.9	286°46.5	15.7	351°24.9	46.0	277°06.7	18.2	Aug 06 Sat	SHA	Mer.pass					
15	180°34.6	26°47.9	25.8	301°47.9	15.9	6°27.0	45.8	292°09.2	18.2	Venus	206°57.4	13:13					
16	195°37.1	41°47.5	24.7	316°49.3	16.1	21°29.0	45.6	307°11.7	18.2	Mars	121°29.4	18:52					
17	210°39.6	56°47.0	23.6	331°50.6	16.3	36°31.0	45.4	322°14.2	18.2	Jupiter	185°58.8	14:34					
18	225°42.0	71°46.5	N12°22.5	346°52.0	S23°16.5	51°33.1	N03°45.2	337°16.7	S20°18.2	Saturn	111°34.1	19:31					
19	240°44.5	86°46.1	21.4	1°53.4	16.7	66°35.1	45.0	352°19.2	18.2	Horizontal parallax							
20	255°47.0	101°45.6	20.3	16°54.8	1												

DUT1 = UT1-UTC = -0.2274 sec ΔT = TT-UT1 = +68.4114 sec

2016 August 04 to Aug. 06 UT

h		Sun		Moon				Lat.		Twilight		Sunrise		Sunset		Twilight	
Thu		GHA	Dec	GHA	ν	Dec	d	HP	Naut.	Civil					Civil	Naut.	
0	178°28.7	N17°10.6		165°20.7	11.3'	N11°26.4	-8.2'	56.7'	N 72°	00:47	23:08						
1	193°28.8	09.9		179°51.0	11.3'	11°18.1	-8.3'	56.6'	N 70°	02:00	22:06						
2	208°28.8	09.3		194°21.4	11.4'	11°09.8	-8.3'	56.6'	68°	02:37	21:31						
3	223°28.9	.. 08.6		208°51.8	11.5'	11°01.4	-8.4'	56.6'	66°	01:18	03:02	21:07	22:46				
4	238°28.9	07.9		223°22.3	11.5'	10°53.0	-8.4'	56.5'	64°	02:03	03:22	20:48	22:04				
5	253°29.0	07.2		237°52.9	11.6'	10°44.5	-8.5'	56.5'	62°	02:32	03:38	20:32	21:37				
6	268°29.1	N17°06.6		252°23.5	11.7'	N10°36.0	-8.5'	56.5'	60°	01:11	02:54	20:19	21:16	22:54			
7	283°29.1	05.9		266°54.2	11.7'	10°27.5	-8.6'	56.5'	N 58°	01:52	03:11	20:08	20:59	22:16			
8	298°29.2	05.2		281°25.0	11.8'	10°18.9	-8.6'	56.4'	56°	02:18	03:25	19:58	20:45	21:51			
9	313°29.2	.. 04.6		295°55.8	11.8'	10°10.2	-8.7'	56.4'	54°	02:38	03:38	19:50	20:33	21:31			
10	328°29.3	03.9		310°26.6	11.9'	10°01.6	-8.7'	56.4'	52°	02:55	03:48	19:42	20:22	21:15			
11	343°29.4	03.2		324°57.5	12.0'	09°52.8	-8.7'	56.4'	50°	03:08	03:58	19:35	20:13	21:02			
12	358°29.4	N17°02.5		339°28.5	12.0'	N09°44.1	-8.8'	56.3'	45°	03:36	04:17	19:21	19:54	20:35			
13	13°29.5	01.9		353°59.6	12.1'	09°35.3	-8.8'	56.3'	N 40°	03:56	04:32	19:09	19:39	20:15			
14	28°29.5	01.2		8°30.7	12.1'	09°26.4	-8.9'	56.3'	35°	04:12	04:45	18:59	19:26	19:59			
15	43°29.6	17°00.5		23°01.8	12.2'	09°17.5	-8.9'	56.3'	30°	04:25	04:56	18:50	19:16	19:46			
16	58°29.7	16°59.9		37°33.0	12.2'	09°08.6	-8.9'	56.2'	20°	04:46	05:14	18:35	18:58	19:25			
17	73°29.7	59.2		52°04.3	12.3'	08°59.7	-9.0'	56.2'	N 10°	05:02	05:28	18:22	18:44	19:09			
18	88°29.8	N16°58.5		66°35.6	12.3'	N08°50.7	-9.0'	56.2'	0°	05:16	05:41	18:09	18:31	18:56			
19	103°29.8	57.8		81°07.0	12.4'	08°41.7	-9.0'	56.2'	S 10°	05:27	05:53	17:57	18:19	18:44			
20	118°29.9	57.1		95°38.4	12.5'	08°32.6	-9.1'	56.1'	20°	05:38	06:05	17:45	18:07	18:34			
21	133°30.0	.. 56.5		110°09.9	12.5'	08°23.5	-9.1'	56.1'	30°	05:49	06:17	17:30	17:55	18:24			
22	148°30.0	55.8		124°41.4	12.6'	08°14.4	-9.1'	56.1'	35°	05:54	06:24	17:22	17:48	18:18			
23	163°30.1	55.1		139°13.0	12.6'	08°05.3	-9.2'	56.1'	40°	05:59	06:32	17:12	17:41	18:13			
	SD.=15.8	d=-0.7				S.D.=15.4			45°	06:05	06:40	17:01	17:32	18:07			
Fri		GHA	Dec	GHA	ν	Dec	d	HP	S 50°	06:11	06:50	16:48	17:23	18:01			
0	178°30.2	N16°54.4		153°44.7	12.7'	N07°56.1	-9.2'	56.0'	52°	06:14	06:54	16:42	17:18	17:59			
1	193°30.2	53.8		168°16.4	12.7'	07°46.9	-9.2'	56.0'	54°	06:17	06:59	16:35	17:13	17:56			
2	208°30.3	53.1		182°48.1	12.8'	07°37.7	-9.2'	56.0'	56°	06:20	07:05	16:27	17:08	17:53			
3	223°30.4	.. 52.4		197°19.9	12.8'	07°28.4	-9.3'	56.0'	58°	06:23	07:11	16:18	17:02	17:50			
4	238°30.4	51.7		211°51.8	12.9'	07°19.1	-9.3'	55.9'	S 60°	06:27	07:17	16:08	16:56	17:46			
5	253°30.5	51.0		226°23.7	12.9'	07°09.8	-9.3'	55.9'									
6	268°30.5	N16°50.4		240°55.6	13.0'	N07°00.5	-9.3'	55.9'									
7	283°30.6	49.7		255°27.7	13.0'	06°51.1	-9.4'	55.9'									
8	298°30.7	49.0		269°59.7	13.1'	06°41.7	-9.4'	55.8'									
9	313°30.7	.. 48.3		284°31.8	13.1'	06°32.3	-9.4'	55.8'									
10	328°30.8	47.6		299°04.0	13.2'	06°22.9	-9.4'	55.8'									
11	343°30.9	46.9		313°36.2	13.2'	06°13.4	-9.5'	55.8'									
12	358°30.9	N16°46.3		328°08.4	13.3'	N06°04.0	-9.5'	55.7'									
13	13°31.0	45.6		342°40.7	13.3'	05°54.5	-9.5'	55.7'									
14	28°31.1	44.9		357°13.0	13.4'	05°45.0	-9.5'	55.7'									
15	43°31.1	.. 44.2		11°45.4	13.4'	05°35.5	-9.5'	55.7'									
16	58°31.2	43.5		26°17.8	13.4'	05°25.9	-9.5'	55.6'									
17	73°31.3	42.8		40°50.3	13.5'	05°16.4	-9.6'	55.6'									
18	88°31.3	N16°42.1		55°22.8	13.5'	N05°06.8	-9.6'	55.6'									
19	103°31.4	41.4		69°55.4	13.6'	04°57.2	-9.6'	55.6'									
20	118°31.5	40.8		84°27.9	13.6'	04°47.6	-9.6'	55.5'									
21	133°31.6	.. 40.1		99°00.6	13.7'	04°38.0	-9.6'	55.5'									
22	148°31.6	39.4		113°33.3	13.7'	04°28.4	-9.6'	55.5'									
23	163°31.7	38.7		128°06.0	13.7'	04°18.8	-9.6'	55.5'									
	SD.=15.8	d=-0.7				S.D.=15.2											
Sat		GHA	Dec	GHA	ν	Dec	d	HP	Day	Eqn.of Time	Mer.	Moon	Mer. Pass.	Upper	Lower	Age	
0	178°31.8	N16°38.0		142°38.7	13.8'	N04°09.2	-9.6'	55.5'	00 <sup>h</sup>	00:55	12:06	13:25	01:01				
1	193°31.8	37.3		157°11.5	13.8'	03°59.5	-9.7'	55.4'	00 <sup>h</sup>	05:59	12:06	14:11	01:48				
2	208°31.9	36.6		171°44.4	13.9'	03°49.8	-9.7'	55.4'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
3	223°32.0	.. 35.9		186°17.2	13.9'	03°40.2	-9.7'	55.4'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
4	238°32.0	35.2		200°50.1	13.9'	03°30.5	-9.7'	55.4'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
5	253°32.1	34.5		215°23.1	14.0'	03°20.8	-9.7'	55.3'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
6	268°32.2	N16°33.9		229°56.1	14.0'	N03°11.1	-9.7'	55.3'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
7	283°32.3	33.2		244°29.1	14.0'	03°01.4	-9.7'	55.3'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
8	298°32.3	32.5		259°02.1	14.1'	02°51.8	-9.7'	55.3'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
9	313°32.4	.. 31.8		273°35.2	14.1'	02°42.1	-9.7'	55.3'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
10	328°32.5	31.1		288°08.3	14.1'	02°32.3	-9.7'	55.2'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
11	343°32.5	30.4		302°41.5	14.2'	02°22.6	-9.7'	55.2'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
12	358°32.6	N16°29.7		317°14.7	14.2'	N02°12.9	-9.7'	55.2'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
13	13°32.7	29.0		331°47.9	14.2'	02°03.2	-9.7'	55.2'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
14	28°32.8	28.3		346°21.1	14.3'	01°53.5	-9.7'	55.1'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
15	43°32.8	.. 27.6		0°54.4	14.3'	01°43.8	-9.7'	55.1'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
16	58°32.9	26.9		15°27.7	14.3'	01°34.1	-9.7'	55.1'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
17	73°33.0	26.2		30°01.0	14.3'	01°24.4	-9.7'	55.1'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
18	88°33.1	N16°25.5		44°34.4	14.4'	N01°14.7	-9.7'	55.1'	00 <sup>h</sup>	05:59	12:06	14:56	02:34				
19	103°33.1	24.8		59°07.8	14.4'</												

**August 07, 08, 09 UT (Sun., Mon., Tue.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	315°56.8	161°43.7	N12°15.9	77°00.2	S23°17.8	141°45.2	N03°44.1	67°31.6	S20°18.2	Alpheratz	357°41.0	29°10.9					
1	330°59.3	176°43.2	14.8	92°01.6	18.0	156°47.3	43.9	82°34.1	18.2	Ankaa	353°13.4	-42°12.7					
2	346°01.7	191°42.8	13.6	107°03.0	18.2	171°49.3	43.7	97°36.6	18.2	Schedar	349°37.6	56°37.5					
3	1°04.2	206°42.3	12.5	122°04.4	18.4	186°51.3	43.5	112°39.1	18.2	Diphda	348°53.6	-17°53.6					
4	16°06.7	221°41.8	11.4	137°05.7	18.6	201°53.3	43.3	127°41.6	18.2	Achernar	335°25.1	-57°08.9					
5	31°09.1	236°41.4	10.3	152°07.1	18.8	216°55.4	43.1	142°44.1	18.3	Hamal	327°58.2	23°32.3					
6	46°11.6	251°40.9	N12°09.2	167°08.5	S23°19.0	231°57.4	N03°42.9	157°46.6	S20°18.3	Polaris	316°46.0	89°19.6					
7	61°14.1	266°40.5	08.1	182°09.8	19.2	246°59.4	42.7	172°49.1	18.3	Acamar	315°16.8	-40°14.2					
8	76°16.5	281°40.0	07.0	197°11.2	19.4	262°01.5	42.5	187°51.6	18.3	Menkar	314°12.8	4°09.2					
9	91°19.0	296°39.5	05.9	212°12.5	19.6	277°03.5	42.3	202°54.1	18.3	Mirfak	308°37.3	49°54.8					
10	106°21.5	311°39.1	04.8	227°13.9	19.8	292°05.5	42.1	217°56.6	18.3	Aldebaran	290°47.1	16°32.3					
11	121°23.9	326°38.6	03.6	242°15.3	20.0	307°07.5	42.0	232°59.1	18.3	Rigel	281°10.2	-8°11.0					
12	136°26.4	341°38.1	N12°02.5	257°16.6	S23°20.2	322°09.6	N03°41.8	248°01.5	S20°18.3	Capella	280°31.5	46°00.5					
13	151°28.8	356°37.7	01.4	272°18.0	20.4	337°11.6	41.6	263°04.0	18.3	Bellatrix	278°29.9	6°21.7					
14	166°31.3	11°37.2	12°00.3	287°19.3	20.6	352°13.6	41.4	278°06.5	18.3	Elnath	278°10.1	28°37.0					
15	181°33.8	26°36.8	11°59.2	302°20.7	20.8	7°15.6	41.2	293°09.0	18.3	Alnilam	275°44.4	-1°11.6					
16	196°36.2	41°36.3	58.1	317°22.1	21.0	22°17.7	41.0	308°11.5	18.3	Betelgeuse	270°59.2	7°24.5					
17	211°38.7	56°35.8	57.0	332°23.4	21.3	37°19.7	40.8	323°14.0	18.3	Canopus	263°55.6	-52°42.2					
18	226°41.2	71°35.4	N11°55.8	347°24.8	S23°21.5	52°21.7	N03°40.6	338°16.5	S20°18.3	Sirius	258°32.1	-16°44.4					
19	241°43.6	86°34.9	54.7	2°26.1	21.7	67°23.8	40.4	353°19.0	18.3	Adhara	255°11.2	-28°59.7					
20	256°46.1	101°34.5	53.6	17°27.5	21.9	82°25.8	40.2	8°21.5	18.3	Procyon	244°57.8	5°10.8					
21	271°48.6	116°34.0	.. 52.5	32°28.8	22.1	97°27.8	40.0	23°24.0	18.3	Pollux	243°25.5	27°59.0					
22	286°51.0	131°33.5	51.4	47°30.2	22.3	112°29.8	39.8	38°26.4	18.3	Avior	234°17.7	-59°33.8					
23	301°53.5	146°33.1	50.2	62°31.5	22.5	127°31.9	39.7	53°28.9	18.4	Suhail	222°51.3	-43°30.0					
Mer.pass.:02:56			v-0.5 d-1.1 m-3.8	v1.4 d-0.2 m-0.7	v2.0 d-0.2 m-1.6	v2.5 d-0.0 m-0.4	Miaplacidus			Zuben ubi	221°40.0	-69°47.2					
Mon			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.3	-8°43.9	
0	316°55.9	161°32.6	N11°49.1	77°32.9	S23°22.7	142°33.9	N03°39.5	68°31.4	S20°18.4	Regulus	207°41.6	11°53.2					
1	331°58.4	176°32.2	48.0	92°34.2	22.9	157°35.9	39.3	83°33.9	18.4	Dubhe	193°49.8	61°39.9					
2	347°00.9	191°31.7	46.9	107°35.6	23.1	172°37.9	39.1	98°36.4	18.4	Denebola	182°31.8	14°28.9					
3	2°03.3	206°31.3	.. 45.8	122°36.9	23.3	187°40.0	38.9	113°38.9	18.4	Gienah	175°50.3	-17°38.0					
4	17°05.8	221°30.8	44.6	137°38.3	23.5	202°42.0	38.7	128°41.4	18.4	Acrux	173°07.2	-63°11.6					
5	32°08.3	236°30.4	43.5	152°39.6	23.7	217°44.0	38.5	143°43.9	18.4	Gacrux	171°58.7	-57°12.5					
6	47°10.7	251°29.9	N11°42.4	167°40.9	S23°23.9	232°46.0	N03°38.3	158°46.3	S20°18.4	Alioth	166°19.2	55°52.5					
7	62°13.2	266°29.4	41.3	182°42.3	24.1	247°48.1	38.1	173°48.8	18.4	Spica	158°29.1	-11°14.7					
8	77°15.7	281°29.0	40.1	197°43.6	24.3	262°50.1	37.9	188°51.3	18.4	Alkaid	152°57.4	49°14.2					
9	92°18.1	296°28.5	.. 39.0	212°45.0	24.6	277°52.1	37.7	203°53.8	18.4	Hadar	148°44.9	-60°27.3					
10	107°20.6	311°28.1	37.9	227°46.3	24.8	292°54.1	37.5	218°56.3	18.4	Menkent	148°05.1	-36°27.1					
11	122°23.1	326°27.6	36.8	242°47.7	25.0	307°56.2	37.3	233°58.8	18.4	Arcturus	145°53.9	19°06.1					
12	137°25.5	341°27.2	N11°35.6	257°49.0	S23°25.2	322°58.2	N03°37.2	249°01.3	S20°18.4	Rigel Kent.	139°48.8	-60°54.3					
13	152°28.0	356°26.7	34.5	272°50.3	25.4	338°00.2	37.0	264°03.8	18.4	Kochab	137°20.3	74°05.7					
14	167°30.4	11°26.3	33.4	287°51.7	25.6	353°02.2	36.8	279°06.2	18.4	Zuben ubi	137°03.0	-16°06.5					
15	182°32.9	26°25.8	.. 32.3	302°53.0	25.8	8°04.3	36.6	294°08.7	18.4	Alphecca	126°09.2	26°39.9					
16	197°35.4	41°25.4	31.1	317°54.3	26.0	23°06.3	36.4	309°11.2	18.5	Antares	112°23.5	-26°27.9					
17	212°37.8	56°24.9	30.0	332°55.7	26.2	38°08.3	36.2	324°13.7	18.5	Atria	107°23.0	-69°03.4					
18	227°40.3	71°24.5	N11°28.9	347°57.0	S23°26.4	53°10.3	N03°36.0	339°16.2	S20°18.5	Sabik	102°09.9	-15°44.5					
19	242°42.8	86°24.0	27.7	2°58.3	26.6	68°12.4	35.8	354°18.7	18.5	Rasalhague	96°18.7	-37°06.8					
20	257°45.2	101°23.6	26.6	17°59.7	26.8	83°14.4	35.6	9°21.2	18.5	Eltanin	90°44.8	51°29.6					
21	272°47.7	116°23.1	.. 25.5	33°01.0	27.0	98°16.4	35.4	24°23.6	18.5	Kaus Aust.	83°40.7	-34°22.4					
22	287°50.2	131°22.7	24.3	48°02.3	27.2	113°18.4	35.2	39°26.1	18.5	Vega	80°37.2	38°48.3					
23	302°52.6	146°22.2	23.2	63°03.7	27.4	128°20.5	35.0	54°28.6	18.5	Nunki	75°55.4	-26°16.3					
Mer.pass.:02:52			v-0.5 d-1.1 m-3.8	v1.3 d-0.2 m-0.7	v2.0 d-0.2 m-1.6	v2.5 d-0.0 m-0.4	Altair			Altair	62°05.8	8°55.0					
Tue			GHA	GHA	Dec	GHA	Dec	GHA	Dec	Peacock	53°15.4	-56°40.7					
0	317°55.1	161°21.8	N11°22.1	78°05.0	S23°27.6	143°22.5	N03°34.8	69°31.1	S20°18.5	Deneb	49°29.5	45°20.6					
1	332°57.6	176°21.4	20.9	93°06.3	27.9	158°24.5	34.6	84°33.6	18.5	Fomalhaut	33°21.4	-29°31.9					
2	348°00.0	191°20.9	19.8	108°07.6	28.1	173°26.5	34.4	99°36.1	18.5	Scheat	13°50.9	28°10.4					
3	3°02.5	206°20.5	.. 18.7	123°09.0	28.3	188°28.6	34.3	114°38.5	18.5	Markab	13°35.9	15°17.8					
4	18°04.9	221°20.0	17.5	138°10.3	28.5	203°30.6	34.1	129°41.0	18.5	Aug 07 Sun	15°21.4	15°21.4					
5	33°07.4	236°19.6	16.4	153°11.6	28.7	218°32.6	33.9	144°43.5	18.5	Venus	205°46.9	13:13					
6	48°09.9	251°19.1	N11°15.3	168°12.9	S23°28.9	233°34.6	N03°33.7	159°46.0	S20°18.5	Mars	121°03.4	18:50					
7	63°12.3	266°18.7	14.1	183°14.3	29.1	248°36.7	33.5	174°48.5	18.5	Jupiter	185°48.4	14:31					
8	78°14.8	281°18.2	13.0	198°15.6	29.3	263°38.7	33.3	189°51.0	18.6	Saturn	111°34.8	19:27					
9	93°17.3	296°17.8	.. 11.9	213°16.9	29.5	278°40.7	33.1	204°53.4	18.6	Aug 08 Mon	15°21.4	15:14					
10	108°19.7	311°17.4	10.7	228°18.2	29.7	293°42.7	32.9	219°55.9	18.6	Venus	204°36.7	13:14					
11	123°22.2	326°16.9	09.6	243°19.5	29.9	308°44.7	32.7	234°58.4	18.6	Mars	120°36.9	18:48					
12	138°24.7	341°16.5	N11°08.4	258°20.9	S23°30.1	323°46.8	N03°32.5	250°00.9	S20°18.6	Jupiter	185°37.9	14:28					
13	153°27.1	356°16.0	07.3	273°22.2	30.3	338°48.8	32.3	265°03.4	18.6	Saturn	111°35.5	19:23					
14	168°29.6	11°15.6	06.2	288°23.5	30.5	353°50.8	32.1	280°05.9	18.6	Aug 09 Tue	15°21.4	15:15					
15	183°32.0	26°15.2	.. 05.0	303°24.8	30.7	8°52.8	31.9	295°08.3	18.6	Venus	203°26.7	13:15					
16	198°34.5	41°14.7	03.9	318°26.1	31.0	23°54.9	31.7	310°10.8	18.6	Mars	120°09.9	18:46					
17	213°37.0	56°14.3	02.7	333°27.4	31.2	38°56.9	31.5	325°13.3	18.6	Jupiter	185°27.4	14:25					
18	228°39.4	71°13.8	N11°01.6	348°28.7	S23°31.4	53°58.9	N03°31.4	340°15.8	S20°18.6	Saturn	111°36.0	19:19					
19	243°41.9	86°13.4	11°00.5	3°30.1	31.6	69°00.9	31.2	355°18.3	18.6	Horizontal parallax							
20	258°44.4	101°13.0	10°5														

DUT1 = UT1-UTC = -0.2295 sec ΔT = TT-UT1 = +68.4135 sec

2016 August 07 to Aug. 09 UT

h		Sun		Moon					
Sun		GHA	Dec	GHA	ν	Dec	d	HP	
0	178°33.5	N16°21.3		131°55.1	14.5'	N00°16.5	-9.7'	54.9'	
1	193°33.6		20.6	146°28.6	14.5'	N00°06.8	-9.7'	54.9'	
2	208°33.7		19.9	161°02.1	14.6'	S00°02.8	-9.7'	54.9'	
3	223°33.7		.	175°35.7	14.6'	00°12.5	-9.7'	54.9'	
4	238°33.8		18.5	190°09.3	14.6'	00°22.1	-9.6'	54.9'	
5	253°33.9		17.8	204°42.9	14.6'	00°31.8	-9.6'	54.9'	
6	268°34.0	N16°17.1		219°16.6	14.6'	S00°41.4	-9.6'	54.8'	
7	283°34.1		16.4	233°50.2	14.7'	00°51.0	-9.6'	54.8'	
8	298°34.1		15.7	248°23.9	14.7'	01°00.6	-9.6'	54.8'	
9	313°34.2		.	262°57.6	14.7'	01°10.2	-9.6'	54.8'	
10	328°34.3		14.3	277°31.3	14.7'	01°19.8	-9.6'	54.8'	
11	343°34.4		13.6	292°05.0	14.7'	01°29.4	-9.6'	54.8'	
12	358°34.4	N16°12.9		306°38.8	14.7'	S01°39.0	-9.6'	54.7'	
13	13°34.5		12.2	321°12.5	14.8'	01°48.5	-9.5'	54.7'	
14	28°34.6		11.4	335°46.3	14.8'	01°58.1	-9.5'	54.7'	
15	43°34.7		.	350°20.1	14.8'	02°07.6	-9.5'	54.7'	
16	58°34.8		10.0	4°53.8	14.8'	02°17.1	-9.5'	54.7'	
17	73°34.8		09.3	19°27.7	14.8'	02°26.6	-9.5'	54.7'	
18	88°34.9	N16°08.6		34°01.5	14.8'	S02°36.1	-9.5'	54.6'	
19	103°35.0		07.9	48°35.3	14.8'	02°45.5	-9.5'	54.6'	
20	118°35.1		07.2	63°09.1	14.8'	02°55.0	-9.4'	54.6'	
21	133°35.2		.	77°43.0	14.9'	03°04.4	-9.4'	54.6'	
22	148°35.3		05.8	92°16.8	14.9'	03°13.8	-9.4'	54.6'	
23	163°35.3		05.1	106°50.7	14.9'	03°23.2	-9.4'	54.6'	
SD.=15.8		d=-0.7		S.D.=14.9					
Mon		GHA	Dec	GHA	ν	Dec	d	HP	
0	178°35.4	N16°04.3		121°24.6	14.9'	S03°32.6	-9.4'	54.6'	
1	193°35.5		03.6	135°58.4	14.9'	03°41.9	-9.3'	54.5'	
2	208°35.6		02.9	150°32.3	14.9'	03°51.2	-9.3'	54.5'	
3	223°35.7		.	165°06.2	14.9'	04°00.5	-9.3'	54.5'	
4	238°35.8		01.5	179°40.1	14.9'	04°09.8	-9.3'	54.5'	
5	253°35.8		00.8	194°14.0	14.9'	04°19.1	-9.3'	54.5'	
6	268°35.9	N16°00.1		208°47.9	14.9'	S04°28.3	-9.2'	54.5'	
7	283°36.0		15°59.4	223°21.8	14.9'	04°37.5	-9.2'	54.5'	
8	298°36.1		58.6	237°55.7	14.9'	04°46.7	-9.2'	54.5'	
9	313°36.2		.	252°29.6	14.9'	04°55.9	-9.2'	54.4'	
10	328°36.3		57.2	267°03.5	14.9'	05°05.0	-9.1'	54.4'	
11	343°36.3		56.5	281°37.4	14.9'	05°14.2	-9.1'	54.4'	
12	358°36.4	N15°55.8		296°11.3	14.9'	S05°23.2	-9.1'	54.4'	
13	13°36.5		55.1	310°45.2	14.9'	05°32.3	-9.1'	54.4'	
14	28°36.6		54.3	325°19.1	14.9'	05°41.3	-9.0'	54.4'	
15	43°36.7		.	339°53.0	14.9'	05°50.4	-9.0'	54.4'	
16	58°36.8		52.9	354°26.9	14.9'	05°59.3	-9.0'	54.4'	
17	73°36.9		52.2	9°00.8	14.9'	06°08.3	-8.9'	54.4'	
18	88°36.9	N15°51.5		23°34.7	14.9'	S06°17.2	-8.9'	54.4'	
19	103°37.0		50.7	38°08.5	14.9'	06°26.1	-8.9'	54.4'	
20	118°37.1		50.0	52°42.4	14.9'	06°35.0	-8.9'	54.3'	
21	133°37.2		.	67°16.3	14.9'	06°43.8	-8.8'	54.3'	
22	148°37.3		48.6	81°50.1	14.9'	06°52.6	-8.8'	54.3'	
23	163°37.4		47.9	96°24.0	14.8'	07°01.4	-8.8'	54.3'	
SD.=15.8		d=-0.7		S.D.=14.8					
Tue		GHA	Dec	GHA	ν	Dec	d	HP	
0	178°37.5	N15°47.1		110°57.8	14.8'	S07°10.1	-8.7'	54.3'	
1	193°37.6		46.4	125°31.7	14.8'	07°18.9	-8.7'	54.3'	
2	208°37.7		45.7	140°05.5	14.8'	07°27.5	-8.7'	54.3'	
3	223°37.7		.	154°39.3	14.8'	07°36.2	-8.6'	54.3'	
4	238°37.8		44.2	169°13.1	14.8'	07°44.8	-8.6'	54.3'	
5	253°37.9		43.5	183°46.9	14.8'	07°53.4	-8.6'	54.3'	
6	268°38.0	N15°42.8		198°20.6	14.8'	S08°01.9	-8.5'	54.3'	
7	283°38.1		42.1	212°54.4	14.8'	08°10.4	-8.5'	54.3'	
8	298°38.2		41.3	227°28.1	14.7'	08°18.9	-8.5'	54.3'	
9	313°38.3		.	242°01.9	14.7'	08°27.3	-8.4'	54.3'	
10	328°38.4		39.9	256°35.6	14.7'	08°35.7	-8.4'	54.3'	
11	343°38.5		39.2	271°09.3	14.7'	08°44.1	-8.3'	54.3'	
12	358°38.6	N15°38.4		285°43.0	14.7'	S08°52.4	-8.3'	54.2'	
13	13°38.6		37.7	300°16.7	14.7'	09°00.7	-8.3'	54.2'	
14	28°38.7		37.0	314°50.3	14.6'	09°08.9	-8.2'	54.2'	
15	43°38.8		.	329°23.9	14.6'	09°17.1	-8.2'	54.2'	
16	58°38.9		35.5	343°57.6	14.6'	09°25.3	-8.1'	54.2'	
17	73°39.0		34.8	358°31.2	14.6'	09°33.4	-8.1'	54.2'	
18	88°39.1	N15°34.0		13°04.7	14.6'	S09°41.5	-8.1'	54.2'	
19	103°39.2		33.3	27°38.3	14.5'	09°49.6	-8.0'	54.2'	
20	118°39.3		32.6	42°11.8	14.5'	09°57.6	-8.0'	54.2'	
21	133°39.4		.	56°45.3	14.5'	10°05.5	-7.9'	54.2'	
22	148°39.5		31.1	71°18.8	14.5'	10°13.4	-7.9'	54.2'	
23	163°39.6		30.4	85°52.3	14.5'	10°21.3	-7.9'	54.2'	
SD.=15.8		d=-0.7		S.D.=14.8					

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> 00 <sup>m</sup> 00 <sup>s</sup>		Mer. Pass.	Upper
	00 <sup>h</sup>	Pass	hh:mm	hh:mm	hh:mm
07	05:46	05:42	12:06	15:40	03:18
08	05:38	05:34	12:06	16:23	04:01
09	05:30	05:26	12:05	17:06	04:44

**August 10, 11, 12 UT (Wed., Thu., Fri.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	318°54.2	161°11.2	N10°54.7	78°36.6	S23°32.6	144°11.0	N03°30.2	70°30.7	S20°18.7	Alpheratz	357°41.0	29°10.9					
1	333°56.7	176°10.8	53.6	93°37.9	32.8	159°13.1	30.0	85°33.1	18.7	Ankaa	353°13.4	-42°12.8					
2	348°59.2	191°10.3	52.4	108°39.2	33.0	174°15.1	29.8	100°35.6	18.7	Schedar	349°37.6	56°37.5					
3	4°01.6	206°09.9	..	51.3	123°40.5	..	33.2	189°17.1	..	Diphda	348°53.6	-17°53.6					
4	19°04.1	221°09.5	50.1	138°41.8	33.4	204°19.1	29.4	130°40.6	18.7	Achernar	335°25.1	-57°08.9					
5	34°06.5	236°09.0	49.0	153°43.1	33.6	219°21.1	29.2	145°43.1	18.7	Hamal	327°58.2	23°32.3					
6	49°09.0	251°08.6	N10°47.9	168°44.4	S23°33.8	234°23.2	N03°29.0	160°45.5	S20°18.7	Polaris	316°44.5	89°19.6					
7	64°11.5	266°08.2	46.7	183°45.7	34.0	249°25.2	28.8	175°48.0	18.7	Acamar	315°16.7	-40°14.2					
8	79°13.9	281°07.7	45.6	198°47.0	34.3	264°27.2	28.6	190°50.5	18.7	Menkar	314°12.8	4°09.2					
9	94°16.4	296°07.3	..	44.4	213°48.3	..	34.5	279°29.2	..	Mirfak	308°37.3	49°54.8					
10	109°18.9	311°06.9	43.3	228°49.6	34.7	294°31.3	28.2	220°55.5	18.7	Aldebaran	290°47.0	16°32.4					
11	124°21.3	326°06.4	42.1	243°50.9	34.9	309°33.3	28.1	235°57.9	18.7	Rigel	281°10.2	-8°11.0					
12	139°23.8	341°06.0	N10°41.0	258°52.2	S23°35.1	324°35.3	N03°27.9	251°00.4	S20°18.7	Capella	280°31.5	46°00.5					
13	154°26.3	356°05.6	39.8	273°53.5	35.3	339°37.3	27.7	266°02.9	18.8	Bellatrix	278°29.9	6°21.7					
14	169°28.7	11°05.1	38.7	288°54.8	35.5	354°39.3	27.5	281°05.4	18.8	Elnath	278°10.1	28°37.0					
15	184°31.2	26°04.7	..	37.5	303°56.1	..	35.7	9°41.4	..	Alnilam	275°44.4	-1°11.6					
16	199°33.6	41°04.3	36.3	318°57.4	35.9	24°43.4	27.1	311°10.3	18.8	Betelgeuse	270°59.2	7°24.5					
17	214°36.1	56°03.8	35.2	333°58.7	36.1	39°45.4	26.9	326°12.8	18.8	Canopus	263°55.6	-52°42.2					
18	229°38.6	71°03.4	N10°34.0	349°00.0	S23°36.3	54°47.4	N03°26.7	341°15.3	S20°18.8	Sirius	258°32.1	-16°44.4					
19	244°41.0	86°03.0	32.9	4°01.3	36.5	69°49.4	26.5	356°17.8	18.8	Adhara	255°11.1	-28°59.7					
20	259°43.5	101°02.6	31.7	19°02.6	36.7	84°51.5	26.3	11°20.2	18.8	Procyon	244°57.8	5°10.8					
21	274°46.0	116°02.1	..	30.6	34°03.9	..	36.9	99°53.5	..	Pollux	243°25.5	-27°59.0					
22	289°48.4	131°01.7	29.4	49°05.2	37.1	114°55.5	25.9	41°25.2	18.8	Avior	234°17.7	-59°33.8					
23	304°50.9	146°01.3	28.3	64°06.4	37.3	129°57.5	25.7	56°27.7	18.8	Suhail	222°51.3	-43°30.0					
Mer.pass.:02:44			v-0.4 d-1.1 m-3.8	v1.3 d-0.2 m-0.6			v2.0 d-0.2 m-1.6			v2.5 d-0.0 m-0.4			Miaplacidus				
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	319°53.4	161°00.8	N10°27.1	79°07.7	S23°37.5	144°59.5	N03°25.5	71°30.1	S20°18.8	Denebola	182°31.8	14°28.9					
1	334°55.8	176°00.4	25.9	94°09.0	37.8	160°01.6	25.3	86°32.6	18.8	Gienah	175°50.3	-17°38.0					
2	349°58.3	191°00.0	24.8	109°10.3	38.0	175°03.6	25.1	101°35.1	18.9	Acrux	173°07.2	-63°11.6					
3	5°00.8	205°59.6	..	23.6	124°11.6	..	38.2	190°05.6	..	Gacrux	171°58.8	-57°12.5					
4	20°03.2	220°59.1	22.5	139°12.9	38.4	205°07.6	24.7	131°40.0	18.9	Alioth	166°19.2	55°52.5					
5	35°05.7	235°58.7	21.3	154°14.2	38.6	220°09.6	24.5	146°42.5	18.9	Spica	158°29.1	-11°14.7					
6	50°08.1	250°58.3	N10°20.2	169°15.4	S23°38.8	235°11.6	N03°24.3	161°45.0	S20°18.9	Alkaid	152°57.5	49°14.2					
7	65°10.6	265°57.9	19.0	184°16.7	39.0	250°13.7	24.2	176°47.5	18.9	Hadar	148°44.9	-60°27.3					
8	80°13.1	280°57.4	17.8	199°18.0	39.2	265°15.7	24.0	191°49.9	18.9	Menkent	148°05.1	-36°27.1					
9	95°15.5	295°57.0	..	16.7	214°19.3	..	39.4	280°17.7	..	Arcturus	145°53.9	19°06.1					
10	110°18.0	310°56.6	15.5	229°20.6	39.6	295°19.7	23.6	221°54.9	18.9	Rigil Kent.	139°48.8	-60°54.3					
11	125°20.5	325°56.2	14.3	244°21.8	39.8	310°21.7	23.4	236°57.4	18.9	Kochab	137°20.4	74°05.7					
12	140°22.9	340°55.7	N10°13.2	259°23.1	S23°40.0	325°23.8	N03°23.2	251°59.8	S20°18.9	Zuben'ubi	137°03.1	-16°06.5					
13	155°25.4	355°55.3	12.0	274°24.4	40.2	340°25.8	23.0	267°02.3	18.9	Alphecca	126°09.2	26°39.9					
14	170°27.9	10°54.9	10.9	289°25.7	40.4	355°27.8	22.8	282°04.8	18.9	Antares	112°23.5	-26°27.9					
15	185°30.3	25°54.5	..	09.7	304°26.9	..	40.6	10°29.8	..	Atria	107°23.1	-69°03.4					
16	200°32.8	40°54.1	08.5	319°28.2	40.8	25°31.8	22.4	312°09.7	19.0	Sabik	102°09.9	-15°44.5					
17	215°35.3	55°53.6	07.4	334°29.5	41.0	40°33.9	22.2	327°12.2	19.0	Shaula	96°18.8	-37°06.8					
18	230°37.7	70°53.2	N10°06.2	349°30.8	S23°41.2	55°35.9	N03°22.0	342°14.7	S20°19.0	Rasalhague	96°04.3	12°33.3					
19	245°40.2	85°52.8	05.0	4°32.0	41.5	70°37.9	21.8	357°17.1	19.0	Eltanin	90°44.8	51°29.6					
20	260°42.6	100°52.4	03.9	19°33.3	41.7	85°39.9	21.6	12°19.6	19.0	Kaus Aust.	83°40.7	-34°22.4					
21	275°45.1	115°52.0	..	02.7	34°34.6	..	41.9	100°41.9	..	Vega	80°37.2	38°48.3					
22	290°47.6	130°51.5	01.5	49°35.8	42.1	115°43.9	21.2	42°24.6	19.0	Nunki	75°55.4	-26°16.3					
23	305°50.0	145°51.1	00.4	64°37.1	42.3	130°46.0	21.0	57°27.0	19.0	Altair	62°05.8	8°55.0					
Mer.pass.:02:40			v-0.4 d-1.2 m-3.8	v1.3 d-0.2 m-0.6			v2.0 d-0.2 m-1.6			Peacock			Deneb				
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			Enif	33°44.7	9°57.3	
0	320°52.5	160°50.7	N09°59.2	79°38.4	S23°42.5	145°48.0	N03°20.8	72°29.5	S20°19.0	Al Na'ir	27°40.7	-46°52.6					
1	335°55.0	175°50.3	58.0	94°39.6	42.7	160°50.0	20.6	87°32.0	19.0	Fomalhaut	15°21.3	-29°31.9					
2	350°57.4	190°49.9	56.9	109°40.9	42.9	175°52.0	20.4	102°34.4	19.0	Scheat	13°50.9	28°10.4					
3	5°59.9	205°49.5	..	55.7	124°42.2	..	43.1	190°54.0	..	Markab	13°35.9	15°17.8					
4	21°02.4	220°49.0	54.5	139°43.4	43.3	205°56.0	20.0	132°39.4	19.1	Aug 10 Wed							
5	36°04.8	235°48.6	53.4	154°44.7	43.5	220°58.1	19.8	147°41.9	19.1	Venus	202°17.0	13:16					
6	51°07.3	250°48.2	N09°52.2	169°46.0	S23°43.7	236°00.1	N03°19.6	162°44.3	S20°19.1	Mars	119°42.4	18:44					
7	66°09.7	265°47.8	51.0	184°47.2	43.9	251°02.1	19.5	177°46.8	19.1	Jupiter	185°16.8	14:21					
8	81°12.2	280°47.4	49.8	199°48.5	44.1	266°04.1	19.3	192°49.3	19.1	Saturn	111°36.4	19:15					
9	96°14.7	295°47.0	..	48.7	214°49.7	..	44.3	281°06.1	..	Aug 11 Thu							
10	111°17.1	310°46.5	47.5	229°51.0	44.5	296°08.1	18.9	222°54.2	19.1	Venus	201°07.5	13:16					
11	126°19.6	325°46.1	46.3	244°52.3	44.7	311°10.2	18.7	237°56.7	19.1	Mars	119°14.4	18:42					
12	141°22.1	340°45.7	N09°45.1	259°53.5	S23°44.9	326°12.2	N03°18.5	252°59.2	S20°19.1	Jupiter	185°06.2	14:18					
13	156°24.5	355°45.3	44.0	274°54.8	45.1	341°14.2	18.3	268°01.6	19.1	Saturn	111°36.8	19:11					
14	171°27.0	10°44.9	42.8	289°56.0	45.4	356°16.2	18.1	283°04.1	19.1	Aug 12 Fri							
15	186°29.5	25°44.5	..	41.6	304°57.3	..	45.6	11°18.2	..	Venus	199°58.2	13:17					
16	201°31.9	40°44.1	40.4	319°58.5	45.8	26°20.2	17.7	313°09.0	19.2	Mars	118°45.9	18:40					
17	216°34.4	55°43.7	39.3	334°59.8	46.0	41°22.3	17.5	328°11.5	19.2	Jupiter	184°55.5	14:15					
18	231°36.9	70°43.2	N09°38.1	350°01.0	S23°46.2	56°24.3	N03°17.3	343°14.0	S20°19.2	Saturn	111°37.0	19:07					
19	246°39.3	85°42.8	36.9	5°02.3	46.4	71°26.3	17.1	358°16.4	19.2	Horizontal parallax							
20	261°41.8	100°42.4	35.7	20°03.5	46.6	86°28.3	16.9	13°18.9	19.2	Venus:	0.1						
21	276°44.2	115°42.0	..	34.6	35°04.8	..	46.8	101°30.3	..	Mars:	0.2						
22	291°46.7	130°41.6	33.4	50°06.0	47.0	116°32.3	16.5	43°23.8	19.2								
23	306°49.2	145°41.2	32.2	65°07.3	47.2	131°34.4	16.3	58°26.3	19.2								

DUT1 = UT1-UTC = -0.2315 sec ΔT = TT-UT1 = +68.4155 sec

2016 August 10 to Aug. 12 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	178°39.7	N15°29.7	100°25.7	14.4'	\$10°29.2	-7.8'	54.2'	
1	193°39.8	28.9	114°59.2	14.4'	10°36.9	-7.8'	54.2'	
2	208°39.9	28.2	129°32.6	14.4'	10°44.7	-7.7'	54.2'	
3	223°40.0	.. 27.5	144°05.9	14.4'	10°52.4	-7.7'	54.2'	
4	238°40.1	26.7	158°39.3	14.3'	11°00.0	-7.6'	54.2'	
5	253°40.2	26.0	173°12.6	14.3'	11°07.6	-7.6'	54.2'	
6	268°40.3	N15°25.3	187°45.9	14.3'	\$11°15.2	-7.5'	54.2'	
7	283°40.3	24.5	202°19.2	14.3'	11°22.7	-7.5'	54.2'	
8	298°40.4	23.8	216°52.4	14.2'	11°30.2	-7.4'	54.2'	
9	313°40.5	.. 23.0	231°25.6	14.2'	11°37.6	-7.4'	54.2'	
10	328°40.6	22.3	245°58.8	14.2'	11°45.0	-7.3'	54.2'	
11	343°40.7	21.6	260°32.0	14.1'	11°52.3	-7.3'	54.2'	
12	358°40.8	N15°20.8	275°05.1	14.1'	\$11°59.6	-7.2'	54.2'	
13	13°40.9	20.1	289°38.2	14.1'	12°06.8	-7.2'	54.3'	
14	28°41.0	19.4	304°11.3	14.1'	12°13.9	-7.1'	54.3'	
15	43°41.1	.. 18.6	318°44.3	14.0'	12°21.1	-7.1'	54.3'	
16	58°41.2	17.9	333°17.3	14.0'	12°28.1	-7.0'	54.3'	
17	73°41.3	17.1	347°50.3	14.0'	12°35.1	-7.0'	54.3'	
18	88°41.4	N15°16.4	2°23.2	13.9'	\$12°42.1	-6.9'	54.3'	
19	103°41.5	15.7	16°56.1	13.9'	12°49.0	-6.9'	54.3'	
20	118°41.6	14.9	31°29.0	13.9'	12°55.9	-6.8'	54.3'	
21	133°41.7	.. 14.2	46°01.8	13.8'	13°02.7	-6.8'	54.3'	
22	148°41.8	13.4	60°34.6	13.8'	13°09.4	-6.7'	54.3'	
23	163°41.9	12.7	75°07.4	13.8'	13°16.1	-6.7'	54.3'	
	SD.=15.8	d=-0.7			S.D.=14.8			

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	178°42.0	N15°11.9	89°40.2	13.7'	\$13°22.8	-6.6'	54.3'
1	193°42.1	11.2	104°12.9	13.7'	13°29.3	-6.6'	54.3'
2	208°42.2	10.5	118°45.5	13.6'	13°35.9	-6.5'	54.3'
3	223°42.3	.. 09.7	133°18.2	13.6'	13°42.3	-6.4'	54.3'
4	238°42.4	09.0	147°50.7	13.6'	13°48.7	-6.4'	54.3'
5	253°42.5	08.2	162°23.3	13.5'	13°55.1	-6.3'	54.4'
6	268°42.6	N15°07.5	176°55.8	13.5'	\$14°01.4	-6.3'	54.4'
7	283°42.7	06.7	191°28.3	13.5'	14°07.6	-6.2'	54.4'
8	298°42.8	06.0	206°00.7	13.4'	14°13.8	-6.1'	54.4'
9	313°42.9	.. 05.2	220°33.2	13.4'	14°19.9	-6.1'	54.4'
10	328°43.0	04.5	235°05.5	13.3'	14°25.9	-6.0'	54.4'
11	343°43.2	03.7	249°37.8	13.3'	14°31.9	-6.0'	54.4'
12	358°43.3	N15°03.0	264°10.1	13.3'	\$14°37.9	-5.9'	54.4'
13	13°43.4	02.2	278°42.4	13.2'	14°43.7	-5.8'	54.4'
14	28°43.5	01.5	293°14.6	13.2'	14°49.5	-5.8'	54.4'
15	43°43.6	.. 00.7	307°46.8	13.1'	14°55.3	-5.7'	54.5'
16	58°43.7	15°00.0	322°18.9	13.1'	15°01.0	-5.6'	54.5'
17	73°43.8	14°59.2	336°51.0	13.1'	15°06.6	-5.6'	54.5'
18	88°43.9	N14°58.5	351°23.0	13.0'	\$15°12.1	-5.5'	54.5'
19	103°44.0	57.7	5°55.0	13.0'	15°17.6	-5.4'	54.5'
20	118°44.1	57.0	20°27.0	12.9'	15°23.0	-5.4'	54.5'
21	133°44.2	.. 56.2	34°58.9	12.9'	15°28.4	-5.3'	54.5'
22	148°44.3	55.5	49°30.8	12.9'	15°33.6	-5.2'	54.5'
23	163°44.4	54.7	64°02.6	12.8'	15°38.9	-5.2'	54.6'
	SD.=15.8	d=-0.7			S.D.=14.8		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	178°44.5	N14°54.0	78°34.4	12.8'	\$15°44.0	-5.1'	54.6'
1	193°44.6	53.2	93°06.2	12.7'	15°49.1	-5.0'	54.6'
2	208°44.7	52.5	107°37.9	12.7'	15°54.1	-5.0'	54.6'
3	223°44.8	.. 51.7	122°09.5	12.6'	15°59.0	-4.9'	54.6'
4	238°45.0	51.0	136°41.2	12.6'	16°03.9	-4.8'	54.6'
5	253°45.1	50.2	151°12.7	12.6'	16°08.7	-4.8'	54.6'
6	268°45.2	N14°49.5	165°44.3	12.5'	\$16°13.4	-4.7'	54.7'
7	283°45.3	48.7	180°15.8	12.5'	16°18.1	-4.6'	54.7'
8	298°45.4	47.9	194°47.2	12.4'	16°22.7	-4.5'	54.7'
9	313°45.5	.. 47.2	209°18.6	12.4'	16°27.2	-4.5'	54.7'
10	328°45.6	46.4	223°50.0	12.3'	16°31.6	-4.4'	54.7'
11	343°45.7	45.7	238°21.3	12.3'	16°36.0	-4.3'	54.7'
12	358°45.8	N14°44.9	252°52.6	12.2'	\$16°40.3	-4.3'	54.8'
13	13°45.9	44.2	267°23.8	12.2'	16°44.5	-4.2'	54.8'
14	28°46.0	43.4	281°55.0	12.2'	16°48.6	-4.1'	54.8'
15	43°46.2	.. 42.6	296°26.1	12.1'	16°52.7	-4.0'	54.8'
16	58°46.3	41.9	310°57.2	12.1'	16°56.7	-3.9'	54.8'
17	73°46.4	41.1	325°28.2	12.0'	17°00.6	-3.9'	54.9'
18	88°46.5	N14°40.4	339°59.2	12.0'	\$17°04.4	-3.8'	54.9'
19	103°46.6	39.6	354°30.2	11.9'	17°08.1	-3.7'	54.9'
20	118°46.7	38.8	9°01.1	11.9'	17°11.8	-3.6'	54.9'
21	133°46.8	.. 38.1	23°31.9	11.8'	17°15.4	-3.6'	54.9'
22	148°46.9	37.3	38°02.8	11.8'	17°18.9	-3.5'	54.9'
23	163°47.0	36.6	52°33.5	11.8'	17°22.4	-3.4'	55.0'
	SD.=15.8	d=-0.8			S.D.=14.9		

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	00 <sup>h</sup> 00 <sup>m</sup> 00 <sup>s</sup>	12 <sup>h</sup>	Mer. Pass.	Age
	mm:ss	mm:ss	mm:ss	hh:mm	hh:mm
10	05:21	05:17	12:05	17:50	05:28
11	05:12	05:07	12:05	18:36	06:13
12	05:02	04:57	12:05	19:23	06:59



**August 13, 14, 15 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec			
0	321°51.6	160°40.8	N09°31.0	80°08.5	S23°47.4	146°36.4	N03°16.1	73°28.8	S20°19.2	Alpheratz	357°41.0	29°10.9						
1	336°54.1	175°40.4	29.9	95°09.8	47.6	161°38.4	15.9	88°31.2	19.2	Ankaa	353°13.4	-42°12.8						
2	351°56.6	190°40.0	28.7	110°11.0	47.8	176°40.4	15.7	103°33.7	19.3	Schedar	349°37.6	56°37.5						
3	6°59.0	205°39.6	.. 27.5	125°12.3	.. 48.0	191°42.4	.. 15.5	118°36.2	.. 19.3	Diphda	348°53.5	-17°53.6						
4	22°01.5	220°39.2	26.3	140°13.5	48.2	206°44.4	15.3	133°38.6	19.3	Achernar	335°25.0	-57°09.0						
5	37°04.0	235°38.7	25.1	155°14.8	48.4	221°46.4	15.1	148°41.1	19.3	Hamal	327°58.2	23°32.3						
6	52°06.4	250°38.3	N09°23.9	170°16.0	S23°48.6	236°48.5	N03°14.9	163°43.6	S20°19.3	Polaris	316°42.9	89°19.6						
7	67°08.9	265°37.9	22.8	185°17.3	48.8	251°50.5	14.7	178°46.0	19.3	Acamar	315°16.7	-40°14.2						
8	82°11.4	280°37.5	21.6	200°18.5	49.0	266°52.5	14.5	193°48.5	19.3	Menkar	314°12.8	4°09.2						
9	97°13.8	295°37.1	.. 20.4	215°19.7	.. 49.2	281°54.5	.. 14.3	208°51.0	.. 19.3	Mirfak	308°37.2	49°54.8						
10	112°16.3	310°36.7	19.2	230°21.0	49.4	296°56.5	14.1	223°53.4	19.3	Aldebaran	290°47.0	16°32.4						
11	127°18.7	325°36.3	18.0	245°22.2	49.6	311°58.5	13.9	238°55.9	19.3	Rigel	281°10.2	-8°11.0						
12	142°21.2	340°35.9	N09°16.9	260°23.4	S23°49.9	327°00.5	N03°13.7	253°58.4	S20°19.3	Capella	280°31.5	46°00.5						
13	157°23.7	355°35.5	15.7	275°24.7	50.1	342°02.6	13.5	269°00.8	19.3	Bellatrix	278°29.9	6°21.7						
14	172°26.1	10°35.1	14.5	290°25.9	50.3	357°04.6	13.4	284°03.3	19.4	El Nath	278°10.1	28°37.0						
15	187°28.6	25°34.7	.. 13.3	305°27.2	.. 50.5	12°06.6	.. 13.2	299°05.8	.. 19.4	Alnilam	275°44.4	-1°11.6						
16	202°31.1	40°34.3	12.1	320°28.4	50.7	27°08.6	13.0	314°08.2	19.4	Betelgeuse	270°59.2	7°24.5						
17	217°33.5	55°33.9	10.9	335°29.6	50.9	42°10.6	12.8	329°10.7	19.4	Canopus	263°55.6	-52°42.2						
18	232°36.0	70°33.5	N09°09.7	350°30.9	S23°51.1	57°12.6	N03°12.6	344°13.6	S20°19.4	Sirius	258°32.1	-16°44.4						
19	247°38.5	85°33.1	08.6	5°32.1	51.3	72°14.6	12.4	359°15.6	19.4	Adhara	255°11.1	-28°59.7						
20	262°40.9	100°32.7	07.4	20°33.3	51.5	87°16.7	12.2	14°18.1	19.4	Procyon	244°57.8	5°10.8						
21	277°43.4	115°32.3	.. 06.2	35°34.6	.. 51.7	102°18.7	.. 12.0	29°20.5	.. 19.4	Pollux	243°25.5	27°59.0						
22	292°45.9	130°31.9	05.0	50°35.8	51.9	117°20.7	11.8	44°23.0	19.4	Avior	234°17.7	-59°33.8						
23	307°48.3	145°31.5	03.8	65°37.0	52.1	132°22.7	11.6	59°25.5	19.4	Suhail	222°51.3	-43°30.0						
Mer.pass.:02:32			v-0.4 d-1.2 m-3.8			v1.2 d-0.2 m-0.6			v2.0 d-0.2 m-1.6			v2.5 d-0.0 m-0.4			Miaplacidus			
Sun			GHA			GHA			GHA			GHA			GHA			
0	322°50.8	160°31.1	N09°02.6	80°38.2	S23°52.3	147°24.7	N03°11.4	74°27.9	S20°19.5	Denebola	182°31.8	14°28.9						
1	337°53.2	175°30.7	01.4	95°39.5	52.5	162°26.7	11.2	89°30.4	19.5	Gienah	175°50.3	-17°38.0						
2	352°55.7	190°30.3	09°00.2	110°40.7	52.7	177°28.7	11.0	104°32.9	19.5	Acrux	173°07.2	-63°11.6						
3	7°58.2	205°29.9	08°59.0	125°41.9	.. 52.9	192°30.8	.. 10.8	119°35.3	.. 19.5	Gacrux	171°58.8	-57°12.5						
4	23°00.6	220°29.5	57.9	140°43.1	53.1	207°32.8	10.6	134°37.8	19.5	Alioth	166°19.3	55°52.5						
5	38°03.1	235°29.1	56.7	155°44.4	53.3	222°34.8	10.4	149°40.2	19.5	Spica	158°29.1	-11°14.7						
6	53°05.6	250°28.7	N08°55.5	170°45.6	S23°53.5	237°36.8	N03°10.2	164°42.7	S20°19.5	Alkaid	152°57.5	49°14.2						
7	68°08.0	265°28.3	54.3	185°46.8	53.7	252°38.8	10.0	179°45.2	19.5	Hadar	148°44.9	-60°27.3						
8	83°10.5	280°27.9	53.1	200°48.0	53.9	267°40.8	09.8	194°47.6	19.5	Menkent	148°05.1	-36°27.1						
9	98°13.0	295°27.5	.. 51.9	215°49.3	.. 54.1	282°42.8	.. 09.6	209°50.1	.. 19.5	Arcturus	145°53.9	19°06.1						
10	113°15.4	310°27.1	50.7	230°50.5	54.3	297°44.8	09.4	224°52.6	19.5	Rigel Kent.	139°48.8	-60°54.3						
11	128°17.9	325°26.7	49.5	245°51.7	54.5	312°46.9	09.2	239°55.0	19.6	Kochab	137°20.4	74°05.7						
12	143°20.3	340°26.3	N08°48.3	260°52.9	S23°54.7	327°48.9	N03°09.0	254°57.5	S20°19.6	Zuben ubi	137°03.1	-16°06.5						
13	158°22.8	355°25.9	47.1	275°54.1	54.9	342°50.9	08.8	269°59.9	19.6	Alphecca	126°09.2	26°39.9						
14	173°25.3	10°25.5	45.9	290°55.4	55.1	357°52.9	08.6	285°02.4	19.6	Antares	112°23.5	-26°27.9						
15	188°27.7	25°25.1	.. 44.7	305°56.6	.. 55.3	12°54.9	.. 08.4	300°04.9	.. 19.6	Atria	107°23.1	-69°03.4						
16	203°30.2	40°24.7	43.5	320°57.8	55.5	27°56.9	08.2	315°07.3	19.6	Sabik	102°09.9	-15°44.5						
17	218°32.7	55°24.3	42.3	335°59.0	55.8	42°58.9	08.0	330°09.8	19.6	Rasalhague	96°04.3	12°33.3						
18	233°35.1	70°23.9	N08°41.1	351°00.2	S23°56.0	58°00.9	N03°07.8	345°12.2	S20°19.6	Eltanin	90°44.8	51°29.7						
19	248°37.6	85°23.5	39.9	6°01.4	56.2	73°03.0	07.6	0°14.7	19.6	Kaus Aust.	83°40.7	-34°22.4						
20	263°40.1	100°23.1	38.7	21°02.6	56.4	88°05.0	07.4	15°17.2	19.6	Vega	80°37.2	38°48.4						
21	278°42.5	115°22.7	.. 37.6	36°03.9	.. 56.6	103°07.0	.. 07.2	30°19.6	.. 19.7	Nunki	75°55.4	-26°16.3						
22	293°45.0	130°23.3	36.4	51°05.1	56.8	118°09.0	07.0	45°22.1	19.7	Altair	62°05.8	8°55.0						
23	308°47.5	145°22.0	35.2	66°06.3	57.0	133°11.0	06.8	60°24.5	19.7	Peacock	53°15.4	-56°40.7						
Mer.pass.:02:28			v-0.4 d-1.2 m-3.8			v1.2 d-0.2 m-0.6			v2.0 d-0.2 m-1.6			v2.5 d-0.0 m-0.4			Deneb			
Mon			GHA			GHA			GHA			GHA			GHA			
0	323°49.9	160°21.6	N08°34.0	81°07.5	S23°57.2	148°13.0	N03°06.6	75°27.0	S20°19.7	Aug 13 Sat	SHA	Mer.pass						
1	338°52.4	175°21.2	32.8	96°08.7	57.4	163°15.0	06.4	90°29.5	19.7	Venus	198°49.1	13:18						
2	353°54.8	190°20.8	31.6	111°09.9	57.6	178°17.0	06.2	105°31.9	19.7	Mars	118°16.9	18:38						
3	8°57.3	205°20.4	.. 30.4	126°11.1	.. 57.8	193°19.0	.. 06.0	120°34.4	.. 19.7	Jupiter	184°44.7	14:12						
4	23°59.8	220°20.0	29.2	141°12.3	58.0	208°21.1	05.8	135°36.8	19.7	Saturn	111°37.1	19:03						
5	39°02.2	235°19.6	28.0	156°13.5	58.2	223°23.1	05.6	150°39.3	19.7	Aug 14 Sun	SHA	Mer.pass						
6	54°04.7	250°19.2	N08°26.8	171°14.7	S23°58.4	238°25.1	N03°05.4	165°41.7	S20°19.7	Venus	197°40.3	13:18						
7	69°07.2	265°18.8	25.6	186°15.9	58.6	253°27.1	05.2	180°44.2	19.8	Mars	117°47.5	18:36						
8	84°09.6	280°18.4	24.4	201°17.1	58.8	268°29.1	05.0	195°46.7	19.8	Jupiter	184°33.9	14:08						
9	99°12.1	295°18.0	.. 23.2	216°18.3	.. 59.0	283°31.1	.. 04.8	210°49.1	.. 19.8	Saturn	111°37.2	18:59						
10	114°14.6	310°17.7	22.0	231°19.5	59.2	298°33.1	04.6	225°51.6	19.8	Aug 15 Mon	SHA	Mer.pass						
11	129°17.0	325°17.3	20.7	246°20.7	59.4	313°35.1	04.4	240°54.0	19.8	Venus	196°31.6							

DUT1 = UT1-UTC = -0.2336 sec ΔT = TT-UT1 = +68.4176 sec

2016 August 13 to Aug. 15 UT

h		Sun		Moon				
Sat		GHA	Dec	GHA	ν	Dec	d	HP
0	178°47.2	N14°35.8	67°04.3	11.7'	\$17°25.7	-3.3'	55.0'	
1	193°47.3	35.0	81°35.0	11.7'	17°29.0	-3.2'	55.0'	
2	208°47.4	34.3	96°05.6	11.6'	17°32.2	-3.2'	55.0'	
3	223°47.5	.. 33.5	110°36.2	11.6'	17°35.3	-3.1'	55.1'	
4	238°47.6	32.7	125°06.7	11.5'	17°38.3	-3.0'	55.1'	
5	253°47.7	32.0	139°37.2	11.5'	17°41.3	-2.9'	55.1'	
6	268°47.8	N14°31.2	154°07.7	11.4'	\$17°44.1	-2.8'	55.1'	
7	283°48.0	30.4	168°38.1	11.4'	17°46.9	-2.7'	55.1'	
8	298°48.1	29.7	183°08.5	11.3'	17°49.6	-2.7'	55.2'	
9	313°48.2	.. 28.9	197°38.8	11.3'	17°52.2	-2.6'	55.2'	
10	328°48.3	28.1	212°09.1	11.3'	17°54.7	-2.5'	55.2'	
11	343°48.4	27.4	226°39.3	11.2'	17°57.2	-2.4'	55.2'	
12	358°48.5	N14°26.6	241°09.5	11.2'	\$17°59.5	-2.3'	55.3'	
13	13°48.7	25.8	255°39.7	11.1'	18°01.8	-2.2'	55.3'	
14	28°48.8	25.1	270°09.8	11.1'	18°04.0	-2.1'	55.3'	
15	43°48.9	.. 24.3	284°39.9	11.0'	18°06.0	-2.0'	55.3'	
16	58°49.0	23.5	299°09.9	11.0'	18°08.0	-2.0'	55.3'	
17	73°49.1	22.8	313°39.9	11.0'	18°10.0	-1.9'	55.4'	
18	88°49.2	N14°22.0	328°09.8	10.9'	\$18°11.8	-1.8'	55.4'	
19	103°49.4	21.2	342°39.7	10.9'	18°13.5	-1.7'	55.4'	
20	118°49.5	20.4	357°09.5	10.8'	18°15.1	-1.6'	55.4'	
21	133°49.6	.. 19.7	11°39.4	10.8'	18°16.7	-1.5'	55.5'	
22	148°49.7	18.9	26°09.1	10.7'	18°18.2	-1.4'	55.5'	
23	163°49.8	18.1	40°38.9	10.7'	18°19.5	-1.3'	55.5'	
	SD.=15.8	d=-0.8			S.D.=15.1			

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
13	04:51	04:46	12:05	20:12 07:47
14	04:40	04:34	12:05	21:03 08:37
15	04:29	04:23	12:04	21:55 09:28

SD.=15.8	d=-0.8	S.D.=15.4
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**August 16, 17, 18 UT (Tue., Wed., Thu.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	324°49.1	160°12.2	N08°05.1	81°36.3	S24°02.0	149°01.3	N03°01.8	76°26.0	S20°19.9					Alpheratz	357°40.9	29°10.9	
1	339°51.5	175°11.9	03.9	96°37.5	02.2	164°03.3	01.6	91°28.4	19.9					Ankaa	353°13.3	-42°12.8	
2	354°54.0	190°11.5	02.7	111°38.7	02.4	179°05.3	01.4	106°30.9	20.0					Schedar	349°37.5	56°37.5	
3	9°56.5	205°11.1	.. 01.5	126°39.9	.. 02.6	194°07.3	.. 01.2	121°33.3	.. 20.0					Diphda	348°53.5	-17°53.6	
4	24°58.9	220°10.7	08°00.2	141°41.1	02.8	209°09.3	01.0	136°35.8	20.0					Achernar	335°25.0	-57°09.0	
5	40°01.4	235°10.3	07°59.0	156°42.2	03.0	224°11.3	00.8	151°38.2	20.0					Hamal	327°58.2	23°32.3	
6	55°03.8	250°09.9	N07°57.8	171°43.4	S24°03.2	239°13.3	N03°00.6	166°40.7	S20°20.0					Polaris	316°41.4	89°19.6	
7	70°06.3	265°09.6	56.6	186°44.6	03.4	254°15.3	00.4	181°43.1	20.0					Acamar	315°16.7	-40°14.2	
8	85°08.8	280°09.2	55.4	201°45.8	03.6	269°17.3	00.2	196°45.6	20.0					Menkar	314°12.8	4°09.2	
9	100°11.2	295°08.8	.. 54.2	216°47.0	.. 03.8	284°19.3	03°00.0	211°48.0	.. 20.0					Mirfak	308°37.2	49°54.8	
10	115°13.7	310°08.4	53.0	231°48.2	04.0	299°21.3	02°59.9	226°50.5	20.0					Aldebaran	290°47.0	16°32.4	
11	130°16.2	325°08.0	51.8	246°49.3	04.2	314°23.4	59.7	241°52.9	20.1					Rigel	281°10.1	-8°11.0	
12	145°18.6	340°07.7	N07°50.6	261°50.5	S24°04.4	329°25.4	N02°59.5	256°55.4	S20°20.1					Capella	280°31.5	46°00.5	
13	160°21.1	355°07.3	49.3	276°51.7	04.6	344°27.4	59.3	271°57.9	20.1					Bellatrix	278°29.9	6°21.7	
14	175°23.6	10°06.9	48.1	291°52.9	04.8	359°29.4	59.1	287°00.3	20.1					El Nath	278°10.1	28°37.0	
15	190°26.0	25°06.5	.. 46.9	306°54.1	.. 05.0	14°31.4	.. 58.9	302°02.8	.. 20.1					Alnilam	275°44.4	-1°11.6	
16	205°28.5	40°06.1	45.7	321°55.3	05.2	29°33.4	58.7	317°05.2	20.1					Betelgeuse	270°59.2	7°24.5	
17	220°30.9	55°05.8	44.5	336°56.4	05.4	44°35.4	58.5	332°07.7	20.1					Canopus	263°55.5	-52°42.2	
18	235°33.4	70°05.4	N07°43.3	351°57.6	S24°05.6	59°37.4	N02°58.3	347°10.1	S20°20.1					Sirius	258°32.1	-16°44.4	
19	250°35.9	85°05.0	42.1	6°58.8	05.8	74°39.4	58.1	2°12.6	20.1					Adhara	255°11.1	-28°59.7	
20	265°38.3	100°04.6	40.8	22°00.0	06.0	89°41.4	57.9	17°15.0	20.2					Procyon	244°57.8	5°10.8	
21	280°40.8	115°04.2	.. 39.6	37°01.1	.. 06.2	104°43.4	.. 57.7	32°17.5	.. 20.2					Pollux	243°25.5	27°59.0	
22	295°43.3	130°03.9	38.4	52°02.3	06.4	119°45.4	57.5	47°19.9	20.2					Avior	234°17.7	-59°33.8	
23	310°45.7	145°03.5	37.2	67°03.5	06.6	134°47.5	57.3	62°22.4	20.2					Suhail	222°51.2	-43°30.0	
Mer.pass.:02:20			v-0.4 d-1.2 m-3.8			v1.2 d-0.2 m-0.5			v2.0 d-0.2 m-1.6			v2.5 d-0.0 m-0.4					
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	325°48.2	160°03.1	N07°36.0	82°04.7	S24°06.8	149°49.5	N02°57.1	77°24.8	S20°20.2					Denebola	182°31.8	14°28.9	
1	340°50.7	175°02.7	34.8	97°05.8	07.0	164°51.5	56.9	92°27.3	20.2					Gienah	175°50.3	-17°38.0	
2	355°53.1	190°02.4	33.5	112°07.0	07.2	179°53.5	56.7	107°29.7	20.2					Acrux	173°07.3	-63°11.6	
3	10°55.6	205°02.0	.. 32.3	127°08.2	.. 07.4	194°55.5	.. 56.5	122°32.2	.. 20.2					Gacrux	171°58.8	-57°12.4	
4	25°58.1	220°01.6	31.1	142°09.3	07.6	209°57.5	56.3	137°34.6	20.2					Alioth	166°19.3	55°52.5	
5	41°00.5	235°01.2	29.9	157°10.5	07.8	224°59.5	56.0	152°37.1	20.3					Spica	158°29.1	-11°14.7	
6	56°03.0	250°00.9	N07°28.7	172°11.7	S24°08.0	240°01.5	N02°55.8	167°39.5	S20°20.3					Alkaid	152°57.5	49°14.2	
7	71°05.4	265°00.5	27.5	187°12.8	08.2	255°03.5	55.6	182°42.0	20.3					Hadar	148°44.9	-60°27.2	
8	86°07.9	280°00.1	26.2	202°14.0	08.4	270°05.5	55.4	197°44.4	20.3					Menkent	148°05.1	-36°27.0	
9	101°10.4	294°59.7	.. 25.0	217°15.2	.. 08.6	285°07.5	.. 55.2	212°46.9	.. 20.3					Arcturus	145°53.9	19°06.1	
10	116°12.8	309°59.4	23.8	232°16.3	08.8	300°09.5	55.0	227°49.3	20.3					Rigel Kent.	139°48.8	-60°54.3	
11	131°15.3	324°59.0	22.6	247°17.5	09.0	315°11.5	54.8	242°51.8	20.3					Kochab	137°20.5	74°05.7	
12	146°17.8	339°58.6	N07°21.4	262°18.7	S24°09.2	330°13.5	N02°54.6	257°54.2	S20°20.3					Zuben' ubi	137°03.1	-16°06.5	
13	161°20.2	354°58.2	20.1	277°19.8	09.4	345°15.6	54.4	272°56.7	20.3					Alphecca	126°09.2	26°39.9	
14	176°22.7	9°57.9	18.9	292°21.0	09.6	0°17.6	54.2	287°59.1	20.4					Antares	112°23.5	-26°27.9	
15	191°25.2	24°57.5	.. 17.7	307°22.2	.. 09.8	15°19.6	.. 54.0	303°01.6	.. 20.4					Atria	107°23.1	-69°03.4	
16	206°27.6	39°57.1	16.5	322°23.3	10.0	30°21.6	53.8	318°04.0	20.4					Sabik	102°09.9	-15°44.5	
17	221°30.1	54°56.7	15.3	337°24.5	10.2	45°23.6	53.6	333°06.4	20.4					Shaula	96°18.8	-37°06.8	
18	236°32.6	69°56.4	N07°14.0	352°25.6	S24°10.4	60°25.6	N02°53.4	348°08.9	S20°20.4					Rasalhague	96°04.3	12°33.3	
19	251°35.0	84°56.0	12.8	7°26.8	10.6	75°27.6	53.2	3°11.3	20.4					Eltanin	90°44.8	51°29.7	
20	266°37.5	99°55.6	11.6	22°28.0	10.8	90°29.6	53.0	18°13.8	20.4					Kaus Aust.	83°40.7	-34°22.4	
21	281°39.9	114°55.3	.. 10.4	37°29.1	.. 11.0	105°31.6	.. 52.8	33°16.2	.. 20.4					Vega	80°37.2	38°48.4	
22	296°42.4	129°54.9	09.1	52°30.3	11.2	120°33.6	52.6	48°18.7	20.5					Nunki	75°55.4	-26°16.3	
23	311°44.9	144°54.5	07.9	67°31.4	11.4	135°35.6	52.4	63°21.1	20.5					Altair	62°05.8	8°55.0	
Mer.pass.:02:16			v-0.4 d-1.2 m-3.8			v1.2 d-0.2 m-0.5			v2.0 d-0.2 m-1.6			v2.5 d-0.0 m-0.4					
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	326°47.3	159°54.1	N07°06.7	82°32.6	S24°11.6	150°37.6	N02°52.2	78°23.6	S20°20.5					Peacock	53°15.4	-56°40.7	
1	341°49.8	174°53.8	05.5	97°33.7	11.8	165°39.6	52.0	93°26.0	20.5					Deneb	49°29.5	45°20.6	
2	356°52.3	189°53.4	04.2	112°34.9	12.0	180°41.6	51.8	108°28.5	20.5					Enif	33°44.7	9°57.3	
3	11°54.7	204°53.0	.. 03.0	127°36.1	.. 12.2	195°43.6	.. 51.6	123°30.9	.. 20.5					AI Na'ir	27°40.6	-46°52.6	
4	26°57.2	219°52.7	01.8	142°37.2	12.3	210°45.6	51.4	138°33.4	20.5					Fomalhaut	15°21.3	-29°31.9	
5	41°59.7	234°52.3	07°00.6	157°38.4	12.5	225°47.6	51.2	153°35.8	20.5					Scheat	13°50.9	28°10.4	
6	57°02.1	249°51.9	N06°59.3	172°39.5	S24°12.7	240°49.7	N02°51.0	168°38.2	S20°20.5					Markab	13°35.9	15°17.8	
7	72°04.6	264°51.6	58.1	187°40.7	12.9	255°51.7	50.8	183°40.7	20.6					Aug 16 Tue	SHA	Mer.pass	
8	87°07.0	279°51.2	56.9	202°41.8	13.1	270°53.7	50.6	198°43.1	20.6					Venus	195°23.2	13:20	
9	102°09.5	294°50.8	.. 55.7	217°43.0	.. 13.3	285°55.7	.. 50.4	213°45.6	.. 20.6					Mars	116°47.2	18:32	
10	117°12.0	309°50.5	54.4	232°44.1	13.5	300°57.7	50.2	228°48.0	20.6					Jupiter	184°12.2	14:02	
11	132°14.4	324°50.1	53.2	247°45.3	13.7	315°59.7	50.0	243°50.5	20.6					Saturn	111°36.9	18:51	
12	147°16.9	339°49.7	N06°52.0	262°46.4	S24°13.9	331°01.7	N02°49.8	258°5									

DUT1 = UT1-UTC = -0.2356 sec ΔT = TT-UT1 = +68.4196 sec

2016 August 16 to Aug. 18 UT

h		Sun			Moon			
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	178°55.9	N13°39.8	30°13.2	9.2'	S17°28.0	3.5'	56.9'	
1	193°56.0	39.0	44°41.4	9.2'	17°24.4	3.6'	57.0'	
2	208°56.2	38.3	59°09.6	9.2'	17°20.7	3.7'	57.0'	
3	223°56.3	.. 37.5	73°37.8	9.2'	17°17.0	3.8'	57.0'	
4	238°56.4	36.7	88°05.9	9.2'	17°13.1	3.9'	57.1'	
5	253°56.6	35.9	102°34.1	9.1'	17°09.1	4.0'	57.1'	
6	268°56.7	N13°35.1	117°02.2	9.1'	S17°05.1	4.1'	57.1'	
7	283°56.8	34.3	131°30.3	9.1'	17°00.9	4.2'	57.2'	
8	298°57.0	33.5	145°58.4	9.1'	16°56.6	4.3'	57.2'	
9	313°57.1	.. 32.7	160°26.5	9.1'	16°52.3	4.4'	57.2'	
10	328°57.2	31.9	174°54.6	9.1'	16°47.8	4.5'	57.2'	
11	343°57.4	31.1	189°22.7	9.1'	16°43.2	4.6'	57.3'	
12	358°57.5	N13°30.3	203°50.7	9.1'	S16°38.6	4.7'	57.3'	
13	13°57.6	29.5	218°18.8	9.0'	16°33.8	4.8'	57.3'	
14	28°57.8	28.7	232°46.8	9.0'	16°28.9	4.9'	57.4'	
15	43°57.9	.. 27.9	247°14.8	9.0'	16°23.9	5.0'	57.4'	
16	58°58.0	27.1	261°42.9	9.0'	16°18.9	5.1'	57.4'	
17	73°58.2	26.3	276°10.9	9.0'	16°13.7	5.2'	57.5'	
18	88°58.3	N13°25.5	290°38.9	9.0'	S16°08.4	5.3'	57.5'	
19	103°58.4	24.7	305°06.9	9.0'	16°03.1	5.4'	57.5'	
20	118°58.6	23.9	319°34.8	9.0'	15°57.6	5.5'	57.6'	
21	133°58.7	.. 23.1	334°02.8	9.0'	15°52.1	5.6'	57.6'	
22	148°58.8	22.3	348°30.8	9.0'	15°46.4	5.7'	57.6'	
23	163°59.0	21.5	2°58.8	9.0'	15°40.7	5.8'	57.6'	
	SD.=15.8	d=-0.8			S.D.=15.6			
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	178°59.1	N13°20.7	17°26.7	9.0'	S15°34.8	5.9'	57.7'	
1	193°59.2	19.9	31°54.7	9.0'	15°28.9	6.0'	57.7'	
2	208°59.4	19.1	46°22.7	9.0'	15°22.8	6.1'	57.7'	
3	223°59.5	.. 18.3	60°50.6	9.0'	15°16.7	6.2'	57.8'	
4	238°59.6	17.5	75°18.6	8.9'	15°10.5	6.3'	57.8'	
5	253°59.8	16.7	89°46.5	8.9'	15°04.1	6.4'	57.8'	
6	268°59.9	N13°15.9	104°14.4	8.9'	S14°57.7	6.5'	57.9'	
7	284°00.1	15.1	118°42.4	8.9'	14°51.2	6.6'	57.9'	
8	299°00.2	14.3	133°10.3	8.9'	14°44.6	6.6'	57.9'	
9	314°00.3	.. 13.5	147°38.3	8.9'	14°37.9	6.7'	57.9'	
10	329°00.5	12.7	162°06.2	8.9'	14°31.1	6.8'	58.0'	
11	344°00.6	11.9	176°34.2	8.9'	14°24.3	6.9'	58.0'	
12	359°00.7	N13°11.1	191°02.1	8.9'	S14°17.3	7.0'	58.0'	
13	14°00.9	10.3	205°30.0	8.9'	14°10.2	7.1'	58.1'	
14	29°01.0	09.5	219°58.0	8.9'	14°03.1	7.2'	58.1'	
15	44°01.2	.. 08.7	234°25.9	8.9'	13°55.9	7.3'	58.1'	
16	59°01.3	07.9	248°53.9	8.9'	13°48.5	7.4'	58.1'	
17	74°01.4	07.1	263°21.8	9.0'	13°41.1	7.5'	58.2'	
18	89°01.6	N13°06.3	277°49.8	9.0'	S13°33.6	7.5'	58.2'	
19	104°01.7	05.5	292°17.7	9.0'	13°26.0	7.6'	58.2'	
20	119°01.9	04.7	306°45.7	9.0'	13°18.4	7.7'	58.3'	
21	134°02.0	.. 03.9	321°13.6	9.0'	13°10.6	7.8'	58.3'	
22	149°02.1	03.1	335°41.6	9.0'	13°02.8	7.9'	58.3'	
23	164°02.3	02.3	350°09.6	9.0'	12°54.9	8.0'	58.3'	
	SD.=15.8	d=-0.8			S.D.=15.8			
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	179°02.4	N13°01.4	4°37.6	9.0'	S12°46.9	8.0'	58.4'	
1	194°02.6	13°00.6	19°05.5	9.0'	12°38.8	8.1'	58.4'	
2	209°02.7	12°59.8	33°33.5	9.0'	12°30.6	8.2'	58.4'	
3	224°02.8	.. 59.0	48°01.5	9.0'	12°22.4	8.3'	58.4'	
4	239°03.0	58.2	62°29.5	9.0'	12°14.0	8.4'	58.5'	
5	254°03.1	57.4	76°57.5	9.0'	12°05.6	8.4'	58.5'	
6	269°03.3	N12°56.6	91°25.5	9.0'	S11°57.1	8.5'	58.5'	
7	284°03.4	55.8	105°53.5	9.0'	11°48.6	8.6'	58.5'	
8	299°03.5	55.0	120°21.5	9.0'	11°39.9	8.7'	58.6'	
9	314°03.7	.. 54.2	134°49.5	9.0'	11°31.2	8.8'	58.6'	
10	329°03.8	53.3	149°17.6	9.0'	11°22.4	8.8'	58.6'	
11	344°04.0	52.5	163°45.6	9.0'	11°13.6	8.9'	58.6'	
12	359°04.1	N12°51.7	178°13.7	9.0'	S11°04.6	9.0'	58.7'	
13	14°04.3	50.9	192°41.7	9.1'	10°55.6	9.0'	58.7'	
14	29°04.4	50.1	207°09.8	9.1'	10°46.5	9.1'	58.7'	
15	44°04.6	.. 49.3	221°37.8	9.1'	10°37.4	9.2'	58.7'	
16	59°04.7	48.5	236°05.9	9.1'	10°28.2	9.3'	58.8'	
17	74°04.8	47.6	250°34.0	9.1'	10°18.9	9.3'	58.8'	
18	89°05.0	N12°46.8	265°02.0	9.1'	S10°09.5	9.4'	58.8'	
19	104°05.1	46.0	279°30.1	9.1'	10°00.1	9.5'	58.8'	
20	119°05.3	45.2	293°58.2	9.1'	09°50.6	9.5'	58.9'	
21	134°05.4	.. 44.4	308°26.3	9.1'	09°41.1	9.6'	58.9'	
22	149°05.6	43.6	322°54.5	9.1'	09°31.4	9.6'	58.9'	
23	164°05.7	42.8	337°22.6	9.1'	09°21.8	9.7'	58.9'	
	SD.=15.8	d=-0.8			S.D.=16.0			

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

**August 19, 20, 21 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	327°46.5	159°45.3	N06°37.2	83°00.1	S24°16.3	151°25.7	N02°47.4	79°22.2	S20°20.8	Alpheratz	357°40.9	29°10.9					
1	342°48.9	174°45.0	36.0	98°01.2	16.5	166°27.7	47.2	94°24.7	20.8	Ankaa	353°13.3	-42°12.8					
2	357°51.4	189°44.6	34.7	113°02.4	16.7	181°29.7	47.0	109°27.1	20.8	Schedar	349°37.5	56°37.5					
3	12°53.9	204°44.3	33.5	128°03.5	16.9	196°31.7	46.8	124°29.6	20.8	Diphda	348°53.5	-17°53.6					
4	27°56.3	219°43.9	32.3	143°04.6	17.0	211°33.8	46.6	139°32.0	20.8	Achernar	335°25.0	-57°09.0					
5	42°58.8	234°43.5	31.0	158°05.8	17.2	226°35.8	46.4	154°34.4	20.8	Hamal	327°58.1	23°32.3					
6	58°01.3	249°43.2	N06°29.8	173°06.9	S24°17.4	241°37.8	N02°46.2	169°36.9	S20°20.8	Polaris	316°40.1	89°19.6					
7	73°03.7	264°42.8	28.6	188°08.0	17.6	256°39.8	46.0	184°39.3	20.9	Acamar	315°16.7	-40°14.2					
8	88°06.2	279°42.4	27.3	203°09.2	17.8	271°41.8	45.8	199°41.8	20.9	Menkar	314°12.7	4°09.2					
9	103°08.7	294°42.1	26.1	218°10.3	18.0	286°43.8	45.6	214°44.2	20.9	Mirfak	308°37.2	49°54.8					
10	118°11.1	309°41.7	24.9	233°11.4	18.2	301°45.8	45.4	229°46.6	20.9	Aldebaran	290°47.0	16°32.4					
11	133°13.6	324°41.4	23.6	248°12.6	18.4	316°47.8	45.2	244°49.1	20.9	Rigel	281°10.1	-8°11.0					
12	148°16.0	339°41.0	N06°22.4	263°13.7	S24°18.6	331°49.8	N02°45.0	259°51.5	S20°20.9	Capella	280°31.4	46°00.5					
13	163°18.5	354°40.6	21.2	278°14.8	18.8	346°51.8	44.8	274°54.0	20.9	Bellatrix	278°29.8	6°21.7					
14	178°21.0	9°40.3	19.9	293°16.0	19.0	1°53.8	44.6	289°56.4	20.9	Elnath	278°10.0	28°37.0					
15	193°23.4	24°39.9	18.7	308°17.1	19.2	16°55.8	44.4	304°58.8	21.0	Alnilam	275°44.3	-1°11.6					
16	208°25.9	39°39.6	17.4	323°18.2	19.4	31°57.8	44.2	320°01.3	21.0	Betelgeuse	270°59.1	7°24.5					
17	223°28.4	54°39.2	16.2	338°19.3	19.6	46°59.8	44.0	335°03.7	21.0	Canopus	263°55.5	-52°42.2					
18	238°30.8	69°38.8	N06°15.0	353°20.5	S24°19.8	62°01.8	N02°43.8	350°06.2	S20°21.0	Sirius	258°32.1	-16°44.4					
19	253°33.3	84°38.5	13.7	8°21.6	20.0	77°03.8	43.6	5°08.6	21.0	Adhara	255°11.1	-28°59.7					
20	268°35.8	99°38.1	12.5	23°22.7	20.1	92°05.8	43.4	20°11.0	21.0	Procyon	244°57.8	5°10.9					
21	283°38.2	114°37.8	11.3	38°23.8	20.3	107°07.8	43.2	35°13.5	21.0	Pollux	243°25.4	27°59.0					
22	298°40.7	129°37.4	10.0	53°25.0	20.5	122°09.8	43.0	50°15.9	21.0	Avior	234°17.7	-59°33.7					
23	313°43.1	144°37.1	08.8	68°26.1	20.7	137°11.8	42.8	65°18.3	21.1	Suhail	222°51.2	-43°30.0					
Mer.pass.:02:09			v-0.4 d-1.2 m-3.8			v1.1 d-0.2 m-0.5			v2.0 d-0.2 m-1.5			v2.4 d-0.0 m-0.4					
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	328°45.6	159°36.7	N06°07.5	83°27.2	S24°20.9	152°13.8	N02°42.6	80°20.8	S20°21.1	Denebola	182°31.8	14°28.9					
1	343°48.1	174°36.3	06.3	98°28.3	21.1	167°15.8	42.4	95°23.2	21.1	Gienah	175°50.3	-17°38.0					
2	358°50.5	189°36.0	05.1	113°29.4	21.3	182°17.8	42.2	110°25.7	21.1	Gacrux	173°07.3	-63°11.6					
3	13°53.0	204°35.6	03.8	128°30.6	21.5	197°19.8	42.0	125°28.1	21.1	Alioth	171°58.8	-57°12.4					
4	28°55.5	219°35.3	02.6	143°31.7	21.7	212°21.8	41.7	140°30.5	21.1	Alkaid	166°19.3	55°52.5					
5	43°57.9	234°34.9	01.3	158°32.8	21.9	227°23.8	41.5	155°33.0	21.1	Hadar	158°29.1	-11°14.7					
6	59°00.4	249°34.6	N06°00.1	173°33.9	S24°22.1	242°25.8	N02°41.3	170°35.4	S20°21.1	Alkaid	152°57.5	49°14.2					
7	74°02.9	264°34.2	05°58.9	188°35.0	22.3	257°27.8	41.1	185°37.8	21.2	Hadar	148°45.0	-60°27.2					
8	89°05.3	279°33.9	57.6	203°36.1	22.5	272°29.8	40.9	200°40.3	21.2	Menkent	148°05.1	-36°27.0					
9	104°07.8	294°33.5	56.4	218°37.3	22.7	287°31.8	40.7	215°42.7	21.2	Arcturus	145°53.9	19°06.1					
10	119°10.3	309°33.1	55.1	233°38.4	22.8	302°33.8	40.5	230°45.1	21.2	Rigel Kent.	139°48.9	-60°54.3					
11	134°12.7	324°32.8	53.9	248°39.5	23.0	317°35.8	40.3	245°47.6	21.2	Kochab	137°20.5	74°05.7					
12	149°15.2	339°32.4	N05°52.6	263°40.6	S24°23.2	332°37.8	N02°40.1	260°50.0	S20°21.2	Zuben 'ubi	137°03.1	-16°06.5					
13	164°17.6	354°32.1	51.4	278°41.7	23.4	347°39.8	39.9	275°52.5	21.2	Alphecca	126°09.2	26°39.9					
14	179°20.1	9°31.7	50.2	293°42.8	23.6	2°41.8	39.7	290°54.9	21.3	Antares	112°23.5	-26°27.9					
15	194°22.6	24°31.4	48.9	308°43.9	23.8	17°43.8	39.5	305°57.3	21.3	Atria	107°23.2	-69°03.5					
16	209°25.0	39°31.0	47.7	323°45.0	24.0	32°45.8	39.3	320°59.8	21.3	Sabik	102°09.9	-15°44.5					
17	224°27.5	54°30.7	46.4	338°46.1	24.2	47°47.8	39.1	336°02.2	21.3	Rasalhague	96°04.3	12°33.3					
18	239°30.0	69°30.3	N05°45.2	353°47.3	S24°24.4	62°49.8	N02°38.9	351°04.6	S20°21.3	Eltanin	90°44.9	51°29.7					
19	254°32.4	84°30.0	43.9	8°48.4	24.6	77°51.8	38.7	6°07.1	21.3	Kaus Aust.	83°40.7	-34°22.4					
20	269°34.9	99°29.6	42.7	23°49.5	24.8	92°53.8	38.5	21°09.5	21.3	Vega	80°37.2	38°48.4					
21	284°37.4	114°29.3	41.4	38°50.6	24.9	107°55.8	38.3	36°11.9	21.3	Nunki	75°55.4	-26°16.3					
22	299°39.8	129°28.9	40.2	53°51.7	25.1	122°57.8	38.1	51°14.4	21.4	Altair	62°05.8	8°55.0					
23	314°42.3	144°28.5	39.0	68°52.8	25.3	137°59.8	37.9	66°16.8	21.4	Peacock	53°15.4	-56°40.7					
Mer.pass.:02:05			v-0.4 d-1.2 m-3.8			v1.1 d-0.2 m-0.5			v2.0 d-0.2 m-1.5			v2.4 d-0.0 m-0.4					
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	329°44.7	159°28.2	N05°37.7	83°53.9	S24°25.5	153°01.8	N02°37.7	81°19.2	S20°21.4	Alnair	150°21.3	-29°31.9					
1	344°47.2	174°27.8	36.5	98°55.0	25.7	168°03.8	37.5	96°21.7	21.4	Regulus	135°50.9	28°10.5					
2	359°49.7	189°27.5	35.2	113°56.1	25.9	183°05.8	37.3	111°24.1	21.4	Markab	135°35.9	15°17.8					
3	14°52.1	204°27.1	34.0	128°57.2	26.1	198°07.8	37.1	126°26.5	21.4	<b>Aug 19 Fri</b>	<b>SHA</b>	<b>Mer.pass</b>					
4	29°54.6	219°26.8	32.7	143°58.3	26.3	213°09.8	36.9	141°29.0	21.4	Venus	191°58.9	13:21					
5	44°57.1	234°26.4	31.5	158°59.4	26.5	228°11.8	36.7	156°31.4	21.5	Mars	115°13.6	18:27					
6	59°59.5	249°26.1	N05°30.2	174°00.5	S24°26.7	243°13.8	N02°36.5	171°33.8	S20°21.5	Jupiter	183°39.3	13:52					
7	75°02.0	264°25.7	29.0	189°01.6	26.8	258°15.8	36.3	186°36.3	21.5	Saturn	111°35.8	18:39					
8	90°04.5	279°25.4	27.7	204°02.7	27.0	273°17.8	36.1	201°38.7	21.5	<b>Aug 20 Sat</b>	<b>SHA</b>	<b>Mer.pass</b>					
9	105°06.9	294°25.0	26.5	219°03.8	27.2	288°19.8	35.9	216°41.1	21.5	Venus	190°51.1	13:22					
10	120°09.4	309°24.7	25.2	234°04.9	27.4	303°21.8	35.7	231°43.6	21.5	Mars	114°41.6	18:25					
11	135°11.9	324°24.3	24.0	249°06.0	27.6	318°23.8	35.5	246°46.0	21.5	Jupiter	183°28.2	13:49					
12	150°14.3	339°24.0	N05°22.7	264°07.1	S24°27.8	333°25.8	N02°35.3	261°48.4	S20°21.6	Saturn	111°35.2	18:36					
13	165°16.8	354°23.6	21.5	279°08.2	28.0	348°27.8	35.0	276°50.8	21.6	<b>Aug 21 Sun</b>	<b>SHA</b>	<b>Mer.pass</b>					
14	180°19.2	9°23.3	20.2	294°09.3	28.2	3°29.8	34.8	291°53.3	21.6	Venus	189°43.4	13:22					
15	195°21.7	24°23.0	19.0	309°10.4	28.4	18°31.8	33.6	306°55.7	21.6	Mars	114°09.1	18:23					
16	210°24.2	39°22.6	17.7	324°11.5	28.5	33°33.8	34.4	321°58.1	21.6	Jupiter	183°17.1	13:46					
17	225°26.6	54°22.3	16.5	339°12.5	28.7	48°35.8	34.2	337°00.6	21.6	Saturn	111°34.5	18:32					
18	240°29.1	69°21.9	N05°15.2	354°13.6	S24°28.9	63°37.8	N02°34.0	352°03.0	S20°21.6	<b>Horizontal parallax</b>							
19	255°31.6	84°21.6	14.0	9°14.7	29.1	78°39.8	33.8	7°05.4	21.6	Venus:	0.1						
20	270°34.0	99															

DUT1 = UT1-UTC = -0.2377 sec ΔT = TT-UT1 = +68.4217 sec

2016 August 19 to Aug. 21 UT

h	Sun			Moon											
Fri	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight	Civil	Sunrise	Sunset	Twilight	Civil	Naut.
0	179°05.9	N12°41.9	351°50.7	9.1'	S09°12.0	9.8'	58.9'	N 72°	01:39	02:39	02:59	21:03	22:20	22:20	22:20
1	194°06.0	41.1	6°18.8	9.1'	09°02.2	9.8'	59.0'	N 70°	01:39	02:20	03:23	20:40	20:40	20:40	20:40
2	209°06.1	40.3	20°47.0	9.1'	08°52.4	9.9'	59.0'	68°	02:20	03:42	03:56	20:08	21:41	21:41	21:41
3	224°06.3	39.5	35°15.1	9.2'	08°42.4	10.0'	59.0'	66°	02:48	03:08	04:08	19:56	21:15	21:15	21:15
4	239°06.4	38.7	49°43.3	9.2'	08°32.5	10.0'	59.0'	64°	01:27	03:08	04:18	19:46	20:55	20:55	20:55
5	254°06.6	37.8	64°11.5	9.2'	08°22.4	10.1'	59.0'	62°	02:04	03:25	04:18	19:46	20:39	20:39	20:39
6	269°06.7	N12°37.0	78°39.6	9.2'	S08°12.3	10.1'	59.1'	60°	02:29	03:38	04:27	19:38	20:26	21:34	21:34
7	284°06.9	36.2	93°07.8	9.2'	08°02.2	10.2'	59.1'	N 58°	02:48	03:50	04:35	19:30	20:15	21:15	21:15
8	299°07.0	35.4	107°36.0	9.2'	07°52.0	10.2'	59.1'	56°	03:04	03:59	04:41	19:24	20:05	21:00	21:00
9	314°07.2	34.6	122°04.2	9.2'	07°41.7	10.3'	59.1'	54°	03:17	04:08	04:47	19:18	19:57	20:47	20:47
10	329°07.3	33.8	136°32.4	9.2'	07°31.4	10.3'	59.1'	52°	03:29	04:16	04:53	19:13	19:50	20:36	20:36
11	344°07.5	32.9	151°00.6	9.2'	07°21.1	10.4'	59.2'	50°	03:38	04:22	04:58	19:08	19:43	20:27	20:27
12	359°07.6	N12°32.1	165°28.8	9.2'	S07°10.7	10.4'	59.2'	45°	03:58	04:37	05:08	18:58	19:29	20:07	20:07
13	14°07.8	31.3	179°57.0	9.2'	07°00.2	10.5'	59.2'	N 40°	04:14	04:48	05:17	18:49	19:18	19:52	19:52
14	29°07.9	30.5	194°25.2	9.2'	06°49.7	10.5'	59.2'	35°	04:26	04:58	05:24	18:42	19:08	19:40	19:40
15	44°08.1	29.6	208°53.5	9.2'	06°39.2	10.6'	59.2'	30°	04:36	05:06	05:30	18:36	19:00	19:30	19:30
16	59°08.2	28.8	223°21.7	9.2'	06°28.6	10.6'	59.2'	20°	04:52	05:19	05:42	18:25	18:47	19:14	19:14
17	74°08.4	28.0	237°49.9	9.2'	06°17.9	10.7'	59.3'	N 10°	05:04	05:29	05:51	18:15	18:37	19:02	19:02
18	89°08.5	N12°27.2	252°18.2	9.2'	S06°07.3	10.7'	59.3'	0°	05:14	05:39	06:00	18:07	18:28	18:52	18:52
19	104°08.7	26.4	266°46.4	9.3'	05°56.5	10.7'	59.3'	S 10°	05:22	05:47	06:09	17:58	18:19	18:44	18:44
20	119°08.8	25.5	281°14.7	9.3'	05°45.8	10.8'	59.3'	20°	05:29	05:55	06:18	17:49	18:11	18:37	18:37
21	134°09.0	24.7	295°43.0	9.3'	05°35.0	10.8'	59.3'	30°	05:36	06:04	06:28	17:39	18:03	18:31	18:31
22	149°09.1	23.9	310°11.2	9.3'	05°24.2	10.9'	59.3'	35°	05:39	06:08	06:34	17:33	17:59	18:28	18:28
23	164°09.3	23.1	324°39.5	9.3'	05°13.3	10.9'	59.4'	40°	05:42	06:13	06:41	17:26	17:54	18:26	18:26
	SD.=15.8	d=-0.8			S.D.=16.1			45°	05:44	06:19	06:49	17:18	17:49	18:23	18:23
Sat	GHA	Dec	GHA	ν	Dec	d	HP	S 50°	05:47	06:25	06:58	17:09	17:43	18:20	18:20
0	179°09.4	N12°22.2	339°07.8	9.3'	S05°02.4	10.9'	59.4'	52°	05:48	06:27	07:02	17:05	17:40	18:19	18:19
1	194°09.6	21.4	353°36.1	9.3'	04°51.4	11.0'	59.4'	54°	05:49	06:30	07:07	17:00	17:37	18:18	18:18
2	209°09.7	20.6	8°04.3	9.3'	04°40.5	11.0'	59.4'	56°	05:50	06:34	07:12	16:55	17:34	18:17	18:17
3	224°09.9	19.8	22°32.6	9.3'	04°29.4	11.0'	59.4'	58°	05:51	06:37	07:18	16:49	17:30	18:16	18:16
4	239°10.0	18.9	37°00.9	9.3'	04°18.4	11.1'	59.4'	S 60°	05:52	06:41	07:25	16:43	17:27	18:15	18:15
5	254°10.2	18.1	51°29.2	9.3'	04°07.3	11.1'	59.4'								
6	269°10.3	N12°17.3	65°57.5	9.3'	S03°56.2	11.1'	59.5'								
7	284°10.5	16.4	80°25.8	9.3'	03°45.1	11.1'	59.5'								
8	299°10.6	15.6	94°54.1	9.3'	03°34.0	11.2'	59.5'								
9	314°10.8	14.8	109°22.4	9.3'	03°22.8	11.2'	59.5'								
10	329°10.9	14.0	123°50.7	9.3'	03°11.6	11.2'	59.5'								
11	344°11.1	13.1	138°19.0	9.3'	03°00.4	11.2'	59.5'								
12	359°11.2	N12°12.3	152°47.3	9.3'	S02°49.1	11.3'	59.5'								
13	14°11.4	11.5	167°15.6	9.3'	02°37.9	11.3'	59.5'								
14	29°11.5	10.6	181°43.9	9.3'	02°26.6	11.3'	59.6'								
15	44°11.7	09.8	196°12.2	9.3'	02°15.3	11.3'	59.6'								
16	59°11.9	09.0	210°40.5	9.3'	02°04.0	11.3'	59.6'								
17	74°12.0	08.2	225°08.8	9.3'	01°52.6	11.3'	59.6'								
18	89°12.2	N12°07.3	239°37.1	9.3'	S01°41.3	11.4'	59.6'								
19	104°12.3	06.5	254°05.4	9.3'	01°29.9	11.4'	59.6'								
20	119°12.5	05.7	268°33.7	9.3'	01°18.6	11.4'	59.6'								
21	134°12.6	04.8	283°02.0	9.3'	01°07.2	11.4'	59.6'								
22	149°12.8	04.0	297°30.3	9.3'	00°55.8	11.4'	59.6'								
23	164°12.9	03.2	311°58.6	9.3'	00°44.4	11.4'	59.6'								
	SD.=15.8	d=-0.8			S.D.=16.2										
Sun	GHA	Dec	GHA	ν	Dec	d	HP	Day	Sun	Eqn.of Time	Mer.	Moon	Mer.Pass.	Age	
0	179°13.1	N12°02.3	326°26.9	9.3'	S00°33.0	11.4'	59.6'	00 <sup>h</sup>	01:37	03:30	12:03	00:34	13:00		
1	194°13.2	01.5	340°55.2	9.3'	00°21.6	11.4'	59.6'	00 <sup>h</sup>	03:22	03:15	12:03	01:27	13:53		
2	209°13.4	12°00.7	355°23.4	9.3'	S00°10.2	11.4'	59.7'	00 <sup>h</sup>	01:00	02:20	20:26	05:06	06:55		
3	224°13.6	11°59.8	9°51.7	9.3'	N00°01.3	11.4'	59.7'	00 <sup>h</sup>	18:57	20:03	21:10	05:17	06:59		
4	239°13.7	59.0	24°20.0	9.3'	00°12.7	11.4'	59.7'	00 <sup>h</sup>	18:53	20:02	21:12	05:26	07:03		
5	254°13.9	58.2	38°48.2	9.3'	00°24.1	11.4'	59.7'	00 <sup>h</sup>	18:49	20:01	21:14	05:34	07:17		
6	269°14.0	N11°57.3	53°16.5	9.3'	N00°35.5	11.4'	59.7'	00 <sup>h</sup>	18:45	20:00	21:17	05:45	07:42		
7	284°14.2	56.5	67°44.7	9.2'	00°46.9	11.4'	59.7'	00 <sup>h</sup>	18:42	20:00	21:18	05:59	07:44		
8	299°14.3	55.7	82°13.0	9.2'	00°58.3	11.4'	59.7'	00 <sup>h</sup>	18:40	20:00	21:20	06:09	07:48		
9	314°14.5	54.8	96°41.2	9.2'	01°09.7	11.4'	59.7'	00 <sup>h</sup>	18:37	19:59	21:21	07:10	07:49		
10	329°14.7	54.0	111°09.4	9.2'	01°21.1	11.4'	59.7'	00 <sup>h</sup>	18:34	19:58	21:23	07:14	07:51		
11	344°14.8	53.1	125°37.7	9.2'	01°32.5	11.4'	59.7'	00 <sup>h</sup>	18:31	19:58	21:25	07:20	07:54		
12	359°15.0	N11°52.3	140°05.9	9.2'	N01°43.9	11.4'	59.7'	00 <sup>h</sup>							
13	14°15.1	51.5	154°34.1	9.2'	01°55.3	11.4'	59.7'	00 <sup>h</sup>							
14	29°15.3	50.6	169°02.3	9.2'	02°06.6	11.4'	59.7'	00 <sup>h</sup>							
15	44°15.4	49.8	183°30.4	9.2'	02°18.0	11.3'	59.7'	00 <sup>h</sup>							
16	59°15.6	49.0	197°58.6	9.2'	02°29.3	11.3'	59.7'	00 <sup>h</sup>							
17	74°15.8	48.1	212°26.8	9.2'	02°40.6	11.3'	59.7'	00 <sup>h</sup>							
18	89°15.9	N11°47.3	226°54.9	9.1'	N02°52.0	11.3'	59.7'	00 <sup>h</sup>							
19	104°16.1	46.4	241°23.1	9.1'	03°03.2	11.3'	59.7'	00 <sup>h</sup>							
20	119°16.2	45.6	255°51.2	9.1'	03°14.5	11.3'	59.7'	00 <sup>h</sup>							
21	134°16.4	44.8	270°19.3	9.1'	03°25.8	11.2'	59.7'	00 <sup>h</sup>							
22	149°16.6	43.9	284°47.4	9.1'	03										

**August 22, 23, 24 UT (Mon., Tue., Wed.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	330°43.9	159°19.8	N05°07.7	84°20.2	S24°30.0	153°49.8	N02°32.8	82°17.6	S20°21.7								Alpheratz	357°40.9	29°10.9				
1	345°46.3	174°19.5	06.5	99°21.3	30.2	168°51.8	32.6	97°20.0	21.7							Ankaa	353°13.3	-42°12.8					
2	0°48.8	189°19.1	05.2	114°22.3	30.4	183°53.8	32.4	112°22.4	21.7							Schedar	349°37.5	56°37.5					
3	15°51.3	204°18.8	04.0	129°23.4	30.6	198°55.8	32.2	127°24.9	21.8							Diphda	348°53.5	-17°53.6					
4	30°53.7	219°18.4	02.7	144°24.5	30.8	213°57.8	32.0	142°27.3	21.8							Achernar	335°24.9	-57°09.0					
5	45°56.2	234°18.1	01.5	159°25.6	31.0	228°59.8	31.8	157°29.7	21.8							Hamal	327°58.1	23°32.3					
6	60°58.7	249°17.8	N05°00.2	174°26.7	S24°31.2	244°01.8	N02°31.6	172°32.2	S20°21.8							Polaris	316°38.7	89°19.7					
7	76°01.1	264°17.4	04°59.0	189°27.8	31.4	259°03.8	31.4	187°34.6	21.8							Acamar	315°16.6	-40°14.2					
8	91°03.6	279°17.1	57.7	204°28.8	31.5	274°05.8	31.2	202°37.0	21.8							Menkar	314°12.7	4°09.2					
9	106°06.1	294°16.7	00.7	219°29.9	31.7	289°07.8	31.0	217°39.4	21.8							Mirfak	308°37.1	49°54.9					
10	121°08.5	309°16.4	55.2	234°31.0	31.9	304°09.8	30.8	232°41.9	21.9							Aldebaran	290°47.0	16°32.4					
11	136°11.0	324°16.0	53.9	249°32.1	32.1	319°11.8	30.6	247°44.3	21.9							Rigel	281°10.1	-8°11.0					
12	151°13.5	339°15.7	N04°52.7	264°33.2	S24°32.3	334°13.8	N02°30.4	262°46.7	S20°21.9							Capella	280°31.4	46°00.5					
13	166°15.9	354°15.3	51.4	279°34.2	32.5	349°15.8	30.2	277°49.1	21.9							Bellatrix	278°29.8	6°21.7					
14	181°18.4	9°15.0	50.2	294°35.3	32.7	4°17.8	30.0	292°51.6	21.9							Elnath	278°10.0	28°37.0					
15	196°20.8	24°14.7	00.9	309°36.4	32.8	19°19.8	29.7	307°54.0	21.9							Alnilam	275°44.3	-1°11.6					
16	211°23.3	39°14.3	47.7	324°37.5	33.0	34°21.8	29.5	322°56.4	21.9							Betelgeuse	270°59.1	7°24.5					
17	226°25.8	54°14.0	46.4	339°38.6	33.2	49°23.8	29.3	337°58.8	22.0							Canopus	263°55.5	-52°42.2					
18	241°28.2	69°13.6	N04°45.1	354°39.6	S24°33.4	64°25.8	N02°29.1	353°01.3	S20°22.0							Sirius	258°32.0	-16°44.4					
19	256°30.7	84°13.3	43.9	9°40.7	33.6	79°27.8	28.9	8°03.7	22.0							Adhara	255°11.1	-28°59.7					
20	271°33.2	99°13.0	42.6	24°41.8	33.8	94°29.8	28.7	23°06.1	22.0							Procyon	244°57.7	5°10.9					
21	286°35.6	114°12.6	00.4	39°42.8	33.9	109°31.8	28.5	38°08.6	22.0							Pollux	243°25.4	27°59.0					
22	301°38.1	129°12.3	40.1	54°43.9	34.1	124°33.8	28.3	53°11.0	22.0							Avior	234°17.6	-59°33.7					
23	316°40.6	144°11.9	38.9	69°45.0	34.3	139°35.8	28.1	68°13.4	22.1							Suhail	222°51.2	-43°30.0					
Mer.pass.:01:57				v-0.3 d-1.3 m-3.8				v1.1 d-0.2 m-0.5				v2.0 d-0.2 m-1.5				v2.4 d-0.0 m-0.4							
Tue	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	331°43.0	159°11.6	N04°37.6	84°46.1	S24°34.5	154°37.8	N02°27.9	83°15.8	S20°22.1							Denebola	182°31.8	14°28.9					
1	346°45.5	174°11.2	36.3	99°47.1	34.7	169°39.8	27.7	98°18.3	22.1							Gienah	175°50.3	-17°38.0					
2	1°48.0	189°10.9	35.1	114°48.2	34.9	184°41.8	27.5	113°20.7	22.1							Acrux	173°07.3	-63°11.5					
3	16°50.4	204°10.6	00.9	129°49.3	35.1	199°43.8	27.3	128°23.1	22.1							Gacrux	171°58.8	-57°12.4					
4	31°52.9	219°10.2	32.6	144°50.3	35.2	214°45.8	27.1	143°25.5	22.1							Alioth	166°19.3	55°52.5					
5	46°55.3	234°09.9	31.3	159°51.4	35.4	229°47.8	26.9	158°27.9	22.1							Spica	158°29.2	-11°14.7					
6	61°57.8	249°09.5	N04°30.0	174°52.5	S24°35.6	244°49.8	N02°26.7	173°30.4	S20°22.2							Alkaid	152°57.5	49°14.2					
7	77°00.3	264°09.2	28.8	189°53.5	35.8	259°51.8	26.5	188°32.8	22.2							Hadar	148°45.0	-60°27.2					
8	92°02.7	279°08.9	27.5	204°54.6	36.0	274°53.8	26.3	203°35.2	22.2							Menkent	148°05.2	-36°27.0					
9	107°05.2	294°08.5	00.9	219°55.7	36.2	289°55.7	26.1	218°37.6	22.2							Arcturus	145°53.9	19°06.1					
10	122°07.7	309°08.2	25.0	234°56.7	36.3	304°57.7	25.9	233°40.1	22.2							Rigel Kent.	139°48.9	-60°54.2					
11	137°10.1	324°07.8	23.7	249°57.8	36.5	319°59.7	25.7	248°42.5	22.2							Kochab	137°20.6	74°05.7					
12	152°12.6	339°07.5	N04°22.5	264°58.9	S24°36.7	335°01.7	N02°25.5	263°44.9	S20°22.2							Zuben ubi	137°03.1	-16°06.5					
13	167°15.1	354°07.2	21.2	279°59.9	36.9	350°03.7	25.2	278°47.3	22.3							Alphecca	126°09.2	26°39.9					
14	182°17.5	9°06.8	20.0	295°01.0	37.1	5°05.7	25.0	293°49.8	22.3							Antares	112°23.5	-26°27.9					
15	197°20.0	24°06.5	00.9	310°02.0	37.3	20°07.7	24.8	308°52.2	22.3							Atria	107°23.2	-69°03.5					
16	212°22.4	39°06.2	17.4	325°03.1	37.4	35°09.7	24.6	323°54.6	22.3							Sabik	102°10.0	-15°44.5					
17	227°24.9	54°05.8	16.2	340°04.2	37.6	50°11.7	24.4	338°57.0	22.3							Rasalhague	96°18.8	-37°06.8					
18	242°27.4	69°05.5	N04°14.9	355°05.2	S24°37.8	65°13.7	N02°24.2	353°59.4	S20°22.3							Eltanin	90°44.9	51°29.7					
19	257°29.8	84°05.1	13.7	10°06.3	38.0	80°15.7	24.0	9°01.9	22.3							Kaus Aust.	83°40.7	-34°22.4					
20	272°32.3	99°04.8	12.4	25°07.3	38.2	95°17.7	23.8	24°04.3	22.4							Vega	80°37.2	38°48.4					
21	287°34.8	114°04.5	00.9	40°08.4	38.3	110°19.7	23.6	39°06.7	22.4							Nunki	75°55.4	-26°16.3					
22	302°37.2	129°04.1	09.9	55°09.4	38.5	125°21.7	23.4	54°09.1	22.4							Altair	62°05.9	8°55.1					
23	317°39.7	144°03.8	08.6	70°10.5	38.7	140°23.7	23.2	69°11.6	22.4							Peacock	53°15.4	-56°40.8					
Mer.pass.:01:53				v-0.3 d-1.3 m-3.8				v1.1 d-0.2 m-0.4				v2.0 d-0.2 m-1.5				v2.4 d-0.0 m-0.4							
Wed	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	SHA	Dec					
0	332°42.2	159°03.5	N04°07.3	85°11.6	S24°38.9	155°25.7	N02°23.0	84°14.0	S20°22.4							Aug 22 Mon	SHA	Mer.pass					
1	347°44.6	174°03.1	06.1	100°12.6	39.1	170°27.7	22.8	99°16.4	22.4							Venus	188°35.9	13:23					
2	2°47.1	189°02.8	04.8	115°13.7	39.2	185°29.7	22.6	114°18.8	22.5							Mars	113°36.3	18:21					
3	17°49.6	204°02.4	00.9	130°14.7	39.4	200°31.7	22.4	129°21.2	22.5							Jupiter	183°05.9	13:43					
4	32°52.0	219°02.1	02.3	145°15.8	39.6	215°33.7	22.2	144°23.7	22.5							Saturn	111°33.7	18:28					
5	47°54.5	234°01.8	04°01.0	160°16.8	39.8	230°35.7	22.0	159°26.1	22.5														
6	62°56.9	249°01.4	N03°59.8	175°17.9	S24°40.0	245°37.7	N02°21.8	174°28.5	S20°22.5							Aug 23 Tue	SHA	Mer.pass					
7	77°59.4	264°01.1	58.5	190°18.9	40.2	260°39.7	21.6	189°30.9	22.5							Venus	187°28.6	13:24					
8	93°01.9	279°00.8	57.2	205°20.0	40.3	275°41.6	21.4	204°33.3	22.5							Mars	113°03.0	18:20					
9	108°04.3	294°00.4	00.9	56.0																			

DUT1 = UT1-UTC = -0.2397 sec ΔT = TT-UT1 = +68.4237 sec

2016 August 22 to Aug. 24 UT

h		Sun		Moon				
Mon		GHA	Dec	GHA	ν	Dec	d	HP
0	179°16.9	N11°42.2		313°43.6	9.1'	N03°59.4	11.2'	59.7'
1	194°17.0	41.4		328°11.6	9.1'	04°10.5	11.1'	59.7'
2	209°17.2	40.5		342°39.7	9.0'	04°21.7	11.1'	59.7'
3	224°17.4	.. 39.7		357°07.7	9.0'	04°32.8	11.1'	59.7'
4	239°17.5	38.9		11°35.8	9.0'	04°43.9	11.1'	59.7'
5	254°17.7	38.0		26°03.8	9.0'	04°54.9	11.0'	59.7'
6	269°17.8	N11°37.2		40°31.8	9.0'	N05°05.9	11.0'	59.7'
7	284°18.0	36.3		54°59.7	9.0'	05°16.9	11.0'	59.7'
8	299°18.2	35.5		69°27.7	9.0'	05°27.9	10.9'	59.7'
9	314°18.3	.. 34.6		83°55.6	8.9'	05°38.8	10.9'	59.7'
10	329°18.5	33.8		98°23.6	8.9'	05°49.7	10.9'	59.7'
11	344°18.7	33.0		112°51.5	8.9'	06°00.5	10.8'	59.7'
12	359°18.8	N11°32.1		127°19.4	8.9'	N06°11.3	10.8'	59.7'
13	14°19.0	31.3		141°47.2	8.9'	06°22.1	10.7'	59.7'
14	29°19.1	30.4		156°15.1	8.8'	06°32.8	10.7'	59.7'
15	44°19.3	.. 29.6		170°42.9	8.8'	06°43.5	10.7'	59.7'
16	59°19.5	28.7		185°10.7	8.8'	06°54.2	10.6'	59.7'
17	74°19.6	27.9		199°38.5	8.8'	07°04.8	10.6'	59.7'
18	89°19.8	N11°27.0		214°06.3	8.8'	N07°15.3	10.5'	59.7'
19	104°20.0	26.2		228°34.1	8.7'	07°25.8	10.5'	59.7'
20	119°20.1	25.3		243°01.8	8.7'	07°36.3	10.4'	59.7'
21	134°20.3	.. 24.5		257°29.5	8.7'	07°46.7	10.4'	59.7'
22	149°20.5	23.6		271°57.2	8.7'	07°57.1	10.3'	59.7'
23	164°20.6	22.8		286°24.9	8.7'	08°07.4	10.3'	59.7'
	SD.=15.8	d=-0.8				S.D.=16.3		
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	179°20.8	N11°22.0		300°52.5	8.6'	N08°17.7	10.2'	59.7'
1	194°20.9	21.1		315°20.2	8.6'	08°27.9	10.2'	59.7'
2	209°21.1	20.3		329°47.8	8.6'	08°38.0	10.1'	59.7'
3	224°21.3	.. 19.4		344°15.4	8.6'	08°48.1	10.1'	59.7'
4	239°21.4	18.6		358°42.9	8.6'	08°58.2	10.0'	59.6'
5	254°21.6	17.7		13°10.5	8.5'	09°08.2	10.0'	59.6'
6	269°21.8	N11°16.9		27°38.0	8.5'	N09°18.1	9.9'	59.6'
7	284°21.9	16.0		42°05.5	8.5'	09°28.0	9.8'	59.6'
8	299°22.1	15.2		56°33.0	8.5'	09°37.8	9.8'	59.6'
9	314°22.3	.. 14.3		71°00.4	8.4'	09°47.5	9.7'	59.6'
10	329°22.4	13.4		85°27.8	8.4'	09°57.2	9.7'	59.6'
11	344°22.6	12.6		99°55.2	8.4'	10°06.8	9.6'	59.6'
12	359°22.8	N11°11.7		114°22.6	8.4'	N10°16.4	9.5'	59.6'
13	14°22.9	10.9		128°50.0	8.3'	10°25.9	9.5'	59.6'
14	29°23.1	10.0		143°17.3	8.3'	10°35.3	9.4'	59.6'
15	44°23.3	.. 09.2		157°44.6	8.3'	10°44.6	9.3'	59.6'
16	59°23.4	08.3		172°11.9	8.3'	10°53.9	9.2'	59.6'
17	74°23.6	07.5		186°39.2	8.2'	11°03.1	9.2'	59.5'
18	89°23.8	N11°06.6		201°06.4	8.2'	N11°12.3	9.1'	59.5'
19	104°23.9	05.8		215°33.6	8.2'	11°21.3	9.0'	59.5'
20	119°24.1	04.9		230°00.8	8.2'	11°30.3	9.0'	59.5'
21	134°24.3	.. 04.1		244°28.0	8.1'	11°39.3	8.9'	59.5'
22	149°24.4	03.2		258°55.1	8.1'	11°48.1	8.8'	59.5'
23	164°24.6	02.3		273°22.2	8.1'	11°56.9	8.7'	59.5'
	SD.=15.8	d=-0.8				S.D.=16.2		
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	179°24.8	N11°01.5		287°49.3	8.1'	N12°05.6	8.7'	59.5'
1	194°24.9	11°00.6		302°16.4	8.1'	12°14.2	8.6'	59.5'
2	209°25.1	10°59.8		316°43.4	8.0'	12°22.7	8.5'	59.5'
3	224°25.3	.. 58.9		331°10.4	8.0'	12°31.2	8.4'	59.4'
4	239°25.5	58.1		345°37.4	8.0'	12°39.6	8.3'	59.4'
5	254°25.6	57.2		0°04.4	8.0'	12°47.9	8.3'	59.4'
6	269°25.8	N10°56.3		14°31.3	7.9'	N12°56.1	8.2'	59.4'
7	284°26.0	55.5		28°58.2	7.9'	13°04.2	8.1'	59.4'
8	299°26.1	54.6		43°25.1	7.9'	13°12.3	8.0'	59.4'
9	314°26.3	.. 53.8		57°52.0	7.9'	13°20.2	7.9'	59.4'
10	329°26.5	52.9		72°18.8	7.8'	13°28.1	7.8'	59.4'
11	344°26.6	52.1		86°45.7	7.8'	13°35.9	7.7'	59.4'
12	359°26.8	N10°51.2		101°12.5	7.8'	N13°43.6	7.7'	59.3'
13	14°27.0	50.3		115°39.2	7.8'	13°51.2	7.6'	59.3'
14	29°27.2	49.5		130°06.0	7.7'	13°58.7	7.5'	59.3'
15	44°27.3	.. 48.6		144°32.7	7.7'	14°06.2	7.4'	59.3'
16	59°27.5	47.7		158°59.4	7.7'	14°13.5	7.3'	59.3'
17	74°27.7	46.9		173°26.1	7.7'	14°20.7	7.2'	59.3'
18	89°27.8	N10°46.0		187°52.8	7.7'	N14°27.9	7.1'	59.3'
19	104°28.0	45.2		202°19.4	7.6'	14°35.0	7.0'	59.2'
20	119°28.2	44.3		216°46.0	7.6'	14°41.9	6.9'	59.2'
21	134°28.4	.. 43.4		231°12.6	7.6'	14°48.8	6.8'	59.2'
22	149°28.5	42.6		245°39.2	7.6'	14°55.6	6.7'	59.2'
23	164°28.7	41.7		260°05.8	7.5'	15°02.3	6.6'	59.2'
	SD.=15.8	d=-0.9				S.D.=16.2		

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

**August 25, 26, 27 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	333°41.3	158°55.4	N03°37.0	85°36.7	S24°43.2	156°13.6	N02°18.1	85°12.0	S20°22.8					Alpheratz	357°40.9	29°10.9	
1	348°43.8	173°55.1	35.7	100°37.7	43.4	171°15.6	17.9	100°14.4	22.8					Ankaa	353°13.3	-42°12.8	
2	3°46.2	188°54.8	34.4	115°38.7	43.5	186°17.5	17.7	115°16.8	22.8					Schedar	349°37.5	56°37.6	
3	18°48.7	203°54.4	.. 33.2	130°39.8	.. 43.7	201°19.5	.. 17.4	130°19.3	.. 22.8					Diphda	348°53.5	-17°53.6	
4	33°51.2	218°54.1	31.9	145°40.8	43.9	216°21.5	17.2	145°21.7	22.9					Achernar	335°24.9	-57°09.0	
5	48°53.6	233°53.8	30.6	160°41.9	44.1	231°23.5	17.0	160°24.1	22.9					Hamal	327°58.1	23°32.3	
6	63°56.1	248°53.4	N03°29.3	175°42.9	S24°44.3	246°25.5	N02°16.8	175°26.5	S20°22.9					Polaris	316°37.2	89°19.7	
7	78°58.5	263°53.1	28.1	190°43.9	44.4	261°27.5	16.6	190°28.9	22.9					Acamar	315°16.6	-40°14.2	
8	94°01.0	278°52.8	26.8	205°45.0	44.6	276°29.5	16.4	205°31.3	22.9					Menkar	314°12.7	4°09.2	
9	109°03.5	293°52.4	.. 25.5	220°46.0	.. 44.8	291°31.5	.. 16.2	220°33.8	.. 22.9					Mirfak	308°37.1	49°54.9	
10	124°05.9	308°52.1	24.3	235°47.0	45.0	306°33.5	16.0	235°36.2	23.0					Aldebaran	290°46.9	16°32.4	
11	139°08.4	323°51.8	23.0	250°48.1	45.1	321°35.5	15.8	250°38.6	23.0					Rigel	281°10.1	-8°11.0	
12	154°10.9	338°51.4	N03°21.7	265°49.1	S24°45.3	336°37.5	N02°15.6	265°41.0	S20°23.0					Capella	280°31.4	46°00.5	
13	169°13.3	353°51.1	20.5	280°50.1	45.5	351°39.5	15.4	280°43.4	23.0					Bellatrix	278°29.8	6°21.8	
14	184°15.8	8°50.8	19.2	295°51.1	45.7	6°41.5	15.2	295°45.8	23.0					El Nath	278°10.0	28°37.0	
15	199°18.3	23°50.5	.. 17.9	310°52.2	.. 45.8	21°43.5	.. 15.0	310°48.2	.. 23.0					Alnilam	275°44.3	-1°11.6	
16	214°20.7	38°50.1	16.6	325°53.2	46.0	36°45.5	14.8	325°50.7	23.1					Betelgeuse	270°59.1	7°24.5	
17	229°23.2	53°49.8	15.4	340°54.2	46.2	51°47.4	14.6	340°53.1	23.1					Canopus	263°55.5	-52°42.2	
18	244°25.7	68°49.5	N03°14.1	355°55.3	S24°46.4	66°49.4	N02°14.4	355°55.5	S20°23.1					Sirius	258°32.0	-16°44.3	
19	259°28.1	83°49.1	12.8	10°56.3	46.5	81°51.4	14.1	10°57.9	23.1					Adhara	255°11.1	-28°59.7	
20	274°30.6	98°48.8	11.6	25°57.3	46.7	96°53.4	13.9	26°00.3	23.1					Procyon	244°57.7	5°10.9	
21	289°33.0	113°48.5	.. 10.3	40°58.3	.. 46.9	111°55.4	.. 13.7	41°02.7	.. 23.1					Pollux	243°25.4	27°59.0	
22	304°35.5	128°48.1	09.0	55°59.4	47.1	126°57.4	13.5	56°05.1	23.2					Avior	234°17.6	-59°33.7	
23	319°38.0	143°47.8	07.7	71°00.4	47.2	141°59.4	13.3	71°07.5	23.2					Suhail	222°51.2	-43°30.0	
Mer.pass.:01:45			v-0.3 d-1.3 m-3.8			v1.0 d-0.2 m-0.4			v2.0 d-0.2 m-1.5			v2.4 d-0.0 m0.4					
Fri			GHA			GHA			GHA			GHA			GHA		
0	334°40.4	158°47.5	N03°06.5	86°01.4	S24°47.4	157°01.4	N02°13.1	86°10.0	S20°23.2					Denebola	182°31.8	14°28.9	
1	349°42.9	173°47.2	05.2	101°02.4	47.6	172°03.4	12.9	101°12.4	23.2					Gienah	175°50.3	-17°38.0	
2	4°45.4	188°46.8	03.9	116°03.4	47.8	187°05.4	12.7	116°14.8	23.2					Acrua	173°07.3	-63°11.5	
3	19°47.8	203°46.5	.. 02.7	131°04.5	.. 47.9	202°07.4	.. 12.5	131°17.2	.. 23.2					Gacrux	171°58.8	-57°12.4	
4	34°50.3	218°46.2	01.4	146°05.5	48.1	217°09.4	12.3	146°19.6	23.2					Alioth	166°19.3	55°52.5	
5	49°52.8	233°45.8	03°00.1	161°06.5	48.3	232°11.4	12.1	161°22.0	23.3					Spica	158°29.2	-11°14.7	
6	64°55.2	248°45.5	N02°58.8	176°07.5	S24°48.5	247°13.3	N02°11.9	176°24.4	S20°23.3					Alkaid	152°57.5	49°14.2	
7	79°57.7	263°45.2	57.6	191°08.5	48.6	262°15.3	11.7	191°26.8	23.3					Hadar	148°45.0	-60°27.2	
8	95°00.2	278°44.9	56.3	206°09.6	48.8	277°17.3	11.5	206°29.2	23.3					Menkent	148°05.2	-36°27.0	
9	110°02.6	293°44.5	.. 55.0	221°10.6	.. 49.0	292°19.3	.. 11.3	221°31.7	.. 23.3					Arcturus	145°53.9	19°06.1	
10	125°05.1	308°44.2	53.7	236°11.6	49.2	307°21.3	11.0	236°34.1	23.3					Rigel Kent.	139°48.9	-60°54.2	
11	140°07.5	323°43.9	52.5	251°12.6	49.3	322°23.3	10.8	251°36.5	23.4					Kochab	137°20.7	74°05.7	
12	155°10.0	338°43.5	N02°51.2	266°13.6	S24°49.5	337°25.3	N02°10.6	266°38.9	S20°23.4					Zuben' ubi	137°03.1	-16°06.5	
13	170°12.5	353°43.2	49.9	281°14.6	49.7	352°27.3	10.4	281°41.3	23.4					Alphecca	126°09.2	26°40.0	
14	185°14.9	8°42.9	48.6	296°15.7	49.8	7°29.3	10.2	296°43.7	23.4					Antares	112°23.6	-26°27.9	
15	200°17.4	23°42.6	.. 47.4	311°16.7	.. 50.0	22°31.3	.. 10.0	311°46.1	.. 23.4					Atria	107°23.2	-69°03.5	
16	215°19.9	38°42.2	46.1	326°17.7	50.2	37°33.3	09.8	326°48.5	23.4					Sabik	102°10.0	-15°44.5	
17	230°22.3	53°41.9	44.8	341°18.7	50.4	52°35.3	09.6	341°50.9	23.5					Shaula	96°18.8	-37°06.8	
18	245°24.8	68°41.6	N02°43.5	356°19.7	S24°50.5	67°37.2	N02°09.4	356°53.3	S20°23.5					Rasalhague	96°04.3	12°33.3	
19	260°27.3	83°41.3	42.3	11°20.7	50.7	82°39.2	09.2	11°55.8	23.5					Eltanin	90°44.9	51°29.7	
20	275°29.7	98°40.9	41.0	26°21.7	50.9	97°41.2	09.0	26°58.2	23.5					Kaus Aust.	83°40.7	-34°22.4	
21	290°32.2	113°40.6	.. 39.7	41°22.7	.. 51.0	112°43.2	.. 08.8	42°00.6	.. 23.5					Vega	80°37.2	38°48.4	
22	305°34.7	128°40.3	38.4	56°23.7	51.2	127°45.2	08.6	57°03.0	23.5					Nunki	75°55.4	-26°16.3	
23	320°37.1	143°40.0	37.2	71°24.7	51.4	142°47.2	08.4	72°05.4	23.6					Altair	62°05.9	8°55.1	
Mer.pass.:01:41			v-0.3 d-1.3 m-3.8			v1.0 d-0.2 m-0.4			v2.0 d-0.2 m-1.5			v2.4 d-0.0 m0.4					
Sat			GHA			GHA			GHA			GHA			GHA		
0	335°39.6	158°39.6	N02°35.9	86°25.8	S24°51.6	157°49.2	N02°08.2	87°07.8	S20°23.6					Aug 25 Thu	SHA	Mer.pass	
1	350°42.0	173°39.3	34.6	101°26.8	51.7	172°51.2	07.9	102°10.2	23.6					Venus	185°14.1	13:25	
2	5°44.5	188°39.0	33.3	116°27.8	51.9	187°53.2	07.7	117°12.6	23.6					Mars	111°55.4	18:16	
3	20°47.0	203°38.6	.. 32.1	131°28.8	.. 52.1	202°55.2	.. 07.5	132°15.0	.. 23.6					Jupiter	182°32.3	13:33	
4	35°49.4	218°38.3	30.8	146°29.8	52.2	217°57.2	07.3	147°17.4	23.7					Saturn	111°30.7	18:16	
5	50°51.9	233°38.0	29.5	161°30.8	52.4	232°59.1	07.1	162°19.8	23.7					Aug 26 Fri	SHA	Mer.pass	
6	65°54.4	248°37.7	N02°28.2	176°31.8	S24°52.6	248°01.1	N02°06.9	177°22.2	S20°23.7					Venus	184°07.0	13:25	
7	80°56.8	263°37.3	26.9	191°32.8	52.7	263°03.1	06.7	192°24.6	23.7					Mars	111°21.0	18:15	
8	95°59.3	278°37.0	25.7	206°33.8	52.9	278°05.1	06.5	207°27.1	23.7					Jupiter	182°21.0	13:30	
9	111°01.8	293°36.7	.. 24.4	221°34.8	.. 53.1	293°07.1	.. 06.3	222°29.5	.. 23.7					Saturn	111°29.5	18:12	
10	126°04.2	308°36.4	23.1	236°35.8	53.2	308°09.1	06.1	237°31.9	23.8					Aug 27 Sat	SHA	Mer.pass	
11	141°06.7	323°36.0	21.8	251°36.8	53.4	323°11.1	05.9	252°34.									

DUT1 = UT1-UTC = -0.2417 sec ΔT = TT-UT1 = +68.4257 sec

2016 August 25 to Aug. 27 UT

h		Sun		Moon				Lat.		Twilight		Sunrise		Sunset		Twilight			
Thu		GHA	Dec	GHA	ν	Dec	d	HP	Naut.	Civil					Civil	Naut.			
0	179°28.9	N10°40.9		274°32.3	7.5'	N15°08.8	6.5'	59.2'											
1	194°29.1	40.0		288°58.8	7.5'	15°15.3	6.4'	59.2'											
2	209°29.2	39.1		303°25.3	7.5'	15°21.7	6.3'	59.2'											
3	224°29.4	.. 38.3		317°51.8	7.5'	15°28.0	6.2'	59.1'											
4	239°29.6	37.4		332°18.2	7.4'	15°34.2	6.1'	59.1'											
5	254°29.7	36.5		346°44.7	7.4'	15°40.3	6.0'	59.1'											
6	269°29.9	N10°35.7		1°11.1	7.4'	N15°46.3	5.9'	59.1'											
7	284°30.1	34.8		15°37.5	7.4'	15°52.2	5.8'	59.1'											
8	299°30.3	33.9		30°03.9	7.4'	15°57.9	5.7'	59.1'											
9	314°30.4	.. 33.1		44°30.2	7.4'	16°03.6	5.6'	59.1'											
10	329°30.6	32.2		58°56.6	7.3'	16°09.2	5.5'	59.0'											
11	344°30.8	31.3		73°22.9	7.3'	16°14.7	5.4'	59.0'											
12	359°31.0	N10°30.5		87°49.3	7.3'	N16°20.0	5.3'	59.0'											
13	14°31.1	29.6		102°15.6	7.3'	16°25.3	5.2'	59.0'											
14	29°31.3	28.7		116°41.9	7.3'	16°30.5	5.1'	59.0'											
15	44°31.5	.. 27.9		131°08.1	7.3'	16°35.5	5.0'	59.0'											
16	59°31.7	27.0		145°34.4	7.3'	16°40.4	4.9'	58.9'											
17	74°31.8	26.1		160°00.7	7.2'	16°45.3	4.8'	58.9'											
18	89°32.0	N10°25.3		174°26.9	7.2'	N16°50.0	4.7'	58.9'											
19	104°32.2	24.4		188°53.1	7.2'	16°54.6	4.6'	58.9'											
20	119°32.4	23.5		203°19.3	7.2'	16°59.1	4.5'	58.9'											
21	134°32.5	.. 22.7		217°45.6	7.2'	17°03.5	4.3'	58.9'											
22	149°32.7	21.8		232°11.8	7.2'	17°07.8	4.2'	58.9'											
23	164°32.9	20.9		246°37.9	7.2'	17°12.0	4.1'	58.8'											
SD.=15.8		d=-0.9		S.D.=16.1															
Fri		GHA	Dec	GHA	ν	Dec	d	HP											
0	179°33.1	N10°20.0		261°04.1	7.2'	N17°16.1	4.0'	58.8'											
1	194°33.3	19.2		275°30.3	7.2'	17°20.0	3.9'	58.8'											
2	209°33.4	18.3		289°56.5	7.2'	17°23.9	3.8'	58.8'											
3	224°33.6	.. 17.4		304°22.6	7.2'	17°27.6	3.7'	58.8'											
4	239°33.8	16.6		318°48.8	7.2'	17°31.3	3.6'	58.8'											
5	254°34.0	15.7		333°15.0	7.2'	17°34.8	3.5'	58.7'											
6	269°34.1	N10°14.8		347°41.1	7.1'	N17°38.2	3.3'	58.7'											
7	284°34.3	13.9		2°07.2	7.1'	17°41.5	3.2'	58.7'											
8	299°34.5	13.1		16°33.4	7.1'	17°44.7	3.1'	58.7'											
9	314°34.7	.. 12.2		30°59.5	7.1'	17°47.7	3.0'	58.7'											
10	329°34.9	11.3		45°25.7	7.1'	17°50.7	2.9'	58.7'											
11	344°35.0	10.4		59°51.8	7.1'	17°53.5	2.8'	58.6'											
12	359°35.2	N10°09.6		74°18.0	7.1'	N17°56.2	2.7'	58.6'											
13	14°35.4	08.7		88°44.1	7.1'	17°58.8	2.6'	58.6'											
14	29°35.6	07.8		103°10.2	7.1'	18°01.3	2.4'	58.6'											
15	44°35.7	.. 07.0		117°36.4	7.2'	18°03.7	2.3'	58.6'											
16	59°35.9	06.1		132°02.5	7.2'	18°06.0	2.2'	58.6'											
17	74°36.1	05.2		146°28.7	7.2'	18°08.1	2.1'	58.5'											
18	89°36.3	N10°04.3		160°54.9	7.2'	N18°10.2	2.0'	58.5'											
19	104°36.5	03.5		175°21.0	7.2'	18°12.1	1.9'	58.5'											
20	119°36.6	02.6		189°47.2	7.2'	18°13.9	1.8'	58.5'											
21	134°36.8	.. 01.7		204°13.4	7.2'	18°15.6	1.6'	58.5'											
22	149°37.0	10°00.8		218°39.6	7.2'	18°17.2	1.5'	58.4'											
23	164°37.2	09°59.9		233°05.8	7.2'	18°18.7	1.4'	58.4'											
SD.=15.8		d=-0.9		S.D.=16.0															
Sat		GHA	Dec	GHA	ν	Dec	d	HP											
0	179°37.4	N09°59.1		247°32.0	7.2'	N18°20.0	1.3'	58.4'											
1	194°37.5	58.2		261°58.2	7.2'	18°21.2	1.2'	58.4'											
2	209°37.7	57.3		276°24.5	7.2'	18°22.4	1.1'	58.4'											
3	224°37.9	.. 56.4		290°50.7	7.3'	18°23.4	0.9'	58.4'											
4	239°38.1	55.6		305°17.0	7.3'	18°24.3	0.8'	58.3'											
5	254°38.3	54.7		319°43.2	7.3'	18°25.0	0.7'	58.3'											
6	269°38.5	N09°53.8		334°09.5	7.3'	N18°25.7	0.6'	58.3'											
7	284°38.6	52.9		348°35.8	7.3'	18°26.3	0.5'	58.3'											
8	299°38.8	52.0		3°02.2	7.3'	18°26.7	0.4'	58.3'											
9	314°39.0	.. 51.2		17°28.5	7.4'	18°27.0	0.3'	58.2'											
10	329°39.2	50.3		31°54.9	7.4'	18°27.2	0.1'	58.2'											
11	344°39.4	49.4		46°21.2	7.4'	18°27.3	0.0'	58.2'											
12	359°39.5	N09°48.5		60°47.6	7.4'	N18°27.3	-0.1'	58.2'											
13	14°39.7	47.6		75°14.1	7.4'	18°27.1	-0.2'	58.2'											
14	29°39.9	46.8		89°40.5	7.5'	18°26.9	-0.3'	58.2'											
15	44°40.1	.. 45.9		104°07.0	7.5'	18°26.5	-0.4'	58.1'											
16	59°40.3	45.0		118°33.4	7.5'	18°26.1	-0.5'	58.1'											
17	74°40.5	44.1		133°00.0	7.5'	18°25.5	-0.6'	58.1'											
18	89°40.6	N09°43.2		147°26.5	7.6'	N18°24.8	-0.8'	58.1'											
19	104°40.8	42.4		161°53.1	7.6'	18°24.0	-0.9'	58.1'											
20	119°41.0	41.5		176°19.7	7.6'	18°23.0	-1.0'	58.0'											
21	134°41.2	.. 40.6		190°46.3	7.6'	18°22.0	-1.1'	58.0'											
22	149°41.4	39.7		205°12.9	7.7'	18°20.9	-1.2'	58.0'											
23	164°41.6	38.8		219°39.6	7.7'	18°19.6	-1.3'	58.0'											
SD.=15.8		d=-0.9		S.D.=15.9															
									Lat.		Moonrise		Moonset						
									Thu	Fri	Sat		Thu	Fri	Sat				
									19:52				16:45						
									20:42	21:07	22:00		15:56	17:28	18:32				

## August 28, 29, 30 UT (Sun., Mon., Tue.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	336°38.7	158°31.8	N02°05.2	86°49.7	\$24°55.6	158°37.0	N02°03.2	88°05.5	\$20°24.0	Alpheratz	357°40.9	29°10.9											
1	351°41.2	173°31.5	03.9	101°50.7	55.8	173°38.9	03.0	103°07.9	24.0	Ankaa	353°13.3	-42°12.8											
2	6°43.6	188°31.2	02.7	116°51.7	55.9	188°40.9	02.8	118°10.3	24.0	Schedar	349°37.4	56°37.6											
3	21°46.1	203°30.9	.. 01.4	131°52.7	.. 56.1	203°42.9	.. 02.6	133°12.7	.. 24.1	Diphda	348°53.5	-17°53.6											
4	36°48.6	218°30.5	02°00.1	146°53.7	56.3	218°44.9	02.3	148°15.1	24.1	Achernar	335°24.9	-57°09.0											
5	51°51.0	233°30.2	01°58.8	161°54.7	56.4	233°46.9	02.1	163°17.6	24.1	Hamal	327°58.1	23°32.3											
6	66°53.5	248°29.9	N01°57.5	176°55.7	\$24°56.6	248°48.9	N02°01.9	178°20.0	\$20°24.1	Polaris	316°35.7	89°19.7											
7	81°56.0	263°29.6	56.3	191°56.7	56.8	263°50.9	01.7	193°22.4	24.1	Acamar	315°16.6	-40°14.1											
8	96°58.4	278°29.3	55.0	206°57.6	56.9	278°52.9	01.5	208°24.8	24.1	Menkar	314°12.7	4°09.2											
9	112°00.9	293°28.9	.. 53.7	221°58.6	.. 57.1	293°54.9	.. 01.3	223°27.2	.. 24.2	Mirfak	308°37.1	49°54.9											
10	127°03.4	308°28.6	52.4	236°59.6	57.3	308°56.8	01.1	238°29.6	24.2	Aldebaran	290°46.9	16°32.4											
11	142°05.8	323°28.3	51.1	252°00.6	57.4	323°58.8	00.9	253°32.0	24.2	Rigel	281°10.0	-8°11.0											
12	157°08.3	338°28.0	N01°49.9	267°01.6	\$24°57.6	339°00.8	N02°00.7	268°34.4	\$20°24.2	Capella	280°31.3	46°00.5											
13	172°10.8	353°27.6	48.6	282°02.6	57.7	354°02.8	00.5	283°36.8	24.2	Bellatrix	278°29.8	6°21.8											
14	187°13.2	8°27.3	47.3	297°03.6	57.9	9°04.8	00.3	298°39.2	24.2	Elnath	278°10.0	28°37.0											
15	202°15.7	23°27.0	.. 46.0	312°04.5	.. 58.1	24°06.8	02°00.1	313°41.6	.. 24.3	Alnilam	275°44.3	-1°11.6											
16	217°18.1	38°26.7	44.7	327°05.5	58.2	39°08.8	01°59.9	328°44.0	24.3	Betelgeuse	270°59.1	7°24.5											
17	232°20.6	53°26.4	43.4	342°06.5	58.4	54°10.8	59.6	343°46.4	24.3	Canopus	263°55.4	-52°42.2											
18	247°23.1	68°26.0	N01°42.2	357°07.5	\$24°58.6	69°12.8	N01°59.4	358°48.8	\$20°24.2	Sirius	258°32.0	-16°44.3											
19	262°25.5	83°25.7	40.9	12°08.5	58.7	84°14.7	59.2	13°51.2	24.3	Adhara	255°11.0	-28°59.6											
20	277°28.0	98°25.4	39.6	27°09.4	58.9	99°16.7	59.0	28°53.6	24.4	Procyon	244°57.7	5°10.9											
21	292°30.5	113°25.1	.. 38.3	42°10.4	.. 59.1	114°18.7	.. 58.8	43°56.0	.. 24.4	Pollux	243°25.4	27°59.0											
22	307°32.9	128°24.8	37.0	57°11.4	59.2	129°20.7	58.6	58°58.4	24.4	Avior	234°17.6	-59°33.7											
23	322°35.4	143°24.4	35.8	72°12.4	59.4	144°22.7	58.4	74°00.8	24.4	Suhail	222°51.2	-43°29.9											
Mer.pass.:01:33				v-0.3 d-1.3 m-3.8				v1.0 d-0.2 m-0.4				v2.0 d-0.2 m-1.5				v2.4 d-0.0 m-0.5							
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Mon					
0	337°37.9	158°24.1	N01°34.5	87°13.4	\$24°59.5	159°24.7	N01°58.2	89°03.2	\$20°24.4	Denebola	182°31.8	14°28.9											
1	352°40.3	173°23.8	33.2	102°14.3	59.7	174°26.7	58.0	104°05.6	24.4	Gienah	175°50.3	-17°37.9											
2	7°42.8	188°23.5	31.9	117°15.3	24°59.9	189°28.7	57.8	119°08.0	24.5	Acrux	173°07.3	-63°11.5											
3	22°45.2	203°23.2	.. 30.6	132°16.3	25°00.0	204°30.6	.. 57.6	134°10.4	.. 24.5	Gacrux	171°58.8	-57°12.4											
4	37°47.7	218°22.8	29.3	147°17.3	00.2	219°32.6	57.4	149°12.8	24.5	Alioth	166°19.3	55°52.5											
5	52°50.2	233°22.5	28.1	162°18.2	00.4	234°34.6	57.1	164°15.2	24.5	Spica	158°29.2	-11°14.7											
6	67°52.6	248°22.2	N01°26.8	177°19.2	\$25°00.5	249°36.6	N01°56.9	179°17.6	\$20°24.5	Alkaid	152°57.6	49°14.2											
7	82°55.1	263°21.9	25.5	192°20.2	00.7	264°38.6	56.7	194°20.0	24.6	Hadar	148°45.0	-60°27.2											
8	97°57.6	278°21.5	24.2	207°21.1	00.8	279°40.6	56.5	209°22.4	24.6	Menkent	148°05.2	-36°27.0											
9	113°00.0	293°21.2	.. 22.9	222°22.1	.. 01.0	294°42.6	.. 56.3	224°24.8	.. 24.6	Arcturus	145°54.0	19°06.1											
10	128°02.5	308°20.9	21.6	237°23.1	01.2	309°44.6	56.1	239°27.2	24.6	Rigel Kent.	139°48.9	-60°54.2											
11	143°05.0	323°20.6	20.4	252°24.1	01.3	324°46.5	55.9	254°29.6	24.6	Kochab	137°20.7	74°05.7											
12	158°07.4	338°20.3	N01°19.1	267°25.0	\$25°01.5	339°48.5	N01°55.7	269°32.0	\$20°24.6	Zuben ubi	137°03.1	-16°06.5											
13	173°09.9	353°19.9	17.8	282°26.0	01.6	354°50.5	55.5	284°34.4	24.7	Alphecca	126°09.3	26°39.9											
14	188°12.4	8°19.6	16.5	297°27.0	01.8	9°52.5	55.3	299°36.7	24.7	Antares	112°23.6	-26°27.9											
15	203°14.8	23°19.3	.. 15.2	312°27.9	.. 02.0	24°54.5	.. 55.1	314°39.1	.. 24.7	Atria	107°23.3	-69°03.5											
16	218°17.3	38°19.0	13.9	327°28.9	02.1	39°56.5	54.9	329°41.5	24.7	Sabik	102°10.0	-15°44.5											
17	233°19.7	53°18.7	12.7	342°29.9	02.3	54°58.5	54.6	344°43.9	24.7	Rasalhague	96°04.3	12°33.3											
18	248°22.2	68°18.4	N01°11.4	357°30.8	\$25°02.4	70°00.5	N01°54.4	359°46.3	\$20°24.8	Eltanin	90°44.9	51°29.7											
19	263°24.7	83°18.0	10.1	12°31.8	02.6	85°02.4	54.2	14°48.7	24.8	Kaus Aust.	83°40.7	-34°22.4											
20	278°27.1	98°17.7	08.8	27°32.8	02.8	100°04.4	54.0	29°51.1	24.8	Vega	80°37.3	38°48.4											
21	293°29.6	113°17.4	.. 07.5	42°33.7	.. 02.9	115°06.4	.. 53.8	44°53.5	.. 24.8	Nunki	75°55.4	-26°16.3											
22	308°32.1	128°17.1	06.2	57°34.7	03.1	130°08.4	53.6	59°55.9	24.8	Altair	62°05.9	8°55.1											
23	323°34.5	143°16.8	05.0	72°35.6	03.2	145°10.4	53.4	74°58.3	24.8	Peacock	53°15.4	-56°40.8											
Mer.pass.:01:29				v-0.3 d-1.3 m-3.8				v1.0 d-0.2 m-0.3				v2.0 d-0.2 m-1.5				v2.4 d-0.0 m-0.5							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Tue					
0	338°37.0	158°16.4	N01°03.7	87°36.6	\$25°03.4	160°12.4	N01°53.2	90°00.7	\$20°24.9	Aug 28 Sun	SHA	Mer.pass											
1	353°39.5	173°16.1	02.4	102°37.6	03.5	175°14.4	53.0	105°03.1	24.9	Venus	181°53.1	13:26											
2	8°41.9	188°15.8	01°01.1	117°38.5	03.7	190°16.4	52.8	120°05.5	24.9	Mars	110°11.0	18:11											
3	23°44.4	203°15.5	00°59.8	132°39.5	.. 03.9	205°18.3	.. 52.6	135°07.9	.. 24.9	Jupiter	181°58.2	13:24											
4	38°46.9	218°15.2	58.5	147°40.4	04.0	220°20.3	52.4	150°10.3	24.9	Saturn	111°26.8	18:05											
5	53°49.3	233°14.8	57.3	162°41.4	04.2	235°22.3	52.1	165°12.7	25.0	Aug 29 Mon	SHA	Mer.pass											
6	68°51.8	248°14.5	N00°56.0	177°42.4	\$25°04.3	250°24.3	N01°51.9	180°15.1	\$20°25.0	Venus	180°46.3	13:27											
7	83°54.2	263°14.2	54.7	192°43.3	04.5	265°26.3	51.7	195°17.5	25.0	Mars	109°35.5	18:10											
8	98°56.7	278°13.9	53.4	207°44.3	04.7	280°28.3	51.5	210°19.9	2														

DUT1 = UT1-UTC = -0.2438 sec ΔT = TT-UT1 = +68.4278 sec

2016 August 28 to Aug. 30 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	ν	Dec	d	HP
0	179°41.7	N09°37.9		234°06.3	7.7'	N18°18.2	-1.4'	58.0'
1	194°41.9	37.1		248°33.0	7.8'	18°16.8	-1.5'	57.9'
2	209°42.1	36.2		262°59.8	7.8'	18°15.2	-1.6'	57.9'
3	224°42.3	.. 35.3		277°26.6	7.8'	18°13.5	-1.7'	57.9'
4	239°42.5	34.4		291°53.4	7.9'	18°11.7	-1.9'	57.9'
5	254°42.7	33.5		306°20.3	7.9'	18°09.8	-2.0'	57.9'
6	269°42.9	N09°32.6		320°47.2	7.9'	N18°07.8	-2.1'	57.9'
7	284°43.0	31.7		335°14.1	8.0'	18°05.6	-2.2'	57.8'
8	299°43.2	30.9		349°41.1	8.0'	18°03.4	-2.3'	57.8'
9	314°43.4	.. 30.0		4°08.1	8.0'	18°01.1	-2.4'	57.8'
10	329°43.6	29.1		18°35.2	8.1'	17°58.6	-2.5'	57.8'
11	344°43.8	28.2		33°02.3	8.1'	17°56.1	-2.6'	57.8'
12	359°44.0	N09°27.3		47°29.4	8.1'	N17°53.4	-2.7'	57.7'
13	14°44.2	26.4		61°56.5	8.2'	17°50.6	-2.8'	57.7'
14	29°44.3	25.5		76°23.7	8.2'	17°47.8	-2.9'	57.7'
15	44°44.5	.. 24.6		90°51.0	8.3'	17°44.8	-3.0'	57.7'
16	59°44.7	23.8		105°18.3	8.3'	17°41.7	-3.1'	57.7'
17	74°44.9	22.9		119°45.6	8.3'	17°38.6	-3.2'	57.6'
18	89°45.1	N09°22.0		134°13.0	8.4'	N17°35.3	-3.3'	57.6'
19	104°45.3	21.1		148°40.4	8.4'	17°31.9	-3.4'	57.6'
20	119°45.5	20.2		163°07.8	8.5'	17°28.4	-3.5'	57.6'
21	134°45.6	.. 19.3		177°35.3	8.5'	17°24.9	-3.6'	57.6'
22	149°45.8	18.4		192°02.9	8.6'	17°21.2	-3.7'	57.5'
23	164°46.0	17.5		206°30.5	8.6'	17°17.4	-3.8'	57.5'
	SD.=15.8	d=-0.9				S.D.=15.7		
Mon	GHA	Dec	GHA	ν	Dec	d	HP	
0	179°46.2	N09°16.6	220°58.1	8.7'	N17°13.5	-3.9'	57.5'	
1	194°46.4	15.8	235°25.8	8.7'	17°09.6	-4.0'	57.5'	
2	209°46.6	14.9	249°53.5	8.8'	17°05.5	-4.1'	57.5'	
3	224°46.8	.. 14.0	264°21.3	8.8'	17°01.3	-4.2'	57.4'	
4	239°47.0	13.1	278°49.1	8.8'	16°57.1	-4.3'	57.4'	
5	254°47.2	12.2	293°17.0	8.9'	16°52.7	-4.4'	57.4'	
6	269°47.3	N09°11.3	307°44.9	8.9'	N16°48.3	-4.5'	57.4'	
7	284°47.5	10.4	322°12.9	9.0'	16°43.7	-4.6'	57.4'	
8	299°47.7	09.5	336°40.9	9.0'	16°39.1	-4.7'	57.3'	
9	314°47.9	.. 08.6	351°08.9	9.1'	16°34.4	-4.8'	57.3'	
10	329°48.1	07.7	5°37.1	9.1'	16°29.6	-4.9'	57.3'	
11	344°48.3	06.8	20°05.2	9.2'	16°24.7	-4.9'	57.3'	
12	359°48.5	N09°05.9	34°33.4	9.2'	N16°19.7	-5.0'	57.3'	
13	14°48.7	05.1	49°01.7	9.3'	16°14.6	-5.1'	57.2'	
14	29°48.9	04.2	63°30.0	9.3'	16°09.4	-5.2'	57.2'	
15	44°49.0	.. 03.3	77°58.4	9.4'	16°04.2	-5.3'	57.2'	
16	59°49.2	02.4	92°26.8	9.5'	15°58.8	-5.4'	57.2'	
17	74°49.4	01.5	106°55.3	9.5'	15°53.4	-5.5'	57.1'	
18	89°49.6	N09°00.6	121°23.9	9.6'	N15°47.9	-5.6'	57.1'	
19	104°49.8	08°59.7	135°52.4	9.6'	15°42.3	-5.6'	57.1'	
20	119°50.0	58.8	150°21.1	9.7'	15°36.6	-5.7'	57.1'	
21	134°50.2	.. 57.9	164°49.8	9.7'	15°30.9	-5.8'	57.1'	
22	149°50.4	57.0	179°18.5	9.8'	15°25.0	-5.9'	57.0'	
23	164°50.6	56.1	193°47.3	9.8'	15°19.1	-6.0'	57.0'	
	SD.=15.8	d=-0.9			S.D.=15.6			
Tue	GHA	Dec	GHA	ν	Dec	d	HP	
0	179°50.8	N08°55.2	208°16.2	9.9'	N15°13.1	-6.0'	57.0'	
1	194°51.0	54.3	222°45.1	9.9'	15°07.0	-6.1'	57.0'	
2	209°51.1	53.4	237°14.0	10.0'	15°00.9	-6.2'	57.0'	
3	224°51.3	.. 52.5	251°43.1	10.0'	14°54.6	-6.3'	56.9'	
4	239°51.5	51.6	266°12.1	10.1'	14°48.3	-6.4'	56.9'	
5	254°51.7	50.7	280°41.3	10.2'	14°41.9	-6.4'	56.9'	
6	269°51.9	N08°49.8	295°10.4	10.2'	N14°35.4	-6.5'	56.9'	
7	284°52.1	48.9	309°39.7	10.3'	14°28.9	-6.6'	56.9'	
8	299°52.3	48.0	324°09.0	10.3'	14°22.3	-6.6'	56.8'	
9	314°52.5	.. 47.1	338°38.3	10.4'	14°15.6	-6.7'	56.8'	
10	329°52.7	46.2	353°07.7	10.4'	14°08.9	-6.8'	56.8'	
11	344°52.9	45.3	7°37.2	10.5'	14°02.0	-6.9'	56.8'	
12	359°53.1	N08°44.4	22°06.7	10.5'	N13°55.1	-6.9'	56.8'	
13	14°53.3	43.5	36°36.3	10.6'	13°48.2	-7.0'	56.7'	
14	29°53.4	42.6	51°05.9	10.7'	13°41.1	-7.1'	56.7'	
15	44°53.6	.. 41.7	65°35.6	10.7'	13°34.0	-7.1'	56.7'	
16	59°53.8	40.8	80°05.3	10.8'	13°26.9	-7.2'	56.7'	
17	74°54.0	39.9	94°35.1	10.8'	13°19.6	-7.3'	56.6'	
18	89°54.2	N08°39.0	109°05.0	10.9'	N13°12.3	-7.3'	56.6'	
19	104°54.4	38.1	123°34.9	10.9'	13°05.0	-7.4'	56.6'	
20	119°54.6	37.2	138°04.8	11.0'	12°57.6	-7.5'	56.6'	
21	134°54.8	.. 36.3	152°34.8	11.0'	12°50.1	-7.5'	56.6'	
22	149°55.0	35.4	167°04.9	11.1'	12°42.5	-7.6'	56.5'	
23	164°55.2	34.5	181°35.0	11.2'	12°34.9	-7.6'	56.5'	
	SD.=15.8	d=-0.9			S.D.=15.5			

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

Day	Sun		Mer.	Moon	
	Eqn.of Time	Mer.		Mer. Pass.	Upper
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	hh:mm	hh:mm
28	01:13 00:55	01:04 00:46	12:01	08:43	21:10
29	00:37	00:28	12:01	09:37	22:03
30	00:37	00:28	12:00	10:28	22:53



**August 31, 01, 02 UT (Wed., Thu., Fri.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	339°36.1	158°08.8	N00°32.8	87°59.5	S25°07.1	161°00.0	N01°48.2	90°58.1	S20°25.3	Alpheratz	357°40.9
1	354°38.6	173°08.5	31.5	103°00.5	07.3	176°02.0	48.0	106°00.5	25.3	Ankaa	353°13.2
2	9°41.1	188°08.2	30.3	118°01.4	07.4	191°04.0	47.8	121°02.9	25.4	Schedar	349°37.4
3	24°43.5	203°07.8	.. 29.0	133°02.3	.. 07.6	206°06.0	.. 47.5	136°05.3	.. 25.4	Diphda	348°53.5
4	39°46.0	218°07.5	27.7	148°03.3	07.7	221°08.0	47.3	151°07.7	25.4	Achernar	335°24.9
5	54°48.5	233°07.2	26.4	163°04.2	07.9	236°10.0	47.1	166°10.1	25.4	Hamal	327°58.1
6	69°50.9	248°06.9	N00°25.1	178°05.2	S25°08.1	251°12.0	N01°46.9	181°12.5	S20°25.4	Polaris	316°34.5
7	84°53.4	263°06.6	23.8	193°06.1	08.2	266°13.9	46.7	196°14.9	25.5	Alcamar	315°16.6
8	99°55.8	278°06.3	22.5	208°07.1	08.4	281°15.9	46.5	211°17.3	25.5	Menkar	314°12.6
9	114°58.3	293°05.9	.. 21.2	223°08.0	.. 08.5	296°17.9	.. 46.3	226°19.7	.. 25.5	Mirfak	308°37.0
10	130°00.8	308°05.6	20.0	238°08.9	08.7	311°19.9	46.1	241°22.0	25.5	Aldebaran	290°46.9
11	145°03.2	323°05.3	18.7	253°09.9	08.8	326°21.9	45.9	256°24.4	25.5	Rigel	281°10.0
12	160°05.7	338°05.0	N00°17.4	268°10.8	S25°09.0	341°23.9	N01°45.7	271°26.8	S20°25.5	Capella	280°31.3
13	175°08.2	353°04.7	16.1	283°11.8	09.1	356°25.8	45.5	286°29.2	25.6	Bellatrix	278°29.7
14	190°10.6	8°04.4	14.8	298°12.7	09.3	11°27.8	45.2	301°31.6	25.6	Elnath	278°09.9
15	205°13.1	23°04.0	.. 13.5	313°13.6	.. 09.4	26°29.8	.. 45.0	316°34.0	.. 25.6	Alnilam	275°44.2
16	220°15.6	38°03.7	12.2	328°14.6	09.6	41°31.8	44.8	331°36.4	25.6	Betelgeuse	270°59.1
17	235°18.0	53°03.4	11.0	343°15.5	09.7	56°33.8	44.6	346°38.8	25.6	Canopus	263°55.4
18	250°20.5	68°03.1	N00°09.7	358°16.5	S25°09.9	71°35.8	N01°44.4	1°41.2	S20°25.7	Sirius	258°32.0
19	265°23.0	83°02.8	08.4	13°17.4	10.0	86°37.8	44.2	16°43.5	25.7	Adhara	255°11.0
20	280°25.4	98°02.5	07.1	28°18.3	10.2	101°39.7	44.0	31°45.9	25.7	Procyon	244°57.7
21	295°27.9	113°02.1	.. 05.8	43°19.3	.. 10.3	116°41.7	.. 43.8	46°48.3	.. 25.7	Pollux	243°25.4
22	310°30.3	128°01.8	04.5	58°20.2	10.5	131°43.7	43.6	61°50.7	25.7	Avior	234°17.6
23	325°32.8	143°01.5	03.2	73°21.1	10.6	146°45.7	43.4	76°53.1	25.8	Suhail	222°51.2
Mer.pass.:01:21		v-0.3 d-1.3 m-3.8		v0.9 d-0.2 m-0.3		v2.0 d-0.2 m-1.5		v2.4 d-0.0 m0.5		Miaplacidus	
Thu		GHA		GHA		Dec		GHA		Dec	
0	340°35.3	158°01.2	N00°01.9	88°22.1	S25°10.8	161°47.7	N01°43.1	91°55.5	S20°25.8	Denebola	193°49.8
1	355°37.7	173°00.9	N00°00.7	103°23.0	10.9	176°49.7	42.9	106°57.9	25.8	Gienah	182°31.8
2	10°40.2	188°00.6	S00°00.6	118°23.9	11.1	191°51.6	42.7	122°00.3	25.8	Acrux	175°50.3
3	25°42.7	203°00.2	.. 01.9	133°24.8	.. 11.2	206°53.6	.. 42.5	137°02.6	.. 25.8	Gacrux	173°07.4
4	40°45.1	217°59.9	03.2	148°25.8	11.4	221°55.6	42.3	152°05.0	25.9	Alioth	171°58.9
5	55°47.6	232°59.6	04.5	163°26.7	11.5	236°57.6	42.1	167°07.4	25.9	Spica	166°19.3
6	70°50.1	247°59.3	S00°05.8	178°27.6	S25°11.7	251°59.6	N01°41.9	182°09.8	S20°25.9	Alkaid	158°29.2
7	85°52.5	262°59.0	07.1	193°28.6	11.8	267°01.6	41.7	197°12.2	25.9	Hadar	152°57.6
8	100°55.0	277°58.7	08.4	208°29.5	12.0	282°03.5	41.5	212°14.6	25.9	Menkent	148°45.1
9	115°57.4	292°58.3	.. 09.6	223°30.4	.. 12.1	297°05.5	.. 41.3	227°17.0	.. 26.0	Arcturus	148°05.2
10	130°59.9	307°58.0	10.9	238°31.3	12.2	312°07.5	41.1	242°19.3	26.0	Rigel Kent.	145°54.0
11	146°02.4	322°57.7	12.2	253°32.3	12.4	327°09.5	40.8	257°21.7	26.0	Kochab	139°49.0
12	161°04.8	337°57.4	S00°13.5	268°33.2	S25°12.5	342°11.5	N01°40.6	272°24.1	S20°26.0	Zuben'ubi	137°03.1
13	176°07.3	352°57.1	14.8	283°34.1	12.7	357°13.5	40.4	287°26.5	26.0	Alphecca	126°09.3
14	191°09.8	7°56.8	16.1	298°35.0	12.8	12°15.4	40.2	302°28.9	26.1	Antares	112°23.6
15	206°12.2	22°56.5	.. 17.4	313°36.0	.. 13.0	27°17.4	.. 40.0	317°31.3	.. 26.1	Atria	107°23.3
16	221°14.7	37°56.1	18.7	328°36.9	13.1	42°19.4	39.8	332°33.6	26.1	Sabik	102°10.0
17	236°17.2	52°55.8	20.0	343°37.8	13.3	57°21.4	39.6	347°36.0	26.1	Rasalhague	96°04.4
18	251°19.6	67°55.5	S00°21.2	358°38.7	S25°13.4	72°23.4	N01°39.4	2°38.4	S20°26.1	Eltanin	90°44.9
19	266°22.1	82°55.2	22.5	13°39.7	13.6	87°25.4	39.2	17°40.8	26.2	Kaus Aust.	83°40.8
20	281°24.6	97°54.9	23.8	28°40.6	13.7	102°27.3	39.0	32°43.2	26.2	Vega	80°37.3
21	296°27.0	112°54.6	.. 25.1	43°41.5	.. 13.8	117°29.3	.. 38.7	47°45.6	.. 26.2	Nunki	75°55.4
22	311°29.5	127°54.2	26.4	58°42.4	14.0	132°31.3	38.5	62°47.9	26.2	Altair	62°05.9
23	326°31.9	142°53.9	27.7	73°43.3	14.1	147°33.3	38.3	77°50.3	26.2	Peacock	53°15.4
Mer.pass.:01:17		v-0.3 d-1.3 m-3.8		v0.9 d-0.1 m-0.3		v2.0 d-0.2 m-1.5		v2.4 d-0.0 m0.5		Deneb	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Mer.pass.
0	341°34.4	157°53.6	S00°29.0	88°44.3	S25°14.3	162°35.3	N01°38.1	92°52.7	S20°26.3	Aug 31 Wed	27°40.6
1	356°36.9	172°53.3	30.3	103°45.2	14.4	177°37.3	37.9	107°55.1	26.3	Venus	-46°52.7
2	11°39.3	187°53.0	31.5	118°46.1	14.6	192°39.2	37.7	122°57.5	26.3	Mars	15°21.3
3	26°41.8	202°52.7	.. 32.8	133°47.0	.. 14.7	207°41.2	.. 37.5	137°59.9	.. 26.3	Jupiter	29°31.9
4	41°44.3	217°52.3	34.1	148°47.9	14.9	222°43.2	37.3	153°02.2	26.3	Saturn	130°50.9
5	56°46.7	232°52.0	35.4	163°48.8	15.0	237°45.2	37.1	168°04.6	26.4	Aug 31 Wed	28°10.5
6	71°49.2	247°51.7	S00°36.7	178°49.8	S25°15.1	252°47.2	N01°36.9	183°07.0	S20°26.4	Venus	178°32.7
7	86°51.7	262°51.4	38.0	193°50.7	15.3	267°49.2	36.6	198°09.4	26.4	Mars	108°23.4
8	101°54.1	277°51.1	39.3	208°51.6	15.4	282°51.1	36.4	213°11.8	26.4	Jupiter	181°23.9
9	116°56.6	292°50.8	.. 40.6	223°52.5	.. 15.6	297°53.1	.. 36.2	228°14.2	.. 26.4	Saturn	181°23.9
10	131°59.0	307°50.5	41.9	238°53.4	15.7	312°55.1	36.0	243°16.5	26.5	Sep 01 Thu	13:14
11	147°01.5	322°50.1	43.1	253°54.3	15.9	327°57.1	35.8	258°18.9	26.5	Venus	177°25.9
12	162°04.0	337°49.8	S00°44.4	268°55.2	S25°16.0	342°59.1	N01°35.6	273°21.3	S20°26.5	Mars	107°46.8
13	177°06.4	352°49.5	45.7	283°56.1	16.1	358°01.1	35.4	288°23.7	26.5	Jupiter	181°12.4
14	192°08.9	7°49.2	47.0	298°57.1	16.3	13°03.0	35.2	303°26.1	26.5	Saturn	111°20.2
15	207°11.4	22°48.9	.. 48.3	313°58.0	.. 16.4	28°05.0	.. 35.0	318°28.4	.. 26.6	Aug 31 Wed	17:49
16	222°13.8	37°48.6	49.6	328°58.9	16.6	43°07.0	34.8	333°30.8	26.6	Venus	176°19.2
17	237°16.3	52°48.2	50.9	343°59.8	16.7	58°09.0	34.5	348°33.2	26.6	Mars	107°09.9
18	252°18.8	67°47.9	S00°52.2	359°00.7	S25°16.8	73°11.0	N01°34.3	3°35.6	S20°26.6	Jupiter	181°00.9
19	267°21.2	82°47.6	53.4	14°01.6	17.0	88°12.9	34.1	18°38.0	26.7	Saturn	111°18.3
20	282°23.7	97°47.3	54.7	29°02.5	17.1	103°14.9	33.9	33°40.3	26.7	Aug 31 Wed	17:46
21	297°26.2	112°47.0	.. 56.0	44°03.4	.. 17.3	118°16.9	.. 33.7	48°42.7	.. 26.7	Venus	176°19.2
22	312°28.6	127°46.7	57.3	59°04.3	17.4	133°18.9	33.5	63°45.1	26.7	Mars	107°09.9
23	327°31.1	142°46.4	58.6	74°05.2	17.5	148°20.9	33.3	78°47.5	26.7	Jupiter	181°00.9
Mer.pass.:01:14		v-0.3 d-1.3 m-3.8		v0.9 d-0.1 m-0.3		v2.0 d-0.2 m-1.5		v2.4 d-0.0 m0.5		Horizontal parallax	
Mer.pass.:01:14		v-0.3 d-1.3 m-3.8		v0.9 d-0.1 m-0.3		v2.0 d-0.2 m-1.5		v2.4 d-0.0 m0.5		Venus:	
										Mars:	

DUT1 = UT1-UTC = -0.2458 sec ΔT = TT-UT1 = +68.4298 sec

2016 August 31 to Sep. 02 UT

h		Sun			Moon		
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	179°55.4	N08°33.6	196°05.2	11.2'	N12°27.3	-7.7'	56.5'
1	194°55.6	32.7	210°35.4	11.3'	12°19.5	-7.8'	56.5'
2	209°55.8	31.8	225°05.7	11.3'	12°11.8	-7.8'	56.5'
3	224°56.0	.. 30.9	239°36.1	11.4'	12°03.9	-7.9'	56.4'
4	239°56.2	30.0	254°06.5	11.4'	11°56.0	-7.9'	56.4'
5	254°56.4	29.1	268°36.9	11.5'	11°48.1	-8.0'	56.4'
6	269°56.6	N08°28.2	283°07.4	11.5'	N11°40.1	-8.0'	56.4'
7	284°56.8	27.3	297°38.0	11.6'	11°32.0	-8.1'	56.3'
8	299°56.9	26.4	312°08.6	11.6'	11°23.9	-8.1'	56.3'
9	314°57.1	.. 25.5	326°39.2	11.7'	11°15.8	-8.2'	56.3'
10	329°57.3	24.6	341°10.0	11.7'	11°07.6	-8.2'	56.3'
11	344°57.5	23.7	355°40.7	11.8'	10°59.3	-8.3'	56.3'
12	359°57.7	N08°22.8	10°11.6	11.8'	N10°51.0	-8.3'	56.2'
13	14°57.9	21.9	24°42.4	11.9'	10°42.6	-8.4'	56.2'
14	29°58.1	21.0	39°13.4	12.0'	10°34.2	-8.4'	56.2'
15	44°58.3	.. 20.1	53°44.3	12.0'	10°25.8	-8.5'	56.2'
16	59°58.5	19.2	68°15.4	12.1'	10°17.3	-8.5'	56.2'
17	74°58.7	18.3	82°46.4	12.1'	10°08.8	-8.6'	56.1'
18	89°58.9	N08°17.4	97°17.6	12.2'	N10°00.2	-8.6'	56.1'
19	104°59.1	16.5	111°48.8	12.2'	09°51.6	-8.6'	56.1'
20	119°59.3	15.5	126°20.0	12.3'	09°42.9	-8.7'	56.1'
21	134°59.5	.. 14.6	140°51.3	12.3'	09°34.2	-8.7'	56.1'
22	149°59.7	13.7	155°22.6	12.4'	09°25.5	-8.8'	56.0'
23	164°59.9	12.8	169°54.0	12.4'	09°16.7	-8.8'	56.0'
	SD.=15.8	d=-0.9			S.D.=15.3		

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	180°00.1	N08°11.9	184°25.4	12.5'	N09°07.9	-8.8'	56.0'
1	195°00.3	11.0	198°56.9	12.5'	08°59.0	-8.9'	56.0'
2	210°00.5	10.1	213°28.4	12.5'	08°50.1	-8.9'	55.9'
3	225°00.7	.. 09.2	228°00.0	12.6'	08°41.2	-8.9'	55.9'
4	240°00.9	08.3	242°31.6	12.6'	08°32.2	-9.0'	55.9'
5	255°01.1	07.4	257°03.3	12.7'	08°23.2	-9.0'	55.9'
6	270°01.3	N08°06.5	271°35.0	12.7'	N08°14.2	-9.0'	55.9'
7	285°01.5	05.6	286°06.7	12.8'	08°05.1	-9.1'	55.8'
8	300°01.7	04.6	300°38.6	12.8'	07°56.0	-9.1'	55.8'
9	315°01.9	.. 03.7	315°10.4	12.9'	07°46.9	-9.1'	55.8'
10	330°02.1	02.8	329°42.3	12.9'	07°37.7	-9.2'	55.8'
11	345°02.3	01.9	344°14.2	13.0'	07°28.6	-9.2'	55.8'
12	0°02.5	N08°01.0	358°46.2	13.0'	N07°19.3	-9.2'	55.7'
13	15°02.7	08°00.1	13°18.3	13.0'	07°10.1	-9.3'	55.7'
14	30°02.9	07°59.2	27°50.3	13.1'	07°00.8	-9.3'	55.7'
15	45°03.1	.. 58.3	42°22.4	13.1'	06°51.6	-9.3'	55.7'
16	60°03.3	57.4	56°54.6	13.2'	06°42.2	-9.3'	55.7'
17	75°03.5	56.5	71°26.8	13.2'	06°32.9	-9.4'	55.6'
18	90°03.7	N07°55.5	85°59.0	13.3'	N06°23.5	-9.4'	55.6'
19	105°03.9	54.6	100°31.3	13.3'	06°14.1	-9.4'	55.6'
20	120°04.1	53.7	115°03.6	13.3'	06°04.7	-9.4'	55.6'
21	135°04.3	.. 52.8	129°36.0	13.4'	05°55.3	-9.4'	55.6'
22	150°04.5	51.9	144°08.4	13.4'	05°45.9	-9.5'	55.5'
23	165°04.7	51.0	158°40.8	13.5'	05°36.4	-9.5'	55.5'
	SD.=15.8	d=-0.9			S.D.=15.2		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°04.9	N07°50.1	173°13.3	13.5'	N05°26.9	-9.5'	55.5'
1	195°05.1	49.2	187°45.8	13.5'	05°17.4	-9.5'	55.5'
2	210°05.3	48.2	202°18.4	13.6'	05°07.9	-9.5'	55.5'
3	225°05.5	.. 47.3	216°51.0	13.6'	04°58.3	-9.5'	55.4'
4	240°05.7	46.4	231°23.6	13.6'	04°48.8	-9.6'	55.4'
5	255°05.9	45.5	245°56.2	13.7'	04°39.2	-9.6'	55.4'
6	270°06.1	N07°44.6	260°28.9	13.7'	N04°29.6	-9.6'	55.4'
7	285°06.3	43.7	275°01.7	13.7'	04°20.1	-9.6'	55.4'
8	300°06.5	42.8	289°34.4	13.8'	04°10.4	-9.6'	55.3'
9	315°06.7	.. 41.8	304°07.2	13.8'	04°00.8	-9.6'	55.3'
10	330°06.9	40.9	318°40.1	13.8'	03°51.2	-9.6'	55.3'
11	345°07.1	40.0	333°12.9	13.9'	03°41.6	-9.6'	55.3'
12	0°07.3	N07°39.1	347°45.8	13.9'	N03°31.9	-9.7'	55.3'
13	15°07.5	38.2	2°18.8	13.9'	03°22.3	-9.7'	55.2'
14	30°07.7	37.3	16°51.7	14.0'	03°12.6	-9.7'	55.2'
15	45°07.9	.. 36.3	31°24.7	14.0'	03°02.9	-9.7'	55.2'
16	60°08.1	35.4	45°57.7	14.0'	02°53.2	-9.7'	55.2'
17	75°08.3	34.5	60°30.8	14.1'	02°43.6	-9.7'	55.2'
18	90°08.5	N07°33.6	75°03.9	14.1'	N02°33.9	-9.7'	55.2'
19	105°08.7	32.7	89°37.0	14.1'	02°24.2	-9.7'	55.1'
20	120°08.9	31.8	104°10.1	14.1'	02°14.5	-9.7'	55.1'
21	135°09.1	.. 30.8	118°43.3	14.2'	02°04.8	-9.7'	55.1'
22	150°09.3	29.9	133°16.4	14.2'	01°55.1	-9.7'	55.1'
23	165°09.5	29.0	147°49.7	14.2'	01°45.4	-9.7'	55.1'
	SD.=15.8	d=-0.9			S.D.=15.1		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°		02:34	04:03	19:53	21:20	
N 70°		03:02	04:17	19:40	20:54	
68°	01:34	03:22	04:27	19:30	20:34	22:17
66°	02:12	03:38	04:36	19:21	20:19	21:43
64°	02:37	03:51	04:44	19:14	20:06	21:18
62°	02:57	04:02	04:50	19:08	19:56	21:00
60°	03:12	04:11	04:56	19:02	19:47	20:45
N 58°	03:25	04:19	05:01	18:58	19:39	20:32
56°	03:36	04:25	05:05	18:53	19:33	20:22
54°	03:45	04:32	05:09	18:50	19:27	20:13
52°	03:54	04:37	05:12	18:46	19:21	20:05
50°	04:01	04:42	05:15	18:43	19:17	19:58
48°	04:16	04:52	05:22	18:37	19:07	19:43
N 40°	04:27	05:00	05:28	18:31	18:59	19:32
35°	04:36	05:07	05:33	18:26	18:52	19:23
30°	04:44	05:13	05:37	18:22	18:46	19:15
20°	04:56	05:22	05:44	18:15	18:37	19:03
N 10°	05:05	05:30	05:51	18:09	18:30	18:55
0°	05:11	05:36	05:57	18:03	18:24	18:48
S 10°	05:17	05:41	06:02	17:58	18:19	18:43
20°	05:20	05:46	06:08	17:52	18:14	18:40
30°	05:23	05:51	06:15	17:45	18:09	18:37
35°	05:24	05:53	06:19	17:41	18:07	18:36
40°	05:24	05:56	06:23	17:37	18:05	18:36
45°	05:24	05:58	06:28	17:32	18:02	18:36
S 50°	05:24	06:01	06:34	17:27	17:59	18:37
52°	05:23	06:02	06:36	17:24	17:58	18:37
54°	05:23	06:04	06:39	17:21	17:57	18:38
56°	05:22	06:05	06:43	17:18	17:56	18:39
58°	05:21	06:07	06:46	17:15	17:54	18:40
S 60°	05:20	06:08	06:50	17:11	17:53	18:41
Day	Sun		Moon		Mer.	
Day	Eqn.of Time 00 <sup>h</sup> mm:ss	Time 12 <sup>h</sup> mm:ss	Mer. Pass Upper hh:mm	Mer. Pass Lower hh:mm	Age Mer.Pass. Upper hh:mm	Age Mer.Pass. Lower hh:mm
31	00:18	00:09	12:00	11:18	23:42	
01	00:00	00:10	12:00	12:05	—	
02	00:19	00:29	12:00	12:50	00:28	

## September 03, 04, 05 UT (Sat., Sun., Mon.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	342°33.5	157°46.0	\$00°59.9	89°06.1	\$25°17.7	163°22.9	N01°33.1	93°49.8	\$20°26.8							Alpheratz	357°40.9	29°11.0					
1	357°36.0	172°45.7	01°01.2	104°07.0	17.8	178°24.8	32.9	108°52.2	26.8							Ankaa	353°13.2	-42°12.8					
2	12°38.5	187°45.4	02.5	119°07.9	18.0	193°26.8	32.6	123°54.6	26.8							Schedar	349°37.4	56°37.6					
3	27°40.9	202°45.1	.. 03.8	134°08.8	.. 18.1	208°28.8	.. 32.4	138°57.0	.. 26.8							Diphda	348°53.4	-17°53.6					
4	42°43.4	217°44.8	05.0	149°09.7	18.2	223°30.8	32.2	153°59.4	26.8							Achernar	335°24.8	-57°09.0					
5	57°45.9	232°44.5	06.3	164°10.6	18.4	238°32.8	32.0	169°01.7	26.9							Hamal	327°58.0	23°32.4					
6	72°48.3	247°44.1	\$01°07.6	179°11.5	\$25°18.5	253°34.7	N01°31.8	184°04.1	\$20°26.9							Polaris	316°33.2	89°19.7					
7	87°50.8	262°43.8	08.9	194°12.4	18.7	268°36.7	31.6	199°06.5	26.9							Acamar	315°16.5	-40°14.2					
8	102°53.3	277°43.5	10.2	209°13.3	18.8	283°38.7	31.4	214°08.9	26.9							Menkar	314°12.6	4°09.2					
9	117°55.7	292°43.2	.. 11.5	224°14.2	.. 18.9	298°40.7	.. 31.2	229°11.2	.. 26.9							Mirfak	308°37.0	49°54.9					
10	132°58.2	307°42.9	12.8	239°15.1	19.1	313°42.7	31.0	244°13.6	27.0							Aldebaran	290°46.9	16°32.4					
11	148°00.7	322°42.6	14.1	254°16.0	19.2	328°44.7	30.8	259°16.0	27.0							Rigel	281°10.0	-8°11.0					
12	163°03.1	337°42.2	\$01°15.4	269°16.9	\$25°19.3	343°46.6	N01°30.5	274°18.4	\$20°27.0							Capella	280°31.3	46°00.5					
13	178°05.6	352°41.9	16.6	284°17.8	19.5	358°48.6	30.3	289°20.8	27.0							Bellatrix	278°29.7	6°21.8					
14	193°08.0	7°41.6	17.9	299°18.7	19.6	13°50.6	30.1	304°23.1	27.0							El Nath	278°09.9	28°37.0					
15	208°10.5	22°41.3	.. 19.2	314°19.6	.. 19.7	28°52.6	.. 29.9	319°25.5	.. 27.1							Alnilam	275°44.2	-1°11.6					
16	223°13.0	37°41.0	20.5	329°20.5	19.9	43°54.6	29.7	334°27.9	27.1							Betelgeuse	270°59.0	7°24.5					
17	238°15.4	52°40.7	21.8	344°21.4	20.0	58°56.5	29.5	349°30.3	27.1							Canopus	263°55.4	-52°42.1					
18	253°17.9	67°40.4	\$01°23.1	359°22.3	\$25°20.2	73°58.5	N01°29.3	4°32.6	\$20°27.1							Sirius	258°32.0	-16°44.3					
19	268°20.4	82°40.0	24.4	14°23.2	20.3	89°00.5	29.1	19°35.0	27.2							Adhara	255°11.0	-28°59.6					
20	283°22.8	97°39.7	25.7	29°24.1	20.4	104°02.5	28.9	34°37.4	27.2							Procyon	244°57.7	5°10.9					
21	298°25.3	112°39.4	.. 27.0	44°25.0	.. 20.6	119°04.5	.. 28.6	49°39.8	.. 27.2							Pollux	243°25.4	27°59.0					
22	313°27.8	127°39.1	28.2	59°25.9	20.7	134°06.4	28.4	64°42.1	27.2							Avior	234°17.6	-59°33.7					
23	328°30.2	142°38.8	29.5	74°26.8	20.8	149°08.4	28.2	79°44.5	27.2							Suhail	222°51.2	-43°29.9					
Mer.pass.:01:10				v-0.3 d-1.3 m-3.8				v0.9 d-0.1 m-0.3				v2.0 d-0.2 m-1.5				v2.4 d-0.0 m-0.5							
Sun				GHA				GHA				GHA				GHA							
0	343°32.7	157°38.5	\$01°30.8	89°27.7	\$25°21.0	164°10.4	N01°28.0	94°46.9	\$20°27.3							Denebola	182°31.8	14°28.9					
1	358°35.1	172°38.1	32.1	104°28.6	21.1	179°12.4	27.8	109°49.3	27.3							Gienah	175°50.3	-17°37.9					
2	13°37.6	187°37.8	33.4	119°29.4	21.2	194°14.4	27.6	124°51.6	27.3							Acrux	173°07.4	-63°11.5					
3	28°40.1	202°37.5	.. 34.7	134°30.3	.. 21.4	209°16.3	.. 27.4	139°54.0	.. 27.3							Gacrux	171°58.9	-57°12.4					
4	43°42.5	217°37.2	36.0	149°31.2	21.5	224°18.3	27.2	154°56.4	27.3							Alioth	166°19.4	55°52.4					
5	58°45.0	232°36.9	37.3	164°32.1	21.6	239°20.3	27.0	169°58.8	27.4							Spica	158°29.2	-11°14.7					
6	73°47.5	247°36.6	\$01°38.5	179°33.0	\$25°21.8	254°22.3	N01°26.7	185°01.1	\$20°27.4							Alkaid	152°57.6	49°14.2					
7	88°49.9	262°36.2	39.8	194°33.9	21.9	269°24.3	26.5	200°03.5	27.4							Hadar	148°45.1	-60°27.2					
8	103°52.4	277°35.9	41.1	209°34.8	22.0	284°26.3	26.3	215°05.9	27.4							Menkent	148°05.2	-36°27.0					
9	118°54.9	292°35.6	.. 42.4	224°35.7	.. 22.2	299°28.2	.. 26.1	230°08.2	.. 27.4							Arcturus	145°54.0	19°06.1					
10	133°57.3	307°35.3	43.7	239°36.5	22.3	314°30.2	25.9	245°10.6	27.5							Rigel Kent.	139°49.0	-60°54.2					
11	148°59.8	322°35.0	45.0	254°37.4	22.4	329°32.2	25.7	260°13.0	27.5							Kochab	137°20.8	74°05.7					
12	164°02.3	337°34.7	\$01°46.3	269°38.3	\$25°22.5	344°34.2	N01°25.5	275°15.4	\$20°27.5							Zuben ubi	137°03.1	-16°06.4					
13	179°04.7	352°34.4	47.6	284°39.2	22.7	359°36.2	25.3	290°17.7	27.5							Alphecca	126°09.3	26°39.9					
14	194°07.2	7°34.0	48.8	299°40.1	22.8	14°38.1	25.1	305°20.1	27.6							Antares	112°23.6	-26°27.9					
15	209°09.6	22°33.7	.. 50.1	314°41.0	.. 22.9	29°40.1	.. 24.8	320°22.5	.. 27.6							Atria	107°23.4	-69°03.5					
16	224°12.1	37°33.4	51.4	329°41.8	23.1	44°42.1	24.6	335°24.9	27.6							Sabik	102°10.0	-15°44.5					
17	239°14.6	52°33.1	52.7	344°42.7	23.2	59°44.1	24.4	350°27.2	27.6							Rasalhague	96°18.9	-37°06.8					
18	254°17.0	67°32.8	\$01°54.0	359°43.6	\$25°23.3	74°46.1	N01°24.2	5°29.6	\$20°27.6							Eltanin	90°45.0	51°29.7					
19	269°19.5	82°32.5	55.3	14°44.5	23.5	89°48.0	24.0	20°32.0	27.7							Kaus Aust.	83°40.8	-34°22.4					
20	284°22.0	97°32.1	56.6	29°45.4	23.6	104°50.0	23.8	35°34.3	27.7							Vega	80°37.3	38°48.4					
21	299°24.4	112°31.8	.. 57.9	44°46.2	.. 23.7	119°52.0	.. 23.6	50°36.7	.. 27.7							Nunki	75°55.4	-26°16.4					
22	314°26.9	127°31.5	01°59.2	59°47.1	23.9	134°54.0	23.4	65°39.1	27.7							Altair	62°05.9	8°55.1					
23	329°29.4	142°31.2	02°00.4	74°48.0	24.0	149°56.0	23.2	80°41.5	27.8							Peacock	53°15.4	-56°40.8					
Mer.pass.:01:06				v-0.3 d-1.3 m-3.8				v0.9 d-0.1 m-0.3				v2.0 d-0.2 m-1.5				v2.4 d-0.0 m-0.5							
Mon				GHA				GHA				GHA				GHA							
0	344°31.8	157°30.9	\$02°01.7	89°48.9	\$25°24.1	164°57.9	N01°22.9	95°43.8	\$20°27.8							Sep 03 Sat	SHA	Mer.pass					
1	359°34.3	172°30.6	03.0	104°49.8	24.2	179°59.9	22.7	110°46.2	27.8							Venus	175°12.5	13:29					
2	14°36.7	187°30.2	04.3	119°50.6	24.4	195°01.9	22.5	125°48.6	27.8							Mars	106°32.6	18:03					
3	29°39.2	202°29.9	.. 05.6	134°51.5	.. 24.5	210°03.9	.. 22.3	140°50.9	.. 27.8							Jupiter	180°49.3	13:05					
4	44°41.7	217°29.6	06.9	149°52.4	24.6	225°05.8	22.1	155°53.3	27.9							Saturn	111°16.3	17:42					
5	59°44.1	232°29.3	08.2	164°53.3	24.7	240°07.8	21.9	170°55.7	27.9														
6	74°46.6	247°29.0	\$02°09.5	179°54.1	\$25°24.9	255°09.8	N01°21.7	185°58.0	\$20°27.9							Sep 04 Sun	SHA	Mer.pass					
7	89°49.1	262°28.7	10.7	194°55.0	25.0	270°11.8	21.5	201°00.4	27.9			</td											

DUT1 = UT1-UTC = -0.2487 sec ΔT = TT-UT1 = +68.4327 sec

2016 September 03 to Sep. 05 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°09.7	N07°28.1	162°22.9	14.3'	N01°35.7	-9.7'	55.0'
1	195°09.9	27.2	176°56.2	14.3'	01°26.0	-9.7'	55.0'
2	210°10.1	26.3	191°29.4	14.3'	01°16.3	-9.7'	55.0'
3	225°10.3	.. 25.3	206°02.8	14.3'	01°06.6	-9.7'	55.0'
4	240°10.5	24.4	220°36.1	14.3'	00°56.9	-9.7'	55.0'
5	255°10.7	23.5	235°09.5	14.4'	00°47.2	-9.7'	55.0'
6	270°10.9	N07°22.6	249°42.8	14.4'	N00°37.5	-9.7'	54.9'
7	285°11.1	21.7	264°16.2	14.4'	00°27.8	-9.7'	54.9'
8	300°11.3	20.7	278°49.7	14.4'	00°18.1	-9.7'	54.9'
9	315°11.6	.. 19.8	293°23.1	14.5'	N00°08.4	-9.7'	54.9'
10	330°11.8	18.9	307°56.6	14.5'	S00°01.3	-9.7'	54.9'
11	345°12.0	18.0	322°30.1	14.5'	00°10.9	-9.7'	54.9'
12	0°12.2	N07°17.1	337°03.6	14.5'	S00°20.6	-9.7'	54.8'
13	15°12.4	16.1	351°37.1	14.5'	00°30.2	-9.6'	54.8'
14	30°12.6	15.2	6°10.6	14.5'	00°39.9	-9.6'	54.8'
15	45°12.8	.. 14.3	20°44.2	14.6'	00°49.5	-9.6'	54.8'
16	60°13.0	13.4	35°17.7	14.6'	00°59.2	-9.6'	54.8'
17	75°13.2	12.5	49°51.3	14.6'	01°08.8	-9.6'	54.8'
18	90°13.4	N07°11.5	64°24.9	14.6'	S01°18.4	-9.6'	54.7'
19	105°13.6	10.6	78°58.5	14.6'	01°28.0	-9.6'	54.7'
20	120°13.8	09.7	93°32.2	14.6'	01°37.5	-9.6'	54.7'
21	135°14.0	.. 08.8	108°05.8	14.7'	01°47.1	-9.6'	54.7'
22	150°14.2	07.8	122°39.5	14.7'	01°56.7	-9.5'	54.7'
23	165°14.4	06.9	137°13.1	14.7'	02°06.2	-9.5'	54.7'
	SD.=15.8	d=-0.9			S.D.=14.9		
<b>Sun</b>	<b>GHA</b>	<b>Dec</b>	<b>GHA</b>	<b>ν</b>	<b>Dec</b>	<b>d</b>	<b>HP</b>
0	180°14.6	N07°06.0	151°46.8	14.7'	S02°15.7	-9.5'	54.7'
1	195°14.8	05.1	166°20.5	14.7'	02°25.2	-9.5'	54.6'
2	210°15.0	04.2	180°54.2	14.7'	02°34.7	-9.5'	54.6'
3	225°15.2	.. 03.2	195°27.9	14.7'	02°44.2	-9.5'	54.6'
4	240°15.5	02.3	210°01.7	14.7'	02°53.7	-9.5'	54.6'
5	255°15.7	01.4	224°35.4	14.7'	03°03.1	-9.4'	54.6'
6	270°15.9	N07°00.5	239°09.1	14.7'	S03°12.5	-9.4'	54.6'
7	285°16.1	06°59.5	253°42.9	14.8'	03°22.0	-9.4'	54.6'
8	300°16.3	58.6	268°16.6	14.8'	03°31.3	-9.4'	54.5'
9	315°16.5	.. 57.7	282°50.4	14.8'	03°40.7	-9.4'	54.5'
10	330°16.7	56.8	297°24.2	14.8'	03°50.1	-9.3'	54.5'
11	345°16.9	55.8	311°57.9	14.8'	03°59.4	-9.3'	54.5'
12	0°17.1	N06°54.9	326°31.7	14.8'	S04°08.7	-9.3'	54.5'
13	15°17.3	54.0	341°05.5	14.8'	04°18.0	-9.3'	54.5'
14	30°17.5	53.1	355°39.3	14.8'	04°27.2	-9.2'	54.5'
15	45°17.7	.. 52.1	10°13.1	14.8'	04°36.5	-9.2'	54.5'
16	60°17.9	51.2	24°46.8	14.8'	04°45.7	-9.2'	54.4'
17	75°18.1	50.3	39°20.6	14.8'	04°54.9	-9.2'	54.4'
18	90°18.4	N06°49.4	53°54.4	14.8'	S05°04.0	-9.1'	54.4'
19	105°18.6	48.4	68°28.2	14.8'	05°13.1	-9.1'	54.4'
20	120°18.8	47.5	83°02.0	14.8'	05°22.3	-9.1'	54.4'
21	135°19.0	.. 46.6	97°35.8	14.8'	05°31.3	-9.1'	54.4'
22	150°19.2	45.6	112°09.6	14.8'	05°40.4	-9.0'	54.4'
23	165°19.4	44.7	126°43.4	14.8'	05°49.4	-9.0'	54.4'
	SD.=15.8	d=-0.9			S.D.=14.8		
<b>Mon</b>	<b>GHA</b>	<b>Dec</b>	<b>GHA</b>	<b>ν</b>	<b>Dec</b>	<b>d</b>	<b>HP</b>
0	180°19.6	N06°43.8	141°17.2	14.8'	S05°58.4	-9.0'	54.4'
1	195°19.8	42.9	155°51.0	14.8'	06°07.4	-9.0'	54.3'
2	210°20.0	41.9	170°24.8	14.8'	06°16.3	-8.9'	54.3'
3	225°20.2	.. 41.0	184°58.6	14.8'	06°25.2	-8.9'	54.3'
4	240°20.4	40.1	199°32.3	14.8'	06°34.1	-8.9'	54.3'
5	255°20.7	39.1	214°06.1	14.8'	06°43.0	-8.8'	54.3'
6	270°20.9	N06°38.2	228°39.9	14.8'	S06°51.8	-8.8'	54.3'
7	285°21.1	37.3	243°13.6	14.8'	07°00.6	-8.8'	54.3'
8	300°21.3	36.4	257°47.4	14.8'	07°09.3	-8.7'	54.3'
9	315°21.5	.. 35.4	272°21.1	14.7'	07°18.1	-8.7'	54.3'
10	330°21.7	34.5	286°54.9	14.7'	07°26.7	-8.7'	54.3'
11	345°21.9	33.6	301°28.6	14.7'	07°35.4	-8.6'	54.3'
12	0°22.1	N06°32.6	316°02.3	14.7'	S07°44.0	-8.6'	54.2'
13	15°22.3	31.7	330°36.1	14.7'	07°52.6	-8.6'	54.2'
14	30°22.5	30.8	345°09.8	14.7'	08°01.1	-8.5'	54.2'
15	45°22.7	.. 29.9	359°43.5	14.7'	08°09.6	-8.5'	54.2'
16	60°23.0	28.9	14°17.2	14.7'	08°18.1	-8.5'	54.2'
17	75°23.2	28.0	28°50.8	14.7'	08°26.6	-8.4'	54.2'
18	90°23.4	N06°27.1	43°24.5	14.7'	S08°35.0	-8.4'	54.2'
19	105°23.6	26.1	57°58.1	14.6'	08°43.3	-8.3'	54.2'
20	120°23.8	25.2	72°31.8	14.6'	08°51.6	-8.3'	54.2'
21	135°24.0	.. 24.3	87°05.4	14.6'	08°59.9	-8.3'	54.2'
22	150°24.2	23.3	101°39.0	14.6'	09°08.2	-8.2'	54.2'
23	165°24.4	22.4	116°12.6	14.6'	09°16.4	-8.2'	54.2'
	SD.=15.9	d=-0.9			S.D.=14.8		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°		02:54	04:18	19:37	20:58	
N 70°	01:09	03:18	04:29	19:26	20:36	22:37
68°	01:59	03:35	04:38	19:17	20:19	21:53
66°	02:29	03:49	04:46	19:10	20:06	21:24
64°	02:51	04:01	04:53	19:03	19:55	21:03
62°	03:08	04:10	04:58	18:58	19:45	20:47
60°	03:22	04:19	05:03	18:53	19:37	20:33
N 58°	03:33	04:26	05:07	18:49	19:30	20:22
56°	03:43	04:32	05:11	18:46	19:24	20:12
54°	03:52	04:37	05:14	18:42	19:19	20:04
52°	03:59	04:42	05:17	18:39	19:14	19:57
50°	04:06	04:47	05:20	18:37	19:10	19:50
48°	04:20	04:56	05:26	18:31	19:01	19:37
N 40°	04:30	05:03	05:31	18:26	18:54	19:26
35°	04:39	05:09	05:35	18:22	18:48	19:18
30°	04:46	05:15	05:39	18:18	18:43	19:11
20°	04:57	05:23	05:45	18:12	18:35	19:01
N 10°	05:05	05:29	05:51	18:07	18:28	18:53
0°	05:11	05:35	05:56	18:02	18:23	18:47
S 10°	05:15	05:39	06:01	17:57	18:18	18:43
20°	05:18	05:44	06:06	17:52	18:14	18:40
30°	05:20	05:47	06:11	17:47	18:11	18:39
35°	05:20	05:49	06:15	17:44	18:09	18:38
40°	05:20	05:51	06:18	17:40	18:07	18:39
50°	05:18	05:55	06:22	17:36	18:05	18:39
52°	05:17	05:56	06:30	17:29	18:03	18:42
54°	05:16	05:57	06:32	17:27	18:02	18:43
56°	05:15	05:58	06:35	17:24	18:01	18:44
58°	05:13	05:58	06:38	17:21	18:00	18:46
S 60°	05:11	05:59	06:41	17:18	18:00	18:48
Lat.	Sat	Sun	Mon	Sat	Sun	Mon
N 72°	07:20	08:55	10:30	19:25	19:20	19:14
N 70°	07:20	08:50	10:19	19:27	19:27	19:27
68°	07:21	08:45	10:09	19:29	19:33	19:38
66°	07:21	08:42	10:02	19:30	19:38	19:47
64°	07:21	08:39	09:55	19:31	19:42	19:54
62°	07:21	08:36	09:50	19:33	19:46	20:01
60°	07:22	08:34	09:45	19:34	19:50	20:07
N 58°	07:22	08:32	09:40	19:34	19:52	20:12
56°	07:22	08:30	09:37	19:35	19:55	20:16
54°	07:22	08:28	09:33	19:36	19:57	20:20
52°	07:22	08:27	09:30	19:37	20:00	20:24
50°	07:22	08:25	09:27	19:37	20:02	20:27
45°	07:23	08:22	09:21	19:38	20:06	20:34
N 40°	07:23	08:20	09:16	19:39	20:09	20:40
35°	07:23	08:18	09:12	19:40	20:13	20:45
30°	07:23	08:16	09:08	19:41	20:15	20:50
20°	07:23	08:13	09:02	19:43	20:20	20:58
N 10°	07:24	08:10	08:56	19:44	20:24	21:05
0°	07:24	08:07	08:51	19:45	20:28	21:12
S 10°	07:24	08:05	08:45	19:46	20:32	21:18
20°	07:25	08:02	08:40	19:47	20:37	21:25
30°	07:25	07:59	08:33	19:49	20:41	21:33
35°	07:25	07:5				

## September 06, 07, 08 UT (Tue., Wed., Thu.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	345°31.0	157°23.3	S02°32.6	90°09.8	S25°27.1	165°45.4	N01°17.9	96°40.7	S20°28.3	Alpheratz	357°40.9	29°11.0											
1	0°33.4	172°23.0	33.9	105°10.6	27.2	180°47.4	17.7	111°43.0	28.3	Ankaa	353°13.2	-42°12.8											
2	15°35.9	187°22.6	35.2	120°11.5	27.4	195°49.4	17.4	126°45.4	28.3	Schedar	349°37.4	56°37.6											
3	30°38.3	202°22.3	· · 36.5	135°12.4	· · 27.5	210°51.4	· · 17.2	141°47.8	· · 28.4	Diphda	348°53.4	-17°53.6											
4	45°40.8	217°22.0	37.8	150°13.2	27.6	225°53.3	17.0	156°50.1	28.4	Achernar	335°24.8	-57°09.0											
5	60°43.3	232°21.7	39.0	165°14.1	27.7	240°55.3	16.8	171°52.5	28.4	Hamal	327°58.0	23°32.4											
6	75°45.7	247°21.4	S02°40.3	180°15.0	S25°27.9	255°57.3	N01°16.6	186°54.9	S20°28.4	Polaris	316°31.9	89°19.7											
7	90°48.2	262°21.0	41.6	195°15.8	28.0	270°59.3	16.4	201°57.2	28.5	Acamar	315°16.5	-40°14.2											
8	105°50.7	277°20.7	42.9	210°16.7	28.1	286°01.3	16.2	216°59.6	28.5	Menkar	314°12.6	4°09.2											
9	120°53.1	292°20.4	· · 44.2	225°17.5	· · 28.2	301°03.2	· · 16.0	232°01.9	· · 28.5	Mirfak	308°37.0	49°54.9											
10	135°55.6	307°20.1	45.5	240°18.4	28.3	316°05.2	15.8	247°04.3	28.5	Aldebaran	290°46.8	16°32.4											
11	150°58.1	322°19.8	46.8	255°19.3	28.5	331°07.2	15.5	262°06.7	28.5	Rigel	281°10.0	-8°11.0											
12	166°00.5	337°19.5	S02°48.0	270°20.1	S25°28.6	346°09.2	N01°15.3	277°09.0	S20°28.6	Capella	280°31.3	46°00.5											
13	181°03.0	352°19.1	49.3	285°21.0	28.7	1°11.2	15.1	292°11.4	28.6	Bellatrix	278°29.7	6°21.8											
14	196°05.5	7°18.8	50.6	300°21.8	28.8	16°13.1	14.9	307°13.8	28.6	El Nath	278°09.9	28°37.0											
15	211°07.9	22°18.5	· · 51.9	315°22.7	· · 28.9	31°15.1	· · 14.7	322°16.1	· · 28.6	Alnilam	275°44.2	-1°11.6											
16	226°10.4	37°18.2	53.2	330°23.5	29.1	46°17.1	14.5	337°18.5	28.7	Betelgeuse	270°59.0	7°24.5											
17	241°12.8	52°17.9	54.5	345°24.4	29.2	61°19.1	14.3	352°20.9	28.7	Canopus	263°55.4	-52°42.1											
18	256°15.3	67°17.5	S02°55.8	0°25.3	S25°29.3	76°21.0	N01°14.1	7°23.2	S20°28.7	Sirius	258°31.9	-16°44.3											
19	271°17.8	82°17.2	57.0	15°26.1	29.4	91°23.0	13.8	22°25.6	28.7	Adhara	255°11.0	-28°59.6											
20	286°20.2	97°16.9	58.3	30°27.0	29.5	106°25.0	13.6	37°28.0	28.7	Procyon	244°57.7	5°10.9											
21	301°22.7	112°16.6	02°59.6	45°27.8	· · 29.7	121°27.0	· · 13.4	52°30.3	· · 28.8	Pollux	243°25.3	27°59.0											
22	316°25.2	127°16.3	03°00.9	60°28.7	29.8	136°29.0	13.2	67°32.7	28.8	Avior	234°17.5	-59°33.7											
23	331°27.6	142°16.0	02.2	75°29.5	29.9	151°30.9	13.0	82°35.0	28.8	Suhail	222°51.2	-43°29.9											
Mer.pass.:00:58				v-0.3 d-1.3 m-3.8				v0.9 d-0.1 m-0.2				v2.0 d-0.2 m-1.5				v2.4 d-0.0 m-0.5							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	346°30.1	157°15.6	S03°03.5	90°30.4	S25°30.0	166°32.9	N01°12.8	97°37.4	S20°28.8	Denebola	182°31.8	14°28.9											
1	1°32.6	172°15.3	04.8	105°31.2	30.1	181°34.9	12.6	112°39.8	28.9	Gienah	175°50.3	-17°37.9											
2	16°35.0	187°15.0	06.0	120°32.1	30.2	196°36.9	12.4	127°42.1	28.9	Acrux	173°07.4	-63°11.5											
3	31°37.5	202°14.7	· · 07.3	135°32.9	· · 30.4	211°38.8	· · 12.2	142°44.5	· · 28.9	Gacrux	171°58.9	-57°12.4											
4	46°40.0	217°14.4	08.6	150°33.8	30.5	226°40.8	11.9	157°46.8	28.9	Alioth	166°19.4	55°52.4											
5	61°42.4	232°14.0	09.9	165°34.6	30.6	241°42.8	11.7	172°49.2	29.0	Spica	158°29.2	-11°14.7											
6	76°44.9	247°13.7	S03°11.2	180°35.5	S25°30.7	256°44.8	N01°11.5	187°51.6	S20°29.0	Alkaid	152°57.6	49°14.2											
7	91°47.3	262°13.4	12.5	195°36.3	30.8	271°46.8	11.3	202°53.9	29.0	Hadar	148°45.1	-60°27.2											
8	106°49.8	277°13.1	13.7	210°37.2	30.9	286°48.7	11.1	217°56.3	29.0	Menkent	148°05.2	-36°27.0											
9	121°52.3	292°12.8	· · 15.0	225°38.0	· · 31.1	301°50.7	· · 10.9	232°58.7	· · 29.0	Arcturus	145°54.0	19°06.1											
10	136°54.7	307°12.4	16.3	240°38.9	31.2	316°52.7	10.7	248°01.0	29.1	Rigel Kent.	139°49.0	-60°54.2											
11	151°57.2	322°12.1	17.6	255°39.7	31.3	331°54.7	10.5	263°03.4	29.1	Kochab	137°20.9	74°05.6											
12	166°59.7	337°11.8	S03°18.9	270°40.5	S25°31.4	346°56.6	N01°10.2	278°05.7	S20°29.1	Zuben ubi	137°03.2	-16°06.4											
13	182°02.1	352°11.5	20.2	285°41.4	31.5	1°58.6	10.0	293°08.1	29.1	Alphecca	126°09.3	26°39.9											
14	197°04.6	7°11.2	21.4	300°42.2	31.6	17°00.6	09.8	308°10.5	29.2	Antares	112°23.6	-26°27.9											
15	212°07.1	22°10.8	· · 22.7	315°43.1	· · 31.7	32°02.6	· · 09.6	323°12.8	· · 29.2	Atria	107°23.4	-69°03.5											
16	227°09.5	37°10.5	24.0	330°43.9	31.9	47°04.5	09.4	338°15.2	29.2	Sabik	102°10.0	-15°44.5											
17	242°12.0	52°10.2	25.3	345°44.8	32.0	62°06.5	09.2	353°17.5	29.2	Rasalhague	96°04.4	12°33.3											
18	257°14.4	67°09.9	S03°26.6	0°45.6	S25°32.1	77°08.5	N01°09.0	8°19.9	S20°29.2	Eltanin	90°45.0	51°29.7											
19	272°16.9	82°09.6	27.9	15°46.5	32.2	92°10.5	08.8	23°22.3	29.3	Kaus Aust.	83°40.8	-34°22.4											
20	287°19.4	97°09.2	29.1	30°47.3	32.3	107°12.5	08.5	38°24.6	29.3	Vega	80°37.3	38°48.4											
21	302°21.8	112°08.9	· · 30.4	45°48.1	· · 32.4	122°14.4	· · 08.3	53°27.0	· · 29.3	Nunki	75°55.5	-26°16.4											
22	317°24.3	127°08.6	31.7	60°49.0	32.5	137°16.4	08.1	68°29.3	29.3	Altair	62°05.9	8°55.1											
23	332°26.8	142°08.3	33.0	75°49.8	32.6	152°18.4	07.9	83°31.7	29.4	Peacock	53°15.4	-56°40.8											
Mer.pass.:00:54				v-0.3 d-1.3 m-3.8				v0.9 d-0.1 m-0.2				v2.0 d-0.2 m-1.5				v2.4 d-0.0 m-0.5							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	347°29.2	157°08.0	S03°34.3	90°50.7	S25°32.8	167°20.4	N01°07.7	98°34.0	S20°29.4	Sep 06 Tue	171°52.3	13:31											
1	2°31.7	172°07.6	35.6	105°51.5	32.9	182°22.3	07.5	113°36.4	29.4	Venus	104°38.8	17:58											
2	17°34.2	187°07.3	36.8	120°52.3	33.0	197°24.3	07.3	128°38.8	29.4	Mars	180°14.5	12:55											
3	32°36.6	202°07.0	· · 38.1	135°53.2	· · 33.1	212°26.3	· · 07.1	143°41.1	· · 29.5	Jupiter	111°09.7	17:31											
4	47°39.1	217°06.7	39.4	150°54.0	33.2	227°28.3	06.8	158°43.5	29.5	Saturn	111°07.3	17:27											
5	62°41.6	232°06.4	40.7	165°54.8	33.3	242°30.2	06.6	173°45.8	29.5	Sep 07 Wed	170°45.5	13:31											
6	77°44.0	247°06.0	S03°42.0	180°55.7	S25°33.4	257°32.2	N01°06.4	188°48.2	S20°29.5	Venus	104°00.3	17:57											
7	92°46.5	262°05.7	43.3	195°56.5	33.5	272°34.2	06.2	203°50.5	29.6	Mars	180°02.8	12:52											
8	107°48.9	277°05.4	44.5	210°57.3	33.6	287°36.2	06.0	218°52.															

DUT1 = UT1-UTC = -0.2519 sec ΔT = TT-UT1 = +68.4359 sec

2016 September 06 to Sep. 08 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	180°24.6	N06°21.5		130°46.2	14.6'	S09°24.5	-8.1'	54.2'
1	195°24.9	20.5		145°19.8	14.6'	09°32.6	-8.1'	54.2'
2	210°25.1	19.6		159°53.3	14.5'	09°40.7	-8.1'	54.2'
3	225°25.3	.	18.7	174°26.9	14.5'	09°48.8	-8.0'	54.2'
4	240°25.5		17.7	189°00.4	14.5'	09°56.8	-8.0'	54.2'
5	255°25.7		16.8	203°33.9	14.5'	10°04.7	-7.9'	54.1'
6	270°25.9	N06°15.9		218°07.4	14.5'	S10°12.6	-7.9'	54.1'
7	285°26.1	14.9		232°40.8	14.5'	10°20.5	-7.8'	54.1'
8	300°26.3	14.0		247°14.3	14.4'	10°28.3	-7.8'	54.1'
9	315°26.5	.	13.1	261°47.7	14.4'	10°36.1	-7.7'	54.1'
10	330°26.8	12.1		276°21.1	14.4'	10°43.8	-7.7'	54.1'
11	345°27.0	11.2		290°54.5	14.4'	10°51.5	-7.7'	54.1'
12	0°27.2	N06°10.3		305°27.9	14.4'	S10°59.1	-7.6'	54.1'
13	15°27.4	09.3		320°01.3	14.3'	11°06.7	-7.6'	54.1'
14	30°27.6	08.4		334°34.6	14.3'	11°14.2	-7.5'	54.1'
15	45°27.8	.	07.5	349°07.9	14.3'	11°21.7	-7.5'	54.1'
16	60°28.0	06.5		341°41.2	14.3'	11°29.2	-7.4'	54.1'
17	75°28.2	05.6		18°14.4	14.3'	11°36.6	-7.4'	54.1'
18	90°28.5	N06°04.7		32°47.7	14.2'	S11°43.9	-7.3'	54.1'
19	105°28.7	03.7		47°20.9	14.2'	11°51.2	-7.3'	54.1'
20	120°28.9	02.8		61°54.1	14.2'	11°58.4	-7.2'	54.1'
21	135°29.1	.	01.9	76°27.3	14.2'	12°05.6	-7.2'	54.1'
22	150°29.3	00.9		91°00.4	14.1'	12°12.8	-7.1'	54.1'
23	165°29.5	00.0		105°33.5	14.1'	12°19.8	-7.1'	54.1'
	SD.=15.9	d=-0.9				S.D.=14.8		

Wed	GHA	Dec	GHA	ν	Dec	d	HP	
0	180°29.7	N05°59.0	120°06.6	14.1'	S12°26.9	-7.0'	54.1'	
1	195°29.9	58.1	134°39.7	14.1'	12°33.9	-7.0'	54.1'	
2	210°30.2	57.2	149°12.7	14.0'	12°40.8	-6.9'	54.1'	
3	225°30.4	.	56.2	163°45.7	14.0'	12°47.7	-6.8'	54.1'
4	240°30.6	55.3	178°18.7	14.0'	12°54.5	-6.8'	54.1'	
5	255°30.8	54.4	192°51.7	13.9'	13°01.3	-6.7'	54.1'	
6	270°31.0	N05°53.4	207°24.6	13.9'	S13°08.0	-6.7'	54.1'	
7	285°31.2	52.5	221°57.5	13.9'	13°14.6	-6.6'	54.1'	
8	300°31.4	51.6	236°30.4	13.9'	13°21.2	-6.6'	54.1'	
9	315°31.7	.	50.6	251°03.2	13.8'	13°27.8	-6.5'	54.1'
10	330°31.9	49.7	265°36.1	13.8'	13°34.2	-6.5'	54.2'	
11	345°32.1	48.7	280°08.9	13.8'	13°40.7	-6.4'	54.2'	
12	0°32.3	N05°47.8	294°41.6	13.7'	S13°47.0	-6.3'	54.2'	
13	15°32.5	46.9	309°14.3	13.7'	13°53.3	-6.3'	54.2'	
14	30°32.7	45.9	323°47.0	13.7'	13°59.6	-6.2'	54.2'	
15	45°32.9	.	45.0	338°19.7	13.6'	14°05.8	-6.2'	54.2'
16	60°33.2	44.0	352°52.3	13.6'	14°11.9	-6.1'	54.2'	
17	75°33.4	43.1	7°24.9	13.6'	14°18.0	-6.0'	54.2'	
18	90°33.6	N05°42.2	21°57.5	13.6'	S14°24.0	-6.0'	54.2'	
19	105°33.8	41.2	36°30.0	13.5'	14°29.9	-5.9'	54.2'	
20	120°34.0	40.3	51°02.6	13.5'	14°35.8	-5.9'	54.2'	
21	135°34.2	.	39.3	65°35.0	13.5'	14°41.6	-5.8'	54.2'
22	150°34.4	38.4	80°07.5	13.4'	14°47.4	-5.7'	54.2'	
23	165°34.7	37.5	94°39.9	13.4'	14°53.1	-5.7'	54.2'	
	SD.=15.9	d=-0.9			S.D.=14.8			

Thu	GHA	Dec	GHA	ν	Dec	d	HP	
0	180°34.9	N05°36.5	109°12.2	13.4'	S14°58.7	-5.6'	54.2'	
1	195°35.1	35.6	123°44.6	13.3'	15°04.3	-5.5'	54.2'	
2	210°35.3	34.6	138°16.9	13.3'	15°09.8	-5.5'	54.3'	
3	225°35.5	.	33.7	152°49.2	13.3'	15°15.2	-5.4'	54.3'
4	240°35.7	32.8	167°21.4	13.2'	15°20.6	-5.3'	54.3'	
5	255°35.9	31.8	181°53.6	13.2'	15°25.9	-5.3'	54.3'	
6	270°36.2	N05°30.9	196°25.8	13.1'	S15°31.2	-5.2'	54.3'	
7	285°36.4	29.9	210°57.9	13.1'	15°36.3	-5.1'	54.3'	
8	300°36.6	29.0	225°30.0	13.1'	15°41.4	-5.1'	54.3'	
9	315°36.8	.	28.1	240°02.0	13.0'	15°46.5	-5.0'	54.3'
10	330°37.0	27.1	254°34.1	13.0'	15°51.4	-4.9'	54.3'	
11	345°37.2	26.2	269°06.0	13.0'	15°56.3	-4.9'	54.3'	
12	0°37.5	N05°25.2	283°38.0	12.9'	S16°01.2	-4.8'	54.4'	
13	15°37.7	24.3	298°09.9	12.9'	16°05.9	-4.7'	54.4'	
14	30°37.9	23.3	312°41.8	12.9'	16°10.6	-4.7'	54.4'	
15	45°38.1	.	22.4	327°13.6	12.8'	16°15.2	-4.6'	54.4'
16	60°38.3	21.5	341°45.4	12.8'	16°19.8	-4.5'	54.4'	
17	75°38.5	20.5	356°17.2	12.7'	16°24.2	-4.4'	54.4'	
18	90°38.8	N05°19.6	10°48.9	12.7'	S16°28.6	-4.4'	54.4'	
19	105°39.0	18.6	25°20.6	12.7'	16°33.0	-4.3'	54.5'	
20	120°39.2	17.7	39°52.2	12.6'	16°37.2	-4.2'	54.5'	
21	135°39.4	.	16.7	54°23.8	12.6'	16°41.4	-4.1'	54.5'
22	150°39.6	15.8	68°55.4	12.6'	16°45.5	-4.1'	54.5'	
23	165°39.8	14.9	83°27.0	12.5'	16°49.5	-4.0'	54.5'	
	SD.=15.9	d=-0.9			S.D.=14.8			

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

## September 09, 10, 11 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	
0	348°28.4	157°00.2	S04°05.0	91°10.6	S25°35.4	168°07.8	N01°02.6	99°30.6	S20°30.0					Alpheratz	357°40.8	29°11.0	
1	3°30.8	171°59.9	06.3	106°11.5	35.5	183°09.8	02.4	114°32.9	30.0					Ankaa	353°13.2	-42°12.8	
2	18°33.3	186°59.6	07.6	121°12.3	35.6	198°11.7	02.2	129°35.3	30.0					Schedar	349°37.4	56°37.6	
3	33°35.8	201°59.3	08.9	136°13.1	35.7	213°13.7	02.0	144°37.7	30.0					Diphda	348°53.4	-17°53.6	
4	48°38.2	216°58.9	10.1	151°13.9	35.8	228°15.7	01.7	159°40.0	30.0					Achernar	335°24.8	-57°09.0	
5	63°40.7	231°58.6	11.4	166°14.8	35.9	243°17.7	01.5	174°42.4	30.1					Hamal	327°58.0	23°32.4	
6	78°43.2	246°58.3	S04°12.7	181°15.6	S25°36.0	258°19.7	N01°01.3	189°44.7	S20°30.1					Polaris	316°30.5	89°19.7	
7	93°45.6	261°58.0	14.0	196°16.4	36.1	273°21.6	01.1	204°47.1	30.1					Acamar	315°16.5	-40°14.2	
8	108°48.1	276°57.6	15.3	211°17.2	36.2	288°23.6	00.9	219°49.4	30.1					Menkar	314°12.6	4°09.2	
9	123°50.5	291°57.3	16.5	226°18.1	36.3	303°25.6	00.7	234°51.8	30.2					Mirfak	308°36.9	49°54.9	
10	138°53.0	306°57.0	17.8	241°18.9	36.4	318°27.6	00.5	249°54.1	30.2					Aldebaran	290°46.8	16°32.4	
11	153°55.5	321°56.7	19.1	256°19.7	36.5	333°29.5	00.3	264°56.5	30.2					Rigel	281°10.0	-8°11.0	
12	168°57.9	336°56.3	S04°20.4	271°20.5	S25°36.6	348°31.5	N01°00.0	279°58.8	S20°30.2					Capella	280°31.2	46°00.5	
13	184°00.4	351°56.0	21.7	286°21.3	36.7	3°33.5	00°59.8	295°01.2	30.3					Bellatrix	278°29.7	6°21.8	
14	199°02.9	6°55.7	22.9	301°22.2	36.8	18°35.5	59.6	310°03.5	30.3					Elnath	278°09.9	28°37.0	
15	214°05.3	21°55.4	24.2	316°23.0	36.9	33°37.4	59.4	325°05.9	30.3					Alnilam	275°44.2	-1°11.6	
16	229°07.8	36°55.0	25.5	331°23.8	37.0	48°39.4	59.2	340°08.2	30.3					Betelgeuse	270°59.0	7°24.5	
17	244°10.3	51°54.7	26.8	346°24.6	37.1	63°41.4	59.0	355°10.6	30.4					Canopus	263°55.3	-52°42.1	
18	259°12.7	66°54.4	S04°28.0	1°25.4	S25°37.2	78°43.4	N00°58.8	10°12.9	S20°30.4					Sirius	258°31.9	-16°44.3	
19	274°15.2	81°54.1	29.3	16°26.3	37.3	93°45.3	58.6	25°15.3	30.4					Adhara	255°11.0	-28°59.6	
20	289°17.7	96°53.7	30.6	31°27.1	37.4	108°47.3	58.3	40°17.6	30.4					Procyon	244°57.6	5°10.9	
21	304°20.1	111°53.4	31.9	46°27.9	37.5	123°49.3	58.1	55°20.0	30.5					Pollux	243°25.3	27°59.0	
22	319°22.6	126°53.1	33.1	61°28.7	37.6	138°51.3	57.9	70°22.3	30.5					Avior	234°17.5	-59°33.7	
23	334°25.0	141°52.8	34.4	76°29.5	37.7	153°53.2	57.7	85°24.7	30.5					Suhail	222°51.2	-43°29.9	
Mer.pass.:00:46			v-0.3 d-1.3 m-3.8	v0.8 d-0.1 m-0.2			v2.0 d-0.2 m-1.5			v2.4 d-0.0 m-0.5			Miaplacidus				
Sat			GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	GHA	Dec	
0	349°27.5	156°52.4	S04°35.7	91°30.3	S25°37.8	168°55.2	N00°57.5	100°27.0	S20°30.5					Denebola	182°31.8	61°39.7	
1	4°30.0	171°52.1	37.0	106°31.2	37.9	183°57.2	57.3	115°29.4	30.5					Gienah	175°50.3	-17°37.9	
2	19°32.4	186°51.8	38.3	121°32.0	38.0	198°59.2	57.1	130°31.7	30.6					Acrux	173°07.4	-63°11.5	
3	34°34.9	201°51.5	39.5	136°32.8	38.1	214°01.1	56.9	145°34.1	30.6					Gacrux	171°58.9	-57°12.4	
4	49°37.4	216°51.1	40.8	151°33.6	38.2	229°03.1	56.6	160°36.4	30.6					Alioth	166°19.4	55°52.4	
5	64°39.8	231°50.8	42.1	166°34.4	38.3	244°05.1	56.4	175°38.8	30.6					Spica	158°29.2	-11°14.7	
6	79°42.3	246°50.5	S04°43.4	181°35.2	S25°38.4	259°07.1	N00°56.2	190°41.1	S20°30.7					Alkaid	152°57.6	49°14.2	
7	94°44.8	261°50.2	44.6	196°36.0	38.5	274°09.0	56.0	205°43.5	30.7					Hadar	148°45.1	-60°27.2	
8	109°47.2	276°49.8	45.9	211°36.8	38.6	289°11.0	55.8	220°45.8	30.7					Menkent	148°05.2	-36°27.0	
9	124°49.7	291°49.5	47.2	226°37.7	38.7	304°13.0	55.6	235°48.2	30.7					Arcturus	145°54.0	19°06.1	
10	139°52.2	306°49.2	48.5	241°38.5	38.8	319°15.0	55.4	250°50.5	30.8					Rigel Kent.	139°49.0	-60°54.2	
11	154°54.6	321°48.9	49.7	256°39.3	38.9	334°16.9	55.2	265°52.9	30.8					Kochab	137°20.9	74°05.6	
12	169°57.1	336°48.5	S04°51.0	271°40.1	S25°39.0	349°18.9	N00°54.9	280°55.2	S20°30.8					Zuben' ubi	137°03.2	-16°06.4	
13	184°59.5	351°48.2	52.3	286°40.9	39.1	4°20.9	54.7	295°57.6	30.8					Alphecca	126°09.3	26°39.9	
14	200°02.0	6°47.9	53.6	301°41.7	39.2	19°22.9	54.5	310°59.9	30.9					Antares	112°23.6	-26°27.9	
15	215°04.5	21°47.5	54.8	316°42.5	39.3	34°24.8	54.3	326°02.3	30.9					Atria	107°23.4	-69°03.5	
16	230°06.9	36°47.2	56.1	331°43.3	39.4	49°26.8	54.1	341°04.6	30.9					Sabik	102°10.0	-15°44.5	
17	245°09.4	51°46.9	57.4	346°44.1	39.5	64°28.8	53.9	356°07.0	30.9					Rasalhague	96°04.4	12°33.3	
18	260°11.9	66°46.6	S04°58.7	1°44.9	S25°39.5	79°30.8	N00°53.7	11°09.3	S20°31.0					Eltanin	90°45.0	51°29.7	
19	275°14.3	81°46.2	04°59.9	16°45.7	39.6	94°32.7	53.4	26°11.7	31.0					Kaus Aust.	83°40.8	-34°22.4	
20	290°16.8	96°45.9	05°01.2	31°46.5	39.7	109°34.7	53.2	41°14.0	31.0					Vega	80°37.3	38°48.4	
21	305°19.3	111°45.6	02.5	46°47.3	39.8	124°36.7	53.0	56°16.4	31.0					Nunki	75°55.5	-26°16.4	
22	320°21.7	126°45.2	03.7	61°48.2	39.9	139°38.7	52.8	71°18.7	31.1					Altair	62°05.9	8°55.1	
23	335°24.2	141°44.9	05.0	76°49.0	40.0	154°40.6	52.6	86°21.0	31.1					Peacock	53°15.5	-56°40.8	
Mer.pass.:00:42			v-0.3 d-1.3 m-3.8	v0.8 d-0.1 m-0.2			v2.0 d-0.2 m-1.5			v2.4 d-0.0 m-0.5			Deneb				
Sun			GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	GHA	GHA	Dec	GHA	Dec	
0	350°26.6	156°44.6	S05°06.3	91°49.8	S25°40.1	169°42.6	N00°52.4	101°23.4	S20°31.1					Sep 09 Fri	SHA	Mer.pass	
1	5°29.1	171°44.3	07.6	106°50.6	40.2	184°44.6	52.2	116°25.7	31.1					Venus	168°31.9	13:32	
2	20°31.6	186°43.9	08.8	121°51.4	40.3	199°46.6	52.0	131°28.1	31.2					Mars	102°42.3	17:54	
3	35°34.0	201°43.6	10.1	136°52.2	40.4	214°48.5	51.7	146°30.4	31.2					Jupiter	179°39.4	12:46	
4	50°36.5	216°43.3	11.4	151°53.0	40.5	229°50.5	51.5	161°32.8	31.2					Saturn	111°02.2	17:19	
5	65°39.0	231°42.9	12.7	166°53.8	40.6	244°52.5	51.3	176°35.1	31.2								
6	80°41.4	246°42.6	S05°13.9	181°54.6	S25°40.7	259°54.4	N00°51.1	191°37.5	S20°31.3					Sep 10 Sat	SHA	Mer.pass	
7	95°43.9	261°42.3	15.2	196°55.4	40.8	274°56.4	50.9	206°39.8	31.3					Venus	167°24.9	13:33	
8	110°46.4	276°42.0	16.5	211°56.2	40.8	289°58.4	50.7	221°42.2	31.3					Mars	102°02.8	17:53	
9	125°48.8	291°41.6	17.7	226°57.0	40.9	305°00.4	50.5	236°44.5	31.3					Jupiter	179°27.7	12:43	
10	140°51.3	306°41.3	19.0	241°57.8	41.0	320°02.3	50.3	251°46.8	31.4					Saturn	110°59.5	17:15	
11	155°53.8	321°41.0	20.3	256°58.6	41.1	335°04.3	50.0	266°49.2	31.4								
12	170°56.2	336°40.6	S05°21.6	271°59.4	S25°41.2	350°06.3	N00°49.8	281°51.5	S20°31.4					Sep 11 Sun	SHA	Mer.pass	
13	185°58.7	351°40.3</td															

DUT1 = UT1-UTC = -0.2552 sec ΔT = TT-UT1 = +68.4392 sec

2016 September 09 to Sep. 11 UT

h	Sun			Moon											
Fri	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight	Civil	Sunrise	Sunset	Twilight	Civil	Naut.
0	180°40.1	N05°13.9	97°58.5	12.5'	\$16°53.5	-3.9'	54.5'	N 72°	01:20	03:30	04:46	19:05	20:19	22:23	
1	195°40.3	13.0	112°29.9	12.4'	16°57.4	-3.8'	54.5'	N 70°	02:08	03:47	04:54	18:57	20:03	21:40	
2	210°40.5	12.0	127°01.3	12.4'	17°01.2	-3.8'	54.6'	68°	02:37	04:00	05:00	18:51	19:50	21:12	
3	225°40.7	.. 11.1	141°32.7	12.4'	17°04.9	-3.7'	54.6'	66°	02:59	04:11	05:05	18:46	19:40	20:51	
4	240°40.9	10.1	156°04.1	12.3'	17°08.6	-3.6'	54.6'	64°	03:15	04:20	05:10	18:42	19:32	20:35	
5	255°41.1	09.2	170°35.4	12.3'	17°12.2	-3.5'	54.6'	62°	03:29	04:27	05:14	18:38	19:24	20:22	
6	270°41.4	N05°08.2	185°06.6	12.2'	\$17°15.7	-3.5'	54.6'	60°	03:40	04:34	05:17	18:35	19:18	20:11	
7	285°41.6	07.3	199°37.9	12.2'	17°19.1	-3.4'	54.6'	N 58°	03:49	04:39	05:20	18:32	19:13	20:02	
8	300°41.8	06.4	214°09.0	12.2'	17°22.4	-3.3'	54.7'	56°	03:58	04:44	05:22	18:30	19:08	19:54	
9	315°42.0	.. 05.4	228°40.2	12.1'	17°25.7	-3.2'	54.7'	54°	04:05	04:49	05:25	18:28	19:04	19:47	
10	330°42.2	04.5	243°11.3	12.1'	17°28.9	-3.1'	54.7'	52°	04:11	04:53	05:27	18:26	19:00	19:41	
11	345°42.5	03.5	257°42.4	12.1'	17°32.0	-3.1'	54.7'	50°	04:16	04:56	05:29	18:24	18:57	19:36	
12	0°42.7	N05°02.6	272°13.4	12.0'	\$17°35.0	-3.0'	54.7'	45°	04:28	05:03	05:33	18:20	18:49	19:25	
13	15°42.9	01.6	286°44.4	12.0'	17°37.9	-2.9'	54.7'	N 40°	04:37	05:09	05:36	18:16	18:44	19:16	
14	30°43.1	05°00.7	301°15.3	11.9'	17°40.8	-2.8'	54.8'	35°	04:44	05:14	05:39	18:14	18:39	19:09	
15	45°43.3	04°59.7	315°46.3	11.9'	17°43.6	-2.7'	54.8'	30°	04:50	05:18	05:42	18:11	18:35	19:03	
16	60°43.5	58.8	330°17.1	11.9'	17°46.3	-2.7'	54.8'	20°	04:58	05:24	05:46	18:07	18:29	18:55	
17	75°43.8	57.8	344°48.0	11.8'	17°48.9	-2.6'	54.8'	N 10°	05:05	05:29	05:50	18:03	18:24	18:49	
18	90°44.0	N04°56.9	359°18.8	11.8'	\$17°51.4	-2.5'	54.8'	0°	05:09	05:33	05:54	18:00	18:21	18:45	
19	105°44.2	55.9	13°49.5	11.7'	17°53.9	-2.4'	54.9'	S 10°	05:11	05:36	05:57	17:57	18:18	18:42	
20	120°44.4	55.0	28°20.2	11.7'	17°56.2	-2.3'	54.9'	20°	05:13	05:38	06:00	17:54	18:16	18:41	
21	135°44.6	.. 54.1	42°50.9	11.7'	17°58.5	-2.2'	54.9'	30°	05:12	05:40	06:04	17:50	18:14	18:42	
22	150°44.9	53.1	57°21.6	11.6'	18°00.7	-2.2'	54.9'	35°	05:12	05:41	06:06	17:48	18:13	18:43	
23	165°45.1	52.2	71°52.2	11.6'	18°02.8	-2.1'	55.0'	40°	05:10	05:42	06:09	17:46	18:13	18:44	
	SD.=15.9	d=-0.9			S.D.=14.9			55°	05:08	05:42	06:11	17:43	18:12	18:46	
Sat	GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Moonrise	Sat	Sun	Fri	Sat	Sun	
0	180°45.3	N04°51.2	86°22.7	11.5'	\$18°04.8	-2.0'	55.0'	S 50°	05:05	05:42	06:14	17:40	18:12	18:50	
1	195°45.5	50.3	100°53.3	11.5'	18°06.8	-1.9'	55.0'	52°	05:03	05:42	06:16	17:39	18:12	18:51	
2	210°45.7	49.3	115°23.8	11.5'	18°08.6	-1.8'	55.0'	54°	05:01	05:42	06:17	17:37	18:12	18:53	
3	225°45.9	.. 48.4	129°54.2	11.4'	18°10.4	-1.7'	55.0'	56°	04:59	05:42	06:19	17:35	18:13	18:56	
4	240°46.2	47.4	144°24.6	11.4'	18°12.1	-1.6'	55.1'	58°	04:57	05:42	06:21	17:34	18:13	18:58	
5	255°46.4	46.5	158°55.0	11.4'	18°13.7	-1.5'	55.1'	S 60°	04:54	05:42	06:23	17:32	18:13	19:02	
6	270°46.6	N04°45.5	173°25.3	11.3'	\$18°15.2	-1.5'	55.1'								
7	285°46.8	44.6	187°55.6	11.3'	18°16.6	-1.4'	55.1'								
8	300°47.0	43.6	202°25.9	11.2'	18°17.9	-1.3'	55.2'								
9	315°47.3	.. 42.7	216°56.1	11.2'	18°19.1	-1.2'	55.2'								
10	330°47.5	41.7	231°26.3	11.2'	18°20.3	-1.1'	55.2'								
11	345°47.7	40.8	245°56.4	11.1'	18°21.4	-1.0'	55.2'								
12	0°47.9	N04°39.8	260°26.6	11.1'	\$18°22.3	-0.9'	55.3'								
13	15°48.1	38.9	274°56.6	11.1'	18°23.2	-0.8'	55.3'								
14	30°48.4	37.9	289°26.7	11.0'	18°24.0	-0.7'	55.3'								
15	45°48.6	.. 37.0	303°56.7	11.0'	18°24.7	-0.7'	55.3'								
16	60°48.8	36.0	318°26.6	10.9'	18°25.3	-0.6'	55.4'								
17	75°49.0	35.1	332°56.6	10.9'	18°25.8	-0.5'	55.4'								
18	90°49.2	N04°34.1	347°26.5	10.9'	\$18°26.2	-0.4'	55.4'								
19	105°49.5	33.2	1°56.3	10.8'	18°26.6	-0.3'	55.4'								
20	120°49.7	32.2	16°26.1	10.8'	18°26.8	-0.2'	55.5'								
21	135°49.9	.. 31.3	30°55.9	10.8'	18°27.0	-0.1'	55.5'								
22	150°50.1	30.3	45°25.7	10.7'	18°27.0	0.0'	55.5'								
23	165°50.3	29.4	59°55.4	10.7'	18°27.0	0.1'	55.6'								
	SD.=15.9	d=-0.9			S.D.=15.1										
Sun	GHA	Dec	GHA	ν	Dec	d	HP	Day	Sun	Mer.	Moon				
0	180°50.6	N04°28.4	74°25.1	10.7'	\$18°26.8	0.2'	55.6'	Eqn.of Time	Mer. Pass.	Upper Pass.	Mer. Pass.	Age			
1	195°50.8	27.5	88°54.7	10.6'	18°26.6	0.3'	55.6'	00 <sup>h</sup>	12 <sup>h</sup>	Lower Pass.	Pass hh:mm	hh:mm	8-10		
2	210°51.0	26.5	103°24.4	10.6'	18°26.3	0.4'	55.6'	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	50-69%		
3	225°51.2	.. 25.6	117°53.9	10.6'	18°25.9	0.5'	55.7'								
4	240°51.4	24.6	132°23.5	10.5'	18°25.3	0.6'	55.7'								
5	255°51.7	23.7	146°53.0	10.5'	18°24.7	0.7'	55.7'								
6	270°51.9	N04°22.7	161°22.5	10.5'	\$18°24.0	0.8'	55.8'								
7	285°52.1	21.8	175°51.9	10.4'	18°23.2	0.8'	55.8'								
8	300°52.3	20.8	190°21.4	10.4'	18°22.3	0.9'	55.8'								
9	315°52.5	.. 19.9	204°50.8	10.4'	18°21.3	1.0'	55.9'								
10	330°52.8	18.9	219°20.1	10.3'	18°20.3	1.1'	55.9'								
11	345°53.0	18.0	233°49.4	10.3'	18°19.1	1.2'	55.9'								
12	0°53.2	N04°17.0	248°18.7	10.3'	\$18°17.8	1.3'	55.9'								
13	15°53.4	16.1	262°48.0	10.2'	18°16.4	1.4'	56.0'								
14	30°53.6	15.1	277°17.2	10.2'	18°14.9	1.5'	56.0'								
15	45°53.9	.. 14.1	291°46.4	10.2'	18°13.4	1.6'	56.0'								
16	60°54.1	13.2	306°15.6	10.2'	18°11.7	1.7'	56.1'								
17	75°54.3	12.2	320°44.8	10.1'	18°09.9	1.8'	56.1'								
18	90°54.5	N04°11.3	335°13.9	10.1'	\$18°08.0	1.9'	56.1'								
19	105°54.7	10.3	349°43.0	10.1'	18°06.1	2.0'	56.2'								
20	120°55.0	09.4	4°12.0	10.0'	18°04.0	2.1'	56.2'								
21	135°55.2	.. 08.4	18°41.1	10.0'	18°01.9	2.2'	56.2'								
22	150°55.4	07.5	33°10.1	10.0'	17°59.6	2.3'	56.3'								
23	165°55.6	06.5	47°39.0	10.0'	17°57.2	2.4'	56.3'								
	SD.=15.9	d=-1.0			S.D.=15.2										

## September 12, 13, 14 UT (Mon., Tue., Wed.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	351°25.8	156°36.7	\$05°36.8	92°08.9	\$25°42.3	170°30.0	N00°47.3	102°19.7	\$20°31.7	Alpheratz	357°40.8	29°11.0											
1	6°28.3	171°36.3	38.1	107°09.7	42.3	185°32.0	47.1	117°22.0	31.7	Ankaa	353°13.2	-42°12.8											
2	21°30.7	186°36.0	39.3	122°10.5	42.4	200°33.9	46.8	132°24.3	31.8	Schedar	349°37.4	56°37.7											
3	36°33.2	201°35.7	· · 40.6	137°11.3	· · 42.5	215°35.9	· · 46.6	147°26.7	· · 31.8	Diphda	348°53.4	-17°53.6											
4	51°35.6	216°35.3	41.9	152°12.1	42.6	230°37.9	46.4	162°29.0	31.8	Achernar	335°24.8	-57°09.0											
5	66°38.1	231°35.0	43.1	167°12.9	42.7	245°39.8	46.2	177°31.4	31.8	Hamal	327°58.0	23°32.4											
6	81°40.6	246°34.7	\$05°44.4	182°13.6	\$25°42.8	260°41.8	N00°46.0	192°33.7	\$20°31.9	Polaris	316°29.2	89°19.7											
7	96°43.0	261°34.3	45.7	197°14.4	42.9	275°43.8	45.8	207°36.0	31.9	Acamar	315°16.5	-40°14.2											
8	111°45.5	276°34.0	46.9	212°15.2	42.9	290°45.8	45.6	222°38.4	31.9	Menkar	314°12.6	4°09.3											
9	126°48.0	291°33.7	· · 48.2	227°16.0	· · 43.0	305°47.7	· · 45.3	237°40.7	· · 31.9	Mirfak	308°36.9	49°54.9											
10	141°50.4	306°33.3	49.5	242°16.8	43.1	320°49.7	45.1	252°43.1	32.0	Aldebaran	290°46.8	16°32.4											
11	156°52.9	321°33.0	50.7	257°17.6	43.2	335°51.7	44.9	267°45.4	32.0	Rigel	281°09.9	-8°11.0											
12	171°55.4	336°32.6	\$05°52.0	272°18.4	\$25°43.3	350°53.7	N00°44.7	282°47.8	\$20°32.0	Capella	280°31.2	46°00.5											
13	186°57.8	351°32.3	53.3	287°19.2	43.4	5°55.6	44.5	297°50.1	32.0	Bellatrix	278°29.7	6°21.8											
14	202°00.3	6°32.0	54.5	302°19.9	43.4	20°57.6	44.3	312°52.4	32.1	El Nath	278°09.9	28°37.0											
15	217°02.7	21°31.6	· · 55.8	317°20.7	· · 43.5	35°59.6	· · 44.1	327°54.8	· · 32.1	Alnilam	275°44.2	-1°11.5											
16	232°05.2	36°31.3	57.1	332°21.5	43.6	51°01.6	43.9	342°57.1	32.1	Betelgeuse	270°59.0	7°24.5											
17	247°07.7	51°31.0	58.3	347°22.3	43.7	66°03.5	43.6	357°59.5	32.1	Canopus	263°55.3	-52°42.1											
18	262°10.1	66°30.6	\$05°59.6	2°23.1	\$25°43.8	81°05.5	N00°43.4	13°01.8	\$20°32.2	Sirius	258°31.9	-16°44.3											
19	277°12.6	81°30.3	06°00.9	17°23.9	43.8	96°07.5	43.2	28°04.1	32.2	Adhara	255°10.9	-28°59.6											
20	292°15.1	96°30.0	02.1	32°24.7	43.9	111°09.4	43.0	43°06.5	32.2	Procyon	244°57.6	5°10.9											
21	307°17.5	111°29.6	· · 03.4	47°25.4	· · 44.0	126°11.4	· · 42.8	58°08.8	· · 32.2	Pollux	243°25.3	27°59.0											
22	322°20.0	126°29.3	04.7	62°26.2	44.1	141°13.4	42.6	73°11.1	32.3	Avior	234°17.5	-59°33.6											
23	337°22.5	141°29.0	05.9	77°27.0	44.2	156°15.4	42.4	88°13.5	32.3	Suhail	222°51.1	-43°29.9											
Mer.pass.:00:34				v-0.3 d-1.3 m-3.8				v0.8 d-0.1 m-0.2				v2.0 d-0.2 m-1.5				v2.3 d-0.0 m-0.5							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	352°24.9	156°28.6	\$06°07.2	92°27.8	\$25°44.2	171°17.3	N00°42.1	103°15.8	\$20°32.3	Denebola	182°31.8	14°28.9											
1	7°27.4	171°28.3	08.4	107°28.6	44.3	186°19.3	41.9	118°18.2	32.3	Gienah	175°50.3	-17°37.9											
2	22°29.9	186°27.9	09.7	122°29.3	44.4	201°21.3	41.7	133°20.5	32.4	Acrua	173°07.4	-63°11.5											
3	37°32.3	201°27.6	· · 11.0	137°30.1	· · 44.5	216°23.3	· · 41.5	148°22.8	· · 32.4	Gacrux	171°58.9	-57°12.3											
4	52°34.8	216°27.3	12.2	152°30.9	44.6	231°25.2	41.3	163°25.2	32.4	Alioth	166°19.4	55°52.4											
5	67°37.2	231°26.9	13.5	167°31.7	44.6	246°27.2	41.1	178°27.5	32.4	Spica	158°29.2	-11°14.7											
6	82°39.7	246°26.6	\$06°14.8	182°32.5	\$25°44.7	261°29.2	N00°40.9	193°29.9	\$20°32.5	Alkaid	152°57.6	49°14.1											
7	97°42.2	261°26.3	16.0	197°33.2	44.8	276°31.2	40.7	208°32.2	32.5	Hadar	148°45.1	-60°27.2											
8	112°44.6	276°25.9	17.3	212°34.0	44.9	291°33.1	40.4	223°34.5	32.5	Menkent	148°05.2	-36°27.0											
9	127°47.1	291°25.6	· · 18.5	227°34.8	· · 45.0	306°35.1	· · 40.2	238°36.9	· · 32.5	Arcturus	145°54.0	19°06.1											
10	142°49.6	306°25.2	19.8	242°35.6	45.0	321°37.1	40.0	253°39.2	32.6	Rigel Kent.	139°49.1	-60°54.2											
11	157°52.0	321°24.9	21.1	257°36.3	45.1	336°39.0	39.8	268°41.5	32.6	Kochab	137°21.0	74°05.6											
12	172°54.5	336°24.6	\$06°22.3	272°37.1	\$25°45.2	351°41.0	N00°39.6	283°43.9	\$20°32.6	Zuben ubi	137°03.2	-16°06.4											
13	187°57.0	351°24.2	23.6	287°37.9	45.3	6°43.0	39.4	298°46.2	32.6	Alphecca	126°09.3	26°39.9											
14	202°59.4	6°23.9	24.9	302°38.7	45.3	21°45.0	39.2	313°48.5	32.7	Antares	112°23.6	-26°27.9											
15	218°01.9	21°23.6	· · 26.1	317°39.4	· · 45.4	36°46.9	· · 38.9	328°50.9	· · 32.7	Atria	107°23.5	-69°03.5											
16	233°04.4	36°23.2	27.4	332°40.2	45.5	51°48.9	38.7	343°53.2	32.7	Sabik	102°10.0	-15°44.5											
17	248°06.8	51°22.9	28.6	347°41.0	45.6	66°50.9	38.5	358°55.6	32.7	Rasalhague	96°04.4	12°33.3											
18	263°09.3	66°22.5	\$06°29.9	2°41.8	\$25°45.6	81°52.9	N00°38.3	13°57.9	\$20°32.8	Eltanin	90°45.1	51°29.7											
19	278°11.7	81°22.2	31.2	17°42.5	45.7	96°54.8	38.1	29°00.2	32.8	Kaus Aust.	83°40.8	-34°22.4											
20	293°14.2	96°21.9	32.4	32°43.3	45.8	111°56.8	37.9	44°02.6	32.8	Vega	80°37.3	38°48.4											
21	308°16.7	111°21.5	· · 33.7	47°44.1	· · 45.9	126°58.8	· · 37.7	59°04.9	· · 32.9	Nunki	75°55.5	-26°16.4											
22	323°19.1	126°21.2	34.9	62°44.9	45.9	142°00.7	37.4	74°07.2	32.9	Altair	62°05.9	8°55.1											
23	338°21.6	141°20.8	36.2	77°45.6	46.0	157°02.7	37.2	89°09.6	32.9	Peacock	53°15.5	-56°40.8											
Mer.pass.:00:30				v-0.3 d-1.3 m-3.8				v0.8 d-0.1 m-0.1				v2.0 d-0.2 m-1.5				v2.3 d-0.0 m-0.5							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	353°24.1	156°20.5	\$06°37.5	92°46.4	\$25°46.1	172°04.7	N00°37.0	104°11.9	\$20°32.9	Sep 12 Mon	15°21.3	-29°31.9											
1	8°26.5	171°20.1	38.7	107°47.2	46.1	187°06.7	36.8	119°14.2	33.0	Venus	165°10.9	13:34											
2	23°29.0	186°19.8	40.0	122°47.9	46.2	202°08.6	36.6	134°16.6	33.0	Mars	100°43.1	17:50											
3	38°31.5	201°19.5	· · 41.2	137°48.7	· · 46.3	217°10.6	· · 36.4	149°18.9	· · 33.0	Jupiter	179°04.2	12:36											
4	53°33.9	216°19.1	42.5	152°49.5	46.4	232°12.6	36.2	164°21.2	33.0	Saturn	110°53.9	17:08											
5	68°36.4	231°18.8	43.7	167°50.2	46.4	247°14.5	36.0	179°23.6	33.1	Sep 13 Tue	13°50.9	28°10.6											
6	83°38.8	246°18.4	\$06°45.0	182°51.0	\$25°46.5	262°16.5	N00°35.7	194°25.9	\$20°33.1	Venus	164°03.7	13:34											
7	98°41.3	261°18.1	46.3	197°51.8	46.6	277°18.5	35.5	209															

DUT1 = UT1-UTC = -0.2584 sec ΔT = TT-UT1 = +68.4424 sec

2016 September 12 to Sep. 14 UT

h		Sun			Moon			
Mon		GHA	Dec	GHA	ν	Dec	d	HP
0	180°55.9	N04°05.6	62°08.0	9.9'	S17°54.8	2.5'	56.3'	
1	195°56.1	04.6	76°36.9	9.9'	17°52.2	2.6'	56.4'	
2	210°56.3	03.7	91°05.8	9.9'	17°49.6	2.7'	56.4'	
3	225°56.5	.. 02.7	105°34.7	9.9'	17°46.8	2.8'	56.4'	
4	240°56.7	01.7	120°03.5	9.8'	17°44.0	2.9'	56.5'	
5	255°57.0	04°00.8	134°32.4	9.8'	17°41.0	3.0'	56.5'	
6	270°57.2	N03°59.8	149°01.2	9.8'	S17°38.0	3.1'	56.5'	
7	285°57.4	58.9	163°29.9	9.8'	17°34.8	3.2'	56.6'	
8	300°57.6	57.9	177°58.7	9.7'	17°31.6	3.3'	56.6'	
9	315°57.8	.. 57.0	192°27.4	9.7'	17°28.2	3.4'	56.6'	
10	330°58.1	56.0	206°56.1	9.7'	17°24.8	3.5'	56.7'	
11	345°58.3	55.1	221°24.8	9.7'	17°21.2	3.6'	56.7'	
12	0°58.5	N03°54.1	235°53.5	9.6'	S17°17.6	3.7'	56.7'	
13	15°58.7	53.2	250°22.1	9.6'	17°13.8	3.8'	56.8'	
14	30°59.0	52.2	264°50.7	9.6'	17°10.0	3.9'	56.8'	
15	45°59.2	.. 51.2	279°19.3	9.6'	17°06.0	4.0'	56.9'	
16	60°59.4	50.3	293°47.9	9.6'	17°02.0	4.1'	56.9'	
17	75°59.6	49.3	308°16.4	9.5'	16°57.8	4.2'	56.9'	
18	90°59.8	N03°48.4	322°45.0	9.5'	S16°53.6	4.3'	57.0'	
19	106°00.1	47.4	337°13.5	9.5'	16°49.2	4.4'	57.0'	
20	121°00.3	46.5	351°42.0	9.5'	16°44.8	4.5'	57.0'	
21	136°00.5	.. 45.5	6°10.5	9.5'	16°40.3	4.6'	57.1'	
22	151°00.7	44.5	20°38.9	9.4'	16°35.6	4.7'	57.1'	
23	166°01.0	43.6	35°07.4	9.4'	16°30.9	4.8'	57.1'	
		SD.=15.9	d=-1.0	S.D.=15.5				

Tue	GHA	Dec	GHA	ν	Dec	d	HP	
0	181°01.2	N03°42.6	49°35.8	9.4'	S16°26.0	4.9'	57.2'	
1	196°01.4	41.7	64°04.2	9.4'	16°21.1	5.0'	57.2'	
2	211°01.6	40.7	78°32.6	9.4'	16°16.1	5.1'	57.3'	
3	226°01.8	.. 39.8	93°01.0	9.4'	16°11.0	5.2'	57.3'	
4	241°02.1	38.8	107°29.3	9.3'	16°05.7	5.3'	57.3'	
5	256°02.3	37.8	121°57.6	9.3'	16°00.4	5.4'	57.4'	
6	271°02.5	N03°36.9	136°26.0	9.3'	S15°55.0	5.5'	57.4'	
7	286°02.7	35.9	150°54.3	9.3'	15°49.5	5.6'	57.4'	
8	301°03.0	35.0	165°22.6	9.3'	15°43.9	5.7'	57.5'	
9	316°03.2	.. 34.0	179°50.9	9.3'	15°38.1	5.8'	57.5'	
10	331°03.4	33.1	194°19.1	9.3'	15°32.3	5.9'	57.5'	
11	346°03.6	32.1	208°47.4	9.2'	15°26.4	6.0'	57.6'	
12	1°03.8	N03°31.1	223°15.6	9.2'	S15°20.4	6.0'	57.6'	
13	16°04.1	30.2	237°43.8	9.2'	15°14.3	6.1'	57.7'	
14	31°04.3	29.2	252°12.0	9.2'	15°08.2	6.2'	57.7'	
15	46°04.5	.. 28.3	266°40.2	9.2'	15°01.9	6.3'	57.7'	
16	61°04.7	27.3	281°08.4	9.2'	14°55.5	6.4'	57.8'	
17	76°05.0	26.4	295°36.6	9.2'	14°49.0	6.5'	57.8'	
18	91°05.2	N03°25.4	310°04.8	9.2'	S14°42.5	6.6'	57.8'	
19	106°05.4	24.4	324°32.9	9.1'	14°35.8	6.7'	57.9'	
20	121°05.6	23.5	339°01.0	9.1'	14°29.0	6.8'	57.9'	
21	136°05.9	.. 22.5	353°29.2	9.1'	14°22.2	6.9'	58.0'	
22	151°06.1	21.6	7°57.3	9.1'	14°15.3	7.0'	58.0'	
23	166°06.3	20.6	22°25.4	9.1'	14°08.2	7.1'	58.0'	
		SD.=15.9	d=-1.0	S.D.=15.7				

Wed	GHA	Dec	GHA	ν	Dec	d	HP	
0	181°06.5	N03°19.6	36°53.5	9.1'	S14°01.1	7.2'	58.1'	
1	196°06.7	18.7	51°21.6	9.1'	13°53.9	7.3'	58.1'	
2	211°07.0	17.7	65°49.7	9.1'	13°46.6	7.3'	58.1'	
3	226°07.2	.. 16.8	80°17.7	9.1'	13°39.2	7.4'	58.2'	
4	241°07.4	15.8	94°45.8	9.1'	13°31.8	7.5'	58.2'	
5	256°07.6	14.8	109°13.8	9.0'	13°24.2	7.6'	58.2'	
6	271°07.9	N03°13.9	123°41.9	9.0'	S13°16.5	7.7'	58.3'	
7	286°08.1	12.9	138°09.9	9.0'	13°08.8	7.8'	58.3'	
8	301°08.3	12.0	152°37.9	9.0'	13°01.0	7.9'	58.4'	
9	316°08.5	.. 11.0	167°05.9	9.0'	12°53.1	8.0'	58.4'	
10	331°08.8	10.0	181°33.9	9.0'	12°45.1	8.0'	58.4'	
11	346°09.0	09.1	196°01.9	9.0'	12°37.0	8.1'	58.5'	
12	1°09.2	N03°08.1	210°29.9	9.0'	S12°28.8	8.2'	58.5'	
13	16°09.4	07.2	224°57.9	9.0'	12°20.6	8.3'	58.5'	
14	31°09.7	06.2	239°25.9	9.0'	12°12.3	8.4'	58.6'	
15	46°09.9	.. 05.2	253°53.9	9.0'	12°03.8	8.5'	58.6'	
16	61°10.1	04.3	268°21.8	9.0'	11°55.3	8.5'	58.6'	
17	76°10.3	03.3	282°49.8	9.0'	11°46.8	8.6'	58.7'	
18	91°10.5	N03°02.4	297°17.7	8.9'	S11°38.1	8.7'	58.7'	
19	106°10.8	01.4	311°45.7	8.9'	11°29.4	8.8'	58.7'	
20	121°11.0	03°00.4	326°13.6	8.9'	11°20.6	8.9'	58.8'	
21	136°11.2	02°59.5	340°41.5	8.9'	11°11.7	8.9'	58.8'	
22	151°11.4	58.5	355°09.4	8.9'	11°02.7	9.0'	58.8'	
23	166°11.7	57.5	9°37.4	8.9'	10°53.7	9.1'	58.9'	
		SD.=15.9	d=-1.0	S.D.=15.9				

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

**September 15, 16, 17 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	354°23.2	156°12.2	S07°07.6	93°04.8	S25°47.7	172°52.0	N00°31.9	105°07.9	S20°33.6	Alpheratz	357°40.8	29°11.0					
1	9°25.7	171°11.9	08.8	108°05.5	47.8	187°54.0	31.7	120°10.2	33.6	Ankaa	353°13.2	-42°12.8					
2	24°28.1	186°11.6	10.1	123°06.3	47.9	202°56.0	31.5	135°12.5	33.6	Schedar	349°37.4	56°37.7					
3	39°30.6	201°11.2	.. 11.3	138°07.0	.. 47.9	217°57.9	.. 31.3	150°14.9	.. 33.6	Diphda	348°53.4	-17°53.6					
4	54°33.1	216°10.9	12.6	153°07.8	48.0	232°59.9	31.0	165°17.2	33.7	Achernar	335°24.7	-57°09.0					
5	69°35.5	231°10.5	13.9	168°08.6	48.1	248°01.9	30.8	180°19.5	33.7	Hamal	327°58.0	23°32.4					
6	84°38.0	246°10.2	S07°15.1	183°09.3	S25°48.1	263°03.8	N00°30.6	195°21.9	S20°33.7	Polaris	316°28.1	89°19.7					
7	99°40.5	261°09.8	16.4	198°10.1	48.2	278°05.8	30.4	210°24.2	33.7	Acamar	315°16.5	-40°14.2					
8	114°42.9	276°09.5	17.6	213°10.8	48.2	293°07.8	30.2	225°26.5	33.8	Menkar	314°12.6	4°09.3					
9	129°45.4	291°09.1	.. 18.9	228°11.6	.. 48.3	308°09.8	.. 30.0	240°28.8	.. 33.8	Mirfak	308°36.9	49°54.9					
10	144°47.8	306°08.8	20.1	243°12.3	48.4	323°11.7	29.8	255°31.2	33.8	Aldebaran	290°46.8	16°32.4					
11	159°50.3	321°08.4	21.4	258°13.1	48.4	338°13.7	29.5	270°33.5	33.8	Rigel	281°09.9	-8°11.0					
12	174°52.8	336°08.1	S07°22.6	273°13.9	S25°48.5	353°15.7	N00°29.3	285°35.8	S20°33.9	Capella	280°31.2	46°00.5					
13	189°55.2	351°07.7	23.9	288°14.6	48.6	8°17.6	29.1	300°38.2	33.9	Bellatrix	278°29.6	6°21.8					
14	204°57.7	6°07.4	25.1	303°15.4	48.6	23°19.6	28.9	315°40.5	33.9	Elnath	278°09.8	28°37.0					
15	220°00.2	21°07.0	.. 26.4	318°16.1	.. 48.7	38°21.6	.. 28.7	330°42.8	.. 34.0	Alnilam	275°44.1	-1°11.5					
16	235°02.6	36°06.7	27.6	333°16.9	48.7	53°23.6	28.5	345°45.1	34.0	Betelgeuse	270°59.0	7°24.5					
17	250°05.1	51°06.3	28.9	348°17.6	48.8	68°25.5	28.3	0°47.5	34.0	Canopus	263°55.3	-52°42.1					
18	265°07.6	66°06.0	S07°30.1	3°18.4	S25°49.9	83°27.5	N00°28.0	15°49.8	S20°34.0	Sirius	258°31.9	-16°44.3					
19	280°10.0	81°05.6	31.3	18°19.1	48.9	98°29.5	27.8	30°52.1	34.1	Adhara	255°10.9	-28°59.6					
20	295°12.5	96°05.3	32.6	33°19.9	49.0	113°31.4	27.6	45°54.5	34.1	Procyon	244°57.6	5°10.9					
21	310°14.9	111°04.9	.. 33.8	48°20.6	.. 49.0	128°33.4	.. 27.4	60°56.8	.. 34.1	Pollux	243°25.3	27°59.0					
22	325°17.4	126°04.6	35.1	63°21.4	49.1	143°35.4	27.2	75°59.1	34.1	Avior	234°17.5	-59°33.6					
23	340°19.9	141°04.2	36.3	78°22.1	49.2	158°37.4	27.0	91°01.4	34.2	Suhail	222°51.1	-43°29.9					
Mer.pass.:00:22		v-0.3 d-1.3 m-3.8			v0.8 d-0.1 m-0.1			v2.0 d-0.2 m-1.5			v2.3 d-0.0 m-0.5						
Fri		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	355°22.3	156°03.9	S07°37.6	93°22.9	S25°49.2	173°39.3	N00°26.8	106°03.8	S20°34.2	Denebola	183°31.8	61°39.7					
1	10°24.8	171°03.5	38.8	108°23.6	49.3	188°41.3	26.5	121°06.1	34.2	Gienah	175°50.3	-17°37.9					
2	25°27.3	186°03.2	40.1	123°24.4	49.3	203°43.3	26.3	136°08.4	34.2	Gacrux	173°07.4	-63°11.4					
3	40°29.7	201°02.8	.. 41.3	138°25.1	.. 49.4	218°45.2	.. 26.1	151°10.7	.. 34.3	Gacrux	171°58.9	-57°12.3					
4	55°32.2	216°02.5	42.6	153°25.9	49.5	233°47.2	25.9	166°13.1	34.3	Alioth	166°19.4	55°52.4					
5	70°34.7	231°02.1	43.8	168°26.6	49.5	248°49.2	25.7	181°15.4	34.3	Alkaid	152°57.6	-11°14.7					
6	85°37.1	246°01.8	S07°45.1	183°27.4	S25°49.6	263°51.2	N00°25.5	196°17.7	S20°34.4	Hadar	148°45.2	-60°27.2					
7	100°39.6	261°01.4	46.3	198°28.1	49.6	278°53.1	25.3	211°20.1	34.4	Menkent	148°05.2	-36°27.0					
8	115°42.1	276°01.1	47.5	213°28.9	49.7	293°55.1	25.1	226°22.4	34.4	Arcturus	145°54.0	19°06.1					
9	130°44.5	291°00.7	.. 48.8	228°29.6	.. 49.7	308°57.1	.. 24.8	241°24.7	.. 34.4	Rigel Kent.	139°49.1	-60°54.2					
10	145°47.0	306°00.4	50.0	243°30.4	49.8	323°59.0	24.6	256°27.0	34.5	Kochab	137°21.0	74°05.6					
11	160°49.4	321°00.0	51.3	258°31.1	49.8	339°01.0	24.4	271°29.4	34.5	Zuben 'ubi	137°03.2	-16°06.4					
12	175°51.9	335°59.7	S07°52.5	273°31.9	S25°49.9	354°03.0	N00°24.2	286°31.7	S20°34.5	Alphecca	126°09.3	26°39.9					
13	190°54.4	350°59.3	53.8	288°32.6	50.0	9°05.0	24.0	301°34.0	34.5	Antares	112°23.7	-26°27.9					
14	205°56.8	5°58.9	55.0	303°33.3	50.0	24°06.9	23.8	316°36.3	34.6	Atria	107°23.5	-69°03.5					
15	220°59.3	20°58.6	.. 56.3	318°34.1	.. 50.1	39°08.9	.. 23.6	331°38.7	.. 34.6	Sabik	102°10.1	-15°44.5					
16	236°01.8	35°58.2	57.5	333°34.8	50.1	54°10.9	23.3	346°41.0	34.6	Rasalhague	96°04.4	12°33.3					
17	251°04.2	50°57.9	07°58.7	348°35.6	50.2	69°12.8	23.1	1°43.3	34.7	Eltanin	90°45.1	51°29.7					
18	266°06.7	65°57.5	S08°00.0	3°36.3	S25°50.2	84°14.8	N00°22.9	16°45.6	S20°34.7	Kaus Aust.	83°40.8	-34°22.4					
19	281°09.2	80°57.2	01.2	18°37.1	50.3	99°16.8	22.7	31°48.0	34.7	Vega	80°37.4	38°48.4					
20	296°11.6	95°56.8	02.5	33°37.8	50.3	114°18.8	22.5	46°50.3	34.7	Nunki	75°55.5	-26°16.4					
21	311°14.1	110°56.5	.. 03.7	48°38.5	.. 50.4	129°20.7	.. 22.3	61°52.6	.. 34.8	Altair	62°05.9	8°55.1					
22	326°16.5	125°56.1	04.9	63°39.3	50.4	144°22.7	22.1	76°54.9	34.8	Peacock	53°15.5	-56°40.8					
23	341°19.0	140°55.7	06.2	78°40.0	50.5	159°24.7	21.8	91°57.2	34.8	Deneb	49°29.6	45°20.8					
Mer.pass.:00:18		v-0.4 d-1.2 m-3.8			v0.7 d-0.1 m-0.1			v2.0 d-0.2 m-1.5			v2.3 d-0.0 m-0.5						
Sat		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	356°21.5	155°55.4	S08°07.4	93°40.8	S25°50.5	174°26.6	N00°21.6	106°59.6	S20°34.8	Sep 15 Thu	161°49.0	13:36					
1	11°23.9	170°55.0	08.7	108°41.5	50.6	189°28.6	21.4	122°01.9	34.9	Venus	98°41.6	17:47					
2	26°26.4	185°54.7	09.9	123°42.2	50.6	204°30.6	21.2	137°04.2	34.9	Mars	178°28.8	12:27					
3	41°28.9	200°54.3	.. 11.1	138°43.0	.. 50.7	219°32.5	.. 21.0	152°06.5	.. 34.9	Jupiter	110°44.7	16:57					
4	56°31.3	215°54.0	12.4	153°43.7	50.7	234°34.5	20.8	167°08.9	35.0	Saturn	160°41.5	13:36					
5	71°33.8	230°53.6	13.6	168°44.5	50.8	249°36.5	20.6	182°11.2	35.0	Sep 16 Fri							
6	86°36.3	245°53.2	S08°14.9	183°45.2	S25°50.8	264°38.5	N00°20.3	197°13.5	S20°35.0	Venus	160°41.5	13:36					
7	101°38.7	260°52.9	16.1	198°45.9	50.9	279°40.4	20.1	212°15.8	35.0	Mars	98°00.5	17:46					
8	116°41.2	275°52.5	17.3	213°46.7	50.9	294°42.4	19.9	227°18.1	35.1	Jupiter	178°17.0	12:24					
9	131°43.7	290°52.2	.. 18.6	228°47.4	.. 51.0	309°44.4	.. 19.7	242°20.5	.. 35.1	Saturn	110°41.4	16:53					
10	146°46.1	305°51.8	19.8	243°48.1	51.0	324°46.3	19.5	257°22.8	35.1	Sep 17 Sat							
11	161°48.6	320°51.4	21.0	258°48.9	51.1	339°48.3	19.3	272°25.1	35.1	Venus	159°33.9	13:37					
12	176°51.0	335°51.1	S08°22.3	273°49.6	S25°51.1	354°50.3	N00°19.1	287°27.4	S20°35.2	Mars	97°19.3	17:44					
13	191°53.5	350°50.7	23.5	288°50.3	51.2	9°52.3	18.8	302°29.8	35.2	Jupiter	178°05.2	12:21					
14	206°56.0	5°50.4	24.8	303°51.1	51.2	24°54.2	18.6	317°32.1	35.2	Saturn	110°38.1	16:49					
15	221°58.4	20°50.0	.. 26.0	318°51.8	.. 51.3	39°56.2	.. 18.4	332°34.4	.. 35.3	Horizontal parallax							
16	237°00.9	35°49.6	27.2	333°52.6	51.3	54°58.2	18.2	347°36.7	35.3	Venus:	0.1						
17	252°03.4	50°49.3	28.5	348°53.3	51.4	70°00.1	18.0	2°39.0	35.3	Mars:	0.1						
18	267°05.8	65°48.9	S08°29.7	3°54.0	S25°51.4	85°02.1	N00°17.8	17°41.4	S20°35.3	Mer.pass.:00:15							
19	282°08.3	80°48.6	30.9	18°54.7	51.5	100°04.1	17.6										

DUT1 = UT1-UTC = -0.2617 sec ΔT = TT-UT1 = +68.4457 sec

2016 September 15 to Sep. 17 UT

h		Sun		Moon				Lat.		Twilight		Sunrise		Sunset		Twilight	
Thu		GHA	Dec	GHA	ν	Dec	d	HP	Naut.	Civil					Civil	Naut.	
0		181°11.9	N02°56.6	24°05.3	8.9°	S10°44.5	9.2'	58.9'	N 72°	02:19	04:02	05:13	18:33	19:44	21:24		
1		196°12.1	55.6	38°33.2	8.9°	10°35.3	9.2'	58.9'	N 70°	02:48	04:14	05:18	18:29	19:32	20:57		
2		211°12.3	54.7	53°01.1	8.9°	10°26.1	9.3'	59.0'	68°	03:08	04:24	05:21	18:26	19:23	20:37		
3		226°12.6	.. 53.7	67°28.9	8.9°	10°16.7	9.4'	59.0'	66°	03:25	04:32	05:24	18:23	19:15	20:22		
4		241°12.8	52.7	81°56.8	8.9°	10°07.3	9.4'	59.0'	64°	03:37	04:38	05:27	18:21	19:09	20:09		
5		256°13.0	51.8	96°24.7	8.9°	09°57.8	9.5'	59.1'	62°	03:48	04:44	05:29	18:19	19:04	19:59		
6		271°13.2	N02°50.8	110°52.6	8.9°	S09°48.3	9.6'	59.1'	60°	03:57	04:49	05:31	18:17	18:59	19:50		
7		286°13.5	49.8	125°20.4	8.9°	09°38.7	9.7'	59.1'	N 58°	04:05	04:53	05:33	18:15	18:55	19:43		
8		301°13.7	48.9	139°48.3	8.9°	09°29.0	9.7'	59.2'	56°	04:11	04:57	05:34	18:14	18:51	19:36		
9		316°13.9	.. 47.9	154°16.2	8.8°	09°19.2	9.8'	59.2'	54°	04:17	05:00	05:35	18:13	18:48	19:31		
10		331°14.1	47.0	168°44.0	8.8°	09°09.4	9.9'	59.2'	52°	04:22	05:03	05:37	18:12	18:45	19:26		
11		346°14.3	46.0	183°11.8	8.8°	08°59.5	9.9'	59.3'	50°	04:27	05:05	05:38	18:11	18:43	19:22		
12		1°14.6	N02°45.0	197°39.7	8.8°	S08°49.5	10.0'	59.3'	45°	04:36	05:11	05:40	18:08	18:38	19:12		
13		16°14.8	44.1	212°07.5	8.8°	08°39.5	10.1'	59.3'	N 40°	04:43	05:15	05:42	18:07	18:34	19:05		
14		31°15.0	43.1	226°35.3	8.8°	08°29.4	10.1'	59.4'	35°	04:49	05:18	05:44	18:05	18:30	19:00		
15		46°15.2	.. 42.1	241°03.1	8.8°	08°19.3	10.2'	59.4'	30°	04:53	05:21	05:45	18:04	18:28	18:56		
16		61°15.5	41.2	255°30.9	8.8°	08°09.1	10.2'	59.4'	20°	05:00	05:26	05:48	18:01	18:23	18:49		
17		76°15.7	40.2	269°58.7	8.8°	07°58.8	10.3'	59.4'	N 10°	05:04	05:29	05:50	18:00	18:21	18:45		
18		91°15.9	N02°39.3	284°26.5	8.8°	S07°48.5	10.4'	59.5'	0°	05:07	05:31	05:51	17:58	18:19	18:43		
19		106°16.1	38.3	298°54.3	8.8°	07°38.1	10.4'	59.5'	S 10°	05:08	05:32	05:53	17:56	18:17	18:42		
20		121°16.4	37.3	313°22.1	8.8°	07°27.6	10.5'	59.5'	20°	05:07	05:33	05:55	17:55	18:17	18:42		
21		136°16.6	.. 36.4	327°49.9	8.8°	07°17.1	10.5'	59.6'	30°	05:05	05:33	05:57	17:53	18:17	18:45		
22		151°16.8	35.4	342°17.7	8.8°	07°06.6	10.6'	59.6'	35°	05:03	05:32	05:58	17:52	18:18	18:47		
23		166°17.0	34.4	356°45.4	8.8°	06°56.0	10.6'	59.6'	40°	05:00	05:32	05:59	17:51	18:18	18:50		
		SD.=15.9	d=-1.0			S.D.=16.2			45°	04:57	05:31	06:00	17:50	18:19	18:54		
Fri		GHA	Dec	GHA	ν	Dec	d	HP	S 50°	04:52	05:29	06:01	17:49	18:21	18:59		
0		181°17.3	N02°33.5	11°13.2	8.8°	S06°45.3	10.7'	59.6'	52°	04:49	05:28	06:02	17:48	18:22	19:01		
1		196°17.5	32.5	25°40.9	8.7°	06°34.6	10.7'	59.7'	54°	04:46	05:28	06:03	17:48	18:23	19:04		
2		211°17.7	31.5	40°08.7	8.7°	06°23.9	10.8'	59.7'	56°	04:43	05:26	06:03	17:47	18:24	19:08		
3		226°17.9	.. 30.6	54°36.4	8.7°	06°13.1	10.8'	59.7'	58°	04:39	05:25	06:04	17:46	18:25	19:12		
4		241°18.2	29.6	69°04.1	8.7°	06°02.2	10.9'	59.8'	S 60°	04:35	05:24	06:05	17:45	18:27	19:16		
5		256°18.4	28.7	83°31.8	8.7°	05°51.3	10.9'	59.8'									
6		271°18.6	N02°27.7	97°59.6	8.7°	S05°40.4	11.0'	59.8'									
7		286°18.8	26.7	112°27.3	8.7°	05°29.4	11.0'	59.8'									
8		301°19.1	25.8	126°55.0	8.7°	05°18.4	11.1'	59.9'									
9		316°19.3	.. 24.8	141°22.6	8.7°	05°07.3	11.1'	59.9'									
10		331°19.5	23.8	155°50.3	8.7°	04°56.2	11.1'	59.9'									
11		346°19.7	22.9	170°18.0	8.7°	04°45.0	11.2'	59.9'									
12		1°19.9	N02°21.9	184°45.7	8.7°	S04°33.8	11.2'	60.0'									
13		16°20.2	20.9	199°13.3	8.6°	04°22.6	11.2'	60.0'									
14		31°20.4	20.0	213°40.9	8.6°	04°11.3	11.3'	60.0'									
15		46°20.6	.. 19.0	228°08.6	8.6°	04°00.0	11.3'	60.0'									
16		61°20.8	18.0	242°36.2	8.6°	03°48.7	11.3'	60.0'									
17		76°21.1	17.1	257°03.8	8.6°	03°37.3	11.4'	60.1'									
18		91°21.3	N02°16.1	271°31.4	8.6°	S03°25.9	11.4'	60.1'									
19		106°21.5	15.1	285°59.0	8.6°	03°14.5	11.4'	60.1'									
20		121°21.7	14.2	300°26.6	8.6°	03°03.1	11.5'	60.1'									
21		136°22.0	.. 13.2	314°54.2	8.6°	02°51.6	11.5'	60.1'									
22		151°22.2	12.2	329°21.7	8.6°	02°40.1	11.5'	60.2'									
23		166°22.4	11.3	343°49.3	8.5°	02°28.6	11.5'	60.2'									
		SD.=15.9	d=-1.0			S.D.=16.3											
Sat		GHA	Dec	GHA	ν	Dec	d	HP	S 50°	16:55	17:52	18:49	04:40	05:30	06:21		
0		181°22.6	N02°10.3	358°16.8	8.5°	S02°17.0	11.6'	60.2'	20°	16:49	17:49	18:51	04:48	05:35	06:21		
1		196°22.9	09.3	12°44.3	8.5°	02°05.5	11.6'	60.2'	30°	16:41	17:46	18:52	04:57	05:40	06:22		
2		211°23.1	08.4	27°11.9	8.5°	01°53.9	11.6'	60.2'	35°	16:37	17:44	18:53	05:02	05:43	06:23		
3		226°23.3	.. 07.4	41°39.4	8.5°	01°42.3	11.6'	60.3'	40°	16:33	17:42	18:53	05:08	05:46	06:23		
4		241°23.5	06.5	56°06.9	8.5°	01°30.6	11.6'	60.3'	45°	16:27	17:40	18:54	05:14	05:50	06:24		
5		256°23.8	05.5	70°34.3	8.5°	01°19.0	11.6'	60.3'									
6		271°24.0	N02°04.5	85°01.8	8.5°	S01°07.3	11.7'	60.3'									
7		286°24.2	03.6	99°29.3	8.4°	00°55.7	11.7'	60.3'									
8		301°24.4	02.6	113°56.7	8.4°	00°44.0	11.7'	60.3'									
9		316°24.7	.. 01.6	128°24.1	8.4°	00°32.3	11.7'	60.3'									
10		331°24.9	02°00.7	142°51.5	8.4°	00°20.6	11.7'	60.4'									
11		346°25.1	01°59.7	157°18.9	8.4°	S00°08.9	11.7'	60.4'									
12		1°25.3	N01°58.7	171°46.3	8.4°	N00°02.8	11.7'	60.4'									
13		16°25.6	57.8	186°13.7	8.4°	00°14.5	11.7'	60.4'									
14		31°25.8	56.8	200°41.0	8.3°	00°26.2	11.7'	60.4'									
15		46°26.0	.. 55.8	215°08.4	8.3°	00°38.0	11.7'	60.4'									
16		61°26.2	54.9	229°35.7	8.3°	00°49.7	11.7'	60.4'									
17		76°26.4	53.9	244°03.0	8.3°	01°01.4	11.7'	60.5'									
18		91°26.7	N01°52.9	258°30.3	8.3°	N01°13.1	11.7'	60.5'									
19		106°26.9	51.9	272°57.6	8.3°	01°24.8	11.7'	60.5'									
20		121°27.1	51.0	287°24.8	8.3°	01°36.6	11.7'	60.5'									
21		136°27.3	.. 50.0	301°52.1	8.2°	01°48.3	11.7'	60.5'									
22		151°27.6	49.0	316°19.3	8.2°	02°00.0	11.7'	60.5'									
23		166°27.8	48.1	330°46.5	8.2°	02°11.6	11.7'	60.5'			</td						

## September 18, 19, 20 UT (Sun., Mon., Tue.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	357°20.6	155°46.8	\$08°37.1	93°58.4	\$25°51.7	175°13.9	N00°16.5	107°55.3	\$20°35.5					Alpheratz	357°40.8	29°11.0	
1	12°23.1	170°46.4	38.3	108°59.1	51.7	190°15.9	16.3	122°57.6	35.5					Ankaa	353°13.2	-42°12.8	
2	27°25.5	185°46.0	39.6	123°59.9	51.8	205°17.9	16.1	137°59.9	35.6					Schedar	349°37.3	56°37.7	
3	42°28.0	200°45.7	· · 40.8	139°00.6	· · 51.8	220°19.8	· · 15.8	153°02.2	· · 35.6					Diphda	348°53.4	-17°53.6	
4	57°30.5	215°45.3	42.0	154°01.3	51.8	235°21.8	15.6	168°04.6	35.6					Achernar	335°24.7	-57°09.0	
5	72°32.9	230°44.9	43.3	169°02.1	51.9	250°23.8	15.4	183°06.9	35.6					Hamal	327°58.0	23°32.4	
6	87°35.4	245°44.6	\$08°44.5	184°02.8	\$25°51.9	265°25.7	N00°15.2	198°09.2	\$20°35.7					Polaris	316°27.0	89°19.7	
7	102°37.9	260°44.2	45.7	199°03.5	52.0	280°27.7	15.0	213°11.5	35.7					Acamar	315°16.4	-40°14.2	
8	117°40.3	275°43.8	46.9	214°04.2	52.0	295°29.7	14.8	228°13.8	35.7					Menkar	314°12.5	4°09.3	
9	132°42.8	290°43.5	· · 48.2	229°05.0	· · 52.1	310°31.7	· · 14.6	243°16.1	· · 35.7					Mirfak	308°36.9	49°54.9	
10	147°45.3	305°43.1	49.4	244°05.7	52.1	325°33.6	14.3	258°18.5	35.8					Aldebaran	290°46.8	16°32.4	
11	162°47.7	320°42.7	50.6	259°06.4	52.1	340°35.6	14.1	273°20.8	35.8					Rigel	281°09.9	-8°11.0	
12	177°50.2	335°42.4	\$08°51.9	274°07.1	\$25°52.2	355°37.6	N00°13.9	288°23.1	\$20°35.8					Capella	280°31.1	46°00.5	
13	192°52.6	350°42.0	53.1	289°07.9	52.2	10°39.5	13.7	303°25.4	35.9					Bellatrix	278°29.6	6°21.8	
14	207°55.1	5°41.6	54.3	304°08.6	52.3	25°41.5	13.5	318°27.7	35.9					El Nath	278°09.8	28°37.0	
15	222°57.6	20°41.3	· · 55.5	319°09.3	· · 52.3	40°43.5	· · 13.3	333°30.1	· · 35.9					Alnilam	275°44.1	-1°11.5	
16	238°00.0	35°40.9	56.8	334°10.0	52.3	55°45.4	13.1	348°32.4	35.9					Betelgeuse	270°58.9	7°24.5	
17	253°02.5	50°40.5	58.0	349°10.8	52.4	70°47.4	12.9	3°34.7	36.0					Canopus	263°55.2	-52°42.1	
18	268°05.0	65°40.2	\$08°59.2	4°11.5	\$25°52.4	85°49.4	N00°12.6	18°37.0	\$20°36.0					Sirius	258°31.9	-16°44.3	
19	283°07.4	80°39.8	09°00.5	19°12.2	52.4	100°51.4	12.4	33°39.3	36.0					Adhara	255°10.9	-28°59.6	
20	298°09.9	95°39.4	01.7	34°12.9	52.5	115°53.3	12.2	48°41.6	36.1					Procyon	244°57.6	5°10.9	
21	313°12.4	110°39.1	· · 02.9	49°13.7	· · 52.5	130°55.3	· · 12.0	63°43.9	· · 36.1					Pollux	243°25.3	27°59.0	
22	328°14.8	125°38.7	04.1	64°14.4	52.6	145°57.3	11.8	78°46.3	36.1					Avior	234°17.4	-59°33.6	
23	343°17.3	140°38.3	05.4	79°15.1	52.6	160°59.2	11.6	93°48.6	36.1					Suhail	222°51.1	-43°29.9	
Mer.pass.:00:11			v-0.4 d-1.2 m-3.8	v0.7 d-0.0 m-0.1			v2.0 d-0.2 m-1.5			v2.3 d-0.0 m-0.5							
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	358°19.7	155°38.0	\$09°06.6	94°15.8	\$25°52.6	176°01.2	N00°11.4	108°50.9	\$20°36.2					Denebola	182°31.8	61°39.6	
1	13°22.2	170°37.6	07.8	109°16.5	52.7	191°03.2	11.1	123°53.2	36.2					Gienah	175°50.3	-17°37.9	
2	28°24.7	185°37.2	09.0	124°17.3	52.7	206°05.1	10.9	138°55.5	36.2					Acrua	173°07.4	-63°11.4	
3	43°27.1	200°36.9	· · 10.3	139°18.0	· · 52.7	221°07.1	· · 10.7	153°57.8	· · 36.2					Gacrux	171°58.9	-57°12.3	
4	58°29.6	215°36.5	11.5	154°18.7	52.8	236°09.1	10.5	169°00.2	36.3					Alioth	166°19.4	55°52.4	
5	73°32.1	230°36.1	12.7	169°19.4	52.8	251°11.1	10.3	184°02.5	36.3					Spica	158°29.2	-11°14.7	
6	88°34.5	245°35.7	\$09°13.9	184°20.1	\$25°52.8	266°13.0	N00°10.1	199°04.8	\$20°36.3					Alkaid	152°57.7	49°14.1	
7	103°37.0	260°35.4	15.1	199°20.9	52.9	281°15.0	09.9	214°07.1	36.4					Hadar	148°45.2	-60°27.1	
8	118°39.5	275°35.0	16.4	214°21.6	52.9	296°17.0	09.6	229°09.4	36.4					Menkent	148°05.3	-36°27.0	
9	133°41.9	290°34.6	· · 17.6	229°22.3	· · 52.9	311°18.9	· · 09.4	244°11.7	· · 36.4					Arcturus	145°54.0	19°06.1	
10	148°44.4	305°34.3	18.8	244°23.0	53.0	326°20.9	09.2	259°14.0	36.4					Rigel Kent.	139°49.1	-60°54.2	
11	163°46.9	320°33.9	20.0	259°23.7	53.0	341°22.9	09.0	274°16.4	36.5					Kochab	137°21.1	74°05.6	
12	178°49.3	335°33.5	\$09°21.3	274°24.4	\$25°53.0	356°24.8	N00°08.8	289°18.7	\$20°36.3					Zuben ubi	137°03.2	-16°06.4	
13	193°51.8	350°33.1	22.5	289°25.2	53.1	11°26.8	08.6	304°21.0	36.5					Alphecca	126°09.4	26°39.9	
14	208°54.2	5°32.8	23.7	304°25.9	53.1	26°28.8	08.4	319°23.3	36.6					Antares	112°23.7	-26°27.9	
15	223°56.7	20°32.4	· · 24.9	319°26.6	· · 53.1	41°30.8	· · 08.1	334°25.6	· · 36.6					Atria	107°23.6	-69°03.5	
16	238°59.2	35°32.0	26.1	334°27.3	53.2	56°32.7	07.9	349°27.9	36.6					Sabik	102°10.1	-15°44.5	
17	254°01.6	50°31.6	27.4	349°28.0	53.2	71°34.7	07.7	4°30.2	36.6					Shaula	96°19.0	-37°06.8	
18	269°04.1	65°31.3	\$09°28.6	4°28.7	\$25°53.2	86°36.7	N00°07.5	19°32.6	\$20°36.7					Rasalhague	96°04.4	12°33.3	
19	284°06.6	80°30.9	29.8	19°29.5	53.3	101°38.6	07.3	34°34.9	36.7					Eltanin	90°45.1	51°29.7	
20	299°09.0	95°30.5	31.0	34°30.2	53.3	116°40.6	07.1	49°37.2	36.7					Kaus Aust.	83°40.9	-34°22.4	
21	314°11.5	110°30.1	· · 32.2	49°30.9	· · 53.3	131°42.6	· · 06.9	64°39.5	· · 36.8					Vega	80°37.4	38°48.4	
22	329°14.0	125°29.8	33.4	64°31.6	53.3	146°44.5	06.6	79°41.8	36.8					Nunki	75°55.5	-26°16.4	
23	344°16.4	140°29.4	34.7	79°32.3	53.4	161°46.5	06.4	94°44.1	36.8					Altair	62°05.9	8°55.1	
Mer.pass.:00:07			v-0.4 d-1.2 m-3.8	v0.7 d-0.0 m-0.1			v2.0 d-0.2 m-1.5			v2.3 d-0.0 m-0.5							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	359°18.9	155°29.0	\$09°35.9	94°33.0	\$25°53.4	176°48.5	N00°06.2	109°46.4	\$20°36.8					Sep 18 Sun	158°26.1	13:37	
1	14°21.4	170°28.6	37.1	109°33.7	53.4	191°50.4	06.0	124°48.7	36.9					Venus	96°37.8	17:43	
2	29°23.8	185°28.3	38.3	124°34.4	53.5	206°52.4	05.8	139°51.1	36.9					Mars	177°53.3	12:17	
3	44°26.3	200°27.9	· · 39.5	139°35.2	· · 53.5	221°54.4	· · 05.6	154°53.4	· · 36.9					Jupiter	110°34.7	16:46	
4	59°28.7	215°27.5	40.7	154°35.9	53.5	236°56.4	05.4	169°55.7	37.0					Saturn	15°21.3	-29°31.9	
5	74°31.2	230°27.1	42.0	169°36.6	53.5	251°58.3	05.1	184°58.0	37.0					Markab	13°35.8	15°17.9	
6	89°33.7	245°26.7	\$09°43.2	184°37.3	\$25°53.6	267°00.3	N00°04.9	200°00.3	\$20°37.0					Sep 19 Mon	157°18.2	13:38	
7	104°36.1	260°26.4	44.4	199°38.0	53.6	282°02.3	04.7	215°02.6	37.0					Venus	95°56.1	17:42	
8	119°38.6	275°26.0	45.6	214°38.7	53.6	297°04.2	04.5	230°04.9	37.1					Mars	177°41.5	12:14	
9	134°41.1	290°25.6	· · 46.8	229°39.4	· · 53.6	312°06.2	· · 04.3	245°07.2	· · 37.1					Jupiter	110°31.1	16:42	
10	149°43.5	305°25.2	48.0	244°40.1	53.7	327°08.2	04.1	260°09.5	37.1					Saturn	15°21.3	-29°10.6	
11	164°46.0	320°24.9	49.2	259°40.8	53.7	342°10.1	03.9	275°11.8	37.2					Al Na'ir	13°50.9	28°10.6	
12	179°48.5	335°24.5	\$09°50.5	274°41.													

DUT1 = UT1-UTC = -0.2649 sec ΔT = TT-UT1 = +68.4489 sec

2016 September 18 to Sep. 20 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	ν	Dec	d	HP
0	181°28.0	N01°47.1		345°13.7	8.2'	N02°23.3	11.7'	60.5'
1	196°28.2	46.1		359°40.9	8.2'	02°35.0	11.7'	60.5'
2	211°28.5	45.2		14°08.0	8.1'	02°46.6	11.6'	60.5'
3	226°28.7	.. 44.2		28°35.2	8.1'	02°58.2	11.6'	60.5'
4	241°28.9	43.2		43°02.3	8.1'	03°09.9	11.6'	60.5'
5	256°29.1	42.3		57°29.4	8.1'	03°21.5	11.6'	60.5'
6	271°29.4	N01°41.3		71°56.5	8.1'	N03°33.0	11.6'	60.6'
7	286°29.6	40.3		86°23.5	8.1'	03°44.6	11.5'	60.6'
8	301°29.8	39.4		100°50.6	8.0'	03°56.1	11.5'	60.6'
9	316°30.0	.. 38.4		115°17.6	8.0'	04°07.6	11.5'	60.6'
10	331°30.3	37.4		129°44.6	8.0'	04°19.1	11.5'	60.6'
11	346°30.5	36.5		144°11.6	8.0'	04°30.6	11.4'	60.6'
12	1°30.7	N01°35.5		158°38.6	8.0'	N04°42.0	11.4'	60.6'
13	16°30.9	34.5		173°05.5	7.9'	04°53.4	11.4'	60.6'
14	31°31.1	33.6		187°32.4	7.9'	05°04.8	11.4'	60.6'
15	46°31.4	.. 32.6		201°59.3	7.9'	05°16.1	11.3'	60.6'
16	61°31.6	31.6		216°26.2	7.9'	05°27.4	11.3'	60.6'
17	76°31.8	30.7		230°53.1	7.9'	05°38.7	11.2'	60.6'
18	91°32.0	N01°29.7		245°19.9	7.8'	N05°49.9	11.2'	60.6'
19	106°32.3	28.7		259°46.7	7.8'	06°01.1	11.2'	60.6'
20	121°32.5	27.7		274°13.5	7.8'	06°12.3	11.1'	60.6'
21	136°32.7	.. 26.8		288°40.3	7.8'	06°23.4	11.1'	60.6'
22	151°32.9	25.8		303°07.1	7.7'	06°34.4	11.0'	60.6'
23	166°33.2	24.8		317°33.8	7.7'	06°45.5	11.0'	60.6'
	SD.=15.9	d=-1.0				S.D.=16.5		
Mon		GHA	Dec	GHA	ν	Dec	d	HP
0	181°33.4	N01°23.9		332°00.5	7.7'	N06°56.5	11.0'	60.6'
1	196°33.6	22.9		346°27.2	7.7'	07°07.4	10.9'	60.6'
2	211°33.8	21.9		0°53.9	7.7'	07°18.3	10.9'	60.6'
3	226°34.1	.. 21.0		15°20.5	7.6'	07°29.1	10.8'	60.6'
4	241°34.3	20.0		29°47.2	7.6'	07°39.9	10.8'	60.6'
5	256°34.5	19.0		44°13.8	7.6'	07°50.6	10.7'	60.6'
6	271°34.7	N01°18.1		58°40.3	7.6'	N08°01.3	10.7'	60.5'
7	286°34.9	17.1		73°06.9	7.5'	08°12.0	10.6'	60.5'
8	301°35.2	16.1		87°33.4	7.5'	08°22.5	10.5'	60.5'
9	316°35.4	.. 15.1		101°59.9	7.5'	08°33.0	10.5'	60.5'
10	331°35.6	14.2		116°26.4	7.5'	08°43.5	10.4'	60.5'
11	346°35.8	13.2		130°52.9	7.5'	08°53.9	10.4'	60.5'
12	1°36.1	N01°12.2		145°19.3	7.4'	N09°04.2	10.3'	60.5'
13	16°36.3	11.3		159°45.8	7.4'	09°14.5	10.2'	60.5'
14	31°36.5	10.3		174°12.2	7.4'	09°24.7	10.2'	60.5'
15	46°36.7	.. 09.3		188°38.6	7.4'	09°34.9	10.1'	60.5'
16	61°37.0	08.4		203°04.9	7.3'	09°45.0	10.0'	60.5'
17	76°37.2	07.4		217°31.2	7.3'	09°55.0	10.0'	60.5'
18	91°37.4	N01°06.4		231°57.6	7.3'	N10°04.9	9.9'	60.5'
19	106°37.6	05.4		246°23.8	7.3'	10°14.8	9.8'	60.4'
20	121°37.8	04.5		260°50.1	7.3'	10°24.6	9.8'	60.4'
21	136°38.1	.. 03.5		275°16.4	7.2'	10°34.3	9.7'	60.4'
22	151°38.3	02.5		289°42.6	7.2'	10°44.0	9.6'	60.4'
23	166°38.5	01.6		304°08.8	7.2'	10°53.6	9.5'	60.4'
	SD.=15.9	d=-1.0				S.D.=16.5		
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	181°38.7	N01°00.6		318°35.0	7.2'	N11°03.1	9.5'	60.4'
1	196°39.0	00°59.6		333°01.1	7.1'	11°12.5	9.4'	60.4'
2	211°39.2	58.7		347°27.3	7.1'	11°21.9	9.3'	60.4'
3	226°39.4	.. 57.7		1°53.4	7.1'	11°31.2	9.2'	60.3'
4	241°39.6	56.7		16°19.5	7.1'	11°40.4	9.2'	60.3'
5	256°39.8	55.7		30°45.6	7.1'	11°49.5	9.1'	60.3'
6	271°40.1	N00°54.8		45°11.6	7.0'	N11°58.5	9.0'	60.3'
7	286°40.3	53.8		59°37.7	7.0'	12°07.5	8.9'	60.3'
8	301°40.5	52.8		74°03.7	7.0'	12°16.3	8.8'	60.3'
9	316°40.7	.. 51.9		88°29.7	7.0'	12°25.1	8.7'	60.3'
10	331°41.0	50.9		102°55.6	7.0'	12°33.8	8.7'	60.2'
11	346°41.2	49.9		117°21.6	6.9'	12°42.4	8.6'	60.2'
12	1°41.4	N00°48.9		131°47.5	6.9'	N12°50.9	8.5'	60.2'
13	16°41.6	48.0		146°13.5	6.9'	12°59.4	8.4'	60.2'
14	31°41.8	47.0		160°39.4	6.9'	13°07.7	8.3'	60.2'
15	46°42.1	.. 46.0		175°05.3	6.9'	13°15.9	8.2'	60.2'
16	61°42.3	45.1		189°31.1	6.9'	13°24.1	8.1'	60.1'
17	76°42.5	44.1		203°57.0	6.8'	13°32.2	8.0'	60.1'
18	91°42.7	N00°43.1		218°22.8	6.8'	N13°40.1	7.9'	60.1'
19	106°43.0	42.1		232°48.6	6.8'	13°48.0	7.8'	60.1'
20	121°43.2	41.2		247°14.4	6.8'	13°55.8	7.7'	60.1'
21	136°43.4	.. 40.2		261°40.2	6.8'	14°03.5	7.6'	60.0'
22	151°43.6	39.2		276°06.0	6.8'	14°11.1	7.5'	60.0'
23	166°43.8	38.3		290°31.8	6.8'	14°18.5	7.4'	60.0'
	SD.=15.9	d=-1.0				S.D.=16.4		

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

## September 21, 22, 23 UT (Wed., Thu., Fri.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Week	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	0°18.0	155°19.9	\$10°05.0	94°50.0	\$25°54.0	177°35.7	N00°01.1	110°41.9	\$20°37.5	Alpheratz	357°40.8	29°11.0											
1	15°20.5	170°19.5	06.2	109°50.7	54.0	192°37.7	00.9	125°44.2	37.6	Ankaa	353°13.2	-42°12.8											
2	30°23.0	185°19.1	07.4	124°51.4	54.0	207°39.7	00.6	140°46.5	37.6	Schedar	349°37.3	56°37.7											
3	45°25.4	200°18.7	· · 08.6	139°52.1	· · 54.1	222°41.6	· · 00.4	155°48.8	· · 37.6	Diphda	348°53.4	-17°53.6											
4	60°27.9	215°18.3	09.8	154°52.8	54.1	237°43.6	N00°00.2	170°51.1	37.6	Achernar	335°24.7	-57°09.0											
5	75°30.3	230°18.0	11.0	169°53.5	54.1	252°45.6	S00°00.0	185°53.4	37.7	Hamal	327°58.0	23°32.4											
6	90°32.8	245°17.6	\$10°12.2	184°54.2	\$25°54.1	267°47.6	S00°00.2	200°55.7	\$20°37.7	Polaris	316°25.7	89°19.8											
7	105°35.3	260°17.2	13.4	199°54.9	54.1	282°49.5	00.4	215°58.0	37.7	Acamar	315°16.4	-40°14.2											
8	120°37.7	275°16.8	14.6	214°55.6	54.1	297°51.5	00.6	231°00.3	37.8	Menkar	314°12.5	4°09.3											
9	135°40.2	290°16.4	· · 15.8	229°56.3	· · 54.2	312°53.5	· · 00.9	246°02.6	· · 37.8	Mirfak	308°36.8	49°54.9											
10	150°42.7	305°16.0	17.0	244°57.0	54.2	327°55.4	01.1	261°04.9	37.8	Aldebaran	290°46.7	16°32.4											
11	165°45.1	320°15.6	18.2	259°57.7	54.2	342°57.4	01.3	276°07.3	37.8	Rigel	281°09.9	-8°11.0											
12	180°47.6	335°15.3	\$10°19.4	274°58.4	\$25°54.2	357°59.4	S00°01.5	291°09.6	\$20°37.9	Capella	280°31.1	46°00.5											
13	195°50.1	350°14.9	20.6	289°59.1	54.2	13°01.3	01.7	306°11.9	37.9	Bellatrix	278°29.6	6°21.8											
14	210°52.5	5°14.5	21.8	304°59.8	54.2	28°03.3	01.9	321°14.2	37.9	El Nath	278°09.8	28°37.0											
15	225°55.0	20°14.1	· · 23.1	320°00.5	· · 54.3	43°05.3	· · 02.1	336°16.5	· · 38.0	Alnilam	275°44.1	-1°11.5											
16	240°57.5	35°13.7	24.3	335°01.2	54.3	58°07.2	02.4	351°18.8	38.0	Betelgeuse	270°58.9	7°24.5											
17	255°59.9	50°13.3	25.5	350°01.9	54.3	73°09.2	02.6	6°21.1	38.0	Canopus	263°55.2	-52°42.1											
18	271°02.4	65°12.9	\$10°26.7	5°02.6	\$25°54.3	88°11.2	S00°02.8	21°23.4	\$20°38.0	Sirius	258°31.8	-16°44.3											
19	286°04.8	80°12.5	27.9	20°03.3	54.3	103°13.1	03.0	36°25.7	38.1	Adhara	255°10.9	-28°59.6											
20	301°07.3	95°12.1	29.1	35°04.0	54.3	118°15.1	03.2	51°28.0	38.1	Procyon	244°57.6	5°10.9											
21	316°09.8	110°11.8	· · 30.3	50°04.7	· · 54.3	133°17.1	· · 03.4	66°30.3	· · 38.1	Pollux	243°25.2	27°59.0											
22	331°12.2	125°11.4	31.5	65°05.4	54.4	148°19.1	03.6	81°32.6	38.2	Avior	234°17.4	-59°33.6											
23	346°14.7	140°11.0	32.7	80°06.1	54.4	163°21.0	03.9	96°34.9	38.2	Suhail	222°51.1	-43°29.9											
Mer.pass.:23:55				v-0.4 d-1.2 m-3.8				v0.7 d-0.0 m-0.1				v2.0 d-0.2 m-1.5				v2.3 d-0.0 m-0.5							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	1°17.2	155°10.6	\$10°33.9	95°06.8	\$25°54.4	178°23.0	S00°04.1	111°37.2	\$20°38.2	Denebola	182°31.8	14°28.9											
1	16°19.6	170°10.2	35.1	110°07.5	54.4	193°25.0	04.3	126°39.5	38.2	Gienah	175°50.3	-17°37.9											
2	31°22.1	185°09.8	36.3	125°08.1	54.4	208°26.9	04.5	141°41.8	38.3	Acrua	173°07.4	-63°11.4											
3	46°24.6	200°09.4	· · 37.4	140°08.8	· · 54.4	223°28.9	· · 04.7	156°44.1	· · 38.3	Gacrux	171°58.9	-57°12.3											
4	61°27.0	215°09.0	38.6	155°09.5	54.4	238°30.9	04.9	171°46.4	38.3	Alioth	166°19.4	55°52.4											
5	76°29.5	230°08.6	39.8	170°10.2	54.4	253°32.8	05.1	186°48.7	38.4	Spica	158°29.2	-11°14.7											
6	91°31.9	245°08.2	\$10°41.0	185°10.9	\$25°54.5	268°34.8	S00°05.4	201°51.0	\$20°38.4	Alkaid	152°57.7	49°14.1											
7	106°34.4	260°07.8	42.2	200°11.6	54.5	283°36.8	05.6	216°53.4	38.4	Hadar	148°45.2	-60°27.1											
8	121°36.9	275°07.4	43.4	215°12.3	54.5	298°38.7	05.8	231°55.7	38.4	Menkent	148°05.3	-36°27.0											
9	136°39.3	290°07.0	· · 44.6	230°13.0	· · 54.5	313°40.7	· · 06.0	246°58.0	· · 38.5	Arcturus	145°54.0	19°06.0											
10	151°41.8	305°06.6	45.8	245°13.7	54.5	328°42.7	06.2	262°00.3	38.5	Rigel Kent.	139°49.1	-60°54.2											
11	166°44.3	320°06.2	47.0	260°14.4	54.5	343°44.6	06.4	277°02.6	38.5	Kochab	137°21.1	74°05.6											
12	181°46.7	335°05.9	\$10°48.2	275°15.1	\$25°54.5	358°46.6	S00°06.6	292°04.9	\$20°38.6	Zuben ubi	137°03.2	-16°06.4											
13	196°49.2	350°05.5	49.4	290°15.8	54.5	13°48.6	06.9	307°07.2	38.6	Alphecca	126°09.4	26°39.9											
14	211°51.7	5°05.1	50.6	305°16.4	54.5	28°50.5	07.1	322°09.5	38.6	Antares	112°23.7	-26°27.9											
15	226°54.1	20°04.7	· · 51.8	320°17.1	· · 54.5	43°52.5	· · 07.3	337°11.8	· · 38.7	Atria	107°23.6	-69°03.4											
16	241°56.6	35°04.3	53.0	335°17.8	54.5	58°54.5	07.5	352°14.1	38.7	Sabik	102°10.1	-15°44.5											
17	256°59.1	50°03.9	54.2	350°18.5	54.6	73°56.5	07.7	7°16.4	38.7	Rasalhague	96°04.5	12°33.3											
18	272°01.5	65°03.5	\$10°55.4	5°19.2	\$25°54.6	88°58.4	S00°07.9	22°18.7	\$20°38.7	Eltanin	90°45.1	51°29.7											
19	287°04.0	80°03.1	56.6	20°19.9	54.6	104°00.4	08.1	37°21.0	38.8	Kaus Aust.	83°40.9	-34°22.4											
20	302°06.4	95°02.7	57.7	35°20.6	54.6	119°02.4	08.4	52°23.3	38.8	Vega	80°37.4	38°48.4											
21	317°08.9	110°02.3	10°58.9	50°21.3	· · 54.6	134°04.3	· · 08.6	67°25.6	· · 38.8	Nunki	75°55.5	-26°16.4											
22	332°11.4	125°01.9	11°00.1	65°21.9	54.6	149°06.3	08.8	82°27.9	38.9	Altair	62°05.9	8°55.1											
23	347°13.8	140°01.5	01.3	80°22.6	54.6	164°08.3	09.0	97°30.2	38.9	Peacock	53°15.5	-56°40.8											
Mer.pass.:23:51				v-0.4 d-1.2 m-3.8				v0.7 d-0.0 m-0.1				v2.0 d-0.2 m-1.5				v2.3 d-0.0 m-0.5							
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	2°16.3	155°01.1	\$11°02.5	95°23.3	\$25°54.6	179°10.2	S00°09.2	112°32.5	\$20°38.9	Sep 21 Wed	SHA	Mer.pass											
1	17°18.8	170°00.7	03.7	110°24.0	54.6	194°12.2	09.4	127°34.8	38.9	Venus	155°01.9	13:39											
2	32°21.2	185°00.3	04.9	125°24.7	54.6	209°14.2	09.6	142°37.1	39.0	Mars	94°32.0	17:40											
3	47°23.7	199°59.9	· · 06.1	140°25.4	· · 54.6	224°16.1	· · 09.9	157°39.4	· · 39.0	Jupiter	177°17.7	12:08											
4	62°26.2	214°59.5	07.3	155°26.1	54.6	239°18.1	10.1	172°41.7	39.0	Saturn	110°23.8	16:35											
5	77°28.6	229°59.1	08.4	170°26.7	54.6	254°20.1	10.3	187°44.0	39.1	Sep 22 Thu	SHA	Mer.pass											
6	92°31.1	244°58.7	\$11°09.6	185°27.4	\$25°54.6	269°22.0	S00°10.5	202°46.3	\$20°39.1	Venus	153°53.4	13:40											
7	107°33.6	259°58.3	10.8	200°28.1	54.6	284°24.0	10.7	217°48.6	39.1														

DUT1 = UT1-UTC = -0.2682 sec ΔT = TT-UT1 = +68.4522 sec

2016 September 21 to Sep. 23 UT

h		Sun		Moon				
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	181°44.1	N00°37.3	304°57.5	6.7'	N14°25.9	7.3'	60.0'	
1	196°44.3	36.3	319°23.2	6.7'	14°33.2	7.2'	60.0'	
2	211°44.5	35.3	333°48.9	6.7'	14°40.4	7.1'	59.9'	
3	226°44.7	.. 34.4	348°14.6	6.7'	14°47.5	7.0'	59.9'	
4	241°45.0	33.4	2°40.3	6.7'	14°54.5	6.9'	59.9'	
5	256°45.2	32.4	17°06.0	6.7'	15°01.3	6.8'	59.9'	
6	271°45.4	N00°31.5	31°31.7	6.7'	N15°08.1	6.7'	59.9'	
7	286°45.6	30.5	45°57.4	6.7'	15°14.8	6.6'	59.8'	
8	301°45.8	29.5	60°23.0	6.6'	15°21.4	6.5'	59.8'	
9	316°46.1	.. 28.5	74°48.6	6.6'	15°27.8	6.4'	59.8'	
10	331°46.3	27.6	89°14.3	6.6'	15°34.2	6.3'	59.8'	
11	346°46.5	26.6	103°39.9	6.6'	15°40.4	6.2'	59.8'	
12	1°46.7	N00°25.6	118°05.5	6.6'	N15°46.6	6.1'	59.7'	
13	16°46.9	24.7	132°31.1	6.6'	15°52.6	6.0'	59.7'	
14	31°47.2	23.7	146°56.7	6.6'	15°58.5	5.9'	59.7'	
15	46°47.4	.. 22.7	161°22.3	6.6'	16°04.3	5.8'	59.7'	
16	61°47.6	21.7	175°47.9	6.6'	16°10.0	5.6'	59.6'	
17	76°47.8	20.8	190°13.5	6.6'	16°15.6	5.5'	59.6'	
18	91°48.0	N00°19.8	204°39.1	6.6'	N16°21.1	5.4'	59.6'	
19	106°48.3	18.8	219°04.7	6.6'	16°26.5	5.3'	59.6'	
20	121°48.5	17.8	233°30.3	6.6'	16°31.7	5.2'	59.5'	
21	136°48.7	.. 16.9	247°55.9	6.6'	16°36.9	5.1'	59.5'	
22	151°48.9	15.9	262°21.4	6.6'	16°41.9	5.0'	59.5'	
23	166°49.2	14.9	276°47.0	6.6'	16°46.8	4.9'	59.5'	
	SD.=15.9	d=-1.0			S.D.=16.3			

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
21	06:56	07:07	11:53	03:49
22	07:17	07:28	11:53	04:46
23	07:39	07:49	11:52	05:43



SD.=15.9	d=-1.0	S.D.=15.9
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## September 24, 25, 26 UT (Sat., Sun., Mon.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	3°15.4	154°51.4	\$11°30.9	95°39.7	\$25°54.6	179°57.5	\$00°14.4	113°27.7	\$20°39.6	Alpheratz	357°40.8	29°11.0											
1	18°17.9	169°51.0	32.1	110°40.3	54.6	194°59.4	14.6	128°30.0	39.7	Ankaa	353°13.2	-42°12.9											
2	33°20.4	184°50.6	33.3	125°41.0	54.6	210°01.4	14.8	143°32.3	39.7	Schedar	349°37.3	56°37.7											
3	48°22.8	199°50.2	· · 34.4	140°41.7	· · 54.6	225°03.4	· · 15.0	158°34.6	· · 39.7	Diphda	348°53.4	-17°53.6											
4	63°25.3	214°49.7	35.6	155°42.4	54.6	240°05.3	15.2	173°36.9	39.7	Achernar	335°24.7	-57°09.1											
5	78°27.8	229°49.3	36.8	170°43.1	54.6	255°07.3	15.4	188°39.2	39.8	Hamal	327°57.9	23°32.4											
6	93°30.2	244°48.9	\$11°38.0	185°43.7	\$25°54.6	270°09.3	\$00°15.6	203°41.5	\$20°39.8	Polaris	316°24.5	89°19.8											
7	108°32.7	259°48.5	39.2	200°44.4	54.6	285°11.2	15.9	218°43.7	39.8	Acamar	315°16.4	-40°14.2											
8	123°35.2	274°48.1	40.3	215°45.1	54.6	300°13.2	16.1	233°46.0	39.9	Menkar	314°12.5	4°09.3											
9	138°37.6	289°47.7	· · 41.5	230°45.8	· · 54.6	315°15.2	· · 16.3	248°48.3	· · 39.9	Mirfak	308°36.8	49°54.9											
10	153°40.1	304°47.3	42.7	245°46.4	54.5	330°17.1	16.5	263°50.6	39.9	Aldebaran	290°46.7	16°32.4											
11	168°42.5	319°46.9	43.9	260°47.1	54.5	345°19.1	16.7	278°52.9	40.0	Rigel	281°09.9	-8°11.0											
12	183°45.0	334°46.5	\$11°45.0	275°47.8	\$25°54.5	0°21.1	\$00°16.9	293°55.2	\$20°40.0	Capella	280°31.1	46°00.5											
13	198°47.5	349°46.0	46.2	290°48.4	54.5	15°23.1	17.1	308°57.5	40.0	Bellatrix	278°29.6	6°21.8											
14	213°49.9	4°45.6	47.4	305°49.1	54.5	30°25.0	17.4	323°59.8	40.0	El Nath	278°09.8	28°37.0											
15	228°52.4	19°45.2	· · 48.5	320°49.8	· · 54.5	45°27.0	· · 17.6	339°02.1	· · 40.1	Alnilam	275°44.1	-1°11.5											
16	243°54.9	34°44.8	49.7	335°50.5	54.5	60°29.0	17.8	354°04.4	40.1	Betelgeuse	270°58.9	7°24.5											
17	258°57.3	49°44.4	50.9	350°51.1	54.5	75°30.9	18.0	9°06.7	40.1	Canopus	263°55.2	-52°42.1											
18	273°59.8	64°44.0	\$11°52.1	5°51.8	\$25°54.5	90°32.9	\$00°18.2	24°09.0	\$20°40.2	Sirius	258°31.8	-16°44.3											
19	289°02.3	79°43.6	53.2	20°52.5	54.5	105°34.9	18.4	39°11.3	40.2	Adhara	255°10.9	-28°59.6											
20	304°04.7	94°43.1	54.4	35°53.1	54.5	120°36.8	18.6	54°13.6	40.2	Procyon	244°57.5	5°10.9											
21	319°07.2	109°42.7	· · 55.6	50°53.8	· · 54.4	135°38.8	· · 18.9	69°15.9	· · 40.3	Pollux	243°25.2	27°58.9											
22	334°09.7	124°42.3	56.7	65°54.5	54.4	150°40.8	19.1	84°18.2	40.3	Avior	234°17.4	-59°33.6											
23	349°12.1	139°41.9	57.9	80°55.2	54.4	165°42.7	19.3	99°20.5	40.3	Suhail	222°51.1	-43°29.9											
Mer.pass.:23:43				v-0.4 d-1.2 m-3.8				v0.7 d0.0 m-0.0				v2.0 d-0.2 m-1.5				v2.3 d-0.0 m-0.5							
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	4°14.6	154°41.5	\$11°59.1	95°55.8	\$25°54.4	180°44.7	\$00°19.5	114°22.8	\$20°40.3	Denebola	182°31.8	14°28.9											
1	19°17.0	169°41.1	12°00.2	110°56.5	54.4	195°46.7	19.7	129°25.1	40.4	Gienah	175°50.3	-17°37.9											
2	34°19.5	184°40.6	01.4	125°57.2	54.4	210°48.6	19.9	144°27.3	40.4	Acrua	173°07.4	-63°11.4											
3	49°22.0	199°40.2	· · 02.6	140°57.8	· · 54.4	225°50.6	· · 20.1	159°29.6	· · 40.4	Gacrux	171°58.9	-57°12.3											
4	64°24.4	214°39.8	03.7	155°58.5	54.4	240°52.6	20.4	174°31.9	40.5	Alioth	166°19.4	55°52.3											
5	79°26.9	229°39.4	04.9	170°59.2	54.3	255°54.5	20.6	189°34.2	40.5	Spica	158°29.2	-11°14.7											
6	94°29.4	244°39.0	\$12°06.1	185°59.8	\$25°54.3	270°56.5	\$00°20.8	204°36.5	\$20°40.5	Alkaid	152°57.7	49°14.1											
7	109°31.8	259°38.5	07.2	201°00.5	54.3	285°58.5	21.0	219°38.8	40.6	Hadar	148°45.2	-60°27.1											
8	124°34.3	274°38.1	08.4	216°01.2	54.3	301°00.4	21.2	234°41.1	40.6	Menkent	148°05.3	-36°27.0											
9	139°36.8	289°37.7	· · 09.6	231°01.8	· · 54.3	316°02.4	· · 21.4	249°43.4	· · 40.6	Arcturus	145°54.0	19°06.0											
10	154°39.2	304°37.3	10.7	246°02.5	54.3	331°04.4	21.6	264°45.7	40.6	Rigel Kent.	139°49.1	-60°54.2											
11	169°41.7	319°36.9	11.9	261°03.2	54.3	346°06.3	21.8	279°48.0	40.7	Kochab	137°21.2	74°05.6											
12	184°44.2	334°36.4	\$12°13.0	276°03.8	\$25°54.2	1°08.3	\$00°22.1	294°50.3	\$20°40.7	Zuben' ubi	137°03.2	-16°06.4											
13	199°46.6	349°36.0	14.2	291°04.5	54.2	16°10.3	22.3	309°52.6	40.7	Alphecca	126°09.4	26°39.9											
14	214°49.1	4°35.6	15.4	306°05.2	54.2	31°12.2	22.5	324°54.9	40.8	Antares	112°23.7	-26°27.9											
15	229°51.5	19°35.2	· · 16.5	321°05.8	· · 54.2	46°14.2	· · 22.7	339°57.2	· · 40.8	Atria	107°23.6	-69°03.4											
16	244°54.0	34°34.7	17.7	336°06.5	54.2	61°16.2	22.9	354°59.4	40.8	Sabik	102°10.1	-15°44.5											
17	259°56.5	49°34.3	18.9	351°07.2	54.2	76°18.2	23.1	10°01.7	40.9	Rasalhague	96°04.5	12°33.3											
18	274°58.9	64°33.9	\$12°20.0	6°07.8	\$25°54.1	91°20.1	\$00°23.3	25°04.0	\$20°40.9	Eltanin	90°45.2	51°29.7											
19	290°01.4	79°33.5	21.2	21°08.5	54.1	106°22.1	23.6	40°06.3	40.9	Kaus Aust.	83°40.9	-34°22.4											
20	305°03.9	94°33.0	22.3	36°09.1	54.1	121°24.1	23.8	55°08.6	40.9	Vega	80°37.4	38°48.4											
21	320°06.3	109°32.6	· · 23.5	51°09.8	· · 54.1	136°26.0	· · 24.0	70°10.9	· · 41.0	Nunki	75°55.5	-26°16.4											
22	335°08.8	124°32.2	24.6	66°10.5	54.1	151°28.0	24.2	85°13.2	41.0	Altair	62°06.0	8°55.1											
23	350°11.3	139°31.8	25.8	81°11.1	54.0	166°30.0	24.4	100°15.5	41.0	Peacock	53°15.5	-56°40.9											
Mer.pass.:23:39				v-0.4 d-1.2 m-3.8				v0.7 d0.0 m-0.0				v2.0 d-0.2 m-1.5				v2.3 d-0.0 m-0.5							
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	5°13.7	154°31.3	\$12°27.0	96°11.8	\$25°54.0	181°31.9	\$00°24.6	115°17.8	\$20°41.1	Sep 24 Sat	151°35.9	13:41											
1	20°16.2	169°30.9	28.1	111°12.4	54.0	196°33.9	24.8	130°20.1	41.1	Venus	152°24.2	17:37											
2	35°18.6	184°30.5	29.3	126°13.1	54.0	211°35.9	25.1	145°22.4	41.1	Mars	176°42.0	11:59											
3	50°21.1	199°30.1	· · 30.4	141°13.8	· · 54.0	226°37.8	· · 25.3	160°24.6	· · 41.2	Jupiter	110°12.2	16:24											
4	65°23.6	214°29.6	31.6	156°14.4	53.9	241°39.8	25.5	175°26.9	41.2	Saturn	150°26.9	13:42											
5	80°26.0	229°29.2	32.7	171°15.1	53.9	256°41.8	25.7	190°29.2	41.2	Sep 25 Sun	91°41.2	17:36											
6	95°28.5	244°28.8	\$12°33.9	186°15.7	\$25°53.9	271°43.7	\$00°25.9	205°31.5	\$20°41.3	Venus	176°30.1	11:55											
7	110°31.0	259°28.3																					

DUT1 = UT1-UTC = -0.2714 sec ΔT = TT-UT1 = +68.4554 sec

2016 September 24 to Sep. 26 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	181°59.9	S00°32.8	263°56.5	7.6'	N18°25.5	-0.8'	58.2'
1	197°00.1	33.7	278°23.1	7.6'	18°24.6	-0.9'	58.1'
2	212°00.3	34.7	292°49.7	7.6'	18°23.6	-1.0'	58.1'
3	227°00.5	.. 35.7	307°16.4	7.7'	18°22.5	-1.2'	58.1'
4	242°00.8	36.6	321°43.1	7.7'	18°21.3	-1.3'	58.1'
5	257°01.0	37.6	336°09.8	7.8'	18°20.0	-1.4'	58.0'
6	272°01.2	S00°38.6	350°36.6	7.8'	N18°18.5	-1.5'	58.0'
7	287°01.4	39.6	5°03.4	7.8'	18°17.0	-1.6'	58.0'
8	302°01.6	40.5	19°30.3	7.9'	18°15.4	-1.7'	57.9'
9	317°01.8	.. 41.5	33°57.2	7.9'	18°13.6	-1.8'	57.9'
10	332°02.1	42.5	48°24.2	8.0'	18°11.7	-1.9'	57.9'
11	347°02.3	43.5	62°51.2	8.0'	18°09.8	-2.0'	57.9'
12	2°02.5	S00°44.4	77°18.2	8.1'	N18°07.7	-2.1'	57.8'
13	17°02.7	45.4	91°45.3	8.1'	18°05.5	-2.2'	57.8'
14	32°02.9	46.4	106°12.4	8.2'	18°03.2	-2.3'	57.8'
15	47°03.1	.. 47.4	120°39.6	8.2'	18°00.8	-2.4'	57.8'
16	62°03.4	48.3	135°06.8	8.3'	17°58.4	-2.5'	57.7'
17	77°03.6	49.3	149°34.1	8.3'	17°55.8	-2.6'	57.7'
18	92°03.8	S00°50.3	164°01.4	8.4'	N17°53.1	-2.8'	57.7'
19	107°04.0	51.3	178°28.8	8.4'	17°50.3	-2.9'	57.7'
20	122°04.2	52.2	192°56.3	8.5'	17°47.3	-3.0'	57.6'
21	137°04.4	.. 53.2	207°23.7	8.5'	17°44.3	-3.1'	57.6'
22	152°04.6	54.2	221°51.3	8.6'	17°41.2	-3.2'	57.6'
23	167°04.9	55.1	236°18.8	8.6'	17°38.0	-3.3'	57.5'
	SD.=15.9	d=-1.0			S.D.=15.8		

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	182°05.1	S00°56.1	250°46.5	8.7'	N17°34.7	-3.4'	57.5'
1	197°05.3	57.1	265°14.1	8.7'	17°31.3	-3.5'	57.5'
2	212°05.5	58.1	279°41.9	8.8'	17°27.8	-3.6'	57.5'
3	227°05.7	00°59.0	294°09.7	8.8'	17°24.2	-3.6'	57.4'
4	242°05.9	01°00.0	308°37.5	8.9'	17°20.5	-3.7'	57.4'
5	257°06.2	01.0	323°05.4	8.9'	17°16.7	-3.8'	57.4'
6	272°06.4	S01°02.0	337°33.3	9.0'	N17°12.8	-3.9'	57.4'
7	287°06.6	02.9	352°01.3	9.0'	17°08.9	-4.0'	57.3'
8	302°06.8	03.9	6°29.4	9.1'	17°04.8	-4.1'	57.3'
9	317°07.0	.. 04.9	20°57.5	9.1'	17°00.6	-4.2'	57.3'
10	332°07.2	05.9	35°25.7	9.2'	16°56.3	-4.3'	57.3'
11	347°07.4	06.8	49°53.9	9.2'	16°52.0	-4.4'	57.2'
12	2°07.7	S01°07.8	64°22.1	9.3'	N16°47.6	-4.5'	57.2'
13	17°07.9	08.8	78°50.5	9.4'	16°43.0	-4.6'	57.2'
14	32°08.1	09.7	93°18.9	9.4'	16°38.4	-4.7'	57.2'
15	47°08.3	.. 10.7	107°47.3	9.5'	16°33.7	-4.8'	57.1'
16	62°08.5	11.7	122°15.8	9.5'	16°28.9	-4.8'	57.1'
17	77°08.7	12.7	136°44.3	9.6'	16°24.0	-4.9'	57.1'
18	92°08.9	S01°13.6	151°12.9	9.6'	N16°19.0	-5.0'	57.1'
19	107°09.2	14.6	165°41.6	9.7'	16°14.0	-5.1'	57.0'
20	122°09.4	15.6	180°10.3	9.7'	16°08.8	-5.2'	57.0'
21	137°09.6	.. 16.6	194°39.1	9.8'	16°03.6	-5.3'	57.0'
22	152°09.8	17.5	209°07.9	9.9'	15°58.3	-5.4'	57.0'
23	167°10.0	18.5	223°36.8	9.9'	15°52.9	-5.4'	56.9'
	SD.=15.9	d=-1.0			S.D.=15.6		

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°10.2	S01°19.5	238°05.8	10.0'	N15°47.4	-5.5'	56.9'
1	197°10.4	20.5	252°34.8	10.0'	15°41.8	-5.6'	56.9'
2	212°10.7	21.4	267°03.8	10.1'	15°36.2	-5.7'	56.9'
3	227°10.9	.. 22.4	281°33.0	10.1'	15°30.5	-5.8'	56.8'
4	242°11.1	23.4	296°02.1	10.2'	15°24.7	-5.8'	56.8'
5	257°11.3	24.4	310°31.4	10.3'	15°18.8	-5.9'	56.8'
6	272°11.5	S01°25.3	325°00.7	10.3'	N15°12.9	-6.0'	56.8'
7	287°11.7	26.3	339°30.0	10.4'	15°06.8	-6.1'	56.7'
8	302°11.9	27.3	353°59.4	10.4'	15°00.7	-6.1'	56.7'
9	317°12.1	.. 28.2	8°28.9	10.5'	14°54.5	-6.2'	56.7'
10	332°12.4	29.2	22°58.4	10.5'	14°48.3	-6.3'	56.7'
11	347°12.6	30.2	37°28.0	10.6'	14°42.0	-6.4'	56.6'
12	2°12.8	S01°31.2	51°57.6	10.7'	N14°35.6	-6.4'	56.6'
13	17°13.0	32.1	66°27.3	10.7'	14°29.1	-6.5'	56.6'
14	32°13.2	33.1	80°57.0	10.8'	14°22.5	-6.6'	56.6'
15	47°13.4	.. 34.1	95°26.8	10.8'	14°15.9	-6.6'	56.5'
16	62°13.6	35.1	109°56.7	10.9'	14°09.3	-6.7'	56.5'
17	77°13.8	36.0	124°26.6	10.9'	14°02.5	-6.8'	56.5'
18	92°14.1	S01°37.0	138°56.6	11.0'	N13°55.7	-6.8'	56.5'
19	107°14.3	38.0	153°26.6	11.1'	13°48.8	-6.9'	56.5'
20	122°14.5	39.0	167°56.7	11.1'	13°41.9	-7.0'	56.4'
21	137°14.7	.. 39.9	182°26.8	11.2'	13°34.8	-7.0'	56.4'
22	152°14.9	40.9	196°57.0	11.2'	13°27.8	-7.1'	56.4'
23	167°15.1	41.9	211°27.3	11.3'	13°20.6	-7.2'	56.4'
	SD.=15.9	d=-1.0			S.D.=15.4		

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

## September 27, 28, 29 UT (Tue., Wed., Thu.)

Aries Venus Mars Jupiter Saturn Stars													
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	6°12.9	154°21.0	\$12°54.6	96°27.6	\$25°53.4	182°19.2	\$00°29.8	116°12.7	\$20°41.8	Alpheratz	357°40.8		
1	21°15.3	169°20.6	55.7	111°28.2	53.4	197°21.1	30.0	131°15.0	41.8	Ankaa	353°13.2		
2	36°17.8	184°20.1	56.9	126°28.9	53.4	212°23.1	30.2	146°17.3	41.9	Schedar	349°37.3		
3	51°20.3	199°19.7	.. 58.0	141°29.5	.. 53.3	227°25.1	.. 30.4	161°19.6	.. 41.9	Diphda	348°53.4		
4	66°22.7	214°19.2	12°59.1	156°30.2	53.3	242°27.0	30.6	176°21.8	41.9	Achernar	335°24.7		
5	81°25.2	229°18.8	13°00.3	171°30.8	53.3	257°29.0	30.8	191°24.1	42.0	Hamal	327°57.9		
6	96°27.6	244°18.4	\$13°01.4	186°31.5	\$25°53.2	272°31.0	\$00°31.1	206°26.4	\$20°42.0	Polaris	316°23.6		
7	111°30.1	259°17.9	02.6	201°32.1	53.2	287°32.9	31.3	221°28.7	42.0	Acamar	315°16.4		
8	126°32.6	274°17.5	03.7	216°32.8	53.2	302°34.9	31.5	236°31.0	42.0	Menkar	314°12.5		
9	141°35.0	289°17.0	.. 04.9	231°33.4	.. 53.2	317°36.9	.. 31.7	251°33.3	.. 42.1	Mirfak	308°36.8		
10	156°37.5	304°16.6	06.0	246°34.1	53.1	332°38.8	31.9	266°35.6	42.1	Aldebaran	290°46.7		
11	171°40.0	319°16.2	07.1	261°34.7	53.1	347°40.8	32.1	281°37.8	42.1	Rigel	281°09.8		
12	186°42.4	334°15.7	\$13°08.3	276°35.4	\$25°53.1	2°42.8	\$00°32.3	296°40.1	\$20°42.2	Capella	280°31.0		
13	201°44.9	349°15.3	09.4	291°36.0	53.0	17°44.7	32.5	311°42.4	42.2	Bellatrix	278°29.6		
14	216°47.4	4°14.8	10.5	306°36.7	53.0	32°46.7	32.8	326°44.7	42.2	El Nath	278°09.7		
15	231°49.8	19°14.4	.. 11.7	321°37.3	.. 53.0	47°48.7	.. 33.0	341°47.0	.. 42.3	Alnilam	275°44.1		
16	246°52.3	34°14.0	12.8	336°38.0	52.9	62°50.6	33.2	356°49.3	42.3	Betelgeuse	270°58.9		
17	261°54.7	49°13.5	14.0	351°38.6	52.9	77°52.6	33.4	11°51.5	42.3	Canopus	263°55.2		
18	276°57.2	64°13.1	\$13°15.1	6°39.3	\$25°52.8	92°54.6	\$00°33.6	26°53.8	\$20°42.4	Sirius	258°31.8		
19	291°59.7	79°12.6	16.2	21°39.9	52.8	107°56.5	33.8	41°56.1	42.4	Adhara	255°10.8		
20	307°02.1	94°12.2	17.4	36°40.6	52.8	122°58.5	34.0	56°58.4	42.4	Procyon	244°57.5		
21	322°04.6	109°11.7	.. 18.5	51°41.2	.. 52.7	138°00.5	.. 34.3	72°00.7	.. 42.4	Pollux	243°25.2		
22	337°07.1	124°11.3	19.6	66°41.9	52.7	153°02.4	34.5	87°03.0	42.5	Avior	234°17.4		
23	352°09.5	139°10.8	20.8	81°42.5	52.7	168°04.4	34.7	102°05.3	42.5	Suhail	222°51.1		
Mer.pass.:23:31		v-0.4	d-1.1	m-3.8	v0.7	d0.0	m0.0	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	Denebola	193°49.8		
0	7°12.0	154°10.4	\$13°21.9	96°43.1	\$25°52.6	183°06.4	\$00°34.9	117°07.5	\$20°42.5	Gienah	182°31.8		
1	22°14.5	169°10.0	23.0	111°43.8	52.6	198°08.3	35.1	132°09.8	42.6	Acrux	175°50.3		
2	37°16.9	184°09.5	24.2	126°44.4	52.6	213°10.3	35.3	147°12.1	42.6	Gacrux	173°07.4		
3	52°19.4	199°09.1	.. 25.3	141°45.1	.. 52.5	228°12.3	.. 35.5	162°14.4	.. 42.6	Alioth	166°19.4		
4	67°21.9	214°08.6	26.4	156°45.7	52.5	243°14.2	35.8	177°16.7	42.7	Spica	158°29.2		
5	82°24.3	229°08.2	27.5	171°46.4	52.4	258°16.2	36.0	192°18.9	42.7	Alkaid	152°57.7		
6	97°26.8	244°07.7	\$13°28.7	186°47.0	\$25°52.4	273°18.2	\$00°36.2	207°21.2	\$20°42.7	Hadar	148°45.2		
7	112°29.2	259°07.3	29.8	201°47.7	52.4	288°20.2	36.4	222°23.5	42.8	Menkent	148°05.3		
8	127°31.7	274°06.8	30.9	216°48.3	52.3	303°22.1	36.6	237°25.8	42.8	Arcturus	145°54.0		
9	142°34.2	289°06.4	.. 32.1	231°48.9	.. 52.3	318°24.1	.. 36.8	252°28.1	.. 42.8	Rigel Kent.	139°49.2		
10	157°36.6	304°05.9	33.2	246°49.6	52.2	333°26.1	37.0	267°30.4	42.9	Kochab	137°21.2		
11	172°39.1	319°05.5	34.3	261°50.2	52.2	348°28.0	37.3	282°32.6	42.9	Zuben ubi	137°03.2		
12	187°41.6	334°05.0	\$13°35.4	276°50.9	\$25°52.2	3°30.0	\$00°37.5	297°34.9	\$20°42.9	Alphecca	126°09.4		
13	202°44.0	349°04.6	36.6	291°51.5	52.1	18°32.0	37.7	312°37.2	42.9	Antares	112°23.7		
14	217°46.5	4°04.1	37.7	306°52.2	52.1	33°33.9	37.9	327°39.5	43.0	Atria	107°23.7		
15	232°49.0	19°03.7	.. 38.8	321°52.8	.. 52.0	48°35.9	.. 38.1	342°41.8	.. 43.0	Sabik	102°10.1		
16	247°51.4	34°03.2	39.9	336°53.4	52.0	63°37.9	38.3	357°44.0	43.0	Shaula	96°19.0		
17	262°53.9	49°02.8	41.1	351°54.1	51.9	78°39.8	38.5	12°46.3	43.1	Rasalhague	96°04.5		
18	277°56.3	64°02.3	\$13°42.2	6°54.7	\$25°51.9	93°41.8	\$00°38.8	27°48.6	\$20°43.1	Eltanin	90°45.2		
19	292°58.8	79°01.9	43.3	21°55.4	51.9	108°43.8	39.0	42°50.9	43.1	Kaus Aust.	83°40.9		
20	308°01.3	94°01.4	44.4	36°56.0	51.8	123°45.7	39.2	57°53.2	43.2	Vega	80°37.4		
21	323°03.7	109°00.9	.. 45.5	51°56.6	.. 51.8	138°47.7	.. 39.4	72°55.5	.. 43.2	Nunki	75°55.5		
22	338°06.2	124°00.5	46.7	66°57.3	51.7	153°49.7	39.6	87°57.7	43.2	Altair	62°06.0		
23	353°08.7	139°00.0	47.8	81°57.9	51.7	168°51.6	39.8	103°00.0	43.3	Peacock	53°15.6		
Mer.pass.:23:27		v-0.4	d-1.1	m-3.8	v0.6	d0.0	m0.0	v2.0	d-0.2	m-1.5	Deneb	49°29.7	
		v-0.5	d-1.1	m-3.8	v0.6	d0.0	m0.0	v2.0	d-0.2	m-1.5	Enif	33°44.7	
		v-0.5	d-1.1	m-3.8	v0.6	d0.0	m0.0	v2.0	d-0.2	m-1.5	Al Na'ir	27°40.7	
		v-0.5	d-1.1	m-3.8	v0.6	d0.0	m0.0	v2.0	d-0.2	m-1.5	Fomalhaut	15°21.3	
		v-0.5	d-1.1	m-3.8	v0.6	d0.0	m0.0	v2.0	d-0.2	m-1.5	Scheat	13°50.9	
		v-0.5	d-1.1	m-3.8	v0.6	d0.0	m0.0	v2.0	d-0.2	m-1.5	Markab	13°35.8	
<b>Sep 27 Tue</b>		SHA	Mer.pass										
Venus		148°08.1	13:43										
Mars		90°14.7	17:33										
Jupiter		176°06.3	11:49										
Saturn		109°59.8	16:13										
<b>Sep 28 Wed</b>		SHA	Mer.pass										
Venus		146°58.4	13:44										
Mars		89°31.2	17:32										
Jupiter		175°54.4	11:46										
Saturn		109°55.5	16:09										
<b>Sep 29 Thu</b>		SHA	Mer.pass										
Venus		145°48.4	13:44										
Mars		88°47.4	17:31										
Jupiter		175°42.5	11:43										
Saturn		109°51.2	16:05										
		Horizontal parallax											
		Venus:	0.1										
		Mars:	0.1										

DUT1 = UT1-UTC = -0.2747 sec ΔT = TT-UT1 = +68.4587 sec

2016 September 27 to Sep. 29 UT

h		Sun		Moon				
Tue		GHA	Dec	GHA	ν	Dec	d	HP
0	182°15.3	S01°42.8		225°57.6	11.3'	N13°13.4	-7.2'	56.3'
1	197°15.5	43.8		240°27.9	11.4'	13°06.2	-7.3'	56.3'
2	212°15.7	44.8		254°58.3	11.4'	12°58.8	-7.4'	56.3'
3	227°16.0	.. 45.8		269°28.8	11.5'	12°51.4	-7.4'	56.3'
4	242°16.2	46.7		283°59.3	11.5'	12°44.0	-7.5'	56.2'
5	257°16.4	47.7		298°29.9	11.6'	12°36.5	-7.5'	56.2'
6	272°16.6	S01°48.7		313°00.5	11.7'	N12°28.9	-7.6'	56.2'
7	287°16.8	49.7		327°31.2	11.7'	12°21.3	-7.6'	56.2'
8	302°17.0	50.6		342°01.9	11.8'	12°13.6	-7.7'	56.2'
9	317°17.2	.. 51.6		356°32.7	11.8'	12°05.9	-7.8'	56.1'
10	332°17.4	52.6		11°03.6	11.9'	11°58.1	-7.8'	56.1'
11	347°17.6	53.6		25°34.5	11.9'	11°50.3	-7.9'	56.1'
12	2°17.9	S01°54.5		40°05.4	12.0'	N11°42.4	-7.9'	56.1'
13	17°18.1	55.5		54°36.4	12.0'	11°34.4	-8.0'	56.1'
14	32°18.3	56.5		69°07.5	12.1'	11°26.4	-8.0'	56.0'
15	47°18.5	.. 57.4		83°38.6	12.1'	11°18.4	-8.1'	56.0'
16	62°18.7	58.4		98°09.7	12.2'	11°10.3	-8.1'	56.0'
17	77°18.9	01°59.4		112°40.9	12.2'	11°02.2	-8.2'	56.0'
18	92°19.1	S02°00.4		127°12.2	12.3'	N10°54.0	-8.2'	55.9'
19	107°19.3	01.3		141°43.5	12.3'	10°45.7	-8.3'	55.9'
20	122°19.5	02.3		156°14.8	12.4'	10°37.4	-8.3'	55.9'
21	137°19.7	.. 03.3		170°46.2	12.4'	10°29.1	-8.4'	55.9'
22	152°19.9	04.3		185°17.7	12.5'	10°20.7	-8.4'	55.9'
23	167°20.2	05.2		199°49.2	12.5'	10°12.3	-8.4'	55.8'
	SD.=15.9	d=-1.0				S.D.=15.3		
Wed		GHA	Dec	GHA	ν	Dec	d	HP
0	182°20.4	S02°06.2		214°20.7	12.6'	N10°03.8	-8.5'	55.8'
1	197°20.6	07.2		228°52.3	12.6'	09°55.3	-8.5'	55.8'
2	212°20.8	08.1		243°23.9	12.7'	09°46.8	-8.6'	55.8'
3	227°21.0	.. 09.1		257°55.6	12.7'	09°38.2	-8.6'	55.8'
4	242°21.2	10.1		272°27.3	12.8'	09°29.6	-8.6'	55.7'
5	257°21.4	11.1		286°59.1	12.8'	09°20.9	-8.7'	55.7'
6	272°21.6	S02°12.0		301°30.9	12.8'	N09°12.2	-8.7'	55.7'
7	287°21.8	13.0		316°02.8	12.9'	09°03.5	-8.8'	55.7'
8	302°22.0	14.0		330°34.7	12.9'	08°54.7	-8.8'	55.7'
9	317°22.2	.. 15.0		345°06.7	13.0'	08°45.9	-8.8'	55.6'
10	332°22.4	15.9		359°38.7	13.0'	08°37.0	-8.9'	55.6'
11	347°22.7	16.9		14°10.7	13.1'	08°28.1	-8.9'	55.6'
12	2°22.9	S02°17.9		28°42.8	13.1'	N08°19.2	-8.9'	55.6'
13	17°23.1	18.8		43°14.9	13.1'	08°10.3	-9.0'	55.6'
14	32°23.3	19.8		57°47.1	13.2'	08°01.3	-9.0'	55.5'
15	47°23.5	.. 20.8		72°19.3	13.2'	07°52.3	-9.0'	55.5'
16	62°23.7	21.8		86°51.5	13.3'	07°43.2	-9.1'	55.5'
17	77°23.9	22.7		101°23.8	13.3'	07°34.1	-9.1'	55.5'
18	92°24.1	S02°23.7		115°56.1	13.3'	N07°25.0	-9.1'	55.5'
19	107°24.3	24.7		130°28.5	13.4'	07°15.9	-9.1'	55.5'
20	122°24.5	25.6		145°00.9	13.4'	07°06.7	-9.2'	55.4'
21	137°24.7	.. 26.6		159°33.4	13.5'	06°57.5	-9.2'	55.4'
22	152°24.9	27.6		174°05.8	13.5'	06°48.3	-9.2'	55.4'
23	167°25.1	28.6		188°38.4	13.5'	06°39.1	-9.3'	55.4'
	SD.=16.0	d=-1.0				S.D.=15.1		
Thu		GHA	Dec	GHA	ν	Dec	d	HP
0	182°25.3	S02°29.5		203°10.9	13.6'	N06°29.8	-9.3'	55.4'
1	197°25.6	30.5		217°43.5	13.6'	06°20.5	-9.3'	55.3'
2	212°25.8	31.5		232°16.1	13.6'	06°11.2	-9.3'	55.3'
3	227°26.0	.. 32.4		246°48.8	13.7'	06°01.9	-9.3'	55.3'
4	242°26.2	33.4		261°21.5	13.7'	05°52.5	-9.4'	55.3'
5	257°26.4	34.4		275°54.2	13.7'	05°43.2	-9.4'	55.3'
6	272°26.6	S02°35.4		290°27.0	13.8'	N05°33.8	-9.4'	55.3'
7	287°26.8	36.3		304°59.8	13.8'	05°24.3	-9.4'	55.2'
8	302°27.0	37.3		319°32.6	13.8'	05°14.9	-9.4'	55.2'
9	317°27.2	.. 38.3		334°05.5	13.9'	05°05.5	-9.5'	55.2'
10	332°27.4	39.2		348°38.4	13.9'	04°56.0	-9.5'	55.2'
11	347°27.6	40.2		3°11.3	13.9'	04°46.5	-9.5'	55.2'
12	2°27.8	S02°41.2		17°44.3	14.0'	N04°37.0	-9.5'	55.1'
13	17°28.0	42.2		32°17.3	14.0'	04°27.5	-9.5'	55.1'
14	32°28.2	43.1		46°50.3	14.0'	04°17.9	-9.5'	55.1'
15	47°28.4	.. 44.1		61°23.3	14.1'	04°08.4	-9.6'	55.1'
16	62°28.6	45.1		75°56.4	14.1'	03°58.8	-9.6'	55.1'
17	77°28.8	46.0		90°29.5	14.1'	03°49.3	-9.6'	55.1'
18	92°29.0	S02°47.0		105°02.6	14.1'	N03°39.7	-9.6'	55.0'
19	107°29.2	48.0		119°35.8	14.2'	03°30.1	-9.6'	55.0'
20	122°29.4	49.0		134°09.0	14.2'	03°20.5	-9.6'	55.0'
21	137°29.7	.. 49.9		148°42.2	14.2'	03°10.9	-9.6'	55.0'
22	152°29.9	50.9		163°15.4	14.2'	03°01.3	-9.6'	55.0'
23	167°30.1	51.9		177°48.7	14.3'	02°51.6	-9.6'	55.0'
	SD.=16.0	d=-1.0				S.D.=15.0		

Lat.	Twilight		Sunrise	Sunset	Twilight	
	Naut.	Civil			Civil	Naut.
N 72°	03:35	05:00	06:07	17:32	18:39	20:02
N 70°	03:49	05:04	06:05	17:34	18:34	19:48
68°	04:01	05:08	06:03	17:36	18:31	19:38
66°	04:10	05:11	06:02	17:37	18:28	19:29
64°	04:17	05:14	06:01	17:38	18:25	19:22
62°	04:23	05:16	06:00	17:39	18:23	19:16
60°	04:29	05:18	05:59	17:40	18:22	19:11
N 58°	04:33	05:19	05:58	17:41	18:20	19:06
56°	04:37	05:21	05:58	17:42	18:19	19:03
54°	04:40	05:22	05:57	17:43	18:18	18:59
52°	04:43	05:23	05:56	17:44	18:17	18:56
50°	04:46	05:24	05:56	17:44	18:16	18:54
48°	04:51	05:25	05:55	17:46	18:15	18:49
N 40°	04:55	05:27	05:54	17:47	18:14	18:45
35°	04:58	05:27	05:53	17:48	18:13	18:42
30°	05:00	05:28	05:52	17:49	18:13	18:40
20°	05:03	05:28	05:50	17:50	18:12	18:38
N 10°	05:03	05:28	05:49	17:52	18:13	18:37
0°	05:03	05:27	05:47	17:54	18:14	18:38
S 10°	05:00	05:25	05:46	17:55	18:16	18:41
20°	04:56	05:22	05:44	17:57	18:19	18:45
30°	04:50	05:18	05:42	18:00	18:24	18:52
35°	04:45	05:15	05:40	18:01	18:27	18:56
40°	04:40	05:12	05:39	18:03	18:30	19:02
45°	04:33	05:08	05:37	18:05	18:34	19:09
S 50°	04:24	05:03	05:35	18:07	18:40	19:18
52°	04:20	05:00	05:34	18:08	18:42	19:23
54°	04:15	04:57	05:33	18:09	18:45	19:28
56°	04:09	04:54	05:32	18:11	18:48	19:33
58°	04:03	04:51	05:30	18:12	18:52	19:40
S 60°	03:55	04:47	05:29	18:14	18:56	19:48
Day	Sun		Moon		Mer.	
	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer. Pass Upper hh:mm	Mer. Pass Lower hh:mm	Age 26-28 12-2%	
27	09:01	09:11	11:51	09:14	21:38	
28	09:21	09:31	11:50	10:01	22:24	
29	09:41	09:51	11:50	10:47	23:09	

## September 30, 01, 02 UT (Fri., Sat., Sun.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	9°10.3	153°48.5	\$14°15.6	97°13.8	S25°50.4	184°40.8	S00°45.2	118°57.0	S20°44.0					Alpheratz	357°40.8	29°11.1	
1	24°12.7	168°48.0	16.7	112°14.4	50.4	199°42.8	45.4	133°59.2	44.1					Ankaa	353°13.2	-42°12.9	
2	39°15.2	183°47.6	17.8	127°15.1	50.3	214°44.8	45.6	149°01.5	44.1					Schedar	349°37.3	56°37.7	
3	54°17.7	198°47.1	18.9	142°15.7	50.2	229°46.7	45.8	164°03.8	44.1					Diphda	348°53.4	-17°53.6	
4	69°20.1	213°46.6	20.0	157°16.3	50.2	244°48.7	46.0	179°06.1	44.2					Achernar	335°24.7	-57°09.1	
5	84°22.6	228°46.2	21.1	172°17.0	50.1	259°50.7	46.2	194°08.3	44.2					Hamal	327°57.9	23°32.4	
6	99°25.1	243°45.7	\$14°22.2	187°17.6	S25°50.1	274°52.6	S00°46.4	209°10.6	S20°44.2					Polaris	316°22.7	89°19.8	
7	114°27.5	258°45.2	23.3	202°18.2	50.0	289°54.6	46.7	224°12.9	44.3					Acamar	315°16.4	-40°14.2	
8	129°30.0	273°44.8	24.4	217°18.8	50.0	304°56.6	46.9	239°15.2	44.3					Menkar	314°12.5	4°09.3	
9	144°32.4	288°44.3	25.5	232°19.5	49.9	319°58.5	47.1	254°17.5	44.3					Mirfak	308°36.8	49°55.0	
10	159°34.9	303°43.8	26.6	247°20.1	49.8	335°00.5	47.3	269°19.7	44.4					Aldebaran	290°46.7	16°32.4	
11	174°37.4	318°43.4	27.7	262°20.7	49.8	350°02.5	47.5	284°22.0	44.4					Rigel	281°09.8	-8°11.0	
12	189°39.8	333°42.9	\$14°28.8	277°21.4	S25°49.7	5°04.4	S00°47.7	299°24.3	S20°44.4					Capella	280°31.0	46°00.5	
13	204°42.3	348°42.4	29.9	292°22.0	49.7	20°06.4	47.9	314°26.5	44.5					Bellatrix	278°29.5	6°21.8	
14	219°44.8	3°41.9	31.0	307°22.6	49.6	35°08.4	48.1	329°28.8	44.5					Elnath	278°09.7	28°37.0	
15	234°47.2	18°41.5	32.1	322°23.2	49.5	50°10.3	48.4	344°31.1	44.5					Alnilam	275°44.0	-1°11.5	
16	249°49.7	33°41.0	33.2	337°23.9	49.5	65°12.3	48.6	359°33.4	44.5					Betelgeuse	270°58.9	7°24.5	
17	264°52.2	48°40.5	34.3	352°24.5	49.4	80°14.3	48.8	14°35.6	44.6					Canopus	263°55.1	-52°42.1	
18	279°54.6	63°40.0	\$14°35.4	7°25.1	S25°49.4	95°16.2	S00°49.0	29°37.9	S20°44.6					Sirius	258°31.8	-16°44.3	
19	294°57.1	78°39.6	36.5	22°25.7	49.3	110°18.2	49.2	44°40.2	44.6					Adhara	255°10.8	-28°59.6	
20	309°59.6	93°39.1	37.6	37°26.4	49.2	125°20.2	49.4	59°42.5	44.7					Procyon	244°57.5	5°10.9	
21	325°02.0	108°38.6	38.7	52°27.0	49.2	140°22.1	49.6	74°44.7	44.7					Pollux	243°25.2	27°58.9	
22	340°04.5	123°38.1	39.8	67°27.6	49.1	155°24.1	49.9	89°47.0	44.7					Avior	234°17.3	-59°33.6	
23	355°06.9	138°37.7	40.9	82°28.2	49.0	170°26.1	50.1	104°49.3	44.8					Suhail	222°51.0	-43°29.8	
Mer.pass.:23:19			v-0.5 d-1.1 m-3.8	v0.6 d0.1 m0.1	v2.0 d-0.2 m-1.5	v2.3 d-0.0 m0.5								Miaplacidus	221°39.6	-69°47.0	
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Alphard	217°54.1	-8°43.8	
0	10°09.4	153°37.2	\$14°42.0	97°28.9	S25°49.0	185°28.0	S00°50.3	119°51.6	S20°44.8					Regulus	207°41.4	11°53.1	
1	25°11.9	168°36.7	43.1	112°29.5	48.9	200°30.0	50.5	134°53.8	44.8					Dubhe	193°49.7	61°39.6	
2	40°14.3	183°36.2	44.2	127°30.1	48.9	215°32.0	50.7	149°56.1	44.9					Denebola	182°31.8	14°28.9	
3	55°16.8	198°35.8	45.3	142°30.7	48.8	230°33.9	50.9	164°58.4	44.9					Gienah	175°50.3	-17°37.9	
4	70°19.3	213°35.3	46.3	157°31.4	48.7	245°35.9	51.1	180°00.7	44.9					Acrux	173°07.4	-63°11.4	
5	85°21.7	228°34.8	47.4	172°32.0	48.7	260°37.9	51.3	195°02.9	45.0					Gacrux	171°58.9	-57°12.3	
6	100°24.2	243°34.3	\$14°48.5	187°32.6	S25°48.6	275°39.8	S00°51.6	210°05.2	S20°45.0					Alioth	166°19.4	55°52.3	
7	115°26.7	258°33.8	49.6	202°33.2	48.5	290°41.8	51.8	225°07.5	45.0					Spica	158°29.2	-11°14.7	
8	130°29.1	273°33.4	50.7	217°33.9	48.5	305°43.8	52.0	240°09.7	45.1					Alkaid	152°57.7	49°14.1	
9	145°31.6	288°32.9	51.8	232°34.5	48.4	320°45.8	52.2	255°12.0	45.1					Hadar	148°45.2	-60°27.1	
10	160°34.0	303°32.4	52.9	247°35.1	48.3	335°47.7	52.4	270°14.3	45.1					Menkent	148°05.3	-36°26.9	
11	175°36.5	318°31.9	54.0	262°35.7	48.3	350°49.7	52.6	285°16.6	45.2					Arcturus	145°54.0	19°06.0	
12	190°39.0	333°31.4	\$14°55.0	277°36.4	S25°48.2	5°51.7	S00°52.8	300°18.8	S20°45.2					Rigel Kent.	139°49.2	-60°54.1	
13	205°41.4	348°30.9	56.1	292°37.0	48.1	20°53.6	53.1	315°21.1	45.2					Kochab	137°21.2	74°05.5	
14	220°43.9	3°30.5	57.2	307°37.6	48.0	35°55.6	53.3	330°23.4	45.3					Zuben' ubi	137°03.2	-16°06.4	
15	235°46.4	18°30.0	58.3	322°38.2	48.0	50°57.6	53.5	345°25.6	45.3					Alphecca	126°09.4	26°39.9	
16	250°48.8	33°29.5	59.4	337°38.8	47.9	65°59.5	53.7	0°27.9	45.3					Antares	112°23.7	-26°27.9	
17	265°51.3	48°29.0	15°00.5	352°39.5	47.8	81°01.5	53.9	15°30.2	45.3					Atria	107°23.7	-69°03.4	
18	280°53.8	63°28.5	\$15°01.5	7°40.1	S25°47.8	96°03.5	S00°54.1	30°32.5	S20°45.4					Sabik	102°10.1	-15°44.5	
19	295°56.2	78°28.0	02.6	22°40.7	47.7	111°05.4	54.3	45°34.7	45.4					Nunki	96°19.0	-37°06.8	
20	310°58.7	93°27.6	03.7	37°41.3	47.6	126°07.4	54.5	60°37.0	45.4					Rasalhague	96°04.5	12°33.3	
21	326°01.2	108°27.1	04.8	52°41.9	47.6	141°09.4	54.8	75°39.3	45.5					Eltanin	90°45.2	51°29.7	
22	341°03.6	123°26.6	05.9	67°42.6	47.5	156°11.3	55.0	90°41.5	45.5					Kaus Aust.	83°40.9	-34°22.4	
23	356°06.1	138°26.1	06.9	82°43.2	47.4	171°13.3	55.2	105°43.8	45.5					Vega	80°37.5	38°48.4	
Mer.pass.:23:16			v-0.5 d-1.1 m-3.8	v0.6 d0.1 m0.1	v2.0 d-0.2 m-1.5	v2.3 d-0.0 m0.5								Nunki	75°55.6	-26°16.4	
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Al Na'ir	27°40.7	-46°52.8	
0	11°08.5	153°25.6	\$15°08.0	97°43.8	S25°47.3	186°15.3	S00°55.4	120°46.1	S20°45.6					Fomalhaut	15°21.3	-29°31.9	
1	26°11.0	168°25.1	09.1	112°44.4	47.3	201°17.2	55.6	135°48.3	45.6					Scheat	13°50.9	28°10.6	
2	41°13.5	183°24.6	10.2	127°45.0	47.2	216°19.2	55.8	150°50.6	45.6					Markab	13°35.8	15°17.9	
3	56°15.9	198°24.1	11.2	142°45.6	47.1	231°21.2	56.0	165°52.9	45.7					Sep 30 Fri	144°38.2	Mer.pass	
4	71°18.4	213°23.6	12.3	157°46.3	47.0	246°23.1	56.2	180°55.2	45.7					Venus	144°38.2	13:45	
5	86°20.9	228°23.2	13.4	172°46.9	47.0	261°25.1	56.5	195°57.4	45.7					Mars	88°03.5	17:30	
6	101°23.3	243°22.7	\$15°14.5	187°47.5	S25°46.9	276°27.1	S00°56.7	210°59.7	S20°45.8					Jupiter	175°30.5	11:40	
7	116°25.8	258°22.2	15.5	202°48.1	46.8	291°29.0	56.9	226°02.0	45.8					Saturn	109°46.7	16:02	
8	131°28.3	273°21.7	16.6	217°48.7	46.7	306°31.0	57.1	241°04.2	45.8					Oct 01 Sat	143°27.8	Mer.pass	
9	146°30.7	288°21.2	17.7	232°49.3	46.7	321°33.0	57.3	256°06.5	45.9					Venus	143°27.8	13:46	
10	161°33.2	303°20.7	18.7	247°50.0	46.6	336°34.9	57.5	271°08.8	45.9					Mars	87°19.5	17:29	
11	176°35.6	318°20.2	19.8	262°50.6	46.5	351°36.9	57.7	286°11.0	45.9					Jupiter	175°18.6	11:37	
12	191°38.1	333°19.7	\$15°20.9	277°51.2	S25°46.4	6°38.9	S00°58.0	301°13.3	S20°46.0					Saturn	109°42.2	15:58	
13	206°40.6	348°19.2	22.0	292°51.8</td													

DUT1 = UT1-UTC = -0.2779 sec ΔT = TT-UT1 = +68.4619 sec

2016 September 30 to Oct. 02 UT

h	Sun			Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	182°30.3	S02°52.8	192°21.9	14.3'	N02°42.0	-9.6'	54.9'
1	197°30.5	53.8	206°55.3	14.3'	02°32.3	-9.6'	54.9'
2	212°30.7	54.8	221°28.6	14.3'	02°22.7	-9.7'	54.9'
3	227°30.9	.. 55.8	236°01.9	14.4'	02°13.0	-9.7'	54.9'
4	242°31.1	56.7	250°35.3	14.4'	02°03.4	-9.7'	54.9'
5	257°31.3	57.7	265°08.7	14.4'	01°53.7	-9.7'	54.9'
6	272°31.5	S02°58.7	279°42.1	14.4'	N01°44.1	-9.7'	54.9'
7	287°31.7	02°59.6	294°15.6	14.4'	01°34.4	-9.7'	54.8'
8	302°31.9	03°00.6	308°49.0	14.5'	01°24.7	-9.7'	54.8'
9	317°32.1	.. 01.6	323°22.5	14.5'	01°15.1	-9.7'	54.8'
10	332°32.3	02.5	337°56.0	14.5'	01°05.4	-9.7'	54.8'
11	347°32.5	03.5	352°29.5	14.5'	00°55.7	-9.7'	54.8'
12	2°32.7	S03°04.5	7°03.0	14.5'	N00°46.0	-9.7'	54.8'
13	17°32.9	05.5	21°36.6	14.6'	00°36.4	-9.7'	54.8'
14	32°33.1	06.4	36°10.2	14.6'	00°26.7	-9.7'	54.7'
15	47°33.3	.. 07.4	50°43.7	14.6'	00°17.0	-9.7'	54.7'
16	62°33.5	08.4	65°17.3	14.6'	N00°07.4	-9.7'	54.7'
17	77°33.7	09.3	79°50.9	14.6'	S00°02.3	-9.7'	54.7'
18	92°33.9	S03°10.3	94°24.6	14.6'	S00°11.9	-9.6'	54.7'
19	107°34.1	11.3	108°58.2	14.6'	00°21.6	-9.6'	54.7'
20	122°34.3	12.2	123°31.9	14.7'	00°31.2	-9.6'	54.7'
21	137°34.5	.. 13.2	138°05.5	14.7'	00°40.8	-9.6'	54.6'
22	152°34.7	14.2	152°39.2	14.7'	00°50.5	-9.6'	54.6'
23	167°34.9	15.2	167°12.9	14.7'	01°00.1	-9.6'	54.6'
	SD.=16.0	d=-1.0			S.D.=14.9		

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	182°35.1	S03°16.1	181°46.6	14.7'	S01°09.7	-9.6'	54.6'
1	197°35.3	17.1	196°20.3	14.7'	01°19.3	-9.6'	54.6'
2	212°35.5	18.1	210°54.0	14.7'	01°28.9	-9.6'	54.6'
3	227°35.7	.. 19.0	225°27.8	14.7'	01°38.5	-9.6'	54.6'
4	242°35.9	20.0	240°01.5	14.7'	01°48.0	-9.6'	54.5'
5	257°36.1	21.0	254°35.3	14.8'	01°57.6	-9.5'	54.5'
6	272°36.3	S03°21.9	269°09.0	14.8'	S02°07.1	-9.5'	54.5'
7	287°36.5	22.9	283°42.8	14.8'	02°16.7	-9.5'	54.5'
8	302°36.7	23.9	298°16.6	14.8'	02°26.2	-9.5'	54.5'
9	317°36.9	.. 24.8	312°50.4	14.8'	02°35.7	-9.5'	54.5'
10	332°37.1	25.8	327°24.1	14.8'	02°45.2	-9.5'	54.5'
11	347°37.3	26.8	341°57.9	14.8'	02°54.6	-9.5'	54.5'
12	2°37.5	S03°27.8	356°31.7	14.8'	S03°04.1	-9.4'	54.4'
13	17°37.7	28.7	11°05.5	14.8'	03°13.5	-9.4'	54.4'
14	32°37.9	29.7	25°39.3	14.8'	03°22.9	-9.4'	54.4'
15	47°38.1	.. 30.7	40°13.2	14.8'	03°32.3	-9.4'	54.4'
16	62°38.3	31.6	54°47.0	14.8'	03°41.7	-9.4'	54.4'
17	77°38.5	32.6	69°20.8	14.8'	03°51.1	-9.4'	54.4'
18	92°38.7	S03°33.6	83°54.6	14.8'	S04°00.4	-9.3'	54.4'
19	107°38.9	34.5	98°28.4	14.8'	04°09.8	-9.3'	54.4'
20	122°39.1	35.5	113°02.2	14.8'	04°19.1	-9.3'	54.4'
21	137°39.3	.. 36.5	127°36.1	14.8'	04°28.3	-9.3'	54.3'
22	152°39.5	37.4	142°09.9	14.8'	04°37.6	-9.2'	54.3'
23	167°39.7	38.4	156°43.7	14.8'	04°46.8	-9.2'	54.3'
	SD.=16.0	d=-1.0			S.D.=14.8		

Sun	GHA	Dec	GHA	ν	Dec	d	HP
0	182°39.9	S03°39.4	171°17.5	14.8'	S04°56.0	-9.2'	54.3'
1	197°40.1	40.3	185°51.4	14.8'	05°05.2	-9.2'	54.3'
2	212°40.3	41.3	200°25.2	14.8'	05°14.4	-9.2'	54.3'
3	227°40.5	.. 42.3	214°59.0	14.8'	05°23.5	-9.1'	54.3'
4	242°40.7	43.2	229°32.8	14.8'	05°32.6	-9.1'	54.3'
5	257°40.9	44.2	244°06.6	14.8'	05°41.7	-9.1'	54.3'
6	272°41.1	S03°45.2	258°40.4	14.8'	S05°50.8	-9.0'	54.3'
7	287°41.3	46.1	273°14.2	14.8'	05°59.8	-9.0'	54.2'
8	302°41.5	47.1	287°48.0	14.8'	06°08.8	-9.0'	54.2'
9	317°41.7	.. 48.1	302°21.8	14.8'	06°17.8	-9.0'	54.2'
10	332°41.9	49.0	316°55.6	14.8'	06°26.7	-8.9'	54.2'
11	347°42.0	50.0	331°29.4	14.8'	06°35.7	-8.9'	54.2'
12	2°42.2	S03°51.0	346°03.1	14.8'	S06°44.6	-8.9'	54.2'
13	17°42.4	51.9	0°36.9	14.8'	06°53.4	-8.8'	54.2'
14	32°42.6	52.9	15°10.7	14.8'	07°02.2	-8.8'	54.2'
15	47°42.8	.. 53.9	29°44.4	14.7'	07°11.0	-8.8'	54.2'
16	62°43.0	54.8	44°18.2	14.7'	07°19.8	-8.7'	54.2'
17	77°43.2	55.8	58°51.9	14.7'	07°28.5	-8.7'	54.2'
18	92°43.4	S03°56.8	73°25.6	14.7'	S07°37.2	-8.7'	54.1'
19	107°43.6	57.7	87°59.3	14.7'	07°45.9	-8.6'	54.1'
20	122°43.8	58.7	102°33.0	14.7'	07°54.5	-8.6'	54.1'
21	137°44.0	03°59.7	117°06.7	14.7'	08°03.1	-8.6'	54.1'
22	152°44.2	04°00.6	131°40.4	14.7'	08°11.6	-8.5'	54.1'
23	167°44.4	01.6	146°14.1	14.7'	08°20.1	-8.5'	54.1'
	SD.=16.0	d=-1.0			S.D.=14.8		

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Pass hh:mm
30	10:01	10:11	11:50	11:31 23:53
01	10:20	10:30	11:49	12:14 --
02	10:40	10:49	11:49	12:57 00:36

## October 03, 04, 05 UT (Mon., Tue., Wed.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	12°07.7	153°13.8	\$15°33.7	97°58.6	\$25°45.5	187°02.5	\$01°00.5	121°40.5	\$20°46.3									Alpheratz	357°40.8	29°11.1			
1	27°10.1	168°13.3	34.7	112°59.2	45.4	202°04.5	00.7	136°42.8	46.4									Ankaa	353°13.2	-42°12.9			
2	42°12.6	183°12.8	35.8	127°59.8	45.3	217°06.4	00.9	151°45.0	46.4								Schedar	349°37.3	56°37.8				
3	57°15.1	198°12.3	· · 36.9	143°00.4	· · 45.2	232°08.4	· · 01.1	166°47.3	· · 46.4								Diphda	348°53.4	-17°53.6				
4	72°17.5	213°11.8	37.9	158°01.0	45.2	247°10.4	01.4	181°49.6	46.5								Achernar	335°24.7	-57°09.1				
5	87°20.0	228°11.3	39.0	173°01.6	45.1	262°12.3	01.6	196°51.8	46.5								Hamal	327°57.9	23°32.4				
6	102°22.5	243°10.8	\$15°40.0	188°02.2	\$25°45.0	277°14.3	\$01°01.8	211°54.1	\$20°46.5								Polaris	316°21.7	89°19.8				
7	117°24.9	258°10.3	41.1	203°02.8	44.9	292°16.3	02.0	226°56.4	46.6								Acamar	315°16.4	-40°14.2				
8	132°27.4	273°09.8	42.2	218°03.4	44.8	307°18.2	02.2	241°58.6	46.6								Menkar	314°12.5	4°09.3				
9	147°29.9	288°09.3	· · 43.2	233°04.0	· · 44.7	322°20.2	· · 02.4	257°00.9	· · 46.6								Mirfak	308°36.7	49°55.0				
10	162°32.3	303°08.7	44.3	248°04.7	44.6	337°22.2	02.6	272°03.2	46.7								Aldebaran	290°46.7	16°32.4				
11	177°34.8	318°08.2	45.3	263°05.3	44.6	352°24.1	02.8	287°05.4	46.7								Rigel	281°09.8	-8°11.0				
12	192°37.2	333°07.7	\$15°46.4	278°05.9	\$25°44.5	7°26.1	\$01°03.1	302°07.7	\$20°46.7								Capella	280°31.0	46°00.5				
13	207°39.7	348°07.2	47.4	293°06.5	44.4	22°28.1	03.3	317°10.0	46.8								Bellatrix	278°29.5	6°21.8				
14	222°42.2	3°06.7	48.5	308°07.1	44.3	37°30.1	03.5	332°12.2	46.8								El Nath	278°09.7	28°37.0				
15	237°44.6	18°06.2	· · 49.5	323°07.7	· · 44.2	52°32.0	· · 03.7	347°14.5	· · 46.8								Alnilam	275°44.0	-1°11.5				
16	252°47.1	33°05.7	50.6	338°08.3	44.1	67°34.0	03.9	2°16.8	46.9								Betelgeuse	270°58.8	7°24.5				
17	267°49.6	48°05.2	51.6	353°08.9	44.0	82°36.0	04.1	17°19.0	46.9								Canopus	263°55.1	-52°42.1				
18	282°52.0	63°04.7	\$15°52.7	8°09.5	\$25°43.9	97°37.9	\$01°04.3	32°21.3	\$20°46.7								Sirius	258°31.8	-16°44.3				
19	297°54.5	78°04.2	53.7	23°10.1	43.9	112°39.9	04.5	47°23.5	47.0								Adhara	255°10.8	-28°59.6				
20	312°57.0	93°03.7	54.8	38°10.7	43.8	127°41.9	04.8	62°25.8	47.0								Procyon	244°57.5	5°10.8				
21	327°59.4	108°03.2	· · 55.8	53°11.3	· · 43.7	142°43.8	· · 05.0	77°28.1	· · 47.0								Pollux	243°25.1	27°58.9				
22	343°01.9	123°02.7	56.9	68°12.0	43.6	157°45.8	05.2	92°30.3	47.1								Avior	234°17.3	-59°33.6				
23	358°04.4	138°02.2	57.9	83°12.6	43.5	172°47.8	05.4	107°32.6	47.1								Suhail	222°51.0	-43°29.8				
Mer.pass.:23:08				v-0.5 d-1.1 m-3.8				v0.6 d0.1 m0.1				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	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	13°06.8	153°01.7	\$15°59.0	98°13.2	\$25°43.4	187°49.7	\$01°05.6	122°34.9	\$20°47.1									Denebola	182°31.7	14°28.8			
1	28°09.3	168°01.1	16°00.0	113°13.8	43.3	202°51.7	05.8	137°37.1	47.2								Gienah	175°50.3	-17°37.9				
2	43°11.7	183°00.6	01.1	128°14.4	43.2	217°53.7	06.0	152°39.4	47.2								Acrux	173°07.4	-63°11.4				
3	58°14.2	198°00.1	· · 02.1	143°15.0	· · 43.1	232°55.6	· · 06.2	167°41.7	· · 47.2								Gacrux	171°58.9	-57°12.2				
4	73°16.7	212°59.6	03.2	158°15.6	43.0	247°57.6	06.5	182°43.9	47.3								Alioth	166°19.4	55°52.3				
5	88°19.1	227°59.1	04.2	173°16.2	42.9	262°59.6	06.7	197°46.2	47.3								Spica	158°29.2	-11°14.7				
6	103°21.6	242°58.6	\$16°05.3	188°16.8	\$25°42.9	278°01.5	\$01°06.9	212°48.4	\$20°47.3								Alkaid	152°57.7	49°14.0				
7	118°24.1	257°58.1	06.3	203°17.4	42.8	293°03.5	07.1	227°50.7	47.4								Hadar	148°45.2	-60°27.1				
8	133°26.5	272°57.6	07.3	218°18.0	42.7	308°05.5	07.3	242°53.0	47.4								Menkent	148°05.3	-36°26.9				
9	148°29.0	287°57.0	· · 08.4	233°18.6	· · 42.6	323°07.4	· · 07.5	257°55.2	· · 47.4								Arcturus	145°54.1	19°06.0				
10	163°31.5	302°56.5	09.4	248°19.2	42.5	338°09.4	07.7	272°57.5	47.4								Rigel Kent.	139°49.2	-60°54.1				
11	178°33.9	317°56.0	10.5	263°19.8	42.4	353°11.4	07.9	287°59.8	47.5								Kochab	137°21.3	74°05.5				
12	193°36.4	332°55.5	\$16°11.5	278°20.4	\$25°42.3	8°13.4	\$01°08.2	303°02.0	\$20°47.5								Zuben' ubi	137°03.2	-16°06.4				
13	208°38.9	347°55.0	12.5	293°21.0	42.2	23°15.3	08.4	318°04.3	47.5								Alphecca	126°09.4	26°39.9				
14	223°41.3	2°54.5	13.6	308°21.6	42.1	38°17.3	08.6	333°06.5	47.6								Antares	112°23.7	-26°27.9				
15	238°43.8	17°53.9	· · 14.6	323°22.2	· · 42.0	53°19.3	· · 08.8	348°08.8	· · 47.6								Atria	107°23.8	-69°03.4				
16	253°46.2	32°53.4	15.6	338°22.8	41.9	68°21.2	09.0	3°11.1	47.6								Sabik	102°10.1	-15°44.5				
17	268°48.7	47°52.9	16.7	353°23.4	41.8	83°23.2	09.2	18°13.3	47.7								Shaula	96°19.0	-37°06.8				
18	283°51.2	62°52.4	\$16°17.7	8°24.0	\$25°41.7	98°25.2	\$01°09.4	33°15.6	\$20°47.7								Rasalhague	96°04.5	12°33.3				
19	298°53.6	77°51.9	18.8	23°24.6	41.6	113°27.1	09.6	48°17.8	47.7								Eltanin	90°45.2	51°29.7				
20	313°56.1	92°51.4	19.8	38°25.2	41.5	128°29.1	09.9	63°20.1	47.8								Kaus Aust.	83°40.9	-34°22.4				
21	328°58.6	107°50.8	· · 20.8	53°25.8	· · 41.4	143°31.1	· · 10.1	78°22.4	· · 47.8								Vega	80°37.5	38°48.4				
22	344°01.0	122°50.3	21.9	68°26.4	41.3	158°33.0	10.3	93°24.6	47.8								Nunki	75°55.6	-26°16.4				
23	359°03.5	137°49.8	22.9	83°27.0	41.2	173°35.0	10.5	108°26.9	47.9								Altair	62°06.0	8°55.1				
Mer.pass.:23:04				v-0.5 d-1.0 m-3.8				v0.6 d0.1 m0.1				v2.0 d-0.2 m-1.5				v2.3 d-0.0 m0.6							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec						
0	14°06.0	152°49.3	\$16°23.9	98°27.6	\$25°41.1	188°37.0	\$01°10.7	123°29.1	\$20°47.9									Oct 03 Mon	SHA	Mer.pass			
1	29°08.4	167°48.7	24.9	113°28.2	41.0	203°38.9	10.9	138°31.4	47.9								Venus	141°06.1	13:48				
2	44°10.9	182°48.2	26.0	128°28.8	40.9	218°40.9	11.1	153°33.7	48.0							Mars	85°50.9	17:27					
3	59°13.3	197°47.7	· · 27.0	143°29.4	· · 40.8	233°42.9	· · 11.3	168°35.9	· · 48.0							Jupiter	174°54.8	11:30					
4	74°15.8	212°47.2	28.0	158°30.0	40.7	248°44.8	11.6	183°38.2	48.0							Saturn	109°32.8	15:51					
5	89°18.3	227°46.7	29.1	173°30.6	40.6	263°46.8	11.8	198°40.4	48.1														
6	104°20.7	242°46.1	\$16°30.1	188°31.2	\$25°40.5	278°48.8	\$01°12.0	213°42.7	\$20°48.1								Oct 04 Tue	SHA	Mer.pass				
7	119°23.2	257°45.6	31.1																				

DUT1 = UT1-UTC = -0.2819 sec ΔT = TT-UT1 = +68.4659 sec

2016 October 03 to Oct. 05 UT

Mon	Sun			Moon			
	GHA	Dec	GHA	ν	Dec	d	HP
0	182°44.6	S04°02.6	160°47.7	14.7'	S08°28.6	-8.5'	54.1'
1	197°44.8	03.5	175°21.4	14.6'	08°37.0	-8.4'	54.1'
2	212°45.0	04.5	189°55.0	14.6'	08°45.4	-8.4'	54.1'
3	227°45.2	.. 05.5	204°28.6	14.6'	08°53.8	-8.3'	54.1'
4	242°45.4	06.4	219°02.2	14.6'	09°02.1	-8.3'	54.1'
5	257°45.6	07.4	233°35.8	14.6'	09°10.4	-8.3'	54.1'
6	272°45.7	S04°08.4	248°09.4	14.6'	S09°18.7	-8.2'	54.1'
7	287°45.9	09.3	262°43.0	14.6'	09°26.9	-8.2'	54.1'
8	302°46.1	10.3	277°16.5	14.5'	09°35.0	-8.1'	54.1'
9	317°46.3	.. 11.3	291°50.1	14.5'	09°43.1	-8.1'	54.1'
10	332°46.5	12.2	306°23.6	14.5'	09°51.2	-8.1'	54.0'
11	347°46.7	13.2	320°57.1	14.5'	09°59.3	-8.0'	54.0'
12	2°46.9	S04°14.2	335°30.6	14.5'	S10°07.2	-8.0'	54.0'
13	17°47.1	15.1	350°04.1	14.5'	10°15.2	-7.9'	54.0'
14	32°47.3	16.1	4°37.5	14.4'	10°23.1	-7.9'	54.0'
15	47°47.5	.. 17.1	19°10.9	14.4'	10°30.9	-7.8'	54.0'
16	62°47.7	18.0	33°44.4	14.4'	10°38.8	-7.8'	54.0'
17	77°47.9	19.0	48°17.8	14.4'	10°46.5	-7.7'	54.0'
18	92°48.1	S04°19.9	62°51.1	14.4'	S10°54.2	-7.7'	54.0'
19	107°48.2	20.9	77°24.5	14.4'	11°01.9	-7.6'	54.0'
20	122°48.4	21.9	91°57.8	14.3'	11°09.5	-7.6'	54.0'
21	137°48.6	.. 22.8	106°31.2	14.3'	11°17.1	-7.6'	54.0'
22	152°48.8	23.8	121°04.5	14.3'	11°24.6	-7.5'	54.0'
23	167°49.0	24.8	135°37.7	14.3'	11°32.1	-7.5'	54.0'
	SD.=16.0	d=-1.0			S.D.=14.7		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	182°49.2	S04°25.7	150°11.0	14.3'	S11°39.5	-7.4'	54.0'
1	197°49.4	26.7	164°44.2	14.2'	11°46.9	-7.4'	54.0'
2	212°49.6	27.7	179°17.5	14.2'	11°54.3	-7.3'	54.0'
3	227°49.8	.. 28.6	193°50.7	14.2'	12°01.5	-7.3'	54.0'
4	242°50.0	29.6	208°23.8	14.2'	12°08.8	-7.2'	54.0'
5	257°50.2	30.5	222°57.0	14.1'	12°15.9	-7.1'	54.0'
6	272°50.3	S04°31.5	237°30.1	14.1'	S12°23.0	-7.1'	54.0'
7	287°50.5	32.5	252°03.2	14.1'	12°30.1	-7.0'	54.0'
8	302°50.7	33.4	266°36.3	14.1'	12°37.1	-7.0'	54.0'
9	317°50.9	.. 34.4	281°09.4	14.0'	12°44.1	-6.9'	54.0'
10	332°51.1	35.4	295°42.4	14.0'	12°51.0	-6.9'	54.0'
11	347°51.3	36.3	310°15.4	14.0'	12°57.8	-6.8'	54.0'
12	2°51.5	S04°37.3	324°48.4	14.0'	S13°04.6	-6.8'	54.0'
13	17°51.7	38.3	339°21.4	14.0'	13°11.4	-6.7'	54.0'
14	32°51.9	39.2	353°54.3	13.9'	13°18.0	-6.7'	54.0'
15	47°52.0	.. 40.2	8°27.2	13.9'	13°24.7	-6.6'	54.0'
16	62°52.2	41.1	23°00.1	13.9'	13°31.2	-6.5'	54.0'
17	77°52.4	42.1	37°33.0	13.8'	13°37.7	-6.5'	54.0'
18	92°52.6	S04°43.1	52°05.8	13.8'	S13°44.2	-6.4'	54.0'
19	107°52.8	44.0	66°38.6	13.8'	13°50.6	-6.4'	54.0'
20	122°53.0	45.0	81°11.4	13.8'	13°56.9	-6.3'	54.0'
21	137°53.2	.. 45.9	95°44.2	13.7'	14°03.2	-6.2'	54.0'
22	152°53.4	46.9	110°16.9	13.7'	14°09.4	-6.2'	54.0'
23	167°53.5	47.9	124°49.6	13.7'	14°15.5	-6.1'	54.0'
	SD.=16.0	d=-1.0			S.D.=14.7		

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	182°53.7	S04°48.8	139°22.3	13.7'	S14°21.6	-6.1'	54.0'
1	197°53.9	49.8	153°54.9	13.6'	14°27.7	-6.0'	54.0'
2	212°54.1	50.8	168°27.5	13.6'	14°33.6	-5.9'	54.0'
3	227°54.3	.. 51.7	183°00.1	13.6'	14°39.5	-5.9'	54.0'
4	242°54.5	52.7	197°32.7	13.6'	14°45.4	-5.8'	54.0'
5	257°54.7	53.6	212°05.2	13.5'	14°51.1	-5.7'	54.0'
6	272°54.8	S04°54.6	226°37.8	13.5'	S14°56.9	-5.7'	54.0'
7	287°55.0	55.6	241°10.2	13.5'	15°02.5	-5.6'	54.0'
8	302°55.2	56.5	255°42.7	13.4'	15°08.1	-5.5'	54.0'
9	317°55.4	.. 57.5	270°15.1	13.4'	15°13.6	-5.5'	54.0'
10	332°55.6	58.4	284°47.5	13.4'	15°19.0	-5.4'	54.0'
11	347°55.8	04°59.4	299°19.9	13.4'	15°24.4	-5.4'	54.0'
12	2°56.0	S05°00.4	313°52.2	13.3'	S15°29.7	-5.3'	54.1'
13	17°56.1	01.3	328°24.5	13.3'	15°35.0	-5.2'	54.1'
14	32°56.3	02.3	342°56.8	13.3'	15°40.2	-5.1'	54.1'
15	47°56.5	.. 03.2	357°29.0	13.2'	15°45.3	-5.1'	54.1'
16	62°56.7	04.2	12°01.3	13.2'	15°50.3	-5.0'	54.1'
17	77°56.9	05.2	26°33.5	13.2'	15°55.3	-4.9'	54.1'
18	92°57.1	S05°06.1	41°05.6	13.1'	S16°00.2	-4.9'	54.1'
19	107°57.3	07.1	55°37.7	13.1'	16°05.1	-4.8'	54.1'
20	122°57.4	08.0	70°09.8	13.1'	16°09.8	-4.7'	54.1'
21	137°57.6	.. 09.0	84°41.9	13.1'	16°14.5	-4.7'	54.1'
22	152°57.8	10.0	99°14.0	13.0'	16°19.1	-4.6'	54.1'
23	167°58.0	10.9	113°46.0	13.0'	16°23.7	-4.5'	54.1'
	SD.=16.0	d=-1.0			S.D.=14.7		

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

Day	Sun		Moon	
	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass. 12 <sup>h</sup> mm:ss	Mer. Pass. Upper hh:mm	Mer. Pass. Lower hh:mm
03	10:58	11:08	11:49	13:41 01:19
04	11:17	11:26	11:49	14:25 02:03
05	11:35	11:44	11:48	15:10 02:48



## October 06, 07, 08 UT (Thu., Fri., Sat.)

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	15° 05.1	152° 36.6	\$16° 48.4	98° 42.0	\$25° 38.6	189° 24.2	\$01° 15.8	124° 23.3	\$20° 48.7	Alpheratz	357° 40.8	29° 11.1					
1	30° 07.6	167° 36.1	49.5	113° 42.6	38.5	204° 26.2	16.0	139° 25.6	48.7	Ankaa	353° 13.2	-42° 12.9					
2	45° 10.0	182° 35.5	50.5	128° 43.2	38.4	219° 28.2	16.2	154° 27.9	48.8	Schedar	349° 37.3	56° 37.8					
3	60° 12.5	197° 35.0	.. 51.5	143° 43.8	.. 38.3	234° 30.1	.. 16.4	169° 30.1	.. 48.8	Diphda	348° 53.4	-17° 53.6					
4	75° 15.0	212° 34.5	52.5	158° 44.4	38.2	249° 32.1	16.6	184° 32.4	48.8	Achernar	335° 24.6	-57° 09.1					
5	90° 17.4	227° 33.9	53.5	173° 45.0	38.0	264° 34.1	16.9	199° 34.6	48.9	Hamal	327° 57.9	23° 32.4					
6	105° 19.9	242° 33.4	\$16° 54.5	188° 45.5	\$25° 37.9	279° 36.0	\$01° 17.1	214° 36.9	\$20° 48.9	Polaris	316° 20.7	89° 19.8					
7	120° 22.3	257° 32.9	55.5	203° 46.1	37.8	294° 38.0	17.3	229° 39.1	48.9	Acamar	315° 16.3	-40° 14.2					
8	135° 24.8	272° 32.3	56.5	218° 46.7	37.7	309° 40.0	17.5	244° 41.4	49.0	Menkar	314° 12.5	4° 09.3					
9	150° 27.3	287° 31.8	.. 57.5	233° 47.3	.. 37.6	324° 41.9	.. 17.7	259° 43.7	.. 49.0	Mirfak	308° 36.7	49° 55.0					
10	165° 29.7	302° 31.3	58.5	248° 47.9	37.5	339° 43.9	17.9	274° 45.9	49.0	Aldebaran	290° 46.6	16° 32.4					
11	180° 32.2	317° 30.7	16° 59.6	263° 48.5	37.4	354° 45.9	18.1	289° 48.2	49.1	Rigel	281° 09.8	-8° 11.0					
12	195° 34.7	332° 30.2	\$17° 00.6	278° 49.1	\$25° 37.3	9° 47.9	\$01° 18.3	304° 50.4	\$20° 49.1	Capella	280° 31.0	46° 00.5					
13	210° 37.1	347° 29.6	01.6	293° 49.7	37.1	24° 49.8	18.5	319° 52.7	49.1	Bellatrix	278° 29.5	6° 21.8					
14	225° 39.6	2° 29.1	02.6	308° 50.3	37.0	39° 51.8	18.8	334° 54.9	49.2	Elnath	278° 09.7	28° 37.0					
15	240° 42.1	17° 28.6	.. 03.6	323° 50.9	.. 36.9	54° 53.8	.. 19.0	349° 57.2	.. 49.2	Alnilam	275° 44.0	-1° 11.6					
16	255° 44.5	32° 28.0	04.6	338° 51.5	36.8	69° 55.7	19.2	4° 59.4	49.2	Betelgeuse	270° 58.8	7° 24.5					
17	270° 47.0	47° 27.5	05.6	353° 52.1	36.7	84° 57.7	19.4	20° 01.7	49.3	Canopus	263° 55.1	-52° 42.1					
18	285° 49.4	62° 26.9	\$17° 06.6	8° 52.7	\$25° 36.6	99° 59.7	\$01° 19.6	35° 03.9	\$20° 49.3	Sirius	258° 31.7	-16° 44.3					
19	300° 51.9	77° 26.4	07.6	23° 53.2	36.4	115° 01.6	19.8	50° 06.2	49.3	Adhara	255° 10.8	-28° 59.6					
20	315° 54.4	92° 25.8	08.6	38° 53.8	36.3	130° 03.6	20.0	65° 08.5	49.4	Procyon	244° 57.5	5° 10.8					
21	330° 56.8	107° 25.3	.. 09.6	53° 54.4	.. 36.2	145° 05.6	.. 20.2	80° 10.7	.. 49.4	Pollux	243° 25.1	27° 58.9					
22	345° 59.3	122° 24.8	10.6	68° 55.0	36.1	160° 07.5	20.5	95° 13.0	49.4	Avior	234° 17.3	-59° 33.6					
23	1° 01.8	137° 24.2	11.6	83° 55.6	36.0	175° 09.5	20.7	110° 15.2	49.5	Suhail	222° 51.0	-43° 29.8					
Mer.pass.:22:56			v-0.5 d-1.0 m-3.8	v0.6 d0.1 m0.1	v2.0 d-0.2 m-1.5	v2.3 d-0.0 m0.6	Miaplacidus			v2.1° 39.6	v2.1° 46.9	v2.1° 43.8	v2.0° 53.1	v1.9° 39.5	v1.9° 39.5	v1.9° 39.5	
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Regulus	207° 41.4	11° 53.1	
0	16° 04.2	152° 23.7	\$17° 12.6	98° 56.2	\$25° 35.9	190° 11.5	\$01° 20.9	125° 17.5	\$20° 49.5	Dubhe	193° 49.7	61° 39.5					
1	31° 06.7	167° 23.1	13.6	113° 56.8	35.7	205° 13.5	21.1	140° 19.7	49.5	Denebola	182° 31.7	14° 28.8					
2	46° 09.2	182° 22.6	14.6	128° 57.4	35.6	220° 15.4	21.3	155° 22.0	49.6	Gienah	175° 50.3	-17° 37.9					
3	61° 11.6	197° 22.0	.. 15.6	143° 58.0	.. 35.5	235° 17.4	.. 21.5	170° 24.2	.. 49.6	Gacrux	173° 07.4	-63° 11.3					
4	76° 14.1	212° 21.5	16.6	158° 58.6	35.4	250° 19.4	21.7	185° 26.5	49.6	Alioth	171° 58.9	-57° 12.2					
5	91° 16.6	227° 20.9	17.5	173° 59.1	35.3	265° 21.3	21.9	200° 28.7	49.7	Alkaid	166° 19.4	55° 52.3					
6	106° 19.0	242° 20.4	\$17° 18.5	188° 59.7	\$25° 35.1	280° 23.3	\$01° 22.1	215° 31.0	\$20° 49.7	Hadar	152° 57.7	49° 14.0					
7	121° 21.5	257° 19.8	19.5	204° 00.3	35.0	295° 25.3	22.4	230° 33.2	49.7	Menkent	148° 05.3	-36° 26.9					
8	136° 23.9	272° 19.3	20.5	219° 00.9	34.9	310° 27.2	22.6	245° 35.5	49.8	Arcturus	145° 54.1	19° 06.0					
9	151° 26.4	287° 18.7	.. 21.5	234° 01.5	.. 34.8	325° 29.2	.. 22.8	260° 37.8	.. 49.8	Rigel Kent.	139° 49.2	-60° 54.1					
10	166° 28.9	302° 18.2	22.5	249° 02.1	34.7	340° 31.2	23.0	275° 40.0	49.8	Kochab	137° 21.3	74° 05.5					
11	181° 31.3	317° 17.6	23.5	264° 02.7	34.5	355° 33.1	23.2	290° 42.3	49.9	Zuben 'ubi	137° 03.2	-16° 06.4					
12	196° 33.8	332° 17.1	\$17° 24.5	279° 03.3	\$25° 34.4	10° 35.1	\$01° 23.4	305° 44.5	\$20° 49.7	Alphecca	126° 09.4	26° 39.9					
13	211° 36.3	347° 16.5	25.5	294° 03.8	34.3	25° 37.1	23.6	320° 46.8	49.9	Antares	112° 23.7	-26° 27.9					
14	226° 38.7	2° 16.0	26.5	309° 04.4	34.2	40° 39.1	23.8	335° 49.0	50.0	Atria	107° 23.8	-69° 03.4					
15	241° 41.2	17° 15.4	.. 27.4	324° 05.0	.. 34.0	55° 41.0	.. 24.0	350° 51.3	.. 50.0	Sabik	102° 10.2	-15° 44.5					
16	256° 43.7	32° 14.9	28.4	339° 05.6	33.9	70° 43.0	24.3	5° 53.5	50.0	Rasalhague	96° 04.5	12° 33.3					
17	271° 46.1	47° 14.3	29.4	354° 06.2	33.8	85° 45.0	24.5	20° 55.8	50.1	Eltanin	90° 45.3	51° 29.7					
18	286° 48.6	62° 13.8	\$17° 30.4	9° 06.8	\$25° 33.7	100° 46.9	\$01° 24.7	35° 58.0	\$20° 50.1	Kaus Aust.	83° 40.9	-34° 22.4					
19	301° 51.1	77° 13.2	31.4	24° 07.4	33.5	115° 48.9	24.9	51° 00.3	50.1	Vega	80° 37.5	38° 48.4					
20	316° 53.5	92° 12.7	32.4	39° 07.9	33.4	130° 50.9	25.1	66° 02.5	50.2	Nunki	75° 55.6	-26° 16.4					
21	331° 56.0	107° 12.1	.. 33.3	54° 08.5	.. 33.3	145° 52.8	.. 25.3	81° 04.8	.. 50.2	Altair	62° 06.0	8° 55.1					
22	346° 58.4	122° 11.6	34.3	69° 09.1	33.2	160° 54.8	25.5	96° 07.0	50.2	Peacock	53° 15.6	-56° 40.9					
23	2° 00.9	137° 11.0	35.3	84° 09.7	33.0	175° 56.8	25.7	111° 09.3	50.3	Deneb	49° 29.7	45° 20.8					
Mer.pass.:22:52			v-0.5 d-1.0 m-3.8	v0.6 d0.1 m0.1	v2.0 d-0.2 m-1.5	v2.3 d-0.0 m0.6	Enif			v33° 44.7	v9° 57.4	v27° 40.7	v-46° 52.8	v15° 21.3	v-29° 32.0	v13° 50.9	v28° 10.6
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Markab	13° 35.8	15° 17.9	
0	17° 03.4	152° 10.5	\$17° 36.3	99° 10.3	\$25° 32.9	190° 58.7	\$01° 25.9	126° 11.5	\$20° 50.3	Oct 06 Thu	137° 31.5	13:50					
1	32° 05.8	167° 09.9	37.3	114° 10.9	32.8	206° 00.7	26.2	141° 13.8	50.3	Venus	136° 19.4	13:51					
2	47° 08.3	182° 09.3	38.2	129° 11.5	32.6	221° 02.7	26.4	156° 16.0	50.4	Mars	83° 36.9	17:25					
3	62° 10.8	197° 08.8	.. 39.2	144° 12.0	.. 32.5	236° 04.7	.. 26.6	171° 18.3	.. 50.4	Jupiter	174° 19.1	11:21					
4	77° 13.2	212° 08.2	40.2	159° 12.6	32.4	251° 06.6	26.8	186° 20.5	50.4	Saturn	109° 18.3	15:40					
5	92° 15.7	227° 07.7	41.2	174° 13.2	32.3	266° 08.6	27.0	201° 22.8	50.5	Oct 07 Fri	136° 07.2	11:18					
6	107° 18.2	242° 07.1	\$17° 42.1	189° 13.8	\$25° 32.1	281° 10.6	\$01° 27.2	216° 25.0	\$20° 50.5	Venus	136° 07.2	11:18					
7	122° 20.6	257° 06.5	43.1	204° 14.4	32.0	296° 12.5	27.4	231° 27.3	50.5	Mars	82° 52.0	17:24					
8	137° 23.1	272° 06.0	44.1	219° 15.0	31.9	311° 14.5	27.6	246° 29.5	50.6	Jupiter	174° 07.2	11:18					
9	152° 25.5	287° 05.4	.. 45.1	234° 15.5	.. 31.7	326° 16.5	.. 27.8	261° 31.8	.. 50.6	Saturn	109° 13.2	15:36					
10	167° 28.0	302° 04.9	46.0	249° 16.1	31.6	341° 18.4	28.1	276° 34.0									

DUT1 = UT1-UTC = -0.2862 sec ΔT = TT-UT1 = +68.4702 sec

2016 October 06 to Oct. 08 UT

h	Sun			Moon				
	Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	182°58.2	S05°11.9	128°17.9	13.0'	\$16°28.2	-4.4'	54.1'	
1	197°58.4	12.8	142°49.9	12.9'	16°32.6	-4.4'	54.1'	
2	212°58.5	13.8	157°21.8	12.9'	16°36.9	-4.3'	54.2'	
3	227°58.7	14.8	171°53.7	12.9'	16°41.2	-4.2'	54.2'	
4	242°58.9	15.7	186°25.5	12.8'	16°45.4	-4.2'	54.2'	
5	257°59.1	16.7	200°57.4	12.8'	16°49.5	-4.1'	54.2'	
6	272°59.3	S05°17.6	215°29.2	12.8'	\$16°53.5	-4.0'	54.2'	
7	287°59.4	18.6	230°00.9	12.7'	16°57.5	-3.9'	54.2'	
8	302°59.6	19.5	244°32.7	12.7'	17°01.4	-3.9'	54.2'	
9	317°59.8	20.5	259°04.4	12.7'	17°05.2	-3.8'	54.2'	
10	333°00.0	21.5	273°36.0	12.7'	17°08.9	-3.7'	54.2'	
11	348°00.2	22.4	288°07.7	12.6'	17°12.6	-3.6'	54.3'	
12	3°00.4	S05°23.4	302°39.3	12.6'	\$17°16.2	-3.5'	54.3'	
13	18°00.5	24.3	317°10.8	12.6'	17°19.7	-3.5'	54.3'	
14	33°00.7	25.3	331°42.4	12.5'	17°23.1	-3.4'	54.3'	
15	48°00.9	26.2	346°13.9	12.5'	17°26.5	-3.3'	54.3'	
16	63°01.1	27.2	0°45.4	12.5'	17°29.8	-3.2'	54.3'	
17	78°01.3	28.2	15°16.8	12.4'	17°32.9	-3.2'	54.3'	
18	93°01.4	S05°29.1	29°48.3	12.4'	\$17°36.1	-3.1'	54.3'	
19	108°01.6	30.1	44°19.7	12.4'	17°39.1	-3.0'	54.4'	
20	123°01.8	31.0	58°51.0	12.3'	17°42.1	-2.9'	54.4'	
21	138°02.0	32.0	73°22.4	12.3'	17°44.9	-2.8'	54.4'	
22	153°02.2	32.9	87°53.7	12.3'	17°47.7	-2.8'	54.4'	
23	168°02.3	33.9	102°24.9	12.3'	17°50.5	-2.7'	54.4'	
	SD.=16.0	d=-1.0			S.D.=14.8			

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
06	11:53	12:01	11:48	15:57 03:33
07	12:10	12:19	11:48	16:45 04:21
08	12:27	12:35	11:47	17:34 05:09



SD.=16.0	d=-1.0	S.D.=15.0
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## October 09, 10, 11 UT (Sun., Mon., Tue.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	18°02.5	151°57.0	\$17°59.6	99°24.3	\$25°29.7	191°46.0	\$01°31.0	127°05.5	\$20°51.1	Alpheratz	357°40.8	29°11.1											
1	33°05.0	166°56.4	18°00.5	114°24.8	29.6	206°48.0	31.2	142°07.8	51.1	Ankaa	353°13.2	-42°12.9											
2	48°07.4	181°55.8	01.5	129°25.4	29.4	221°50.0	31.4	157°10.0	51.2	Schedar	349°37.3	56°37.8											
3	63°09.9	196°55.2	· · 02.4	144°26.0	· · 29.3	236°51.9	· · 31.6	172°12.2	· · 51.2	Diphda	348°53.4	-17°53.7											
4	78°12.4	211°54.7	03.4	159°26.6	29.2	251°53.9	31.9	187°14.5	51.2	Achernar	335°24.6	-57°09.1											
5	93°14.8	226°54.1	04.3	174°27.2	29.0	266°55.9	32.1	202°16.7	51.3	Hamal	327°57.9	23°32.4											
6	108°17.3	241°53.5	\$18°05.3	189°27.7	\$25°28.9	281°57.9	\$01°32.3	217°19.0	\$20°51.3	Polaris	316°19.8	89°19.9											
7	123°19.8	256°53.0	06.3	204°28.3	28.7	296°59.8	32.5	232°21.2	51.3	Acamar	315°16.3	-40°14.2											
8	138°22.2	271°52.4	07.2	219°28.9	28.6	312°01.8	32.7	247°23.5	51.4	Menkar	314°12.4	4°09.3											
9	153°24.7	286°51.8	· · 08.2	234°29.5	· · 28.5	327°03.8	· · 32.9	262°25.7	· · 51.4	Mirfak	308°36.7	49°55.0											
10	168°27.2	301°51.2	09.1	249°30.1	28.3	342°05.7	33.1	277°28.0	51.4	Aldebaran	290°46.6	16°32.4											
11	183°29.6	316°50.7	10.1	264°30.6	28.2	357°07.7	33.3	292°30.2	51.5	Rigel	281°09.8	-8°11.0											
12	198°32.1	331°50.1	\$18°11.0	279°31.2	\$25°28.0	12°09.7	\$01°33.5	307°32.5	\$20°51.5	Capella	280°30.9	46°00.5											
13	213°34.5	346°49.5	12.0	294°31.8	27.9	27°11.6	33.7	322°34.7	51.5	Bellatrix	278°29.5	6°21.8											
14	228°37.0	1°48.9	12.9	309°32.4	27.8	42°13.6	34.0	337°37.0	51.6	El Nath	278°09.6	28°37.0											
15	243°39.5	16°48.4	· · 13.9	324°32.9	· · 27.6	57°15.6	· · 34.2	352°39.2	· · 51.6	Alnilam	275°44.0	-1°11.6											
16	258°41.9	31°47.8	14.8	339°33.5	27.5	72°17.6	34.4	7°41.4	51.6	Betelgeuse	270°58.8	7°24.5											
17	273°44.4	46°47.2	15.8	354°34.1	27.3	87°19.5	34.6	22°43.7	51.7	Canopus	263°55.0	-52°42.1											
18	288°46.9	61°46.6	\$18°16.7	9°34.7	\$25°27.2	102°21.5	\$01°34.8	37°45.9	\$20°51.7	Sirius	258°31.7	-16°44.3											
19	303°49.3	76°46.1	17.7	24°35.3	27.0	117°23.5	35.0	52°48.2	51.7	Adhara	255°10.7	-28°59.6											
20	318°51.8	91°45.5	18.6	39°35.8	26.9	132°25.4	35.2	67°50.4	51.8	Procyon	244°57.4	5°10.8											
21	333°54.3	106°44.9	· · 19.6	54°36.4	· · 26.7	147°27.4	· · 35.4	82°52.7	· · 51.8	Pollux	243°25.1	27°58.9											
22	348°56.7	121°44.3	20.5	69°37.0	26.6	162°29.4	35.6	97°54.9	51.8	Avior	234°17.2	-59°33.6											
23	3°59.2	136°43.7	21.4	84°37.6	26.5	177°31.4	35.9	112°57.2	51.9	Suhail	222°51.0	-43°29.8											
Mer.pass.:22:44				v-0.6 d-1.0 m-3.8				v0.6 d0.1 m0.1				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Mon					
0	19°01.7	151°43.2	\$18°22.4	99°38.1	\$25°26.3	192°33.3	\$01°36.1	127°59.4	\$20°51.9	Denebola	182°31.7	14°28.8											
1	34°04.1	166°42.6	23.3	114°38.7	26.2	207°35.3	36.3	143°01.7	51.9	Gienah	175°50.3	-17°37.9											
2	49°06.6	181°42.0	24.3	129°39.3	26.0	222°37.3	36.5	158°03.9	52.0	Acrux	173°07.4	-63°11.3											
3	64°09.0	196°41.4	· · 25.2	144°39.9	· · 25.9	237°39.2	· · 36.7	173°06.1	· · 52.0	Gacrux	171°58.9	-57°12.2											
4	79°11.5	211°40.8	26.1	159°40.4	25.7	252°41.2	36.9	188°08.4	52.0	Alioth	166°19.4	55°52.3											
5	94°14.0	226°40.3	27.1	174°41.0	25.6	267°43.2	37.1	203°10.6	52.1	Spica	158°29.2	-11°14.7											
6	109°16.4	241°39.7	\$18°28.0	189°41.6	\$25°24.4	282°45.1	\$01°37.3	218°12.9	\$20°52.1	Alkaid	152°57.7	49°14.0											
7	124°18.9	256°39.1	29.0	204°42.2	25.3	297°47.1	37.5	233°15.1	52.1	Hadar	148°45.2	-60°27.1											
8	139°21.4	271°38.5	29.9	219°42.7	25.1	312°49.1	37.7	248°17.4	52.2	Menkent	148°05.3	-36°26.9											
9	154°23.8	286°37.9	· · 30.8	234°43.3	· · 25.0	327°51.1	· · 38.0	263°19.6	· · 52.2	Arcturus	145°54.1	19°06.0											
10	169°26.3	301°37.3	31.8	249°43.9	24.8	342°53.0	38.2	278°21.9	52.2	Rigel Kent.	139°49.2	-60°54.1											
11	184°28.8	316°36.7	32.7	264°44.5	24.7	357°55.0	38.4	293°24.1	52.3	Kochab	137°21.3	74°05.5											
12	199°31.2	331°36.2	\$18°33.6	279°45.0	\$25°24.5	12°57.0	\$01°38.6	308°26.3	\$20°52.3	Zuben ubi	137°03.2	-16°06.4											
13	214°33.7	346°35.6	34.6	294°45.6	24.4	27°58.9	38.8	323°28.6	52.3	Alphecca	126°09.4	26°39.9											
14	229°36.1	1°35.0	35.5	309°46.2	24.2	43°00.9	39.0	338°30.8	52.4	Antares	112°23.8	-26°27.9											
15	244°38.6	16°34.4	· · 36.4	324°46.8	· · 24.1	58°02.9	· · 39.2	353°33.1	· · 52.4	Atria	107°23.8	-69°03.4											
16	259°41.1	31°33.8	37.3	339°47.3	23.9	73°04.9	39.4	8°35.3	52.4	Sabik	102°10.2	-15°44.5											
17	274°43.5	46°33.2	38.3	354°47.9	23.8	88°06.8	39.6	23°37.6	52.5	Rasalhague	96°04.5	12°33.3											
18	289°46.0	61°32.6	\$18°39.2	9°48.5	\$25°23.6	103°08.8	\$01°39.8	38°39.8	\$20°52.5	Eltanin	90°45.3	51°29.7											
19	304°48.5	76°32.0	40.1	24°49.1	23.4	118°10.8	40.1	53°42.0	52.6	Kaus Aust.	83°41.0	-34°22.4											
20	319°50.9	91°31.5	41.1	39°49.6	23.3	133°12.7	40.3	68°44.3	52.6	Vega	80°37.5	38°48.4											
21	334°53.4	106°30.9	· · 42.0	54°50.2	· · 23.1	148°14.7	· · 40.5	83°46.5	· · 52.6	Nunki	75°55.6	-26°16.4											
22	349°55.9	121°30.3	42.9	69°50.8	23.0	163°16.7	40.7	98°48.8	52.7	Altair	62°06.0	8°55.1											
23	4°58.3	136°29.7	43.8	84°51.3	22.8	178°18.7	40.9	113°51.0	52.7	Peacock	53°15.7	-56°40.9											
Mer.pass.:22:40				v-0.6 d-0.9 m-3.8				v0.6 d0.1 m0.2				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Tue					
0	20°00.8	151°29.1	\$18°44.8	99°51.9	\$25°22.7	193°20.6	\$01°41.1	128°53.2	\$20°52.7	Oct 09 Sun	133°54.4	13:53											
1	35°03.3	166°28.5	45.7	114°52.5	22.5	208°22.6	41.3	143°55.5	52.8	Venus	132°41.5	13:54											
2	50°05.7	181°27.9	46.6	129°53.1	22.4	223°24.6	41.5	158°57.7	52.8	Mars	81°21.8	17:22											
3	65°08.2	196°27.3	· · 47.5	144°53.6	· · 22.2	238°26.5	· · 41.7	174°00.0	· · 52.8	Jupiter	173°43.5	11:11											
4	80°10.6	211°26.7	48.4	159°54.2	22.0	253°28.5	41.9	189°02.2	52.9	Saturn	109°03.0	15:29											
5	95°13.1	226°26.1	49.4	174°54.8	21.9	268°30.5	42.2	204°04.5	52.9	Oct 10 Mon	130°50.9	28°10.6											
6	110°15.6	241°25.5	\$18°50.3	189°55.3	\$25°21.7	283°32.5	\$01°42.4	219°06.7	\$20°52.9	Venus	130°35.8	15:38											
7	125°18.0	256°24.9	51.2	204°55.9	21.6	298°34.4	42.6	234°08.9	53.0	Mars	130°21.7	17:22											
8	140°20.5	271°24.3	52.1	219°56.5	21.4	31																	

DUT1 = UT1-UTC = -0.2906 sec  $\Delta T$  = TT-UT1 = +68.4746 sec

2016 October 09 to Oct. 11 UT

h	Sun			Moon				
	Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°10.9	S06°20.6	93°22.0	10.9'	S18°18.0	1.7'	55.5'	
1	198°11.1	21.5	107°51.9	10.9'	18°16.3	1.7'	55.5'	
2	213°11.2	22.5	122°21.8	10.9'	18°14.5	1.8'	55.5'	
3	228°11.4	.. 23.4	136°51.6	10.8'	18°12.6	1.9'	55.6'	
4	243°11.6	24.4	151°21.5	10.8'	18°10.7	2.0'	55.6'	
5	258°11.8	25.3	165°51.3	10.8'	18°08.6	2.1'	55.6'	
6	273°11.9	S06°26.3	180°21.1	10.8'	S18°06.4	2.2'	55.6'	
7	288°12.1	27.2	194°50.9	10.8'	18°04.1	2.3'	55.7'	
8	303°12.3	28.2	209°20.6	10.7'	18°01.8	2.4'	55.7'	
9	318°12.4	.. 29.1	223°50.3	10.7'	17°59.3	2.5'	55.7'	
10	333°12.6	30.1	238°20.1	10.7'	17°56.8	2.6'	55.8'	
11	348°12.8	31.0	252°49.7	10.7'	17°54.2	2.7'	55.8'	
12	3°12.9	S06°32.0	267°19.4	10.7'	S17°51.4	2.8'	55.8'	
13	18°13.1	32.9	281°49.1	10.6'	17°48.6	2.9'	55.9'	
14	33°13.3	33.9	296°18.7	10.6'	17°45.7	3.0'	55.9'	
15	48°13.4	.. 34.8	310°48.3	10.6'	17°42.6	3.1'	55.9'	
16	63°13.6	35.8	325°17.9	10.6'	17°39.5	3.2'	56.0'	
17	78°13.8	36.7	339°47.5	10.6'	17°36.3	3.3'	56.0'	
18	93°13.9	S06°37.6	354°17.0	10.5'	S17°33.0	3.3'	56.0'	
19	108°14.1	38.6	8°46.5	10.5'	17°29.6	3.4'	56.1'	
20	123°14.3	39.5	23°16.1	10.5'	17°26.1	3.5'	56.1'	
21	138°14.4	.. 40.5	37°45.5	10.5'	17°22.6	3.6'	56.1'	
22	153°14.6	41.4	52°15.0	10.5'	17°18.9	3.7'	56.2'	
23	168°14.8	42.4	66°44.5	10.4'	17°15.1	3.8'	56.2'	
	SD.=16.0	d=-0.9			S.D.=15.2			

Mon	GHA			Dec			
	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°14.9	S06°43.3	81°13.9	10.4'	S17°11.2	3.9'	56.2'
1	198°15.1	44.3	95°43.3	10.4'	17°07.3	4.0'	56.3'
2	213°15.3	45.2	110°12.8	10.4'	17°03.2	4.1'	56.3'
3	228°15.4	.. 46.2	124°42.1	10.4'	16°59.0	4.2'	56.3'
4	243°15.6	47.1	139°11.5	10.4'	16°54.8	4.3'	56.4'
5	258°15.8	48.0	153°40.9	10.3'	16°50.5	4.4'	56.4'
6	273°15.9	S06°49.0	168°10.2	10.3'	S16°46.0	4.5'	56.4'
7	288°16.1	49.9	182°39.5	10.3'	16°41.5	4.6'	56.5'
8	303°16.3	50.9	197°08.8	10.3'	16°36.9	4.7'	56.5'
9	318°16.4	.. 51.8	211°38.1	10.3'	16°32.2	4.8'	56.5'
10	333°16.6	52.8	226°07.4	10.3'	16°27.3	4.9'	56.6'
11	348°16.7	53.7	240°36.6	10.2'	16°22.4	5.0'	56.6'
12	3°16.9	S06°54.7	255°05.9	10.2'	S16°17.4	5.0'	56.6'
13	18°17.1	55.6	269°35.1	10.2'	16°12.3	5.1'	56.7'
14	33°17.2	56.5	284°04.3	10.2'	16°07.2	5.2'	56.7'
15	48°17.4	.. 57.5	298°33.5	10.2'	16°01.9	5.3'	56.8'
16	63°17.6	58.4	313°02.7	10.2'	15°56.5	5.4'	56.8'
17	78°17.7	06°59.4	327°31.8	10.2'	15°51.0	5.5'	56.8'
18	93°17.9	S07°00.3	342°01.0	10.1'	S15°45.5	5.6'	56.9'
19	108°18.0	01.3	356°30.1	10.1'	15°39.8	5.7'	56.9'
20	123°18.2	02.2	10°59.2	10.1'	15°34.1	5.8'	56.9'
21	138°18.4	.. 03.1	25°28.3	10.1'	15°28.3	5.9'	57.0'
22	153°18.5	04.1	39°57.4	10.1'	15°22.3	6.0'	57.0'
23	168°18.7	05.0	54°26.5	10.1'	15°16.3	6.1'	57.1'
	SD.=16.0	d=-0.9			S.D.=15.4		

Tue	GHA			Dec			
	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°18.9	S07°06.0	68°55.5	10.0'	S15°10.2	6.2'	57.1'
1	198°19.0	06.9	83°24.6	10.0'	15°04.0	6.2'	57.1'
2	213°19.2	07.9	97°53.6	10.0'	14°57.7	6.3'	57.2'
3	228°19.3	.. 08.8	112°22.6	10.0'	14°51.4	6.4'	57.2'
4	243°19.5	09.7	126°51.6	10.0'	14°44.9	6.5'	57.3'
5	258°19.7	10.7	141°20.6	10.0'	14°38.3	6.6'	57.3'
6	273°19.8	S07°11.6	155°49.6	10.0'	S14°31.7	6.7'	57.3'
7	288°20.0	12.6	170°18.5	9.9'	14°25.0	6.8'	57.4'
8	303°20.1	13.5	184°47.5	9.9'	14°18.1	6.9'	57.4'
9	318°20.3	.. 14.4	199°16.4	9.9'	14°11.2	7.0'	57.5'
10	333°20.5	15.4	213°45.3	9.9'	14°04.2	7.0'	57.5'
11	348°20.6	16.3	228°14.2	9.9'	13°57.1	7.1'	57.5'
12	3°20.8	S07°17.3	242°43.1	9.9'	S13°50.0	7.2'	57.6'
13	18°20.9	18.2	257°12.0	9.9'	13°42.7	7.3'	57.6'
14	33°21.1	19.1	271°40.8	9.9'	13°35.4	7.4'	57.7'
15	48°21.2	.. 20.1	286°09.7	9.8'	13°27.9	7.5'	57.7'
16	63°21.4	21.0	300°38.5	9.8'	13°20.4	7.6'	57.7'
17	78°21.6	22.0	315°07.3	9.8'	13°12.8	7.6'	57.8'
18	93°21.7	S07°22.9	329°36.1	9.8'	S13°05.1	7.7'	57.8'
19	108°21.9	23.8	344°04.9	9.8'	12°57.3	7.8'	57.9'
20	123°22.0	24.8	358°33.7	9.8'	12°49.5	7.9'	57.9'
21	138°22.2	.. 25.7	13°02.4	9.8'	12°41.5	8.0'	57.9'
22	153°22.3	26.6	27°31.2	9.7'	12°33.5	8.1'	58.0'
23	168°22.5	27.6	41°59.9	9.7'	12°25.4	8.1'	58.0'
	SD.=16.0	d=-0.9			S.D.=15.7		

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

Lat.	Sun	Moonrise		Sunset	Moonset	
		Mon	Tue		Mon	Tue
N 72°	17:37	17:17	17:07	19:16	21:23	23:20
N 70°	16:26	16:37	16:42	20:27	22:02	23:44
68°	15:49	16:10	16:23	21:04	22:28	—
66°	15					

**October 12, 13, 14 UT (Wed., Thu., Fri.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	20°59.9	151°14.7	\$19°06.7	100°05.6	\$25°18.8	194°07.9	\$01°46.1	129°47.0	\$20°53.5	Alpheratz	357°40.8	29°11.1											
1	36°02.4	166°14.1	07.6	115°06.2	18.6	209°09.9	46.3	144°49.2	53.6	Ankaa	353°13.2	-42°12.9											
2	51°04.9	181°13.5	08.5	130°06.7	18.5	224°11.9	46.6	159°51.5	53.6	Schedar	349°37.3	56°37.8											
3	66°07.3	196°12.9	.. 09.4	145°07.3	.. 18.3	239°13.9	.. 46.8	174°53.7	.. 53.6	Diphda	348°53.4	-17°53.7											
4	81°09.8	211°12.3	10.3	160°07.9	18.1	254°15.8	47.0	189°56.0	53.7	Achernar	335°24.6	-57°09.1											
5	96°12.2	226°11.7	11.2	175°08.4	18.0	269°17.8	47.2	204°58.2	53.7	Hamal	327°57.9	23°32.4											
6	111°14.7	241°11.1	\$19°12.1	190°09.0	\$25°17.8	284°19.8	\$01°47.4	220°00.4	\$20°53.7	Polaris	316°19.2	89°19.9											
7	126°17.2	256°10.5	13.0	205°09.6	17.6	299°21.8	47.6	235°02.7	53.8	Acamar	315°16.3	-40°14.2											
8	141°19.6	271°09.9	13.8	220°10.1	17.5	314°23.7	47.8	250°04.9	53.8	Menkar	314°12.4	4°09.3											
9	156°22.1	286°09.3	.. 14.7	235°10.7	.. 17.3	329°25.7	.. 48.0	265°07.2	.. 53.8	Mirfak	308°36.7	49°55.0											
10	171°24.6	301°08.7	15.6	250°11.3	17.1	344°27.7	48.2	280°09.4	53.9	Aldebaran	290°46.6	16°32.4											
11	186°27.0	316°08.0	16.5	265°11.8	17.0	359°29.6	48.4	295°11.6	53.9	Rigel	281°09.7	-8°11.0											
12	201°29.5	331°07.4	\$19°17.4	280°12.4	\$25°16.8	14°31.6	\$01°48.6	310°13.9	\$20°53.9	Capella	280°30.9	46°00.6											
13	216°32.0	346°06.8	18.3	295°13.0	16.6	29°33.6	48.9	325°16.1	54.0	Bellatrix	278°29.5	6°21.8											
14	231°34.4	1°06.2	19.2	310°13.5	16.4	44°35.6	49.1	340°18.3	54.0	El Nath	278°09.6	28°37.0											
15	246°36.9	16°05.6	.. 20.1	325°14.1	.. 16.3	59°37.5	.. 49.3	355°20.6	.. 54.1	Alnilam	275°44.0	-1°11.6											
16	261°39.4	31°05.0	21.0	340°14.7	16.1	74°39.5	49.5	10°22.8	54.1	Betelgeuse	270°58.8	7°24.5											
17	276°41.8	46°04.4	21.9	355°15.2	15.9	89°41.5	49.7	25°25.1	54.1	Canopus	263°55.0	-52°42.1											
18	291°44.3	61°03.8	\$19°22.8	10°15.8	\$25°15.8	104°43.4	\$01°49.9	40°27.3	\$20°54.2	Sirius	258°31.7	-16°44.3											
19	306°46.7	76°03.1	23.7	25°16.4	15.6	119°45.4	50.1	55°29.5	54.2	Adhara	255°10.7	-28°59.6											
20	321°49.2	91°02.5	24.5	40°16.9	15.4	134°47.4	50.3	70°31.8	54.2	Procyon	244°57.4	5°10.8											
21	336°51.7	106°01.9	.. 25.4	55°17.5	.. 15.2	149°49.4	.. 50.5	85°34.0	.. 54.3	Pollux	243°25.1	27°58.9											
22	351°54.1	121°01.3	26.3	70°18.1	15.1	164°51.3	50.7	100°36.2	54.3	Avior	234°17.2	-59°33.6											
23	6°56.6	136°00.7	27.2	85°18.6	14.9	179°53.3	50.9	115°38.5	54.3	Suhail	222°50.9	-43°29.8											
Mer.pass.:22:32				v-0.6 d-0.9 m-3.9				v0.6 d0.2 m0.2				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	21°59.1	151°00.1	\$19°28.1	100°19.2	\$25°14.7	194°55.3	\$01°51.2	130°40.7	\$20°54.4	Denebola	182°31.7	14°28.8											
1	37°01.5	165°59.5	29.0	115°19.7	14.5	209°57.3	51.4	145°42.9	54.4	Gienah	175°50.3	-17°37.9											
2	52°04.0	180°58.8	29.8	130°20.3	14.4	224°59.2	51.6	160°45.2	54.4	Acrua	173°07.4	-63°11.3											
3	67°06.5	195°58.2	.. 30.7	145°20.9	.. 14.2	240°01.2	.. 51.8	175°47.4	.. 54.5	Gacrux	171°58.9	-57°12.2											
4	82°08.9	210°57.6	31.6	160°21.4	14.0	255°03.2	52.0	190°49.6	54.5	Alioth	166°19.4	55°52.2											
5	97°11.4	225°57.0	32.5	175°22.0	13.8	270°05.1	52.2	205°51.9	54.5	Spica	158°29.2	-11°14.7											
6	112°13.8	240°56.4	\$19°33.4	190°22.6	\$25°13.6	285°07.1	\$01°52.4	220°54.1	\$20°54.6	Alkaid	152°57.7	49°14.0											
7	127°16.3	255°55.7	34.2	205°23.1	13.5	300°09.1	52.6	235°56.4	54.6	Hadar	148°45.2	-60°27.1											
8	142°18.8	270°55.1	35.1	220°23.7	13.3	315°11.1	52.8	250°58.6	54.6	Menkent	148°05.3	-36°26.9											
9	157°21.2	285°54.5	.. 36.0	235°24.3	.. 13.1	330°13.0	.. 53.0	266°00.8	.. 54.7	Arcturus	145°54.1	19°06.0											
10	172°23.7	300°53.9	36.9	250°24.8	12.9	345°15.0	53.2	281°03.1	54.7	Rigel Kent.	139°49.2	-60°54.1											
11	187°26.2	315°53.3	37.7	265°25.4	12.8	0°17.0	53.4	296°05.3	54.7	Kochab	137°21.4	74°05.5											
12	202°28.6	330°52.6	\$19°38.6	280°26.0	\$25°12.6	15°19.0	\$01°53.7	311°07.5	\$20°54.8	Zuben ubi	137°03.2	-16°06.4											
13	217°31.1	345°52.0	39.5	295°26.5	12.4	30°20.9	53.9	326°09.8	54.8	Alphecca	126°09.5	26°39.9											
14	232°33.6	0°51.4	40.3	310°27.1	12.2	45°22.9	54.1	341°12.0	54.8	Antares	112°23.8	-26°27.9											
15	247°36.0	15°50.8	.. 41.2	325°27.6	.. 12.0	60°24.9	.. 54.3	356°14.2	.. 54.9	Atria	107°23.9	-69°03.4											
16	262°38.5	30°50.1	42.1	340°28.2	11.8	75°26.8	54.5	11°16.5	54.9	Sabik	102°10.2	-15°44.5											
17	277°41.0	45°49.5	42.9	355°28.8	11.7	90°28.8	54.7	26°18.7	54.9	Shaula	96°19.1	-37°06.8											
18	292°43.4	60°48.9	\$19°43.8	10°29.3	\$25°11.5	105°30.8	\$01°54.9	41°20.9	\$20°55.0	Rasalhague	96°04.5	12°33.3											
19	307°45.9	75°48.3	44.7	25°29.9	11.3	120°32.8	55.1	56°23.2	55.0	Eltanin	90°45.3	51°29.7											
20	322°48.3	90°47.6	45.5	40°30.5	11.1	135°34.7	55.3	71°25.4	55.0	Kaus Aust.	83°41.0	-34°22.4											
21	337°50.8	105°47.0	.. 46.4	55°31.0	.. 10.9	150°36.7	.. 55.5	86°27.6	.. 55.1	Vega	80°37.5	38°48.4											
22	352°53.3	120°46.4	47.3	70°31.6	10.7	165°38.7	55.7	101°29.9	55.1	Nunki	75°55.6	-26°16.4											
23	7°55.7	135°45.8	48.1	85°32.1	10.6	180°40.7	56.0	116°32.1	55.2	Altair	62°06.0	8°55.1											
Mer.pass.:22:28				v-0.6 d-0.9 m-3.9				v0.6 d0.2 m0.2				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	22°58.2	150°45.1	\$19°49.0	100°32.7	\$25°10.4	195°42.6	\$01°56.2	131°34.3	\$20°55.2	Oct 12 Wed	15°21.3	-29°32.0											
1	38°00.7	165°44.5	49.9	115°33.3	10.2	210°44.6	56.4	146°36.6	55.2	Venus	130°14.8	13:56											
2	53°03.1	180°43.9	50.7	130°33.8	10.0	225°46.6	56.6	161°38.8	55.3	Mars	79°05.7	17:19											
3	68°06.5	195°43.2	.. 51.6	145°34.4	.. 09.8	240°48.6	.. 56.8	176°41.0	.. 55.3	Jupiter	173°08.0	11:02											
4	83°08.1	210°42.6	52.4	160°34.9	09.6	255°50.5	57.0	191°43.3	55.3	Saturn	108°47.1	15:19											
5	98°10.5	225°42.0	53.3	175°35.5	09.4	270°52.5	57.2	206°45.5	55.4	Oct 13 Thu	129°01.0	13:57											
6	113°13.0	240°41.4	\$19°54.2	190°36.1	\$25°09.3	285°54.5	\$01°57.4	221°47.7	\$20°55.4	Venus	128°20.1	17:18											
7	128°15.4	255°40.7	55.0	205°36.6	09.1	300°56.4	57.6	236°50.0	55.4	Mars	172°56.2	10:											

DUT1 = UT1-UTC = -0.2949 sec ΔT = TT-UT1 = +68.4789 sec

2016 October 12 to Oct. 14 UT

	Sun			Moon			
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°22.7	S07°28.5	56°28.6	9.7'	S12°17.2	8.2'	58.1'
1	198°22.8	29.5	70°57.3	9.7'	12°09.0	8.3'	58.1'
2	213°23.0	30.4	85°26.0	9.7'	12°00.6	8.4'	58.1'
3	228°23.1	.. 31.3	99°54.7	9.7'	11°52.2	8.5'	58.2'
4	243°23.3	32.3	114°23.4	9.7'	11°43.7	8.5'	58.2'
5	258°23.4	33.2	128°52.0	9.6'	11°35.1	8.6'	58.3'
6	273°23.6	S07°34.1	143°20.6	9.6'	S11°26.4	8.7'	58.3'
7	288°23.7	35.1	157°49.3	9.6'	11°17.7	8.8'	58.3'
8	303°23.9	36.0	172°17.9	9.6'	11°08.9	8.9'	58.4'
9	318°24.1	.. 37.0	186°46.4	9.6'	11°00.0	8.9'	58.4'
10	333°24.2	37.9	201°15.0	9.6'	10°51.0	9.0'	58.5'
11	348°24.4	38.8	215°43.6	9.5'	10°41.9	9.1'	58.5'
12	3°24.5	S07°39.8	230°12.1	9.5'	S10°32.8	9.2'	58.5'
13	18°24.7	40.7	244°40.6	9.5'	10°23.6	9.2'	58.6'
14	33°24.8	41.6	259°09.1	9.5'	10°14.4	9.3'	58.6'
15	48°25.0	.. 42.6	273°37.6	9.5'	10°05.0	9.4'	58.7'
16	63°25.1	43.5	288°06.1	9.5'	09°55.6	9.4'	58.7'
17	78°25.3	44.4	302°34.6	9.5'	09°46.1	9.5'	58.7'
18	93°25.4	S07°45.4	317°03.0	9.4'	S09°36.6	9.6'	58.8'
19	108°25.6	46.3	331°31.4	9.4'	09°26.9	9.7'	58.8'
20	123°25.7	47.2	345°59.8	9.4'	09°17.3	9.7'	58.9'
21	138°25.9	.. 48.2	0°28.2	9.4'	09°07.5	9.8'	58.9'
22	153°26.0	49.1	14°56.6	9.4'	08°57.7	9.9'	58.9'
23	168°26.2	50.0	29°25.0	9.3'	08°47.8	9.9'	59.0'
	SD.=16.0	d=-0.9			S.D.=16.0		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Upper	Lower	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass	hh:mm	hh:mm	11-13 82-96%
12	13:31	13:38	11:46	20:58	08:32	
13	13:45	13:53	11:46	21:51	09:24	
14	14:00	14:06	11:46	22:45	10:18	

SD.=16.0	d=-0.9	S.D.=16.4
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**October 15, 16, 17 UT (Sat., Sun., Mon.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	23°57.3	150°29.9	\$20°09.4	100°46.1	\$25°05.8	196°30.0	\$02°01.2	132°27.9	\$20°56.0	Alpheratz	357°40.8	29°11.1											
1	38°59.8	165°29.3	10.3	115°46.7	05.6	211°32.0	01.4	147°30.1	56.0	Ankaa	353°13.2	-42°12.9											
2	54°02.3	180°28.6	11.1	130°47.3	05.4	226°34.0	01.6	162°32.4	56.1	Schedar	349°37.3	56°37.8											
3	69°04.7	195°28.0	.. 11.9	145°47.8	.. 05.2	241°35.9	.. 01.8	177°34.6	.. 56.1	Diphda	348°53.4	-17°53.7											
4	84°07.2	210°27.3	12.8	160°48.4	05.0	256°37.9	02.0	192°36.8	56.2	Achernar	335°24.6	-57°09.2											
5	99°09.7	225°26.7	13.6	175°48.9	04.8	271°39.9	02.2	207°39.0	56.2	Hamal	327°57.9	23°32.5											
6	114°12.1	240°26.1	\$20°14.4	190°49.5	\$25°04.6	286°41.9	\$02°02.4	222°41.3	\$20°56.2	Polaris	316°18.5	89°19.9											
7	129°14.6	255°25.4	15.3	205°50.0	04.5	301°43.8	02.6	237°43.5	56.3	Acamar	315°16.3	-40°14.3											
8	144°17.1	270°24.8	16.1	220°50.6	04.3	316°45.8	02.8	252°45.7	56.3	Menkar	314°12.4	4°09.3											
9	159°19.5	285°24.1	.. 16.9	235°51.2	.. 04.1	331°47.8	.. 03.0	267°48.0	.. 56.3	Mirfak	308°36.7	49°55.0											
10	174°22.0	300°23.5	17.8	250°51.7	03.9	346°49.7	03.2	282°50.2	56.4	Aldebaran	290°46.6	16°32.4											
11	189°24.4	315°22.8	18.6	265°52.3	03.7	1°51.7	03.4	297°52.4	56.4	Rigel	281°09.7	-8°11.0											
12	204°26.9	330°22.2	\$20°19.4	280°52.8	\$25°03.5	16°53.7	\$02°03.6	312°54.7	\$20°56.4	Capella	280°30.9	46°00.6											
13	219°29.4	345°21.5	20.3	295°53.4	03.3	31°55.7	03.9	327°56.9	56.5	Bellatrix	278°29.4	6°21.8											
14	234°31.8	0°20.9	21.1	310°53.9	03.1	46°57.6	04.1	342°59.1	56.5	El Nath	278°09.6	28°37.0											
15	249°34.3	15°20.2	.. 21.9	325°54.5	.. 02.9	61°59.6	.. 04.3	358°01.3	.. 56.5	Alnilam	275°43.9	-1°11.6											
16	264°36.8	30°19.6	22.7	340°55.1	02.7	77°01.6	04.5	13°03.6	56.6	Betelgeuse	270°58.7	7°24.5											
17	279°39.2	45°18.9	23.6	355°55.6	02.5	92°03.6	04.7	28°05.8	56.6	Canopus	263°55.0	-52°42.1											
18	294°41.7	60°18.3	\$20°24.4	10°56.2	\$25°02.3	107°05.5	\$02°04.9	43°08.0	\$20°56.6	Sirius	258°31.7	-16°44.3											
19	309°44.2	75°17.6	25.2	25°56.7	02.1	122°07.5	05.1	58°10.3	56.7	Adhara	255°10.7	-28°59.6											
20	324°46.6	90°17.0	26.0	40°57.3	01.8	137°09.5	05.3	73°12.5	56.7	Procyon	244°57.4	5°10.8											
21	339°49.1	105°16.3	.. 26.9	55°57.8	.. 01.6	152°11.5	.. 05.5	88°14.7	.. 56.7	Pollux	243°25.0	27°58.9											
22	354°51.5	120°15.7	27.7	70°58.4	01.4	167°13.4	05.7	103°16.9	56.8	Avior	234°17.2	-59°33.6											
23	9°54.0	135°15.0	28.5	85°59.0	01.2	182°15.4	05.9	118°19.2	56.8	Suhail	222°50.9	-43°29.8											
Mer.pass.:22:21				v-0.6 d-0.8 m-3.9				v0.6 d0.2 m0.2				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Sun				GHA				GHA				GHA				GHA							
0	24°56.5	150°14.4	\$20°29.3	100°59.5	\$25°01.0	197°17.4	\$02°06.1	133°21.4	\$20°56.8	Denebola	183°31.7	14°28.8											
1	39°58.9	165°13.7	30.1	116°00.1	00.8	212°19.4	06.3	148°23.6	56.9	Gienah	175°50.3	-17°37.9											
2	55°01.4	180°13.1	30.9	131°00.6	00.6	227°21.3	06.5	163°25.8	56.9	Acrux	173°07.4	-63°11.3											
3	70°03.9	195°12.4	.. 31.8	146°01.2	.. 00.4	242°23.3	.. 06.8	178°28.1	.. 56.9	Gacrux	171°58.9	-57°12.2											
4	85°06.3	210°11.8	32.6	161°01.7	00.2	257°25.3	07.0	193°30.3	57.0	Alioth	166°19.4	55°52.2											
5	100°08.8	225°11.1	33.4	176°02.3	25°00.0	272°27.3	07.2	208°32.5	57.0	Spica	158°29.2	-11°14.7											
6	115°11.3	240°10.5	\$20°34.2	191°02.8	\$24°59.8	287°29.2	\$02°07.4	223°34.8	\$20°57.0	Alkaid	152°57.7	49°14.0											
7	130°13.7	255°09.8	35.0	206°03.4	59.6	302°31.2	07.6	238°37.0	57.1	Hadar	148°45.2	-60°27.0											
8	145°16.2	270°09.2	35.8	221°04.0	59.4	317°33.2	07.8	253°39.2	57.1	Menkent	148°05.3	-36°26.9											
9	160°18.7	285°08.5	.. 36.6	236°04.5	.. 09.2	332°35.2	.. 08.0	268°41.4	.. 57.2	Arcturus	145°54.1	19°06.0											
10	175°21.1	300°07.8	37.4	251°05.1	59.0	347°37.1	08.2	283°43.7	57.2	Rigel Kent.	139°49.2	-60°54.1											
11	190°23.6	315°07.2	38.3	266°05.6	58.8	298°39.1	08.4	298°45.9	57.2	Kochab	137°21.4	74°05.5											
12	205°26.0	330°06.5	\$20°39.1	281°06.2	\$24°58.6	17°41.1	\$02°08.6	313°48.1	\$20°57.3	Zuben' ubi	137°03.3	-16°06.4											
13	220°28.5	345°05.9	39.9	296°06.7	58.3	32°43.1	08.8	328°50.3	57.3	Alphecca	126°09.5	26°39.9											
14	235°31.0	0°05.2	40.7	311°07.3	58.1	47°45.0	09.0	343°52.6	57.3	Antares	112°23.8	-26°27.9											
15	250°33.4	15°04.5	.. 41.5	326°07.8	.. 57.9	62°47.0	.. 09.2	358°54.8	.. 57.4	Atria	107°23.9	-69°03.4											
16	265°35.9	30°03.9	42.3	341°08.4	57.7	77°49.0	09.4	13°57.0	57.4	Sabik	102°10.2	-15°44.5											
17	280°38.4	45°03.2	43.1	356°08.9	57.5	92°51.0	09.7	28°59.2	57.4	Shaula	96°19.1	-37°06.8											
18	295°40.8	60°02.6	\$20°43.9	11°09.5	\$24°57.3	107°52.9	\$02°09.9	44°01.5	\$20°57.5	Rasalhague	96°04.6	12°33.3											
19	310°43.3	75°01.9	44.7	26°10.0	57.1	122°54.9	10.1	59°03.7	57.5	Eltanin	90°45.3	51°29.7											
20	325°45.8	90°01.2	45.5	41°10.6	56.9	137°56.9	10.3	74°05.9	57.5	Kaus Aust.	83°41.0	-34°22.4											
21	340°48.2	105°00.6	.. 46.3	56°11.2	.. 56.7	152°58.9	.. 10.5	89°08.1	.. 56.6	Vega	80°37.6	38°48.4											
22	355°50.7	119°59.9	47.1	71°11.7	56.4	168°00.9	10.7	104°10.4	57.6	Nunki	75°55.6	-26°16.4											
23	10°53.1	134°59.3	47.9	86°12.3	56.2	183°02.8	10.9	119°12.6	57.6	Altair	62°06.1	8°55.1											
Mer.pass.:22:17				v-0.7 d-0.8 m-3.9				v0.6 d0.2 m0.2				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Mon				GHA				GHA				GHA				GHA							
0	25°55.6	149°58.6	\$20°48.7	101°12.8	\$24°56.0	198°04.8	\$02°11.1	134°14.8	\$20°57.7	Oct 15 Sat	126°32.6	13:59											
1	40°58.1	164°57.9	49.5	116°13.4	55.8	213°06.8	11.3	149°17.0	57.7	Venus	125°17.9	14:00											
2	56°00.5	179°57.3	50.3	131°13.9	55.6	228°08.8	11.5	164°19.3	57.7	Mars	76°48.8	17:16											
3	71°03.0	194°56.6	.. 51.1	146°14.5	.. 55.4	243°10.7	.. 11.7	179°21.5	.. 57.8	Jupiter	172°32.7	10:53											
4	86°05.5	209°55.9	51.9	161°15.0	55.2	258°12.7	11.9	194°23.7	57.8	Saturn	108°30.6	15:08											
5	101°07.9	224°55.3	52.6	176°15.6	54.9	273°14.7	12.1	209°25.9	57.8	Oct 16 Sun	125°17.9	14:00											
6	116°10.4	239°54.6	\$20°53.4	191°16.1	\$24°54.7	288°16.7	\$02°12.3	224°28.2	\$20°57.9	Venus	76°03.0	17:15	</td										

DUT1 = UT1-UTC = -0.2992 sec ΔT = TT-UT1 = +68.4832 sec

2016 October 15 to Oct. 17 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	183°33.3	S08°35.5	18°07.7	8.2'	N00°17.5	11.9'	60.6'
1	198°33.4	36.5	32°34.8	8.1'	00°29.3	11.9'	60.7'
2	213°33.6	37.4	47°01.9	8.1'	00°41.2	11.9'	60.7'
3	228°33.7	.. 38.3	61°29.0	8.1'	00°53.1	11.9'	60.7'
4	243°33.9	39.2	75°56.0	8.0'	01°05.0	11.9'	60.7'
5	258°34.0	40.1	90°23.0	8.0'	01°16.9	11.9'	60.8'
6	273°34.1	S08°41.1	104°50.0	8.0'	N01°28.8	11.9'	60.8'
7	288°34.3	42.0	119°16.9	7.9'	01°40.7	11.9'	60.8'
8	303°34.4	42.9	133°43.8	7.9'	01°52.6	11.9'	60.8'
9	318°34.6	.. 43.8	148°10.7	7.9'	02°04.4	11.9'	60.8'
10	333°34.7	44.8	162°37.5	7.8'	02°16.3	11.9'	60.9'
11	348°34.8	45.7	177°04.3	7.8'	02°28.2	11.9'	60.9'
12	3°35.0	S08°46.6	191°31.1	7.7'	N02°40.1	11.9'	60.9'
13	18°35.1	47.5	205°57.8	7.7'	02°51.9	11.9'	60.9'
14	33°35.2	48.4	220°24.5	7.7'	03°03.8	11.8'	60.9'
15	48°35.4	.. 49.4	234°51.2	7.6'	03°15.6	11.8'	61.0'
16	63°35.5	50.3	249°17.8	7.6'	03°27.4	11.8'	61.0'
17	78°35.6	51.2	263°44.4	7.6'	03°39.3	11.8'	61.0'
18	93°35.8	S08°52.1	278°10.9	7.5'	N03°51.0	11.8'	61.0'
19	108°35.9	53.0	292°37.4	7.5'	04°02.8	11.8'	61.0'
20	123°36.1	54.0	307°03.9	7.5'	04°14.6	11.7'	61.0'
21	138°36.2	.. 54.9	321°30.4	7.4'	04°26.3	11.7'	61.1'
22	153°36.3	55.8	335°56.8	7.4'	04°38.0	11.7'	61.1'
23	168°36.5	56.7	350°23.1	7.3'	04°49.7	11.7'	61.1'
	SD.=16.0	d=-0.9			S.D.=16.6		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Pass.	Mer. Pass.	Upper	Lower
	00 <sup>h</sup>	12 <sup>h</sup>	mm:ss	Pass	hh:mm	hh:mm
15	14:13	14:20		11:46	23:40	11:12
16	14:26	14:33		11:45	—	12:08
17	14:39	14:45		11:45	00:37	13:06

SD.=16.0	d=-0.9	S.D.=16.7
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**October 18, 19, 20 UT (Tue., Wed., Thu.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	26°54.8	149°42.5	\$21°07.5	101°26.1	\$24°50.8	198°52.2	\$02°16.1	135°08.2	\$20°58.5	Alpheratz	357°40.8	29°11.1											
1	41°57.2	164°41.8	08.3	116°26.6	50.5	213°54.2	16.3	150°10.4	58.5	Ankaa	353°13.2	-42°12.9											
2	56°59.7	179°41.2	09.0	131°27.2	50.3	228°56.2	16.5	165°12.6	58.6	Schedar	349°37.3	56°37.8											
3	72°02.1	194°40.5	.. 09.8	146°27.7	.. 50.1	243°58.2	.. 16.7	180°14.9	.. 58.6	Diphda	348°53.4	-17°53.7											
4	87°04.6	209°39.8	10.6	161°28.3	49.9	259°00.1	16.9	195°17.1	58.6	Achernar	335°24.6	-57°09.2											
5	102°07.1	224°39.1	11.4	176°28.8	49.6	274°02.1	17.1	210°19.3	58.7	Hamal	327°57.9	23°32.5											
6	117°09.5	239°38.4	\$21°12.1	191°29.4	\$24°49.4	289°04.1	\$02°17.3	225°21.5	\$20°58.7	Polaris	316°17.7	89°19.9											
7	132°12.0	254°37.8	12.9	206°29.9	49.2	304°06.1	17.5	240°23.7	58.8	Acamar	315°16.3	-40°14.3											
8	147°14.5	269°37.1	13.7	221°30.5	49.0	319°08.0	17.7	255°26.0	58.8	Menkar	314°12.4	4°09.3											
9	162°16.9	284°36.4	.. 14.4	236°31.0	.. 48.7	334°10.0	.. 17.9	270°28.2	.. 58.8	Mirfak	308°36.6	49°55.0											
10	177°19.4	299°35.7	15.2	251°31.6	48.5	349°12.0	18.1	285°30.4	58.9	Aldebaran	290°46.6	16°32.4											
11	192°21.9	314°35.0	15.9	266°32.1	48.3	4°14.0	18.3	300°32.6	58.9	Rigel	281°09.7	-8°11.0											
12	207°24.3	329°34.4	\$21°16.7	281°32.7	\$24°48.0	19°16.0	\$02°18.5	315°34.8	\$20°58.9	Capella	280°30.8	46°00.6											
13	222°26.8	344°33.7	17.5	296°33.2	47.8	34°17.9	18.7	330°37.1	59.0	Bellatrix	278°29.4	6°21.8											
14	237°29.2	359°33.0	18.2	311°33.8	47.6	49°19.9	18.9	345°39.3	59.0	El Nath	278°09.6	28°37.0											
15	252°31.7	14°32.3	.. 19.0	326°34.3	.. 47.4	64°21.9	.. 19.1	0°41.5	.. 59.0	Alnilam	275°43.9	-1°11.6											
16	267°34.2	29°31.6	19.7	341°34.9	47.1	79°23.9	19.3	15°43.7	59.1	Betelgeuse	270°58.7	7°24.5											
17	282°36.6	44°30.9	20.5	356°35.4	46.9	94°25.8	19.6	30°45.9	59.1	Canopus	263°54.9	-52°42.2											
18	297°39.1	59°30.3	\$21°21.3	11°36.0	\$24°46.7	109°27.8	\$02°19.8	45°48.2	\$20°59.1	Sirius	258°31.6	-16°44.3											
19	312°41.6	74°29.6	22.0	26°36.5	46.4	124°29.8	20.0	60°50.4	59.2	Adhara	255°10.7	-28°59.6											
20	327°44.0	89°28.9	22.8	41°37.1	46.2	139°31.8	20.2	75°52.6	59.2	Procyon	244°57.4	5°10.8											
21	342°46.5	104°28.2	.. 23.5	56°37.6	.. 46.0	154°33.7	.. 20.4	90°54.8	.. 59.2	Pollux	243°25.0	27°58.9											
22	357°49.0	119°27.5	24.3	71°38.2	45.7	169°35.7	20.6	105°57.0	59.3	Avior	234°17.1	-59°33.6											
23	12°51.4	134°26.8	25.0	86°38.7	45.5	184°37.7	20.8	120°59.3	59.3	Suhail	222°50.9	-43°29.8											
Mer.pass.:22:09				v-0.7 d-0.8 m-3.9				v0.6 d0.2 m0.2				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	27°53.9	149°26.1	\$21°25.8	101°39.3	\$24°45.3	199°39.7	\$02°21.0	136°01.5	\$20°59.3	Denebola	182°31.7	14°28.8											
1	42°56.4	164°25.5	26.5	116°39.8	45.0	214°41.7	21.2	151°03.7	59.4	Gienah	175°50.3	-17°37.9											
2	57°58.8	179°24.8	27.3	131°40.4	44.8	229°43.6	21.4	166°05.9	59.4	Acrua	173°07.3	-63°11.3											
3	73°01.3	194°24.1	.. 28.0	146°40.9	.. 44.6	244°45.6	.. 21.6	181°08.1	.. 59.4	Gacrux	171°58.8	-57°12.2											
4	88°03.7	209°23.4	28.8	161°41.5	44.3	259°47.6	21.8	196°10.4	59.5	Alioth	166°19.4	55°52.2											
5	103°06.2	224°22.7	29.5	176°42.0	44.1	274°49.6	22.0	211°12.6	59.5	Spica	158°29.2	-11°14.7											
6	118°08.7	239°22.0	\$21°30.3	191°42.6	\$24°43.9	289°51.5	\$02°22.2	226°14.8	\$20°59.6	Alkaid	152°57.7	49°14.0											
7	133°11.1	254°21.3	31.0	206°43.1	43.6	304°53.5	22.4	241°17.0	59.6	Hadar	148°45.2	-60°27.0											
8	148°13.6	269°20.6	31.7	221°43.7	43.4	319°55.5	22.6	256°19.2	59.6	Menkent	148°05.3	-36°26.9											
9	163°16.1	284°19.9	.. 32.5	236°44.2	.. 43.2	334°57.5	.. 22.8	271°21.5	.. 59.7	Arcturus	145°54.1	19°06.0											
10	178°18.5	299°19.2	33.2	251°44.7	42.9	349°59.5	23.0	286°23.7	59.7	Rigel Kent.	139°49.2	-60°54.1											
11	193°21.0	314°18.6	34.0	266°45.3	42.7	5°01.4	23.2	301°25.9	59.7	Kochab	137°21.4	74°05.4											
12	208°23.5	329°17.9	\$21°34.7	281°45.8	\$24°42.4	20°03.4	\$02°23.5	316°28.1	\$20°59.8	Zuben' ubi	137°03.3	-16°06.4											
13	223°25.9	344°17.2	35.4	296°46.4	42.2	35°05.4	23.7	331°30.3	59.8	Alphecca	126°09.5	26°39.8											
14	238°28.4	359°16.5	36.2	311°46.9	42.0	50°07.4	23.9	346°32.6	59.8	Antares	112°23.8	-26°27.9											
15	253°30.9	14°15.8	.. 36.9	326°47.5	.. 41.7	65°09.3	.. 24.1	1°34.8	.. 59.9	Atria	107°23.9	-69°03.4											
16	268°33.3	29°15.1	37.6	341°48.0	41.5	80°11.3	24.3	16°37.0	59.9	Sabik	102°10.2	-15°44.5											
17	283°35.8	44°14.4	38.4	356°48.6	41.3	95°13.3	24.5	31°39.2	59.9	Rasalhague	96°04.6	12°33.3											
18	298°38.2	59°13.7	\$21°39.1	11°49.1	\$24°41.0	110°15.3	\$02°24.7	46°41.4	\$21°00.0	Eltanin	90°45.4	51°29.7											
19	313°40.7	74°13.0	39.8	26°49.7	40.8	125°17.3	24.9	61°43.6	00.0	Kaus Aust.	83°41.0	-34°22.4											
20	328°43.2	89°12.3	40.6	41°50.2	40.5	140°19.2	25.1	76°45.9	00.0	Vega	80°37.6	38°48.4											
21	343°45.6	104°11.6	.. 41.3	56°50.8	.. 40.3	155°21.2	.. 25.3	91°48.1	.. 00.1	Nunki	75°55.7	-26°16.4											
22	358°48.1	119°10.9	42.0	71°51.3	40.0	170°23.2	25.5	106°50.3	00.1	Altair	62°06.1	8°55.1											
23	13°50.6	134°10.2	42.8	86°51.9	39.8	185°25.2	25.7	121°52.5	00.1	Peacock	53°15.7	-56°40.9											
Mer.pass.:22:05				v-0.7 d-0.7 m-3.9				v0.5 d0.2 m0.2				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	28°53.0	149°09.5	\$21°43.5	101°52.4	\$24°39.6	200°27.2	\$02°25.9	136°54.7	\$21°00.2	Oct 18 Tue	122°47.8	14:02											
1	43°55.5	164°08.8	44.2	116°53.0	39.3	215°29.1	26.1	151°56.9	00.2	Venus	121°32.3	14:03											
2	58°58.0	179°08.1	44.9	131°53.5	39.1	230°31.1	26.3	166°59.2	00.3	Mars	73°45.4	17:14											
3	74°00.4	194°07.4	.. 45.7	146°54.1	.. 38.8	245°33.1	.. 26.5	182°01.4	.. 00.3	Jupiter	171°57.5	10:43											
4	89°02.9	209°06.7	46.4	161°54.6	38.6	260°35.1	26.7	197°03.6	00.3	Saturn	108°13.4	14:57											
5	104°05.4	224°06.0	47.1	176°55.1	38.3	275°37.0	26.9	212°05.8	00.4	Oct 19 Wed				Oct 20 Thu									
6	119°07.8	239°05.3	\$21°47.8	191°55.7	\$24°38.1	290°39.0	\$02°27.1	227°08.0	\$21°00.4	Oct 19 Wed	121°32.3	14:03			Oct 21 Fri								
7	134°10.3	254°04.6	48.5	206°56.2	37.8	305°41.0	27.3	242°10.2	00.4	Venus	73°45.4	17:13			Oct 22 Sat								
8	149°12.7	269°03.9	4																				

DUT1 = UT1-UTC = -0.3036 sec  $\Delta T$  = TT-UT1 = +68.4876 sec

2016 October 18 to Oct. 20 UT

h		Sun			Moon			Twilight						Twilight			
Tue		GHA	Dec	GHA	$\nu$	Dec	d	HP	Lat.	Naut.	Civil	Sunrise	Sunset	Civil	Twilight		
0		183°42.7	\$09°41.4	337°10.0	5.6'	N13°19.9	8.6'	61.1'	N 72°	05:14	06:33	07:46	15:42	16:55	18:13		
1		198°42.8	42.3	351°34.7	5.6'	13°28.4	8.5'	61.1'	N 70°	05:16	06:27	07:32	15:56	17:01	18:12		
2		213°43.0	43.2	5°59.3	5.6'	13°36.8	8.4'	61.1'	68°	05:17	06:22	07:20	16:08	17:06	18:11		
3		228°43.1	44.2	20°23.8	5.6'	13°45.2	8.3'	61.1'	66°	05:18	06:17	07:11	16:18	17:11	18:10		
4		243°43.2	45.1	34°48.4	5.5'	13°53.4	8.2'	61.0'	64°	05:18	06:14	07:03	16:26	17:15	18:10		
5		258°43.3	46.0	49°12.9	5.5'	14°01.5	8.1'	61.0'	62°	05:19	06:10	06:56	16:33	17:18	18:10		
6		273°43.4	\$09°46.9	63°37.4	5.5'	N14°09.5	8.0'	61.0'	60°	05:19	06:07	06:50	16:39	17:21	18:09		
7		288°43.6	47.8	78°01.9	5.5'	14°17.4	7.9'	61.0'	N 58°	05:19	06:05	06:45	16:44	17:24	18:09		
8		303°43.7	48.7	92°26.4	5.5'	14°25.2	7.8'	61.0'	56°	05:19	06:02	06:40	16:49	17:27	18:10		
9		318°43.8	49.6	106°50.8	5.4'	14°32.9	7.6'	61.0'	54°	05:19	06:00	06:36	16:53	17:29	18:10		
10		333°43.9	50.5	121°15.2	5.4'	14°40.5	7.5'	60.9'	52°	05:19	05:58	06:32	16:57	17:31	18:10		
11		348°44.0	51.4	135°39.6	5.4'	14°48.0	7.4'	60.9'	50°	05:18	05:56	06:29	17:00	17:33	18:10		
12		3°44.1	\$09°52.3	150°04.0	5.4'	N14°55.4	7.3'	60.9'	45°	05:17	05:52	06:21	17:08	17:38	18:12		
13		18°44.3	53.2	164°28.4	5.4'	15°02.6	7.2'	60.9'	N 40°	05:16	05:48	06:15	17:14	17:42	18:13		
14		33°44.4	54.1	178°52.7	5.3'	15°09.8	7.1'	60.9'	35°	05:14	05:44	06:10	17:20	17:45	18:15		
15		48°44.5	55.0	193°17.1	5.3'	15°16.8	7.0'	60.8'	30°	05:13	05:40	06:05	17:25	17:49	18:17		
16		63°44.6	55.9	207°41.4	5.3'	15°23.8	6.9'	60.8'	20°	05:08	05:34	05:56	17:33	17:56	18:21		
17		78°44.7	56.8	222°05.7	5.3'	15°30.6	6.8'	60.8'	N 10°	05:03	05:27	05:49	17:41	18:02	18:27		
18		93°44.8	\$09°57.7	236°30.0	5.3'	N15°37.3	6.6'	60.8'	0°	04:56	05:21	05:42	17:48	18:09	18:34		
19		108°45.0	58.6	250°54.3	5.3'	15°43.9	6.5'	60.8'	S 10°	04:48	05:13	05:34	17:56	18:17	18:42		
20		123°45.1	59.5	265°18.5	5.3'	15°50.3	6.4'	60.7'	20°	04:38	05:04	05:26	18:04	18:26	18:53		
21		138°45.2	10°00.4	279°42.8	5.3'	15°56.7	6.3'	60.7'	30°	04:24	04:53	05:17	18:13	18:38	19:07		
22		153°45.3	01.3	294°07.1	5.3'	16°02.9	6.2'	60.7'	35°	04:15	04:46	05:12	18:18	18:44	19:16		
23		168°45.4	02.2	308°31.3	5.2'	16°09.0	6.1'	60.7'	40°	04:04	04:38	05:06	18:24	18:53	19:26		
		SD.=16.0	d=−0.9			S.D.=16.6			45°	03:51	04:28	04:59	18:32	19:03	19:40		
Wed		GHA	Dec	GHA	$\nu$	Dec	d	HP	Lat.	Tue	Moonrise	Wed	Thu	Tue	Moonset	Wed	Thu
0		183°45.5	\$10°03.1	322°55.6	5.2'	N16°15.0	5.9'	60.6'	N 50°	03:34	04:16	04:50	18:40	19:15	19:57		
1		198°45.7	04.0	337°19.8	5.2'	16°20.9	5.8'	60.6'	52°	03:26	04:10	04:46	18:44	19:21	20:06		
2		213°45.8	04.9	351°44.0	5.2'	16°26.7	5.7'	60.6'	54°	03:16	04:04	04:42	18:49	19:27	20:15		
3		228°45.9	05.8	6°08.3	5.2'	16°32.3	5.6'	60.6'	56°	03:05	03:57	04:37	18:54	19:35	20:27		
4		243°46.0	06.7	20°32.5	5.2'	16°37.9	5.5'	60.5'	58°	02:53	03:49	04:32	18:59	19:43	20:40		
5		258°46.1	07.6	34°56.7	5.2'	16°43.3	5.3'	60.5'	S 60°	02:37	03:39	04:26	19:06	19:53	20:56		
		SD.=16.0	d=−0.9			S.D.=16.4											
Thu		GHA	Dec	GHA	$\nu$	Dec	d	HP	Lat.	Tue	Moonrise	Wed	Thu	Tue	Moonset	Wed	Thu
0		183°48.2	\$10°24.7	308°38.3	5.4'	N18°02.3	3.0'	60.0'	N 72°	16:22	16:07	□	11:34	13:54	□		
1		198°48.3	25.6	323°02.7	5.4'	18°05.1	2.8'	59.9'	N 70°	16:56	17:09	17:42	11:01	12:52	14:23		
2		213°48.4	26.5	337°27.2	5.5'	18°07.9	2.7'	59.9'	68°	17:21	17:45	18:26	10:37	12:17	13:39		
3		228°48.5	27.4	351°51.7	5.5'	18°10.6	2.6'	59.9'	66°	17:40	18:11	18:56	10:18	11:52	13:09		
4		243°48.6	28.3	6°16.2	5.5'	18°13.1	2.5'	59.8'	64°	17:56	18:31	19:18	10:03	11:32	12:47		
5		258°48.7	29.2	20°40.7	5.5'	18°15.5	2.3'	59.8'	62°	18:09	18:47	19:36	09:51	11:16	12:29		
6		273°48.8	\$10°30.1	35°05.3	5.6'	N18°17.7	2.2'	59.8'	60°	18:20	19:00	19:51	09:40	11:03	12:14		
7		288°49.0	30.9	49°29.9	5.6'	18°19.9	2.1'	59.7'	N 58°	18:30	19:12	20:04	09:31	10:52	12:02		
8		303°49.1	31.8	63°54.5	5.6'	18°21.9	1.9'	59.7'	56°	18:38	19:22	20:15	09:23	10:42	11:51		
9		318°49.2	32.7	78°19.1	5.7'	18°23.8	1.8'	59.7'	54°	18:46	19:31	20:24	09:16	10:33	11:41		
10		333°49.3	33.6	92°43.8	5.7'	18°25.5	1.7'	59.6'	52°	18:53	19:39	20:33	09:10	10:25	11:33		
11		348°49.4	34.5	107°08.5	5.7'	18°27.1	1.6'	59.6'	50°	18:59	19:47	20:41	09:04	10:18	11:25		
12		3°49.5	\$10°35.4	121°33.3	5.8'	N18°28.6	1.4'	59.6'	45°	19:12	20:02	20:57	08:51	10:03	11:09		
13		18°49.6	36.3	135°58.0	5.8'	18°30.0	1.3'	59.5'	N 40°	19:23	20:15	21:10	08:41	09:51	10:55		
14		33°49.7	37.2	150°22.9	5.8'	18°31.3	1.2'	59.5'	20°	19:33	20:26	21:22	08:32	09:40	10:44		
15		48°49.8	38.1	164°47.7	5.9'	18°32.4	1.1'	59.5'	30°	19:41	20:35	21:32	08:25	09:31	10:34		
16		63°49.9	39.0	179°12.6	5.9'	18°33.4	0.9'	59.4'	20°	19:56	20:52	21:49	08:11	09:15	10:17		
17		78°50.0	39.9	193°37.5	6.0'	18°34.3	0.8'	59.4'	N 10°	20:08	21:06	22:04	08:00	09:02	10:02		
18		93°50.1	\$10°40.8	208°02.5	6.0'	N18°35.0	0.7'	59.4'	0°	20:20	21:20	22:18	07:49	08:49	09:48		
19		108°50.2	41.6	222°27.5	6.0'	18°35.7	0.6'	59.3'	S 10°	20:32	21:33	22:33	07:38	08:36	09:34		
20		123°50.3	42.5	236°52.6	6.1'	18°36.2	0.4'	59.3'	20°	20:45	21:48	22:48	07:27	08:22	09:19		
21		138°50.4	43.4	251°17.7	6.1'	18°36.5	0.3'	59.3'	30°	21:00	22:05	23:05	07:14	08:06	09:02		
22		153°50.5	44.3	265°42.8	6.2'	18°36.8	0.2'	59.2'	35°	21:09	22:15	23:15	07:06	07:57	08:52		
23		168°50.6	45.2	280°08.0	6.2'	18°36.9	0.1'	59.2'	40°	21:18	22:26	23:27	06:57	07:47	08:40		
		SD.=16.1	d=−0.9			S.D.=16.2			45°	21:30	22:39	23:41	06:47	07:34	08:27		
Day		Eqn.of Time	00 <sup>h</sup> mm:ss	Time	12 <sup>h</sup> mm:ss	Mer. Pass.	Upper hh:mm	Mer. Pass.	Mer.	Mer. Pass.	Mer. Pass.	Sun	Moon	Mer. Pass.	Age		
18		14:51		14:57		11:45		01:35		14:05							
19		15:02		15:08		11:45		02:34		15:04							
20		15:13		15:18		11:45		03:34		16:03							

**October 21, 22, 23 UT (Fri., Sat., Sun.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	29°52.2	148°52.6	S22°00.6	102°05.5	S24°33.6	201°14.7	S02°30.8	137°47.9	S21°01.0	Alpheratz	357°40.8
1	44°54.6	163°51.9	01.3	117°06.1	33.4	216°16.6	31.0	152°50.1	01.1	Ankaa	353°13.2
2	59°57.1	178°51.2	02.0	132°06.6	33.1	231°18.6	31.2	167°52.3	01.1	Schedar	349°37.3
3	74°59.6	193°50.5	.. 02.7	147°07.2	.. 32.8	246°20.6	.. 31.4	182°54.5	.. 01.1	Diphda	348°53.4
4	90°02.0	208°49.7	03.4	162°07.7	32.6	261°22.6	31.6	197°56.8	01.2	Achernar	335°24.6
5	105°04.5	223°49.0	04.1	177°08.2	32.3	276°24.5	31.8	212°59.0	01.2	Hamal	327°57.8
6	120°07.0	238°48.3	S22°04.8	192°08.8	S24°32.1	291°26.5	S02°32.0	228°01.2	S21°01.2	Polaris	316°16.9
7	135°09.4	253°47.6	05.5	207°09.3	31.8	306°28.5	32.2	243°03.4	01.3	Acamar	315°16.3
8	150°11.9	268°46.9	06.2	222°09.9	31.6	321°30.5	32.5	258°05.6	01.3	Menkar	314°12.4
9	165°14.3	283°46.2	.. 06.9	237°10.4	.. 31.3	336°32.5	.. 32.7	273°07.8	.. 01.3	Mirfak	308°36.6
10	180°16.8	298°45.5	07.6	252°11.0	31.1	351°34.4	32.9	288°10.0	01.4	Aldebaran	290°46.5
11	195°19.3	313°44.7	08.3	267°11.5	30.8	6°36.4	33.1	303°12.3	01.4	Rigel	281°09.7
12	210°21.7	328°44.0	S22°09.0	282°12.1	S24°30.5	21°38.4	S02°33.3	318°14.5	S21°01.4	Capella	280°30.8
13	225°24.2	343°43.3	09.6	297°12.6	30.3	36°40.4	33.5	333°16.7	01.5	Bellatrix	278°29.4
14	240°26.7	358°42.6	10.3	312°13.1	30.0	51°42.4	33.7	348°18.9	01.5	Elnath	278°09.5
15	255°29.1	13°41.9	.. 11.0	327°13.7	.. 29.8	66°44.3	.. 33.9	3°21.1	.. 01.5	Alnilam	275°43.9
16	270°31.6	28°41.2	11.7	342°14.2	29.5	81°46.3	34.1	18°23.3	01.6	Betelgeuse	270°58.7
17	285°34.1	43°40.4	12.4	357°14.8	29.3	96°48.3	34.3	33°25.5	01.6	Canopus	263°54.9
18	300°36.5	58°39.7	S22°13.1	12°15.3	S24°29.0	111°50.3	S02°34.5	48°27.8	S21°01.7	Sirius	258°31.6
19	315°39.0	73°39.0	13.8	27°15.9	28.7	126°52.3	34.7	63°30.0	01.7	Adhara	255°10.6
20	330°41.5	88°38.3	14.4	42°16.4	28.5	141°54.2	34.9	78°32.2	01.7	Procyon	244°57.4
21	345°43.9	103°37.6	.. 15.1	57°17.0	.. 28.2	156°56.2	.. 35.1	93°34.4	.. 01.8	Pollux	243°25.0
22	0°46.4	118°36.8	15.8	72°17.5	27.9	171°58.2	35.3	108°36.6	01.8	Avior	234°17.1
23	15°48.8	133°36.1	16.5	87°18.0	27.7	187°00.2	35.5	123°38.8	01.8	Suhail	222°50.9
Mer.pass.:21:57		v-0.7 d-0.7 m-3.9		v0.5 d0.3 m0.3		v2.0 d-0.2 m-1.5		v2.2 d-0.0 m0.6		Miaplacidus	
Sat		GHA		GHA		GHA		GHA		GHA	
0	30°51.3	148°35.4	S22°17.2	102°18.6	S24°27.4	202°02.2	S02°35.7	138°41.0	S21°01.9	Denebola	182°31.7
1	45°53.8	163°34.7	17.8	117°19.1	27.2	217°04.2	35.9	153°43.2	01.9	Gienah	175°50.3
2	60°56.2	178°34.0	18.5	132°19.7	26.9	232°06.1	36.1	168°45.4	01.9	Acrux	173°07.3
3	75°58.7	193°33.2	.. 19.2	147°20.2	.. 26.6	247°08.1	.. 36.3	183°47.7	.. 02.0	Gacrux	171°58.8
4	91°01.2	208°32.5	19.9	162°20.8	26.4	262°10.1	36.5	198°49.9	02.0	Alioth	166°19.4
5	106°03.6	223°31.8	20.5	177°21.3	26.1	277°12.1	36.7	213°52.1	02.0	Spica	158°29.2
6	121°06.1	238°31.1	S22°21.2	192°21.8	S24°25.8	292°14.1	S02°36.9	228°54.3	S21°02.1	Alkaid	152°57.7
7	136°08.6	253°30.3	21.9	207°22.4	25.6	307°16.0	37.1	243°56.5	02.1	Hadar	148°45.2
8	151°11.0	268°29.6	22.5	222°22.9	25.3	322°18.0	37.3	258°58.7	02.1	Menkent	148°05.3
9	166°13.5	283°28.9	.. 23.2	237°23.5	.. 25.0	337°20.0	.. 37.5	274°00.9	.. 02.2	Arcturus	145°54.1
10	181°16.0	298°28.2	23.9	252°24.0	24.8	352°22.0	37.7	289°03.1	02.2	Rigil Kent.	139°49.2
11	196°18.4	313°27.4	24.5	267°24.6	24.5	7°24.0	37.9	304°05.3	02.3	Kochab	137°21.4
12	211°20.9	328°26.7	S22°25.2	282°25.1	S24°24.2	22°25.9	S02°38.2	319°07.6	S21°02.3	Zuben'ubi	137°03.3
13	226°23.3	343°26.0	25.9	297°25.6	24.0	37°27.9	38.4	334°09.8	02.3	Alphecca	126°09.5
14	241°25.8	358°25.3	26.5	312°26.2	23.7	52°29.9	38.6	349°12.0	02.4	Antares	112°23.8
15	256°28.3	13°24.5	.. 27.2	327°26.7	.. 23.4	67°31.9	.. 38.8	4°14.2	.. 02.4	Atria	107°23.9
16	271°30.7	28°23.8	27.8	342°27.3	23.2	82°33.9	39.0	19°16.4	02.4	Sabik	102°10.2
17	286°33.2	43°23.1	28.5	357°27.8	22.9	97°35.8	39.2	34°18.6	02.5	Rasalhague	96°04.6
18	301°35.7	58°22.3	S22°29.2	12°28.4	S24°22.6	112°37.8	S02°39.4	49°20.8	S21°02.5	Eltanin	90°45.4
19	316°38.1	73°21.6	29.8	27°28.9	22.4	127°39.8	39.6	64°23.0	02.5	Kaus Aust.	83°41.0
20	331°40.6	88°20.9	30.5	42°29.4	22.1	142°41.8	39.8	79°25.2	02.6	Vega	80°37.6
21	346°43.1	103°20.1	.. 31.1	57°30.0	.. 21.8	157°43.8	.. 40.0	94°27.5	.. 02.6	Nunki	75°55.7
22	1°45.5	118°19.4	31.8	72°30.5	21.6	172°45.8	40.2	109°29.7	02.6	Altair	62°06.1
23	16°48.0	133°18.7	32.4	87°31.1	21.3	187°47.7	40.4	124°31.9	02.7	Peacock	53°15.7
Mer.pass.:21:53		v-0.7 d-0.7 m-3.9		v0.5 d0.3 m0.3		v2.0 d-0.2 m-1.5		v2.2 d-0.0 m0.6		Deneb	
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Enif	49°29.8
0	31°50.4	148°17.9	S22°33.1	102°31.6	S24°21.0	202°49.7	S02°40.6	139°34.1	S21°02.7	Al Na'ir	33°44.8
1	46°52.9	163°17.2	33.7	117°32.1	20.7	217°51.7	40.8	154°36.3	02.7	Fomalhaut	27°40.8
2	61°55.4	178°16.5	34.4	132°32.7	20.5	232°53.7	41.0	169°38.5	02.8	Scheat	15°21.3
3	76°57.8	193°15.7	.. 35.0	147°33.2	.. 20.2	247°55.7	.. 41.2	184°40.7	.. 02.8	Markab	13°50.9
4	92°00.3	208°15.0	35.7	162°33.8	19.9	262°57.6	41.4	199°42.9	02.8	Oct 21 Fri	119°00.4
5	107°02.8	223°14.3	36.3	177°34.3	19.6	277°59.6	41.6	214°45.1	02.9	Venus	14:05
6	122°05.2	238°13.5	S22°37.0	192°34.9	S24°19.4	293°01.6	S02°41.8	229°47.3	S21°02.9	Mars	12:33
7	137°07.7	253°12.8	37.6	207°35.4	19.1	308°03.6	42.0	244°49.5	03.0	Jupiter	171°22.5
8	152°10.2	268°12.1	38.3	222°35.9	18.8	323°05.6	42.2	259°51.8	03.0	Saturn	107°55.7
9	167°12.6	283°11.3	.. 38.9	237°36.5	.. 18.5	338°07.6	.. 42.4	274°54.0	.. 03.0	Oct 22 Sat	117°44.1
10	182°15.1	298°10.6	39.6	252°37.0	18.3	353°09.5	42.6	289°56.2	03.1	Venus	14:06
11	197°17.6	313°09.9	40.2	267°37.6	18.0	8°11.5	42.8	304°58.4	03.1	Mars	12:37.3
12	212°20.0	328°09.1	S22°40.8	282°38.1	S24°17.7	23°13.5	S02°43.0	320°00.6	S21°03.1	Jupiter	171°10.9
13	227°22.5	343°08.4	41.5	297°38.6	17.4	38°15.5	43.2	335°02.8	03.2	Saturn	107°49.7
14	242°24.9	358°07.6	42.1	312°39.2	17.2	53°17.5	43.4	350°05.0	03.2	Oct 23 Sun	116°27.5
15	257°27.4	13°06.9	.. 42.8	327°39.7	.. 16.9	68°19.4	.. 43.6	5°07.2	.. 03.2	Venus	14:08
16	272°29.9	28°06.2	43.4	342°40.3	16.6	83°21.4	43.8	20°09.4	03.3	Mars	12:09
17	287°32.3	43°05.4	44.0	357°40.8	16.3	98°23.4	44.0	35°11.6	03.3	Jupiter	170°59.3
18	302°34.8	58°04.7	S22°44.7	12°41.4	S24°16.0	113°25.4	S02°44.2	50°13.8	S21°03.3	Saturn	107°43.6
19	317°37.3	73°04.0	45.3	27°41.9	15.8	128°27.4	44.4	65°16.0	03.4	Horizontal parallax	
20	332°39.7	88°03.2	45.9	42°42.4	15.5	143°29.4	44.6	80°18.3	03.4	Venus:	0.1
21	347°42.2	103°02.5	.. 46.6	57°43.0	.. 15.2	158°31.3	.. 44.8	95°20.5	.. 03.4	Mars:	0.1
22	2°44.7	118°01.7	47.2	72°43.5	14.9	173°33.3	45.0	110°22.7	03.5	Oct 24 Mon	14:40
23	17°47.1	133°01.0	47.8	87°44.1	14.6	188°35.3	45.2	125°24.9	03.5	Mer.pass.:21:49	v-0.7 d-0.7 m-3.9
Mer.pass.:21:49		v-0.7 d-0.7 m-3.9		v0.5 d0.3 m0.3		v2.0 d-0.2 m-1.5		v2.2 d-0.0 m0.6		Mer.pass.:21:50	

DUT1 = UT1-UTC = -0.3079 sec ΔT = TT-UT1 = +68.4919 sec

2016 October 21 to Oct. 23 UT

h		Sun		Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	183°50.7	S10°46.1	294°33.2	6.3'	N18°36.9	-0.0'	59.2'
1	198°50.8	47.0	308°58.5	6.3'	18°36.8	-0.2'	59.1'
2	213°50.9	47.9	323°23.8	6.4'	18°36.6	-0.3'	59.1'
3	228°51.0	.. 48.7	337°49.2	6.4'	18°36.3	-0.4'	59.1'
4	243°51.1	49.6	352°14.6	6.4'	18°35.8	-0.5'	59.0'
5	258°51.2	50.5	6°40.1	6.5'	18°35.2	-0.6'	59.0'
6	273°51.3	S10°51.4	21°05.6	6.6'	N18°34.5	-0.8'	59.0'
7	288°51.4	52.3	35°31.2	6.6'	18°33.7	-0.9'	58.9'
8	303°51.5	53.2	49°56.8	6.7'	18°32.7	-1.0'	58.9'
9	318°51.6	.. 54.1	64°22.5	6.7'	18°31.6	-1.1'	58.8'
10	333°51.7	55.0	78°48.3	6.8'	18°30.5	-1.2'	58.8'
11	348°51.8	55.8	93°14.1	6.8'	18°29.2	-1.4'	58.8'
12	3°51.9	S10°56.7	107°39.9	6.9'	N18°27.8	-1.5'	58.7'
13	18°52.0	57.6	122°05.8	6.9'	18°26.2	-1.6'	58.7'
14	33°52.1	58.5	136°31.8	7.0'	18°24.6	-1.7'	58.7'
15	48°52.2	10°59.4	150°57.8	7.1'	18°22.8	-1.8'	58.6'
16	63°52.3	11°00.3	165°23.9	7.1'	18°21.0	-1.9'	58.6'
17	78°52.4	01.1	179°50.0	7.2'	18°19.0	-2.0'	58.6'
18	93°52.5	S11°02.0	194°16.2	7.2'	N18°16.9	-2.1'	58.5'
19	108°52.6	02.9	208°42.5	7.3'	18°14.7	-2.3'	58.5'
20	123°52.7	03.8	223°08.8	7.4'	18°12.4	-2.4'	58.4'
21	138°52.8	.. 04.7	237°35.2	7.4'	18°10.0	-2.5'	58.4'
22	153°52.9	05.6	252°01.7	7.5'	18°07.4	-2.6'	58.4'
23	168°52.9	06.4	266°28.2	7.5'	18°04.8	-2.7'	58.3'
	SD.=16.1	d=-0.9			S.D.=16.0		

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

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

Day	Sun		Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Age	
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm	
21	15:23	15:28	11:45	04:32	17:01
22	15:32	15:37	11:44	05:28	17:56
23	15:41	15:45	11:44	06:22	18:47



SD.=16.1	d=-0.9	S.D.=15.6
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## October 24, 25, 26 UT (Mon., Tue., Wed.)

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	32°49.6	148°00.2	\$22°48.4	102°44.6	\$24°14.4	203°37.3	\$02°45.4	140°27.1	\$21°03.6	Alpheratz	357°40.8	29°11.1											
1	47°52.1	162°59.5	49.1	117°45.1	14.1	218°39.3	45.6	155°29.3	03.6	Ankaa	353°13.2	-42°13.0											
2	62°54.5	177°58.8	49.7	132°45.7	13.8	233°41.3	45.8	170°31.5	03.6	Schedar	349°37.3	56°37.9											
3	77°57.0	192°58.0	.. 50.3	147°46.2	.. 13.5	248°43.2	.. 46.0	185°33.7	.. 03.7	Diphda	348°53.4	-17°53.7											
4	92°59.4	207°57.3	50.9	162°46.8	13.2	263°45.2	46.2	200°35.9	03.7	Achernar	335°24.6	-57°09.2											
5	108°01.9	222°56.5	51.6	177°47.3	12.9	278°47.2	46.5	215°38.1	03.7	Hamal	327°57.8	23°32.5											
6	123°04.4	237°55.8	\$22°52.2	192°47.8	\$24°12.7	293°49.2	\$02°46.7	230°40.3	\$21°03.8	Polaris	316°16.5	89°19.9											
7	138°06.8	252°55.0	52.8	207°48.4	12.4	308°51.2	46.9	245°42.5	03.8	Acamar	315°16.3	-40°14.3											
8	153°09.3	267°54.3	53.4	222°48.9	12.1	323°53.2	47.1	260°44.7	03.8	Menkar	314°12.4	4°09.3											
9	168°11.8	282°53.5	.. 54.0	237°49.5	.. 11.8	338°55.1	.. 47.3	275°46.9	.. 03.9	Mirfak	308°36.6	49°55.0											
10	183°14.2	297°52.8	54.6	252°50.0	11.5	353°57.1	47.5	290°49.1	03.9	Aldebaran	290°46.5	16°32.4											
11	198°16.7	312°52.0	55.3	267°50.5	11.2	8°59.1	47.7	305°51.4	03.9	Rigel	281°09.7	-8°11.0											
12	213°19.2	327°51.3	\$22°55.9	282°51.1	\$24°10.9	24°01.1	\$02°47.9	320°53.6	\$21°04.0	Capella	280°30.8	46°00.6											
13	228°21.6	342°50.5	56.5	297°51.6	10.7	39°03.1	48.1	335°55.8	04.0	Bellatrix	278°29.4	6°21.8											
14	243°24.1	357°49.8	57.1	312°52.2	10.4	54°05.1	48.3	350°58.0	04.0	El Nath	278°09.5	28°37.1											
15	258°26.5	12°49.0	.. 57.7	327°52.7	.. 10.1	69°07.0	.. 48.5	6°00.2	.. 04.1	Alnilam	275°43.9	-1°11.6											
16	273°29.0	27°48.3	58.3	342°53.2	09.8	84°09.0	48.7	21°02.4	04.1	Betelgeuse	270°58.7	7°24.5											
17	288°31.5	42°47.5	58.9	357°53.8	09.5	99°11.0	48.9	36°04.6	04.2	Canopus	263°54.9	-52°42.2											
18	303°33.9	57°46.8	\$22°59.5	12°54.3	\$24°09.2	114°13.0	\$02°49.1	51°06.8	\$21°04.2	Sirius	258°31.6	-16°44.4											
19	318°36.4	72°46.0	23°00.1	27°54.9	08.9	129°15.0	49.3	66°09.0	04.2	Adhara	255°10.6	-28°59.6											
20	333°38.9	87°45.3	00.7	42°55.4	08.6	144°17.0	49.5	81°11.2	04.3	Procyon	244°57.3	5°10.8											
21	348°41.3	102°44.5	.. 01.3	57°55.9	.. 08.4	159°18.9	.. 49.7	96°13.4	.. 04.3	Pollux	243°25.0	27°58.9											
22	3°43.8	117°43.8	01.9	72°56.5	08.1	174°20.9	49.9	111°15.6	04.3	Avior	234°17.0	-59°33.6											
23	18°46.3	132°43.0	02.6	87°57.0	07.8	189°22.9	50.1	126°17.8	04.4	Suhail	222°50.8	-43°29.8											
Mer.pass.:21:45				v-0.7 d-0.6 m-3.9				v0.5 d0.3 m0.3				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	33°48.7	147°42.3	\$23°03.2	102°57.6	\$24°07.5	204°24.9	\$02°50.3	141°20.0	\$21°04.4	Denebola	182°31.7	14°28.8											
1	48°51.2	162°41.5	03.8	117°58.1	07.2	219°26.9	50.5	156°22.2	04.4	Gienah	175°50.3	-17°37.9											
2	63°53.7	177°40.8	04.4	132°58.6	06.9	234°28.9	50.7	171°24.4	04.5	Acrua	173°07.3	-63°11.3											
3	78°56.1	192°40.0	.. 04.9	147°59.2	.. 06.6	249°30.8	.. 50.9	186°26.6	.. 04.5	Gacrux	171°58.8	-57°12.2											
4	93°58.6	207°39.3	05.5	162°59.7	06.3	264°32.8	51.1	201°28.8	04.5	Alioth	166°19.4	55°52.2											
5	109°01.0	222°38.5	06.1	178°00.3	06.0	279°34.8	51.3	216°31.0	04.6	Spica	158°29.2	-11°14.7											
6	124°03.5	237°37.8	\$23°06.7	193°00.8	\$24°05.7	294°36.8	\$02°51.5	231°33.2	\$21°04.6	Alkaid	152°57.7	49°13.9											
7	139°06.0	252°37.0	07.3	208°01.3	05.4	309°38.8	51.7	246°35.5	04.6	Hadar	148°45.2	-60°27.0											
8	154°08.4	267°36.2	07.9	223°01.9	05.1	324°40.8	51.9	261°37.7	04.7	Menkent	148°05.3	-36°26.9											
9	169°10.9	282°35.5	.. 08.5	238°02.4	.. 04.8	339°42.8	.. 52.1	276°39.9	.. 04.7	Arcturus	145°54.1	19°06.0											
10	184°13.4	297°34.7	09.1	253°03.0	04.5	354°44.7	52.3	291°42.1	04.7	Rigel Kent.	139°49.2	-60°54.0											
11	199°15.8	312°34.0	09.7	268°03.5	04.2	9°46.7	52.5	306°44.3	04.8	Kochab	137°21.4	74°05.4											
12	214°18.3	327°33.2	\$23°10.3	283°04.0	\$24°04.0	24°48.7	\$02°52.7	321°46.5	\$21°04.8	Zuben' ubi	137°03.2	-16°06.4											
13	229°20.8	342°32.5	10.9	298°04.6	03.7	39°50.7	52.9	336°48.7	04.9	Alphecca	126°09.5	26°39.8											
14	244°23.2	357°31.7	11.4	313°05.1	03.4	54°52.7	53.1	351°50.9	04.9	Antares	112°23.8	-26°27.9											
15	259°25.7	12°30.9	.. 12.0	328°05.7	.. 03.1	69°54.7	.. 53.3	6°53.1	.. 04.9	Atria	107°24.0	-69°03.4											
16	274°28.2	27°30.2	12.6	343°06.2	02.8	84°56.6	53.5	21°55.3	05.0	Sabik	102°10.2	-15°44.5											
17	289°30.6	42°29.4	13.2	358°06.7	02.5	99°58.6	53.7	36°57.5	05.0	Rasalhague	96°04.6	12°33.2											
18	304°33.1	57°28.7	\$23°13.8	13°07.3	\$24°02.2	115°00.6	\$02°53.9	51°59.7	\$21°05.0	Eltanin	90°45.4	51°29.7											
19	319°35.5	72°27.9	14.4	28°07.8	01.9	130°02.6	54.1	67°01.9	05.1	Kaus Aust.	83°41.0	-34°22.4											
20	334°38.0	87°27.1	14.9	43°08.4	01.6	145°04.6	54.3	82°04.1	05.1	Vega	80°37.6	38°48.4											
21	349°40.5	102°26.4	.. 15.5	58°08.9	.. 01.3	160°06.6	.. 54.5	97°06.3	.. 05.1	Nunki	75°55.7	-26°16.4											
22	4°42.9	117°25.6	16.1	73°09.4	01.0	175°08.6	54.7	112°08.5	05.2	Altair	62°06.1	8°55.1											
23	19°45.4	132°24.8	16.7	88°10.0	00.7	190°10.5	54.9	127°10.7	05.2	Peacock	53°15.8	-56°40.9											
Mer.pass.:21:41				v-0.8 d-0.6 m-3.9				v0.5 d0.3 m0.3				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.6							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	34°47.9	147°24.1	\$23°17.2	103°10.5	\$24°00.4	205°12.5	\$02°55.1	142°12.9	\$21°05.2	Oct 24 Mon	115°10.7	14:09											
1	49°50.3	162°23.3	17.8	118°11.0	24°00.1	220°14.5	55.3	157°15.1	05.3	Venus	69°55.0	17:08											
2	64°52.8	177°22.6	18.4	133°11.6	23°59.8	235°16.5	55.5	172°17.3	05.3	Mars	170°47.7	10:24											
3	79°55.3	192°21.8	.. 19.0	148°12.1	.. 59.5	250°18.5	.. 55.7	187°19.5	.. 05.3	Jupiter	107°37.5	14:36											
4	94°57.7	207°21.0	19.5	163°12.7	59.2	265°20.5	55.9	202°21.7	05.4	Saturn	107°37.5	14:36											
5	110°00.2	222°20.3	20.1	178°13.2	58.9	280°22.5	56.1	217°23.9	05.4	Oct 25 Tue	113°53.6	14:10											
6	125°02.6	237°19.5	\$23°20.7	193°13.7	\$23°58.6	295°24.4	\$02°56.3	232°26.1	\$21°05.5	Venus	69°08.8	17:08											
7	140°05.1	252°18.7	21.2	208°14.3	58.2	310°26.4	56.5	247°28.3	05.5	Mars	170°36												

DUT1 = UT1-UTC = -0.3122 sec ΔT = TT-UT1 = +68.4962 sec

2016 October 24 to Oct. 26 UT

Mon	Sun			Moon			
	GHA	Dec	GHA	ν	Dec	d	HP
0	183°57.2	S11°49.3	255°30.8	10.9'	N14°00.3	-6.9'	56.7'
1	198°57.3	50.2	270°00.7	11.0'	13°53.3	-7.0'	56.6'
2	213°57.3	51.0	284°30.7	11.0'	13°46.3	-7.1'	56.6'
3	228°57.4	.. 51.9	299°00.8	11.1'	13°39.2	-7.1'	56.6'
4	243°57.5	52.8	313°30.9	11.2'	13°32.0	-7.2'	56.6'
5	258°57.6	53.6	328°01.1	11.2'	13°24.8	-7.3'	56.5'
6	273°57.6	S11°45.4	342°31.4	11.3'	N13°17.5	-7.3'	56.5'
7	288°57.7	55.4	357°01.8	11.4'	13°10.2	-7.4'	56.5'
8	303°57.8	56.2	11°32.2	11.4'	13°02.8	-7.4'	56.4'
9	318°57.9	.. 57.1	26°02.6	11.5'	12°55.3	-7.5'	56.4'
10	333°57.9	58.0	40°33.2	11.6'	12°47.8	-7.5'	56.4'
11	348°58.0	58.8	55°03.8	11.6'	12°40.2	-7.6'	56.3'
12	3°58.1	S11°59.7	69°34.4	11.7'	N12°32.6	-7.7'	56.3'
13	18°58.2	12°00.6	84°05.1	11.7'	12°24.9	-7.7'	56.3'
14	33°58.2	01.4	98°35.9	11.8'	12°17.2	-7.8'	56.3'
15	48°58.3	.. 02.3	113°06.7	11.9'	12°09.4	-7.8'	56.2'
16	63°58.4	03.1	127°37.6	11.9'	12°01.5	-7.9'	56.2'
17	78°58.5	04.0	142°08.6	12.0'	11°53.6	-7.9'	56.2'
18	93°58.5	S12°04.9	156°39.6	12.1'	N11°45.7	-8.0'	56.2'
19	108°58.6	05.7	171°10.7	12.1'	11°37.7	-8.0'	56.1'
20	123°58.7	06.6	185°41.9	12.2'	11°29.6	-8.1'	56.1'
21	138°58.8	.. 07.5	200°13.1	12.2'	11°21.5	-8.1'	56.1'
22	153°58.8	08.3	214°44.3	12.3'	11°13.4	-8.2'	56.0'
23	168°58.9	09.2	229°15.6	12.3'	11°05.2	-8.2'	56.0'
	SD.=16.1	d=-0.9			S.D.=15.3		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	183°59.0	S12°10.0	243°47.0	12.4'	N10°56.9	-8.3'	56.0'
1	198°59.0	10.9	258°18.4	12.5'	10°48.7	-8.3'	56.0'
2	213°59.1	11.8	272°49.9	12.5'	10°40.3	-8.3'	55.9'
3	228°59.2	.. 12.6	287°21.4	12.6'	10°32.0	-8.4'	55.9'
4	243°59.3	13.5	301°53.0	12.6'	10°23.6	-8.4'	55.9'
5	258°59.3	14.3	316°24.7	12.7'	10°15.1	-8.5'	55.9'
6	273°59.4	S12°15.2	330°56.4	12.7'	N10°06.6	-8.5'	55.8'
7	288°59.5	16.0	345°28.1	12.8'	09°58.1	-8.6'	55.8'
8	303°59.5	16.9	359°59.9	12.8'	09°49.5	-8.6'	55.8'
9	318°59.6	.. 17.8	14°31.8	12.9'	09°40.9	-8.6'	55.8'
10	333°59.7	18.6	29°03.7	12.9'	09°32.2	-8.7'	55.7'
11	348°59.7	19.5	43°35.7	13.0'	09°23.5	-8.7'	55.7'
12	3°59.8	S12°20.3	58°07.7	13.0'	N09°14.8	-8.7'	55.7'
13	18°59.9	21.2	72°39.7	13.1'	09°06.0	-8.8'	55.7'
14	33°59.9	22.0	87°11.9	13.1'	08°57.2	-8.8'	55.6'
15	49°00.0	.. 22.9	101°44.0	13.2'	08°48.4	-8.9'	55.6'
16	64°00.1	23.7	116°16.2	13.2'	08°39.5	-8.9'	55.6'
17	79°00.1	24.6	130°48.5	13.3'	08°30.6	-8.9'	55.6'
18	94°00.2	S12°25.5	145°20.8	13.3'	N08°21.7	-8.9'	55.5'
19	109°00.3	26.3	159°53.1	13.4'	08°12.7	-9.0'	55.5'
20	124°00.3	27.2	174°25.5	13.4'	08°03.7	-9.0'	55.5'
21	139°00.4	.. 28.0	188°57.9	13.5'	07°54.7	-9.0'	55.5'
22	154°00.5	28.9	203°30.4	13.5'	07°45.7	-9.1'	55.4'
23	169°00.5	29.7	218°02.9	13.5'	07°36.6	-9.1'	55.4'
	SD.=16.1	d=-0.9			S.D.=15.2		

Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	184°00.6	S12°30.6	232°35.5	13.6'	N07°27.5	-9.1'	55.4'
1	199°00.6	31.4	247°08.1	13.6'	07°18.3	-9.2'	55.4'
2	214°00.7	32.3	261°40.8	13.7'	07°09.2	-9.2'	55.4'
3	229°00.8	.. 33.1	276°13.5	13.7'	07°00.0	-9.2'	55.3'
4	244°00.8	34.0	290°46.2	13.8'	06°50.8	-9.2'	55.3'
5	259°00.9	34.8	305°19.0	13.8'	06°41.5	-9.3'	55.3'
6	274°01.0	S12°35.7	319°51.8	13.8'	N06°32.3	-9.3'	55.3'
7	289°01.0	36.5	334°24.6	13.9'	06°23.0	-9.3'	55.3'
8	304°01.1	37.4	348°57.5	13.9'	06°13.7	-9.3'	55.2'
9	319°01.1	.. 38.2	3°30.4	13.9'	06°04.3	-9.3'	55.2'
10	334°01.2	39.1	18°03.4	14.0'	05°55.0	-9.4'	55.2'
11	349°01.3	39.9	32°36.4	14.0'	05°45.6	-9.4'	55.2'
12	4°01.3	S12°40.8	47°09.4	14.0'	N05°36.2	-9.4'	55.1'
13	19°01.4	41.6	61°42.5	14.1'	05°26.8	-9.4'	55.1'
14	34°01.4	42.5	76°15.6	14.1'	05°17.4	-9.4'	55.1'
15	49°01.5	.. 43.3	90°48.7	14.1'	05°07.9	-9.5'	55.1'
16	64°01.6	44.2	105°21.9	14.2'	04°58.5	-9.5'	55.1'
17	79°01.6	45.0	119°55.1	14.2'	04°49.0	-9.5'	55.1'
18	94°01.7	S12°45.9	134°28.3	14.2'	N04°39.5	-9.5'	55.0'
19	109°01.7	46.7	149°01.6	14.3'	04°30.0	-9.5'	55.0'
20	124°01.8	47.5	163°34.8	14.3'	04°20.5	-9.5'	55.0'
21	139°01.8	.. 48.4	178°08.2	14.3'	04°11.0	-9.5'	55.0'
22	154°01.9	49.2	192°41.5	14.4'	04°01.4	-9.6'	55.0'
23	169°02.0	50.1	207°14.9	14.4'	03°51.8	-9.6'	54.9'
	SD.=16.1	d=-0.9			S.D.=15.0		

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

Lat.	Mon	Moonrise		Monset	Moonset	
		Tue	Wed		Mon	Tue
N 72°	23:18	--:	01:00	16:11	16:05	15:59
N 70°	23:36	--:	01:11	15:51	15:52	15:53
68°	23:51	--:	01:20	15:35	15:42	15:47
66°	00:03	01:27		15:22	15:34	15:43
64°	00:13	01:33		15:11	15:26	15:39
62°	00:22	01:38		15:02	15:20	15:35
60°	00:29	01:43		14:54	15:15	15:32
N 58°	--:	00:35	01:47	14:47	15:10	15:29
56°	--:	00:41	01:51	14:41	15:05	1

**October 27, 28, 29 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars		Jupiter		Saturn		Stars	
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	35°47.0	147°05.7	\$23°30.7	103°23.4	\$23°53.0	206°00.2	S02°59.9	143°05.7	\$21°06.1	Alpheratz	357°40.8	29°11.1	
1	50°49.5	162°04.9	31.2	118°24.0	52.7	221°02.2	03°00.1	158°07.9	06.1	Ankaa	353°13.2	-42°13.0	
2	65°51.9	177°04.1	31.8	133°24.5	52.4	236°04.2	00.3	173°10.1	06.2	Schedar	349°37.3	56°37.9	
3	80°54.4	192°03.3	.. 32.3	148°25.0	.. 52.1	251°06.2	.. 00.5	188°12.3	.. 06.2	Diphda	348°53.4	-17°53.7	
4	95°56.9	207°02.6	32.9	163°25.6	51.8	266°08.1	00.7	203°14.5	06.2	Achernar	335°24.6	-57°09.2	
5	110°59.3	222°01.8	33.4	178°26.1	51.5	281°10.1	00.9	218°16.7	06.3	Hamal	327°57.8	23°32.5	
6	126°01.8	237°01.0	\$23°34.0	193°26.7	\$23°51.1	296°12.1	S03°01.1	233°18.9	\$21°06.3	Polaris	316°16.1	89°20.0	
7	141°04.2	252°00.2	34.5	208°27.2	50.8	311°14.1	01.3	248°21.1	06.3	Acamar	315°16.3	-40°14.3	
8	156°06.7	266°59.5	35.0	223°27.7	50.5	326°16.1	01.5	263°23.3	06.4	Menkar	314°12.4	4°09.3	
9	171°09.2	281°58.7	.. 35.6	238°28.3	.. 50.2	341°18.1	.. 01.7	278°25.5	.. 06.4	Mirfak	308°36.6	49°55.1	
10	186°11.6	296°57.9	36.1	253°28.8	49.9	356°20.1	01.9	293°27.7	06.4	Aldebaran	290°46.5	16°32.4	
11	201°14.1	311°57.1	36.6	268°29.3	49.6	11°22.1	02.1	308°29.9	06.5	Rigel	281°09.7	-8°11.0	
12	216°16.6	326°56.4	\$23°37.2	283°29.9	\$23°49.3	26°24.0	S03°02.3	323°32.1	\$21°06.5	Capella	280°30.8	46°00.6	
13	231°19.0	341°55.6	37.7	298°30.4	48.9	41°26.0	02.5	338°34.3	06.5	Bellatrix	278°29.4	6°21.8	
14	246°21.5	356°54.8	38.2	313°31.0	48.6	56°28.0	02.7	353°36.5	06.6	Elnath	278°09.5	28°37.1	
15	261°24.0	11°54.0	.. 38.8	328°31.5	.. 48.3	71°30.0	.. 02.9	8°38.7	.. 06.6	Alnilam	275°43.9	-1°11.6	
16	276°26.4	26°53.2	39.3	343°32.0	48.0	86°32.0	03.1	23°40.9	06.7	Betelgeuse	270°58.7	7°24.5	
17	291°28.9	41°52.5	39.8	358°32.6	47.7	101°34.0	03.3	38°43.1	06.7	Canopus	263°54.9	-52°42.2	
18	306°31.4	56°51.7	\$23°40.4	13°33.1	\$23°47.4	116°36.0	S03°03.5	53°45.3	\$21°06.7	Sirius	258°31.6	-16°44.4	
19	321°33.8	71°50.9	40.9	28°33.6	47.0	131°38.0	03.7	68°47.5	06.8	Adhara	255°10.6	-28°59.6	
20	336°36.3	86°50.1	41.4	43°34.2	46.7	146°39.9	03.9	83°49.7	06.8	Procyon	244°57.3	5°10.8	
21	351°38.7	101°49.3	.. 41.9	58°34.7	.. 46.4	161°41.9	.. 04.1	98°51.9	.. 06.8	Pollux	243°24.9	27°58.9	
22	6°41.2	116°48.6	42.5	73°35.3	46.1	176°43.9	04.3	113°54.1	06.9	Avior	234°17.0	-59°33.6	
23	21°43.7	131°47.8	43.0	88°35.8	45.8	191°45.9	04.5	128°56.3	06.9	Suhail	222°50.8	-43°29.8	
Mer.pass.:21:33		v-0.8 d-0.5 m-3.9			v0.5 d0.3 m0.3			v2.0 d-0.2 m-1.5			v2.2 d-0.0 m0.5		
Fri		GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA		
0	36°46.1	146°47.0	\$23°43.5	103°36.3	\$23°45.4	206°47.9	S03°04.7	143°58.5	\$21°06.9	Denebola	182°31.7	14°28.8	
1	51°48.6	161°46.2	44.0	118°36.9	45.1	221°49.9	04.9	159°00.7	07.0	Gienah	175°50.2	-17°37.9	
2	66°51.1	176°45.4	44.5	133°37.4	44.8	236°51.9	05.1	174°02.9	07.0	Gacrux	173°07.3	-63°11.3	
3	81°53.5	191°44.6	.. 45.1	148°37.9	.. 44.5	251°53.9	.. 05.3	189°05.1	.. 07.0	Alioth	166°19.4	55°52.2	
4	96°56.0	206°43.9	45.6	163°38.5	44.2	266°55.8	05.5	204°07.3	07.1	Spica	158°29.2	-11°14.7	
5	111°58.5	221°43.1	46.1	178°39.0	43.8	281°57.8	05.7	219°09.5	07.1	Alkaid	152°57.7	49°13.9	
6	127°00.9	236°42.3	\$23°46.6	193°39.6	\$23°43.5	296°59.8	S03°05.9	234°11.7	\$21°07.1	Hadar	148°45.2	-60°27.0	
7	142°03.4	251°41.5	47.1	208°40.1	43.2	312°01.8	06.1	249°13.9	07.2	Menkent	148°05.3	-36°26.9	
8	157°05.8	266°40.7	47.6	223°40.6	42.9	327°03.8	06.3	264°16.1	07.2	Arcturus	145°54.1	19°05.9	
9	172°08.3	281°39.9	.. 48.1	238°41.2	.. 42.5	342°05.8	.. 06.5	279°18.3	.. 07.2	Rigel Kent.	139°49.2	-60°54.0	
10	187°10.8	296°39.2	48.6	253°41.7	42.2	357°07.8	06.7	294°20.5	07.3	Kochab	137°21.5	74°05.4	
11	202°13.2	311°38.4	49.2	268°42.2	41.9	12°09.8	06.9	309°22.7	07.3	Zuben' ubi	137°03.3	-16°06.4	
12	217°15.7	326°37.6	\$23°49.7	283°42.8	\$23°41.6	27°11.8	S03°07.1	324°24.9	\$21°07.4	Alphecca	126°09.5	26°39.8	
13	232°18.2	341°36.8	50.2	298°43.3	41.2	42°13.7	07.3	339°27.1	07.4	Antares	112°23.8	-26°27.9	
14	247°20.6	356°36.0	50.7	313°43.9	40.9	57°15.7	07.5	354°29.3	07.4	Atria	107°24.0	-69°03.4	
15	262°23.1	11°35.2	.. 51.2	328°44.4	.. 40.6	72°17.7	.. 07.7	9°31.5	.. 07.5	Sabik	102°10.2	-15°44.5	
16	277°25.6	26°34.4	51.7	343°44.9	40.3	87°19.7	07.9	24°33.7	07.5	Rasalhague	96°04.6	12°33.2	
17	292°28.0	41°33.7	52.2	358°45.5	39.9	102°21.7	08.1	39°35.9	07.5	Eltanin	90°45.4	51°29.7	
18	307°30.5	56°32.9	\$23°52.7	13°46.0	\$23°39.6	117°23.7	S03°08.2	54°38.1	\$21°07.6	Kaus Aust.	83°41.1	-34°22.4	
19	322°33.0	71°32.1	53.2	28°46.5	39.3	132°25.7	08.4	69°40.2	07.6	Vega	80°37.6	38°48.4	
20	337°35.4	86°31.3	53.7	43°47.1	39.0	147°27.7	08.6	84°42.4	07.6	Nunki	75°55.7	-26°16.4	
21	352°37.9	101°30.5	.. 54.2	58°47.6	.. 38.6	162°29.7	.. 08.8	99°44.6	.. 07.7	Altair	62°06.1	8°55.1	
22	7°40.3	116°29.7	54.7	73°48.2	38.3	177°31.6	09.0	114°46.8	07.7	Peacock	53°15.8	-56°40.9	
23	22°42.8	131°28.9	55.2	88°48.7	38.0	192°33.6	09.2	129°49.0	07.7	Deneb	49°29.9	45°20.8	
Mer.pass.:21:29		v-0.8 d-0.5 m-3.9			v0.5 d0.3 m0.3			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	GHA		
0	37°45.3	146°28.1	\$23°55.6	103°49.2	\$23°37.6	207°35.6	S03°09.4	144°51.2	\$21°07.8	Alnair	15°21.3	-29°32.0	
1	52°47.7	161°27.3	56.1	118°49.8	37.3	222°37.6	09.6	159°53.4	07.8	Scheat	13°50.9	28°10.7	
2	67°50.2	176°26.5	56.6	133°50.3	37.0	237°39.6	09.8	174°55.6	07.8	Markab	13°35.9	15°17.9	
3	82°52.7	191°25.8	.. 57.1	148°50.8	.. 36.6	252°41.6	.. 10.0	189°57.8	.. 07.9	Oct 27 Thu			
4	97°55.1	206°25.0	57.6	163°51.4	36.3	267°43.6	10.2	205°00.0	07.9	Venus			
5	112°57.6	221°24.2	58.1	178°51.9	36.0	282°45.6	10.4	220°02.2	08.0	Mer.pass.			
6	128°00.1	236°23.4	\$23°58.6	193°52.4	\$23°35.7	297°47.6	S03°10.6	235°04.4	\$21°08.0	Mars			
7	143°02.5	251°22.6	59.1	208°53.0	35.3	312°49.6	10.8	250°06.6	08.0	Jupiter			
8	158°05.0	266°21.8	23°59.6	223°53.5	35.0	327°51.5	11.0	265°08.8	08.1	Saturn			
9	173°07.5	281°21.0	24°00.0	238°54.1	.. 34.7	342°53.5	.. 11.2	280°11.0	.. 08.1	Oct 28 Fri			
10	188°09.9	296°20.2	00.5	253°54.6	34.3	357°55.5	11.4	295°13.2	08.1	Venus			
11	203°12.4	311°19.4	01.0	268°55.1	34.0	12°57.5	11.6	310°15.4	08.2	Mer.pass.			
12	218°14.8	326°18.6	\$24°01.5	283°55.7	\$23°33.7	27°59.5	S03°11.8	325°17.6	\$21°08.2	Mars			
13	233°17.3	341°17.8	02.0	298°56.2	33.3	43°01.5	12.0	340°19.8	08.2	Jupiter			
14	248°19.8	356°17.0	02.4	313°56.7	33.0	58°03.5	12.2	355°22.0	08.3	Saturn			
15	263°22.2	11°16.2	.. 02.9	328°57.3	.. 32.6	73°05.5	.. 12.4	10°24.2	.. 08.3	Oct 29 Sat			
16	278°24.7	26°15.4	03.4	343°57.8	32.3	88°07.5	12.6	25°26.3	08.3	Venus			
17	293°27.2	41°14.6	03.9	358°58.4	32.0	103°09.5	12.8	40°28.5	08.4	Mer.pass.			
18	308°29.6	56°13.8	\$24°04.3	13°58.9	\$23°31.6	118°11.4	S03°13.0	55°30.7	\$21°08.4	Mars			
19	323°32.1	71°13.0	04.8	28°59.4	31.3	133°13.4	13.2	70°32.9	08.4	Jupiter			
20	338°34.6	86°12.3	05.3	44°00.0	31.0								

DUT1 = UT1-UTC = -0.3166 sec ΔT = TT-UT1 = +68.5006 sec

2016 October 27 to Oct. 29 UT

h		Sun			Moon										
Thu		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight	Sunrise	Sunset	Twilight	Civil	Naut.
0	184°02.0	S12°50.9	221°48.3	14.4'	N03°42.3	-9.6'	54.9'		N 72°	05:52	07:13	08:35	14:51	16:13	17:34
1	199°02.1	51.8	236°21.7	14.4'	03°32.7	-9.6'	54.9'		N 70°	05:49	07:02	08:13	15:13	16:24	17:37
2	214°02.1	52.6	250°55.2	14.5'	03°23.1	-9.6'	54.9'		68°	05:47	06:53	07:56	15:30	16:33	17:39
3	229°02.2	.. 53.5	265°28.7	14.5'	03°13.5	-9.6'	54.9'		66°	05:45	06:45	07:42	15:44	16:41	17:41
4	244°02.2	54.3	280°02.2	14.5'	03°03.9	-9.6'	54.9'		64°	05:43	06:39	07:31	15:56	16:47	17:43
5	259°02.3	55.1	294°35.7	14.5'	02°54.3	-9.6'	54.8'		62°	05:41	06:33	07:21	16:05	16:53	17:45
6	274°02.3	S12°56.0	309°09.2	14.6'	N02°44.7	-9.6'	54.8'		60°	05:39	06:28	07:13	16:14	16:58	17:47
7	289°02.4	56.8	323°42.8	14.6'	02°35.0	-9.6'	54.8'		N 58°	05:38	06:24	07:06	16:21	17:02	17:49
8	304°02.4	57.7	338°16.4	14.6'	02°25.4	-9.6'	54.8'		56°	05:36	06:20	06:59	16:27	17:07	17:50
9	319°02.5	.. 58.5	352°50.1	14.6'	02°15.7	-9.6'	54.8'		54°	05:35	06:16	06:53	16:33	17:10	17:52
10	334°02.6	12°59.3	7°23.7	14.7'	02°06.1	-9.6'	54.8'		52°	05:33	06:13	06:48	16:38	17:14	17:53
11	349°02.6	13°00.2	21°57.4	14.7'	01°56.4	-9.7'	54.7'		50°	05:32	06:10	06:44	16:43	17:17	17:55
12	4°02.7	S13°01.0	36°31.0	14.7'	N01°46.8	-9.7'	54.7'		45°	05:29	06:03	06:33	16:53	17:24	17:58
13	19°02.7	01.9	51°04.7	14.7'	01°37.1	-9.7'	54.7'		N 40°	05:25	05:57	06:25	17:02	17:30	18:02
14	34°02.8	02.7	65°38.5	14.7'	01°27.5	-9.7'	54.7'		35°	05:22	05:52	06:18	17:09	17:35	18:05
15	49°02.8	.. 03.5	80°12.2	14.7'	01°17.8	-9.7'	54.7'		30°	05:18	05:47	06:11	17:16	17:41	18:09
16	64°02.9	04.4	94°46.0	14.8'	01°08.1	-9.7'	54.7'		20°	05:11	05:37	06:00	17:27	17:50	18:16
17	79°02.9	05.2	109°19.7	14.8'	00°58.5	-9.7'	54.6'		N 10°	05:03	05:28	05:50	17:38	17:59	18:24
18	94°03.0	S13°06.1	123°53.5	14.8'	N00°48.8	-9.7'	54.6'		0°	04:54	05:19	05:40	17:47	18:08	18:33
19	109°03.0	06.9	138°27.3	14.8'	00°39.2	-9.7'	54.6'		S 10°	04:44	05:09	05:31	17:57	18:19	18:44
20	124°03.1	07.7	153°01.2	14.8'	00°29.5	-9.7'	54.6'		20°	04:31	04:58	05:20	18:07	18:30	18:57
21	139°03.1	.. 08.6	167°35.0	14.8'	00°19.8	-9.7'	54.6'		30°	04:14	04:44	05:09	18:19	18:44	19:14
22	154°03.2	09.4	182°08.8	14.9'	00°10.2	-9.7'	54.6'		35°	04:03	04:35	05:02	18:27	18:53	19:25
23	169°03.2	10.2	196°42.7	14.9'	00°00.5	-9.7'	54.6'		40°	03:50	04:25	04:54	18:35	19:03	19:38
		SD.=16.1	d=-0.8			S.D.=14.9		45°	03:34	04:13	04:44	18:44	19:16	19:55	
Fri		GHA	Dec	GHA	ν	Dec	d	HP	S 50°	03:13	03:57	04:33	18:56	19:31	20:16
0	184°03.3	S13°11.1	211°16.6	14.9'	\$00°09.1	-9.6'	54.5'		52°	03:02	03:50	04:28	19:01	19:39	20:27
1	199°03.3	11.9	225°50.5	14.9'	00°18.8	-9.6'	54.5'		54°	02:50	03:42	04:22	19:07	19:47	20:39
2	214°03.3	12.7	240°24.4	14.9'	00°28.4	-9.6'	54.5'		56°	02:36	03:33	04:16	19:13	19:56	20:54
3	229°03.4	.. 13.6	254°58.3	14.9'	00°38.1	-9.6'	54.5'		58°	02:19	03:22	04:08	19:21	20:07	21:11
4	244°03.4	14.4	269°32.2	14.9'	00°47.7	-9.6'	54.5'		S 60°	01:58	03:10	04:00	19:29	20:20	21:33
5	259°03.5	15.2	284°06.1	14.9'	00°57.3	-9.6'	54.5'								
6	274°03.5	S13°16.1	298°40.1	14.9'	\$01°06.9	-9.6'	54.5'								
7	289°03.6	16.9	313°14.0	15.0'	01°16.5	-9.6'	54.4'								
8	304°03.6	17.7	327°48.0	15.0'	01°26.1	-9.6'	54.4'								
9	319°03.7	.. 18.6	342°21.9	15.0'	01°35.7	-9.6'	54.4'								
10	334°03.7	19.4	356°55.9	15.0'	01°45.3	-9.6'	54.4'								
11	349°03.8	20.2	11°29.9	15.0'	01°54.9	-9.6'	54.4'								
12	4°03.8	S13°21.1	26°03.9	15.0'	\$02°04.4	-9.6'	54.4'								
13	19°03.8	21.9	40°37.8	15.0'	02°14.0	-9.5'	54.4'								
14	34°03.9	22.7	55°11.8	15.0'	02°23.5	-9.5'	54.4'								
15	49°03.9	.. 23.6	69°45.8	15.0'	02°33.0	-9.5'	54.4'								
16	64°04.0	24.4	84°19.8	15.0'	02°42.5	-9.5'	54.3'								
17	79°04.0	25.2	98°53.8	15.0'	02°52.0	-9.5'	54.3'								
18	94°04.1	S13°26.1	113°27.8	15.0'	\$03°01.5	-9.5'	54.3'								
19	109°04.1	26.9	128°01.8	15.0'	03°11.0	-9.5'	54.3'								
20	124°04.1	27.7	142°35.8	15.0'	03°20.4	-9.4'	54.3'								
21	139°04.2	.. 28.5	157°09.8	15.0'	03°29.8	-9.4'	54.3'								
22	154°04.2	29.4	171°43.8	15.0'	03°39.2	-9.4'	54.3'								
23	169°04.3	30.2	186°17.8	15.0'	03°48.6	-9.4'	54.3'								
		SD.=16.1	d=-0.8			S.D.=14.8									
Sat		GHA	Dec	GHA	ν	Dec	d	HP	S 50°	03:35	03:59	04:22	15:34	16:37	17:39
0	184°04.3	S13°31.0	200°51.8	15.0'	\$03°58.0	-9.4'	54.3'		52°	03:24	04:01	04:38	15:38	16:27	17:16
1	199°04.3	31.8	215°25.8	15.0'	04°07.4	-9.3'	54.2'		54°	03:27	04:00	04:34	15:37	16:30	17:22
2	214°04.4	32.7	229°59.8	15.0'	04°16.7	-9.3'	54.2'		56°	03:28	04:00	04:32	15:36	16:31	17:25
3	229°04.4	.. 33.5	244°33.8	15.0'	04°26.0	-9.3'	54.2'		40°	03:30	04:00	04:29	15:36	16:33	17:29
4	244°04.5	34.3	259°07.8	15.0'	04°35.3	-9.3'	54.2'		45°	03:32	03:59	04:26	15:35	16:34	17:33
5	259°04.5	35.1	273°41.8	15.0'	04°44.6	-9.3'	54.2'								
6	274°04.5	S13°36.0	288°15.8	15.0'	\$04°53.9	-9.2'	54.2'								
7	289°04.6	36.8	302°49.8	15.0'	05°03.1	-9.2'	54.2'								
8	304°04.6	37.6	317°23.7	15.0'	05°12.3	-9.2'	54.2'								
9	319°04.6	.. 38.4	331°57.7	15.0'	05°21.5	-9.2'	54.2'								
10	334°04.7	39.3	346°31.7	15.0'	05°30.6	-9.1'	54.2'								
11	349°04.7	40.1	1°05.6	15.0'	05°39.8	-9.1'	54.2'								
12	4°04.7	S13°40.9	15°39.6	14.9'	\$05°48.9	-9.1'	54.1'								
13	19°04.8	41.7	30°13.5	14.9'	05°58.0	-9.1'	54.1'								
14	34°04.8	42.6	44°47.5	14.9'	06°07.0	-9.0'	54.1'								
15	49°04.9	.. 43.4	59°21.4	14.9'	06°16.1	-9.0'	54.1'								
16	64°04.9	44.2	73°55.3	14.9'	06°25.1	-9.0'	54.1'								
17	79°04.9	45.0	88°29.2	14.9'	06°34.1	-9.0'	54.1'								
18	94°05.0	S13°45.8	103°03.1	14.9'	\$06°43.0	-8.9'	54.1'								
19	109°05.0	46.7	117°37.0	14.9'	06°51.9	-8.9'	54.1'								
20	124°05.0	47.5	132°10.8	14.9'	07°00.8	-8.9'	54.1'								
21	139°05.1	.. 48.3	146°44.7	14.9'	07°09.7	-8.8'	54.1'								
22	154°05.1	49.1	161°18.6	14.8'	07°18.5	-8.8'	54.1'								
23	169°05.1	49.9	175°52.4	14.8'	07°27.3	-8.8'	54.1'								
		SD.=16.1	d=-0.8			S.D.=14.8									
Day		Eqn.of Time	00 <sup>h</sup> mm:ss	Mer. Pass.	Upper hh:mm	Mer. Pass.	Lower hh:mm	Age 9-1%							
27	16:08	16:11	11:44		09:30	21:51			</						

**October 30, 31, 01 UT (Sun., Mon., Tue.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	38°44.4	146°09.1	\$24°07.1	104°02.1	\$23°29.6	208°23.4	\$03°14.2	145°43.9	\$21°08.6	Alpheratz	357°40.8	29°11.1											
1	53°46.9	161°08.3	07.6	119°02.6	29.3	223°25.4	14.4	160°46.1	08.7	Ankaa	353°13.2	-42°13.0											
2	68°49.3	176°07.5	08.1	134°03.2	28.9	238°27.4	14.6	175°48.3	08.7	Schedar	349°37.3	56°37.9											
3	83°51.8	191°06.7	.. 08.5	149°03.7	.. 28.6	253°29.4	.. 14.8	190°50.5	.. 08.7	Diphda	348°53.4	-17°53.7											
4	98°54.3	206°05.9	09.0	164°04.3	28.2	268°31.4	15.0	205°52.7	08.8	Achernar	335°24.6	-57°09.2											
5	113°56.7	221°05.1	09.4	179°04.8	27.9	283°33.3	15.2	220°54.9	08.8	Hamal	327°57.8	23°32.5											
6	128°59.2	236°04.3	\$24°09.9	194°05.3	\$23°27.6	298°35.3	\$03°15.4	235°57.1	\$21°08.8	Polaris	316°15.7	89°20.0											
7	144°01.7	251°03.5	10.4	209°05.9	27.2	313°37.3	15.6	250°59.2	08.9	Acamar	315°16.3	-40°14.3											
8	159°04.1	266°02.7	10.8	224°06.4	26.9	328°39.3	15.7	266°01.4	08.9	Menkar	314°12.4	4°09.3											
9	174°06.6	281°01.9	.. 11.3	239°06.9	.. 26.5	343°41.3	.. 15.9	281°03.6	.. 08.9	Mirfak	308°36.6	49°55.1											
10	189°09.1	296°01.1	11.7	254°07.5	26.2	358°43.3	16.1	296°05.8	09.0	Aldebaran	290°46.5	16°32.4											
11	204°11.5	311°00.3	12.2	269°08.0	25.8	13°45.3	16.3	311°08.0	09.0	Rigel	281°09.6	-8°11.0											
12	219°14.0	325°59.5	\$24°12.6	284°08.6	\$23°25.5	28°47.3	\$03°16.5	326°10.2	\$21°09.0	Capella	280°30.7	46°00.6											
13	234°16.4	340°58.7	13.1	299°09.1	25.2	43°49.3	16.7	341°12.4	09.1	Bellatrix	278°29.3	6°21.8											
14	249°18.9	355°57.8	13.5	314°09.6	24.8	58°51.3	16.9	356°14.6	09.1	El Nath	278°09.5	28°37.1											
15	264°21.4	10°57.0	.. 14.0	329°10.2	.. 24.5	73°53.3	.. 17.1	11°16.8	.. 09.1	Alnilam	275°43.9	-1°11.6											
16	279°23.8	25°56.2	14.4	344°10.7	24.1	88°55.3	17.3	26°19.0	09.2	Betelgeuse	270°58.6	7°24.5											
17	294°26.3	40°55.4	14.9	359°11.2	23.8	103°57.3	17.5	41°21.2	09.2	Canopus	263°54.8	-52°42.2											
18	309°28.8	55°54.6	\$24°15.3	14°11.8	\$23°23.4	118°59.2	\$03°17.7	56°23.4	\$21°09.0	Sirius	258°31.6	-16°44.4											
19	324°31.2	70°53.8	15.8	29°12.3	23.1	134°01.2	17.9	71°25.6	09.3	Adhara	255°10.6	-28°59.6											
20	339°33.7	85°53.0	16.2	44°12.8	22.7	149°03.2	18.1	86°27.7	09.3	Procyon	244°57.3	5°10.8											
21	354°36.2	100°52.2	.. 16.6	59°13.4	.. 22.4	164°05.2	.. 18.3	101°29.9	.. 09.4	Pollux	243°24.9	27°58.9											
22	9°38.6	115°51.4	17.1	74°13.9	22.0	179°07.2	18.5	116°32.1	09.4	Avior	234°17.0	-59°33.6											
23	24°41.1	130°50.6	17.5	89°14.5	21.7	194°09.2	18.7	131°34.3	09.4	Suhail	222°50.8	-43°29.8											
Mer.pass.:21:22				v-0.8 d-0.5 m-3.9				v0.5 d0.3 m0.4				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.5							
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	39°43.5	145°49.8	\$24°17.9	104°15.0	\$23°21.3	209°11.2	\$03°18.9	146°36.5	\$21°09.5	Denebola	182°31.6	14°28.8											
1	54°46.0	160°49.0	18.4	119°15.5	21.0	224°13.2	19.1	161°38.7	09.5	Gienah	175°50.2	-17°37.9											
2	69°48.5	175°48.2	18.8	134°16.1	20.6	239°15.2	19.3	176°40.9	09.5	Acrua	173°07.2	-63°11.2											
3	84°50.9	190°47.4	.. 19.3	149°16.6	.. 20.3	254°17.2	.. 19.5	191°43.1	.. 09.6	Gacrux	171°58.8	-57°12.2											
4	99°53.4	205°46.6	19.7	164°17.1	19.9	269°19.2	19.7	206°45.3	09.6	Alioth	166°19.3	55°52.1											
5	114°55.9	220°45.8	20.1	179°17.7	19.6	284°21.2	19.9	221°47.5	09.6	Spica	158°29.2	-11°14.7											
6	129°58.3	235°45.0	\$24°20.5	194°18.2	\$23°19.2	299°23.2	\$03°20.1	236°49.7	\$21°09.7	Alkaid	152°57.7	49°13.9											
7	145°00.8	250°44.2	21.0	209°18.7	18.9	314°25.1	20.3	251°51.9	09.7	Hadar	148°45.2	-60°27.0											
8	160°03.3	265°43.3	21.4	224°19.3	18.5	329°27.1	20.5	266°54.0	09.7	Menkent	148°05.3	-36°26.9											
9	175°05.7	280°42.5	.. 21.8	239°19.8	.. 18.2	344°29.1	.. 20.7	281°56.2	.. 09.8	Arcturus	145°54.1	19°05.9											
10	190°08.2	295°41.7	22.3	254°20.4	17.8	359°31.1	20.8	296°58.4	09.8	Rigel Kent.	139°49.2	-60°54.0											
11	205°10.7	310°40.9	22.7	269°20.9	17.5	14°33.1	21.0	312°00.6	09.8	Kochab	137°21.5	74°05.4											
12	220°13.1	325°40.1	\$24°23.1	284°21.4	\$23°17.1	29°35.1	\$03°21.2	327°02.8	\$21°09.9	Zuben ubi	137°03.3	-16°06.4											
13	235°15.6	340°39.3	23.5	299°22.0	16.8	44°37.1	21.4	342°05.0	09.9	Alphecca	126°09.5	26°39.8											
14	250°18.0	355°38.5	23.9	314°22.5	16.4	59°39.1	21.6	357°07.2	10.0	Antares	112°23.8	-26°27.9											
15	265°20.5	10°37.7	.. 24.4	329°23.0	.. 16.1	74°41.1	.. 21.8	12°09.4	.. 10.0	Atria	107°24.0	-69°03.3											
16	280°23.0	25°36.9	24.8	344°23.6	15.7	89°43.1	22.0	27°11.6	10.0	Sabik	102°10.2	-15°44.5											
17	295°25.4	40°36.1	25.2	359°24.1	15.3	104°45.1	22.2	42°13.8	10.1	Shaula	96°19.2	-37°06.8											
18	310°27.9	55°35.2	\$24°25.6	14°24.7	\$23°15.0	119°47.1	\$03°22.4	57°15.9	\$21°10.1	Rasalhague	96°04.6	12°33.2											
19	325°30.4	70°34.4	26.0	29°25.2	14.6	134°49.1	22.6	72°18.1	10.1	Eltanin	90°45.4	51°29.6											
20	340°32.8	85°33.6	26.4	44°25.7	14.3	149°51.1	22.8	87°20.3	10.2	Kaus Aust.	83°41.1	-34°22.4											
21	355°35.3	100°32.8	.. 26.9	59°26.3	.. 13.9	164°53.1	.. 23.0	102°22.5	.. 10.2	Vega	80°37.7	38°48.4											
22	10°37.8	115°32.0	27.3	74°26.8	13.6	179°55.1	23.2	117°47.7	10.2	Nunki	75°55.7	-26°16.4											
23	25°40.2	130°31.2	27.7	89°27.3	13.2	194°57.0	23.4	132°26.9	10.3	Altair	62°06.1	8°55.1											
Mer.pass.:21:18				v-0.8 d-0.4 m-3.9				v0.5 d0.3 m0.4				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.5							
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	40°42.7	145°30.4	\$24°28.1	104°27.9	\$23°12.8	209°59.0	\$03°23.6	147°29.1	\$21°10.3	Fomalhaut	15°21.3	-29°32.0											
1	55°45.2	160°29.6	28.5	119°28.4	12.5	225°01.0	23.8	162°31.3	10.3	Scheat	13°50.9	28°10.7											
2	70°47.6	175°28.7	28.9	134°29.0	12.1	240°03.0	24.0	177°33.5	10.4	Markab	13°35.9	15°17.9											
3	85°50.1	190°27.9	.. 29.3	149°29.5	.. 11.8	255°05.0	.. 24.2	192°35.6	.. 10.4	<b>Oct 30 Sun</b>				<b>Mer.pass</b>									
4	100°52.5	205°27.1	29.7	164°30.0	11.4	270°07.0	24.4	207°37.8	10.4	Venus	107°24.6	14:16											
5	115°55.0	220°26.3	30.1	179°30.6	11.1	285°09.0	24.6	222°40.0	10.5	Mars	65°17.7	17:03											
6	130°57.5	235°25.5	\$24°30.5	194°31.1	\$23°10.7	300°11.0	\$03°24.8	237°42.2	\$21°10.5	Jupiter	169°39.0	10:05											
7	145°59.9	250°24.7	30.9	209°31.6	10.3	315°13.0	24.9	252°44.4	10.5	Saturn	106°59.5	14:15											
8	161°02.4	265°23.9	31.3	224°32.2	10.0	330°15.0	25.1	267°46.6	10.6	<b>Oct 31 Mon</b>				<b>Mer.pass</b>									
9	176°04.9	280°23.0	.. 31.7	239°32.7	.. 09.6	345°17.0	.. 25.3	282°48.8	.. 10.6	Venus	106°06.3	14:17											
10	191°07.3	295°22.2	32.1	254°33.2	09.2	0°19.0	25.5	297°51.0	10.7	Mars	64°31.4	17:02											

DUT1 = UT1-UTC = -0.3209 sec ΔT = TT-UT1 = +68.5049 sec

2016 October 30 to Nov. 01 UT

Sun	Sun			Moon			
	GHA	Dec	GHA	ν	Dec	d	HP
0	184°05.1	S13°50.7	190°26.2	14.8'	S07°36.0	-8.7'	54.1'
1	199°05.2	51.6	205°00.0	14.8'	07°44.8	-8.7'	54.0'
2	214°05.2	52.4	219°33.8	14.8'	07°53.5	-8.7'	54.0'
3	229°05.2	.. 53.2	234°07.6	14.8'	08°02.1	-8.6'	54.0'
4	244°05.3	54.0	248°41.4	14.8'	08°10.8	-8.6'	54.0'
5	259°05.3	54.8	263°15.1	14.7'	08°19.4	-8.6'	54.0'
6	274°05.3	S13°55.6	277°48.9	14.7'	S08°27.9	-8.5'	54.0'
7	289°05.4	56.5	292°22.6	14.7'	08°36.4	-8.5'	54.0'
8	304°05.4	57.3	306°56.3	14.7'	08°44.9	-8.5'	54.0'
9	319°05.4	.. 58.1	321°30.0	14.7'	08°53.4	-8.4'	54.0'
10	334°05.4	58.9	336°03.7	14.7'	09°01.8	-8.4'	54.0'
11	349°05.5	13°59.7	350°37.3	14.6'	09°10.1	-8.4'	54.0'
12	4°05.5	S14°00.5	5°11.0	14.6'	S09°18.5	-8.3'	54.0'
13	19°05.5	01.3	19°44.6	14.6'	09°26.8	-8.3'	54.0'
14	34°05.6	02.2	34°18.2	14.6'	09°35.0	-8.2'	54.0'
15	49°05.6	.. 03.0	48°51.8	14.6'	09°43.2	-8.2'	54.0'
16	64°05.6	03.8	63°25.4	14.6'	09°51.4	-8.1'	54.0'
17	79°05.6	04.6	77°58.9	14.5'	09°59.5	-8.1'	54.0'
18	94°05.7	S14°05.4	92°32.4	14.5'	S10°07.6	-8.1'	54.0'
19	109°05.7	06.2	107°06.0	14.5'	10°15.7	-8.0'	54.0'
20	124°05.7	07.0	121°39.4	14.5'	10°23.7	-8.0'	54.0'
21	139°05.7	.. 07.8	136°12.9	14.5'	10°31.6	-7.9'	54.0'
22	154°05.8	08.6	150°46.4	14.4'	10°39.5	-7.9'	53.9'
23	169°05.8	09.5	165°19.8	14.4'	10°47.4	-7.8'	53.9'
	SD.=16.1	d=-0.8			S.D.=14.7		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer.Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Upper 0-2 Lower 0-3% hh:mm
30	16:21	16:22	11:44	11:39
31	16:23	16:24	11:44	12:23
01	16:25	16:26	11:44	13:07
				00:45

SD.=16.1	d=-0.8	S.D.=14.7
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**November 02, 03, 04 UT (Wed., Thu., Fri.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Week	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	41°41.8	145°10.8	\$24°37.5	104°40.8	\$23°04.1	210°46.9	\$03°28.3	148°21.6	\$21°11.1	Alpheratz	357°40.8	29°11.1											
1	56°44.3	160°10.0	37.9	119°41.3	03.8	225°48.9	28.4	163°23.8	11.2	Ankaa	353°13.2	-42°13.0											
2	71°46.8	175°09.1	38.3	134°41.8	03.4	240°50.9	28.6	178°26.0	11.2	Schedar	349°37.3	56°37.9											
3	86°49.2	190°08.3	· · 38.7	149°42.4	· · 03.0	255°52.9	· · 28.8	193°28.2	· · 11.3	Diphda	348°53.4	-17°53.7											
4	101°51.7	205°07.5	39.0	164°42.9	02.7	270°54.9	29.0	208°30.3	11.3	Achernar	335°24.6	-57°09.2											
5	116°54.1	220°06.7	39.4	179°43.5	02.3	285°56.9	29.2	223°32.5	11.3	Hamal	327°57.8	23°32.5											
6	131°56.6	235°05.9	\$24°39.8	194°44.0	\$23°01.9	300°58.9	\$03°29.4	238°34.7	\$21°11.4	Polaris	316°15.2	89°20.0											
7	146°59.1	250°05.0	40.2	209°44.5	01.5	316°00.9	29.6	253°36.9	11.4	Acamar	315°16.2	-40°14.3											
8	162°01.5	265°04.2	40.5	224°45.1	01.2	331°02.9	29.8	268°39.1	11.4	Menkar	314°12.4	4°09.3											
9	177°04.0	280°03.4	· · 40.9	239°45.6	· · 00.8	346°04.9	· · 30.0	283°41.3	· · 11.5	Mirfak	308°36.5	49°55.1											
10	192°06.5	295°02.6	41.3	254°46.1	00.4	1°06.9	30.2	298°43.5	11.5	Aldebaran	290°46.5	16°32.4											
11	207°08.9	310°01.7	41.6	269°46.7	23°00.1	16°08.9	30.4	313°45.7	11.5	Rigel	281°09.6	-8°11.0											
12	222°11.4	325°00.9	\$24°42.0	284°47.2	\$22°59.7	31°10.9	\$03°30.6	328°47.8	\$21°11.6	Capella	280°30.7	46°00.6											
13	237°13.9	340°00.1	42.4	299°47.8	59.3	46°12.9	30.8	343°50.0	11.6	Bellatrix	278°29.3	6°21.7											
14	252°16.3	354°59.3	42.7	314°48.3	58.9	61°14.9	31.0	358°52.2	11.6	Elnath	278°09.5	28°37.1											
15	267°18.8	9°58.5	· · 43.1	329°48.8	· · 58.6	76°16.9	· · 31.2	13°54.4	· · 11.7	Alnilam	275°43.8	-1°11.6											
16	282°21.3	24°57.6	43.4	344°49.4	58.2	91°18.9	31.4	28°56.6	11.7	Betelgeuse	270°58.6	7°24.5											
17	297°23.7	39°56.8	43.8	359°49.9	57.8	106°20.9	31.5	43°58.8	11.7	Canopus	263°54.8	-52°42.2											
18	312°26.2	54°56.0	\$24°44.2	14°50.4	\$22°57.4	121°22.9	\$03°31.7	59°01.0	\$21°11.8	Sirius	258°31.5	-16°44.4											
19	327°28.6	69°55.2	44.5	29°51.0	57.1	136°24.9	31.9	74°03.1	11.8	Adhara	255°10.6	-28°59.7											
20	342°31.1	84°54.3	44.9	44°51.5	56.7	151°26.9	32.1	89°05.3	11.8	Procyon	244°57.3	5°10.8											
21	357°33.6	99°53.5	· · 45.2	59°52.1	· · 56.3	166°28.9	· · 32.3	104°07.5	· · 11.9	Pollux	243°24.9	27°58.9											
22	12°36.0	114°52.7	45.6	74°52.6	55.9	181°30.9	32.5	119°09.7	11.9	Avior	234°16.9	-59°33.6											
23	27°38.5	129°51.9	45.9	89°53.1	55.6	196°32.9	32.7	134°11.9	12.0	Suhail	222°50.8	-43°29.8											
Mer.pass.:21:10				v-0.8 d-0.4 m-3.9				v0.5 d0.4 m0.4				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.5							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	42°41.0	144°51.0	\$24°46.3	104°53.7	\$22°55.2	211°34.9	\$03°32.9	149°14.1	\$21°12.0	Denebola	182°31.6	14°28.8											
1	57°43.4	159°50.2	46.6	119°54.2	54.8	226°36.9	33.1	164°16.3	12.0	Gienah	175°50.2	-17°37.9											
2	72°45.9	174°49.4	47.0	134°54.7	54.4	241°38.8	33.3	179°18.4	12.1	Acrux	173°07.2	-63°11.2											
3	87°48.4	189°48.6	· · 47.3	149°55.3	· · 54.1	256°40.8	· · 33.5	194°20.6	· · 12.1	Gacrux	171°58.7	-57°12.1											
4	102°50.8	204°47.7	47.7	164°55.8	53.7	271°42.8	33.7	209°22.8	12.1	Alioth	166°19.3	55°52.1											
5	117°53.3	219°46.9	48.0	179°56.4	53.3	286°44.8	33.9	224°25.0	12.2	Spica	158°29.2	-11°14.7											
6	132°55.8	234°46.1	\$24°48.4	194°56.9	\$22°52.9	301°46.8	\$03°34.1	239°27.2	\$21°12.2	Alkaid	152°57.7	49°13.9											
7	147°58.2	249°45.3	48.7	209°57.4	52.5	316°48.8	34.3	254°29.4	12.2	Hadar	148°45.2	-60°27.0											
8	163°00.7	264°44.4	49.0	224°58.0	52.2	331°50.8	34.4	269°31.5	12.3	Menkent	148°05.3	-36°26.9											
9	178°03.1	279°43.6	· · 49.4	239°58.5	· · 51.8	346°52.8	· · 34.6	284°33.7	· · 12.3	Arcturus	145°54.0	19°05.9											
10	193°05.6	294°42.8	49.7	254°59.0	51.4	1°54.8	34.8	299°35.9	12.3	Rigel Kent.	139°49.2	-60°54.0											
11	208°08.1	309°41.9	50.1	269°59.6	51.0	16°56.8	35.0	314°38.1	12.4	Kochab	137°21.5	74°05.3											
12	223°10.5	324°41.1	\$24°50.4	285°00.1	\$22°50.6	31°58.8	\$03°35.2	329°40.3	\$21°12.4	Zuben ubi	137°03.2	-16°06.4											
13	238°13.0	339°40.3	50.7	300°00.7	50.3	47°00.8	35.4	344°42.5	12.4	Alphecca	126°09.5	26°39.8											
14	253°15.5	354°39.5	51.1	315°01.2	49.9	62°02.8	35.6	359°44.7	12.5	Antares	112°23.8	-26°27.9											
15	268°17.9	9°38.6	· · 51.4	330°01.7	· · 49.5	77°04.8	· · 35.8	14°46.8	· · 12.5	Atria	107°24.0	-69°03.3											
16	283°20.4	24°37.8	51.7	345°02.3	49.1	92°06.8	36.0	29°49.0	12.5	Sabik	102°10.2	-15°44.5											
17	298°22.9	39°37.0	52.1	0°02.8	48.7	107°08.8	36.2	44°51.2	12.6	Rasalhague	96°19.2	-37°06.8											
18	313°25.3	54°36.1	\$24°52.4	15°03.4	\$22°48.3	122°10.8	\$03°36.4	59°53.4	\$21°12.6	Eltanin	90°45.5	51°29.6											
19	328°27.8	69°35.3	52.7	30°03.9	48.0	137°12.8	36.6	74°55.6	12.6	Kaus Aust.	83°41.1	-34°22.4											
20	343°30.2	84°34.5	53.0	45°04.4	47.6	152°14.8	36.8	89°57.8	12.7	Vega	80°37.7	38°48.4											
21	358°32.7	99°33.7	· · 53.4	60°05.0	· · 47.2	167°16.8	· · 36.9	104°59.9	· · 12.7	Nunki	75°55.7	-26°16.4											
22	13°35.2	114°32.8	53.7	75°05.5	46.8	182°18.8	37.1	120°02.1	12.8	Altair	62°06.1	8°55.1											
23	28°37.6	129°32.0	54.0	90°06.0	46.4	197°20.8	37.3	135°04.3	12.8	Peacock	53°15.9	-56°40.9											
Mer.pass.:21:06				v-0.8 d-0.3 m-3.9				v0.5 d0.4 m0.4				v2.0 d-0.2 m-1.5				v2.2 d-0.0 m0.5							
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	43°40.1	144°31.2	\$24°54.3	105°06.6	\$22°46.0	212°22.8	\$03°37.5	150°06.5	\$21°12.8	Nov 02 Wed	SHA	Mer.pass											
1	58°42.6	159°30.3	54.7	120°07.1	45.6	227°24.8	37.7	165°08.7	12.9	Venus	103°29.0	14:20											
2	73°45.0	174°29.5	55.0	135°07.7	45.3	242°26.8	37.9	180°10.9	12.9	Mars	62°58.9	17:01											
3	88°47.5	189°28.7	· · 55.3	150°08.2	· · 44.9	257°28.8	· · 38.1	195°13.0	· · 12.9	Jupiter	169°05.1	09:56											
4	103°50.0	204°27.8	55.6	165°08.7	44.5	272°30.8	38.3	210°15.2	13.0	Saturn	106°39.8	14:05											
5	118°52.4	219°27.0	55.9	180°09.3	44.1	287°32.8	38.5	225°17.4	13.0	Nov 03 Thu	SHA	Mer.pass											
6	133°54.9	234°26.2	195°09.8	\$22°43.7	302°34.8	\$03°38.7	240°19.6	\$21°13.0	Venus	102°10.1	14:21												
7	148°57.4	249°25.4	56.5	210°10.4	43.3	317°36.8	38.9	255°21.8	13.1	Mars	62°12.7</td												

DUT1 = UT1-UTC = -0.3253 sec ΔT = TT-UT1 = +68.5093 sec

2016 November 02 to Nov. 04 UT

h	Sun			Moon			
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.5	S14°48.6	158°06.8	13.1'	S16°06.4	-5.0'	54.0'
1	199°06.5	49.4	172°38.9	13.1'	16°11.3	-4.9'	54.0'
2	214°06.5	50.2	187°11.0	13.1'	16°16.2	-4.8'	54.0'
3	229°06.5	.. 51.0	201°43.1	13.0'	16°21.0	-4.8'	54.0'
4	244°06.5	51.8	216°15.1	13.0'	16°25.7	-4.7'	54.0'
5	259°06.6	52.5	230°47.1	13.0'	16°30.3	-4.6'	54.0'
6	274°06.6	S14°53.3	245°19.1	13.0'	S16°34.9	-4.5'	54.0'
7	289°06.6	54.1	259°51.0	12.9'	16°39.4	-4.5'	54.0'
8	304°06.6	54.9	274°22.9	12.9'	16°43.9	-4.4'	54.0'
9	319°06.6	.. 55.7	288°54.8	12.9'	16°48.2	-4.3'	54.0'
10	334°06.6	56.5	303°26.6	12.8'	16°52.5	-4.2'	54.0'
11	349°06.6	57.3	317°58.5	12.8'	16°56.7	-4.2'	54.0'
12	4°06.6	S14°58.0	332°30.3	12.8'	S17°00.8	-4.1'	54.0'
13	19°06.6	58.8	347°02.0	12.8'	17°04.9	-4.0'	54.1'
14	34°06.6	14°59.6	1°33.8	12.7'	17°08.9	-3.9'	54.1'
15	49°06.6	15°00.4	16°05.5	12.7'	17°12.8	-3.9'	54.1'
16	64°06.6	01.2	30°37.2	12.7'	17°16.6	-3.8'	54.1'
17	79°06.6	02.0	45°08.8	12.6'	17°20.4	-3.7'	54.1'
18	94°06.6	S15°02.7	59°40.5	12.6'	S17°24.1	-3.6'	54.1'
19	109°06.6	03.5	74°12.1	12.6'	17°27.7	-3.6'	54.1'
20	124°06.6	04.3	88°43.7	12.6'	17°31.2	-3.5'	54.1'
21	139°06.6	.. 05.1	103°15.2	12.5'	17°34.6	-3.4'	54.1'
22	154°06.6	05.9	117°46.7	12.5'	17°38.0	-3.3'	54.1'
23	169°06.6	06.6	132°18.2	12.5'	17°41.3	-3.2'	54.1'
	SD.=16.1	d=-0.8			S.D.=14.7		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer.Pass.	Mer.	Pass.	Age
	00 <sup>h</sup>	12 <sup>h</sup>	mm:ss	Upper	Lower	3-5
02	16:26	16:26		11:44	13:54	01:30
03	16:26	16:26		11:44	14:41	02:17
04	16:26	16:25		11:44	15:29	03:05



SD.=16.1	d=-0.8	S.D.=14.9
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**November 05, 06, 07 UT (Sat., Sun., Mon.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	44°39.2	144°11.2	\$25°01.7	105°19.5	\$22°36.6	213°10.8	\$03°42.1	150°58.9	\$21°13.7	Alpheratz	357°40.8	29°11.1					
1	59°41.7	159°10.3	02.0	120°20.1	36.2	228°12.8	42.3	166°01.1	13.7	Ankaa	353°13.2	-42°13.0					
2	74°44.2	174°09.5	02.3	135°20.6	35.8	243°14.8	42.5	181°03.2	13.7	Schedar	349°37.3	56°37.9					
3	89°46.6	189°08.7	.. 02.5	150°21.1	.. 35.5	258°16.8	.. 42.7	196°05.4	.. 13.8	Diphda	348°53.4	-17°53.7					
4	104°49.1	204°07.8	02.8	165°21.7	35.1	273°18.8	42.9	211°07.6	13.8	Achernar	335°24.6	-57°09.3					
5	119°51.6	219°07.0	03.1	180°22.2	34.7	288°20.8	43.1	226°09.8	13.8	Hamal	327°57.8	23°32.5					
6	134°54.0	234°06.2	\$25°03.4	195°22.8	\$22°34.3	303°22.8	\$03°43.3	241°12.0	\$21°13.9	Polaris	316°14.9	89°20.0					
7	149°56.5	249°05.3	03.7	210°23.3	33.9	318°24.8	43.5	256°14.1	13.9	Acamar	315°16.2	-40°14.3					
8	164°59.0	264°04.5	04.0	225°23.8	33.5	333°26.8	43.6	271°16.3	13.9	Menkar	314°12.3	4°09.3					
9	180°01.4	279°03.7	.. 04.2	240°24.4	.. 33.1	348°28.9	.. 43.8	286°18.5	.. 14.0	Mirfak	308°36.5	49°55.1					
10	195°03.9	294°02.8	04.5	255°24.9	32.7	3°30.9	44.0	301°20.7	14.0	Aldebaran	290°46.5	16°32.4					
11	210°06.4	309°02.0	04.8	270°25.5	32.3	18°32.9	44.2	316°22.9	14.0	Rigel	281°09.6	-8°11.0					
12	225°08.8	324°01.2	\$25°05.1	285°26.0	\$22°31.9	33°34.9	\$03°44.4	331°25.0	\$21°14.1	Capella	280°30.7	46°00.6					
13	240°11.3	339°00.3	05.4	300°26.5	31.5	48°36.9	44.6	346°27.2	14.1	Bellatrix	278°29.3	6°21.7					
14	255°13.7	353°59.5	05.6	315°27.1	31.1	63°38.9	44.8	1°29.4	14.1	Elnath	278°09.4	28°37.1					
15	270°16.2	8°58.6	.. 05.9	330°27.6	.. 30.7	78°40.9	.. 45.0	16°31.6	.. 14.2	Alnilam	275°43.8	-1°11.6					
16	285°18.7	23°57.8	06.2	345°28.2	30.3	93°42.9	45.2	31°33.8	14.2	Betelgeuse	270°58.6	7°24.5					
17	300°21.1	38°57.0	06.4	0°28.7	29.9	108°44.9	45.4	46°35.9	14.3	Canopus	263°54.8	-52°42.2					
18	315°23.6	53°56.1	\$25°06.7	15°29.2	\$22°29.5	123°46.9	\$03°45.6	61°38.1	\$21°14.3	Sirius	258°31.5	-16°44.4					
19	330°26.1	68°55.3	07.0	30°29.8	29.1	138°48.9	45.7	76°40.3	14.3	Adhara	255°10.5	-28°59.7					
20	345°28.5	83°54.4	07.3	45°30.3	28.7	153°50.9	45.9	91°42.5	14.4	Procyon	244°57.2	5°10.8					
21	0°31.0	98°53.6	.. 07.5	60°30.9	.. 28.2	168°52.9	.. 46.1	106°44.7	.. 14.4	Pollux	243°24.9	27°58.9					
22	15°33.5	113°52.8	07.8	75°31.4	27.8	183°54.9	46.3	121°46.8	14.4	Avior	234°16.9	-59°33.6					
23	30°35.9	128°51.9	08.0	90°31.9	27.4	198°56.9	46.5	136°49.0	14.5	Suhail	222°50.7	-43°29.8					
Mer.pass.:20:58			v-0.8 d-0.3 m-3.9	v0.5	d0.4	m0.4	v2.0	d-0.2	m-1.6	v2.2	d-0.0	m0.5	Miaplacidus				
										Alphard	221°39.1	-69°46.9					

Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	45°38.4	143°51.1	\$25°08.3	105°32.5	\$22°27.0	213°58.9	\$03°46.7	151°51.2	\$21°14.5			
1	60°40.8	158°50.3	08.6	120°33.0	26.6	229°00.9	46.9	166°53.4	14.5			
2	75°43.3	173°49.4	08.8	135°33.6	26.2	244°02.9	47.1	181°55.6	14.6			
3	90°45.8	188°48.6	.. 09.1	150°34.1	.. 25.8	259°04.9	.. 47.3	196°57.7	.. 14.6			
4	105°48.2	203°47.7	09.3	165°34.6	25.4	274°06.9	47.5	211°59.9	14.6			
5	120°50.7	218°46.9	09.6	180°35.2	25.0	289°08.9	47.6	227°02.1	14.7			
6	135°53.2	233°46.1	\$25°09.9	195°35.7	\$22°24.6	304°10.9	\$03°47.8	242°04.3	\$21°14.7			
7	150°55.6	248°45.2	10.1	210°36.3	24.2	319°12.9	48.0	257°06.5	14.7			
8	165°58.1	263°44.4	10.4	225°36.8	23.8	334°14.9	48.2	272°08.6	14.8			
9	181°00.6	278°43.5	.. 10.6	240°37.3	.. 23.4	349°16.9	.. 48.4	287°10.8	.. 14.8			
10	196°03.0	293°42.7	10.9	255°37.9	23.0	4°18.9	48.6	302°13.0	14.8			
11	211°05.5	308°41.9	11.1	270°38.4	22.6	19°20.9	48.8	317°15.2	14.9			
12	226°08.0	323°41.0	\$25°11.4	285°39.0	\$22°22.2	34°22.9	\$03°49.0	332°17.4	\$21°14.9			
13	241°10.4	338°40.2	11.6	300°39.5	21.7	49°24.9	49.2	347°19.5	14.9			
14	256°12.9	353°39.3	11.8	315°40.1	21.3	64°26.9	49.3	2°21.7	15.0			
15	271°15.3	8°38.5	.. 12.1	330°40.6	.. 20.9	79°29.0	.. 49.5	17°23.9	.. 15.0			
16	286°17.8	23°37.7	12.3	345°41.1	20.5	94°31.0	49.7	32°26.1	15.0			
17	301°20.3	38°36.8	12.6	0°41.7	20.1	109°33.0	49.9	47°28.3	15.1			
18	316°22.7	53°36.0	\$25°12.8	15°42.2	\$22°19.7	124°35.0	\$03°50.1	62°30.4	\$21°15.1			
19	331°25.2	68°35.1	13.1	30°42.8	19.3	139°37.0	50.3	77°32.6	15.2			
20	346°27.7	83°34.3	13.3	45°43.3	18.9	154°39.0	50.5	92°34.8	15.2			
21	1°30.1	98°33.5	.. 13.5	60°43.8	.. 18.5	169°41.0	.. 50.7	107°37.0	.. 15.2			
22	16°32.6	113°32.6	13.8	75°44.4	18.0	184°43.0	50.9	122°39.1	15.3			
23	31°35.1	128°31.8	14.0	90°44.9	17.6	199°45.0	51.0	137°41.3	15.3			
Mer.pass.:20:54		v-0.8	d-0.3	m-3.9	v0.5	d0.4	m0.4	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	46°37.5	143°30.9	\$25°14.2	105°45.5	\$22°17.2	214°47.0	\$03°51.2	152°43.5	\$21°15.3
1	61°40.0	158°30.1	14.5	120°46.0	16.8	229°49.0	51.4	167°45.7	15.4
2	76°42.5	173°29.2	14.7	135°46.6	16.4	244°51.0	51.6	182°47.9	15.4
3	91°44.9	188°28.4	.. 14.9	150°47.1	.. 16.0	259°53.0	.. 51.8	197°50.0	.. 15.4
4	106°47.4	203°27.6	15.1	165°47.6	15.6	274°55.0	52.0	212°52.2	15.5
5	121°49.8	218°26.7	15.4	180°48.2	15.1	289°57.0	52.2	227°54.4	15.5
6	136°52.3	233°25.9	\$25°15.6	195°48.7	\$22°14.7	304°59.0	\$03°52.4	242°56.6	\$21°15.5
7	151°54.8	248°25.0	15.8	210°49.3	14.3	320°01.0	52.6	257°58.7	15.6
8	166°57.2	263°24.2	16.0	225°49.8	13.9	335°03.0	52.7	273°00.9	15.6
9	181°59.7	278°23.3	.. 16.3	240°50.3	.. 13.5	350°05.1	.. 52.9	288°03.1	.. 15.6
10	197°02.2	293°22.5	16.5	255°50.9	13.1	5°07.1	53.1	303°05.3	15.7
11	212°04.6	308°21.7	16.7	270°51.4	12.6	20°09.1	53.3	318°07.5	15.7
12	227°07.1	323°20.8	\$25°16.9	285°52.0	\$22°12.2	35°11.1	\$03°53.5	333°09.6	\$21°15.7
13	242°09.6	338°20.0	17.1	300°52.5	11.8	50°13.1	53.7	348°11.8	15.8
14	257°12.0	353°19.1	17.3	315°53.1	11.4	65°15.1	53.9	3°14.0	15.8
15	272°14.5	8°18.3	.. 17.6	330°53.6	.. 11.0	80°17.1	.. 54.1	18°16.2	.. 15.8
16	287°16.9	23°17.4	17.8	345°54.1	10.5	95°19.1	54.3	33°18.3	15.9
17	302°19.4	38°16.6	18.0	0°54.7	10.1	110°21.1	54.4	48°20.5	15.9
18	317°21.9	53°15.8	\$25°18.2	15°55.2	\$22°09.7	125°23.1	\$03°54.6	63°22.7	\$21°15.9
19	332°24.3	68°14.9	18.4	30°55.8	09.3	140°25.1	54.8	78°24.9	16.0
20	347°26.8	83°14.1	18.6	45°56.3	08.9	155°27.1	55.0	93°27.0	16.0
21	2°29.3	98°13.2	.. 18.8	60°56.9	.. 08.4	170°29.1	.. 55.2	108°29.2	.. 16.1
22	17°31.7	113°12.4	19.0	75°57.4	08.0	185°31.1	55.4	123°31.4	16.1
23	32°34.2	128°11.5	19.2	90°57.9	07.6	200°33.1	55.6	138°33.6	16.1
Mer.pass.:20:50		v-0.8 d-0.2 m-3.9		v0.5 d0.4 m0.4		v2.0 d-0.2 m-1.6		v2.2 d-0.0 m0.5	

	Stars	SHA	Dec
Alpheratz	357°40.8	29°11.1	
Ankaa	353°13.2	-42°13.0	
Schedar	349°37.3	56°37.9	
Diphda	348°53.4	-17°53.7	
Achernar	335°24.6	-57°09.3	
Hamal	327°57.8	23°32.5	
Polaris	316°14.9	89°20.0	
Acamar	315°16.2	-40°14.3	
Menkar	314°12.3	4°09.3	
Mirfak	308°36.5	49°55.1	
Aldebaran	290°46.5	16°32.4	
Rigel	281°09.6	-8°11.0	
Capella	280°30.7	46°00.6	
Bellatrix	278°29.3	6°21.7	
Elnath	278°09.4	28°37.1	
Alnilam	275°43.8	-1°11.6	
Betelgeuse	270°58.6	7°24.5	
Canopus	263°54.8	-52°42.2	
Sirius	258°31.5	-16°44.4	
Adhara	255°10.5	-28°59.7	
Procyon	244°57.2	5°10.8	
Pollux	243°24.9	27°58.9	
Avior	234°16.9	-59°33.6	
Suhail	222°50.7	-43°29.8	
Miaplacidus	221°39.1	-69°46.9	
Alphard	217°53.9	-8°43.8	
Regulus	207°41.2	11°53.1	
Dubhe	193°49.4	61°39.4	
Denebola	182°31.6	14°28.7	
Gienah	175°50.2	-17°37.9	
Acrux	173°07.2	-63°11.2	
Gacrux	171°58.7	-57°12.1	
Alioth	166°19.3	55°52.1	
Spica	158°29.2	-11°14.7	
Alkaid	152°57.7	49°13.9	
Hadar	148°45.2	-60°27.0	
Menkent	148°05.2	-36°26.9	
Arcturus	145°54.0	19°05.9	
Rigel Kent.	139°49.2	-60°54.0	
Kochab	137°21.5	74°05.3	
Zuben'ubi	137°03.2	-16°06.4	
Alphecca	126°09.5	26°39.8	
Antares	112°23.8	-26°27.9	
Atria	107°24.0	-69°03.3	
Sabik	102°10.2	-15°44.5	
Shaula	96°19.2	-37°06.8	
Rasalhague	96°04.6	12°33.2	
Eltanin	90°45.5	51°29.6	
Kaus Aust.	83°41.1	-34°22.4	
Vega	80°37.7	38°48.4	
Nunki	75°55.7	-26°16.4	
Altair	62°06.1	8°55.1	
Peacock	53°15.9	-56°40.9	
Deneb	49°29.9	45°20.8	
Enif	33°44.8	9°57.4	
Al Na'ir	27°40.9	-46°52.9	
Fomalhaut	15°21.4	-29°32.0	
Scheat	13°51.0	28°10.7	
Markab	13°35.9	15°17.9	

Nov 05 Sat	SHA	Mer.pass
Venus	99°31.9	14:24
Mars	60°40.3	16:58
Jupiter	168°31.6	09:46
Saturn	106°19.6	13:54

Nov 06 Sun	SHA	Mer.pass
Venus	98°12.7	14:25
Mars	59°54.1	16:57
Jupiter	168°20.5	09:43
Saturn	106°12.8	13:51

<b>Nov 07 Mon</b>	<b>SHA</b>	<b>Mer.pass</b>
Venus	96° 53.4	14:27
Mars	59° 07.9	16:56
Jupiter	168° 09.5	09:40
Saturn	106° 06.0	13:47

Horizontal parallax	
Venus:	0.1
Mars:	0.1

## Horizontal parallax

## Venus:

DUT1 = UT1-UTC = -0.3299 sec ΔT = TT-UT1 = +68.5139 sec

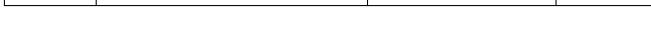
2016 November 05 to Nov. 07 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	184°06.1	\$15°44.3	123°33.6	11.5'	\$18°38.9	1.0'	54.8'
1	199°06.1	45.0	138°04.0	11.5'	18°37.8	1.1'	54.9'
2	214°06.1	45.8	152°34.5	11.4'	18°36.7	1.2'	54.9'
3	229°06.0	.. 46.6	167°04.9	11.4'	18°35.5	1.3'	54.9'
4	244°06.0	47.3	181°35.3	11.4'	18°34.2	1.3'	54.9'
5	259°06.0	48.1	196°05.7	11.4'	18°32.8	1.4'	54.9'
6	274°06.0	\$15°48.8	210°36.1	11.4'	\$18°31.3	1.5'	55.0'
7	289°06.0	49.6	225°06.5	11.4'	18°29.7	1.6'	55.0'
8	304°05.9	50.3	239°36.9	11.4'	18°28.1	1.7'	55.0'
9	319°05.9	.. 51.1	254°07.2	11.3'	18°26.3	1.8'	55.0'
10	334°05.9	51.8	268°37.5	11.3'	18°24.5	1.9'	55.0'
11	349°05.9	52.6	283°07.9	11.3'	18°22.5	2.0'	55.1'
12	4°05.9	\$15°53.3	297°38.2	11.3'	\$18°20.5	2.1'	55.1'
13	19°05.8	54.1	312°08.5	11.3'	18°18.4	2.2'	55.1'
14	34°05.8	54.8	326°38.8	11.3'	18°16.2	2.3'	55.1'
15	49°05.8	.. 55.6	341°09.1	11.3'	18°13.9	2.3'	55.2'
16	64°05.8	56.4	355°39.3	11.3'	18°11.5	2.4'	55.2'
17	79°05.7	57.1	10°09.6	11.3'	18°09.0	2.5'	55.2'
18	94°05.7	\$15°57.9	24°39.9	11.2'	\$18°06.4	2.6'	55.2'
19	109°05.7	58.6	39°10.1	11.2'	18°03.8	2.7'	55.3'
20	124°05.7	15°59.3	53°40.3	11.2'	18°01.0	2.8'	55.3'
21	139°05.6	16°00.1	68°10.6	11.2'	17°58.1	2.9'	55.3'
22	154°05.6	00.8	82°40.8	11.2'	17°55.2	3.0'	55.3'
23	169°05.6	01.6	97°11.0	11.2'	17°52.2	3.1'	55.4'
	SD.=16.1	d=-0.8			S.D.=15.0		

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

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

Day	Sun		Moon	
	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass. 12 <sup>h</sup> mm:ss	Mer. Pass. Upper hh:mm	Age 6-8 28-47%
05	16:24	16:23	11:44	16:18 03:53
06	16:22	16:21	11:44	17:07 04:43
07	16:19	16:17	11:44	17:57 05:32



SD.=16.1	d=-0.7	S.D.=15.4
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**November 08, 09, 10 UT (Tue., Wed., Thu.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	47°36.7	143°10.7	\$25°19.4	105°58.5	\$22°07.2	215°35.2	\$03°55.8	153°35.7	\$21°16.2	Alpheratz	357°40.8	29°11.2											
1	62°39.1	158°09.8	19.6	120°59.0	06.7	230°37.2	55.9	168°37.9	16.2	Ankaa	353°13.2	-42°13.0											
2	77°41.6	173°09.0	19.8	135°59.6	06.3	245°39.2	56.1	183°40.1	16.2	Schedar	349°37.3	56°37.9											
3	92°44.1	188°08.2	20.0	151°00.1	05.9	260°41.2	56.3	198°42.3	16.3	Diphda	348°53.4	-17°53.7											
4	107°46.5	203°07.3	20.2	166°00.7	05.5	275°43.2	56.5	213°44.5	16.3	Achernar	335°24.6	-57°09.3											
5	122°49.0	218°06.5	20.4	181°01.2	05.0	290°45.2	56.7	228°46.6	16.3	Hamal	327°57.8	23°32.5											
6	137°51.4	233°05.6	\$25°20.6	196°01.8	\$22°04.6	305°47.2	\$03°56.9	243°48.8	\$21°16.4	Polaris	316°14.8	89°20.0											
7	152°53.9	248°04.8	20.8	211°02.3	04.2	320°49.2	57.1	258°51.0	16.4	Acamar	315°16.2	-40°14.4											
8	167°56.4	263°03.9	21.0	226°02.8	03.8	335°51.2	57.3	273°53.2	16.4	Menkar	314°12.3	4°09.2											
9	182°58.8	278°03.1	21.2	241°03.4	03.3	350°53.2	57.4	288°55.3	16.5	Mirfak	308°36.5	49°55.1											
10	198°01.3	293°02.2	21.4	256°03.9	02.9	5°55.2	57.6	303°57.5	16.5	Aldebaran	290°46.4	16°32.4											
11	213°03.8	308°01.4	21.6	271°04.5	02.5	20°57.2	57.8	318°59.7	16.5	Rigel	281°09.6	-8°11.0											
12	228°06.2	323°00.6	\$25°21.8	286°05.0	\$22°02.1	35°59.3	\$03°58.0	334°01.9	\$21°16.6	Capella	280°30.7	46°00.6											
13	243°08.7	337°59.7	21.9	301°05.6	01.6	51°01.3	58.2	349°04.0	16.6	Bellatrix	278°29.3	6°21.7											
14	258°11.2	352°58.9	22.1	316°06.1	01.2	66°03.3	58.4	4°06.2	16.6	Elnath	278°09.4	28°37.1											
15	273°13.6	7°58.0	22.3	331°06.6	00.8	81°05.3	58.6	19°08.4	16.7	Alnilam	275°43.8	-1°11.6											
16	288°16.1	22°57.2	22.5	346°07.2	02.2	22°00.4	96°07.3	58.8	34°10.6	Betelgeuse	270°58.6	7°24.5											
17	303°18.6	37°56.3	22.7	1°07.7	21°59.9	111°09.3	58.9	49°12.7	16.7	Canopus	263°54.7	-52°42.2											
18	318°21.0	52°55.5	\$25°22.8	16°08.3	\$21°59.5	126°11.3	\$03°59.1	64°14.9	\$21°16.8	Sirius	258°31.5	-16°44.4											
19	333°23.5	67°54.6	23.0	31°08.8	59.1	141°13.3	59.3	79°17.1	16.8	Adhara	255°10.5	-28°59.7											
20	348°25.9	82°53.8	23.2	46°09.4	58.6	156°15.3	59.5	94°19.3	16.8	Procyon	244°57.2	5°10.8											
21	3°28.4	97°52.9	23.4	61°09.9	58.2	171°17.3	59.7	109°21.4	16.9	Pollux	243°24.8	27°58.9											
22	18°30.9	112°52.1	23.6	76°10.5	57.8	186°19.3	03°59.9	124°23.6	16.9	Avior	234°16.9	-59°33.6											
23	33°33.3	127°51.3	23.7	91°11.0	57.3	201°21.3	04°00.1	139°25.8	16.9	Suhail	222°50.7	-43°29.8											
Mer.pass.:20:46				v-0.8 d-0.2 m-3.9				v0.5 d0.4 m0.4				v2.0 d-0.2 m-1.6				v2.2 d-0.0 m0.5							
Wed				GHA				GHA				GHA				GHA							
0	48°35.8	142°50.4	\$25°23.9	106°11.6	\$21°56.9	216°23.4	\$04°00.2	154°28.0	\$21°17.0	Denebola	182°31.6	14°28.7											
1	63°38.3	157°49.6	24.1	121°12.1	56.5	231°25.4	00.4	169°30.1	17.0	Gienah	175°50.2	-17°37.9											
2	78°40.7	172°48.7	24.2	136°12.6	56.0	246°27.4	00.6	184°32.3	17.1	Acrux	173°07.2	-63°11.2											
3	93°43.2	187°47.9	24.4	151°13.2	55.6	261°29.4	00.8	199°34.5	17.1	Gacrux	171°58.7	-57°12.1											
4	108°45.7	202°47.0	24.6	166°13.7	55.2	276°31.4	01.0	214°36.7	17.1	Alioth	166°19.3	55°52.1											
5	123°48.1	217°46.2	24.7	181°14.3	54.7	291°33.4	01.2	229°38.8	17.2	Spica	158°29.1	-11°14.7											
6	138°50.6	232°45.3	\$25°24.9	196°14.8	\$21°54.3	306°35.4	\$04°01.4	244°41.0	\$21°17.2	Alkaid	152°57.7	49°13.8											
7	153°53.0	247°44.5	25.1	211°15.4	53.9	321°37.4	01.6	259°43.2	17.2	Hadar	148°45.2	-60°26.9											
8	168°55.5	262°43.6	25.2	226°15.9	53.4	336°39.4	01.7	274°45.4	17.3	Menkent	148°05.2	-36°26.9											
9	183°58.0	277°42.8	25.4	241°16.5	53.0	351°41.4	01.9	289°47.5	17.3	Arcturus	145°54.0	19°05.9											
10	199°00.4	292°41.9	25.5	256°17.0	52.6	6°43.5	02.1	304°49.7	17.3	Rigel Kent.	139°49.2	-60°54.0											
11	214°02.9	307°41.1	25.7	271°17.6	52.1	21°45.5	02.3	319°51.9	17.4	Kochab	137°21.5	74°05.3											
12	229°05.4	322°40.3	\$25°25.9	286°18.1	\$21°51.7	36°47.5	\$04°02.5	334°54.1	\$21°17.4	Zuben ubi	137°03.2	-16°06.4											
13	244°07.8	337°39.4	26.0	301°18.6	51.3	51°49.5	02.7	349°56.2	17.4	Alphecca	126°09.5	26°39.8											
14	259°10.3	352°38.6	26.2	316°19.2	50.8	66°51.5	02.9	4°58.4	17.5	Antares	112°23.8	-26°27.9											
15	274°12.8	7°37.7	26.3	331°19.7	50.4	81°53.5	03.0	20°00.6	17.5	Atria	107°24.0	-69°03.3											
16	289°15.2	22°36.9	26.5	346°20.3	50.0	96°55.5	03.2	35°02.7	17.5	Sabik	102°10.2	-15°44.5											
17	304°17.7	37°36.0	26.6	1°20.8	49.5	111°57.5	03.4	50°04.9	17.6	Rasalhague	96°19.2	-37°06.8											
18	319°20.2	52°35.2	\$25°26.8	16°21.4	\$21°49.1	126°59.5	\$04°03.6	65°07.1	\$21°17.6	Eltanin	90°45.5	51°29.6											
19	334°22.6	67°34.3	26.9	31°21.9	48.6	142°01.6	03.8	80°09.3	17.6	Kaus Aust.	83°41.1	-34°22.4											
20	349°25.1	82°33.5	27.1	46°22.5	48.2	157°03.6	04.0	95°11.4	17.7	Vega	80°37.7	38°48.4											
21	4°27.5	97°32.6	27.2	61°23.0	47.8	172°05.6	04.2	110°13.6	17.7	Nunki	75°55.7	-26°16.4											
22	19°30.0	112°31.8	27.4	76°23.6	47.3	187°07.6	04.3	125°15.8	17.7	Altair	62°06.2	8°55.1											
23	34°32.5	127°30.9	27.5	91°24.1	46.9	202°09.6	04.5	140°18.0	17.8	Peacock	53°15.9	-56°40.9											
Mer.pass.:20:42				v-0.8 d-0.2 m-3.9				v0.5 d0.4 m0.5				v2.0 d-0.2 m-1.6				v2.2 d-0.0 m0.5							
Thu				GHA				GHA				GHA				GHA							
0	49°34.9	142°30.1	\$25°27.6	106°24.7	\$21°46.4	217°11.6	\$04°04.7	155°20.1	\$21°17.8	Nov 08 Tue	SHA	Mer.pass											
1	64°37.4	157°29.2	27.8	121°25.2	46.0	232°13.6	04.9	170°22.3	17.8	Venus	95°34.0	14:28											
2	79°39.9	172°28.4	27.9	136°25.7	45.6	247°15.6	05.1	185°24.5	17.9	Mars	58°21.8	16:55											
3	94°43.3	187°27.6	28.1	151°26.3	45.1	262°17.7	05.3	200°26.7	17.9	Jupiter	167°58.5	09:36											
4	109°44.8	202°26.7	28.2	166°26.8	44.7	277°19.7	05.4	215°28.8	17.9	Saturn	105°59.1	13:44											
5	124°47.3	217°25.9	28.3	181°27.4	44.2	292°21.7	05.6	230°31.0	18.0	Nov 09 Wed	SHA	Mer.pass											
6	139°49.7	232°25.0	28.5	196°27.9	\$21°43.8	307°23.7	\$04°05.8	245°33.2	\$21°18.0	Venus	94°14.6	14:29											
7	154°52.2	247°24.2	28.6																				

DUT1 = UT1-UTC = -0.3345 sec ΔT = TT-UT1 = +68.5185 sec

2016 November 08 to Nov. 10 UT

h	Sun			Moon			
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	184°03.8	S16°37.6	87°42.2	10.9'	S13°35.0	7.3'	56.9'
1	199°03.8	38.4	102°12.0	10.9'	13°27.7	7.4'	56.9'
2	214°03.8	39.1	116°41.9	10.8'	13°20.2	7.5'	56.9'
3	229°03.7	.. 39.8	131°11.7	10.8'	13°12.7	7.6'	57.0'
4	244°03.7	40.5	145°41.5	10.8'	13°05.1	7.6'	57.0'
5	259°03.6	41.2	160°11.4	10.8'	12°57.4	7.7'	57.0'
6	274°03.6	S16°42.0	174°41.2	10.8'	S12°49.6	7.8'	57.1'
7	289°03.5	42.7	189°11.0	10.8'	12°41.8	7.9'	57.1'
8	304°03.5	43.4	203°40.8	10.8'	12°33.9	8.0'	57.2'
9	319°03.4	.. 44.1	218°10.6	10.8'	12°25.9	8.0'	57.2'
10	334°03.4	44.8	232°40.3	10.8'	12°17.8	8.1'	57.2'
11	349°03.3	45.6	247°10.1	10.8'	12°09.7	8.2'	57.3'
12	4°03.3	S16°46.3	261°39.9	10.8'	S12°01.4	8.3'	57.3'
13	19°03.2	47.0	276°09.6	10.7'	11°53.1	8.3'	57.3'
14	34°03.2	47.7	290°39.3	10.7'	11°44.8	8.4'	57.4'
15	49°03.1	.. 48.4	305°09.1	10.7'	11°36.3	8.5'	57.4'
16	64°03.1	49.1	319°38.8	10.7'	11°27.8	8.6'	57.5'
17	79°03.0	49.9	334°08.5	10.7'	11°19.2	8.6'	57.5'
18	94°03.0	S16°50.6	348°38.2	10.7'	S11°10.6	8.7'	57.5'
19	109°02.9	51.3	3°07.9	10.7'	11°01.8	8.8'	57.6'
20	124°02.9	52.0	17°37.5	10.7'	10°53.0	8.8'	57.6'
21	139°02.8	.. 52.7	32°07.2	10.6'	10°44.2	8.9'	57.7'
22	154°02.8	53.4	46°36.8	10.6'	10°35.2	9.0'	57.7'
23	169°02.7	54.1	61°06.4	10.6'	10°26.2	9.0'	57.7'
	SD.=16.1	d=-0.7			S.D.=15.6		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
08	16:15	16:13	11:44	9-11
09	16:11	16:08	11:44	57-78%
10	16:05	16:02	11:44	08:03



SD.=16.1	d=-0.7	S.D.=16.1
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**November 11, 12, 13 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	50°34.1	142°09.8	\$25°30.7	106°37.8	S21°35.8	217°59.9	S04°09.1	156°12.3	S21°18.6	Alpheratz	357°40.9	29°11.2					
1	65°36.5	157°08.9	30.8	121°38.3	35.3	233°01.9	09.3	171°14.4	18.7	Ankaa	353°13.2	-42°13.0					
2	80°39.0	172°08.1	30.9	136°38.9	34.9	248°04.0	09.5	186°16.6	18.7	Schedar	349°37.4	56°37.9					
3	95°41.5	187°07.2	.. 31.0	151°39.4	.. 34.4	263°06.0	.. 09.7	201°18.8	.. 18.7	Diphda	348°53.4	-17°53.7					
4	110°43.9	202°06.4	31.1	166°40.0	34.0	278°08.0	09.9	216°21.0	18.8	Achernar	335°24.7	-57°09.3					
5	125°46.4	217°05.5	31.2	181°40.5	33.5	293°10.0	10.1	231°23.1	18.8	Hamal	327°57.8	23°32.5					
6	140°48.9	232°04.7	\$25°31.3	196°41.1	S21°33.1	308°12.0	S04°10.2	246°25.3	S21°18.8	Polaris	316°14.8	89°20.0					
7	155°51.3	247°03.8	31.4	211°41.6	32.6	323°14.0	10.4	261°27.5	18.9	Acamar	315°16.2	-40°14.4					
8	170°53.8	262°03.0	31.5	226°42.2	32.2	338°16.0	10.6	276°29.6	18.9	Menkar	314°12.3	4°09.2					
9	185°56.3	277°02.1	.. 31.6	241°42.7	.. 31.7	353°18.1	.. 10.8	291°31.8	.. 18.9	Mirfak	308°36.5	49°55.1					
10	200°58.7	292°01.3	31.7	256°43.3	31.2	8°20.1	11.0	306°34.0	19.0	Aldebaran	290°46.4	16°32.4					
11	216°01.2	307°00.5	31.8	271°43.8	30.8	23°22.1	11.2	321°36.1	19.0	Rigel	281°09.6	-8°11.0					
12	231°03.6	321°59.6	\$25°31.9	286°44.4	S21°30.3	38°24.1	S04°11.3	336°38.3	S21°19.0	Capella	280°30.6	46°00.6					
13	246°06.1	336°58.8	32.0	301°44.9	29.9	53°26.1	11.5	351°40.5	19.1	Bellatrix	278°29.3	6°21.7					
14	261°08.6	351°57.9	32.1	316°45.5	29.4	68°28.1	11.7	6°42.7	19.1	Elnath	278°09.4	28°37.1					
15	276°11.0	6°57.1	.. 32.2	331°46.0	.. 29.0	83°30.1	.. 11.9	21°44.8	.. 19.1	Alnilam	275°43.8	-1°11.6					
16	291°13.5	21°56.2	32.3	346°46.6	28.5	98°32.2	12.1	36°47.0	19.2	Betelgeuse	270°58.6	7°24.4					
17	306°16.0	36°55.4	32.4	1°47.1	28.1	113°34.2	12.3	51°49.2	19.2	Canopus	263°54.7	-52°42.2					
18	321°18.4	51°54.5	\$25°32.4	16°47.7	S21°27.6	128°36.2	S04°12.4	66°51.3	S21°19.2	Sirius	258°31.5	-16°44.4					
19	336°20.9	66°53.7	32.5	318°48.2	27.2	143°38.2	12.6	81°53.5	19.3	Adhara	255°10.5	-28°59.7					
20	351°23.4	81°52.8	32.6	46°48.8	26.7	158°40.2	12.8	96°55.7	19.3	Procyon	244°57.2	5°10.8					
21	6°25.8	96°52.0	.. 32.7	61°49.3	.. 26.2	173°42.2	.. 13.0	111°57.9	.. 19.3	Pollux	243°24.8	27°58.9					
22	21°28.3	111°51.1	32.8	76°49.9	25.8	188°44.3	13.2	127°00.0	19.4	Avior	234°16.8	-59°33.6					
23	36°30.7	126°50.3	32.9	91°50.4	25.3	203°46.3	13.4	142°02.2	19.4	Suhail	222°50.7	-43°29.8					
Mer.pass.:20:34			v-0.8 d-0.1 m-3.9	v0.5 d0.4 m0.5	v2.0 d-0.2 m-1.6	v2.2 d-0.0 m0.5				Miaplacidus	221°39.0	-69°46.9					
Sat			GHA			GHA			GHA			GHA			GHA		
0	51°33.2	141°49.5	\$25°32.9	106°51.0	S21°24.9	218°48.3	S04°13.5	157°04.4	S21°19.4	Denebola	183°49.4	61°39.4					
1	66°35.7	156°48.6	33.0	121°51.5	24.4	233°50.3	13.7	172°06.5	19.5	Gienah	182°31.6	14°28.7					
2	81°38.1	171°47.8	33.1	136°52.1	24.0	248°52.3	13.9	187°08.7	19.5	Gacrux	175°50.2	-17°37.9					
3	96°40.6	186°46.9	.. 33.2	151°52.6	.. 23.5	263°54.3	.. 14.1	202°10.9	.. 19.5	Alioth	173°07.1	-63°11.2					
4	111°43.1	201°46.1	33.3	166°53.2	23.0	278°56.3	14.3	217°13.0	19.6	Alkaid	171°58.7	-57°12.1					
5	126°45.5	216°45.2	33.3	181°53.7	22.6	293°58.4	14.5	232°15.2	19.6	Hadar	166°19.3	55°52.1					
6	141°48.0	231°44.4	\$25°33.4	196°54.3	S21°22.1	309°00.4	S04°14.6	247°17.4	S21°19.6	Nemenkt	152°57.6	-11°14.7					
7	156°50.5	246°43.5	33.5	211°54.9	21.7	324°02.4	14.8	262°19.6	19.7	Arcturus	152°45.2	-60°26.9					
8	171°52.9	261°42.7	33.5	226°55.4	21.2	339°04.4	15.0	277°21.7	19.7	Rigel Kent.	148°05.2	-36°26.9					
9	186°55.4	276°41.8	.. 33.6	241°56.0	.. 20.7	354°06.4	.. 15.2	292°23.9	.. 19.7	Kochab	145°54.0	19°05.9					
10	201°57.9	291°41.0	33.7	256°56.5	20.3	9°08.5	15.4	307°26.1	19.8	Zuben' ubi	139°49.2	-60°54.0					
11	217°00.3	306°40.1	33.7	271°57.1	19.8	24°10.5	15.6	322°28.2	19.8	Alphecca	137°03.2	-16°06.4					
12	232°02.8	321°39.3	\$25°33.8	286°57.6	S21°19.3	39°12.5	S04°15.7	337°30.4	S21°19.9	Antares	126°09.5	26°39.8					
13	247°05.2	336°38.5	33.9	301°58.2	18.9	54°14.5	15.9	352°32.6	19.9	Atria	112°23.8	-26°27.9					
14	262°07.7	351°37.6	33.9	316°58.7	18.4	69°16.5	16.1	7°34.7	19.9	Sabik	107°24.1	-69°03.3					
15	277°10.2	6°36.8	.. 34.0	331°59.3	.. 18.0	84°18.5	.. 16.3	22°36.9	.. 20.0	Shaula	102°10.2	-15°44.5					
16	292°12.6	21°35.9	34.1	346°59.8	17.5	99°20.6	16.5	37°39.1	20.0	Rasalhague	96°19.2	-37°06.8					
17	307°15.1	36°35.1	34.1	2°00.4	17.0	114°22.6	16.6	52°41.2	20.0	Eltanin	90°45.5	51°29.6					
18	322°17.6	51°34.2	\$25°34.2	17°00.9	S21°16.6	129°24.6	S04°16.8	67°43.4	S21°20.1	Kaus Aust.	83°41.1	-34°22.4					
19	337°20.0	66°33.4	34.2	32°01.5	16.1	144°26.6	17.0	82°45.6	20.1	Vega	80°37.7	38°48.4					
20	352°22.5	81°32.5	34.3	47°02.0	15.6	159°28.6	17.2	97°47.8	20.1	Nunki	75°55.8	-26°16.4					
21	7°25.0	96°31.7	.. 34.3	62°02.6	.. 15.2	174°30.6	.. 17.4	112°49.9	.. 20.2	Altair	62°06.2	8°55.1					
22	22°27.4	111°30.8	34.4	77°03.1	14.7	189°32.7	17.6	127°52.1	20.2	Peacock	53°15.9	-56°40.9					
23	37°29.9	126°30.0	34.4	92°03.7	14.2	204°34.7	17.7	142°54.3	20.2	Deneb	49°30.0	45°20.8					
Mer.pass.:20:30			v-0.8 d-0.1 m-3.9	v0.6 d0.5 m0.5	v2.0 d-0.2 m-1.6	v2.2 d-0.0 m0.5				Enif	33°44.9	9°57.4					
Sun			GHA			GHA			GHA			GHA			GHA		
0	52°32.4	141°29.2	\$25°34.5	107°04.2	S21°13.8	219°36.7	S04°17.9	157°56.4	S21°20.3	Al Na'ir	27°40.9	-46°52.9					
1	67°34.8	156°28.3	34.5	122°04.8	13.3	234°38.7	18.1	172°58.6	20.3	Fomalhaut	15°21.4	-29°32.0					
2	82°37.3	171°27.5	34.6	137°05.3	12.8	249°40.7	18.3	188°00.8	20.3	Scheat	13°51.0	28°10.7					
3	97°39.7	186°26.6	.. 34.6	152°05.9	.. 12.4	264°42.8	.. 18.5	203°02.9	.. 20.4	Markab	13°35.9	15°17.9					
4	112°42.2	201°25.8	34.7	167°06.5	11.9	279°44.8	18.6	218°05.1	20.4	<b>Nov 11 Fri</b>							
5	127°44.7	216°24.9	34.7	182°07.0	11.4	294°46.8	18.8	233°07.3	20.4	<b>SHA</b>	91°35.7	14:32					
6	142°47.1	231°24.1	\$25°34.8	197°07.6	S21°11.0	309°48.8	S04°19.0	248°09.4	S21°20.5	<b>Mer.pass</b>	56°03.7	16:53					
7	157°49.6	246°23.2	34.8	212°08.1	10.5	324°50.8	19.2	263°11.6	20.5	Venus	167°25.8	09:27					
8	172°52.1	261°22.4	34.8	227°08.7	10.0	339°52.9	19.4	278°13.8	20.5	Mars	105°38.2	13:33					
9	187°54.5	276°21.6	.. 34.9	242°09.2	.. 09.6	354°54.9	.. 19.6	293°15.9	.. 20.6	Jupiter	90°16.2	14:34					
10	202°57.0	291°20.7	34.9	257°09.8	09.1	9°56.9	19.7	308°18.1	20.6	Saturn	55°17.8	16:52					
11	217°59.5	306°19.9	35.0	272°10.3	08.6	24°58.9	19.9	323°20.3	20.6	<b>Nov 12 Sat</b>							
12	233°01.9	321°19.0	\$25°35.0	287°10.9	S21°08.1	40°00.9	S04°20.1	338°22.4	S21°20.7	<b>SHA</b>	167°15.1	09:24					
13	248°04.4	336°18.2	35.0	302°11.4	07.7	55°02.9	20.3	353°24.6	20.7	<b>Mer.pass</b>	105°31.2	13:30					
14	263°06.8	351°17.3	35.1	317°12.0	07.2	70°05.0	20.5	8°26.8	20.7	Venus	88°56.8	14:35					
15	278°09.3	6°16.5	.. 35.1	332°12.5	.. 06.7	85°07.0	.. 20.6	23°28.9	.. 20.8	Mars	54°31.9	16:51					
16	293°11.8	21°15.7	35.1	347°13.1	06.3	100°09.0	20.8	38°31.1	20.8	Jupiter	167°04.3	09:20					
17	308°14.2	36°14.8	35.1	2°13.7	05.8	115°11.0	21.0	53°33.3	20.8	Saturn	105°24.1	13:26					
18	323°16.7	51°14.0	\$25°35.2	17°14.2	S21°05.3	130°13.1	S04°21.2										

DUT1 = UT1-UTC = -0.3391 sec ΔT = TT-UT1 = +68.5231 sec

2016 November 11 to Nov. 13 UT

h		Sun		Moon				
Fri		GHA	Dec	GHA	ν	Dec	d	HP
0	183°59.7	S17°28.4	50°52.5	9.4'	S01°54.6	11.5'	59.7'	
1	198°59.7	29.1	65°20.9	9.4'	01°43.1	11.5'	59.7'	
2	213°59.6	29.8	79°49.2	9.3'	01°31.5	11.5'	59.7'	
3	228°59.5	.. 30.5	94°17.5	9.3'	01°20.0	11.6'	59.8'	
4	243°59.4	31.2	108°45.8	9.2'	01°08.4	11.6'	59.8'	
5	258°59.4	31.9	123°14.0	9.2'	00°56.8	11.6'	59.9'	
6	273°59.3	S17°32.5	137°42.2	9.2'	S00°45.2	11.6'	59.9'	
7	288°59.2	33.2	152°10.3	9.1'	00°33.5	11.7'	59.9'	
8	303°59.2	33.9	166°38.4	9.1'	00°21.9	11.7'	60.0'	
9	318°59.1	.. 34.6	181°06.5	9.0'	S00°10.2	11.7'	60.0'	
10	333°59.0	35.3	195°34.5	9.0'	N00°01.5	11.7'	60.0'	
11	348°58.9	36.0	210°02.5	8.9'	00°13.2	11.7'	60.1'	
12	3°58.9	S17°36.6	224°30.4	8.9'	N00°25.0	11.7'	60.1'	
13	18°58.8	37.3	238°58.3	8.9'	00°36.7	11.7'	60.1'	
14	33°58.7	38.0	253°26.1	8.8'	00°48.4	11.8'	60.2'	
15	48°58.6	.. 38.7	267°53.9	8.8'	01°00.2	11.8'	60.2'	
16	63°58.6	39.4	282°21.7	8.7'	01°12.0	11.8'	60.2'	
17	78°58.5	40.0	296°49.4	8.7'	01°23.7	11.8'	60.3'	
18	93°58.4	S17°40.7	311°17.0	8.6'	N01°35.5	11.8'	60.3'	
19	108°58.3	41.4	325°44.6	8.6'	01°47.3	11.8'	60.3'	
20	123°58.3	42.1	340°12.2	8.5'	01°59.1	11.8'	60.4'	
21	138°58.2	.. 42.7	354°39.7	8.5'	02°10.9	11.8'	60.4'	
22	153°58.1	43.4	9°07.2	8.4'	02°22.7	11.8'	60.4'	
23	168°58.0	44.1	23°34.6	8.4'	02°34.4	11.8'	60.5'	
	SD.=16.1	d=-0.7			S.D.=16.4			

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
11	15:59	15:55	11:44	21:22
12	15:52	15:48	11:44	22:17
13	15:44	15:39	11:44	23:15
				10:46

SD.=16.2	d=-0.7	S.D.=16.7
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**November 14, 15, 16 UT (Mon., Tue., Wed.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	53°31.5	141°08.9	\$25°35.3	107°17.5	\$21°02.5	220°25.2	\$04°22.3	158°48.5	\$21°21.1	Alpheratz	357°40.9	29°11.2											
1	68°34.0	156°08.1	35.3	122°18.1	02.0	235°27.2	22.4	173°50.6	21.1	Ankaa	353°13.2	-42°13.0											
2	83°36.4	171°07.2	35.3	137°18.7	01.5	250°29.2	22.6	188°52.8	21.1	Schedar	349°37.4	56°37.9											
3	98°38.9	186°06.4	• 35.4	152°19.2	• 01.0	265°31.2	• 22.8	203°55.0	• 21.2	Diphda	348°53.4	-17°53.7											
4	113°41.3	201°05.5	35.4	167°19.8	00.6	280°33.3	23.0	218°57.1	21.2	Achernar	335°24.7	-57°09.3											
5	128°43.8	216°04.7	35.4	182°20.3	21°00.1	295°35.3	23.2	233°59.3	21.2	Hamal	327°57.8	23°32.5											
6	143°46.3	231°03.9	\$25°35.4	197°20.9	\$20°59.6	310°37.3	\$04°23.3	249°01.5	\$21°21.3	Polaris	316°14.5	89°20.1											
7	158°48.7	246°03.0	35.4	212°21.4	59.1	325°39.3	23.5	264°03.6	21.3	Acamar	315°16.2	-40°14.4											
8	173°51.2	261°02.2	35.4	227°22.0	58.7	340°41.3	23.7	279°05.8	21.3	Menkar	314°12.3	4°09.2											
9	188°53.7	276°01.3	• 35.4	242°22.5	• 58.2	355°43.4	• 23.9	294°08.0	• 21.4	Mirfak	308°36.5	49°55.1											
10	203°56.1	291°00.5	35.4	257°23.1	57.7	10°45.4	24.1	309°10.1	21.4	Aldebaran	290°46.4	16°32.4											
11	218°58.6	305°59.6	35.4	272°23.7	57.2	25°47.4	24.2	324°12.3	21.4	Rigel	281°09.6	-8°11.1											
12	234°01.1	320°58.8	\$25°35.4	287°24.2	\$20°56.7	40°49.4	\$04°24.4	339°14.5	\$21°21.5	Capella	280°30.6	46°00.6											
13	249°03.5	335°58.0	35.4	302°24.8	56.3	55°51.5	24.6	354°16.6	21.5	Bellatrix	278°29.3	6°21.7											
14	264°06.0	350°57.1	35.4	317°25.3	55.8	70°53.5	24.8	9°18.8	21.5	Elnath	278°09.4	28°37.1											
15	279°08.5	5°56.3	• 35.4	332°25.9	• 55.3	85°55.5	• 25.0	24°21.0	• 21.6	Alnilam	275°43.8	-1°11.6											
16	294°10.9	20°55.4	35.4	347°26.4	54.8	100°57.5	25.1	39°23.1	21.6	Betelgeuse	270°58.6	7°24.4											
17	309°13.4	35°54.6	35.4	2°27.0	54.3	115°59.5	25.3	54°25.3	21.6	Canopus	263°54.7	-52°42.2											
18	324°15.8	50°53.8	\$25°35.4	17°27.6	\$20°53.9	131°01.6	\$04°25.5	69°27.5	\$21°21.7	Sirius	258°31.5	-16°44.4											
19	339°18.3	65°52.9	35.4	32°28.1	53.4	146°03.6	25.7	84°29.6	21.7	Adhara	255°10.5	-28°59.7											
20	354°20.8	80°52.1	35.4	47°28.7	52.9	161°05.6	25.9	99°31.8	21.7	Procyon	244°57.2	5°10.8											
21	9°23.2	95°51.2	• 35.4	62°29.2	• 52.4	176°07.6	• 26.0	114°33.9	• 21.8	Pollux	243°24.8	27°58.9											
22	24°25.7	110°50.4	35.4	77°29.8	51.9	191°09.7	26.2	129°36.1	21.8	Avior	234°16.8	-59°33.6											
23	39°28.2	125°49.6	35.4	92°30.3	51.4	206°11.7	26.4	144°38.3	21.8	Suhail	222°50.6	-43°29.9											
Mer.pass.:20:23				v-0.8 d-0.0 m-3.9				v0.6 d0.5 m0.5				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	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	54°30.6	140°48.7	\$25°35.4	107°30.9	\$20°51.0	221°13.7	\$04°26.6	159°40.4	\$21°21.9	Denebola	182°31.5	14°28.7											
1	69°33.1	155°47.9	35.4	122°31.5	50.5	236°15.7	26.8	174°42.6	21.9	Gienah	175°50.1	-17°37.9											
2	84°35.6	170°47.0	35.4	137°32.0	50.0	251°17.8	26.9	189°44.8	21.9	Acrux	173°07.1	-63°11.2											
3	99°38.0	185°46.2	• 35.3	152°32.6	• 49.5	266°19.8	• 27.1	204°46.9	• 22.0	Gacrux	171°58.6	-57°12.1											
4	114°40.5	200°45.4	35.3	167°33.1	49.0	281°21.8	27.3	219°49.1	22.0	Alioth	166°19.2	55°52.1											
5	129°42.9	215°44.5	35.3	182°33.7	48.5	296°23.8	27.5	234°51.3	22.0	Spica	158°29.1	-11°14.7											
6	144°45.4	230°43.7	\$25°35.3	197°34.3	\$20°48.0	311°25.8	\$04°27.7	249°53.4	\$21°22.1	Alkaid	152°57.6	49°13.8											
7	159°47.9	245°42.8	35.3	212°34.8	47.6	326°27.9	27.8	264°55.6	22.1	Hadar	148°45.1	-60°26.9											
8	174°50.3	260°42.0	35.2	227°35.4	47.1	341°29.9	28.0	279°57.8	22.1	Menkent	148°05.2	-36°26.9											
9	189°52.8	275°41.2	• 35.2	242°35.9	• 46.6	356°31.9	• 28.2	294°59.9	• 22.2	Arcturus	145°54.0	19°05.9											
10	204°55.3	290°40.3	35.2	257°36.5	46.1	11°33.9	28.4	310°02.1	22.2	Rigel Kent.	139°49.2	-60°54.0											
11	219°57.7	305°39.5	35.2	272°37.1	45.6	26°36.0	28.5	325°04.3	22.2	Kochab	137°21.5	74°05.3											
12	235°00.2	320°38.6	\$25°35.1	287°37.6	\$20°45.1	41°38.0	\$04°28.7	340°06.4	\$21°22.3	Zuben ubi	137°03.2	-16°06.4											
13	250°02.7	335°37.8	35.1	302°38.2	44.6	56°40.0	28.9	355°08.6	22.3	Alphecca	126°09.5	26°39.7											
14	265°05.1	350°37.0	35.1	317°38.7	44.1	71°42.0	29.1	10°10.8	22.3	Antares	112°23.8	-26°27.9											
15	280°07.6	5°36.1	• 35.1	332°39.3	• 43.7	86°44.1	• 29.3	25°12.9	• 22.4	Atria	107°24.1	-69°03.3											
16	295°10.1	20°35.3	35.0	347°39.8	43.2	101°46.1	29.4	40°15.1	22.4	Sabik	102°10.2	-15°44.5											
17	310°12.5	35°34.5	35.0	2°40.4	42.7	116°48.1	29.6	55°17.3	22.4	Rasalhague	96°04.6	12°33.2											
18	325°15.0	50°33.6	\$25°35.0	17°41.0	\$20°42.2	131°50.1	\$04°29.8	70°19.4	\$21°22.5	Eltanin	90°45.5	51°29.6											
19	340°17.4	65°32.8	34.9	32°41.5	41.7	146°52.2	30.0	85°21.6	22.5	Kaus Aust.	83°41.1	-34°22.4											
20	355°19.9	80°31.9	34.9	47°42.1	41.2	161°54.2	30.2	100°23.8	22.5	Vega	80°37.7	38°48.4											
21	10°22.4	95°31.1	• 34.8	62°42.6	• 40.7	176°56.2	• 30.3	115°25.9	• 22.6	Nunki	75°55.8	-26°16.4											
22	25°24.8	110°30.3	34.8	77°43.2	40.2	191°58.2	30.5	130°28.1	22.6	Altair	62°06.2	8°55.1											
23	40°27.3	125°29.4	34.8	92°43.8	39.7	207°00.3	30.7	145°30.2	22.6	Peacock	53°15.9	-56°40.9											
Mer.pass.:20:19				v-0.8 d0.0 m-3.9				v0.6 d0.5 m0.5				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	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	55°29.8	140°28.6	\$25°34.7	107°44.3	\$20°39.2	222°02.3	\$04°30.9	160°32.4	\$21°22.7	Nov 14 Mon	SHA	Mer.pass											
1	70°32.2	155°27.8	34.7	122°44.9	38.8	237°04.3	31.0	175°34.6	22.7	Venus	87°37.4	14:36											
2	85°34.7	170°26.9	34.6	137°45.4	38.3	252°06.3	31.2	190°36.7	22.7	Mars	53°46.1	16:50											
3	100°37.2	185°26.1	• 34.6	152°46.0	• 37.8	267°08.4	• 31.4	205°38.9	• 22.8	Jupiter	166°53.7	09:17											
4	115°39.6	200°25.3	34.5	167°46.6	37.3	282°10.4	31.6	220°41.1	22.8	Saturn	105°17.0	13:23											
5	130°42.1	215°24.4	34.5	182°47.1	36.8	297°12.4	31.8	235°43.2	22.8	Nov 15 Tue	SHA	Mer.pass											
6	145°44.6	230°23.6	\$25°34.4	197°47.7	\$20°36.3	312°14.4	\$04°31.9	250°45.4	\$21°22.9	Venus	86°18.1	14:38											
7	160°47.0	245°22.7	34.4	212°48.3	35.8	327°16.5	32.1	265°47.6	22.9	Mars	53°00.3	16:49					</						

DUT1 = UT1-UTC = -0.3437 sec ΔT = TT-UT1 = +68.5277 sec

2016 November 14 to Nov. 16 UT

h		Sun			Moon										
Mon		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Twilight	Sunrise	Sunset	Twilight	Civil	Naut.
0	183°53.7	\$18°16.5	10°51.5	5.7'	N11°38.9	9.8'	61.5'		N 72°	07:01	08:36	11:11	12:18	14:52	16:27
1	198°53.6	17.2	25°16.2	5.6'	11°48.7	9.7'	61.5'		N 70°	06:51	08:13	09:52	13:36	15:15	16:38
2	213°53.6	17.8	39°40.8	5.6'	11°58.3	9.6'	61.5'		68°	06:42	07:55	09:15	14:14	15:33	16:46
3	228°53.5	18.5	54°05.4	5.5'	12°07.9	9.6'	61.5'		66°	06:35	07:41	08:49	14:40	15:48	16:54
4	243°53.4	19.1	68°29.9	5.5'	12°17.5	9.5'	61.5'		64°	06:28	07:29	08:29	15:00	16:00	17:00
5	258°53.3	19.7	82°54.3	5.4'	12°26.9	9.4'	61.5'		62°	06:23	07:19	08:12	15:16	16:10	17:06
6	273°53.2	\$18°20.4	97°18.7	5.4'	N12°36.2	9.3'	61.5'		60°	06:18	07:10	07:59	15:30	16:19	17:11
7	288°53.1	21.0	111°43.1	5.3'	12°45.5	9.2'	61.5'		N 58°	06:13	07:02	07:47	15:41	16:27	17:15
8	303°53.0	21.7	126°07.4	5.3'	12°54.7	9.1'	61.5'		56°	06:09	06:55	07:37	15:51	16:34	17:20
9	318°52.9	22.3	140°31.6	5.2'	13°03.7	9.0'	61.5'		54°	06:05	06:49	07:28	16:00	16:40	17:23
10	333°52.8	23.0	154°55.8	5.2'	13°12.7	8.9'	61.5'		52°	06:02	06:43	07:20	16:08	16:46	17:27
11	348°52.7	23.6	169°20.0	5.1'	13°21.6	8.8'	61.5'		50°	05:58	06:38	07:13	16:15	16:51	17:30
12	3°52.6	\$18°24.3	183°44.1	5.1'	N13°30.4	8.7'	61.5'		45°	05:51	06:26	06:58	16:31	17:03	17:38
13	18°52.5	24.9	198°08.2	5.0'	13°39.1	8.6'	61.5'		N 40°	05:44	06:16	06:45	16:43	17:12	17:45
14	33°52.4	25.5	212°32.2	5.0'	13°47.7	8.6'	61.5'		35°	05:37	06:08	06:35	16:54	17:21	17:52
15	48°52.3	26.2	226°56.2	5.0'	13°56.2	8.4'	61.5'		30°	05:31	06:00	06:25	17:04	17:29	17:58
16	63°52.2	26.8	241°20.1	4.9'	14°04.6	8.3'	61.5'		20°	05:19	05:46	06:09	17:20	17:43	18:10
17	78°52.1	27.5	255°44.0	4.9'	14°12.9	8.2'	61.5'		N 10°	05:07	05:33	05:55	17:35	17:57	18:22
18	93°52.0	\$18°28.1	270°07.8	4.8'	N14°21.1	8.1'	61.5'		0°	04:54	05:19	05:41	17:48	18:10	18:35
19	108°51.9	28.7	284°31.6	4.8'	14°29.2	8.0'	61.5'		S 10°	04:39	05:05	05:27	18:02	18:24	18:50
20	123°51.7	29.4	298°55.4	4.7'	14°37.2	7.9'	61.5'		20°	04:21	04:49	05:13	18:17	18:40	19:08
21	138°51.6	30.0	313°19.1	4.7'	14°45.0	7.8'	61.5'		30°	03:58	04:30	04:56	18:34	19:00	19:32
22	153°51.5	30.6	327°42.8	4.7'	14°52.8	7.7'	61.5'		35°	03:44	04:18	04:46	18:44	19:12	19:46
23	168°51.4	31.3	342°06.5	4.6'	15°00.5	7.6'	61.5'		40°	03:26	04:04	04:34	18:56	19:26	20:04
	SD.=16.2	d=−0.6			S.D.=16.8				45°	03:04	03:47	04:21	19:09	19:43	20:27
Tue		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Moonrise			Moonset		
0	183°51.3	\$18°31.9	356°30.1	4.6'	N15°08.0	7.5'	61.4'		N 72°	02:33	03:25	04:04	19:26	20:05	20:58
1	198°51.2	32.5	10°53.6	4.6'	15°15.4	7.4'	61.4'		52°	02:17	03:15	03:56	19:34	20:16	21:14
2	213°51.1	33.2	25°17.2	4.5'	15°22.8	7.3'	61.4'		54°	01:58	03:03	03:48	19:43	20:28	21:34
3	228°51.0	33.8	39°40.7	4.5'	15°30.0	7.1'	61.4'		56°	01:33	02:49	03:38	19:53	20:43	21:59
4	243°50.9	34.4	54°04.2	4.5'	15°37.1	7.0'	61.4'		58°	00:57	02:32	03:27	20:04	21:00	22:38
5	258°50.8	35.1	68°27.6	4.4'	15°44.0	6.9'	61.4'		S 60°	02:11	03:14	04:21	20:18	21:21	
6	273°50.7	\$18°35.7	82°51.0	4.4'	N15°50.9	6.8'	61.4'								
7	288°50.6	36.3	97°14.4	4.4'	15°57.6	6.7'	61.4'								
8	303°50.5	37.0	111°37.8	4.3'	16°04.2	6.6'	61.4'								
9	318°50.4	37.6	126°01.1	4.3'	16°10.7	6.4'	61.4'								
10	333°50.3	38.2	140°24.4	4.3'	16°17.1	6.3'	61.3'								
11	348°50.2	38.9	154°47.7	4.3'	16°23.3	6.2'	61.3'								
12	3°50.0	\$18°39.5	169°11.0	4.3'	N16°29.5	6.1'	61.3'								
13	18°49.9	40.1	183°34.2	4.2'	16°35.5	5.9'	61.3'								
14	33°49.8	40.7	197°57.4	4.2'	16°41.4	5.8'	61.3'								
15	48°49.7	41.4	212°20.6	4.2'	16°47.1	5.7'	61.3'								
16	63°49.6	42.0	226°43.8	4.2'	16°52.7	5.6'	61.3'								
17	78°49.5	42.6	241°07.0	4.2'	16°58.2	5.4'	61.2'								
18	93°49.4	\$18°43.2	255°30.2	4.2'	N17°03.6	5.3'	61.2'								
19	108°49.3	43.9	269°53.3	4.1'	17°08.8	5.2'	61.2'								
20	123°49.2	44.5	284°16.4	4.1'	17°13.9	5.0'	61.2'								
21	138°49.0	45.1	298°39.6	4.1'	17°18.9	4.9'	61.2'								
22	153°48.9	45.7	313°02.7	4.1'	17°23.8	4.8'	61.1'								
23	168°48.8	46.4	327°25.8	4.1'	17°28.5	4.7'	61.1'								
	SD.=16.2	d=−0.6			S.D.=16.7										
Wed		GHA	Dec	GHA	ν	Dec	d	HP	Lat.	Mon	Tue	Wed	Mon	Tue	Wed
0	183°48.7	\$18°47.0	341°48.9	4.1'	N17°33.1	4.5'	61.1'		N 72°	14:37	14:24	15:00	08:35	10:54	12:00
1	198°48.6	47.6	356°12.0	4.1'	17°37.5	4.4'	61.1'		70°	15:03	15:11	15:30	08:10	10:09	11:58
2	213°48.5	48.2	10°35.1	4.1'	17°41.8	4.3'	61.1'		68°	15:23	15:41	16:13	07:51	09:39	11:16
3	228°48.4	48.8	24°58.2	4.1'	17°46.0	4.1'	61.0'		66°	15:39	16:04	16:42	07:36	09:17	10:48
4	243°48.2	49.5	39°21.3	4.1'	17°50.1	4.0'	61.0'		64°	15:53	16:22	17:03	07:23	09:00	10:26
5	258°48.1	50.1	53°44.4	4.1'	17°54.0	3.9'	61.0'		62°	16:04	16:37	17:21	07:13	08:46	10:09
6	273°48.0	\$18°50.7	68°07.5	4.1'	N17°57.8	3.7'	61.0'		60°	16:14	16:49	17:36	07:04	08:33	09:54
7	288°47.9	51.3	82°30.6	4.1'	18°01.4	3.6'	60.9'		N 58°	16:22	17:00	17:48	06:56	08:23	09:42
8	303°47.8	51.9	96°53.7	4.1'	18°04.9	3.4'	60.9'		56°	16:29	17:10	17:59	06:50	08:14	09:31
9	318°47.7	52.5	111°16.9	4.1'	18°08.3	3.3'	60.9'		54°	16:36	17:18	18:09	06:44	08:06	09:22
10	333°47.5	53.2	125°40.0	4.1'	18°11.6	3.2'	60.9'		30°	16:48	17:32	18:25	06:33	07:52	09:06
11	348°47.4	53.8	140°03.1	4.2'	18°14.7	3.0'	60.8'		45°	16:59	17:47	18:41	06:23	07:38	08:50
12	3°47.3	\$18°54.4	154°26.3	4.2'	N18°17.6	2.9'	60.8'		N 40°	17:09	17:59	18:55	06:14	07:27	08:37
13	18°47.2	55.0	168°49.5	4.2'	18°20.5	2.8'	60.8'		20°	17:18	18:10	19:06	06:06	07:17	08:26
14	33°47.1	55.6	183°12.7	4.2'	18°23.2	2.6'	60.8'		30°	17:25	18:19	19:16	06:00	07:09	08:16
15	48°47.0	56.2	197°35.9	4.2'	18°25.7	2.5'	60.7'		45°	17:38	18:34	19:33	05:48	06:54	07:59
16	63°46.8	56.8	211°59.1	4.2'	18°28.2	2.4'	60.7'		S 10°	18:11	19:14	20:17	05:19	06:17	07:17
17	78°46.7	57.4	226°22.4	4.3'	18°30.5	2.2'	60.7'		20°	18:23	19:28	20:32	05:10	06:04	07:02
18	93°46.6	\$18°58.1	240°45.7	4.3'	N18°32.6	2.1'	60.6'		30°	18:36	19:44	20:50	04:58	05:50	06:45
19	108°46.5	58.7	255°09.0	4.3'	18°34.6	1.9'	60.6'		35°	18:44	19:54	21:00	04:52	05:41	06:35
20	123°46.4	59.3	269°32.3	4.3'	18°36.5	1.8'	60.6'		40°	18:53	20:04	21:11	04:44	05:32	06:24
21	138°46.2	18°59.9	283°55.7	4.4'	18°38.2	1.7'	60.6'		45°	19					

**November 17, 18, 19 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	56°28.9	140°08.6	\$25°33.3	107°57.8	\$20°27.3	222°50.9	\$04°35.1	161°24.3	\$21°23.5	Alpheratz	357°40.9	29°11.2					
1	71°31.4	155°07.7	33.3	122°58.4	26.8	237°53.0	35.3	176°26.5	23.5	Ankaa	353°13.2	-42°13.1					
2	86°33.8	170°06.9	33.2	137°58.9	26.3	252°55.0	35.5	191°28.7	23.5	Schedar	349°37.4	56°38.0					
3	101°36.3	185°06.1	.. 33.1	152°59.5	.. 25.8	267°57.0	.. 35.6	206°30.8	.. 23.6	Diphda	348°53.4	-17°53.7					
4	116°38.8	200°05.2	33.0	168°00.1	25.3	282°59.1	35.8	221°33.0	23.6	Achernar	335°24.7	-57°09.3					
5	131°41.2	215°04.4	33.0	183°00.6	24.8	298°01.1	36.0	236°35.2	23.6	Hamal	327°57.8	23°32.5					
6	146°43.7	230°03.6	\$25°32.9	198°01.2	\$20°24.3	313°03.1	\$04°36.2	251°37.3	\$21°23.7	Polaris	316°14.4	89°20.1					
7	161°46.2	245°02.8	32.8	213°01.8	23.8	328°05.1	36.4	266°39.5	23.7	Acamar	315°16.2	-40°14.4					
8	176°48.6	260°01.9	32.7	228°02.3	23.3	343°07.2	36.5	281°41.6	23.7	Menkar	314°12.3	4°09.2					
9	191°51.1	275°01.1	.. 32.6	243°02.9	.. 22.8	358°09.2	.. 36.7	296°43.8	.. 23.8	Mirfak	308°36.5	49°55.1					
10	206°53.6	290°00.3	32.5	258°03.4	22.3	13°11.2	36.9	311°46.0	23.8	Aldebaran	290°46.4	16°32.4					
11	221°56.0	304°59.4	32.5	273°04.0	21.8	28°13.3	37.1	326°48.1	23.8	Rigel	281°09.5	-8°11.1					
12	236°58.5	319°58.6	\$25°32.4	288°04.6	\$20°21.3	43°15.3	\$04°37.2	341°50.3	\$21°23.9	Capella	280°30.6	46°00.6					
13	252°00.9	334°57.8	32.3	303°05.1	20.8	58°17.3	37.4	356°52.5	23.9	Bellatrix	278°29.2	6°21.7					
14	267°03.4	349°56.9	32.2	318°05.7	20.3	73°19.3	37.6	11°54.6	23.9	Elnath	278°09.4	28°37.1					
15	282°05.9	4°56.1	.. 32.1	333°06.3	.. 19.8	88°21.4	.. 37.8	26°56.8	.. 24.0	Alnilam	275°43.7	-1°11.6					
16	297°08.3	19°55.3	32.0	348°06.8	19.3	103°23.4	37.9	41°58.9	24.0	Betelgeuse	270°58.5	7°24.4					
17	312°10.8	34°54.5	31.9	3°07.4	18.8	118°25.4	38.1	57°01.1	24.0	Canopus	263°54.7	-52°42.3					
18	327°13.3	49°53.6	\$25°31.8	18°08.0	\$20°18.3	133°27.5	\$04°38.3	72°03.3	\$21°24.1	Sirius	258°31.4	-16°44.4					
19	342°15.7	64°52.8	31.7	33°08.5	17.8	148°29.5	38.5	87°05.4	24.1	Adhara	255°10.5	-28°59.7					
20	357°18.2	79°52.0	31.6	48°09.1	17.3	163°31.5	38.6	102°07.6	24.1	Procyon	244°57.2	5°10.8					
21	12°20.7	94°51.1	.. 31.5	63°09.7	.. 16.8	178°33.6	.. 38.8	117°09.8	.. 24.2	Pollux	243°24.8	27°58.9					
22	27°23.1	109°50.3	31.4	78°10.2	16.2	193°35.6	39.0	132°11.9	24.2	Avior	234°16.7	-59°33.6					
23	42°25.6	124°49.5	31.3	93°10.8	15.7	208°37.6	39.2	147°14.1	24.2	Suhail	222°50.6	-43°29.9					
Mer.pass.:20:11			v-0.8 d0.1 m-4.0	v0.6 d0.5 m0.5	v2.0 d-0.2 m-1.6	v2.2 d-0.0 m0.5	Miaplacidus			221°38.9	-69°46.9						
Fri			GHA			GHA			GHA			GHA			Alphard	217°53.8	-8°43.9
Fri			GHA			Dec			GHA			GHA			Regulus	207°41.1	11°53.0
Fri			GHA			Dec			GHA			GHA			Dubhe	193°49.3	61°39.3
Fri			GHA			Dec			GHA			GHA			Denebola	182°31.5	14°28.7
Fri			GHA			Dec			GHA			GHA			Gienah	175°50.1	-17°37.9
Fri			GHA			Dec			GHA			GHA			Acrux	173°07.0	-63°11.2
Fri			GHA			Dec			GHA			GHA			Gacrux	171°58.6	-57°12.1
Fri			GHA			Dec			GHA			GHA			Alioth	166°19.2	55°52.0
Fri			GHA			Dec			GHA			GHA			Spica	158°29.1	-11°14.7
Fri			GHA			Dec			GHA			GHA			Alkaid	152°57.6	49°13.8
Fri			GHA			Dec			GHA			GHA			Hadar	148°45.1	-60°26.9
Fri			GHA			Dec			GHA			GHA			Menkent	148°05.2	-36°26.9
Fri			GHA			Dec			GHA			GHA			Arcturus	145°54.0	19°05.9
Fri			GHA			Dec			GHA			GHA			Rigel Kent.	139°49.1	-60°53.9
Fri			GHA			Dec			GHA			GHA			Kochab	137°21.5	74°05.3
Fri			GHA			Dec			GHA			GHA			Zuben' ubi	137°03.2	-16°06.4
Fri			GHA			Dec			GHA			GHA			Alphecca	126°09.5	26°39.7
Fri			GHA			Dec			GHA			GHA			Antares	112°23.8	-26°27.9
Fri			GHA			Dec			GHA			GHA			Atria	107°24.0	-69°03.3
Fri			GHA			Dec			GHA			GHA			Sabik	102°10.2	-15°44.5
Fri			GHA			Dec			GHA			GHA			Shaula	96°19.2	-37°06.7
Fri			GHA			Dec			GHA			GHA			Rasalhague	96°04.6	12°33.2
Fri			GHA			Dec			GHA			GHA			Eltanin	90°45.5	51°29.6
Fri			GHA			Dec			GHA			GHA			Kaus Aust.	83°41.1	-34°22.4
Fri			GHA			Dec			GHA			GHA			Vega	80°37.7	38°48.3
Fri			GHA			Dec			GHA			GHA			Nunki	75°55.8	-26°16.4
Fri			GHA			Dec			GHA			GHA			Altair	62°06.2	8°55.1
Fri			GHA			Dec			GHA			GHA			Peacock	53°16.0	-56°40.9
Fri			GHA			Dec			GHA			GHA			Deneb	49°30.0	45°20.8
Fri			GHA			Dec			GHA			GHA			Enif	33°44.9	9°57.4
Fri			GHA			Dec			GHA			GHA			Al Na'ir	27°40.9	-46°52.9
Fri			GHA			Dec			GHA			GHA			Fomalhaut	15°21.4	-29°32.1
Fri			GHA			Dec			GHA			GHA			Scheat	13°51.0	28°10.7
Fri			GHA			Dec			GHA			GHA			Markab	13°35.9	15°17.9

DUT1 = UT1-UTC = -0.3483 sec ΔT = TT-UT1 = +68.5323 sec

2016 November 17 to Nov. 19 UT

		Sun			Moon		
Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	183°45.9	S19°01.7	327°05.9	4.5'	N18°42.7	1.3'	60.5'
1	198°45.7	02.3	341°29.4	4.5'	18°43.9	1.1'	60.4'
2	213°45.6	02.9	355°52.9	4.5'	18°44.9	1.0'	60.4'
3	228°45.5	03.5	10°16.5	4.6'	18°45.9	0.9'	60.4'
4	243°45.4	04.1	24°40.1	4.6'	18°46.7	0.7'	60.3'
5	258°45.2	04.7	39°03.7	4.7'	18°47.3	0.6'	60.3'
6	273°45.1	S19°05.3	53°27.4	4.7'	N18°47.8	0.5'	60.3'
7	288°45.0	05.9	67°51.1	4.7'	18°48.2	0.3'	60.2'
8	303°44.9	06.6	82°14.8	4.8'	18°48.5	0.2'	60.2'
9	318°44.7	07.2	96°38.6	4.8'	18°48.6	0.1'	60.2'
10	333°44.6	07.8	111°02.5	4.9'	18°48.6	-0.1'	60.1'
11	348°44.5	08.4	125°26.4	4.9'	18°48.5	-0.2'	60.1'
12	3°44.4	S19°09.0	139°50.3	5.0'	N18°48.2	-0.3'	60.1'
13	18°44.2	09.6	154°14.3	5.0'	18°47.8	-0.5'	60.0'
14	33°44.1	10.2	168°38.4	5.1'	18°47.3	-0.6'	60.0'
15	48°44.0	08.8	183°02.5	5.1'	18°46.6	-0.7'	59.9'
16	63°43.9	11.3	197°26.7	5.2'	18°45.9	-0.9'	59.9'
17	78°43.7	11.9	211°50.9	5.2'	18°44.9	-1.0'	59.9'
18	93°43.6	S19°12.5	226°15.2	5.3'	N18°43.9	-1.1'	59.8'
19	108°43.5	13.1	240°39.5	5.4'	18°42.7	-1.2'	59.8'
20	123°43.3	13.7	255°03.9	5.4'	18°41.4	-1.4'	59.8'
21	138°43.2	14.3	269°28.3	5.5'	18°40.0	-1.5'	59.7'
22	153°43.1	14.9	283°52.8	5.5'	18°38.5	-1.6'	59.7'
23	168°42.9	15.5	298°17.4	5.6'	18°36.8	-1.7'	59.7'
	SD.=16.2	d=-0.6			S.D.=16.4		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Upper	Lower	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass	hh:mm	hh:mm	88-69%
17	15:03	14:57	11:45	02:17	14:47	
18	14:51	14:45	11:45	03:17	15:46	
19	14:38	14:31	11:45	04:14	16:41	

SD.=16.2	d=-0.6	S.D.=15.9
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**November 20, 21, 22 UT (Sun., Mon., Tue.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	59°26.3	139°09.2	\$25°24.8	108°38.7	\$19°50.4	225°17.3	\$04°47.7	164°00.0	\$21°25.8									Alpheratz	357°40.9	29°11.2			
1	74°28.8	154°08.4	24.6	123°39.2	49.9	240°19.3	47.8	179°02.1	25.9									Ankaa	353°13.2	-42°13.1			
2	89°31.3	169°07.6	24.5	138°39.8	49.4	255°21.3	48.0	194°04.3	25.9									Schedar	349°37.4	56°38.0			
3	104°33.7	184°06.8	.. 24.3	153°40.4	.. 48.9	270°23.4	.. 48.2	209°06.4	.. 25.9									Diphda	348°53.4	-17°53.7			
4	119°36.2	199°06.0	24.1	168°40.9	48.3	285°25.4	48.4	224°08.6	26.0									Achernar	335°24.7	-57°09.3			
5	134°38.7	214°05.2	23.9	183°41.5	47.8	300°27.4	48.5	239°10.7	26.0									Hamal	327°57.8	23°32.5			
6	149°41.1	229°04.4	\$25°23.8	198°42.1	\$19°47.3	315°29.5	\$04°48.7	254°12.9	\$21°26.0									Polaris	316°14.6	89°20.1			
7	164°43.6	244°03.5	23.6	213°42.7	46.8	330°31.5	48.9	269°15.1	26.1									Acamar	315°16.2	-40°14.4			
8	179°46.0	259°02.7	23.4	228°43.2	46.2	345°33.6	49.1	284°17.2	26.1									Menkar	314°12.3	4°09.2			
9	194°48.5	274°01.9	.. 23.3	243°43.8	.. 45.7	0°35.6	.. 49.2	299°19.4	.. 26.1									Mirfak	308°36.5	49°55.1			
10	209°51.0	289°01.1	23.1	258°44.4	45.2	15°37.6	49.4	314°21.5	26.2									Aldebaran	290°46.4	16°32.4			
11	224°53.4	304°00.3	22.9	273°44.9	44.6	30°39.7	49.6	329°23.7	26.2									Rigel	281°09.5	-8°11.1			
12	239°55.9	318°59.5	\$25°22.7	288°45.5	\$19°44.1	45°41.7	\$04°49.7	344°25.9	\$21°26.2									Capella	280°30.6	46°00.6			
13	254°58.4	333°58.7	22.5	303°46.1	43.6	60°43.7	49.9	359°28.0	26.3									Bellatrix	278°29.2	6°21.7			
14	270°00.8	348°57.9	22.4	318°46.7	43.1	75°45.8	50.1	14°30.2	26.3									Elnath	278°09.4	28°37.1			
15	285°03.3	3°57.1	.. 22.2	333°47.2	.. 42.5	90°47.8	.. 50.3	29°32.3	.. 26.3									Alnilam	275°43.7	-1°11.6			
16	300°05.8	18°56.2	22.0	348°47.8	42.0	105°49.9	50.4	44°34.5	26.3									Betelgeuse	270°58.5	7°24.4			
17	315°08.2	33°55.4	21.8	3°48.4	41.5	120°51.9	50.6	59°36.7	26.4									Canopus	263°54.7	-52°42.3			
18	330°10.7	48°54.6	\$25°21.6	18°49.0	\$19°40.9	135°53.9	\$04°50.8	74°38.8	\$21°26.4									Sirius	258°31.4	-16°44.4			
19	345°13.1	63°53.8	21.4	33°49.5	40.4	150°56.0	50.9	89°41.0	26.4									Adhara	255°10.4	-28°59.7			
20	0°15.6	78°53.0	21.2	48°50.1	39.9	165°58.0	51.1	104°43.1	26.5									Procyon	244°57.1	5°10.8			
21	15°18.1	93°52.2	.. 21.1	63°50.7	.. 39.3	181°00.0	.. 51.3	119°45.3	.. 26.5									Pollux	243°24.7	27°58.9			
22	30°20.5	108°51.4	20.9	78°51.3	38.8	196°02.1	51.5	134°47.4	26.5									Avior	234°16.7	-59°33.6			
23	45°23.0	123°50.6	20.7	93°51.8	38.3	211°04.1	51.6	149°49.6	26.6									Suhail	222°50.6	-43°29.9			
Mer.pass.:19:59				v-0.8 d0.2 m-4.0				v0.6 d0.5 m0.6				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	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	60°25.5	138°49.8	\$25°20.5	108°52.4	\$19°37.8	226°06.2	\$04°51.8	164°51.8	\$21°26.6									Denebola	182°31.5	14°28.7			
1	75°27.9	153°49.0	20.3	123°53.0	37.2	241°08.2	52.0	179°53.9	26.6									Gienah	175°50.1	-17°37.9			
2	90°30.4	168°48.2	20.1	138°53.5	36.7	256°10.2	52.1	194°56.1	26.7									Acrux	173°07.0	-63°11.2			
3	105°32.9	183°47.3	.. 19.9	153°54.1	.. 36.2	271°12.3	.. 52.3	209°58.2	.. 26.7									Gacrux	171°58.6	-57°12.1			
4	120°35.3	198°46.5	19.7	168°54.7	35.6	286°14.3	52.5	225°00.4	26.7									Alioth	166°19.2	55°52.0			
5	135°37.8	213°45.7	19.5	183°55.3	35.1	301°16.4	52.6	240°02.6	26.8									Spica	158°29.1	-11°14.7			
6	150°40.3	228°44.9	\$25°19.3	198°55.8	\$19°34.6	316°18.4	\$04°52.8	255°04.7	\$21°26.8									Alkaid	152°57.6	49°13.8			
7	165°42.7	243°44.1	19.1	213°56.4	34.0	331°20.4	53.0	270°06.9	26.8									Hadar	148°45.1	-60°26.9			
8	180°45.2	258°43.3	18.9	228°57.0	33.5	346°22.5	53.2	285°09.0	26.9									Menkent	148°05.2	-36°26.9			
9	195°47.6	273°42.5	.. 18.7	243°57.6	.. 32.9	1°24.5	.. 53.3	300°11.2	.. 26.9									Arcturus	145°54.0	19°05.8			
10	210°50.1	288°41.7	18.5	258°58.1	32.4	16°26.6	53.5	315°13.3	26.9									Rigel Kent.	139°49.1	-60°53.9			
11	225°52.6	303°40.9	18.3	273°58.7	31.9	31°28.6	53.7	330°15.5	27.0									Kochab	137°21.5	74°05.2			
12	240°55.0	318°40.1	\$25°18.1	288°59.3	\$19°31.3	46°30.6	\$04°53.8	345°17.7	\$21°27.0									Zuben ubi	137°03.2	-16°06.4			
13	255°57.5	333°39.3	17.9	303°59.9	30.8	61°32.7	54.0	0°19.8	27.0									Alphecca	126°09.5	26°39.7			
14	271°00.0	348°38.5	17.6	319°00.4	30.3	76°34.7	54.2	15°22.0	27.1									Antares	112°23.8	-26°27.9			
15	286°02.4	3°37.7	.. 17.4	334°01.0	.. 29.7	91°36.8	.. 54.4	30°24.1	.. 27.1									Atria	107°24.0	-69°03.3			
16	301°04.9	18°36.9	17.2	349°01.6	29.2	106°38.8	54.5	45°26.3	27.1									Sabik	102°10.2	-15°44.5			
17	316°07.4	33°36.1	17.0	4°02.2	28.7	121°40.8	54.7	60°28.5	27.2									Shaula	96°19.2	-37°06.7			
18	331°09.8	48°35.3	\$25°16.8	19°02.8	\$19°28.1	136°42.9	\$04°54.9	75°30.6	\$21°27.2									Rasalhague	96°04.6	12°33.2			
19	346°12.3	63°34.5	16.6	34°03.3	27.6	151°44.9	55.0	90°32.8	27.2									Eltanin	90°45.6	51°29.6			
20	1°14.8	78°33.7	16.3	49°03.9	27.0	166°47.0	55.2	105°34.9	27.3									Kaus Aust.	83°41.1	-34°22.4			
21	16°17.2	93°32.9	.. 16.1	64°04.5	.. 26.5	181°49.0	.. 55.4	120°37.1	.. 27.3									Vega	80°37.7	38°48.3			
22	31°19.7	108°32.1	15.9	79°05.1	26.0	196°51.0	55.5	135°39.2	27.3									Nunki	75°55.8	-26°16.4			
23	46°22.1	123°31.3	15.7	94°05.6	25.4	211°53.1	55.7	150°41.4	27.3									Altair	62°06.2	8°55.1			
Mer.pass.:19:59				v-0.8 d0.2 m-4.0				v0.6 d0.5 m0.6				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	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	61°24.6	138°30.5	\$25°15.5	109°06.2	\$19°24.9	226°55.1	\$04°55.9	165°43.6	\$21°27.4									Nov 20 Sun	SHA	Mer.pass			
1	76°27.1	153°29.7	15.2	124°06.8	24.3	241°57.2	56.0	180°45.7	27.4									Venus	79°42.9	14:44			
2	91°29.5	168°28.9	15.0	139°07.4	23.8	256°59.2	56.2	195°47.9	27.4								Mars	49°12.3	16:45				
3	106°32.0	183°28.1	.. 14.8	154°07.9	.. 23.3	272°01.3	.. 56.4	210°50.0	.. 27.5								Jupiter	165°50.9	08:58				
4	121°34.5	198°27.3	14.6	169°08.5	22.7	287°03.3	56.6	225°52.2	27.5								Saturn	104°33.6	13:02				
5	136°36.9	213°26.5	14.3	184°09.1	22.2	302°05.3	56.7	240°54.3	27.5														
6	151°39.4	228°25.7	\$25°14.1	199°09																			

DUT1 = UT1-UTC = -0.3529 sec ΔT = TT-UT1 = +68.5369 sec

2016 November 20 to Nov. 22 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	ν	Dec	d	HP
0	183°36.1	S19°43.9		285°54.2	9.5'	N15°01.8	-6.6'	57.7'
1	198°35.9	44.4		300°22.7	9.6'	14°55.1	-6.7'	57.7'
2	213°35.8	45.0		314°51.3	9.6'	14°48.3	-6.8'	57.6'
3	228°35.6	.. 45.6		329°20.0	9.7'	14°41.5	-6.9'	57.6'
4	243°35.5	46.1		343°48.7	9.8'	14°34.6	-6.9'	57.5'
5	258°35.3	46.7		358°17.6	9.9'	14°27.7	-7.0'	57.5'
6	273°35.2	S19°47.2		12°46.5	10.0'	N14°20.6	-7.1'	57.5'
7	288°35.0	47.8		27°15.5	10.1'	14°13.5	-7.1'	57.4'
8	303°34.9	48.4		41°44.6	10.1'	14°06.4	-7.2'	57.4'
9	318°34.7	.. 48.9		56°13.8	10.2'	13°59.1	-7.3'	57.3'
10	333°34.6	49.5		70°43.1	10.3'	13°51.8	-7.3'	57.3'
11	348°34.4	50.0		85°12.4	10.4'	13°44.5	-7.4'	57.3'
12	3°34.3	S19°50.6		99°41.8	10.5'	N13°37.0	-7.5'	57.2'
13	18°34.1	51.1		114°11.3	10.5'	13°29.5	-7.5'	57.2'
14	33°34.0	51.7		128°40.9	10.6'	13°22.0	-7.6'	57.1'
15	48°33.8	.. 52.2		143°10.6	10.7'	13°14.4	-7.6'	57.1'
16	63°33.7	52.8		157°40.3	10.8'	13°06.7	-7.7'	57.1'
17	78°33.5	53.4		172°10.1	10.9'	12°59.0	-7.8'	57.0'
18	93°33.3	S19°53.9		186°40.0	10.9'	N12°51.2	-7.8'	57.0'
19	108°33.2	54.5		201°10.0	11.0'	12°43.4	-7.9'	57.0'
20	123°33.0	55.0		215°40.0	11.1'	12°35.5	-7.9'	56.9'
21	138°32.9	.. 55.6		230°10.1	11.2'	12°27.5	-8.0'	56.9'
22	153°32.7	56.1		244°40.3	11.2'	12°19.5	-8.0'	56.9'
23	168°32.6	56.7		259°10.6	11.3'	12°11.4	-8.1'	56.8'
	SD.=16.2	d=-0.6				S.D.=15.6		

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

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

Day	Sun		Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Age	
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm	
20	14:24	14:17	11:46	05:07	17:32
21	14:10	14:02	11:46	05:57	18:21
22	13:54	13:46	11:46	06:44	19:06



SD.=16.2	d=0.5	S.D.=15.2
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**November 23, 24, 25 UT (Wed., Thu., Fri.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	62°23.7	138°11.4	\$25°09.7	109°20.1	\$19°11.8	227°44.2	\$04°59.9	166°35.3	\$21°28.1	Alpheratz	357°40.9	29°11.2											
1	77°26.2	153°10.6	09.5	124°20.7	11.3	242°46.2	05°00.1	181°37.5	28.2	Ankaa	353°13.3	-42°13.1											
2	92°28.7	168°09.8	09.2	139°21.3	10.7	257°48.3	00.3	196°39.6	28.2	Schedar	349°37.4	56°38.0											
3	107°31.1	183°09.0	.. 09.0	154°21.8	.. 10.2	272°50.3	.. 00.4	211°41.8	.. 28.2	Diphda	348°53.4	-17°53.8											
4	122°33.6	198°08.2	08.7	169°22.4	09.6	287°52.4	00.6	226°43.9	28.3	Achernar	335°24.7	-57°09.3											
5	137°36.1	213°07.4	08.4	184°23.0	09.1	302°54.4	00.8	241°46.1	28.3	Hamal	327°57.8	23°32.5											
6	152°38.5	228°06.6	\$25°08.2	199°23.6	\$19°08.5	317°56.4	\$05°00.9	256°48.3	\$21°28.3	Polaris	316°14.8	89°20.1											
7	167°41.0	243°05.9	07.9	214°24.2	08.0	332°58.5	01.1	271°50.4	28.4	Acamar	315°16.2	-40°14.4											
8	182°43.5	258°05.1	07.6	229°24.7	07.4	348°00.5	01.3	286°52.6	28.4	Menkar	314°12.3	4°09.2											
9	197°45.9	273°04.3	.. 07.4	244°25.3	.. 06.9	3°02.6	.. 01.4	301°54.7	.. 28.4	Mirfak	308°36.5	49°55.2											
10	212°48.4	288°03.5	07.1	259°25.9	06.3	18°04.6	01.6	316°56.9	28.5	Aldebaran	290°46.4	16°32.4											
11	227°50.9	303°02.7	06.9	274°26.5	05.8	33°06.7	01.8	331°59.0	28.5	Rigel	281°09.5	-8°11.1											
12	242°53.3	318°01.9	\$25°06.6	289°27.1	\$19°05.2	48°08.7	\$05°01.9	347°01.2	\$21°28.5	Capella	280°30.6	46°00.6											
13	257°55.8	333°01.1	06.3	304°27.6	04.7	63°10.8	02.1	2°03.3	28.6	Bellatrix	278°29.2	6°21.7											
14	272°58.2	348°00.3	06.0	319°28.2	04.1	78°12.8	02.3	17°05.5	28.6	Elnath	278°09.3	28°37.1											
15	288°00.7	2°59.6	.. 05.8	334°28.8	.. 03.6	93°14.9	.. 02.4	32°07.7	.. 28.6	Alnilam	275°43.7	-1°11.6											
16	303°03.2	17°58.8	05.5	349°29.4	03.0	108°16.9	02.6	47°09.8	28.7	Betelgeuse	270°58.5	7°24.4											
17	318°05.6	32°58.0	05.2	4°30.0	02.5	123°19.0	02.8	62°12.0	28.7	Canopus	263°54.6	-52°42.3											
18	333°08.1	47°57.2	\$25°04.9	19°30.6	\$19°01.9	138°21.0	\$05°02.9	77°14.1	\$21°28.7	Sirius	258°31.4	-16°44.4											
19	348°10.6	62°56.4	04.7	34°31.1	01.4	153°23.0	03.1	92°16.3	28.7	Adhara	255°10.4	-28°59.7											
20	3°13.0	77°55.6	04.4	49°31.7	00.8	168°25.1	03.3	107°18.4	28.8	Procyon	244°57.1	5°10.8											
21	18°15.5	92°54.8	.. 04.1	64°32.3	19°00.2	183°27.1	.. 03.4	122°20.6	.. 28.8	Pollux	243°24.7	27°58.9											
22	33°18.0	107°54.1	03.8	79°32.9	18°59.7	198°29.2	03.6	137°22.8	28.8	Avior	234°16.7	-59°33.7											
23	48°20.4	122°53.3	03.6	94°33.5	59.1	213°31.2	03.8	152°24.9	28.9	Suhail	222°50.6	-43°29.9											
Mer.pass.:19:47				v-0.8 d0.3 m-4.0				v0.6 d0.5 m0.6				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	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	63°22.9	137°52.5	\$25°03.3	109°34.1	\$18°58.6	228°33.3	\$05°03.9	167°27.1	\$21°28.9	Denebola	182°31.5	14°28.7											
1	78°25.3	152°51.7	03.0	124°34.6	58.0	243°35.3	04.1	182°29.2	28.9	Gienah	175°50.1	-17°37.9											
2	93°27.8	167°50.9	02.7	139°35.2	57.5	258°37.4	04.3	197°31.4	29.0	Acrux	173°07.0	-63°11.2											
3	108°30.3	182°50.2	.. 02.4	154°35.8	.. 56.9	273°39.4	.. 04.4	212°33.5	.. 29.0	Gacrux	171°58.5	-57°12.1											
4	123°32.7	197°49.4	02.1	169°36.4	56.4	288°41.5	04.6	227°35.7	29.0	Alioth	166°19.2	55°52.0											
5	138°35.2	212°48.6	01.8	184°37.0	55.8	303°43.5	04.8	242°37.8	29.1	Spica	158°29.1	-11°14.7											
6	153°37.7	227°47.8	\$25°01.5	199°37.6	\$18°55.2	318°45.6	\$05°04.9	257°40.0	\$21°29.1	Alkaid	152°57.6	49°13.8											
7	168°40.1	242°47.0	01.3	214°38.1	54.7	333°47.6	05.1	272°42.1	29.1	Hadar	148°45.1	-60°26.9											
8	183°42.6	257°46.3	01.0	229°38.7	54.1	348°49.7	05.3	287°44.3	29.2	Menkent	148°05.2	-36°26.9											
9	198°45.1	272°45.5	.. 00.7	244°39.3	.. 53.6	3°51.7	.. 05.4	302°46.5	.. 29.2	Arcturus	145°54.0	19°05.8											
10	213°47.5	287°44.7	00.4	259°39.9	53.0	18°53.8	05.6	317°48.6	29.2	Rigel Kent.	139°49.1	-60°53.9											
11	228°50.0	302°43.9	25°00.1	274°40.5	52.5	33°55.8	05.8	332°50.8	29.3	Kochab	137°21.4	74°05.2											
12	243°52.5	317°43.1	\$24°59.8	289°41.1	\$18°51.9	48°57.9	\$05°05.9	347°52.9	\$21°29.3	Zuben ubi	137°03.2	-16°06.4											
13	258°54.9	332°42.4	59.5	304°41.6	51.3	63°59.9	06.1	2°55.1	29.3	Alphecca	126°09.5	26°39.7											
14	273°57.4	347°41.6	59.2	319°42.2	50.8	79°02.0	06.3	17°57.2	29.3	Antares	112°23.8	-26°27.9											
15	288°59.8	2°40.8	.. 58.9	334°42.8	.. 50.2	94°04.0	.. 06.4	32°59.4	.. 29.4	Atria	107°24.1	-69°03.2											
16	304°02.3	17°40.0	58.6	349°43.4	49.7	109°06.1	06.6	48°01.5	29.4	Sabik	102°10.2	-15°44.5											
17	319°04.8	32°39.3	58.3	4°44.0	49.1	124°08.1	06.8	63°03.7	29.4	Shaula	96°19.2	-37°06.7											
18	334°07.2	47°38.5	\$24°58.0	19°44.6	\$18°48.5	139°10.2	\$05°06.9	78°05.9	\$21°29.5	Rasalhague	96°04.7	12°33.2											
19	349°09.7	62°37.7	57.7	34°45.2	48.0	154°12.2	07.1	93°08.0	29.5	Eltanin	90°45.6	51°29.5											
20	4°12.2	77°36.9	57.4	49°45.7	47.4	169°14.3	07.3	108°10.2	29.5	Kaus Aust.	83°41.1	-34°22.4											
21	19°14.6	92°36.2	.. 57.0	64°46.3	.. 48.8	184°16.3	.. 07.4	123°12.3	.. 29.6	Vega	80°37.8	38°48.3											
22	34°17.1	107°35.4	56.7	79°46.9	46.3	199°18.4	07.6	138°14.5	29.6	Nunki	75°55.8	-26°16.4											
23	49°19.6	122°34.6	56.4	94°47.5	45.7	214°20.4	07.7	153°16.6	29.6	Altair	62°06.2	8°55.0											
Mer.pass.:19:43				v-0.8 d0.3 m-4.0				v0.6 d0.6 m0.6				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	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	64°22.0	137°33.8	\$24°56.1	109°48.1	\$18°45.2	229°22.5	\$05°07.9	168°18.8	\$21°29.7	Nov 23 Wed	75°47.6	14:48											
1	79°24.5	152°33.1	55.8	124°48.7	44.6	244°24.5	08.1	183°20.9	29.7	Venus	75°56.4	16:42											
2	94°26.9	167°32.3	55.5	139°49.3	44.0	259°26.6	08.2	198°23.1	29.7	Mars	165°20.4	08:48											
3	109°29.4	182°31.5	.. 55.2	154°49.8	.. 43.5	274°28.6	.. 08.4	213°25.2	.. 29.8	Jupiter	104°11.6	12:52											
4	124°31.9	197°30.8	54.9	169°50.4	42.9	289°30.7	08.6	228°27.4	29.8	Saturn	104°04.2	12:48											
5	139°34.3	212°30.0	54.5	184°51.0	42.3	304°32.7	08.7	243°29.6	29.8	Nov 24 Thu	74°29.6	14:49											
6	154°36.8	227°29.2	\$24°54.2	199°51.6	\$18°41.8	319°34.8	\$05°08.9	258°31.7	\$21°29.8	Venus	74°11.8	14:49											
7	169°39.3	242°28.5	53.9	214°52.2	41.2	334°36.8	09.1	273°33.9	29.9	Mars	46°11.2	16:41</td											

DUT1 = UT1-UTC = -0.3575 sec ΔT = TT-UT1 = +68.5415 sec

2016 November 23 to Nov. 25 UT

		Sun			Moon		
Wed	GHA	Dec	GHA	ν	Dec	d	HP
0	183°24.4	S20°22.8	251°11.9	14.1'	N04°50.3	-9.6'	55.3'
1	198°24.3	23.3	265°45.1	14.2'	04°40.7	-9.6'	55.3'
2	213°24.1	23.8	280°18.3	14.2'	04°31.0	-9.6'	55.2'
3	228°23.9	.. 24.3	294°51.5	14.2'	04°21.4	-9.6'	55.2'
4	243°23.7	24.9	309°24.8	14.3'	04°11.7	-9.7'	55.2'
5	258°23.6	25.4	323°58.1	14.3'	04°02.1	-9.7'	55.2'
6	273°23.4	S20°25.9	338°31.4	14.4'	N03°52.4	-9.7'	55.1'
7	288°23.2	26.4	353°04.8	14.4'	03°42.7	-9.7'	55.1'
8	303°23.0	26.9	7°38.2	14.4'	03°33.1	-9.7'	55.1'
9	318°22.9	.. 27.4	22°11.6	14.5'	03°23.4	-9.7'	55.1'
10	333°22.7	27.9	36°45.1	14.5'	03°13.7	-9.7'	55.1'
11	348°22.5	28.5	51°18.6	14.5'	03°04.0	-9.7'	55.0'
12	3°22.3	S20°29.0	65°52.1	14.5'	N02°54.2	-9.7'	55.0'
13	18°22.1	29.5	80°25.7	14.6'	02°44.5	-9.7'	55.0'
14	33°22.0	30.0	94°59.2	14.6'	02°34.8	-9.7'	55.0'
15	48°21.8	.. 30.5	109°32.9	14.6'	02°25.1	-9.7'	54.9'
16	63°21.6	31.0	124°06.5	14.7'	02°15.3	-9.7'	54.9'
17	78°21.4	31.5	138°40.2	14.7'	02°05.6	-9.7'	54.9'
18	93°21.2	S20°32.0	153°13.9	14.7'	N01°55.9	-9.7'	54.9'
19	108°21.1	32.5	167°47.6	14.7'	01°46.1	-9.7'	54.9'
20	123°20.9	33.0	182°21.3	14.8'	01°36.4	-9.7'	54.8'
21	138°20.7	.. 33.5	196°55.1	14.8'	01°26.7	-9.7'	54.8'
22	153°20.5	34.0	211°28.9	14.8'	01°16.9	-9.7'	54.8'
23	168°20.3	34.5	226°02.7	14.8'	01°07.2	-9.7'	54.8'
	SD.=16.2	d=-0.5			S.D.=15.0		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
23	13:38	13:29	11:47	19:50
24	13:21	13:12	11:47	20:33
25	13:03	12:53	11:47	21:16



SD.=16.2	d=-0.5	S.D.=14.8
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**November 26, 27, 28 UT (Sat., Sun., Mon.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	65°21.2	137°15.4	\$24°48.3	110°02.2	\$18°31.6	230°11.7	\$05°11.9	169°10.5	\$21°30.4	Alpheratz	357°40.9	29°11.2											
1	80°23.6	152°14.7	47.9	125°02.8	31.0	245°13.8	12.0	184°12.6	30.4	Ankaa	353°13.3	-42°13.1											
2	95°26.1	167°13.9	47.6	140°03.4	30.4	260°15.8	12.2	199°14.8	30.5	Schedar	349°37.4	56°38.0											
3	110°28.6	182°13.2	• 47.2	155°03.9	• 29.8	275°17.9	• 12.3	214°16.9	• 30.5	Diphda	348°53.4	-17°53.8											
4	125°31.0	197°12.4	46.9	170°04.5	29.3	290°19.9	12.5	229°19.1	30.5	Achernar	335°24.7	-57°09.4											
5	140°33.5	212°11.6	46.5	185°05.1	28.7	305°22.0	12.7	244°21.2	30.6	Hamal	327°57.8	23°32.5											
6	155°35.9	227°10.9	\$24°46.2	200°05.7	\$18°28.1	320°24.0	\$05°12.8	259°23.4	\$21°30.6	Polaris	316°15.1	89°20.1											
7	170°38.4	242°10.1	45.8	215°06.3	27.6	335°26.1	13.0	274°25.6	30.6	Acamar	315°16.2	-40°14.4											
8	185°40.9	257°09.4	45.5	230°06.9	27.0	350°28.2	13.2	289°27.7	30.7	Menkar	314°12.3	4°09.2											
9	200°43.3	272°08.6	• 45.1	245°07.5	• 26.4	5°30.2	• 13.3	304°29.9	• 30.7	Mirfak	308°36.5	49°55.2											
10	215°45.8	287°07.8	44.8	260°08.1	25.8	20°32.3	13.5	319°32.0	30.7	Aldebaran	290°46.4	16°32.4											
11	230°48.3	302°07.1	44.4	275°08.7	25.3	35°34.3	13.6	334°34.2	30.8	Rigel	281°09.5	-8°11.1											
12	245°50.7	317°06.3	\$24°44.1	290°09.3	\$18°24.7	50°36.4	\$05°13.8	349°36.3	\$21°30.8	Capella	280°30.5	46°00.6											
13	260°53.2	332°05.6	43.7	305°09.8	24.1	65°38.4	14.0	4°38.5	30.8	Bellatrix	278°29.2	6°21.7											
14	275°55.7	347°04.8	43.4	320°10.4	23.5	80°40.5	14.1	19°40.6	30.8	Elnath	278°09.3	28°37.1											
15	290°58.1	2°04.1	• 43.0	335°11.0	• 23.0	95°42.5	• 14.3	34°42.8	• 30.9	Alnilam	275°43.7	-1°11.6											
16	305°00.6	17°03.3	42.6	350°11.6	22.4	110°44.6	14.5	49°44.9	30.9	Betelgeuse	270°58.5	7°24.4											
17	321°03.0	32°02.6	42.3	5°12.2	21.8	125°46.7	14.6	64°47.1	30.9	Canopus	263°54.6	-52°42.3											
18	336°05.5	47°01.8	\$24°41.9	20°12.8	\$18°21.2	140°48.7	\$05°14.8	79°49.2	\$21°31.0	Sirius	258°31.4	-16°44.5											
19	351°08.0	62°01.1	41.5	35°13.4	20.7	155°50.8	14.9	94°51.4	31.0	Adhara	255°10.4	-28°59.7											
20	6°10.4	77°00.3	41.2	50°14.0	20.1	170°52.8	15.1	109°53.5	31.0	Procyon	244°57.1	5°10.7											
21	21°12.9	91°59.6	• 40.8	65°14.6	• 19.5	185°54.9	• 15.3	124°55.7	• 31.1	Pollux	243°24.7	27°58.9											
22	36°15.4	106°58.8	40.4	80°15.2	18.9	200°56.9	15.4	139°57.9	31.1	Avior	234°16.6	-59°33.7											
23	51°17.8	121°58.0	40.1	95°15.8	18.4	215°59.0	15.6	155°00.0	31.1	Suhail	222°50.5	-43°29.9											
Mer.pass.:19:35				v-0.8 d0.3 m-4.0				v0.6 d0.6 m0.6				v2.1 d-0.2 m-1.6				v2.2 d-0.0 m0.5							
Sun				GHA				GHA				GHA				GHA							
0	66°20.3	136°57.3	\$24°39.7	110°16.4	\$18°17.8	231°01.1	\$05°15.8	170°02.2	\$21°31.2	Denebola	182°31.5	14°28.7											
1	81°22.8	151°56.5	39.3	125°16.9	17.2	246°03.1	15.9	185°04.3	31.2	Gienah	175°50.1	-17°37.9											
2	96°25.2	166°55.8	39.0	140°17.5	16.6	261°05.2	16.1	200°06.5	31.2	Acrux	173°06.9	-63°11.2											
3	111°27.7	181°55.0	• 38.6	155°18.1	• 16.1	276°07.2	• 16.2	215°08.6	• 31.2	Gacrux	171°58.5	-57°12.1											
4	126°30.2	196°54.3	38.2	170°18.7	15.5	291°09.3	16.4	230°10.8	31.3	Alioth	166°19.1	55°52.0											
5	141°32.6	211°53.6	37.8	185°19.3	14.9	306°11.3	16.6	245°12.9	31.3	Spica	158°29.0	-11°14.7											
6	156°35.1	226°52.8	\$24°37.5	200°19.9	\$18°14.3	321°13.4	\$05°16.7	260°15.1	\$21°31.3	Alkaid	152°57.6	49°13.7											
7	171°37.5	241°52.1	37.1	215°20.5	13.7	336°15.5	16.9	275°17.2	31.4	Hadar	148°45.0	-60°26.9											
8	186°40.0	256°51.3	36.7	230°21.1	13.2	351°17.5	17.0	290°19.4	31.4	Menkent	148°05.1	-36°26.9											
9	201°42.5	271°50.6	• 36.3	245°21.7	• 12.6	6°19.6	• 17.2	305°21.5	• 31.4	Arcturus	145°54.0	19°05.8											
10	216°44.9	286°49.8	35.9	260°22.3	12.0	21°21.6	17.4	320°23.7	31.5	Rigel Kent.	139°49.1	-60°53.9											
11	231°47.4	301°49.1	35.6	275°22.9	11.4	36°23.7	17.5	335°25.8	31.5	Kochab	137°21.4	74°05.2											
12	246°49.9	316°48.3	\$24°35.2	290°23.5	\$18°10.8	51°25.8	\$05°17.7	350°28.0	\$21°31.5	Zuben ubi	137°03.2	-16°06.4											
13	261°52.3	331°47.6	34.8	305°24.1	10.3	66°27.8	17.8	5°30.1	31.6	Alphecca	126°09.5	26°39.7											
14	276°54.8	346°46.8	34.4	320°24.7	09.7	81°29.9	18.0	20°32.3	31.6	Antares	112°23.8	-26°27.9											
15	291°57.3	1°46.1	• 34.0	335°25.3	• 09.1	96°31.9	• 18.2	35°34.4	• 31.6	Atria	107°24.0	-69°03.2											
16	306°59.7	16°45.4	33.6	350°25.8	08.5	111°34.0	18.3	50°36.6	31.6	Sabik	102°10.2	-15°44.5											
17	322°02.2	31°44.6	33.2	5°26.4	07.9	126°36.0	18.5	65°38.8	31.7	Rasalhague	96°19.2	-37°06.7											
18	337°04.7	46°43.9	\$24°32.8	20°27.0	\$18°07.3	141°38.1	\$05°18.7	80°40.9	\$21°31.7	Eltanin	90°45.6	51°29.5											
19	352°07.1	61°43.1	32.4	35°27.6	06.8	156°40.2	18.8	95°43.1	31.7	Kaus Aust.	83°41.1	-34°22.4											
20	7°09.6	76°42.4	32.1	50°28.2	06.2	171°42.2	19.0	110°45.2	31.8	Vega	80°37.8	38°48.3											
21	22°12.0	91°41.7	• 31.7	65°28.8	• 05.6	186°44.3	• 19.1	125°47.4	• 31.8	Nunki	75°55.8	-26°16.4											
22	37°14.5	106°40.9	31.3	80°29.4	05.0	201°46.3	19.3	140°49.5	31.8	Altair	62°06.2	8°55.0											
23	52°17.0	121°40.2	30.9	95°30.0	04.4	216°48.4	19.5	155°51.7	31.9	Peacock	53°16.0	-56°40.9											
Mer.pass.:19:31				v-0.8 d0.4 m-4.0				v0.6 d0.6 m0.6				v2.1 d-0.2 m-1.6				v2.2 d-0.0 m0.5							
Mon				GHA				GHA				GHA				GHA							
0	67°19.4	136°39.4	\$24°30.5	110°30.6	\$18°03.8	231°50.5	\$05°19.6	170°53.8	\$21°31.9	Nov 26 Sat	SHA	Mer.pass											
1	82°21.9	151°38.7	30.1	125°31.2	03.3	246°52.5	19.8	185°56.0	31.9	Venus	71°54.3	14:52											
2	97°24.4	166°38.0	29.7	140°31.8	02.7	261°54.6	19.9	200°58.1	32.0	Mars	44°41.0	16:39											
3	112°26.8	181°37.2	• 29.3	155°32.4	• 02.1	276°56.7	• 20.1	216°00.3	• 32.0	Jupiter	164°50.6	08:38											
4	127°29.3	196°36.5	28.9	170°33.0	01.5	291°58.7	20.3	231°02.4	32.0	Saturn	103°49.3	12:41											
5	142°31.8	211°35.7	28.5	185°33.6	00.9	307°00.8	20.4	246°04.6	32.0	Nov 27 Sun	SHA	Mer.pass											
6	157°34.2	226°35.0	\$24°28.1	200°34.2	\$18°00.3	322°02.8	\$05°20.6	261°06.7	\$21°32.1	Venus	70°37.0	14:53											

DUT1 = UT1-UTC = -0.3621 sec  $\Delta T$  = TT-UT1 = +68.5461 sec

2016 November 26 to Nov. 28 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	183°11.0	S20°58.4	219°51.9	15.0'	S06°37.4	-9.0'	54.1'
1	198°10.8	58.8	234°25.9	15.0'	06°46.3	-9.0'	54.1'
2	213°10.6	59.3	248°59.9	15.0'	06°55.3	-8.9'	54.1'
3	228°10.4	20°59.8	263°34.0	15.0'	07°04.2	-8.9'	54.1'
4	243°10.2	21°00.2	278°08.0	15.0'	07°13.1	-8.9'	54.1'
5	258°10.0	00.7	292°41.9	15.0'	07°22.0	-8.9'	54.1'
6	273°09.8	S21°01.2	307°15.9	15.0'	S07°30.8	-8.8'	54.1'
7	288°09.6	01.6	321°49.9	14.9'	07°39.6	-8.8'	54.1'
8	303°09.4	02.1	336°23.8	14.9'	07°48.4	-8.8'	54.0'
9	318°09.2	.. 02.6	350°57.7	14.9'	07°57.1	-8.7'	54.0'
10	333°09.0	03.0	5°31.6	14.9'	08°05.8	-8.7'	54.0'
11	348°08.8	03.5	20°05.5	14.9'	08°14.5	-8.7'	54.0'
12	3°08.6	S21°03.9	34°39.4	14.9'	S08°23.2	-8.6'	54.0'
13	18°08.4	04.4	49°13.3	14.8'	08°31.8	-8.6'	54.0'
14	33°08.2	04.9	63°47.1	14.8'	08°40.3	-8.5'	54.0'
15	48°08.0	.. 05.3	78°20.9	14.8'	08°48.9	-8.5'	54.0'
16	63°07.8	05.8	92°54.7	14.8'	08°57.4	-8.5'	54.0'
17	78°07.6	06.2	107°28.5	14.8'	09°05.8	-8.4'	54.0'
18	93°07.4	S21°06.7	122°02.3	14.8'	S09°14.2	-8.4'	54.0'
19	108°07.2	07.2	136°36.0	14.7'	09°22.6	-8.4'	54.0'
20	123°07.0	07.6	151°09.7	14.7'	09°30.9	-8.3'	54.0'
21	138°06.8	.. 08.1	165°43.4	14.7'	09°39.3	-8.3'	54.0'
22	153°06.5	08.5	180°17.1	14.7'	09°47.5	-8.2'	54.0'
23	168°06.3	09.0	194°50.8	14.6'	09°55.7	-8.2'	54.0'
	SD.=16.2	d=-0.5			S.D.=14.7		

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

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

Day	Sun			Moon		
	Eqn.of Time 00 <sup>h</sup> mm:ss	Mer. Pass. 12 <sup>h</sup> mm:ss	Mer. Pass. hh:mm	Mer.Pass. Upper hh:mm	Mer.Pass. Lower hh:mm	Age 27-29 8-1%
26	12:44	12:34	11:47	09:37	21:59	
27	12:25	12:15	11:48	10:21	22:43	
28	12:04	11:54	11:48	11:05	23:28	

SD.=16.2	d=-0.4	S.D.=14.7
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**November 29, 30, 01 UT (Tue., Wed., Thu.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	68°18.6	136°21.9	\$24°20.6	110°44.9	\$17°49.7	232°40.0	\$05°23.4	171°45.5	\$21°32.6									Alpheratz	357°40.9	29°11.2			
1	83°21.0	151°21.1	20.1	125°45.5	49.1	247°42.0	23.6	186°47.6	32.7									Ankaa	353°13.3	-42°13.1			
2	98°23.5	166°20.4	19.7	140°46.1	48.5	262°44.1	23.8	201°49.8	32.7								Schedar	349°37.4	56°38.0				
3	113°26.0	181°19.7	19.3	155°46.7	47.9	277°46.2	23.9	216°51.9	32.7								Diphda	348°53.4	-17°53.8				
4	128°28.4	196°19.0	18.8	170°47.3	47.4	292°48.2	24.1	231°54.1	32.7								Achernar	335°24.7	-57°09.4				
5	143°30.9	211°18.2	18.4	185°47.9	46.8	307°50.3	24.2	246°56.2	32.8								Hamal	327°57.8	23°32.5				
6	158°33.4	226°17.5	\$24°18.0	200°48.5	\$17°46.2	322°52.3	\$05°24.4	261°58.4	\$21°32.8								Polaris	316°15.3	89°20.2				
7	173°35.8	241°16.8	17.5	215°49.1	45.6	337°54.4	24.5	277°00.5	32.8								Acamar	315°16.2	-40°14.5				
8	188°38.3	256°16.1	17.1	230°49.7	45.0	352°56.5	24.7	292°02.7	32.9								Menkar	314°12.3	4°09.2				
9	203°40.8	271°15.4	16.7	245°50.3	44.4	7°58.5	24.9	307°04.8	32.9								Mirfak	308°36.5	49°55.2				
10	218°43.2	286°14.6	16.2	260°50.9	43.8	23°00.6	25.0	322°07.0	32.9								Aldebaran	290°46.4	16°32.4				
11	233°45.7	301°13.9	15.8	275°51.5	43.2	38°02.7	25.2	337°09.1	33.0								Rigel	281°09.5	-8°11.1				
12	248°48.1	316°13.2	\$24°15.3	290°52.1	\$17°42.6	53°04.7	\$05°25.3	352°11.3	\$21°33.0								Capella	280°30.5	46°00.6				
13	263°50.6	331°12.5	14.9	305°52.7	42.0	68°06.8	25.5	7°13.4	33.0								Bellatrix	278°29.2	6°21.7				
14	278°53.1	346°11.8	14.5	320°53.3	41.4	83°08.9	25.6	22°15.6	33.0								El Nath	278°09.3	28°37.1				
15	293°55.5	1°11.0	14.0	335°53.9	40.8	98°10.9	25.8	37°17.7	33.1								Alnilam	275°43.7	-1°11.6				
16	308°58.0	16°10.3	13.6	350°54.5	40.2	113°13.0	26.0	52°19.9	33.1								Betelgeuse	270°58.5	7°24.4				
17	324°00.5	31°09.6	13.1	5°55.1	39.6	128°15.1	26.1	67°22.0	33.1								Canopus	263°54.6	-52°42.3				
18	339°02.9	46°08.9	\$24°12.7	20°55.7	\$17°39.0	143°17.1	\$05°26.3	82°24.2	\$21°33.2								Sirius	258°31.4	-16°44.5				
19	354°05.4	61°08.2	12.2	35°56.3	38.4	158°19.2	26.4	97°26.3	33.2								Adhara	255°10.4	-28°59.8				
20	9°07.9	76°07.5	11.8	50°56.9	37.8	173°21.3	26.6	112°28.5	33.2								Procyon	244°57.1	5°10.7				
21	24°10.3	91°06.7	11.3	65°57.5	37.2	188°23.3	26.7	127°30.6	33.3								Pollux	243°24.7	27°58.9				
22	39°12.8	106°06.0	10.9	80°58.1	36.6	203°25.4	26.9	142°32.8	33.3								Avior	234°16.6	-59°33.7				
23	54°15.3	121°05.3	10.4	95°58.7	36.0	218°27.5	27.1	157°34.9	33.3								Suhail	222°50.5	-43°29.9				
Mer.pass.:19:24				v-0.7 d0.4 m-4.0				v0.6 d0.6 m0.6				v2.1 d-0.2 m-1.6				v2.2 d-0.0 m0.5							
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	69°17.7	136°04.6	\$24°10.0	110°59.3	\$17°35.4	233°29.5	\$05°27.2	172°37.1	\$21°33.3								Denebola	182°31.4	14°28.7				
1	84°20.2	151°03.9	09.5	125°59.9	34.8	248°31.6	27.4	187°39.2	33.4								Gienah	175°50.0	-17°37.9				
2	99°22.6	166°03.2	09.1	141°00.5	34.2	263°33.7	27.5	202°41.4	33.4								Acrux	173°06.9	-63°11.2				
3	114°25.1	181°02.5	08.6	156°01.1	33.6	278°35.7	27.7	217°43.5	33.4								Gacrux	171°58.5	-57°12.1				
4	129°27.6	196°01.8	08.1	171°01.7	33.0	293°37.8	27.8	232°45.7	33.5								Alioth	166°19.1	55°52.0				
5	144°30.0	211°01.0	07.7	186°02.3	32.4	308°39.9	28.0	247°47.8	33.5								Spica	158°29.0	-11°14.7				
6	159°32.5	226°00.3	\$24°07.2	201°02.9	\$17°31.8	323°41.9	\$05°28.2	262°50.0	\$21°33.5								Alkaid	152°57.5	49°13.7				
7	174°35.0	240°59.6	06.8	216°03.6	31.2	338°44.0	28.3	277°52.1	33.6								Hadar	148°45.0	-60°26.9				
8	189°37.4	255°58.9	06.3	231°04.2	30.6	353°46.1	28.5	292°54.3	33.6								Menkent	148°05.1	-36°26.9				
9	204°39.9	270°58.2	05.8	246°04.8	30.0	8°48.1	28.6	307°56.4	33.6								Arcturus	145°53.9	19°05.8				
10	219°42.4	285°57.5	05.4	261°05.4	29.4	23°50.2	28.8	322°58.6	33.6								Rigel Kent.	139°49.0	-60°53.9				
11	234°44.8	300°56.8	04.9	276°06.0	28.8	38°52.3	28.9	338°00.7	33.7								Kochab	137°21.4	74°05.2				
12	249°47.3	315°56.1	\$24°04.4	291°06.6	\$17°28.2	53°54.4	\$05°29.1	353°02.9	\$21°33.7								Zuben ubi	137°03.2	-16°06.4				
13	264°49.7	330°55.4	04.0	306°07.2	27.6	68°56.4	29.2	8°05.0	33.7								Alphecca	126°09.4	26°39.7				
14	279°52.2	345°54.7	03.5	321°07.8	27.0	83°58.5	29.4	23°07.2	33.8								Antares	112°23.8	-26°27.9				
15	294°54.7	0°54.0	03.0	336°08.4	26.4	99°00.6	29.6	38°09.3	33.8								Atria	107°24.0	-69°03.2				
16	309°57.1	15°53.3	02.5	351°09.0	25.8	114°02.6	29.7	53°11.5	33.8								Sabik	102°10.2	-15°44.5				
17	324°59.6	30°52.6	02.1	6°09.6	25.2	129°04.7	29.9	68°13.6	33.9								Rasalhague	96°19.2	-37°06.7				
18	340°02.1	45°51.9	\$24°01.6	21°10.2	\$17°24.6	144°06.8	\$05°30.0	83°15.8	\$21°33.9								Eltanin	90°45.6	51°29.5				
19	355°04.5	60°51.2	01.1	36°10.8	24.0	159°08.8	30.2	98°17.9	33.9								Kaus Aust.	83°41.1	-34°22.4				
20	10°07.0	75°50.5	00.6	51°11.4	23.4	174°10.9	30.3	113°20.1	33.9								Vega	80°37.8	38°48.3				
21	25°09.5	90°49.8	24°00.2	66°12.0	22.8	189°13.0	30.5	128°22.2	34.0								Nunki	75°55.8	-26°16.4				
22	40°11.9	105°49.1	23°59.7	81°12.6	22.2	204°15.0	30.6	143°24.4	34.0								Altair	62°06.2	8°55.0				
23	55°14.4	120°48.4	59.2	96°13.2	21.6	219°17.1	30.8	158°26.5	34.0								Peacock	53°16.0	-56°40.9				
Mer.pass.:19:20				v-0.7 d0.5 m-4.0				v0.6 d0.6 m0.6				v2.1 d-0.2 m-1.6				v2.2 d-0.0 m0.5							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	70°16.9	135°47.7	\$23°58.7	111°13.8	\$17°21.0	234°19.2	\$05°31.0	173°28.7	\$21°34.1								Fomalhaut	15°21.5	-29°32.1				
1	85°19.3	150°47.0	58.2	126°14.4	20.4	249°21.3	31.1	188°30.8	34.1								Scheat	13°51.0	28°10.7				
2	100°21.8	165°46.3	57.8	141°15.0	19.8	264°23.3	31.3	203°33.0	34.1								Markab	13°36.0	15°17.9				
3	115°24.2	180°45.6	57.3	156°15.6	19.2	279°25.4	31.4	218°35.1	34.2								Nov 29 Tue	SHA	Mer.pass				
4	130°26.7	195°44.9	56.8	171°16.2	18.6	294°27.5	31.6	233°37.3	34.2								Venus	68°03.3	14:55				
5	145°29.2	210°44.2	56.3	186°16.8	18.0	309°29.5	31.7	248°39.4	34.2								Mars	42°26.4	16:36				
6	160°31.6	225°43.5	\$23°55.8	201°17.5	\$17°13.7	324°31.6	\$05°31.9	263°41.6	\$21°34.4								Jupiter	164°21.4	08:28				
7	175°34.1	240°42.8	55.3	216°18.1	16.7	339°33.7	32.0	278°43.7	34.3														

DUT1 = UT1-UTC = -0.3666 sec ΔT = TT-UT1 = +68.5506 sec

2016 November 29 to Dec. 01 UT

h	Sun			Moon			
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	182°55.9	S21°30.4	187°46.7	13.2'	S15°37.5	-5.5'	54.0'
1	197°55.7	30.8	202°18.9	13.2'	15°43.0	-5.5'	54.0'
2	212°55.4	31.2	216°51.1	13.2'	15°48.4	-5.4'	54.0'
3	227°55.2	.. 31.6	231°23.3	13.1'	15°53.7	-5.3'	54.0'
4	242°55.0	32.1	245°55.4	13.1'	15°59.0	-5.3'	54.0'
5	257°54.8	32.5	260°27.5	13.1'	16°04.3	-5.2'	54.0'
6	272°54.5	S21°32.9	274°59.5	13.0'	S16°09.4	-5.1'	54.0'
7	287°54.3	33.3	289°31.5	13.0'	16°14.5	-5.0'	54.0'
8	302°54.1	33.7	304°03.5	13.0'	16°19.5	-5.0'	54.0'
9	317°53.9	.. 34.1	318°35.4	12.9'	16°24.4	-4.9'	54.0'
10	332°53.7	34.6	333°07.4	12.9'	16°29.3	-4.8'	54.0'
11	347°53.4	35.0	347°39.2	12.9'	16°34.1	-4.8'	54.0'
12	2°53.2	S21°35.4	2°11.1	12.8'	S16°38.8	-4.7'	54.0'
13	17°53.0	35.8	16°42.9	12.8'	16°43.5	-4.6'	54.1'
14	32°52.8	36.2	31°14.7	12.8'	16°48.0	-4.5'	54.1'
15	47°52.5	.. 36.6	45°46.5	12.7'	16°52.5	-4.5'	54.1'
16	62°52.3	37.0	60°18.2	12.7'	16°57.0	-4.4'	54.1'
17	77°52.1	37.4	74°49.9	12.7'	17°01.3	-4.3'	54.1'
18	92°51.9	S21°37.8	89°21.6	12.7'	S17°05.6	-4.2'	54.1'
19	107°51.6	38.2	103°53.2	12.6'	17°09.8	-4.2'	54.1'
20	122°51.4	38.6	118°24.8	12.6'	17°13.9	-4.1'	54.1'
21	137°51.2	.. 39.0	132°56.4	12.6'	17°17.9	-4.0'	54.1'
22	152°50.9	39.5	147°27.9	12.5'	17°21.9	-3.9'	54.1'
23	167°50.7	39.9	161°59.4	12.5'	17°25.8	-3.8'	54.1'
	SD.=16.2	d=-0.4			S.D.=14.7		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Pass.	Mer.Pass.	Upper	Lower
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	hh:mm	hh:mm	Age
29	11:44	11:33	11:48	11:51	—	
30	11:22	11:11	11:49	12:38	00:14	
01	11:00	10:48	11:49	13:26	01:02	

SD.=16.2	d=-0.4	S.D.=14.9
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**December 02, 03, 04 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	71°16.0	135°31.1	\$23°46.8	111°28.4	\$17°06.4	235°08.9	\$05°34.7	174°20.3	\$21°34.8	Alpheratz	357°40.9	29°11.2					
1	86°18.5	150°30.4	46.3	126°29.0	50.8	250°11.0	34.8	189°22.4	34.8	Ankaa	353°13.3	-42°13.1					
2	101°20.9	165°29.7	45.8	141°29.6	50.2	265°13.1	35.0	204°24.6	34.8	Schedar	349°37.5	56°38.0					
3	116°23.4	180°29.0	• 45.3	156°30.2	• 04.5	280°15.2	• 35.1	219°26.7	• 34.9	Diphda	348°53.4	-17°53.8					
4	131°25.9	195°28.3	44.8	171°30.8	03.9	295°17.2	35.3	234°28.9	34.9	Achernar	335°24.8	-57°09.4					
5	146°28.3	210°27.7	44.3	186°31.4	03.3	310°19.3	35.4	249°31.0	34.9	Hamal	327°57.8	23°32.5					
6	161°30.8	225°27.0	\$23°43.7	201°32.0	\$17°02.7	325°21.4	\$05°35.6	264°33.2	\$21°35.0	Polaris	316°15.6	89°20.2					
7	176°33.2	240°26.3	43.2	216°32.6	02.1	340°23.5	35.7	279°35.3	35.0	Acamar	315°16.2	-40°14.5					
8	191°35.7	255°25.6	42.7	231°33.3	01.5	355°25.5	35.9	294°37.5	35.0	Menkar	314°12.3	4°09.2					
9	206°38.2	270°24.9	• 42.2	246°33.9	• 00.9	10°27.6	• 36.0	309°39.6	• 35.0	Mirfak	308°36.5	49°55.2					
10	221°40.6	285°24.3	41.7	261°34.5	17°00.2	25°29.7	36.2	324°41.8	35.1	Aldebaran	290°46.3	16°32.4					
11	236°43.1	300°23.6	41.1	276°35.1	16°59.6	40°31.8	36.3	339°43.9	35.1	Rigel	281°09.5	-8°11.1					
12	251°45.6	315°22.9	\$23°40.6	291°35.7	\$16°59.0	55°33.8	\$05°36.5	354°46.1	\$21°35.1	Capella	280°30.5	46°00.7					
13	266°48.0	330°22.2	40.1	306°36.3	58.4	70°35.9	36.6	9°48.2	35.2	Bellatrix	278°29.2	6°21.7					
14	281°50.5	345°21.6	39.6	321°36.9	57.8	85°38.0	36.8	24°50.4	35.2	Elnath	278°09.3	28°37.1					
15	296°53.0	0°20.9	• 39.0	336°37.5	• 57.2	100°40.1	• 36.9	39°52.5	• 35.2	Alnilam	275°43.7	-1°11.7					
16	311°55.4	15°20.2	38.5	351°38.1	56.5	115°42.1	37.1	54°54.7	35.2	Betelgeuse	270°58.5	7°24.4					
17	326°57.9	30°19.5	38.0	6°38.8	55.9	130°44.2	37.3	69°56.8	35.3	Canopus	263°54.6	-52°42.3					
18	342°00.4	45°18.9	\$23°37.5	21°39.4	\$16°55.3	145°46.3	\$05°37.4	84°59.0	\$21°35.3	Sirius	258°31.4	-16°44.5					
19	357°02.8	60°18.2	36.9	36°40.0	54.7	160°48.4	37.6	100°01.1	35.3	Adhara	255°10.4	-28°59.8					
20	12°05.3	75°17.5	36.4	51°40.6	54.1	175°50.4	37.7	115°03.3	35.4	Procyon	244°57.1	5°10.7					
21	27°07.7	90°16.8	• 35.9	66°41.2	• 53.5	190°52.5	• 37.9	130°05.4	• 35.4	Pollux	243°24.6	27°58.9					
22	42°10.2	105°16.2	35.3	81°41.8	52.8	205°54.6	38.0	145°07.6	35.4	Avior	234°16.6	-59°33.7					
23	57°12.7	120°15.5	34.8	96°42.4	52.2	220°56.7	38.2	160°09.7	35.4	Suhail	222°50.5	-43°29.9					
Mer.pass.:19:12			v-0.7 d0.5 m-4.0	v0.6 d0.6 m0.7	v2.1 d-0.2 m-1.6	v2.1 d-0.0 m0.5	Mer.pass.:19:08			Alplacidus	221°38.6	-69°47.0					
										Alphard	217°53.7	-8°43.9					
										Regulus	207°41.0	11°53.0					
										Dubhe	193°49.1	61°39.3					
										Denebola	182°31.4	14°28.6					
										Gienah	175°50.0	-17°37.9					
										Acrux	173°06.9	-63°11.2					
										Gacrux	171°58.4	-57°12.1					
										Alioth	166°19.1	55°52.0					
										Spica	158°29.0	-11°14.8					
										Alkaid	152°57.5	49°13.7					
										Hadar	148°45.0	-60°26.9					
										Menkent	148°05.1	-36°26.9					
										Arcturus	145°53.9	19°05.8					
										Rigel Kent.	139°49.0	-60°53.9					
										Kochab	137°21.4	74°05.2					
										Zuben 'ubi	137°03.1	-16°06.4					
										Alphecca	126°09.4	26°39.7					
										Antares	112°23.8	-26°27.9					
										Atria	107°24.0	-69°03.2					
										Sabik	102°10.2	-15°44.5					
										Shaula	96°19.2	-37°06.7					
										Rasalhague	96°04.6	12°33.1					
										Eltanin	90°45.6	51°29.5					
										Kaus Aust.	83°41.1	-34°22.4					
										Vega	80°37.8	38°48.3					
										Nunki	75°55.8	-26°16.4					
										Altair	62°06.2	8°55.0					
										Peacock	53°16.0	-56°40.9					
										Deneb	49°30.1	45°20.8					
										Enif	33°44.9	9°57.3					
										Al Na'ir	27°41.0	-46°52.9					
										Fomalhaut	15°21.5	-29°32.1					
										Scheat	13°51.1	28°10.7					
										Markab	13°36.0	15°17.9					
<b>Dec 02 Fri</b>							<b>SHA</b>			<b>Mer.pass</b>							
										Venus	64°15.1	14:59					
										Mars	40°12.4	16:33					
										Jupiter	163°52.9	08:18					
										Saturn	103°04.3	12:21					
<b>Dec 03 Sat</b>							<b>SHA</b>			<b>Mer.pass</b>							
										Venus	62°59.7	15:00					
										Mars	39°27.9	16:32					
										Jupiter	163°43.6	08:15					
										Saturn	102°56.7	12:17					
<b>Dec 04 Sun</b>							<b>SHA</b>			<b>Mer.pass</b>							
										Venus	61°44.7	15:01					
										Mars	38°43.5	16:31					
										Jupiter	163°34.4	08:12					
										Saturn	102°49.2	12:14					
							<b>Horizontal parallax</b>										
										Venus:	0.2						
										Mars:	0.1						
Mer.pass.:19:04																	

DUT1 = UT1-UTC = -0.3710 sec ΔT = TT-UT1 = +68.5550 sec

2016 December 02 to Dec. 04 UT

h		Sun			Moon		
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	182°39.2	S21°58.8	153°12.9	11.4'	S18°53.7	0.4'	54.7'
1	197°39.0	59.1	167°43.3	11.4'	18°53.3	0.5'	54.7'
2	212°38.7	59.5	182°13.7	11.4'	18°52.8	0.6'	54.7'
3	227°38.5	21°59.9	196°44.1	11.4'	18°52.2	0.6'	54.7'
4	242°38.3	22°00.2	211°14.5	11.4'	18°51.5	0.7'	54.7'
5	257°38.0	00.6	225°44.9	11.4'	18°50.8	0.8'	54.7'
6	272°37.8	S22°00.9	240°15.2	11.4'	S18°49.9	0.9'	54.7'
7	287°37.5	01.3	254°45.6	11.3'	18°48.9	1.0'	54.8'
8	302°37.3	01.7	269°15.9	11.3'	18°47.9	1.1'	54.8'
9	317°37.0	.. 02.0	283°46.2	11.3'	18°46.7	1.2'	54.8'
10	332°36.8	02.4	298°16.6	11.3'	18°45.5	1.3'	54.8'
11	347°36.5	02.8	312°46.9	11.3'	18°44.2	1.4'	54.8'
12	2°36.3	S22°03.1	327°17.2	11.3'	S18°42.7	1.5'	54.8'
13	17°36.1	03.5	341°47.5	11.3'	18°41.2	1.6'	54.9'
14	32°35.8	03.8	356°17.8	11.3'	18°39.6	1.7'	54.9'
15	47°35.6	.. 04.2	10°48.1	11.3'	18°37.9	1.7'	54.9'
16	62°35.3	04.5	25°18.4	11.3'	18°36.1	1.8'	54.9'
17	77°35.1	04.9	39°48.7	11.3'	18°34.2	1.9'	54.9'
18	92°34.8	S22°05.3	54°18.9	11.3'	S18°32.3	2.0'	54.9'
19	107°34.6	05.6	68°49.2	11.3'	18°30.2	2.1'	55.0'
20	122°34.3	06.0	83°19.5	11.3'	18°28.1	2.2'	55.0'
21	137°34.1	.. 06.3	97°49.7	11.3'	18°25.8	2.3'	55.0'
22	152°33.8	06.7	112°20.0	11.3'	18°23.5	2.4'	55.0'
23	167°33.6	07.0	126°50.2	11.3'	18°21.0	2.5'	55.0'
	SD.=16.2	d=-0.4			S.D.=14.9		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer.Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	Upper hh:mm
02	10:37	10:25	11:50	01:51
03	10:13	10:01	11:50	02:40
04	09:49	09:37	11:50	03:29



SD.=16.2	d=-0.3	S.D.=15.2
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**December 05, 06, 07 UT (Mon., Tue., Wed.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	74°13.4	134°43.5	\$23°07.3	112°12.6	\$16°21.6	237°38.7	\$05°45.5	176°55.0	\$21°36.9	Alpheratz	357°40.9	29°11.2											
1	89°15.9	149°42.8	06.7	127°13.2	21.0	252°40.8	45.7	191°57.2	36.9	Ankaa	353°13.3	-42°13.1											
2	104°18.3	164°42.2	06.1	142°13.8	20.4	267°42.9	45.8	206°59.3	36.9	Schedar	349°37.5	56°38.0											
3	119°20.8	179°41.5	• 05.5	157°14.4	• 19.7	282°44.9	• 45.9	222°01.5	• 37.0	Diphda	348°53.4	-17°53.8											
4	134°23.3	194°40.9	04.9	172°15.1	19.1	297°47.0	46.1	237°03.6	37.0	Achernar	335°24.8	-57°09.4											
5	149°25.7	209°40.3	04.3	187°15.7	18.5	312°49.1	46.2	252°05.8	37.0	Hamal	327°57.8	23°32.5											
6	164°28.2	224°39.6	\$23°03.7	202°16.3	\$16°17.8	327°51.2	\$05°46.4	267°07.9	\$21°37.0	Polaris	316°16.2	89°20.2											
7	179°30.7	239°39.0	03.1	217°16.9	17.2	342°53.3	46.5	282°10.1	37.1	Acamar	315°16.2	-40°14.5											
8	194°33.1	254°38.4	02.5	232°17.5	16.6	357°55.4	46.7	297°12.2	37.1	Menkar	314°12.3	4°09.2											
9	209°35.6	269°37.7	• 01.9	247°18.2	• 15.9	12°57.5	• 46.8	312°14.4	• 37.1	Mirfak	308°36.5	49°55.2											
10	224°38.1	284°37.1	01.3	262°18.8	15.3	27°59.5	47.0	327°16.5	37.2	Aldebaran	290°46.3	16°32.4											
11	239°40.5	299°36.5	00.7	277°19.4	14.7	43°01.6	47.1	342°18.7	37.2	Rigel	281°09.5	-8°11.1											
12	254°43.0	314°35.9	\$23°00.1	292°20.0	\$16°14.0	58°03.7	\$05°47.3	357°20.8	\$21°37.2	Capella	280°30.5	46°00.7											
13	269°45.4	329°35.2	22°59.5	307°20.6	13.4	73°05.8	47.4	12°23.0	37.2	Bellatrix	278°29.2	6°21.7											
14	284°47.9	344°34.6	58.9	322°21.3	12.8	88°07.9	47.6	27°25.1	37.3	El Nath	278°09.3	28°37.1											
15	299°50.4	359°34.0	• 58.3	337°21.9	• 12.1	103°10.0	• 47.7	42°27.2	• 37.3	Alnilam	275°43.7	-1°11.7											
16	314°52.8	14°33.3	57.7	352°22.5	11.5	118°12.1	47.9	57°29.4	37.3	Betelgeuse	270°58.4	7°24.4											
17	329°55.3	29°32.7	57.1	7°23.1	10.8	133°14.2	48.0	72°31.5	37.4	Canopus	263°54.6	-52°42.4											
18	344°57.8	44°32.1	\$22°56.5	22°23.7	\$16°10.2	148°16.2	\$05°48.2	87°33.7	\$21°37.4	Sirius	258°31.3	-16°44.5											
19	0°00.2	59°31.5	55.9	37°24.4	09.6	163°18.3	48.3	102°35.8	37.4	Adhara	255°10.3	-28°59.8											
20	15°02.7	74°30.8	55.3	52°25.0	08.9	178°20.4	48.4	117°38.0	37.4	Procyon	244°57.0	5°10.7											
21	30°05.2	89°30.2	• 54.7	67°25.6	• 08.3	193°22.5	• 48.6	132°40.1	• 37.5	Pollux	243°24.6	27°58.9											
22	45°07.6	104°29.6	54.1	82°26.2	07.7	208°24.6	48.7	147°42.3	37.5	Avior	234°16.6	-59°33.7											
23	60°10.1	119°29.0	53.5	97°26.8	07.0	223°26.7	48.9	162°44.4	37.5	Suhail	222°50.4	-43°29.9											
Mer.pass.:19:00				v-0.6 d0.6 m-4.0				v0.6 d0.6 m0.7				v2.1 d-0.1 m-1.6				v2.1 d-0.0 m0.5							
Tue				GHA				GHA				GHA				GHA							
0	75°12.6	134°28.3	\$22°52.9	112°27.5	\$16°06.4	238°28.8	\$05°49.0	177°46.6	\$21°37.5	Denebola	182°31.4	14°28.6											
1	90°15.0	149°27.7	52.2	127°28.1	05.8	253°30.9	49.2	192°48.7	37.6	Gienah	175°50.0	-17°38.0											
2	105°17.5	164°27.1	51.6	142°28.7	05.1	268°33.0	49.3	207°50.9	37.6	Acrux	173°06.8	-63°11.2											
3	120°19.9	179°26.5	• 51.0	157°29.3	• 04.5	283°35.1	• 49.5	222°53.0	• 37.6	Gacrux	171°58.4	-57°12.1											
4	135°22.4	194°25.9	50.4	172°30.0	03.8	298°37.1	49.6	237°55.2	37.7	Alioth	166°19.0	55°51.9											
5	150°24.9	209°25.3	49.8	187°30.6	03.2	313°39.2	49.8	252°57.3	37.7	Spica	158°29.0	-11°14.8											
6	165°27.3	224°24.6	\$22°49.2	202°31.2	\$16°02.6	328°41.3	\$05°49.9	267°59.5	\$21°37.7	Alkaid	152°57.5	49°13.7											
7	180°29.8	239°24.0	48.5	217°31.8	01.9	343°43.4	50.1	283°01.6	37.7	Hadar	148°44.9	-60°26.9											
8	195°32.3	254°23.4	47.9	232°32.5	01.3	358°45.5	50.2	298°03.8	37.8	Menkent	148°05.1	-36°26.9											
9	210°34.7	269°22.8	• 47.3	247°33.1	• 00.6	13°47.6	• 50.3	313°05.9	• 37.8	Arcturus	145°53.9	19°05.8											
10	225°37.2	284°22.2	46.7	262°33.7	16°00.0	28°49.7	50.5	328°08.1	37.8	Rigel Kent.	139°49.0	-60°53.9											
11	240°39.7	299°21.6	46.0	277°34.3	15.9	43°51.8	50.6	343°10.2	37.9	Kochab	137°21.3	74°05.1											
12	255°42.1	314°20.9	\$22°45.4	292°35.0	\$15°58.7	58°53.9	\$05°50.8	358°12.4	\$21°37.9	Zuben ubi	137°03.1	-16°06.4											
13	270°44.6	329°20.3	44.8	307°35.6	58.1	73°56.0	50.9	13°14.5	37.9	Alphecca	126°09.4	26°39.6											
14	285°47.1	344°19.7	44.2	322°36.2	57.4	88°58.0	51.1	28°16.7	37.9	Antares	112°23.8	-26°27.9											
15	300°49.5	359°19.1	• 43.5	337°36.8	• 56.8	104°00.1	• 51.2	43°18.8	• 38.0	Atria	107°24.0	-69°03.2											
16	315°52.0	14°18.5	42.9	352°37.5	56.2	119°02.2	51.4	58°21.0	38.0	Sabik	102°10.2	-15°44.5											
17	330°54.4	29°17.9	42.3	7°38.1	55.5	134°04.3	51.5	73°23.1	38.0	Rasalhague	96°19.2	-37°06.7											
18	345°56.9	44°17.3	\$22°41.6	22°38.7	\$15°54.9	149°06.4	\$05°51.7	88°25.2	\$21°38.1	Eltanin	90°45.6	51°29.5											
19	0°59.4	59°16.7	41.0	37°39.3	54.2	164°08.5	51.8	103°27.4	38.1	Kaus Aust.	83°41.1	-34°22.4											
20	16°01.8	74°16.1	40.4	52°40.0	53.6	179°10.6	51.9	118°29.5	38.1	Vega	80°37.8	38°48.3											
21	31°04.3	89°15.5	• 39.7	67°40.6	• 53.0	194°12.7	• 52.1	133°31.7	• 38.1	Nunki	75°55.8	-26°16.4											
22	46°06.8	104°14.9	39.1	82°41.2	52.3	209°14.8	52.2	148°33.8	38.2	Altair	62°06.2	8°55.0											
23	61°09.2	119°14.3	38.5	97°41.8	51.7	224°16.9	52.4	163°36.0	38.2	Peacock	53°16.1	-56°40.9											
Mer.pass.:18:56				v-0.6 d0.6 m-4.0				v0.6 d0.6 m0.7				v2.1 d-0.1 m-1.6				v2.1 d-0.0 m0.5							
Wed				GHA				GHA				GHA				GHA							
0	76°11.7	134°13.6	\$22°37.8	112°42.5	\$15°51.0	239°19.0	\$05°52.5	178°38.1	\$21°38.2	Dec 05 Mon	SHA	Mer.pass											
1	91°14.2	149°13.0	37.2	127°43.1	50.4	254°21.1	52.7	193°40.3	38.3	Venus	60°30.0	15:02											
2	106°16.6	164°12.4	36.6	142°43.7	49.7	269°23.2	52.8	208°42.4	38.3	Mars	37°59.2	16:30											
3	121°19.1	179°11.8	• 35.9	157°44.3	• 49.1	284°25.3	• 53.0	223°44.6	• 38.3	Jupiter	163°25.3	08:08											
4	136°21.5	194°11.2	35.3	172°45.0	48.4	299°27.3	53.1	238°46.7	38.3	Saturn	102°41.6	12:11											
5	151°24.0	209°10.6	34.6	187°45.6	47.8	314°29.4	53.2	253°48.9	38.4	Dec 06 Tue	SHA	Mer.pass											
6	166°26.5	224°10.0	\$22°34.0	202°46.2	\$15°47.2	329°31.5	\$05°53.4	268°51.0	\$21°38.4	Venus	59°15.8	15:03											
7	181°28.9	239°09.4	33.3	217°46.8	46.5	344°33.6																	

DUT1 = UT1-UTC = -0.3747 sec ΔT = TT-UT1 = +68.5587 sec

2016 December 05 to Dec. 07 UT

h	Sun	Moon					
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	182°21.2	S22°23.3	117°34.5	11.4'	\$14°33.9	6.7'	56.1'
1	197°20.9	23.6	132°04.9	11.4'	14°27.1	6.8'	56.1'
2	212°20.7	23.9	146°35.3	11.4'	14°20.3	6.8'	56.2'
3	227°20.4	.. 24.2	161°05.8	11.4'	14°13.4	6.9'	56.2'
4	242°20.1	24.6	175°36.2	11.4'	14°06.5	7.0'	56.2'
5	257°19.9	24.9	190°06.6	11.4'	13°59.4	7.1'	56.2'
6	272°19.6	S22°25.2	204°37.0	11.4'	\$13°52.3	7.2'	56.3'
7	287°19.4	25.5	219°07.4	11.4'	13°45.1	7.2'	56.3'
8	302°19.1	25.8	233°37.9	11.4'	13°37.8	7.3'	56.3'
9	317°18.8	.. 26.1	248°08.3	11.4'	13°30.5	7.4'	56.3'
10	332°18.6	26.4	262°38.7	11.4'	13°23.1	7.5'	56.4'
11	347°18.3	26.7	277°09.2	11.4'	13°15.6	7.5'	56.4'
12	2°18.1	S22°27.0	291°39.6	11.4'	\$13°08.0	7.6'	56.4'
13	17°17.8	27.3	306°10.1	11.5'	13°00.4	7.7'	56.5'
14	32°17.5	27.6	320°40.5	11.5'	12°52.7	7.7'	56.5'
15	47°17.3	.. 27.9	335°11.0	11.5'	12°44.9	7.8'	56.5'
16	62°17.0	28.2	349°41.4	11.5'	12°37.1	7.9'	56.5'
17	77°16.7	28.5	4°11.9	11.5'	12°29.1	8.0'	56.6'
18	92°16.5	S22°28.8	18°42.4	11.5'	\$12°21.1	8.0'	56.6'
19	107°16.2	29.1	33°12.8	11.5'	12°13.1	8.1'	56.6'
20	122°16.0	29.4	47°43.3	11.5'	12°04.9	8.2'	56.7'
21	137°15.7	.. 29.7	62°13.8	11.5'	11°56.7	8.2'	56.7'
22	152°15.4	30.0	76°44.2	11.5'	11°48.5	8.3'	56.7'
23	167°15.2	30.3	91°14.7	11.5'	11°40.1	8.4'	56.7'
	SD.=16.2	d=-0.3			S.D.=15.4		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Upper	Lower	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass hh:mm	hh:mm	hh:mm	6-8 31-51%
05	09:25	09:12	11:51	16:43	04:18	
06	09:00	08:47	11:51	17:32	05:07	
07	08:34	08:21	11:52	18:21	05:56	

SD.=16.2	d=-0.3	S.D.=15.8
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**December 08, 09, 10 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	77°10.8	133°59.4	\$22°22.2	112°57.5	\$15°35.5	240°09.3	\$05°56.0	179°29.7	\$21°38.9					Alpheratz	357°40.9	29°11.2	
1	92°13.3	148°58.8	21.6	127°58.2	34.9	255°11.4	56.1	194°31.8	38.9					Ankaa	353°13.3	-42°13.1	
2	107°15.8	163°58.2	20.9	142°58.8	34.2	270°13.5	56.2	209°34.0	38.9					Schedar	349°37.5	56°38.0	
3	122°18.2	178°57.6	• 20.2	157°59.4	• 33.6	285°15.6	• 56.4	224°36.1	• 39.0					Diphda	348°53.4	-17°53.8	
4	137°20.7	193°57.0	19.6	173°00.0	32.9	300°17.6	56.5	239°38.3	39.0					Achernar	335°24.8	-57°09.4	
5	152°23.2	208°56.4	18.9	188°00.7	32.3	315°19.7	56.7	254°40.4	39.0					Hamal	327°57.8	23°32.5	
6	167°25.6	223°55.9	\$22°18.2	203°01.3	\$15°31.6	330°21.8	\$05°56.8	269°42.6	\$21°39.1					Polaris	316°16.8	89°20.2	
7	182°28.1	238°55.3	17.6	218°01.9	31.0	345°23.9	57.0	284°44.7	39.1					Acamar	315°16.3	-40°14.5	
8	197°30.5	253°54.7	16.9	233°02.6	30.3	0°26.0	57.1	299°46.9	39.1					Menkar	314°12.3	4°09.2	
9	212°33.0	268°54.1	• 16.2	248°03.2	• 29.7	15°28.1	• 57.2	314°49.0	• 39.1					Mirfak	308°36.5	49°55.2	
10	227°35.5	283°53.5	15.5	263°03.8	29.0	30°30.2	57.4	329°51.2	39.2					Aldebaran	290°46.3	16°32.4	
11	242°37.9	298°53.0	14.9	278°04.5	28.4	45°32.3	57.5	344°53.3	39.2					Rigel	281°09.5	-8°11.1	
12	257°40.4	313°52.4	\$22°14.2	293°05.1	\$15°27.7	60°34.4	\$05°57.7	359°55.5	\$21°39.2					Capella	280°30.5	46°00.7	
13	272°42.9	328°51.8	13.5	308°05.7	27.1	75°36.5	57.8	14°57.6	39.2					Bellatrix	278°29.2	6°21.7	
14	287°45.3	343°51.2	12.8	323°06.4	26.4	90°38.6	57.9	29°59.7	39.3					Elnath	278°09.3	28°37.1	
15	302°47.8	358°50.6	• 12.2	338°07.0	• 25.8	105°40.7	• 58.1	45°01.9	• 39.3					Alnilam	275°43.7	-1°11.7	
16	317°50.3	13°50.1	11.5	353°07.6	25.1	120°42.8	58.2	60°04.0	39.3					Betelgeuse	270°58.4	7°24.4	
17	332°52.7	28°49.5	10.8	8°08.3	24.4	135°44.9	58.4	75°06.2	39.4					Canopus	263°54.6	-52°42.4	
18	347°55.2	43°48.9	\$22°10.1	23°08.9	\$15°23.8	150°47.0	\$05°58.5	90°08.3	\$21°39.4					Sirius	258°31.3	-16°44.5	
19	2°57.6	58°48.4	09.4	38°09.5	23.1	165°49.1	58.6	105°10.5	39.4					Adhara	255°10.3	-28°59.8	
20	18°00.1	73°47.8	08.8	53°10.2	22.5	180°51.2	58.8	120°12.6	39.4					Procyon	244°57.0	5°10.7	
21	33°02.6	88°47.2	• 08.1	68°10.8	• 21.8	195°53.3	• 58.9	135°14.8	• 39.5					Pollux	243°24.6	27°58.9	
22	48°05.0	103°46.6	07.4	83°11.4	21.2	210°55.4	59.1	150°16.9	39.5					Avior	234°16.5	-59°33.7	
23	63°07.5	118°46.1	06.7	98°12.1	20.5	225°57.5	59.2	165°19.1	39.5					Suhail	222°50.4	-43°29.9	
Mer.pass.:18:48			v-0.6 d0.7 m-4.0	v0.6 d0.6 m0.7	v2.1 d-0.1 m-1.7	v2.1 d-0.0 m0.5											
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	78°10.0	133°45.5	\$22°06.0	113°12.7	\$15°19.9	240°59.6	\$05°59.4	180°21.2	\$21°39.5					Denebola	182°31.4	14°28.6	
1	93°12.4	148°44.9	05.3	128°13.3	19.2	256°01.7	59.5	195°23.4	39.6					Gienah	175°50.0	-17°38.0	
2	108°14.9	163°44.4	04.6	143°14.0	18.6	271°03.8	59.6	210°25.5	39.6					Acru	173°06.8	-63°11.2	
3	123°17.4	178°43.8	• 04.0	158°14.6	• 17.9	286°05.9	• 59.8	225°27.7	• 39.6					Gacrux	171°58.4	-57°12.1	
4	138°19.8	193°43.2	03.3	173°15.2	17.2	301°08.0	05°59.9	240°29.8	39.7					Alioth	166°19.0	55°51.9	
5	153°22.3	208°42.7	02.6	188°15.9	16.6	316°10.2	06°00.1	255°32.0	39.7					Spica	158°29.0	-11°14.8	
6	168°24.8	223°42.1	\$22°01.9	203°16.5	\$15°15.9	331°12.3	\$06°00.2	270°34.1	\$21°39.7					Alkaid	152°57.5	49°13.7	
7	183°27.2	238°41.5	01.2	218°17.1	15.3	346°14.4	00.3	285°36.3	39.7					Hadar	148°44.9	-60°26.9	
8	198°29.7	253°41.0	22°00.5	233°17.8	14.6	1°16.5	00.5	300°38.4	39.8					Menkent	148°05.1	-36°26.9	
9	213°32.1	268°40.4	21°59.8	248°18.4	• 14.0	16°18.6	• 00.6	315°40.6	• 39.8					Arcturus	145°53.9	19°05.8	
10	228°34.6	283°39.9	59.1	263°19.0	13.3	31°20.7	00.8	330°42.7	39.8					Rigel Kent.	139°49.0	-60°53.9	
11	243°37.1	298°39.3	58.4	278°19.7	12.6	46°22.8	00.9	345°44.8	39.8					Kochab	137°21.3	74°05.1	
12	258°39.5	313°38.7	\$21°57.7	293°20.3	\$15°12.0	61°24.9	\$06°01.0	0°47.0	\$21°39.9					Zuben' ubi	137°03.1	-16°06.5	
13	273°42.0	328°38.2	57.0	308°20.9	11.3	76°27.0	01.2	15°49.1	39.9					Alphecca	126°09.4	26°39.6	
14	288°44.5	343°37.6	56.3	323°21.6	10.7	91°29.1	01.3	30°51.3	39.9					Antares	112°23.8	-26°27.9	
15	303°46.9	358°37.1	• 55.6	338°22.2	• 10.0	106°31.2	• 01.4	45°53.4	• 40.0					Atria	107°24.0	-69°03.2	
16	318°49.4	13°36.5	54.9	353°22.8	09.4	121°33.3	01.6	60°55.6	40.0					Sabik	102°10.2	-15°44.5	
17	333°51.9	28°35.9	54.2	8°23.5	08.7	136°35.4	01.7	75°57.7	40.0					Shaula	96°19.2	-37°06.7	
18	348°54.3	43°35.4	\$21°53.5	23°24.1	\$15°08.0	151°37.5	\$06°01.9	90°59.9	\$21°40.0					Rasalhague	96°04.6	12°33.1	
19	3°56.8	58°34.8	52.8	38°24.8	07.4	166°39.6	02.0	106°02.0	40.1					Eltanin	90°45.6	51°29.5	
20	18°59.3	73°34.3	52.1	53°25.4	06.7	181°41.7	02.1	121°04.2	40.1					Kaus Aust.	83°41.1	-34°22.4	
21	34°01.7	88°33.7	• 51.4	68°26.0	• 06.1	196°43.8	• 02.3	136°06.3	• 40.1					Vega	80°37.8	38°48.3	
22	49°04.2	103°33.2	50.7	83°26.7	05.4	211°45.9	02.4	151°08.5	40.1					Nunki	75°55.8	-26°16.4	
23	64°06.6	118°32.6	50.0	98°27.3	04.7	226°48.0	02.6	166°10.6	40.2					Altair	62°06.2	8°55.0	
Mer.pass.:18:44			v-0.6 d0.7 m-4.0	v0.6 d0.7 m0.7	v2.1 d-0.1 m-1.7	v2.1 d-0.0 m0.5											
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	79°09.1	133°32.1	\$21°49.3	113°27.9	\$15°04.1	241°50.1	\$06°02.7	181°12.8	\$21°40.2					Dec 08 Thu	SHA	Mer.pass	
1	94°11.6	148°31.5	48.5	128°28.6	03.4	256°52.2	02.8	196°14.9	40.2					Venus	56°48.5	15:05	
2	109°14.0	163°31.0	47.8	143°29.2	02.8	271°54.3	03.0	211°17.1	40.3					Mars	35°46.7	16:27	
3	124°16.5	178°30.4	• 47.1	158°29.9	• 02.1	286°56.4	• 03.1	226°19.2	• 40.3					Jupiter	162°58.4	07:58	
4	139°19.0	193°29.9	46.4	173°30.5	01.4	301°58.5	03.3	241°21.4	40.3					Saturn	102°18.9	12:00	
5	154°21.4	208°29.3	45.7	188°31.1	00.8	317°00.7	03.4	256°23.5	40.3								
6	169°23.9	223°28.8	\$21°45.0	203°31.8	\$15°00.1	332°02.8	\$06°03.5	271°25.7	\$21°40.4					Dec 09 Fri	SHA	Mer.pass	
7	184°26.4	238°28.2	44.3	218°32.4	14°59.5	347°04.9	03.7	286°27.8	40.4					Venus	55°35.5	15:06	
8	199°28.8	253°27.7	43.5	233°33.0	58.8	2°07.0	03.8	301°29.9	40.4					Mars	35°02.7	16:26	
9	214°31.3	268°27.2	• 42.8	248°33.7	• 58.1	17°09.1	• 03.9	316°32.1	• 40.4					Jupiter	162°49.7	07:55	
10	229°33.7	283°26.6	42.1	263°34.3	57.5	32°11.2	04.1	331°34.2	40.5					Saturn	102°11.3	11:57	
11	244°36.2	298°26.1	41.4	278°35.0	56.8	47°13.3	04.2	346°36.4	40.5								
12	259°38.7	313°25.5	\$21°40.7	293°35.6	\$14°56.1	62°15.4	\$06°04.4	1°38.5	\$21°40.5					Dec 10 Sat	SHA	Mer.pass	
13	274°41.																

DUT1 = UT1-UTC = -0.3785 sec ΔT = TT-UT1 = +68.5625 sec

2016 December 08 to Dec. 10 UT

h	Sun			Moon				
	Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	182°02.0	S22°43.9	81°59.3	10.9'	S03°41.4	10.9'	58.3'	
1	197°01.7	44.2	96°29.2	10.9'	03°30.5	10.9'	58.4'	
2	212°01.4	44.5	110°59.1	10.9'	03°19.6	11.0'	58.4'	
3	227°01.1	.. 44.7	125°29.0	10.8'	03°08.6	11.0'	58.4'	
4	242°00.9	45.0	139°58.8	10.8'	02°57.6	11.0'	58.5'	
5	257°00.6	45.2	154°28.6	10.8'	02°46.6	11.0'	58.5'	
6	272°00.3	S22°45.5	168°58.3	10.7'	S02°35.5	11.1'	58.5'	
7	287°00.0	45.7	183°28.1	10.7'	02°24.4	11.1'	58.6'	
8	301°59.8	46.0	197°57.8	10.7'	02°13.3	11.1'	58.6'	
9	316°59.5	.. 46.2	212°27.4	10.7'	02°02.2	11.2'	58.6'	
10	331°59.2	46.5	226°57.1	10.6'	01°51.0	11.2'	58.7'	
11	346°58.9	46.7	241°26.7	10.6'	01°39.8	11.2'	58.7'	
12	1°58.7	S22°47.0	255°56.3	10.6'	S01°28.6	11.2'	58.8'	
13	16°58.4	47.2	270°25.8	10.5'	01°17.4	11.2'	58.8'	
14	31°58.1	47.5	284°55.3	10.5'	01°06.1	11.3'	58.8'	
15	46°57.8	.. 47.7	299°24.8	10.4'	00°54.9	11.3'	58.9'	
16	61°57.5	48.0	313°54.2	10.4'	00°43.6	11.3'	58.9'	
17	76°57.3	48.2	328°23.6	10.4'	00°32.3	11.3'	58.9'	
18	91°57.0	S22°48.5	342°52.9	10.3'	S00°20.9	11.3'	59.0'	
19	106°56.7	48.7	357°22.3	10.3'	S00°09.6	11.3'	59.0'	
20	121°56.4	49.0	11°51.5	10.3'	N00°01.8	11.4'	59.0'	
21	136°56.2	.. 49.2	26°20.8	10.2'	00°13.1	11.4'	59.1'	
22	151°55.9	49.5	40°50.0	10.2'	00°24.5	11.4'	59.1'	
23	166°55.6	49.7	55°19.1	10.1'	00°35.9	11.4'	59.1'	
	SD.=16.2	d=-0.3			S.D.=16.0			

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	181°55.3	S22°49.9	69°48.2	10.1'	N00°47.3	11.4'	59.2'
1	196°55.0	50.2	84°17.3	10.0'	00°58.7	11.4'	59.2'
2	211°54.8	50.4	98°46.3	10.0'	01°10.1	11.4'	59.2'
3	226°54.5	.. 50.7	113°15.3	10.0'	01°21.6	11.4'	59.3'
4	241°54.2	50.9	127°44.2	9.9'	01°33.0	11.4'	59.3'
5	256°53.9	51.1	142°13.1	9.9'	01°44.4	11.4'	59.3'
6	271°53.6	S22°51.4	156°42.0	9.8'	N01°55.9	11.4'	59.4'
7	286°53.4	51.6	171°10.8	9.8'	02°07.3	11.4'	59.4'
8	301°53.1	51.8	185°39.5	9.7'	02°18.8	11.4'	59.4'
9	316°52.8	.. 52.1	200°08.2	9.7'	02°30.2	11.4'	59.5'
10	331°52.5	52.3	214°36.9	9.6'	02°41.7	11.4'	59.5'
11	346°52.2	52.5	229°05.5	9.6'	02°53.1	11.4'	59.5'
12	1°52.0	S22°52.8	243°34.0	9.5'	N03°04.6	11.4'	59.6'
13	16°51.7	53.0	258°02.5	9.5'	03°16.0	11.4'	59.6'
14	31°51.4	53.2	272°31.0	9.4'	03°27.4	11.4'	59.6'
15	46°51.1	.. 53.5	286°59.4	9.4'	03°38.8	11.4'	59.7'
16	61°50.8	53.7	301°27.7	9.3'	03°50.3	11.4'	59.7'
17	76°50.6	53.9	315°56.0	9.3'	04°01.7	11.4'	59.7'
18	91°50.3	S22°54.1	330°24.3	9.2'	N04°13.1	11.4'	59.8'
19	106°50.0	54.4	344°52.4	9.2'	04°24.4	11.4'	59.8'
20	121°49.7	54.6	359°20.6	9.1'	04°35.8	11.4'	59.8'
21	136°49.4	.. 54.8	13°48.6	9.0'	04°47.2	11.3'	59.8'
22	151°49.1	55.0	28°16.6	9.0'	04°58.5	11.3'	59.9'
23	166°48.9	55.3	42°44.6	8.9'	05°09.8	11.3'	59.9'
	SD.=16.2	d=-0.2			S.D.=16.2		

Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	181°48.6	S22°55.5	57°12.5	8.9'	N05°21.1	11.3'	59.9'
1	196°48.3	55.7	71°40.3	8.8'	05°32.4	11.3'	60.0'
2	211°48.0	55.9	86°08.1	8.8'	05°43.7	11.2'	60.0'
3	226°47.7	.. 56.1	100°35.8	8.7'	05°54.9	11.2'	60.0'
4	241°47.4	56.4	115°03.5	8.6'	06°06.1	11.2'	60.1'
5	256°47.2	56.6	129°31.1	8.6'	06°17.3	11.2'	60.1'
6	271°46.9	S22°56.8	143°58.6	8.5'	N06°28.5	11.1'	60.1'
7	286°46.6	57.0	158°26.1	8.4'	06°39.6	11.1'	60.1'
8	301°46.3	57.2	172°53.5	8.4'	06°50.7	11.1'	60.2'
9	316°46.0	.. 57.4	187°20.9	8.3'	07°01.8	11.1'	60.2'
10	331°45.7	57.7	201°48.2	8.3'	07°12.8	11.0'	60.2'
11	346°45.5	57.9	216°15.4	8.2'	07°23.8	11.0'	60.3'
12	1°45.2	S22°58.1	230°42.6	8.1'	N07°34.8	11.0'	60.3'
13	16°44.9	58.3	245°09.7	8.1'	07°45.7	10.9'	60.3'
14	31°44.6	58.5	259°36.7	8.0'	07°56.6	10.9'	60.3'
15	46°44.3	.. 58.7	274°03.7	7.9'	08°07.5	10.8'	60.4'
16	61°44.0	58.9	288°30.6	7.9'	08°18.3	10.8'	60.4'
17	76°43.7	59.1	302°57.4	7.8'	08°29.1	10.8'	60.4'
18	91°43.5	S22°59.3	317°24.2	7.7'	N08°39.8	10.7'	60.4'
19	106°43.2	59.5	331°50.9	7.7'	08°50.5	10.7'	60.5'
20	121°42.9	22°59.7	346°17.5	7.6'	09°01.1	10.6'	60.5'
21	136°42.6	23°00.0	0°44.1	7.5'	09°11.7	10.6'	60.5'
22	151°42.3	00.2	15°10.6	7.5'	09°22.3	10.5'	60.5'
23	166°42.0	00.4	29°37.1	7.4'	09°32.8	10.5'	60.6'
	SD.=16.2	d=-0.2			S.D.=16.4		

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

Lat.	Thu	Moonrise		Sat	Moonset	
		Fri	Sat		Thu	Fri
N 72°	13:16	13:09	13:02	—	01:36	03:32
N 70°	13:14	13:14	13:13	—	01:34	03:24
68°	13:13	13:17	13:22	—	01:33	03:16
66°	13:11	13:20	13:30	—	01:32	03:11
64°	13:10	13:23	13:36	00:00	01:31	03:06
62°	13:09	13:25	13:42	00:03	01:31	03:01
60°	13:08	13:27	13:47	00:06	01:30	02:58

**December 11, 12, 13 UT (Sun., Mon., Tue.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	80°08.2	133°19.1	\$21°31.9	113°43.3	\$14°48.2	242°40.7	\$06°06.0	182°04.3	\$21°40.8									Alpheratz	357°41.0	29°11.2			
1	95°10.7	148°18.6	31.2	128°43.9	47.5	257°42.8	06.1	197°06.5	40.9									Ankaa	353°13.3	-42°13.1			
2	110°13.2	163°18.0	30.5	143°44.6	46.8	272°44.9	06.3	212°08.6	40.9								Schedar	349°37.5	56°38.0				
3	125°15.6	178°17.5	· · 29.7	158°45.2	· · 46.2	287°47.0	· · 06.4	227°10.8	· · 40.9								Diphda	348°53.5	-17°53.8				
4	140°18.1	193°17.0	29.0	173°45.8	45.5	302°49.1	06.5	242°12.9	40.9								Achernar	335°24.8	-57°09.4				
5	155°20.6	208°16.4	28.3	188°46.5	44.8	317°51.3	06.7	257°15.0	41.0								Hamal	327°57.8	23°32.5				
6	170°23.0	223°15.9	\$21°27.5	203°47.1	\$14°44.2	332°53.4	\$06°06.8	272°17.2	\$21°41.0								Polaris	316°17.3	89°20.2				
7	185°25.5	238°15.4	26.8	218°47.8	43.5	347°55.5	07.0	287°19.3	41.0								Acamar	315°16.3	-40°14.5				
8	200°28.0	253°14.9	26.0	233°48.4	42.8	2°57.6	07.1	302°21.5	41.1								Menkar	314°12.3	4°09.2				
9	215°30.4	268°14.3	· · 25.3	248°49.1	· · 42.2	17°59.7	· · 07.2	317°23.6	· · 41.1								Mirfak	308°36.5	49°55.2				
10	230°32.9	283°13.8	24.5	263°49.7	41.5	33°01.8	07.4	332°25.8	41.1								Aldebaran	290°46.3	16°32.4				
11	245°35.4	298°13.3	23.8	278°50.3	40.8	48°03.9	07.5	347°27.9	41.1								Rigel	281°09.5	-8°11.1				
12	260°37.8	313°12.8	\$21°23.1	293°51.0	\$14°40.2	63°06.0	\$06°07.6	2°30.1	\$21°41.2								Capella	280°30.5	46°00.7				
13	275°40.3	328°12.3	22.3	308°51.6	39.5	78°08.1	07.8	17°32.2	41.2								Bellatrix	278°29.2	6°21.7				
14	290°42.7	343°11.7	21.6	323°52.3	38.8	93°10.3	07.9	32°34.4	41.2								El Nath	278°09.3	28°37.1				
15	305°45.2	358°11.2	· · 20.8	338°52.9	· · 38.1	108°12.4	· · 08.0	47°36.5	· · 41.2								Alnilam	275°43.7	-1°11.7				
16	320°47.7	13°10.7	20.1	353°53.6	37.5	123°14.5	08.2	62°38.7	41.3								Betelgeuse	270°58.4	7°24.4				
17	335°50.1	28°10.2	19.3	8°54.2	36.8	138°16.6	08.3	77°40.8	41.3								Canopus	263°54.5	-52°42.4				
18	350°52.6	43°09.7	\$21°18.6	23°54.8	\$14°36.1	153°18.7	\$06°08.4	92°43.0	\$21°41.3								Sirius	258°31.3	-16°44.5				
19	5°55.1	58°09.1	17.8	38°55.5	35.5	168°20.8	08.6	107°45.1	41.3								Adhara	255°10.3	-28°59.8				
20	20°57.5	73°08.6	17.1	53°56.1	34.8	183°22.9	08.7	122°47.3	41.4								Procyon	244°57.0	5°10.7				
21	36°00.0	88°08.1	· · 16.3	68°56.8	· · 34.1	198°25.0	· · 08.8	137°49.4	· · 41.4								Pollux	243°24.6	27°58.8				
22	51°02.5	103°07.6	15.6	83°57.4	33.5	213°27.2	09.0	152°51.6	41.4								Avior	234°16.5	-59°33.7				
23	66°04.9	118°07.1	14.8	98°58.1	32.8	228°29.3	09.1	167°53.7	41.5								Suhail	222°50.4	-43°30.0				
Mer.pass.:18:36				v-0.5 d0.7 m-4.1				v0.6 d0.7 m0.7				v2.1 d-0.1 m-1.7				v2.1 d-0.0 m0.5							
Mon				GHA				GHA				GHA				GHA				GHA			
0	81°07.4	133°06.6	\$21°14.1	113°58.7	\$14°32.1	243°31.4	\$06°09.3	182°55.8	\$21°41.5								Denebola	182°31.3	14°28.6				
1	96°09.8	148°06.1	13.3	128°59.4	31.4	258°33.5	09.4	197°58.0	41.5								Gienah	175°49.9	-17°38.0				
2	111°12.3	163°05.5	12.5	144°00.0	30.8	273°35.6	09.5	213°00.1	41.5								Acrux	173°06.7	-63°11.2				
3	126°14.8	178°05.0	· · 11.8	159°06.0	· · 30.1	288°37.7	· · 09.7	228°02.3	· · 41.6								Gacrux	171°58.3	-57°12.1				
4	141°17.2	193°04.5	11.0	174°01.3	29.4	303°39.8	09.8	243°04.4	41.6								Alioth	166°19.0	55°51.9				
5	156°19.7	208°04.0	10.3	189°01.9	28.8	318°42.0	09.9	258°06.6	41.6								Spica	158°28.9	-11°14.8				
6	171°22.2	223°03.5	\$21°09.5	204°02.6	\$14°28.1	333°44.1	\$06°10.1	273°08.7	\$21°41.6								Alkaid	152°57.4	49°13.7				
7	186°24.6	238°03.0	08.7	219°03.2	27.4	348°46.2	10.2	288°10.9	41.7								Hadar	148°44.9	-60°26.9				
8	201°27.1	253°02.5	08.0	234°03.9	26.7	3°48.3	10.3	303°13.0	41.7								Menkent	148°05.0	-36°26.9				
9	216°29.6	268°02.0	· · 07.2	249°04.5	· · 26.1	18°50.4	· · 10.5	318°15.2	· · 41.7								Arcturus	145°53.9	19°05.7				
10	231°32.0	283°01.5	06.5	264°05.2	25.4	33°52.5	10.6	333°17.3	41.7								Rigel Kent.	139°48.9	-60°53.9				
11	246°34.5	298°01.0	05.7	279°05.8	24.7	48°54.6	10.7	348°19.5	41.8								Kochab	137°21.3	74°05.1				
12	261°37.0	313°00.5	\$21°04.9	294°06.5	\$14°24.0	63°56.8	\$06°10.9	3°21.6	\$21°41.8								Zuben ubi	137°03.1	-16°06.5				
13	276°39.4	328°00.0	04.2	309°07.1	23.4	78°58.9	11.0	18°23.8	41.8								Alphecca	126°09.4	26°39.6				
14	291°41.9	342°59.5	03.4	324°07.7	22.7	94°01.0	11.1	33°25.9	41.8								Antares	112°23.7	-26°27.9				
15	306°44.3	357°59.0	· · 02.6	339°08.4	· · 22.0	109°03.1	· · 11.3	48°28.1	· · 41.9								Atria	107°24.0	-69°03.2				
16	321°46.8	12°58.5	01.8	354°09.0	21.3	124°05.2	11.4	63°30.2	41.9								Sabik	102°10.2	-15°44.5				
17	336°49.3	27°58.0	01.1	9°09.7	20.7	139°07.3	11.5	78°32.4	41.9								Shaula	96°19.2	-37°06.7				
18	351°51.7	42°57.5	\$21°00.3	24°10.3	\$14°20.0	154°09.5	\$06°11.7	93°34.5	\$21°42.0								Rasalhague	96°04.6	12°33.1				
19	6°54.2	57°57.0	20°59.5	39°11.0	19.3	169°11.6	11.8	108°36.7	42.0								Eltanin	90°45.6	51°29.4				
20	21°56.7	72°56.5	58.8	54°11.6	18.6	184°13.7	11.9	123°38.8	42.0								Kaus Aust.	83°41.1	-34°22.4				
21	36°59.1	87°56.0	· · 58.0	69°12.3	· · 18.0	199°15.8	· · 12.1	138°40.9	· · 42.0								Vega	80°37.8	38°48.2				
22	52°01.6	102°55.5	57.2	84°12.9	17.3	214°17.9	12.2	153°43.1	42.1								Nunki	75°55.8	-26°16.4				
23	67°04.1	117°55.0	56.4	99°13.6	16.6	229°20.0	12.3	168°45.2	42.1								Altair	62°06.2	8°55.0				
Mer.pass.:18:32				v-0.5 d0.8 m-4.1				v0.6 d0.7 m0.7				v2.1 d-0.1 m-1.7				v2.1 d-0.0 m0.5							
Tue				GHA				GHA				GHA				GHA				GHA			
0	82°06.5	132°54.5	\$20°55.7	114°14.2	\$14°15.9	244°22.2	\$06°12.5	183°47.4	\$21°42.1								Dec 11 Sun	SHA	Mer.pass				
1	97°09.0	147°54.0	54.9	129°14.9	15.3	259°24.3	12.6	198°49.5	42.1								Venus	53°10.8	15:07				
2	112°11.5	162°53.5	54.1	144°15.5	14.6	274°26.4	12.7	213°51.7	42.2								Mars	33°35.0	16:24				
3	127°13.9	177°53.0	· · 53.3	159°16.2	· · 13.9	289°28.5	· · 12.9	228°53.8	· · 42.2								Jupiter	162°32.5	07:48				
4	142°16.4	192°52.5	52.5	174°16.8	13.2	304°30.6	13.0	243°56.0	42.2								Saturn	101°56.1	11:50				
5	157°18.8	207°52.0	51.8	189°17.5	12.6	319°32.8	13.1	258°58.1	42.2</td														

DUT1 = UT1-UTC = -0.3823 sec ΔT = TT-UT1 = +68.5663 sec

2016 December 11 to Dec. 13 UT

h		Sun		Moon				
Sun		GHA	Dec	GHA	ν	Dec	d	HP
0	181°41.7	S23°00.6	44°03.5	7.3'	N09°43.2	10.4'	60.6'	
1	196°41.5	09.8	58°29.8	7.3'	09°53.6	10.4'	60.6'	
2	211°41.2	01.0	72°56.0	7.2'	10°03.9	10.3'	60.6'	
3	226°40.9	.. 01.2	87°22.2	7.1'	10°14.2	10.2'	60.6'	
4	241°40.6	01.4	101°48.3	7.1'	10°24.4	10.2'	60.7'	
5	256°40.3	01.6	116°14.3	7.0'	10°34.5	10.1'	60.7'	
6	271°40.0	S23°01.8	130°40.3	6.9'	N10°44.6	10.1'	60.7'	
7	286°39.7	02.0	145°06.2	6.9'	10°54.7	10.0'	60.7'	
8	301°39.4	02.2	159°32.0	6.8'	11°04.6	9.9'	60.7'	
9	316°39.1	.. 02.4	173°57.8	6.7'	11°14.5	9.9'	60.8'	
10	331°38.9	02.5	188°23.5	6.7'	11°24.3	9.8'	60.8'	
11	346°38.6	02.7	202°49.1	6.6'	11°34.1	9.7'	60.8'	
12	1°38.3	S23°02.9	217°14.7	6.5'	N11°43.8	9.7'	60.8'	
13	16°38.0	03.1	231°40.2	6.5'	11°53.4	9.6'	60.8'	
14	31°37.7	03.3	246°05.6	6.4'	12°03.0	9.5'	60.9'	
15	46°37.4	.. 03.5	260°31.0	6.3'	12°12.4	9.4'	60.9'	
16	61°37.1	03.7	274°56.3	6.3'	12°21.8	9.4'	60.9'	
17	76°36.8	03.9	289°21.5	6.2'	12°31.1	9.3'	60.9'	
18	91°36.5	S23°04.1	303°46.6	6.1'	N12°40.4	9.2'	60.9'	
19	106°36.3	04.3	318°11.7	6.1'	12°49.5	9.1'	60.9'	
20	121°36.0	04.5	332°36.8	6.0'	12°58.6	9.0'	61.0'	
21	136°35.7	.. 04.6	347°01.7	5.9'	13°07.6	8.9'	61.0'	
22	151°35.4	04.8	1°26.6	5.9'	13°16.5	8.9'	61.0'	
23	166°35.1	05.0	15°51.5	5.8'	13°25.3	8.8'	61.0'	
	SD.=16.2	d=-0.2			S.D.=16.6			

Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	181°34.8	S23°05.2	30°16.2	5.7'	N13°34.0	8.7'	61.0'
1	196°34.5	05.4	44°40.9	5.7'	13°42.6	8.6'	61.0'
2	211°34.2	05.6	59°05.6	5.6'	13°51.2	8.5'	61.0'
3	226°33.9	.. 05.7	73°30.2	5.6'	13°59.6	8.4'	61.0'
4	241°33.6	05.9	87°54.7	5.5'	14°08.0	8.3'	61.1'
5	256°33.4	06.1	102°19.1	5.4'	14°16.2	8.2'	61.1'
6	271°33.1	S23°06.3	116°43.5	5.4'	N14°24.4	8.1'	61.1'
7	286°32.8	06.5	131°07.9	5.3'	14°32.4	8.0'	61.1'
8	301°32.5	06.6	145°32.2	5.2'	14°40.4	7.9'	61.1'
9	316°32.2	.. 06.8	159°56.4	5.2'	14°48.3	7.8'	61.1'
10	331°31.9	07.0	174°20.5	5.1'	14°56.0	7.7'	61.1'
11	346°31.6	07.2	188°44.7	5.1'	15°03.7	7.6'	61.1'
12	1°31.3	S23°07.3	203°08.7	5.0'	N15°11.2	7.5'	61.1'
13	16°31.0	07.5	217°32.7	5.0'	15°18.7	7.4'	61.1'
14	31°30.7	07.7	231°56.6	4.9'	15°26.0	7.3'	61.1'
15	46°30.4	.. 07.9	246°20.5	4.9'	15°33.3	7.2'	61.1'
16	61°30.1	08.0	260°44.4	4.8'	15°40.4	7.1'	61.1'
17	76°29.8	08.2	275°08.1	4.8'	15°47.4	7.0'	61.1'
18	91°29.6	S23°08.4	289°31.9	4.7'	N15°54.3	6.8'	61.2'
19	106°29.3	08.5	303°55.6	4.7'	16°01.1	6.7'	61.2'
20	121°29.0	08.7	318°19.2	4.6'	16°07.7	6.6'	61.2'
21	136°28.7	.. 08.9	332°42.8	4.6'	16°14.3	6.5'	61.2'
22	151°28.4	09.0	347°06.3	4.5'	16°20.7	6.4'	61.2'
23	166°28.1	09.2	1°29.8	4.5'	16°27.0	6.3'	61.2'
	SD.=16.2	d=-0.2			S.D.=16.7		

Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	181°27.8	S23°09.4	15°53.3	4.4'	N16°33.2	6.1'	61.2'
1	196°27.5	09.5	30°16.7	4.4'	16°39.3	6.0'	61.2'
2	211°27.2	09.7	44°40.1	4.4'	16°45.2	5.9'	61.2'
3	226°26.9	.. 09.9	59°03.4	4.3'	16°51.1	5.8'	61.2'
4	241°26.6	10.0	73°26.7	4.3'	16°56.8	5.6'	61.2'
5	256°26.3	10.2	87°49.9	4.2'	17°02.4	5.5'	61.2'
6	271°26.0	S23°10.3	102°13.2	4.2'	N17°07.8	5.4'	61.1'
7	286°25.7	10.5	116°36.3	4.2'	17°13.1	5.3'	61.1'
8	301°25.4	10.7	130°59.5	4.1'	17°18.4	5.1'	61.1'
9	316°25.1	.. 10.8	145°22.6	4.1'	17°23.4	5.0'	61.1'
10	331°24.8	11.0	159°45.7	4.1'	17°28.4	4.9'	61.1'
11	346°24.5	11.1	174°08.8	4.0'	17°33.2	4.8'	61.1'
12	1°24.3	S23°11.3	188°31.8	4.0'	N17°37.9	4.6'	61.1'
13	16°24.0	11.4	202°54.8	4.0'	17°42.4	4.5'	61.1'
14	31°23.7	11.6	217°17.8	4.0'	17°46.9	4.4'	61.1'
15	46°23.4	.. 11.7	231°40.8	4.0'	17°51.2	4.2'	61.1'
16	61°23.1	11.9	246°03.7	3.9'	17°55.3	4.1'	61.1'
17	76°22.8	12.0	260°26.6	3.9'	17°59.3	4.0'	61.1'
18	91°22.5	S23°12.2	274°49.5	3.9'	N18°03.2	3.8'	61.1'
19	106°22.2	12.3	289°12.4	3.9'	18°07.0	3.7'	61.1'
20	121°21.9	12.5	303°35.3	3.9'	18°10.6	3.6'	61.0'
21	136°21.6	.. 12.6	317°58.2	3.9'	18°14.1	3.4'	61.0'
22	151°21.3	12.8	332°21.0	3.9'	18°17.4	3.3'	61.0'
23	166°21.0	12.9	346°43.9	3.8'	18°20.6	3.1'	61.0'
	SD.=16.2	d=-0.2			S.D.=16.7		

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

Lat.	Sun	Moonrise		Moonset	
		Mon	Tue	Sun	Tue
N 72°	12:55	12:44	12:23	05:36	07:48
N 70°	13:14	13:18	13:28	05:18	07:16
68°	13:30	13:42	14:04	05:03	06:52
66°	13:43	14:01	14:30	04:52	06:34
64°	13:53	14:17	14:50	04:42	06:20
62°	14:03	14:29	15:06	04:34	06:07
60°	14:11	14:41	15:20	04:27	05:57
N 58°	14:17	14:50	15:32	04:21	05:48
56°	14:24	14:59	15:42	04:16	05:40
54°	14:29	15:06	15:51	04:11	05:33
52°	14:34	15:13	15:59	04:06	05:27

**December 14, 15, 16 UT (Wed., Thu., Fri.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	83°05.7	132°42.9	\$20°36.7	114°29.8	\$13°59.6	245°13.1	\$06°15.6	184°38.9	\$21°42.7	Alpheratz	357°41.0	29°11.2											
1	98°08.1	147°42.4	35.9	129°30.5	59.0	260°15.2	15.8	199°41.1	42.8	Ankaa	353°13.4	-42°13.1											
2	113°10.6	162°42.0	35.1	144°31.1	58.3	275°17.3	15.9	214°43.2	42.8	Schedar	349°37.5	56°38.0											
3	128°13.1	177°41.5	· · 34.3	159°31.8	· · 57.6	290°19.4	· · 16.0	229°45.4	· · 42.8	Diphda	348°53.5	-17°53.8											
4	143°15.5	192°41.0	33.5	174°32.4	56.9	305°21.5	16.1	244°47.5	42.8	Achernar	335°24.8	-57°09.4											
5	158°18.0	207°40.5	32.7	189°33.1	56.2	320°23.7	16.3	259°49.7	42.9	Hamal	327°57.8	23°32.5											
6	173°20.5	222°40.1	\$20°31.9	204°33.8	\$13°55.5	335°25.8	\$06°16.4	274°51.8	\$21°42.9	Polaris	316°17.8	89°20.2											
7	188°22.9	237°39.6	31.1	219°34.4	54.9	350°27.9	16.5	289°54.0	42.9	Acamar	315°16.3	-40°14.5											
8	203°25.4	252°39.1	30.3	234°35.1	54.2	5°30.0	16.7	304°56.1	42.9	Menkar	314°12.3	4°09.2											
9	218°27.8	267°38.7	· · 29.5	249°35.7	· · 53.5	20°32.2	· · 16.8	319°58.3	· · 43.0	Mirfak	308°36.5	49°55.2											
10	233°30.3	282°38.2	28.7	264°36.4	52.8	35°34.3	16.9	335°00.4	43.0	Aldebaran	290°46.3	16°32.4											
11	248°32.8	297°37.7	27.9	279°37.0	52.1	50°36.4	17.1	350°02.6	43.0	Rigel	281°09.5	-8°11.1											
12	263°35.2	312°37.3	\$20°27.1	294°37.7	\$13°51.4	65°38.5	\$06°17.2	5°04.7	\$21°43.0	Capella	280°30.5	46°00.7											
13	278°37.7	327°36.8	26.3	309°38.3	50.8	80°40.7	17.3	20°06.8	43.1	Bellatrix	278°29.1	6°21.7											
14	293°40.2	342°36.4	25.5	324°39.0	50.1	95°42.8	17.4	35°09.0	43.1	El Nath	278°09.2	28°37.1											
15	308°42.6	357°35.9	· · 24.6	339°39.6	· · 49.4	110°44.9	· · 17.6	50°11.1	· · 43.1	Alnilam	275°43.6	-1°11.7											
16	323°45.1	12°35.4	23.8	354°40.3	48.7	125°47.0	17.7	65°13.3	43.1	Betelgeuse	270°58.4	7°24.4											
17	338°47.6	27°35.0	23.0	9°40.9	48.0	140°49.2	17.8	80°15.4	43.2	Canopus	263°54.5	-52°42.4											
18	353°50.0	42°34.5	\$20°22.2	24°41.6	\$13°47.3	155°51.3	\$06°18.0	95°17.6	\$21°43.2	Sirius	258°31.3	-16°44.5											
19	8°52.5	57°34.1	21.4	39°42.3	46.7	170°53.4	18.1	110°19.7	43.2	Adhara	255°10.3	-28°59.8											
20	23°55.0	72°33.6	20.6	54°42.9	46.0	185°55.5	18.2	125°21.9	43.2	Procyon	244°57.0	5°10.7											
21	38°57.4	87°33.1	· · 19.8	69°43.6	· · 45.3	200°57.7	· · 18.3	140°24.0	· · 43.3	Pollux	243°24.6	27°58.8											
22	53°59.9	102°32.7	18.9	84°44.2	44.6	215°59.8	18.5	155°26.2	43.3	Avior	234°16.5	-59°33.8											
23	69°02.3	117°32.2	18.1	99°44.9	43.9	231°01.9	18.6	170°28.3	43.3	Suhail	222°50.4	-43°30.0											
Mer.pass.:18:25				v-0.5 d0.8 m-4.1				v0.7 d0.7 m0.8				v2.1 d-0.1 m-1.7				v2.1 d-0.0 m0.5							
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	84°04.8	132°31.8	\$20°17.3	114°45.5	\$13°43.2	246°04.0	\$06°18.7	185°30.5	\$21°43.3	Denebola	182°31.3	61°39.3											
1	99°07.3	147°31.3	16.5	129°46.2	42.5	261°06.2	18.9	200°32.6	43.4	Gienah	175°49.9	-17°38.0											
2	114°09.7	162°30.9	15.7	144°46.8	41.8	276°08.3	19.0	215°34.8	43.4	Acrux	173°06.7	-63°11.2											
3	129°12.2	177°30.4	· · 14.8	159°47.5	· · 41.2	291°10.4	· · 19.1	230°36.9	· · 43.4	Gacrux	171°58.3	-57°12.1											
4	144°14.7	192°30.0	14.0	174°48.2	40.5	306°12.6	19.2	245°39.1	43.4	Alioth	166°19.0	55°51.9											
5	159°17.1	207°29.5	13.2	189°48.8	39.8	321°14.7	19.4	260°41.2	43.5	Spica	158°28.9	-11°14.8											
6	174°19.6	222°29.1	\$20°12.4	204°49.5	\$13°39.1	336°16.8	\$06°19.5	275°43.4	\$21°43.5	Alkaid	152°57.4	49°13.6											
7	189°22.1	237°28.6	11.5	219°50.1	38.4	351°18.9	19.6	290°45.5	43.5	Hadar	148°44.8	-60°26.9											
8	204°24.5	252°28.2	10.7	234°50.8	37.7	6°21.1	19.8	305°47.7	43.5	Menkent	148°05.0	-36°26.9											
9	219°27.0	267°27.7	· · 09.9	249°51.4	· · 37.0	21°23.2	· · 19.9	320°49.8	· · 43.6	Arcturus	145°53.8	19°05.7											
10	234°29.4	282°27.3	09.0	264°52.1	36.3	36°25.3	20.0	335°51.9	43.6	Rigil Kent.	139°48.9	-60°53.9											
11	249°31.9	297°26.8	08.2	279°52.8	35.7	51°27.5	20.1	350°54.1	43.6	Kochab	137°21.2	74°05.1											
12	264°34.4	312°26.4	\$20°07.4	294°53.4	\$13°35.0	66°29.6	\$06°20.3	5°56.2	\$21°43.6	Zuben ubi	137°03.1	-16°06.5											
13	279°36.8	327°26.0	06.6	309°54.1	34.3	81°31.7	20.4	20°58.4	43.7	Alphecca	126°09.4	26°39.6											
14	294°39.3	342°25.5	05.7	324°54.7	33.6	96°33.8	20.5	36°00.5	43.7	Antares	112°23.7	-26°27.9											
15	309°41.8	357°25.1	· · 04.9	339°55.4	· · 32.9	111°36.0	· · 20.7	51°02.7	· · 43.7	Atria	107°23.9	-69°03.2											
16	324°44.2	12°24.6	04.1	354°56.0	32.2	126°38.1	20.8	66°04.8	43.7	Sabik	102°10.2	-15°44.5											
17	339°46.7	27°24.2	03.2	9°56.7	31.5	141°40.2	20.9	81°07.0	43.8	Rasalhague	96°19.1	-37°06.7											
18	354°49.2	42°23.8	\$20°02.4	24°57.4	\$13°30.8	156°42.4	\$06°21.0	96°09.1	\$21°43.8	Eltanin	90°45.6	51°29.4											
19	9°51.6	57°23.3	01.6	39°58.0	30.1	171°44.5	21.2	111°11.3	43.8	Kaus Aust.	83°41.1	-34°22.4											
20	24°54.1	72°22.9	20°00.7	54°58.7	29.4	186°46.6	21.3	126°13.4	43.8	Vega	80°37.8	38°48.2											
21	39°56.6	87°22.4	19°59.9	69°59.3	· · 28.8	201°48.7	· · 21.4	141°15.6	· · 43.9	Nunki	75°55.8	-26°16.4											
22	54°59.0	102°22.0	59.0	85°00.0	28.1	216°50.9	21.5	156°17.7	43.9	Altair	62°06.2	8°55.0											
23	70°01.5	117°21.6	58.2	100°00.7	27.4	231°53.0	21.7	171°19.9	43.9	Peacock	53°16.1	-56°40.8											
Mer.pass.:18:21				v-0.5 d0.8 m-4.1				v0.7 d0.7 m0.8				v2.1 d-0.1 m-1.7				v2.1 d-0.0 m0.5							
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	85°03.9	132°21.1	\$19°57.4	115°01.3	\$13°26.7	246°55.1	\$06°21.8	186°22.0	\$21°43.9	Dec 14 Wed	15°21.5	-29°32.1											
1	100°06.4	147°20.7	56.5	130°02.0	26.0	261°57.3	21.9	201°24.2	44.0	Venus	49°37.2	15:10											
2	115°08.9	162°20.3	55.7	145°02.6	25.3	276°59.4	22.0	216°26.3	44.0	Mars	31°24.2	16:21											
3	130°11.3	177°19.8	· · 54.8	160°03.3	· · 24.6	292°01.5	· · 22.2	231°28.5	· · 44.0	Jupiter	162°07.4	07:38											
4	145°13.8	192°19.4	54.0	175°04.0	23.9	307°03.7	22.3	246°30.6	44.0	Saturn	101°33.3	11:40											
5	160°16.3	207°19.0	53.2	190°04.6	23.2	322°05.8	22.4	261°32.8	44.1	Dec 15 Thu	15°51.1	28°10.7											
6	175°18.7	222°18.5	\$19°52.3	205°05.3	\$13°22.5	337°07.9	\$06°22.6	276°34.9	\$21°44.1	Venus	48°27.0	15:10											
7	190°21.2	237°18.1	51.5	220°05.9	21.8	352°10.1	22.7	291°37.1															

DUT1 = UT1-UTC = -0.3861 sec ΔT = TT-UT1 = +68.5701 sec

2016 December 14 to Dec. 16 UT

	Sun			Moon			
h	GHA	Dec	GHA	ν	Dec	d	HP
0	181°20.7	S23°13.1	1°06.7	3.8'	N18°23.7	3.0'	61.0'
1	196°20.4	13.2	15°29.5	3.8'	18°26.7	2.9'	61.0'
2	211°20.1	13.4	29°52.4	3.8'	18°29.5	2.7'	61.0'
3	226°19.8	.. 13.5	44°15.2	3.8'	18°32.1	2.6'	61.0'
4	241°19.5	13.7	58°38.0	3.8'	18°34.6	2.5'	60.9'
5	256°19.2	13.8	73°00.9	3.8'	18°37.0	2.3'	60.9'
6	271°18.9	S23°13.9	87°23.7	3.8'	N18°39.3	2.2'	60.9'
7	286°18.6	14.1	101°46.5	3.8'	18°41.4	2.0'	60.9'
8	301°18.3	14.2	116°09.4	3.8'	18°43.3	1.9'	60.9'
9	316°18.0	.. 14.4	130°32.2	3.9'	18°45.1	1.8'	60.9'
10	331°17.7	14.5	144°55.1	3.9'	18°46.8	1.6'	60.8'
11	346°17.4	14.6	159°18.0	3.9'	18°48.4	1.5'	60.8'
12	1°17.1	S23°14.8	173°40.9	3.9'	N18°49.8	1.3'	60.8'
13	16°16.8	14.9	188°03.8	3.9'	18°51.1	1.2'	60.8'
14	31°16.5	15.0	202°26.7	3.9'	18°52.2	1.1'	60.8'
15	46°16.2	.. 15.2	216°49.6	4.0'	18°53.2	0.9'	60.7'
16	61°15.9	15.3	231°12.6	4.0'	18°54.0	0.8'	60.7'
17	76°15.6	15.4	245°35.6	4.0'	18°54.7	0.6'	60.7'
18	91°15.3	S23°15.6	259°58.6	4.0'	N18°55.3	0.5'	60.7'
19	106°15.0	15.7	274°21.6	4.1'	18°55.7	0.4'	60.6'
20	121°14.7	15.8	288°44.7	4.1'	18°56.0	0.2'	60.6'
21	136°14.4	.. 15.9	303°07.8	4.1'	18°56.2	0.1'	60.6'
22	151°14.1	16.1	317°30.9	4.1'	18°56.2	-0.1'	60.6'
23	166°13.8	16.2	331°54.1	4.2'	18°56.1	-0.2'	60.5'
	SD.=16.2	d=-0.1			S.D.=16.6		

Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	181°13.5	S23°16.3	346°17.3	4.2'	N18°55.8	-0.3'	60.5'
1	196°13.2	16.5	0°40.5	4.3'	18°55.4	-0.5'	60.5'
2	211°12.9	16.6	15°03.8	4.3'	18°54.9	-0.6'	60.5'
3	226°12.6	.. 16.7	29°27.1	4.3'	18°54.2	-0.7'	60.4'
4	241°12.3	16.8	43°50.5	4.4'	18°53.4	-0.9'	60.4'
5	256°12.0	16.9	58°13.9	4.4'	18°52.5	-1.0'	60.4'
6	271°11.7	S23°17.1	72°37.3	4.5'	N18°51.4	-1.1'	60.4'
7	286°11.4	17.2	87°00.8	4.5'	18°50.2	-1.3'	60.3'
8	301°11.1	17.3	101°24.3	4.6'	18°48.9	-1.4'	60.3'
9	316°10.8	.. 17.4	115°47.9	4.6'	18°47.4	-1.5'	60.3'
10	331°10.5	17.5	130°11.5	4.7'	18°45.8	-1.7'	60.3'
11	346°10.2	17.7	144°35.2	4.7'	18°44.1	-1.8'	60.2'
12	1°09.9	S23°17.8	158°59.0	4.8'	N18°42.2	-1.9'	60.2'
13	16°09.6	17.9	173°22.8	4.8'	18°40.2	-2.1'	60.2'
14	31°09.3	18.0	187°46.6	4.9'	18°38.1	-2.2'	60.1'
15	46°09.0	.. 18.1	202°10.5	4.9'	18°35.8	-2.3'	60.1'
16	61°08.7	18.2	216°34.5	5.0'	18°33.5	-2.4'	60.1'
17	76°08.4	18.3	230°58.5	5.1'	18°30.9	-2.6'	60.0'
18	91°08.1	S23°18.5	245°22.6	5.1'	N18°28.3	-2.7'	60.0'
19	106°07.8	18.6	259°46.8	5.2'	18°25.6	-2.8'	60.0'
20	121°07.5	18.7	274°11.0	5.3'	18°22.7	-2.9'	59.9'
21	136°07.2	.. 18.8	288°35.3	5.3'	18°19.7	-3.1'	59.9'
22	151°06.9	18.9	302°59.7	5.4'	18°16.5	-3.2'	59.9'
23	166°06.6	19.0	317°24.1	5.5'	18°13.3	-3.3'	59.8'
	SD.=16.2	d=-0.1			S.D.=16.4		

Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	181°06.3	S23°19.1	331°48.6	5.5'	N18°09.9	-3.4'	59.8'
1	196°06.0	19.2	346°13.2	5.6'	18°06.4	-3.5'	59.8'
2	211°05.7	19.3	0°37.8	5.7'	18°02.8	-3.7'	59.7'
3	226°05.4	.. 19.4	15°02.5	5.7'	17°59.1	-3.8'	59.7'
4	241°05.1	19.5	29°27.3	5.8'	17°55.3	-3.9'	59.7'
5	256°04.8	19.6	43°52.1	5.9'	17°51.3	-4.0'	59.6'
6	271°04.5	S23°19.7	58°17.1	6.0'	N17°47.3	-4.1'	59.6'
7	286°04.2	19.8	72°42.1	6.0'	17°43.1	-4.2'	59.6'
8	301°03.9	19.9	87°07.2	6.1'	17°38.8	-4.4'	59.5'
9	316°03.6	.. 20.0	101°32.3	6.2'	17°34.4	-4.5'	59.5'
10	331°03.3	20.1	115°57.6	6.3'	17°29.8	-4.6'	59.5'
11	346°03.0	20.2	130°22.9	6.4'	17°25.2	-4.7'	59.4'
12	1°02.7	S23°20.3	144°48.3	6.4'	N17°20.5	-4.8'	59.4'
13	16°02.4	20.4	159°13.8	6.5'	17°15.6	-4.9'	59.3'
14	31°02.1	20.5	173°39.4	6.6'	17°10.7	-5.0'	59.3'
15	46°01.7	.. 20.6	188°05.0	6.7'	17°05.7	-5.1'	59.3'
16	61°01.4	20.7	202°30.7	6.8'	17°00.5	-5.2'	59.2'
17	76°01.1	20.8	216°56.6	6.9'	16°55.2	-5.3'	59.2'
18	91°00.8	S23°20.9	231°22.5	6.9'	N16°49.9	-5.4'	59.2'
19	106°00.5	21.0	245°48.4	7.0'	16°44.4	-5.5'	59.1'
20	121°00.2	21.1	260°14.5	7.1'	16°38.9	-5.6'	59.1'
21	135°59.9	.. 21.2	274°40.7	7.2'	16°33.2	-5.7'	59.0'
22	150°59.6	21.3	289°06.9	7.3'	16°27.5	-5.8'	59.0'
23	165°59.3	21.3	303°33.2	7.4'	16°21.6	-5.9'	59.0'
	SD.=16.2	d=-0.1			S.D.=16.2		

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

Lat.	Wed	Moonrise		Fri	Moonset	
		Thu	Fri		Wed	Thu
N 72°			15:54			13:08
N 70°	13:56	15:06	16:48	10:54	11:52	12:14
68°	14:44	15:52	17:21	10:06	11:07	11:40
66°	15:15	16:22	17:44	09:36	10:37	11:16
64°	15:38	16:44	18:03	09:13	10:14	10:57
62°	15:57	17:02	18:18	08:54	09:56	10:41
60°	16:12	17:17	18:31	08:39	09:41	10:28
N 58°	16:25	17:29	18:42	08:26	09:28	10:16
56°	16:36	17:40	18:52	08:15	09:17	10:07
54°	16:46	17:50	19:00	08:05	09:07	09:58
52°	16:55	17:58	19:08	07:57	08	

**December 17, 18, 19 UT (Sat., Sun., Mon.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	86°03.1	132°11.0	\$19°37.0	115°17.2	\$13°10.0	247°46.4	\$06°24.8	187°13.6	\$21°44.5									Alpheratz	357°41.0	29°11.2			
1	101°05.6	147°10.6	36.1	130°17.9	09.3	262°48.5	24.9	202°15.7	44.6									Ankaa	353°13.4	-42°13.1			
2	116°08.0	162°10.1	35.2	145°18.5	08.6	277°50.6	25.1	217°17.9	44.6								Schedar	349°37.5	56°38.0				
3	131°10.5	177°09.7	· · 34.4	160°19.2	· · 07.9	292°52.8	· · 25.2	232°20.0	· · 44.6								Diphda	348°53.5	-17°53.8				
4	146°12.9	192°09.3	33.5	175°19.8	07.2	307°54.9	25.3	247°22.2	44.6								Achernar	335°24.8	-57°09.4				
5	161°15.4	207°08.9	32.6	190°20.5	06.6	322°57.0	25.4	262°24.3	44.7								Hamal	327°57.8	23°32.5				
6	176°17.9	222°08.5	\$19°31.8	205°21.2	\$13°05.9	337°59.2	\$06°25.6	277°26.5	\$21°44.7								Polaris	316°18.6	89°20.3				
7	191°20.3	237°08.1	30.9	220°21.8	05.2	353°01.3	25.7	292°28.6	44.7								Acamar	315°16.3	-40°14.5				
8	206°22.8	252°07.7	30.0	235°22.5	04.5	8°03.4	25.8	307°30.8	44.7								Menkar	314°12.3	4°09.2				
9	221°25.3	267°07.3	· · 29.2	250°23.2	· · 03.8	23°05.6	· · 25.9	322°32.9	· · 44.8								Mirfak	308°36.5	49°55.2				
10	236°27.7	282°06.9	28.3	265°23.8	03.1	38°07.7	26.0	337°35.1	44.8								Aldebaran	290°46.3	16°32.4				
11	251°30.2	297°06.5	27.4	280°24.5	02.4	53°09.9	26.2	352°37.2	44.8								Rigel	281°09.4	-8°11.2				
12	266°32.7	312°06.1	\$19°26.6	295°25.2	\$13°01.7	68°12.0	\$06°26.3	7°39.4	\$21°44.8								Capella	280°30.4	46°00.7				
13	281°35.1	327°05.7	25.7	310°25.8	01.0	83°14.1	26.4	22°41.5	44.9								Bellatrix	278°29.1	6°21.7				
14	296°37.6	342°05.3	24.8	325°26.5	13°00.3	98°16.3	26.5	37°43.6	44.9								El Nath	278°09.2	28°37.1				
15	311°40.1	357°04.9	· · 24.0	340°27.2	12°59.6	113°18.4	· · 26.7	52°45.8	· · 44.9								Alnilam	275°43.6	-1°11.7				
16	326°42.5	12°04.5	23.1	355°27.8	58.9	128°20.6	26.8	67°47.9	44.9								Betelgeuse	270°58.4	7°24.4				
17	341°45.0	27°04.1	22.2	10°28.5	58.2	143°22.7	26.9	82°50.1	45.0								Canopus	263°54.5	-52°42.4				
18	356°47.4	42°03.7	\$19°21.3	25°29.1	\$12°57.5	158°24.8	\$06°27.0	97°52.2	\$21°45.0								Sirius	258°31.3	-16°44.5				
19	11°49.9	57°03.3	20.5	40°29.8	56.8	173°27.0	27.2	112°54.4	45.0								Adhara	255°10.3	-28°59.8				
20	26°52.4	72°02.9	19.6	55°30.5	56.1	188°29.1	27.3	127°56.5	45.0								Procyon	244°57.0	5°10.7				
21	41°54.8	87°02.5	· · 18.7	70°31.1	· · 55.4	203°31.2	· · 27.4	142°58.7	· · 45.1								Pollux	243°24.5	27°58.8				
22	56°57.3	102°02.1	17.8	85°31.8	54.7	218°33.4	27.5	158°00.8	45.1								Avior	234°16.4	-59°33.8				
23	71°59.8	117°01.7	16.9	100°32.5	54.0	233°35.8	27.6	173°03.0	45.1								Suhail	222°50.3	-43°30.0				
Mer.pass.:18:13				v-0.4 d0.9 m-4.1				v0.7 d0.7 m0.8				v2.1 d-0.1 m-1.7				v2.1 d-0.0 m0.5							
Sun				GHA				GHA				GHA				GHA				GHA			
0	87°02.2	132°01.3	\$19°16.1	115°33.1	\$12°53.3	248°37.7	\$06°27.8	188°05.1	\$21°45.1								Denebola	182°31.3	61°39.3				
1	102°04.7	147°00.9	15.2	130°33.8	52.6	263°39.8	27.9	203°07.3	45.2								Gienah	175°49.9	-17°38.0				
2	117°07.2	162°00.5	14.3	145°34.5	51.9	278°42.0	28.0	218°09.4	45.2								Acrux	173°06.6	-63°11.2				
3	132°09.6	177°00.1	· · 13.4	160°35.1	· · 51.2	293°44.1	· · 28.1	233°11.6	· · 45.2								Gacrux	171°58.2	-57°12.1				
4	147°12.1	191°59.7	12.5	175°35.8	50.5	308°46.2	28.3	248°13.7	45.2								Alioth	166°18.9	55°51.9				
5	162°14.5	206°59.3	11.7	190°36.5	49.8	323°48.4	28.4	263°15.9	45.2								Spica	158°28.9	-11°14.8				
6	177°17.0	221°59.0	\$19°10.8	205°37.1	\$12°49.1	338°50.5	\$06°28.5	278°18.0	\$21°45.3								Alkaid	152°57.4	49°13.6				
7	192°19.5	236°58.6	09.9	220°37.8	48.4	353°52.7	28.6	293°20.2	45.3								Hadar	148°44.8	-60°26.9				
8	207°21.9	251°58.2	09.0	235°38.5	47.7	8°54.8	28.7	308°22.3	45.3								Menkent	148°05.0	-36°26.9				
9	222°24.4	266°57.8	· · 08.1	250°39.2	· · 47.0	23°56.9	· · 28.9	323°24.5	· · 45.3								Arcturus	145°53.8	19°05.7				
10	237°26.9	281°57.4	07.2	265°39.8	46.3	38°59.1	29.0	338°26.6	45.4								Rigel Kent.	139°48.8	-60°53.9				
11	252°29.3	296°57.0	06.3	280°40.5	45.6	54°01.2	29.1	353°28.8	45.4								Kochab	137°21.2	74°05.1				
12	267°31.8	311°56.6	\$19°05.5	295°41.2	\$12°44.9	69°03.4	\$06°29.2	8°30.9	\$21°45.4								Zuben ubi	137°03.0	-16°06.5				
13	282°34.3	326°56.3	04.6	310°41.8	44.1	84°05.5	29.3	23°33.1	45.4								Alphecca	126°09.4	26°39.6				
14	297°36.7	341°55.9	03.7	325°42.5	43.4	99°07.7	29.5	38°35.2	45.5								Antares	112°23.7	-26°27.9				
15	312°39.2	356°55.5	· · 02.8	340°43.2	· · 42.7	114°09.8	· · 29.6	53°37.4	· · 45.5								Atria	107°23.9	-69°03.1				
16	327°41.7	11°55.1	01.9	355°43.8	42.0	129°11.9	29.7	68°39.5	45.5								Sabik	102°10.2	-15°44.5				
17	342°44.1	26°54.7	01.0	10°44.5	41.3	144°14.1	29.8	83°41.7	45.5								Shaula	96°19.1	-37°06.7				
18	357°46.6	41°54.4	\$19°00.1	25°45.2	\$12°40.6	159°16.2	\$06°30.0	98°43.8	\$21°45.6								Rasalhague	96°04.6	12°33.1				
19	12°49.0	56°54.0	18°59.2	40°45.8	39.9	174°18.4	30.1	113°46.0	45.6								Eltanin	90°45.6	51°29.4				
20	27°51.5	71°53.6	58.3	55°46.5	39.2	189°20.5	30.2	128°48.1	45.6								Kaus Aust.	83°41.1	-34°22.4				
21	42°54.0	86°53.2	· · 57.4	70°47.2	· · 38.5	204°22.7	· · 30.3	143°50.3	· · 45.6								Vega	80°37.8	38°48.2				
22	57°56.4	101°52.9	56.5	85°47.8	37.8	219°24.8	30.4	158°52.4	45.7								Nunki	75°55.8	-26°16.4				
23	72°58.9	116°52.5	55.6	100°48.5	37.1	234°27.0	30.6	173°54.5	45.7								Altair	62°06.2	8°55.0				
Mer.pass.:18:09				v-0.4 d0.9 m-4.1				v0.7 d0.7 m0.8				v2.1 d-0.1 m-1.7				v2.1 d-0.0 m0.5							
Mon				GHA				GHA				GHA				GHA				GHA			
0	88°01.4	131°52.1	\$18°54.7	115°49.2	\$12°36.4	249°29.1	\$06°30.7	188°56.7	\$21°45.7								Dec 17 Sat	SHA	Mer.pass				
1	103°03.8	146°51.7	53.8	130°49.9	35.7	264°31.2	30.8	203°58.8	45.7								Venus	46°07.9	15:12				
2	118°06.3	161°51.4	52.9	145°50.5	35.0	279°33.4	30.9	219°01.0	45.8								Mars	29°14.1	16:18				
3	133°08.8	176°51.0	· · 52.0	160°51.2	· · 34.3	294°35.5	· · 31.0	234°03.1	· · 45.8								Jupiter	161°43.3	07:28				
4	148°11.2	191°50.6	51.1	175°51.9	33.6	309°37.7	31.2	249°05.3	45.8								Saturn	101°10.5	11:29				
5	163°13.7	206°50.3	50.2	190°52.5	32.9	324°39.8	31.3	264°07.															

DUT1 = UT1-UTC = -0.3898 sec ΔT = TT-UT1 = +68.5738 sec

2016 December 17 to Dec. 19 UT

h	Sun			Moon			
Sat	GHA	Dec	GHA	ν	Dec	d	HP
0	180°59.0	S23°21.4	317°59.6	7.5'	N16°15.7	-6.0'	58.9'
1	195°58.7	21.5	332°26.1	7.5'	16°09.7	-6.1'	58.9'
2	210°58.4	21.6	346°52.7	7.6'	16°03.5	-6.2'	58.8'
3	225°58.1	.. 21.7	1°19.4	7.7'	15°57.3	-6.3'	58.8'
4	240°57.8	21.8	15°46.2	7.8'	15°51.0	-6.3'	58.8'
5	255°57.5	21.9	30°13.0	7.9'	15°44.6	-6.4'	58.7'
6	270°57.2	S23°21.9	44°40.0	8.0'	N15°38.2	-6.5'	58.7'
7	285°56.9	22.0	59°07.0	8.1'	15°31.6	-6.6'	58.6'
8	300°56.6	22.1	73°34.1	8.2'	15°25.0	-6.7'	58.6'
9	315°56.3	.. 22.2	88°01.3	8.3'	15°18.2	-6.8'	58.6'
10	330°56.0	22.3	102°28.6	8.3'	15°11.4	-6.8'	58.5'
11	345°55.7	22.3	116°56.0	8.4'	15°04.5	-6.9'	58.5'
12	0°55.3	S23°22.4	131°23.5	8.5'	N14°57.6	-7.0'	58.4'
13	15°55.0	22.5	145°51.0	8.6'	14°50.5	-7.1'	58.4'
14	30°54.7	22.6	160°18.7	8.7'	14°43.4	-7.2'	58.4'
15	45°54.4	.. 22.6	174°46.4	8.8'	14°36.2	-7.2'	58.3'
16	60°54.1	22.7	189°14.3	8.9'	14°28.9	-7.3'	58.3'
17	75°53.8	22.8	203°42.2	9.0'	14°21.6	-7.4'	58.2'
18	90°53.5	S23°22.9	218°10.2	9.0'	N14°14.2	-7.5'	58.2'
19	105°53.2	22.9	232°38.3	9.1'	14°06.7	-7.5'	58.2'
20	120°52.9	23.0	247°06.5	9.2'	13°59.1	-7.6'	58.1'
21	135°52.6	.. 23.1	261°34.7	9.3'	13°51.5	-7.7'	58.1'
22	150°52.3	23.1	276°03.1	9.4'	13°43.8	-7.7'	58.0'
23	165°52.0	23.2	290°31.5	9.5'	13°36.0	-7.8'	58.0'
	SD.=16.2	d=-0.1			S.D.=15.9		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer. Pass.	Mer. Pass.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Pass	Upper hh:mm	Lower hh:mm	18-20 84-66%
17	03:56	03:41	11:56	02:55	15:22	
18	03:27	03:12	11:57	03:48	16:13	
19	02:57	02:42	11:57	04:38	17:01	

**December 20, 21, 22 UT (Tue., Wed., Thu.)**

Aries		Venus		Mars		Jupiter		Saturn		Stars	
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec
0	89°00.5	131°43.4	\$18°32.9	116°05.3	\$12°19.4	250°20.6	\$06°33.5	189°48.3	\$21°46.3	Alpheratz	357°41.0
1	104°03.0	146°43.1	32.0	131°06.0	18.7	265°22.8	33.7	204°50.4	46.3	Ankaa	353°13.4
2	119°05.4	161°42.7	31.1	146°06.7	18.0	280°24.9	33.8	219°52.6	46.3	Schedar	349°37.6
3	134°07.9	176°42.4	.. 30.2	161°07.3	.. 17.3	295°27.1	.. 33.9	234°54.7	.. 46.3	Diphda	348°53.5
4	149°10.4	191°42.0	29.3	176°08.0	16.6	310°29.2	34.0	249°56.9	46.4	Achernar	335°24.9
5	164°12.8	206°41.7	28.4	191°08.7	15.9	325°31.4	34.1	264°59.0	46.4	Hamal	327°57.9
6	179°15.3	221°41.3	\$18°27.4	206°09.4	\$12°15.2	340°33.6	\$06°34.2	280°01.2	\$21°46.4	Polaris	316°19.5
7	194°17.8	236°41.0	26.5	221°10.0	14.5	355°35.7	34.4	295°03.3	46.4	Acamar	315°16.3
8	209°20.2	251°40.6	25.6	236°10.7	13.7	10°37.9	34.5	310°05.5	46.5	Menkar	314°12.3
9	224°22.7	266°40.3	.. 24.7	251°11.4	.. 13.0	255°40.0	.. 34.6	325°07.6	.. 46.5	Mirfak	308°36.5
10	239°25.1	281°39.9	23.7	266°12.1	12.3	40°42.2	34.7	340°09.8	46.5	Aldebaran	290°46.3
11	254°27.6	296°39.6	22.8	281°12.7	11.6	55°44.3	34.8	355°11.9	46.5	Rigel	281°09.4
12	269°30.1	311°39.3	\$18°21.9	296°13.4	\$12°10.9	70°46.5	\$06°34.9	10°14.1	\$21°46.6	Capella	280°30.4
13	284°32.5	326°38.9	21.0	311°14.1	10.2	85°48.6	35.1	25°16.2	46.6	Bellatrix	278°29.1
14	299°35.0	341°38.6	20.0	326°14.8	09.5	100°50.8	35.2	40°18.4	46.6	Elnath	278°09.2
15	314°37.5	356°38.2	.. 19.1	341°15.4	.. 08.8	115°52.9	.. 35.3	55°20.5	.. 46.6	Alnilam	275°43.6
16	329°39.9	11°37.9	18.2	356°16.1	08.1	130°55.1	35.4	70°22.7	46.7	Betelgeuse	270°58.4
17	344°42.4	26°37.6	17.3	11°16.8	07.3	145°57.2	35.5	85°24.8	46.7	Canopus	263°54.5
18	359°44.9	41°37.2	\$18°16.3	26°17.5	\$12°06.6	160°59.4	\$06°35.6	100°27.0	\$21°46.7	Sirius	258°31.3
19	14°47.3	56°36.9	15.4	41°18.1	05.9	176°01.5	35.8	115°29.1	46.7	Adhara	255°10.3
20	29°49.8	71°36.5	14.5	56°18.8	05.2	191°03.7	35.9	130°31.3	46.7	Procyon	244°57.0
21	44°52.3	86°36.2	.. 13.5	71°19.5	.. 04.5	206°05.8	.. 36.0	145°33.4	.. 46.8	Pollux	243°24.5
22	59°54.7	101°35.9	12.6	86°20.2	03.8	221°08.0	36.1	160°35.6	46.8	Avior	234°16.4
23	74°57.2	116°35.5	11.7	101°20.8	03.1	236°10.2	36.2	175°37.7	46.8	Suhail	222°50.3
Mer.pass.:18:01		v-0.4 d0.9 m-4.1		v0.7 d0.7 m0.8		v2.2 d-0.1 m-1.7		v2.1 d-0.0 m0.5		Miaplacidus	
Wed		GHA		GHA		Dec		GHA		Dec	
0	89°59.6	131°35.2	\$18°10.7	116°21.5	\$12°02.3	251°12.3	\$06°36.3	190°39.9	\$21°46.8	Denebola	182°31.3
1	105°02.1	146°34.9	09.8	131°22.2	01.6	266°14.5	36.5	205°42.0	46.9	Gienah	175°49.9
2	120°04.6	161°34.6	08.9	146°22.9	00.9	281°16.6	36.6	220°44.2	46.9	Acrux	173°06.6
3	135°07.0	176°34.2	.. 07.9	161°23.6	12°00.2	296°18.8	.. 36.7	235°46.3	.. 46.9	Gacrux	171°58.2
4	150°09.5	191°33.9	07.0	176°24.2	11°59.5	311°20.9	36.8	250°48.5	46.9	Alioth	166°18.9
5	165°12.0	206°33.6	06.1	191°24.9	58.8	326°23.1	36.9	265°50.6	47.0	Alkaid	152°57.4
6	180°14.4	221°33.2	\$18°05.1	206°25.6	\$11°58.1	341°25.2	\$06°37.0	280°52.8	\$21°47.0	Hadar	148°44.7
7	195°16.9	236°32.9	04.2	221°26.3	57.3	356°27.4	37.2	295°54.9	47.0	Menkent	148°05.0
8	210°19.4	251°32.6	03.2	236°26.9	56.6	11°29.6	37.3	310°57.1	47.0	Arcturus	145°53.8
9	225°21.8	266°32.3	.. 02.3	251°27.6	.. 55.9	26°31.7	.. 37.4	325°59.2	.. 47.0	Rigel Kent.	139°48.8
10	240°24.3	281°31.9	01.4	266°28.3	55.2	41°33.9	37.5	341°01.4	47.1	Kochab	137°21.2
11	255°26.7	296°31.6	18°00.4	281°29.0	54.5	56°36.0	37.6	356°03.5	47.1	Zuben'ubi	137°03.0
12	270°29.2	311°31.3	\$17°59.5	296°29.7	\$11°53.8	71°38.2	\$06°37.7	11°05.7	\$21°47.1	Alphecca	126°09.3
13	285°31.7	326°31.0	58.5	311°30.3	53.1	86°40.3	37.8	26°07.8	47.1	Antares	112°23.7
14	300°34.1	341°30.7	57.6	326°31.0	52.3	101°42.5	38.0	41°10.0	47.2	Atria	107°23.9
15	315°36.6	356°30.3	.. 56.6	341°31.7	.. 51.6	116°44.7	.. 38.1	56°12.1	.. 47.2	Sabik	102°10.2
16	330°39.1	11°30.0	55.7	356°32.4	50.9	131°46.8	38.2	71°14.3	47.2	Shaula	96°19.1
17	345°41.5	26°29.7	54.7	11°33.0	50.2	146°49.0	38.3	86°16.4	47.2	Rasalhague	96°04.6
18	0°44.0	41°29.4	\$17°53.8	26°33.7	\$11°49.5	161°51.1	\$06°38.4	101°18.6	\$21°47.3	Eltanin	90°45.6
19	15°46.5	56°29.1	52.9	41°34.4	48.8	176°53.3	38.5	116°20.7	47.3	Kaus Aust.	83°41.1
20	30°48.9	71°28.8	51.9	56°35.1	48.0	191°55.4	38.6	131°22.9	47.3	Vega	80°37.8
21	45°51.4	86°28.4	.. 51.0	71°35.8	.. 47.3	206°57.6	.. 38.8	146°25.0	.. 47.3	Nunki	75°55.8
22	60°53.9	101°28.1	50.0	86°36.4	46.6	221°59.8	38.9	161°27.2	47.3	Altair	62°06.2
23	75°56.3	116°27.8	49.1	101°37.1	45.9	237°01.9	39.0	176°29.3	47.4	Peacock	53°16.1
Mer.pass.:17:57		v-0.3 d0.9 m-4.1		v0.7 d0.7 m0.8		v2.2 d-0.1 m-1.7		v2.1 d-0.0 m0.5		Enif	33°45.0
Thu		GHA		GHA		Dec		GHA		Dec	
0	90°58.8	131°27.5	\$17°48.1	116°37.8	\$11°45.2	252°04.1	\$06°39.1	191°31.5	\$21°47.4	Al Na'ir	27°41.1
1	106°01.2	146°27.2	47.2	131°38.5	44.5	267°06.2	39.2	206°33.6	47.4	Fomalhaut	15°21.5
2	121°03.7	161°26.9	46.2	146°39.2	43.7	282°08.4	39.3	221°35.8	47.4	Scheat	13°51.1
3	136°06.2	176°26.6	.. 45.2	161°39.8	.. 43.0	297°10.6	.. 39.4	236°37.9	.. 47.5	Markab	13°36.0
4	151°08.6	191°26.3	44.3	176°40.5	42.3	312°12.7	39.5	251°40.1	47.5	Dec 20 Tue	15°21.5
5	166°11.1	206°26.0	43.3	191°41.2	41.6	327°14.9	39.7	266°42.2	47.5	Venus	42°42.9
6	181°13.6	221°25.7	\$17°42.4	206°41.9	\$11°40.9	342°17.1	\$06°39.8	281°44.4	\$21°47.5	Mars	27°04.8
7	196°16.0	236°25.4	41.4	221°42.6	40.1	357°19.2	39.9	296°46.5	47.5	Jupiter	161°20.1
8	211°18.5	251°25.1	40.5	236°43.3	39.4	12°21.4	40.0	311°48.7	47.6	Saturn	100°47.8
9	226°21.0	266°24.8	.. 39.5	251°43.9	.. 38.7	27°23.5	.. 40.1	326°50.8	.. 47.6	Dec 21 Wed	15°11.9
10	241°23.4	281°24.5	38.6	266°44.6	38.0	42°25.7	40.2	341°53.0	47.6	Venus	41°35.6
11	256°25.9	296°24.2	37.6	281°45.3	37.3	57°27.9	40.3	356°55.1	47.6	Mars	26°21.9
12	271°28.4	311°23.9	\$17°36.6	296°46.0	\$11°36.5	72°30.0	\$06°40.5	11°57.3	\$21°47.7	Jupiter	161°12.7
13	286°30.8	326°23.6	35.7	311°46.7	35.8	87°32.2	40.6	26°59.4	47.7	Saturn	100°40.2
14	301°33.3	341°23.3	34.7	326°47.3	35.1	102°34.3	40.7	42°01.6	47.7	Dec 22 Thu	11:16
15	316°35.7	356°23.0	.. 33.8	341°48.0	.. 34.4	117°36.5	.. 40.8	57°03.7	.. 47.7	Venus	40°28.7
16	331°38.2	11°22.7	32.8	356°48.7	33.7	132°38.7	40.9	72°05.9	47.8	Mars	25°39.0
17	346°40.7	26°22.4	31.8	11°49.4	32.9	147°40.8	41.0	87°08.0	47.8	Jupiter	161°05.3
18	1°43.1	41°22.1	\$17°30.9	26°50.1	\$11°32.2	162°43.0	\$06°41.1	102°10.2	\$21°47.8	Saturn	100°32.7
19	16°45.6	56°21.8	29.9	41°50.8	31.5	177°45.2	41.2	117°12.3	47.8	Horizontal parallax	
20	31°48.1	71°21.5	28.9	56°51.4	30.8	192°47.3	41.3	132°14.5	47.8	Venus:	0.2
21	46°50.5	86°21.2	.. 28.0	71°52.1	.. 30.1	207°49.5	.. 41.5	147°16.6	.. 47.9	Mars:	0.1
22	61°53.0	101°20.9	27.0	86°52.8	29.3	222°51.7	41.6	162°18.8	47.9	Mer.pass.:17:53	v-0.3 d1.0 m-4.1
23	76°55.5	116°20.6	26.0	101°53.5	28.6	237°53.8	41.7	177°20.9	47.9	v0.7 d0.7 m0.8	v2.2 d-0.1 m-1.7
Mer.pass.:17:53		v-0.3 d0.9 m-4.1		v0.7 d0.7 m0.8		v2.2 d-0.1 m-1.7		v2.2 d-0.0 m0.5		Dec	29°11.2

DUT1 = UT1-UTC = -0.3936 sec ΔT = TT-UT1 = +68.5776 sec

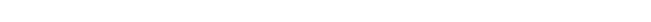
2016 December 20 to Dec. 22 UT

h	Sun			Moon			
Tue	GHA	Dec	GHA	ν	Dec	d	HP
0	180°36.9	S23°25.6	281°22.6	13.1'	N06°17.2	-9.7'	56.1'
1	195°36.6	25.6	295°54.7	13.2'	06°07.4	-9.7'	56.1'
2	210°36.3	25.6	310°26.9	13.2'	05°57.7	-9.8'	56.1'
3	225°35.9	.. 25.7	324°59.2	13.3'	05°47.9	-9.8'	56.0'
4	240°35.6	25.7	339°31.5	13.3'	05°38.1	-9.8'	56.0'
5	255°35.3	25.7	354°03.9	13.4'	05°28.3	-9.8'	56.0'
6	270°35.0	S23°25.7	8°36.3	13.4'	N05°18.5	-9.8'	55.9'
7	285°34.7	25.8	23°08.7	13.5'	05°08.7	-9.8'	55.9'
8	300°34.4	25.8	37°41.3	13.5'	04°58.9	-9.8'	55.9'
9	315°34.1	.. 25.8	52°13.8	13.6'	04°49.0	-9.8'	55.8'
10	330°33.8	25.8	66°46.4	13.6'	04°39.2	-9.9'	55.8'
11	345°33.5	25.8	81°19.1	13.7'	04°29.3	-9.9'	55.8'
12	0°33.2	S23°25.9	95°51.8	13.7'	N04°19.4	-9.9'	55.8'
13	15°32.8	25.9	110°24.6	13.8'	04°09.6	-9.9'	55.7'
14	30°32.5	25.9	124°57.4	13.8'	03°59.7	-9.9'	55.7'
15	45°32.2	.. 25.9	139°30.2	13.9'	03°49.8	-9.9'	55.7'
16	60°31.9	25.9	154°03.1	13.9'	03°39.9	-9.9'	55.6'
17	75°31.6	25.9	168°36.1	14.0'	03°30.0	-9.9'	55.6'
18	90°31.3	S23°26.0	183°09.0	14.0'	N03°20.1	-9.9'	55.6'
19	105°31.0	26.0	197°42.1	14.0'	03°10.2	-9.9'	55.5'
20	120°30.7	26.0	212°15.1	14.1'	03°00.2	-9.9'	55.5'
21	135°30.4	.. 26.0	226°48.2	14.1'	02°50.3	-9.9'	55.5'
22	150°30.1	26.0	241°21.4	14.2'	02°40.4	-9.9'	55.5'
23	165°29.7	26.0	255°54.5	14.2'	02°30.5	-9.9'	55.4'
	SD.=16.2	d=0.0			S.D.=15.2		

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

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

Day	Sun		Moon	
	Eqn.of Time	Mer.	Mer. Pass.	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Upper hh:mm	Lower hh:mm
20	02:28	02:13	11:58	56-37%
21	01:58	01:43	11:58	21-23%
22	01:28	01:13	11:59	56-37%



SD.=16.2	d=0.0	S.D.=14.9
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**December 23, 24, 25 UT (Fri., Sat., Sun.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	91° 57.9	131° 20.3	\$17° 25.1	116° 54.2	\$11° 27.9	252° 56.0	\$06° 41.8	192° 23.1	\$21° 47.9					Alpheratz	357° 41.0	29° 11.2	
1	107° 00.4	146° 20.0	24.1	131° 54.9	27.2	267° 58.2	41.9	207° 25.2	48.0					Ankaa	353° 13.4	-42° 13.1	
2	122° 02.8	161° 19.7	23.1	146° 55.5	26.5	283° 00.3	42.0	222° 27.4	48.0					Schedar	349° 37.6	56° 38.0	
3	137° 05.3	176° 19.4	22.2	161° 56.2	25.7	298° 02.5	42.1	237° 29.5	48.0					Diphda	348° 53.5	-17° 53.8	
4	152° 07.8	191° 19.2	21.2	176° 56.9	25.0	313° 04.7	42.2	252° 31.7	48.0					Achernar	335° 24.9	-57° 09.4	
5	167° 10.2	206° 18.9	20.2	191° 57.6	24.3	328° 06.8	42.4	267° 33.8	48.0					Hamal	327° 57.9	23° 32.5	
6	182° 12.7	221° 18.6	\$17° 19.2	206° 58.3	\$11° 23.6	343° 09.0	\$06° 42.5	282° 36.0	\$21° 48.1					Polaris	316° 20.4	89° 20.3	
7	197° 15.2	236° 18.3	18.3	221° 59.0	22.8	358° 11.1	42.6	297° 38.1	48.1					Acamar	315° 16.3	-40° 14.6	
8	212° 17.6	251° 18.0	17.3	236° 59.6	22.1	13° 13.3	42.7	312° 40.3	48.1					Menkar	314° 12.3	4° 09.2	
9	227° 20.1	266° 17.7	16.3	252° 00.3	21.4	28° 15.5	42.8	327° 42.4	48.1					Mirfak	308° 36.5	49° 55.2	
10	242° 22.6	281° 17.5	15.4	267° 01.0	20.7	43° 17.6	42.9	342° 44.6	48.2					Aldebaran	290° 46.3	16° 32.4	
11	257° 25.0	296° 17.2	14.4	282° 01.7	19.9	58° 19.8	43.0	357° 46.7	48.2					Rigel	281° 09.4	-8° 11.2	
12	272° 27.5	311° 16.9	\$17° 13.4	297° 02.4	\$11° 19.2	73° 22.0	\$06° 43.1	12° 48.9	\$21° 48.2					Capella	280° 30.4	46° 00.7	
13	287° 30.0	326° 16.6	12.4	312° 03.1	18.5	88° 24.2	43.2	27° 51.0	48.2					Bellatrix	278° 29.1	6° 21.7	
14	302° 32.4	341° 16.3	11.5	327° 03.8	17.8	103° 26.3	43.3	42° 53.2	48.2					Elnath	278° 09.2	28° 37.1	
15	317° 34.9	356° 16.1	10.5	342° 04.4	17.1	118° 28.5	43.5	57° 55.3	48.3					Alnilam	275° 43.6	-1° 11.7	
16	332° 37.3	11° 15.8	09.5	357° 05.1	16.3	133° 30.7	43.6	72° 57.5	48.3					Betelgeuse	270° 58.4	7° 24.4	
17	347° 39.8	26° 15.5	08.5	12° 05.8	15.6	148° 32.8	43.7	87° 59.6	48.3					Canopus	263° 54.5	-52° 42.5	
18	2° 42.3	41° 15.2	\$17° 07.5	27° 06.5	\$11° 14.9	163° 35.0	\$06° 43.8	103° 01.8	\$21° 48.3					Sirius	258° 31.3	-16° 44.6	
19	17° 44.7	56° 15.0	06.6	42° 07.2	14.2	178° 37.2	43.9	118° 03.9	48.4					Adhara	255° 10.3	-28° 59.9	
20	32° 47.2	71° 14.7	05.6	57° 07.9	13.4	193° 39.3	44.0	133° 06.1	48.4					Procyon	244° 56.9	5° 10.7	
21	47° 49.7	86° 14.4	04.6	72° 08.6	12.7	208° 41.5	44.1	148° 08.2	48.4					Pollux	243° 24.5	27° 58.8	
22	62° 52.1	101° 14.2	03.6	87° 09.2	12.0	223° 43.7	44.2	163° 10.4	48.4					Avior	234° 16.4	-59° 33.8	
23	77° 54.6	116° 13.9	02.6	102° 09.9	11.3	238° 45.8	44.3	178° 12.5	48.4					Suhail	222° 50.3	-43° 30.0	
Mer.pass.:17:49			v-0.3 d1.0 m-4.1	v0.7 d0.7 m0.8	v2.2 d-0.1 m-1.7	v2.2 d-0.0 m0.5								Miaplacidus	221° 38.3	-69° 47.1	
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe	193° 48.8	61° 39.3	
0	92° 57.1	131° 13.6	\$17° 01.6	117° 10.6	\$11° 10.5	253° 48.0	\$06° 44.4	193° 14.7	\$21° 48.5					Denebola	182° 31.2	14° 28.6	
1	107° 59.5	146° 13.4	17° 00.7	132° 11.3	09.8	268° 50.2	44.6	208° 16.8	48.5					Gienah	175° 49.8	-17° 38.0	
2	123° 02.0	161° 13.1	16° 59.7	147° 12.0	09.1	283° 52.4	44.7	223° 19.0	48.5					Acrux	173° 06.5	-63° 11.2	
3	138° 04.5	176° 12.8	58.7	162° 12.7	08.4	298° 54.5	44.8	238° 21.1	48.5					Gacrux	171° 58.2	-57° 12.1	
4	153° 06.9	191° 12.6	57.7	177° 13.4	07.6	313° 56.7	44.9	253° 23.3	48.6					Alioth	166° 18.8	55° 51.9	
5	168° 09.4	206° 12.3	56.7	192° 14.1	06.9	328° 58.9	45.0	268° 25.4	48.6					Spica	158° 28.8	-11° 14.8	
6	183° 11.8	221° 12.0	\$16° 55.7	207° 14.7	\$11° 06.2	344° 01.0	\$06° 45.1	283° 27.6	\$21° 48.6					Alkaid	152° 57.3	49° 13.6	
7	198° 14.3	236° 11.8	54.7	222° 15.4	05.4	359° 03.2	45.2	298° 29.7	48.6					Hadar	148° 44.7	-60° 26.9	
8	213° 16.8	251° 11.5	53.8	237° 16.1	04.7	14° 05.4	45.3	313° 31.9	48.6					Menkent	148° 04.9	-36° 26.9	
9	228° 19.2	266° 11.2	52.8	252° 16.8	04.0	29° 07.6	45.4	328° 34.1	48.7					Arcturus	145° 53.8	19° 05.7	
10	243° 21.7	281° 11.0	51.8	267° 17.5	03.3	44° 09.7	45.5	343° 36.2	48.7					Rigel Kent.	139° 48.8	-60° 53.9	
11	258° 24.2	296° 10.7	50.8	282° 18.2	02.5	59° 11.9	45.6	358° 38.4	48.7					Kochab	137° 21.1	74° 05.0	
12	273° 26.6	311° 10.5	\$16° 49.8	297° 18.9	\$11° 01.8	74° 14.1	\$06° 45.7	13° 40.5	\$21° 48.7					Zuben 'ubi	137° 03.0	-16° 06.5	
13	288° 29.1	326° 10.2	48.8	312° 19.6	01.1	89° 16.2	45.9	28° 42.7	48.8					Alphecca	126° 09.3	26° 39.5	
14	303° 31.6	341° 09.9	47.8	327° 20.2	11° 00.4	104° 18.4	46.0	43° 44.8	48.8					Antares	112° 23.7	-26° 27.9	
15	318° 34.0	356° 09.7	46.8	342° 20.9	10° 59.6	119° 20.6	46.1	58° 47.0	48.8					Atria	107° 23.9	-69° 03.1	
16	333° 36.5	11° 09.4	45.8	357° 21.6	58.9	134° 22.8	46.2	73° 49.1	48.8					Sabik	102° 10.2	-15° 44.5	
17	348° 38.9	26° 09.2	44.8	12° 22.3	58.2	149° 24.9	46.3	88° 51.3	48.8					Rasalhague	96° 04.6	12° 33.1	
18	3° 41.4	41° 08.9	\$16° 43.8	27° 23.0	\$10° 57.4	164° 27.1	\$06° 46.4	103° 53.4	\$21° 48.9					Eltanin	90° 45.6	51° 29.4	
19	18° 43.9	56° 08.7	42.8	42° 23.7	56.7	179° 29.3	46.5	118° 55.6	48.9					Kaus Aust.	83° 41.1	-34° 22.4	
20	33° 46.3	71° 08.4	41.8	57° 24.4	56.0	194° 31.5	46.6	133° 57.7	48.9					Vega	80° 37.8	38° 48.2	
21	48° 48.8	86° 08.2	40.8	72° 25.1	55.3	209° 33.6	46.7	148° 59.9	48.9					Nunki	75° 55.8	-26° 16.4	
22	63° 51.3	101° 07.9	39.8	87° 25.8	54.5	224° 35.8	46.8	164° 02.0	49.0					Altair	62° 06.2	8° 55.0	
23	78° 53.7	116° 07.7	38.8	102° 26.4	53.8	239° 38.0	46.9	179° 04.2	49.0					Peacock	53° 16.1	-56° 40.8	
Mer.pass.:17:45			v-0.3 d1.0 m-4.1	v0.7 d0.7 m0.8	v2.2 d-0.1 m-1.8	v2.2 d-0.0 m0.5								Deneb	49° 30.2	45° 20.7	
Sun			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Markab	13° 36.0	15° 17.9	
0	93° 56.2	131° 07.4	\$16° 37.8	117° 27.1	\$10° 53.1	254° 40.2	\$06° 47.0	194° 06.3	\$21° 49.0					Dec 23 Fri	SHA	Mer.pass	
1	108° 58.7	146° 07.2	36.8	132° 27.8	52.3	269° 42.3	47.1	209° 08.5	49.0					Venus	39° 22.4	15:15	
2	124° 01.1	161° 06.9	35.8	147° 28.5	51.6	284° 44.5	47.2	224° 10.6	49.0					Mars	24° 56.3	16:12	
3	139° 03.6	176° 06.7	34.8	162° 29.2	50.9	299° 46.7	47.4	239° 12.8	49.1					Jupiter	160° 58.1	07:07	
4	154° 06.1	191° 06.4	33.8	177° 29.9	50.2	314° 48.9	47.5	254° 14.9	49.1					Saturn	100° 25.1	11:09	
5	169° 08.5	206° 06.2	32.8	192° 30.6	49.4	329° 51.0	47.6	269° 17.1	49.1					Dec 24 Sat	SHA	Mer.pass	
6	184° 11.0	221° 06.0	\$16° 31.8	207° 31.3	\$10° 48.7	344° 53.2	\$06° 47.7	284° 19.2	\$21° 49.1					Venus	38° 16.6	15:15	
7	199° 13.4	236° 05.7	30.8	222° 32.0	48.0	359° 55.4	47.8	299° 21.4	49.1					Mars	24° 13.6	16:11	
8	214° 15.9	251° 05.5	29.8	237° 32.7	47.2	14° 57.6	47.9	314° 23.5	49.2					Jupiter	160° 51.0	07:04	
9	229° 18.4	266° 05.2	28.8	252° 33.3	46.5	29° 59.7	48.0	329° 25.7	49.2					Saturn	100° 17.6	11:05	
10	244° 20.8	281° 05.0	27.8	267° 34.0	45.8	45° 01.9	48.1	344° 27									

DUT1 = UT1-UTC = -0.3974 sec ΔT = TT-UT1 = +68.5814 sec

2016 December 23 to Dec. 25 UT

h		Sun		Moon			
Fri	GHA	Dec	GHA	ν	Dec	d	HP
0	180°14.5	S23°25.5	249°29.6	15.0'	S05°25.2	-9.3'	54.4'
1	195°14.2	25.5	264°03.6	15.0'	05°34.5	-9.2'	54.4'
2	210°13.9	25.4	278°37.7	15.0'	05°43.7	-9.2'	54.4'
3	225°13.6	.. 25.4	293°11.7	15.0'	05°52.9	-9.2'	54.3'
4	240°13.3	25.4	307°45.7	15.0'	06°02.1	-9.2'	54.3'
5	255°13.0	25.3	322°19.8	15.0'	06°11.2	-9.1'	54.3'
6	270°12.6	S23°25.3	336°53.8	15.0'	S06°20.4	-9.1'	54.3'
7	285°12.3	25.3	351°27.8	15.0'	06°29.5	-9.1'	54.3'
8	300°12.0	25.2	6°01.8	15.0'	06°38.5	-9.0'	54.3'
9	315°11.7	.. 25.2	20°35.8	15.0'	06°47.6	-9.0'	54.3'
10	330°11.4	25.2	35°09.8	15.0'	06°56.6	-9.0'	54.3'
11	345°11.1	25.1	49°43.8	15.0'	07°05.5	-9.0'	54.3'
12	0°10.8	S23°25.1	64°17.8	15.0'	S07°14.5	-8.9'	54.2'
13	15°10.5	25.0	78°51.8	15.0'	07°23.4	-8.9'	54.2'
14	30°10.1	25.0	93°25.7	15.0'	07°32.3	-8.9'	54.2'
15	45°09.8	.. 25.0	107°59.7	14.9'	07°41.1	-8.8'	54.2'
16	60°09.5	24.9	122°33.6	14.9'	07°49.9	-8.8'	54.2'
17	75°09.2	24.9	137°07.5	14.9'	07°58.7	-8.8'	54.2'
18	90°08.9	S23°24.8	151°41.4	14.9'	S08°07.4	-8.7'	54.2'
19	105°08.6	24.8	166°15.3	14.9'	08°16.1	-8.7'	54.2'
20	120°08.3	24.7	180°49.2	14.9'	08°24.8	-8.7'	54.2'
21	135°08.0	.. 24.7	195°23.1	14.9'	08°33.4	-8.6'	54.2'
22	150°07.7	24.6	209°56.9	14.8'	08°42.0	-8.6'	54.1'
23	165°07.3	24.6	224°30.8	14.8'	08°50.6	-8.5'	54.1'
	SD.=16.2	d=0.0			S.D.=14.8		

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

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

Day	Sun			Moon		
	Eqn. of Time	Mer. Pass.	Mer. Pass.	Upper	Lower	Age
	00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	hh:mm	hh:mm	hh:mm	24-26 28-13%
23	00:58	00:43	11:59	07:35	19:57	
24	00:28	00:13	12:00	08:18	20:40	
25	00:02	00:17	12:00	09:02	21:25	

SD.=16.3	d=0.1	S.D.=14.7
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**December 26, 27, 28 UT (Mon., Tue., Wed.)**

Aries				Venus				Mars				Jupiter				Saturn				Stars			
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec				
0	94°55.3	131°01.7	\$16°13.7	117°43.7	\$10°35.5	255°32.4	\$06°49.6	194°58.0	\$21°49.5	Alpheratz	357°41.0	29°11.2	Ankaa	353°13.4	-42°13.1	Schedar	349°37.6	56°38.0	Diphda	348°53.5	-17°53.8		
1	109°57.8	146°01.5	12.7	132°44.4	34.8	270°34.6	49.7	210°00.1	49.5	Achernar	335°24.9	-57°09.4	Hamal	327°57.9	23°32.5	Polaris	316°21.3	89°20.3	Acamar	315°16.3	-40°14.6		
2	125°00.3	161°01.3	11.6	147°45.1	34.1	285°36.8	49.8	225°02.3	49.6	Menkar	314°12.3	4°09.2	Mirfak	308°36.5	49°55.2	Aldebaran	290°46.3	16°32.4	Rigel	281°09.4	-8°11.2		
3	140°02.7	176°01.1	10.6	162°45.8	33.3	300°39.0	49.9	240°04.4	49.6	Capella	280°30.4	46°00.7	Bellatrix	278°29.1	6°21.7	200°12.6	236°00.2	30.4	0°47.7	50.3	300°13.1	49.7	
4	155°05.2	191°00.9	09.6	177°46.5	32.6	315°41.2	50.0	255°06.6	49.6	Alnilam	275°43.6	-1°11.7	El Nath	278°09.2	28°37.1	215°15.1	251°00.0	29.7	15°49.9	50.4	315°15.2	49.7	
5	170°07.7	206°00.6	08.6	192°47.2	31.9	330°43.3	50.1	270°08.7	49.6	Betelgeuse	270°58.4	7°24.4	Canopus	263°54.5	-52°42.5	225°20.0	280°59.5	28.2	45°54.2	50.6	330°17.4	49.7	
6	185°10.1	221°00.4	\$16°07.6	207°47.9	\$10°31.1	345°45.5	\$06°50.2	285°10.9	\$21°49.6	Sirius	258°31.3	-16°44.6	230°29.8	340°58.7	15°59.4	327°53.4	106°03.0	51.0	45°28.1	50.8	310°59.1	49.8	
7	200°12.6	236°00.2	06.6	222°48.6	30.4	0°47.7	50.3	300°13.1	49.7	Adhara	255°10.3	-28°59.9	215°34.8	265°59.8	10.5	287°49.3	29.7	15°49.9	50.4	310°58.6	49.8		
8	215°15.1	251°00.0	05.5	237°49.3	29.7	15°49.9	50.4	315°15.2	49.7	Procyon	244°56.9	5°10.7	225°34.8	265°59.8	10.5	252°50.0	28.9	30°52.1	50.5	315°30.3	49.8		
9	230°16.5	265°59.8	04.5	252°50.0	28.9	30°52.1	50.5	330°17.4	49.7	Pollux	243°24.5	27°58.8	240°20.0	280°59.5	03.5	267°50.7	28.2	45°54.2	50.6	345°19.5	49.7		
10	245°20.0	280°59.5	03.5	267°50.7	28.2	45°54.2	50.6	345°19.5	49.7	Avior	234°16.4	-59°33.8	260°22.4	295°59.3	02.5	282°51.4	27.5	60°56.4	50.7	345°20.7	49.7		
11	260°22.4	295°59.3	02.5	282°51.4	27.5	60°56.4	50.7	0°21.7	49.7	Suhail	222°50.3	-43°30.0	Mer.pass.:17:37	v-0.2 d1.0 m-4.2	v0.7 d0.7 m0.8	v2.2 d-0.1 m-1.8	v2.2 d-0.0 m0.5						
12	275°24.9	310°59.1	\$16°01.5	297°52.1	\$10°26.7	75°58.6	\$06°50.8	15°23.8	\$21°49.8	Alphard	217°53.5	-8°44.0	20°42.2	55°57.6	54.3	312°52.7	26.0	91°00.8	50.9	30°26.0	49.8		
13	290°27.4	325°58.9	16°00.4	312°52.7	26.0	91°00.8	50.9	30°26.0	49.8	Regulus	207°40.8	11°52.9	21°41.3	55°57.6	54.3	312°52.7	21.6	181°13.9	51.5	120°38.9	49.9		
14	305°29.8	340°58.7	15°59.4	327°53.4	25.3	106°03.0	51.0	120°38.9	49.9	Dubhe	193°48.7	61°39.3	22°47.1	85°57.2	52.2	72°58.3	20.8	196°16.1	51.6	135°41.0	49.9		
15	320°32.3	355°58.5	14.6	342°54.1	24.5	121°05.2	51.1	135°41.0	49.9	Denebola	182°31.2	14°28.6	23°47.1	85°57.2	52.2	211°18.3	20.1	211°18.3	51.7	150°43.2	50.0		
16	335°34.8	370°58.2	13.5	357°54.8	23.8	136°07.3	51.2	150°43.2	50.0	Gienah	175°49.8	-17°38.0	24°47.1	85°57.2	52.2	226°20.5	19.4	136°07.3	51.8	165°45.3	50.0		
17	350°37.2	385°58.0	12.5	375°54.8	23.0	151°09.5	51.3	165°45.3	50.0	Acrux	173°06.5	-63°11.2	25°47.1	85°57.2	52.2	241°22.6	18.6	180°47.5	51.9	180°47.5	50.0		
18	5°39.7	40°57.8	\$15°55.3	27°56.2	\$10°22.3	166°11.7	\$06°51.4	105°36.7	\$21°49.9	Hadar	148°44.7	-60°26.9	26°47.1	85°57.2	52.2	298°56.6	20.2	298°56.6	52.7	286°02.6	50.1		
19	20°42.2	55°57.6	54.3	42°56.9	21.6	181°13.9	51.5	120°38.9	49.9	Menkent	148°04.9	-36°26.9	27°47.1	85°57.2	52.2	287°49.3	20.1	287°49.3	52.7	301°04.7	50.2		
20	35°44.6	70°57.4	53.3	57°57.6	20.8	196°16.1	51.6	135°41.0	49.9	Arcturus	145°53.8	19°05.7	28°47.1	85°57.2	52.2	211°18.3	20.1	211°18.3	51.7	150°43.2	50.0		
21	50°47.1	85°57.2	52.2	72°58.3	20.1	226°20.5	51.8	165°45.3	50.0	Rigel Kent.	139°48.7	-60°53.9	29°47.1	85°57.2	52.2	241°22.6	18.6	241°22.6	51.9	180°47.5	50.0		
22	65°49.5	100°57.0	51.2	87°59.0	19.4	166°37.0	51.8	165°45.3	50.0	Kochab	137°21.1	74°05.0	30°47.1	115°56.8	50.2	241°22.6	18.6	241°22.6	51.9	180°47.5	50.0		
23	80°52.0	115°56.8	50.2	102°59.7	18.6	241°22.6	51.9	180°47.5	50.0	Zuben ubi	137°03.0	-16°06.5	Mer.pass.:17:33	v-0.2 d1.0 m-4.2	v0.7 d0.7 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	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec						
0	95°54.5	130°56.6	\$15°49.2	118°00.4	\$10°17.9	256°24.8	\$06°52.1	195°49.7	\$21°50.0	Denebola	182°31.2	14°28.6	1	110°56.9	145°56.4	48.1	133°01.1	17.2	271°27.0	52.2	210°51.8	50.0	
1	110°56.9	145°56.4	48.1	148°01.8	16.4	286°29.2	52.3	225°54.0	50.1	Gienah	175°49.8	-17°38.0	2	125°59.4	160°56.2	47.1	148°01.8	16.4	306°03.0	51.0	240°54.1	50.1	
2	125°59.4	160°56.2	47.1	164°02.8	15.7	301°31.4	52.4	240°54.1	50.1	Acrux	173°06.5	-63°11.2	3	141°01.9	175°56.0	46.1	163°02.5	15.7	327°53.4	25.3	225°54.0	50.1	
3	141°01.9	175°56.0	46.1	180°03.2	14.9	316°33.6	52.5	255°58.3	50.1	Gacrux	171°58.1	-57°12.1	4	156°04.3	190°55.8	45.0	178°03.2	14.9	330°31.4	25.3	225°54.0	50.1	
4	156°04.3	190°55.8	45.0	196°16.1	14.1	316°56.1	52.5	255°58.3	50.1	Alioth	166°18.8	55°51.9	5	171°06.8	205°55.6	44.0	193°03.9	14.2	331°35.8	25.3	275°53.5	50.1	
6	186°09.3	220°55.4	\$15°43.0	208°04.6	\$10°13.5	346°37.9	\$06°52.7	286°02.6	\$21°50.1	Alkaid	152°57.3	49°13.6	7	201°11.7	235°55.2	42.0	223°05.3	12.7	1°40.1	52.8	301°04.7	50.2	
8	216°14.2	250°55.0	40.9	238°06.0	12.0	16°42.3	52.9	316°06.9	50.2	Hadar	148°44.7	-60°26.9	9	231°16.7	265°54.8	39.9	253°06.7	11.3	31°44.5	53.0	331°09.0	50.2	
10	246°19.1	280°54.6	38.9	268°07.4	10.5	46°46.7	53.1	346°11.2	50.2	Menkent	148°04.9	-36°26.9	11	261°21.6	295°54.4	37.8	283°08.1	09.8	61°48.9	53.2	1°13.3	50.2	
12	276°24.0	310°54.2	\$15°36.8	298°08.8	\$10°09.1	76°51.1	\$06°53.3	16°15.5	\$21°50.3	Alphecca	126°09.3	26°39.5	13	291°26.5	325°54.0	35.7	313°09.5	08.3	91°53.3	53.4	31°17.7	50.3	
14	306°29.0	340°53.8	34.7	328°10.2	07.6	106°55.5	53.5	46°19.8	50.3	Antares	112°23.7	-26°27.9	15	321°31.4	355°53.6	33.7	343°10.9	06.8	121°57.6	53.6	46°22.0	50.3	
16	336°33.9	360°53.6	32.6	358°11.6	06.1	136°59.8	53.7	76°24.1	50.4	Atria	107°23.8	-69°03.1	17	351°36.4	375°53.6	31.6	358°11.6	05.4	121°57.6	53.8	61°22.0	50.4	
18	6°38.8	40°53.0	\$15°30.6	28°12.9	\$10°04.6	167°04.2	\$06°53.9	106°28.4	\$21°50.4	Sabik	102°10.1	-15°44.5	19	21°41.3	55°52.9	29.5	43°13.6	03.9	182°06.4	54.0	121°30.6	50.4	
20	36°43.8	70°52.7	28.5	58°14.3	03.1	197°08.6	54.1	136°32.7	50.4	Shaula	96°19.1	-37°06.7	21	51°46.2	85°52.5	27.4	73°15.0	02.4	212°10.8	54.2	151°34.9	50.5	
22	66°48.7	100°52.3	26.4	88°15.7	01.7	227°13.0	54.3	166°37.0	50.5	Altair	62°06.2	8°55.0	23	81°51.2	115°52.1	25.4	103°16.4	00.9	242°15.2	54.4	181°39.2	50.5	
24	277°23.2	310°49.8	\$15°11.8	298°25.5	\$09°51.3	77°43.7	\$06°55.7	17°07.2	\$21°50.6	Peacock	53°16.1	-56°40.8	25	292°25.7	325°49.6	10.7	313°26.2	50.6	92°45.9	55.8	32°09.4	50.8	
26	307°28.1	340°49.4	09.7	328°26.9	49.8	107°48.1	55.9	47°11.5	50.8	Deneb	49°30.2	45°20.7	27	322°30.6	355°49.3	08.6	343°27.6	09.1	122°50.3	56.0	62°13.7	50.8	
28	327°31.3	360°50.5	16.0	328°22.7	54.3	17°34.9	55.3	316°58.6	50.7	Fomalhaut	15°21.6	-29°32.1	29	347°32.0	370°50.5	14.9	253°23.4	05.					

DUT1 = UT1-UTC = -0.4012 sec ΔT = TT-UT1 = +68.5852 sec

2016 December 26 to Dec. 28 UT

	Sun			Moon			
Mon	GHA	Dec	GHA	ν	Dec	d	HP
0	179°52.1	S23°21.2	217°39.4	13.5'	\$14°53.7	-6.1'	54.1'
1	194°51.8	21.1	232°11.9	13.5'	14°59.7	-6.0'	54.1'
2	209°51.5	21.0	246°44.3	13.4'	15°05.7	-5.9'	54.1'
3	224°51.2	.. 20.9	261°16.7	13.4'	15°11.6	-5.9'	54.1'
4	239°50.9	20.8	275°49.1	13.3'	15°17.4	-5.8'	54.1'
5	254°50.6	20.7	290°21.4	13.3'	15°23.2	-5.7'	54.1'
6	269°50.3	S23°20.6	304°53.7	13.3'	\$15°28.9	-5.7'	54.1'
7	284°50.0	20.5	319°26.0	13.2'	15°34.6	-5.6'	54.1'
8	299°49.7	20.4	333°58.2	13.2'	15°40.2	-5.5'	54.1'
9	314°49.4	.. 20.4	348°30.4	13.2'	15°45.7	-5.5'	54.1'
10	329°49.0	20.3	3°02.5	13.1'	15°51.1	-5.4'	54.1'
11	344°48.7	20.2	17°34.6	13.1'	15°56.5	-5.3'	54.1'
12	359°48.4	S23°20.1	32°06.7	13.1'	\$16°01.8	-5.3'	54.1'
13	14°48.1	20.0	46°38.8	13.0'	16°07.1	-5.2'	54.1'
14	29°47.8	19.9	61°10.8	13.0'	16°12.2	-5.1'	54.1'
15	44°47.5	.. 19.8	75°42.7	12.9'	16°17.3	-5.1'	54.1'
16	59°47.2	19.7	90°14.7	12.9'	16°22.4	-5.0'	54.1'
17	74°46.9	19.6	104°46.6	12.9'	16°27.3	-4.9'	54.2'
18	89°46.6	S23°19.4	119°18.4	12.8'	\$16°32.2	-4.9'	54.2'
19	104°46.3	19.3	133°50.2	12.8'	16°37.0	-4.8'	54.2'
20	119°46.0	19.2	148°22.0	12.8'	16°41.8	-4.7'	54.2'
21	134°45.6	.. 19.1	162°53.8	12.7'	16°46.4	-4.6'	54.2'
22	149°45.3	19.0	177°25.5	12.7'	16°51.0	-4.6'	54.2'
23	164°45.0	18.9	191°57.2	12.7'	16°55.6	-4.5'	54.2'
	SD.=16.3	d=0.1			S.D.=14.7		

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer.Pass.	Upper	Lower	Age
	00 <sup>h</sup>	12 <sup>h</sup>	Pass	hh:mm	hh:mm	27-29
26	00:31	00:46		12:01	09:47	22:11
27	01:01	01:16		12:01	10:34	22:58
28	01:31	01:45		12:02	11:22	23:47

SD.=16.3	d=0.1	S.D.=14.9
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**December 29, 30, 31 UT (Thu., Fri., Sat.)**

Aries			Venus			Mars			Jupiter			Saturn			Stars		
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	97°52.8	130°47.8	\$14°59.1	118°34.0	\$09°42.4	258°10.0	\$06°56.8	197°33.1	\$21°51.0	Alpheratz	357°41.0	29°11.2					
1	112°55.2	145°47.6	58.1	133°34.7	41.7	273°12.2	56.9	212°35.2	51.0	Ankaa	353°13.4	-42°13.1					
2	127°57.7	160°47.5	57.0	148°35.4	40.9	288°14.4	57.0	227°37.4	51.0	Schedar	349°37.6	56°38.0					
3	143°00.1	175°47.3	· · 56.0	163°36.1	· · 40.2	303°16.6	· · 57.1	242°39.5	· · 51.1	Diphda	348°53.5	-17°53.8					
4	158°02.6	190°47.1	54.9	178°36.8	39.4	318°18.8	57.2	257°41.7	51.1	Achernar	335°24.9	-57°09.4					
5	173°05.1	205°47.0	53.9	193°37.5	38.7	333°21.0	57.3	272°43.8	51.1	Hamal	327°57.9	23°32.5					
6	188°07.5	220°46.8	\$14°52.8	208°38.2	\$09°37.9	348°23.2	\$06°57.4	287°46.0	\$21°51.1	Polaris	316°22.2	89°20.3					
7	203°10.0	235°46.7	51.7	223°38.9	37.2	3°25.4	57.5	302°48.1	51.2	Acamar	315°16.3	-40°14.6					
8	218°12.5	250°46.5	50.7	238°39.6	36.4	18°27.6	57.6	317°50.3	51.2	Menkar	314°12.3	4°09.2					
9	233°14.9	265°46.4	· · 49.6	253°40.3	· · 35.7	33°29.8	· · 57.7	332°52.5	· · 51.2	Mirfak	308°36.5	49°55.3					
10	248°17.4	280°46.2	48.6	268°41.0	35.0	48°32.0	57.8	347°54.6	51.2	Aldebaran	290°46.3	16°32.4					
11	263°19.9	295°46.1	47.5	283°41.7	34.2	63°34.2	57.9	2°56.8	51.2	Rigel	281°09.4	-8°11.2					
12	278°22.3	310°45.9	\$14°46.4	298°42.4	\$09°33.5	78°36.4	\$06°58.0	17°58.9	\$21°51.3	Capella	280°30.4	46°00.7					
13	293°24.8	325°45.8	45.4	313°43.1	32.7	93°38.6	58.1	33°01.1	51.3	Bellatrix	278°29.1	6°21.7					
14	308°27.3	340°45.6	44.3	328°43.8	32.0	108°40.8	58.2	48°03.2	51.3	Elnath	278°09.2	28°37.1					
15	323°29.7	355°45.5	· · 43.3	343°44.5	· · 31.2	123°43.0	· · 58.3	63°05.4	· · 51.3	Alnilam	275°43.6	-1°11.7					
16	338°32.2	10°45.3	42.2	358°45.2	30.5	138°45.2	58.4	78°07.5	51.3	Betelgeuse	270°58.4	7°24.4					
17	353°34.6	25°45.2	41.1	13°45.9	29.7	153°47.4	58.5	93°09.7	51.4	Canopus	263°54.5	-52°42.5					
18	8°37.1	40°45.0	\$14°40.1	28°46.6	\$09°29.0	168°49.6	\$06°58.6	108°11.9	\$21°51.4	Sirius	258°31.3	-16°44.6					
19	23°39.6	55°44.9	39.0	43°47.3	28.3	183°51.8	58.7	123°14.0	51.4	Adhara	255°10.2	-28°59.9					
20	38°42.0	70°44.7	37.9	58°48.0	27.5	198°54.0	58.8	138°16.2	51.4	Procyon	244°56.9	5°10.7					
21	53°44.5	85°44.6	· · 36.9	73°48.7	· · 26.8	213°56.2	· · 58.9	153°18.3	· · 51.4	Pollux	243°24.5	27°58.8					
22	68°47.0	100°44.4	35.8	88°49.4	26.0	228°58.4	59.0	168°20.5	51.5	Avior	234°16.4	-59°33.8					
23	83°49.4	115°44.3	34.7	103°50.1	25.3	244°00.6	59.1	183°22.6	51.5	Suhail	222°50.3	-43°30.0					
Mer.pass.:17:26			v-0.2 d1.1 m-4.2	v0.7 d0.7 m0.9	v2.2 d-0.1 m-1.8	v2.2 d-0.0 m0.5	Miaplacidus			v21°38.2	v21°38.2	v21°38.2	v21°38.2	v21°38.2	v21°38.2	v21°38.2	
Fri			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	98°51.9	130°44.2	\$14°33.7	118°50.8	\$09°24.5	259°02.8	\$06°59.2	198°24.8	\$21°51.5	Denebola	182°31.2	14°39.3					
1	113°54.4	145°44.0	32.6	133°51.5	23.8	274°05.0	59.2	213°27.0	51.5	Gienah	175°49.8	-17°38.0					
2	128°56.8	160°43.9	31.5	148°52.3	23.0	289°07.2	59.3	228°29.1	51.5	Gacrux	173°06.5	-63°11.2					
3	143°59.3	175°43.7	· · 30.5	163°53.0	· · 22.3	304°09.4	· · 59.4	243°31.3	· · 51.6	Alioth	171°58.1	-57°12.1					
4	159°01.8	190°43.6	29.4	178°53.7	21.5	319°11.6	59.5	258°33.4	51.6	Spica	166°18.8	55°51.8					
5	174°04.2	205°43.5	28.3	193°54.4	20.8	334°13.8	59.6	273°35.6	51.6	Alkaid	152°57.3	49°13.6					
6	189°06.7	220°43.3	\$14°27.3	208°55.1	\$09°20.1	349°16.0	\$06°59.7	288°37.7	\$21°51.6	Hadar	148°44.6	-60°26.9					
7	204°09.1	235°43.2	26.2	223°55.8	19.3	4°18.2	59.8	303°39.9	51.6	Menkent	148°04.9	-36°26.9					
8	219°11.6	250°43.1	25.1	238°56.5	18.6	19°20.4	06°59.9	318°42.0	51.7	Arcturus	145°53.7	19°05.7					
9	234°14.1	265°42.9	· · 24.0	253°57.2	· · 17.8	34°22.6	07°00.0	333°44.2	· · 51.7	Rigel Kent.	139°48.7	-60°53.9					
10	249°16.5	280°42.8	23.0	268°57.9	17.1	49°24.9	00.1	348°46.4	51.7	Kochab	137°21.0	74°05.0					
11	264°19.0	295°42.7	21.9	283°58.6	16.3	64°27.1	00.2	3°48.5	51.7	Zuben' ubi	137°03.0	-16°06.5					
12	279°21.5	310°42.5	\$14°20.8	298°59.3	\$09°15.6	79°29.3	\$07°00.3	18°50.7	\$21°51.7	Alphecca	126°09.3	26°39.5					
13	294°23.9	325°42.4	19.7	314°00.0	14.8	94°31.5	00.4	33°52.8	51.7	Antares	112°23.6	-26°27.9					
14	309°26.4	340°42.3	18.7	329°00.7	14.1	109°33.7	00.5	48°55.0	51.8	Atria	107°23.8	-69°03.1					
15	324°28.9	355°42.2	· · 17.6	344°01.4	· · 13.3	124°35.9	· · 00.6	63°57.1	· · 51.8	Sabik	102°10.1	-15°44.5					
16	339°31.3	10°42.0	16.5	359°02.1	12.6	139°38.1	00.7	78°59.3	51.8	Shaula	96°19.1	-37°06.7					
17	354°33.8	25°41.9	15.4	14°02.8	11.8	154°40.3	00.8	94°01.5	51.8	Rasalhague	96°04.6	12°33.0					
18	9°36.3	40°41.8	\$14°14.4	29°03.6	\$09°11.1	169°42.5	\$07°00.8	109°03.6	\$21°51.8	Eltanin	90°45.6	51°29.3					
19	24°38.7	55°41.7	13.3	44°04.3	10.3	184°44.7	00.9	124°05.8	51.9	Kaus Aust.	83°41.1	-34°22.4					
20	39°41.2	70°41.5	12.2	59°05.0	09.6	199°46.9	01.0	139°07.9	51.9	Vega	80°37.8	38°48.1					
21	54°43.6	85°41.4	· · 11.1	74°05.7	· · 08.8	214°49.1	· · 01.1	154°10.1	· · 51.9	Nunki	75°55.7	-26°16.3					
22	69°46.1	100°41.3	10.1	89°06.4	08.1	229°51.3	01.2	169°12.2	51.9	Altair	62°06.2	8°55.0					
23	84°48.6	115°41.2	09.0	104°07.1	07.3	244°53.5	01.3	184°14.4	51.9	Peacock	53°16.1	-56°40.8					
Mer.pass.:17:22			v-0.1 d1.1 m-4.2	v0.7 d0.7 m0.9	v2.2 d-0.1 m-1.8	v2.2 d-0.0 m0.5	Deneb			v21°38.2	v21°38.2	v21°38.2	v21°38.2	v21°38.2	v21°38.2	v21°38.2	
Sat			GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec		
0	99°51.0	130°41.1	\$14°07.9	119°07.8	\$09°06.6	259°55.7	\$07°01.4	199°16.6	\$21°52.0	Dec 29 Thu	32°55.0	15:17					
1	114°53.5	145°40.9	06.8	134°08.5	05.8	274°58.0	01.5	214°18.7	52.0	Venus	20°41.2	16:05					
2	129°56.0	160°40.8	05.7	149°09.2	05.1	290°00.2	01.6	229°20.9	52.0	Mars	160°17.3	06:46					
3	144°58.4	175°40.7	· · 04.7	164°09.9	· · 04.3	305°02.4	· · 01.7	244°23.0	· · 52.0	Jupiter	99°40.3	10:48					
4	160°00.9	190°40.6	03.6	179°10.6	03.6	320°04.6	01.8	259°25.2	52.0	Saturn	15°21.6	-29°32.1					
5	175°03.4	205°40.5	02.5	194°11.3	02.9	335°06.8	01.9	274°27.3	52.1	Dec 30 Fri	13°52.3	15:17					
6	190°05.8	220°40.4	\$14°01.4	209°12.0	\$09°02.1	350°09.0	\$07°02.0	289°29.5	\$21°52.1	Venus	19°58.9	16:04					
7	205°08.3	235°40.3	14°00.3	224°12.8	01.4	5°11.2	02.1	304°31.7	52.1	Mars	160°10.9	06:43					
8	220°10.8	250°40.1	13°59.2	239°13.5	09°00.6	20°13.4	02.1	319°33.8	52.1	Jupiter	99°32.9	10:45					
9	235°13.2	265°40.0	· · 58.2	254°14.2	08°59.9	35°15.6	· · 02.2	334°36.0	· · 52.1	Saturn	13°51.2	28°10.6					
10	250°15.7	280°39.9	57.1	269°14.9	59.1	50°17.8	02.3	349°38.1	52.2	Dec 31 Sat	13°36.1	15°17.9					
11	265°18.1	295°39.8	56.0	284°15.6	58.4	65°20.1	02.4	4°40.3	52.2	Venus	30°50.0	15:17					
12	280°20.6	3															

DUT1 = UT1-UTC = -0.4049 sec ΔT = TT-UT1 = +68.5889 sec

2016 December 29 to Dec. 31 UT

h	Sun			Moon				
	Thu	GHA	Dec	GHA	ν	Dec	d	HP
0	179°30.0	S23°12.7	183°09.7	11.2'	\$18°57.0	-0.3'	54.8'	
1	194°29.7	12.5	197°39.9	11.2'	18°57.3	-0.2'	54.8'	
2	209°29.4	12.4	212°10.1	11.2'	18°57.5	-0.1'	54.8'	
3	224°29.1	.. 12.2	226°40.2	11.2'	18°57.6	-0.1'	54.8'	
4	239°28.8	12.1	241°10.4	11.1'	18°57.6	0.0'	54.8'	
5	254°28.5	11.9	255°40.5	11.1'	18°57.5	0.1'	54.8'	
6	269°28.2	S23°11.8	270°10.6	11.1'	\$18°57.3	0.2'	54.9'	
7	284°27.9	11.6	284°40.7	11.1'	18°57.0	0.3'	54.9'	
8	299°27.6	11.4	299°10.8	11.1'	18°56.6	0.4'	54.9'	
9	314°27.3	.. 11.3	313°40.9	11.1'	18°56.2	0.5'	54.9'	
10	329°27.0	11.1	328°10.9	11.0'	18°55.6	0.6'	54.9'	
11	344°26.7	11.0	342°40.9	11.0'	18°55.0	0.7'	54.9'	
12	359°26.4	S23°10.8	357°11.0	11.0'	\$18°54.2	0.8'	54.9'	
13	14°26.1	10.7	11°41.0	11.0'	18°53.4	0.9'	55.0'	
14	29°25.8	10.5	26°11.0	11.0'	18°52.5	1.0'	55.0'	
15	44°25.5	.. 10.3	40°40.9	11.0'	18°51.4	1.1'	55.0'	
16	59°25.2	10.2	55°10.9	11.0'	18°50.3	1.2'	55.0'	
17	74°24.9	10.0	69°40.9	11.0'	18°49.1	1.3'	55.0'	
18	89°24.5	S23°09.9	84°10.8	10.9'	\$18°47.8	1.4'	55.0'	
19	104°24.2	09.7	98°40.8	10.9'	18°46.4	1.4'	55.1'	
20	119°23.9	09.5	113°10.7	10.9'	18°44.9	1.5'	55.1'	
21	134°23.6	.. 09.4	127°40.6	10.9'	18°43.3	1.6'	55.1'	
22	149°23.3	09.2	142°10.5	10.9'	18°41.6	1.7'	55.1'	
23	164°23.0	09.0	156°40.4	10.9'	18°39.8	1.8'	55.1'	
	SD.=16.3	d=0.1			S.D.=15.0			

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

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

Day	Sun			Moon		
	Eqn.of Time	Mer.	Mer.Pass.	Mer.	Pass.	Age
	00 <sup>h</sup>	12 <sup>h</sup>	mm:ss	Upper	Lower	0-5%
29	02:00	02:15		12:02	12:12	—
30	02:29	02:44		12:03	13:01	00:37
31	02:58	03:12		12:03	13:51	01:26

SD.=16.3	d=0.2	S.D.=15.2
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## Increments and Corrections

m 0	Sun Plan.	Aries	Moon	v and d corr				m 1	Sun Plan.	Aries	Moon	v and d corr				m 2	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		0	0°15.0	0°15.0	0°14.3	0.0 - 0.0	6.0 - 0.2	12.0 - 0.3		0	0°30.0	0°30.1	0°28.6	0.0 - 0.0	6.0 - 0.3	12.0 - 0.5	
1	0°00.3	0°00.3	0°00.2	0.1 - 0.0	6.1 - 0.1	12.1 - 0.1		1	0°15.3	0°15.3	0°14.6	0.1 - 0.0	6.1 - 0.2	12.1 - 0.3		1	0°30.3	0°30.3	0°28.9	0.1 - 0.0	6.1 - 0.3	12.1 - 0.5	
2	0°00.5	0°00.5	0°00.5	0.2 - 0.0	6.2 - 0.1	12.2 - 0.1		2	0°15.5	0°15.5	0°14.8	0.2 - 0.0	6.2 - 0.2	12.2 - 0.3		2	0°30.5	0°30.6	0°29.1	0.2 - 0.0	6.2 - 0.3	12.2 - 0.5	
3	0°00.8	0°00.8	0°00.7	0.3 - 0.0	6.3 - 0.1	12.3 - 0.1		3	0°15.8	0°15.8	0°15.0	0.3 - 0.0	6.3 - 0.2	12.3 - 0.3		3	0°30.7	0°30.8	0°29.3	0.3 - 0.0	6.3 - 0.3	12.3 - 0.5	
4	0°01.0	0°01.0	0°01.0	0.4 - 0.0	6.4 - 0.1	12.4 - 0.1		4	0°16.0	0°16.0	0°15.3	0.4 - 0.0	6.4 - 0.2	12.4 - 0.3		4	0°31.0	0°31.1	0°29.6	0.4 - 0.0	6.4 - 0.3	12.4 - 0.5	
5	0°01.3	0°01.3	0°01.2	0.5 - 0.0	6.5 - 0.1	12.5 - 0.1		5	0°16.3	0°16.3	0°15.5	0.5 - 0.0	6.5 - 0.2	12.5 - 0.3		5	0°31.3	0°31.3	0°29.8	0.5 - 0.0	6.5 - 0.3	12.5 - 0.5	
6	0°01.5	0°01.5	0°01.4	0.6 - 0.0	6.6 - 0.1	12.6 - 0.1		6	0°16.5	0°16.5	0°15.7	0.6 - 0.0	6.6 - 0.2	12.6 - 0.3		6	0°31.5	0°31.6	0°30.1	0.6 - 0.0	6.6 - 0.3	12.6 - 0.5	
7	0°01.8	0°01.8	0°01.7	0.7 - 0.0	6.7 - 0.1	12.7 - 0.1		7	0°16.8	0°16.8	0°16.0	0.7 - 0.0	6.7 - 0.2	12.7 - 0.3		7	0°31.8	0°31.8	0°30.3	0.7 - 0.0	6.7 - 0.3	12.7 - 0.5	
8	0°02.0	0°02.0	0°01.9	0.8 - 0.0	6.8 - 0.1	12.8 - 0.1		8	0°17.0	0°17.0	0°16.2	0.8 - 0.0	6.8 - 0.2	12.8 - 0.3		8	0°32.0	0°32.1	0°30.5	0.8 - 0.0	6.8 - 0.3	12.8 - 0.5	
9	0°02.3	0°02.3	0°02.1	0.9 - 0.0	6.9 - 0.1	12.9 - 0.1		9	0°17.3	0°17.3	0°16.5	0.9 - 0.0	6.9 - 0.2	12.9 - 0.3		9	0°32.3	0°32.3	0°30.8	0.9 - 0.0	6.9 - 0.3	12.9 - 0.5	
10	0°02.5	0°02.5	0°02.4	1.0 - 0.0	7.0 - 0.1	13.0 - 0.1		10	0°17.5	0°17.5	0°16.7	1.0 - 0.0	7.0 - 0.2	13.0 - 0.3		10	0°32.5	0°32.6	0°31.0	1.0 - 0.0	7.0 - 0.3	13.0 - 0.5	
11	0°02.8	0°02.8	0°02.6	1.1 - 0.0	7.1 - 0.1	13.1 - 0.1		11	0°17.8	0°17.8	0°16.9	1.1 - 0.0	7.1 - 0.2	13.1 - 0.3		11	0°32.8	0°32.8	0°31.3	1.1 - 0.0	7.1 - 0.3	13.1 - 0.5	
12	0°03.0	0°03.0	0°02.9	1.2 - 0.0	7.2 - 0.1	13.2 - 0.1		12	0°18.0	0°18.0	0°17.2	1.2 - 0.0	7.2 - 0.2	13.2 - 0.3		12	0°33.0	0°33.1	0°31.5	1.2 - 0.1	7.2 - 0.3	13.2 - 0.5	
13	0°03.3	0°03.3	0°03.1	1.3 - 0.0	7.3 - 0.1	13.3 - 0.1		13	0°18.3	0°18.3	0°17.4	1.3 - 0.0	7.3 - 0.2	13.3 - 0.3		13	0°33.3	0°33.3	0°31.7	1.3 - 0.1	7.3 - 0.3	13.3 - 0.6	
14	0°03.5	0°03.5	0°03.3	1.4 - 0.0	7.4 - 0.1	13.4 - 0.1		14	0°18.5	0°18.6	0°17.7	1.4 - 0.0	7.4 - 0.2	13.4 - 0.3		14	0°33.5	0°33.6	0°32.0	1.4 - 0.1	7.4 - 0.3	13.4 - 0.6	
15	0°03.8	0°03.8	0°03.6	1.5 - 0.0	7.5 - 0.1	13.5 - 0.1		15	0°18.8	0°18.8	0°17.9	1.5 - 0.0	7.5 - 0.2	13.5 - 0.3		15	0°33.8	0°33.8	0°32.2	1.5 - 0.1	7.5 - 0.3	13.5 - 0.6	
16	0°04.0	0°04.0	0°03.8	1.6 - 0.0	7.6 - 0.1	13.6 - 0.1		16	0°19.0	0°19.1	0°18.1	1.6 - 0.0	7.6 - 0.2	13.6 - 0.3		16	0°34.0	0°34.1	0°32.5	1.6 - 0.1	7.6 - 0.3	13.6 - 0.6	
17	0°04.3	0°04.3	0°04.1	1.7 - 0.0	7.7 - 0.1	13.7 - 0.1		17	0°19.3	0°19.3	0°18.4	1.7 - 0.0	7.7 - 0.2	13.7 - 0.3		17	0°34.3	0°34.3	0°32.7	1.7 - 0.1	7.7 - 0.3	13.7 - 0.6	
18	0°04.5	0°04.5	0°04.3	1.8 - 0.0	7.8 - 0.1	13.8 - 0.1		18	0°19.5	0°19.6	0°18.6	1.8 - 0.0	7.8 - 0.2	13.8 - 0.3		18	0°34.5	0°34.6	0°32.9	1.8 - 0.1	7.8 - 0.3	13.8 - 0.6	
19	0°04.8	0°04.8	0°04.5	1.9 - 0.0	7.9 - 0.1	13.9 - 0.1		19	0°19.8	0°19.8	0°18.9	1.9 - 0.0	7.9 - 0.2	13.9 - 0.3		19	0°34.8	0°34.8	0°33.2	1.9 - 0.1	7.9 - 0.3	13.9 - 0.6	
20	0°05.0	0°05.0	0°04.8	2.0 - 0.0	8.0 - 0.1	14.0 - 0.1		20	0°20.0	0°20.1	0°19.1	2.0 - 0.1	8.0 - 0.2	14.0 - 0.4		20	0°35.0	0°35.1	0°33.4	2.0 - 0.1	8.0 - 0.3	14.0 - 0.6	
21	0°05.3	0°05.3	0°05.0	2.1 - 0.0	8.1 - 0.1	14.1 - 0.1		21	0°20.3	0°20.3	0°19.3	2.1 - 0.1	8.1 - 0.2	14.1 - 0.4		21	0°35.3	0°35.3	0°33.6	2.1 - 0.1	8.1 - 0.3	14.1 - 0.6	
22	0°05.5	0°05.5	0°05.2	2.2 - 0.0	8.2 - 0.1	14.2 - 0.1		22	0°20.5	0°20.6	0°19.6	2.2 - 0.1	8.2 - 0.2	14.2 - 0.4		22	0°35.5	0°35.6	0°33.9	2.2 - 0.1	8.2 - 0.3	14.2 - 0.6	
23	0°05.8	0°05.8	0°05.5	2.3 - 0.0	8.3 - 0.1	14.3 - 0.1		23	0°20.8	0°20.8	0°19.8	2.3 - 0.1	8.3 - 0.2	14.3 - 0.4		23	0°35.8	0°35.8	0°34.1	2.3 - 0.1	8.3 - 0.3	14.3 - 0.6	
24	0°06.0	0°06.0	0°05.7	2.4 - 0.0	8.4 - 0.1	14.4 - 0.1		24	0°21.0	0°21.1	0°20.0	2.4 - 0.1	8.4 - 0.2	14.4 - 0.4		24	0°36.0	0°36.1	0°34.4	2.4 - 0.1	8.4 - 0.3	14.4 - 0.6	
25	0°06.3	0°06.3	0°06.0	2.5 - 0.0	8.5 - 0.1	14.5 - 0.1		25	0°21.3	0°21.3	0°20.3	2.5 - 0.1	8.5 - 0.2	14.5 - 0.4		25	0°36.3	0°36.3	0°34.6	2.5 - 0.1	8.5 - 0.4	14.5 - 0.6	
26	0°06.5	0°06.5	0°06.2	2.6 - 0.0	8.6 - 0.1	14.6 - 0.1		26	0°21.5	0°21.6	0°20.5	2.6 - 0.1	8.6 - 0.2	14.6 - 0.4		26	0°36.5	0°36.6	0°34.8	2.6 - 0.1	8.6 - 0.4	14.6 - 0.6	
27	0°06.8	0°06.8	0°06.4	2.7 - 0.0	8.7 - 0.1	14.7 - 0.1		27	0°21.8	0°21.8	0°20.8	2.7 - 0.1	8.7 - 0.2	14.7 - 0.4		27	0°36.8	0°36.9	0°35.1	2.7 - 0.1	8.7 - 0.4	14.7 - 0.6	
28	0°07.0	0°07.0	0°06.7	2.8 - 0.0	8.8 - 0.1	14.8 - 0.1		28	0°22.0	0°22.1	0°21.0	2.8 - 0.1	8.8 - 0.2	14.8 - 0.4		28	0°37.0	0°37.1	0°35.3	2.8 - 0.1	8.8 - 0.4	14.8 - 0.6	
29	0°07.3	0°07.3	0°06.9	2.9 - 0.0	8.9 - 0.1	14.9 - 0.1		29	0°22.3	0°22.3	0°21.2	2.9 - 0.1	8.9 - 0.2	14.9 - 0.4		29	0°37.3	0°37.4	0°35.6	2.9 - 0.1	8.9 - 0.4	14.9 - 0.6	
30	0°07.5	0°07.5	0°07.2	3.0 - 0.0	9.0 - 0.1	15.0 - 0.1		30	0°22.5	0°22.6	0°21.5	3.0 - 0.1	9.0 - 0.2	15.0 - 0.4		30	0°37.5	0°37.6	0°35.8	3.0 - 0.1	9.0 - 0.4	15.0 - 0.6	
31	0°07.8	0°07.8	0°07.4	3.1 - 0.0	9.1 - 0.1	15.1 - 0.1		31	0°22.8	0°22.8	0°21.7	3.1 - 0.1	9.1 - 0.2	15.1 - 0.4		31	0°37.8	0°37.9	0°36.0	3.1 - 0.1	9.1 - 0.4	15.1 - 0.6	
32	0°08.0	0°08.0	0°07.6	3.2 - 0.0	9.2 - 0.1	15.2 - 0.1		32	0°23.0	0°23.1	0°22.0	3.2 - 0.1	9.2 - 0.2	15.2 - 0.4		32	0°38.0	0°38.1	0°36.3	3.2 - 0.1	9.2 - 0.4	15.2 - 0.6	
33	0°08.3	0°08.3	0°07.9	3.3 - 0.0	9.3 - 0.1	15.3 - 0.1		33	0°23.3	0°23.3	0°22.3	3.3 - 0.1	9.3 - 0.2	15.3 - 0.4		33	0°38.3	0°38.4	0°36.5	3.3 - 0.1	9.3 - 0.4	15.3 - 0.6	
34	0°08.5	0°08.5	0°08.1	3.4 - 0.0	9.4 - 0.1	15.4 - 0.1		34	0°23.5	0°23.6	0°22.4	3.4 - 0.1	9.4 - 0.2	15.4 - 0.4		34	0°38.5	0°38.6	0°36.7	3.4 - 0.1	9.4 - 0.4	15.4 - 0.6	
35	0°08.8	0°08.8	0°08.4	3.5 - 0.0	9.5 - 0.1	15.5 - 0.1		35	0°23.8	0°23.8	0°22.7	3.5 - 0.1	9.5 - 0.2	15.5 - 0.4		35	0°38.8	0°38.9	0°37.0	3.5 - 0.1	9.5 - 0.4	15.5 - 0.6	
36	0°09.0	0°09.0	0°08.6	3.6 - 0.0	9.6 - 0.1	15.6 - 0.1		36	0°24.0	0°24.1	0°22.9	3.6 - 0.1	9.6 - 0.2	15.6 - 0.4		36	0°39.0	0°39.1	0°37.2	3.6 - 0.1	9.6 - 0.4	15.6 - 0.6	
37	0°09.3	0°09.3	0°08.8	3.7 - 0.0	9.7 - 0.1	15.7 - 0.1		37	0°24.3	0°24.3	0°23.1	3.7 - 0.1	9.7 - 0.2	15.7 - 0.4		37	0°39.3	0°39.4	0°37.5	3.7 - 0.2	9.7 - 0.4	15.7 - 0.7	
38	0°09.5	0°09.5	0°09.1	3.8 - 0.0	9.8 - 0.1	15.8 - 0.1		38	0°24.5	0°24.6	0°23.4	3.8 - 0.1	9.8 - 0.2	15.8 - 0.4		38	0°39.5	0°39.6	0°37.7	3.8 - 0.2	9.8 - 0.4	15.8 - 0.7	
39	0°09.8	0°09.8	0°09.3	3.9 - 0.0	9.9 - 0.1	15.9 - 0.1		39	0°24.8	0°24.8	0°23.6	3.9 - 0.1	9.9 - 0.2	15.9 - 0.4		39	0°39.8	0°39.9	0°37.9	3.9 - 0.2	9.9 - 0.4	15.9 - 0.7	
40	0°10.0	0°10.0	0°09.5	4.0 - 0.0	10.0 - 0.1	16.0 - 0.1		40	0°25.0	0°25.1	0°23.9	4.0 - 0.1	10.0 - 0.3	16.0 - 0.4		40	0°40.0	0°40.1	0°38.2	4.0 - 0.2	10.0 - 0.4	16.0 - 0.7	
41	0°10.3	0°10.3	0°09.8	4.1 - 0.0	10.1 - 0.1	16.1 - 0.1		41	0°25.3	0°25.3	0°24.1	4.1 - 0.1	10.1 - 0.3	16.1 - 0.4		41	0°40.3	0°40.4	0°38.4	4.1 - 0.2	10.1 - 0.4	16.1 - 0.7	

## Increments and Corrections

m 3	Sun Plan.	Aries	Moon	v and d corr				m 4	Sun Plan.	Aries	Moon	v and d corr				m 5	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		0	1°00.0	1°00.2	0°57.3	0.0 - 0.0	6.0 - 0.4	12.0 - 0.9		0	1°15.0	1°15.2	1°11.6	0.0 - 0.0	6.0 - 0.5	12.0 - 1.1	
1	0°45.3	0°45.4	0°43.2	0.1 - 0.0	6.1 - 0.4	12.1 - 0.7		1	1°00.2	1°00.4	0°57.5	0.1 - 0.0	6.1 - 0.5	12.1 - 0.9		1	1°15.3	1°15.5	1°11.8	0.1 - 0.0	6.1 - 0.6	12.1 - 1.1	
2	0°45.5	0°45.6	0°43.4	0.2 - 0.0	6.2 - 0.4	12.2 - 0.7		2	1°00.5	1°00.7	0°57.7	0.2 - 0.0	6.2 - 0.5	12.2 - 0.9		2	1°15.5	1°15.7	1°12.1	0.2 - 0.0	6.2 - 0.6	12.2 - 1.1	
3	0°45.8	0°45.9	0°43.7	0.3 - 0.0	6.3 - 0.4	12.3 - 0.7		3	1°00.7	1°00.9	0°58.0	0.3 - 0.0	6.3 - 0.5	12.3 - 0.9		3	1°15.7	1°16.0	1°12.3	0.3 - 0.0	6.3 - 0.6	12.3 - 1.1	
4	0°46.0	0°46.1	0°43.9	0.4 - 0.0	6.4 - 0.4	12.4 - 0.7		4	1°01.0	1°01.2	0°58.2	0.4 - 0.0	6.4 - 0.5	12.4 - 0.9		4	1°16.0	1°16.2	1°12.5	0.4 - 0.0	6.4 - 0.6	12.4 - 1.1	
5	0°46.3	0°46.4	0°44.1	0.5 - 0.0	6.5 - 0.4	12.5 - 0.7		5	1°01.2	1°01.4	0°58.5	0.5 - 0.0	6.5 - 0.5	12.5 - 0.9		5	1°16.2	1°16.5	1°12.8	0.5 - 0.0	6.5 - 0.6	12.5 - 1.1	
6	0°46.5	0°46.6	0°44.4	0.6 - 0.0	6.6 - 0.4	12.6 - 0.7		6	1°01.5	1°01.7	0°58.7	0.6 - 0.0	6.6 - 0.5	12.6 - 0.9		6	1°16.5	1°16.7	1°13.0	0.6 - 0.1	6.6 - 0.6	12.6 - 1.2	
7	0°46.8	0°46.9	0°44.6	0.7 - 0.0	6.7 - 0.4	12.7 - 0.7		7	1°01.7	1°01.9	0°58.9	0.7 - 0.1	6.7 - 0.5	12.7 - 1.0		7	1°16.7	1°17.0	1°13.3	0.7 - 0.1	6.7 - 0.6	12.7 - 1.2	
8	0°47.0	0°47.1	0°44.9	0.8 - 0.0	6.8 - 0.4	12.8 - 0.7		8	1°02.0	1°02.2	0°59.2	0.8 - 0.1	6.8 - 0.5	12.8 - 1.0		8	1°17.0	1°17.2	1°13.5	0.8 - 0.1	6.8 - 0.6	12.8 - 1.2	
9	0°47.3	0°47.4	0°45.1	0.9 - 0.1	6.9 - 0.4	12.9 - 0.8		9	1°02.3	1°02.4	0°59.4	0.9 - 0.1	6.9 - 0.5	12.9 - 1.0		9	1°17.3	1°17.5	1°13.7	0.9 - 0.1	6.9 - 0.6	12.9 - 1.2	
10	0°47.5	0°47.6	0°45.3	1.0 - 0.1	7.0 - 0.4	13.0 - 0.8		10	1°02.5	1°02.7	0°59.7	1.0 - 0.1	7.0 - 0.5	13.0 - 1.0		10	1°17.5	1°17.7	1°14.0	1.0 - 0.1	7.0 - 0.6	13.0 - 1.2	
11	0°47.8	0°47.9	0°45.6	1.1 - 0.1	7.1 - 0.4	13.1 - 0.8		11	1°02.8	1°02.9	0°59.9	1.1 - 0.1	7.1 - 0.5	13.1 - 1.0		11	1°17.8	1°18.0	1°14.2	1.1 - 0.1	7.1 - 0.7	13.1 - 1.2	
12	0°48.0	0°48.1	0°45.8	1.2 - 0.1	7.2 - 0.4	13.2 - 0.8		12	1°03.0	1°03.2	1°00.1	1.2 - 0.1	7.2 - 0.5	13.2 - 1.0		12	1°18.0	1°18.2	1°14.4	1.2 - 0.1	7.2 - 0.7	13.2 - 1.2	
13	0°48.3	0°48.4	0°46.1	1.3 - 0.1	7.3 - 0.4	13.3 - 0.8		13	1°03.3	1°03.4	1°00.4	1.3 - 0.1	7.3 - 0.5	13.3 - 1.0		13	1°18.3	1°18.5	1°14.7	1.3 - 0.1	7.3 - 0.7	13.3 - 1.2	
14	0°48.5	0°48.6	0°46.3	1.4 - 0.1	7.4 - 0.4	13.4 - 0.8		14	1°03.5	1°03.7	1°00.6	1.4 - 0.1	7.4 - 0.6	13.4 - 1.0		14	1°18.5	1°18.7	1°14.9	1.4 - 0.1	7.4 - 0.7	13.4 - 1.2	
15	0°48.8	0°48.9	0°46.5	1.5 - 0.1	7.5 - 0.4	13.5 - 0.8		15	1°03.8	1°03.9	1°00.8	1.5 - 0.1	7.5 - 0.6	13.5 - 1.0		15	1°18.8	1°19.0	1°15.2	1.5 - 0.1	7.5 - 0.7	13.5 - 1.2	
16	0°49.0	0°49.1	0°46.8	1.6 - 0.1	7.6 - 0.4	13.6 - 0.8		16	1°04.0	1°04.2	1°01.1	1.6 - 0.1	7.6 - 0.6	13.6 - 1.0		16	1°19.0	1°19.2	1°15.4	1.6 - 0.1	7.6 - 0.7	13.6 - 1.2	
17	0°49.3	0°49.4	0°47.0	1.7 - 0.1	7.7 - 0.4	13.7 - 0.8		17	1°04.2	1°04.4	1°01.3	1.7 - 0.1	7.7 - 0.6	13.7 - 1.0		17	1°19.3	1°19.5	1°15.6	1.7 - 0.2	7.7 - 0.7	13.7 - 1.3	
18	0°49.5	0°49.6	0°47.2	1.8 - 0.1	7.8 - 0.5	13.8 - 0.8		18	1°04.5	1°04.7	1°01.6	1.8 - 0.1	7.8 - 0.6	13.8 - 1.0		18	1°19.5	1°19.7	1°15.9	1.8 - 0.2	7.8 - 0.7	13.8 - 1.3	
19	0°49.8	0°49.9	0°47.5	1.9 - 0.1	7.9 - 0.5	13.9 - 0.8		19	1°04.7	1°04.9	1°01.8	1.9 - 0.1	7.9 - 0.6	13.9 - 1.0		19	1°19.7	1°20.0	1°16.1	1.9 - 0.2	7.9 - 0.7	13.9 - 1.3	
20	0°50.0	0°50.1	0°47.7	2.0 - 0.1	8.0 - 0.5	14.0 - 0.8		20	1°05.0	1°05.2	1°02.0	2.0 - 0.1	8.0 - 0.6	14.0 - 1.1		20	1°20.0	1°20.2	1°16.4	2.0 - 0.2	8.0 - 0.7	14.0 - 1.3	
21	0°50.3	0°50.4	0°48.0	2.1 - 0.1	8.1 - 0.5	14.1 - 0.8		21	1°05.2	1°05.4	1°02.3	2.1 - 0.2	8.1 - 0.6	14.1 - 1.1		21	1°20.2	1°20.5	1°16.6	2.1 - 0.2	8.1 - 0.7	14.1 - 1.3	
22	0°50.5	0°50.6	0°48.2	2.2 - 0.1	8.2 - 0.5	14.2 - 0.8		22	1°05.5	1°05.7	1°02.5	2.2 - 0.2	8.2 - 0.6	14.2 - 1.1		22	1°20.5	1°20.7	1°16.8	2.2 - 0.2	8.2 - 0.8	14.2 - 1.3	
23	0°50.8	0°50.9	0°48.4	2.3 - 0.1	8.3 - 0.5	14.3 - 0.8		23	1°05.8	1°05.9	1°02.8	2.3 - 0.2	8.3 - 0.6	14.3 - 1.1		23	1°20.8	1°21.0	1°17.1	2.3 - 0.2	8.3 - 0.8	14.3 - 1.3	
24	0°51.0	0°51.1	0°48.7	2.4 - 0.1	8.4 - 0.5	14.4 - 0.8		24	1°06.0	1°06.2	1°03.0	2.4 - 0.2	8.4 - 0.6	14.4 - 1.1		24	1°21.0	1°21.2	1°17.3	2.4 - 0.2	8.4 - 0.8	14.4 - 1.3	
25	0°51.3	0°51.4	0°48.9	2.5 - 0.1	8.5 - 0.5	14.5 - 0.8		25	1°06.3	1°06.4	1°03.2	2.5 - 0.2	8.5 - 0.6	14.5 - 1.1		25	1°21.3	1°21.5	1°17.5	2.5 - 0.2	8.5 - 0.8	14.5 - 1.3	
26	0°51.5	0°51.6	0°49.2	2.6 - 0.2	8.6 - 0.5	14.6 - 0.9		26	1°06.5	1°06.7	1°03.5	2.6 - 0.2	8.6 - 0.6	14.6 - 1.1		26	1°21.5	1°21.7	1°17.8	2.6 - 0.2	8.6 - 0.8	14.6 - 1.3	
27	0°51.8	0°51.9	0°49.4	2.7 - 0.2	8.7 - 0.5	14.7 - 0.9		27	1°06.8	1°06.9	1°03.7	2.7 - 0.2	8.7 - 0.7	14.7 - 1.1		27	1°21.8	1°22.0	1°18.0	2.7 - 0.2	8.7 - 0.8	14.7 - 1.3	
28	0°52.0	0°52.1	0°49.6	2.8 - 0.2	8.8 - 0.5	14.8 - 0.9		28	1°07.0	1°07.2	1°03.9	2.8 - 0.2	8.8 - 0.7	14.8 - 1.1		28	1°22.0	1°22.2	1°18.3	2.8 - 0.3	8.8 - 0.8	14.8 - 1.4	
29	0°52.3	0°52.4	0°49.9	2.9 - 0.2	8.9 - 0.5	14.9 - 0.9		29	1°07.3	1°07.4	1°04.2	2.9 - 0.2	8.9 - 0.7	14.9 - 1.1		29	1°22.3	1°22.5	1°18.5	2.9 - 0.3	8.9 - 0.8	14.9 - 1.4	
30	0°52.5	0°52.6	0°50.1	3.0 - 0.2	9.0 - 0.5	15.0 - 0.9		30	1°07.5	1°07.7	1°04.4	3.0 - 0.2	9.0 - 0.7	15.0 - 1.1		30	1°22.5	1°22.7	1°18.7	3.0 - 0.3	9.0 - 0.8	15.0 - 1.4	
31	0°52.8	0°52.9	0°50.3	3.1 - 0.2	9.1 - 0.5	15.1 - 0.9		31	1°07.7	1°07.9	1°04.7	3.1 - 0.2	9.1 - 0.7	15.1 - 1.1		31	1°22.8	1°23.0	1°19.0	3.1 - 0.3	9.1 - 0.8	15.1 - 1.4	
32	0°53.0	0°53.1	0°50.6	3.2 - 0.2	9.2 - 0.5	15.2 - 0.9		32	1°08.0	1°08.2	1°04.9	3.2 - 0.2	9.2 - 0.7	15.2 - 1.1		32	1°23.0	1°23.2	1°19.2	3.2 - 0.3	9.2 - 0.8	15.2 - 1.4	
33	0°53.3	0°53.4	0°50.8	3.3 - 0.2	9.3 - 0.5	15.3 - 0.9		33	1°08.2	1°08.4	1°05.1	3.3 - 0.2	9.3 - 0.7	15.3 - 1.1		33	1°23.2	1°23.5	1°19.5	3.3 - 0.3	9.3 - 0.9	15.3 - 1.4	
34	0°53.5	0°53.6	0°51.1	3.4 - 0.2	9.4 - 0.5	15.4 - 0.9		34	1°08.5	1°08.7	1°05.4	3.4 - 0.3	9.4 - 0.7	15.4 - 1.2		34	1°23.5	1°23.7	1°19.7	3.4 - 0.3	9.4 - 0.9	15.4 - 1.4	
35	0°53.8	0°53.9	0°51.3	3.5 - 0.2	9.5 - 0.6	15.5 - 0.9		35	1°08.7	1°08.9	1°05.6	3.5 - 0.3	9.5 - 0.7	15.5 - 1.2		35	1°23.7	1°24.0	1°19.9	3.5 - 0.3	9.5 - 0.9	15.5 - 1.4	
36	0°54.0	0°54.1	0°51.5	3.6 - 0.2	9.6 - 0.6	15.6 - 0.9		36	1°09.0	1°09.2	1°05.9	3.6 - 0.3	9.6 - 0.7	15.6 - 1.2		36	1°24.0	1°24.2	1°20.2	3.6 - 0.3	9.6 - 0.9	15.6 - 1.4	
37	0°54.3	0°54.4	0°51.8	3.7 - 0.2	9.7 - 0.6	15.7 - 0.9		37	1°09.3	1°09.4	1°06.1	3.7 - 0.3	9.7 - 0.7	15.7 - 1.2		37	1°24.3	1°24.5	1°20.4	3.7 - 0.3	9.7 - 0.9	15.7 - 1.4	
38	0°54.5	0°54.6	0°52.0	3.8 - 0.2	9.8 - 0.6	15.8 - 0.9		38	1°09.5	1°09.7	1°06.3	3.8 - 0.3	9.8 - 0.7	15.8 - 1.2		38	1°24.5	1°24.7	1°20.7	3.8 - 0.3	9.8 - 0.9	15.8 - 1.4	
39	0°54.8	0°54.9	0°52.3	3.9 - 0.2	9.9 - 0.6	15.9 - 0.9		39	1°09.8	1°09.9	1°06.6	3.9 - 0.3	9.9 - 0.7	15.9 - 1.2		39	1°24.8	1°25.0	1°20.9	3.9 - 0.4	9.9 - 0.9	15.9 - 1.5	
40	0°55.0	0°55.2	0°52.5	4.0 - 0.2	10.0 - 0.6	16.0 - 0.9		40	1°10.0	1°10.2	1°06.8	4.0 - 0.3	10.0 - 0.8	16.0 - 1.2		40	1°25.0	1°25.2	1°21.1	4.0 - 0.4	10.0 - 0.9	16.0 - 1.5	
41	0°55.3	0°55.4	0°52.7	4.1 - 0.2	10.1 - 0.6	16.1 - 0.9		41	1°10.3	1°10.4	1°07.0	4.1 - 0.3	10.1 - 0.8	16.1 - 1.2		41	1°25.3	1°25.5	1°21.4	4.1 - 0.4	10.1 - 0.9	16.1 - 1.5	

## Increments and Corrections

m 6	Sun Plan.	Aries	Moon	v and d corr			m 7	Sun Plan.	Aries	Moon	v and d corr			m 8	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	0	1°45.0	1°45.3	1°40.2	0.0 - 0.0	6.0 - 0.8	12.0 - 1.5	0	2°00.0	2°00.3	1°54.5	0.0 - 0.0	6.0 - 0.8	12.0 - 1.7
1	1°30.3	1°30.5	1°26.1	0.1 - 0.0	6.1 - 0.7	12.1 - 1.3	1	1°45.3	1°45.5	1°40.5	0.1 - 0.0	6.1 - 0.8	12.1 - 1.5	1	2°00.3	2°00.6	1°54.8	0.1 - 0.0	6.1 - 0.9	12.1 - 1.7
2	1°30.5	1°30.7	1°26.4	0.2 - 0.0	6.2 - 0.7	12.2 - 1.3	2	1°45.5	1°45.8	1°40.7	0.2 - 0.0	6.2 - 0.8	12.2 - 1.5	2	2°00.5	2°00.8	1°55.0	0.2 - 0.0	6.2 - 0.9	12.2 - 1.7
3	1°30.7	1°31.0	1°26.6	0.3 - 0.0	6.3 - 0.7	12.3 - 1.3	3	1°45.8	1°46.0	1°40.9	0.3 - 0.0	6.3 - 0.8	12.3 - 1.5	3	2°00.8	2°01.1	1°55.2	0.3 - 0.0	6.3 - 0.9	12.3 - 1.7
4	1°31.0	1°31.2	1°26.9	0.4 - 0.0	6.4 - 0.7	12.4 - 1.3	4	1°46.0	1°46.3	1°41.2	0.4 - 0.1	6.4 - 0.8	12.4 - 1.6	4	2°01.0	2°01.3	1°55.5	0.4 - 0.1	6.4 - 0.9	12.4 - 1.8
5	1°31.2	1°31.5	1°27.1	0.5 - 0.1	6.5 - 0.7	12.5 - 1.4	5	1°46.2	1°46.5	1°41.4	0.5 - 0.1	6.5 - 0.8	12.5 - 1.6	5	2°01.3	2°01.6	1°55.7	0.5 - 0.1	6.5 - 0.9	12.5 - 1.8
6	1°31.5	1°31.8	1°27.3	0.6 - 0.1	6.6 - 0.7	12.6 - 1.4	6	1°46.5	1°46.8	1°41.6	0.6 - 0.1	6.6 - 0.8	12.6 - 1.6	6	2°01.5	2°01.8	1°56.0	0.6 - 0.1	6.6 - 0.9	12.6 - 1.8
7	1°31.7	1°32.0	1°27.6	0.7 - 0.1	6.7 - 0.7	12.7 - 1.4	7	1°46.7	1°47.0	1°41.9	0.7 - 0.1	6.7 - 0.8	12.7 - 1.6	7	2°01.8	2°02.1	1°56.2	0.7 - 0.1	6.7 - 0.9	12.7 - 1.8
8	1°32.0	1°32.3	1°27.8	0.8 - 0.1	6.8 - 0.7	12.8 - 1.4	8	1°47.0	1°47.3	1°42.1	0.8 - 0.1	6.8 - 0.8	12.8 - 1.6	8	2°02.0	2°02.3	1°56.4	0.8 - 0.1	6.8 - 1.0	12.8 - 1.8
9	1°32.3	1°32.5	1°28.0	0.9 - 0.1	6.9 - 0.7	12.9 - 1.4	9	1°47.3	1°47.5	1°42.4	0.9 - 0.1	6.9 - 0.9	12.9 - 1.6	9	2°02.3	2°02.6	1°56.7	0.9 - 0.1	6.9 - 1.0	12.9 - 1.8
10	1°32.5	1°32.8	1°28.3	1.0 - 0.1	7.0 - 0.8	13.0 - 1.4	10	1°47.5	1°47.8	1°42.6	1.0 - 0.1	7.0 - 0.9	13.0 - 1.6	10	2°02.5	2°02.8	1°56.9	1.0 - 0.1	7.0 - 1.0	13.0 - 1.8
11	1°32.8	1°33.0	1°28.5	1.1 - 0.1	7.1 - 0.8	13.1 - 1.4	11	1°47.8	1°48.0	1°42.8	1.1 - 0.1	7.1 - 0.9	13.1 - 1.6	11	2°02.8	2°03.1	1°57.2	1.1 - 0.2	7.1 - 1.0	13.1 - 1.9
12	1°33.0	1°33.3	1°28.8	1.2 - 0.1	7.2 - 0.8	13.2 - 1.4	12	1°48.0	1°48.3	1°43.1	1.2 - 0.2	7.2 - 0.9	13.2 - 1.6	12	2°03.0	2°03.3	1°57.4	1.2 - 0.2	7.2 - 1.0	13.2 - 1.9
13	1°33.3	1°33.5	1°29.0	1.3 - 0.1	7.3 - 0.8	13.3 - 1.4	13	1°48.3	1°48.5	1°43.3	1.3 - 0.2	7.3 - 0.9	13.3 - 1.7	13	2°03.3	2°03.6	1°57.6	1.3 - 0.2	7.3 - 1.0	13.3 - 1.9
14	1°33.5	1°33.8	1°29.2	1.4 - 0.2	7.4 - 0.8	13.4 - 1.5	14	1°48.5	1°48.8	1°43.6	1.4 - 0.2	7.4 - 0.9	13.4 - 1.7	14	2°03.5	2°03.8	1°57.9	1.4 - 0.2	7.4 - 1.0	13.4 - 1.9
15	1°33.8	1°34.0	1°29.5	1.5 - 0.2	7.5 - 0.8	13.5 - 1.5	15	1°48.8	1°49.0	1°43.8	1.5 - 0.2	7.5 - 0.9	13.5 - 1.7	15	2°03.8	2°04.1	1°58.1	1.5 - 0.2	7.5 - 1.1	13.5 - 1.9
16	1°34.0	1°34.3	1°29.7	1.6 - 0.2	7.6 - 0.8	13.6 - 1.5	16	1°49.0	1°49.3	1°44.0	1.6 - 0.2	7.6 - 0.9	13.6 - 1.7	16	2°04.0	2°04.3	1°58.4	1.6 - 0.2	7.6 - 1.1	13.6 - 1.9
17	1°34.3	1°34.5	1°30.0	1.7 - 0.2	7.7 - 0.8	13.7 - 1.5	17	1°49.3	1°49.5	1°44.3	1.7 - 0.2	7.7 - 1.0	13.7 - 1.7	17	2°04.2	2°04.6	1°58.6	1.7 - 0.2	7.7 - 1.1	13.7 - 1.9
18	1°34.5	1°34.8	1°30.2	1.8 - 0.2	7.8 - 0.8	13.8 - 1.5	18	1°49.5	1°49.8	1°44.5	1.8 - 0.2	7.8 - 1.0	13.8 - 1.7	18	2°04.5	2°04.8	1°58.8	1.8 - 0.3	7.8 - 1.1	13.8 - 2.0
19	1°34.8	1°35.0	1°30.4	1.9 - 0.2	7.9 - 0.9	13.9 - 1.5	19	1°49.8	1°50.0	1°44.8	1.9 - 0.2	7.9 - 1.0	13.9 - 1.7	19	2°04.7	2°05.1	1°59.1	1.9 - 0.3	7.9 - 1.1	13.9 - 2.0
20	1°35.0	1°35.3	1°30.7	2.0 - 0.2	8.0 - 0.9	14.0 - 1.5	20	1°50.0	1°50.3	1°45.0	2.0 - 0.3	8.0 - 1.0	14.0 - 1.8	20	2°05.0	2°05.3	1°59.3	2.0 - 0.3	8.0 - 1.1	14.0 - 2.0
21	1°35.2	1°35.5	1°30.9	2.1 - 0.2	8.1 - 0.9	14.1 - 1.5	21	1°50.2	1°50.6	1°45.2	2.1 - 0.3	8.1 - 1.0	14.1 - 1.8	21	2°05.2	2°05.6	1°59.5	2.1 - 0.3	8.1 - 1.1	14.1 - 2.0
22	1°35.5	1°35.8	1°31.1	2.2 - 0.2	8.2 - 0.9	14.2 - 1.5	22	1°50.5	1°50.8	1°45.5	2.2 - 0.3	8.2 - 1.0	14.2 - 1.8	22	2°05.5	2°05.8	1°59.8	2.2 - 0.3	8.2 - 1.2	14.2 - 2.0
23	1°35.8	1°36.0	1°31.4	2.3 - 0.2	8.3 - 0.9	14.3 - 1.5	23	1°50.8	1°51.1	1°45.7	2.3 - 0.3	8.3 - 1.0	14.3 - 1.8	23	2°05.7	2°06.1	2°00.0	2.3 - 0.3	8.3 - 1.2	14.3 - 2.0
24	1°36.0	1°36.3	1°31.6	2.4 - 0.3	8.4 - 0.9	14.4 - 1.6	24	1°51.0	1°51.3	1°45.9	2.4 - 0.3	8.4 - 1.1	14.4 - 1.8	24	2°06.0	2°06.3	2°00.3	2.4 - 0.3	8.4 - 1.2	14.4 - 2.0
25	1°36.3	1°36.5	1°31.9	2.5 - 0.3	8.5 - 0.9	14.5 - 1.6	25	1°51.3	1°51.6	1°46.2	2.5 - 0.3	8.5 - 1.1	14.5 - 1.8	25	2°06.2	2°06.6	2°00.5	2.5 - 0.4	8.5 - 1.2	14.5 - 2.1
26	1°36.5	1°36.8	1°32.1	2.6 - 0.3	8.6 - 0.9	14.6 - 1.6	26	1°51.5	1°51.8	1°46.4	2.6 - 0.3	8.6 - 1.1	14.6 - 1.8	26	2°06.5	2°06.8	2°00.7	2.6 - 0.4	8.6 - 1.2	14.6 - 2.1
27	1°36.8	1°37.0	1°32.3	2.7 - 0.3	8.7 - 0.9	14.7 - 1.6	27	1°51.8	1°52.1	1°46.7	2.7 - 0.3	8.7 - 1.1	14.7 - 1.8	27	2°06.7	2°07.1	2°01.0	2.7 - 0.4	8.7 - 1.2	14.7 - 2.1
28	1°37.0	1°37.3	1°32.6	2.8 - 0.3	8.8 - 1.0	14.8 - 1.6	28	1°52.0	1°52.3	1°46.9	2.8 - 0.4	8.8 - 1.1	14.8 - 1.9	28	2°07.0	2°07.3	2°01.2	2.8 - 0.4	8.8 - 1.2	14.8 - 2.1
29	1°37.3	1°37.5	1°32.8	2.9 - 0.3	8.9 - 1.0	14.9 - 1.6	29	1°52.3	1°52.6	1°47.1	2.9 - 0.4	8.9 - 1.1	14.9 - 1.9	29	2°07.2	2°07.6	2°01.5	2.9 - 0.4	8.9 - 1.3	14.9 - 2.1
30	1°37.5	1°37.8	1°33.1	3.0 - 0.3	9.0 - 1.0	15.0 - 1.6	30	1°52.5	1°52.8	1°47.4	3.0 - 0.4	9.0 - 1.1	15.0 - 1.9	30	2°07.5	2°07.8	2°01.7	3.0 - 0.4	9.0 - 1.3	15.0 - 2.1
31	1°37.8	1°38.0	1°33.3	3.1 - 0.3	9.1 - 1.0	15.1 - 1.6	31	1°52.7	1°53.1	1°47.6	3.1 - 0.4	9.1 - 1.1	15.1 - 1.9	31	2°07.8	2°08.1	2°01.9	3.1 - 0.4	9.1 - 1.3	15.1 - 2.1
32	1°38.0	1°38.3	1°33.5	3.2 - 0.3	9.2 - 1.0	15.2 - 1.6	32	1°53.0	1°53.3	1°47.9	3.2 - 0.4	9.2 - 1.1	15.2 - 1.9	32	2°08.0	2°08.3	2°02.2	3.2 - 0.5	9.2 - 1.3	15.2 - 2.2
33	1°38.3	1°38.5	1°33.8	3.3 - 0.4	9.3 - 1.0	15.3 - 1.7	33	1°53.3	1°53.6	1°48.1	3.3 - 0.4	9.3 - 1.2	15.3 - 1.9	33	2°08.3	2°08.6	2°02.4	3.3 - 0.5	9.3 - 1.3	15.3 - 2.2
34	1°38.5	1°38.8	1°34.0	3.4 - 0.4	9.4 - 1.0	15.4 - 1.7	34	1°53.5	1°53.8	1°48.3	3.4 - 0.4	9.4 - 1.2	15.4 - 1.9	34	2°08.5	2°08.9	2°02.6	3.4 - 0.5	9.4 - 1.3	15.4 - 2.2
35	1°38.7	1°39.0	1°34.3	3.5 - 0.4	9.5 - 1.0	15.5 - 1.7	35	1°53.7	1°54.1	1°48.6	3.5 - 0.4	9.5 - 1.2	15.5 - 1.9	35	2°08.8	2°09.1	2°02.9	3.5 - 0.5	9.5 - 1.3	15.5 - 2.2
36	1°39.0	1°39.3	1°34.5	3.6 - 0.4	9.6 - 1.0	15.6 - 1.7	36	1°54.0	1°54.3	1°48.8	3.6 - 0.5	9.6 - 1.2	15.6 - 1.9	36	2°09.0	2°09.4	2°03.1	3.6 - 0.5	9.6 - 1.4	15.6 - 2.2
37	1°39.3	1°39.5	1°34.7	3.7 - 0.4	9.7 - 1.1	15.7 - 1.7	37	1°54.2	1°54.6	1°49.0	3.7 - 0.5	9.7 - 1.2	15.7 - 2.0	37	2°09.3	2°09.6	2°03.4	3.7 - 0.5	9.7 - 1.4	15.7 - 2.2
38	1°39.5	1°39.8	1°35.0	3.8 - 0.4	9.8 - 1.1	15.8 - 1.7	38	1°54.5	1°54.8	1°49.3	3.8 - 0.5	9.8 - 1.2	15.8 - 2.0	38	2°09.5	2°09.9	2°03.6	3.8 - 0.5	9.8 - 1.4	15.8 - 2.2
39	1°39.8	1°40.0	1°35.2	3.9 - 0.4	9.9 - 1.1	15.9 - 1.7	39	1°54.8	1°55.1	1°49.5	3.9 - 0.5	9.9 - 1.2	15.9 - 2.0	39	2°09.8	2°10.1	2°03.8	3.9 - 0.6	9.9 - 1.4	15.9 - 2.3
40	1°40.0	1°40.3	1°35.4	4.0 - 0.4	10.0 - 1.1	16.0 - 1.7	40	1°55.0	1°55.3	1°49.8	4.0 - 0.5	10.0 - 1.3	16.0 - 2.0	40	2°10.0	2°10.4	2°04.1	4.0 - 0.6	10.0 - 1.4	16.0 - 2.3
41	1°40.3	1°40.5	1°35.7	4.1 - 0.4	10.1 - 1.1	16.1 - 1.7	41	1°55.3	1°55.6	1°50.0	4.1 - 0.5	10.1 - 1.3	16.1 - 2.0	41	2°10.3	2°10.6	2°04.3	4.1 - 0.6	10.1 - 1.4	16.1 - 2.3
42	1°40.5	1°40.8	1°35.9	4.2 - 0.5	10.2 - 1.1	16.2 - 1.8	42	1°55.5	1°55.8	1°50.2	4.2 - 0.5	10.2 - 1.3	16.2 - 2.0	42	2°10.5	2°10.9	2°04.6	4.2 - 0.6	10.2 - 1.4	16.2 - 2.3
43	1°40.8	1°41.0	1°36.2	4.3 - 0.5	10.3 - 1.1	16.3 - 1.8	43	1°55.8	1°56.1											

## Increments and Corrections

m 9	Sun Plan.	Aries	Moon	v and d corr	m 10	Sun Plan.	Aries	Moon	v and d corr	m 11	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	0	2°30.0	2°30.4	2°23.2	0.0 - 0.0    6.0 - 1.0    12.0 - 2.1	0	2°45.0	2°45.5	2°37.5	0.0 - 0.0    6.0 - 1.2    12.0 - 2.3
1	2°15.3	2°15.6	2°09.1	0.1 - 0.0    6.1 - 1.0    12.1 - 1.9	1	2°30.3	2°30.7	2°23.4	0.1 - 0.0    6.1 - 1.1    12.1 - 2.1	1	2°45.3	2°45.7	2°37.7	0.1 - 0.0    6.1 - 1.2    12.1 - 2.3
2	2°15.5	2°15.9	2°09.3	0.2 - 0.0    6.2 - 1.0    12.2 - 1.9	2	2°30.5	2°30.9	2°23.6	0.2 - 0.0    6.2 - 1.1    12.2 - 2.1	2	2°45.5	2°46.0	2°38.0	0.2 - 0.0    6.2 - 1.2    12.2 - 2.3
3	2°15.8	2°16.1	2°09.6	0.3 - 0.0    6.3 - 1.0    12.3 - 1.9	3	2°30.8	2°31.2	2°23.9	0.3 - 0.1    6.3 - 1.1    12.3 - 2.2	3	2°45.8	2°46.2	2°38.2	0.3 - 0.1    6.3 - 1.2    12.3 - 2.4
4	2°16.0	2°16.4	2°09.8	0.4 - 0.1    6.4 - 1.0    12.4 - 2.0	4	2°31.0	2°31.4	2°24.1	0.4 - 0.1    6.4 - 1.1    12.4 - 2.2	4	2°46.0	2°46.5	2°38.4	0.4 - 0.1    6.4 - 1.2    12.4 - 2.4
5	2°16.3	2°16.6	2°10.0	0.5 - 0.1    6.5 - 1.0    12.5 - 2.0	5	2°31.3	2°31.7	2°24.4	0.5 - 0.1    6.5 - 1.1    12.5 - 2.2	5	2°46.3	2°46.7	2°38.7	0.5 - 0.1    6.5 - 1.2    12.5 - 2.4
6	2°16.5	2°16.9	2°10.3	0.6 - 0.1    6.6 - 1.0    12.6 - 2.0	6	2°31.5	2°31.9	2°24.6	0.6 - 0.1    6.6 - 1.2    12.6 - 2.2	6	2°46.5	2°47.0	2°38.9	0.6 - 0.1    6.6 - 1.3    12.6 - 2.4
7	2°16.8	2°17.1	2°10.5	0.7 - 0.1    6.7 - 1.1    12.7 - 2.0	7	2°31.8	2°32.2	2°24.8	0.7 - 0.1    6.7 - 1.2    12.7 - 2.2	7	2°46.8	2°47.2	2°39.2	0.7 - 0.1    6.7 - 1.3    12.7 - 2.4
8	2°17.0	2°17.4	2°10.8	0.8 - 0.1    6.8 - 1.1    12.8 - 2.0	8	2°32.0	2°32.4	2°25.1	0.8 - 0.1    6.8 - 1.2    12.8 - 2.2	8	2°47.0	2°47.5	2°39.4	0.8 - 0.2    6.8 - 1.3    12.8 - 2.5
9	2°17.3	2°17.6	2°11.0	0.9 - 0.1    6.9 - 1.1    12.9 - 2.0	9	2°32.3	2°32.7	2°25.3	0.9 - 0.2    6.9 - 1.2    12.9 - 2.3	9	2°47.3	2°47.7	2°39.6	0.9 - 0.2    6.9 - 1.3    12.9 - 2.5
10	2°17.5	2°17.9	2°11.2	1.0 - 0.2    7.0 - 1.1    13.0 - 2.1	10	2°32.5	2°32.9	2°25.6	1.0 - 0.2    7.0 - 1.2    13.0 - 2.3	10	2°47.5	2°48.0	2°39.9	1.0 - 0.2    7.0 - 1.3    13.0 - 2.5
11	2°17.8	2°18.1	2°11.5	1.1 - 0.2    7.1 - 1.1    13.1 - 2.1	11	2°32.8	2°33.2	2°25.8	1.1 - 0.2    7.1 - 1.2    13.1 - 2.3	11	2°47.8	2°48.2	2°40.1	1.1 - 0.2    7.1 - 1.4    13.1 - 2.5
12	2°18.0	2°18.4	2°11.7	1.2 - 0.2    7.2 - 1.1    13.2 - 2.1	12	2°33.0	2°33.4	2°26.0	1.2 - 0.2    7.2 - 1.3    13.2 - 2.3	12	2°48.0	2°48.5	2°40.3	1.2 - 0.2    7.2 - 1.4    13.2 - 2.5
13	2°18.3	2°18.6	2°12.0	1.3 - 0.2    7.3 - 1.2    13.3 - 2.1	13	2°33.3	2°33.7	2°26.3	1.3 - 0.2    7.3 - 1.3    13.3 - 2.3	13	2°48.3	2°48.7	2°40.6	1.3 - 0.2    7.3 - 1.4    13.3 - 2.5
14	2°18.5	2°18.9	2°12.2	1.4 - 0.2    7.4 - 1.2    13.4 - 2.1	14	2°33.5	2°33.9	2°26.5	1.4 - 0.2    7.4 - 1.3    13.4 - 2.3	14	2°48.5	2°49.0	2°40.8	1.4 - 0.3    7.4 - 1.4    13.4 - 2.6
15	2°18.8	2°19.1	2°12.4	1.5 - 0.2    7.5 - 1.2    13.5 - 2.1	15	2°33.8	2°34.2	2°26.7	1.5 - 0.3    7.5 - 1.3    13.5 - 2.4	15	2°48.8	2°49.2	2°41.1	1.5 - 0.3    7.5 - 1.4    13.5 - 2.6
16	2°19.0	2°19.4	2°12.7	1.6 - 0.3    7.6 - 1.2    13.6 - 2.2	16	2°34.0	2°34.4	2°27.0	1.6 - 0.3    7.6 - 1.3    13.6 - 2.4	16	2°49.0	2°49.5	2°41.3	1.6 - 0.3    7.6 - 1.5    13.6 - 2.6
17	2°19.3	2°19.6	2°12.9	1.7 - 0.3    7.7 - 1.2    13.7 - 2.2	17	2°34.3	2°34.7	2°27.2	1.7 - 0.3    7.7 - 1.3    13.7 - 2.4	17	2°49.3	2°49.7	2°41.5	1.7 - 0.3    7.7 - 1.5    13.7 - 2.6
18	2°19.5	2°19.9	2°13.1	1.8 - 0.3    7.8 - 1.2    13.8 - 2.2	18	2°34.5	2°34.9	2°27.5	1.8 - 0.3    7.8 - 1.4    13.8 - 2.4	18	2°49.5	2°50.0	2°41.8	1.8 - 0.3    7.8 - 1.5    13.8 - 2.6
19	2°19.7	2°20.1	2°13.4	1.9 - 0.3    7.9 - 1.3    13.9 - 2.2	19	2°34.8	2°35.2	2°27.7	1.9 - 0.3    7.9 - 1.4    13.9 - 2.4	19	2°49.8	2°50.2	2°42.0	1.9 - 0.4    7.9 - 1.5    13.9 - 2.7
20	2°20.0	2°20.4	2°13.6	2.0 - 0.3    8.0 - 1.3    14.0 - 2.2	20	2°35.0	2°35.4	2°27.9	2.0 - 0.3    8.0 - 1.4    14.0 - 2.4	20	2°50.0	2°50.5	2°42.3	2.0 - 0.4    8.0 - 1.5    14.0 - 2.7
21	2°20.2	2°20.6	2°13.9	2.1 - 0.3    8.1 - 1.3    14.1 - 2.2	21	2°35.2	2°35.7	2°28.2	2.1 - 0.4    8.1 - 1.4    14.1 - 2.5	21	2°50.2	2°50.7	2°42.5	2.1 - 0.4    8.1 - 1.6    14.1 - 2.7
22	2°20.5	2°20.9	2°14.1	2.2 - 0.3    8.2 - 1.3    14.2 - 2.2	22	2°35.5	2°35.9	2°28.4	2.2 - 0.4    8.2 - 1.4    14.2 - 2.5	22	2°50.5	2°51.0	2°42.7	2.2 - 0.4    8.2 - 1.6    14.2 - 2.7
23	2°20.7	2°21.1	2°14.3	2.3 - 0.4    8.3 - 1.3    14.3 - 2.3	23	2°35.7	2°36.2	2°28.7	2.3 - 0.4    8.3 - 1.5    14.3 - 2.5	23	2°50.7	2°51.2	2°43.0	2.3 - 0.4    8.3 - 1.6    14.3 - 2.7
24	2°21.0	2°21.4	2°14.6	2.4 - 0.4    8.4 - 1.3    14.4 - 2.3	24	2°36.0	2°36.4	2°28.9	2.4 - 0.4    8.4 - 1.5    14.4 - 2.5	24	2°51.0	2°51.5	2°43.2	2.4 - 0.5    8.4 - 1.6    14.4 - 2.8
25	2°21.2	2°21.6	2°14.8	2.5 - 0.4    8.5 - 1.3    14.5 - 2.3	25	2°36.2	2°36.7	2°29.1	2.5 - 0.4    8.5 - 1.5    14.5 - 2.5	25	2°51.2	2°51.7	2°43.4	2.5 - 0.5    8.5 - 1.6    14.5 - 2.8
26	2°21.5	2°21.9	2°15.1	2.6 - 0.4    8.6 - 1.4    14.6 - 2.3	26	2°36.5	2°36.9	2°29.4	2.6 - 0.5    8.6 - 1.5    14.6 - 2.6	26	2°51.5	2°52.0	2°43.7	2.6 - 0.5    8.6 - 1.6    14.6 - 2.8
27	2°21.7	2°22.1	2°15.3	2.7 - 0.4    8.7 - 1.4    14.7 - 2.3	27	2°36.7	2°37.2	2°29.6	2.7 - 0.5    8.7 - 1.5    14.7 - 2.6	27	2°51.7	2°52.2	2°43.9	2.7 - 0.5    8.7 - 1.7    14.7 - 2.8
28	2°22.0	2°22.4	2°15.5	2.8 - 0.4    8.8 - 1.4    14.8 - 2.3	28	2°37.0	2°37.4	2°29.8	2.8 - 0.5    8.8 - 1.5    14.8 - 2.6	28	2°52.0	2°52.5	2°44.2	2.8 - 0.5    8.8 - 1.7    14.8 - 2.8
29	2°22.2	2°22.6	2°15.8	2.9 - 0.5    8.9 - 1.4    14.9 - 2.4	29	2°37.2	2°37.7	2°30.1	2.9 - 0.5    8.9 - 1.6    14.9 - 2.6	29	2°52.2	2°52.7	2°44.4	2.9 - 0.6    8.9 - 1.7    14.9 - 2.9
30	2°22.5	2°22.9	2°16.0	3.0 - 0.5    9.0 - 1.4    15.0 - 2.4	30	2°37.5	2°37.9	2°30.3	3.0 - 0.5    9.0 - 1.6    15.0 - 2.6	30	2°52.5	2°53.0	2°44.6	3.0 - 0.6    9.0 - 1.7    15.0 - 2.9
31	2°22.8	2°23.1	2°16.2	3.1 - 0.5    9.1 - 1.4    15.1 - 2.4	31	2°37.8	2°38.2	2°30.6	3.1 - 0.5    9.1 - 1.6    15.1 - 2.6	31	2°52.8	2°53.2	2°44.9	3.1 - 0.6    9.1 - 1.7    15.1 - 2.9
32	2°23.0	2°23.4	2°16.5	3.2 - 0.5    9.2 - 1.5    15.2 - 2.4	32	2°38.0	2°38.4	2°30.8	3.2 - 0.6    9.2 - 1.6    15.2 - 2.7	32	2°53.0	2°53.5	2°45.1	3.2 - 0.6    9.2 - 1.8    15.2 - 2.9
33	2°23.3	2°23.6	2°16.7	3.3 - 0.5    9.3 - 1.5    15.3 - 2.4	33	2°38.3	2°38.7	2°31.0	3.3 - 0.6    9.3 - 1.6    15.3 - 2.7	33	2°53.3	2°53.7	2°45.4	3.3 - 0.6    9.3 - 1.8    15.3 - 2.9
34	2°23.5	2°23.9	2°17.0	3.4 - 0.5    9.4 - 1.5    15.4 - 2.4	34	2°38.5	2°38.9	2°31.3	3.4 - 0.6    9.4 - 1.6    15.4 - 2.7	34	2°53.5	2°54.0	2°45.6	3.4 - 0.7    9.4 - 1.8    15.4 - 3.0
35	2°23.8	2°24.1	2°17.2	3.5 - 0.6    9.5 - 1.5    15.5 - 2.5	35	2°38.8	2°39.2	2°31.5	3.5 - 0.6    9.5 - 1.7    15.5 - 2.7	35	2°53.8	2°54.2	2°45.8	3.5 - 0.7    9.5 - 1.8    15.5 - 3.0
36	2°24.0	2°24.4	2°17.4	3.6 - 0.6    9.6 - 1.5    15.6 - 2.5	36	2°39.0	2°39.4	2°31.8	3.6 - 0.6    9.6 - 1.7    15.6 - 2.7	36	2°54.0	2°54.5	2°46.1	3.6 - 0.7    9.6 - 1.8    15.6 - 3.0
37	2°24.3	2°24.6	2°17.7	3.7 - 0.6    9.7 - 1.5    15.7 - 2.5	37	2°39.3	2°39.7	2°32.0	3.7 - 0.6    9.7 - 1.7    15.7 - 2.7	37	2°54.3	2°54.7	2°46.3	3.7 - 0.7    9.7 - 1.9    15.7 - 3.0
38	2°24.5	2°24.9	2°17.9	3.8 - 0.6    9.8 - 1.6    15.8 - 2.5	38	2°39.5	2°39.9	2°32.2	3.8 - 0.7    9.8 - 1.7    15.8 - 2.8	38	2°54.5	2°55.0	2°46.6	3.8 - 0.7    9.8 - 1.9    15.8 - 3.0
39	2°24.8	2°25.1	2°18.2	3.9 - 0.6    9.9 - 1.6    15.9 - 2.5	39	2°39.8	2°40.2	2°32.5	3.9 - 0.7    9.9 - 1.7    15.9 - 2.8	39	2°54.8	2°55.2	2°46.8	3.9 - 0.7    9.9 - 1.9    15.9 - 3.0
40	2°25.0	2°25.4	2°18.4	4.0 - 0.6    10.0 - 1.6    16.0 - 2.5	40	2°40.0	2°40.4	2°32.7	4.0 - 0.7    10.0 - 1.8    16.0 - 2.8	40	2°55.0	2°55.5	2°47.0	4.0 - 0.8    10.0 - 1.9    16.0 - 3.1
41	2°25.3	2°25.6	2°18.6	4.1 - 0.6    10.1 - 1.6    16.1 - 2.5	41	2°40.3	2°40.7	2°32.9	4.1 - 0.7    10.1 - 1.8    16.1 - 2.8	41	2°55.3	2°55.7	2°47.3	4.1 - 0.8    10.1 - 1.9    16.1 - 3.1
42	2°25.5	2°25.9	2°18.9	4.2 - 0.7    10.2 - 1.6    16.2 - 2.6	42	2°40.5	2°40.9	2°33.2	4.2 - 0.7    10.2 - 1.8    16.2 - 2.8	42	2°55.5	2°56.0	2°47.5	4.2 - 0.8    10.2 - 2.0    16.2 - 3.1
43	2°25.8	2°26.1	2°19.1	4.3 - 0.7    10.3 - 1.6    16.3 - 2.6	43	2°40.8	2°41.2	2°33.4	4.3 - 0.8    10.3 - 1.8    16.3 - 2.9	43	2°55.8	2°56.2	2°47.7	4.3 - 0.8    10.3 - 2.0    16.3 - 3.1
44	2°26.0	2°26.4	2°19.3	4.4 - 0.7    10.4 - 1.6    16.4 - 2.6	44	2°41.0	2°41.4	2°33.7	4.4 - 0.8    10.4 - 1.8    16.4 - 2.9	44	2°56.0	2°56.5	2°48.0	4.4 - 0.8    10.4 - 2.0    16.4 - 3.1
45	2°26.3	2°26.6	2°19.6	4.5 - 0.7    10.5 - 1.7    16.5 - 2.6	45	2°41.3	2°41.7	2°33.9	4.5 - 0.8    10.5 - 1.8    16.5 - 2.9	45	2°56.3	2°56.7	2°48.2	4.5 - 0.9    10.5 - 2.0    16.5 - 3.2
46	2°													

## Increments and Corrections

m 12	Sun Plan.	Aries	Moon	v and d corr	m 13	Sun Plan.	Aries	Moon	v and d corr	m 14	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	0	3°15.0	3°15.5	3°06.1	0.0 - 0.0    6.0 - 1.4    12.0 - 2.7	0	3°30.0	3°30.6	3°20.4	0.0 - 0.0    6.0 - 1.4    12.0 - 2.9
1	3°00.3	3°00.7	2°52.0	0.1 - 0.0    6.1 - 1.3    12.1 - 2.5	1	3°15.3	3°15.8	3°06.4	0.1 - 0.0    6.1 - 1.4    12.1 - 2.7	1	3°30.3	3°30.8	3°20.7	0.1 - 0.0    6.1 - 1.5    12.1 - 2.9
2	3°00.5	3°01.0	2°52.3	0.2 - 0.0    6.2 - 1.3    12.2 - 2.5	2	3°15.5	3°16.0	3°06.6	0.2 - 0.0    6.2 - 1.4    12.2 - 2.7	2	3°30.5	3°31.1	3°20.9	0.2 - 0.0    6.2 - 1.5    12.2 - 2.9
3	3°00.8	3°01.2	2°52.5	0.3 - 0.1    6.3 - 1.3    12.3 - 2.6	3	3°15.8	3°16.3	3°06.8	0.3 - 0.1    6.3 - 1.4    12.3 - 2.8	3	3°30.8	3°31.3	3°21.1	0.3 - 0.1    6.3 - 1.5    12.3 - 3.0
4	3°01.0	3°01.5	2°52.8	0.4 - 0.1    6.4 - 1.3    12.4 - 2.6	4	3°16.0	3°16.5	3°07.1	0.4 - 0.1    6.4 - 1.4    12.4 - 2.8	4	3°31.0	3°31.6	3°21.4	0.4 - 0.1    6.4 - 1.5    12.4 - 3.0
5	3°01.3	3°01.7	2°53.0	0.5 - 0.1    6.5 - 1.4    12.5 - 2.6	5	3°16.3	3°16.8	3°07.3	0.5 - 0.1    6.5 - 1.5    12.5 - 2.8	5	3°31.3	3°31.8	3°21.6	0.5 - 0.1    6.5 - 1.6    12.5 - 3.0
6	3°01.5	3°02.0	2°53.2	0.6 - 0.1    6.6 - 1.4    12.6 - 2.6	6	3°16.5	3°17.0	3°07.5	0.6 - 0.1    6.6 - 1.5    12.6 - 2.8	6	3°31.5	3°32.1	3°21.9	0.6 - 0.1    6.6 - 1.6    12.6 - 3.0
7	3°01.8	3°02.2	2°53.5	0.7 - 0.1    6.7 - 1.4    12.7 - 2.6	7	3°16.8	3°17.3	3°07.8	0.7 - 0.2    6.7 - 1.5    12.7 - 2.9	7	3°31.8	3°32.3	3°22.1	0.7 - 0.2    6.7 - 1.6    12.7 - 3.1
8	3°02.0	3°02.5	2°53.7	0.8 - 0.2    6.8 - 1.4    12.8 - 2.7	8	3°17.0	3°17.5	3°08.0	0.8 - 0.2    6.8 - 1.5    12.8 - 2.9	8	3°32.0	3°32.6	3°22.3	0.8 - 0.2    6.8 - 1.6    12.8 - 3.1
9	3°02.3	3°02.7	2°53.9	0.9 - 0.2    6.9 - 1.4    12.9 - 2.7	9	3°17.3	3°17.8	3°08.3	0.9 - 0.2    6.9 - 1.6    12.9 - 2.9	9	3°32.3	3°32.8	3°22.6	0.9 - 0.2    6.9 - 1.7    12.9 - 3.1
10	3°02.5	3°03.0	2°54.2	1.0 - 0.2    7.0 - 1.5    13.0 - 2.7	10	3°17.5	3°18.0	3°08.5	1.0 - 0.2    7.0 - 1.6    13.0 - 2.9	10	3°32.5	3°33.1	3°22.8	1.0 - 0.2    7.0 - 1.7    13.0 - 3.1
11	3°02.8	3°03.2	2°54.4	1.1 - 0.2    7.1 - 1.5    13.1 - 2.7	11	3°17.8	3°18.3	3°08.7	1.1 - 0.2    7.1 - 1.6    13.1 - 2.9	11	3°32.8	3°33.3	3°23.1	1.1 - 0.3    7.1 - 1.7    13.1 - 3.2
12	3°03.0	3°03.5	2°54.7	1.2 - 0.3    7.2 - 1.5    13.2 - 2.8	12	3°18.0	3°18.5	3°09.0	1.2 - 0.3    7.2 - 1.6    13.2 - 3.0	12	3°33.0	3°33.6	3°23.3	1.2 - 0.3    7.2 - 1.7    13.2 - 3.2
13	3°03.3	3°03.8	2°54.9	1.3 - 0.3    7.3 - 1.5    13.3 - 2.8	13	3°18.3	3°18.8	3°09.2	1.3 - 0.3    7.3 - 1.6    13.3 - 3.0	13	3°33.3	3°33.8	3°23.5	1.3 - 0.3    7.3 - 1.8    13.3 - 3.2
14	3°03.5	3°04.0	2°55.1	1.4 - 0.3    7.4 - 1.5    13.4 - 2.8	14	3°18.5	3°19.0	3°09.5	1.4 - 0.3    7.4 - 1.7    13.4 - 3.0	14	3°33.5	3°34.1	3°23.8	1.4 - 0.3    7.4 - 1.8    13.4 - 3.2
15	3°03.8	3°04.3	2°55.4	1.5 - 0.3    7.5 - 1.6    13.5 - 2.8	15	3°18.8	3°19.3	3°09.7	1.5 - 0.3    7.5 - 1.7    13.5 - 3.0	15	3°33.8	3°34.3	3°24.0	1.5 - 0.4    7.5 - 1.8    13.5 - 3.3
16	3°04.0	3°04.5	2°55.6	1.6 - 0.3    7.6 - 1.6    13.6 - 2.8	16	3°19.0	3°19.5	3°09.9	1.6 - 0.4    7.6 - 1.7    13.6 - 3.1	16	3°34.0	3°34.6	3°24.3	1.6 - 0.4    7.6 - 1.8    13.6 - 3.3
17	3°04.2	3°04.8	2°55.9	1.7 - 0.4    7.7 - 1.6    13.7 - 2.9	17	3°19.3	3°19.8	3°10.2	1.7 - 0.4    7.7 - 1.7    13.7 - 3.1	17	3°34.3	3°34.8	3°24.5	1.7 - 0.4    7.7 - 1.9    13.7 - 3.3
18	3°04.5	3°05.0	2°56.1	1.8 - 0.4    7.8 - 1.6    13.8 - 2.9	18	3°19.5	3°20.0	3°10.4	1.8 - 0.4    7.8 - 1.8    13.8 - 3.1	18	3°34.5	3°35.1	3°24.7	1.8 - 0.4    7.8 - 1.9    13.8 - 3.3
19	3°04.7	3°05.3	2°56.3	1.9 - 0.4    7.9 - 1.6    13.9 - 2.9	19	3°19.7	3°20.3	3°10.7	1.9 - 0.4    7.9 - 1.8    13.9 - 3.1	19	3°34.8	3°35.3	3°25.0	1.9 - 0.5    7.9 - 1.9    13.9 - 3.4
20	3°05.0	3°05.5	2°56.6	2.0 - 0.4    8.0 - 1.7    14.0 - 2.9	20	3°20.0	3°20.5	3°10.9	2.0 - 0.5    8.0 - 1.8    14.0 - 3.1	20	3°35.0	3°35.6	3°25.2	2.0 - 0.5    8.0 - 1.9    14.0 - 3.4
21	3°05.2	3°05.8	2°56.8	2.1 - 0.4    8.1 - 1.7    14.1 - 2.9	21	3°20.2	3°20.8	3°11.1	2.1 - 0.5    8.1 - 1.8    14.1 - 3.2	21	3°35.2	3°35.8	3°25.4	2.1 - 0.5    8.1 - 2.0    14.1 - 3.4
22	3°05.5	3°06.0	2°57.0	2.2 - 0.5    8.2 - 1.7    14.2 - 3.0	22	3°20.5	3°21.0	3°11.4	2.2 - 0.5    8.2 - 1.8    14.2 - 3.2	22	3°35.5	3°36.1	3°25.7	2.2 - 0.5    8.2 - 2.0    14.2 - 3.4
23	3°05.7	3°06.3	2°57.3	2.3 - 0.5    8.3 - 1.7    14.3 - 3.0	23	3°20.7	3°21.3	3°11.6	2.3 - 0.5    8.3 - 1.9    14.3 - 3.2	23	3°35.7	3°36.3	3°25.9	2.3 - 0.6    8.3 - 2.0    14.3 - 3.5
24	3°06.0	3°06.5	2°57.5	2.4 - 0.5    8.4 - 1.8    14.4 - 3.0	24	3°21.0	3°21.5	3°11.8	2.4 - 0.5    8.4 - 1.9    14.4 - 3.2	24	3°36.0	3°36.6	3°26.2	2.4 - 0.6    8.4 - 2.0    14.4 - 3.5
25	3°06.2	3°06.8	2°57.8	2.5 - 0.5    8.5 - 1.8    14.5 - 3.0	25	3°21.2	3°21.8	3°12.1	2.5 - 0.6    8.5 - 1.9    14.5 - 3.3	25	3°36.2	3°36.8	3°26.4	2.5 - 0.6    8.5 - 2.1    14.5 - 3.5
26	3°06.5	3°07.0	2°58.0	2.6 - 0.5    8.6 - 1.8    14.6 - 3.0	26	3°21.5	3°22.1	3°12.3	2.6 - 0.6    8.6 - 1.9    14.6 - 3.3	26	3°36.5	3°37.1	3°26.6	2.6 - 0.6    8.6 - 2.1    14.6 - 3.5
27	3°06.7	3°07.3	2°58.2	2.7 - 0.6    8.7 - 1.8    14.7 - 3.1	27	3°21.7	3°22.3	3°12.6	2.7 - 0.6    8.7 - 2.0    14.7 - 3.3	27	3°36.7	3°37.3	3°26.9	2.7 - 0.7    8.7 - 2.1    14.7 - 3.6
28	3°07.0	3°07.5	2°58.5	2.8 - 0.6    8.8 - 1.8    14.8 - 3.1	28	3°22.0	3°22.6	3°12.8	2.8 - 0.6    8.8 - 2.0    14.8 - 3.3	28	3°37.0	3°37.6	3°27.1	2.8 - 0.7    8.8 - 2.1    14.8 - 3.6
29	3°07.2	3°07.8	2°58.7	2.9 - 0.6    8.9 - 1.9    14.9 - 3.1	29	3°22.2	3°22.8	3°13.0	2.9 - 0.7    8.9 - 2.0    14.9 - 3.4	29	3°37.2	3°37.8	3°27.4	2.9 - 0.7    8.9 - 2.2    14.9 - 3.6
30	3°07.5	3°08.0	2°59.0	3.0 - 0.6    9.0 - 1.9    15.0 - 3.1	30	3°22.5	3°23.1	3°13.3	3.0 - 0.7    9.0 - 2.0    15.0 - 3.4	30	3°37.5	3°38.1	3°27.6	3.0 - 0.7    9.0 - 2.2    15.0 - 3.6
31	3°07.8	3°08.3	2°59.2	3.1 - 0.6    9.1 - 1.9    15.1 - 3.1	31	3°22.8	3°23.3	3°13.5	3.1 - 0.7    9.1 - 2.0    15.1 - 3.4	31	3°37.8	3°38.3	3°27.8	3.1 - 0.7    9.1 - 2.2    15.1 - 3.6
32	3°08.0	3°08.5	2°59.4	3.2 - 0.7    9.2 - 1.9    15.2 - 3.2	32	3°23.0	3°23.6	3°13.8	3.2 - 0.7    9.2 - 2.1    15.2 - 3.4	32	3°38.0	3°38.6	3°28.1	3.2 - 0.8    9.2 - 2.2    15.2 - 3.7
33	3°08.3	3°08.8	2°59.7	3.3 - 0.7    9.3 - 1.9    15.3 - 3.2	33	3°23.3	3°23.8	3°14.0	3.3 - 0.7    9.3 - 2.1    15.3 - 3.4	33	3°38.3	3°38.8	3°28.3	3.3 - 0.8    9.3 - 2.2    15.3 - 3.7
34	3°08.5	3°09.0	2°59.9	3.4 - 0.7    9.4 - 2.0    15.4 - 3.2	34	3°23.5	3°24.1	3°14.2	3.4 - 0.8    9.4 - 2.1    15.4 - 3.5	34	3°38.5	3°39.1	3°28.5	3.4 - 0.8    9.4 - 2.3    15.4 - 3.7
35	3°08.8	3°09.3	3°00.2	3.5 - 0.7    9.5 - 2.0    15.5 - 3.2	35	3°23.8	3°24.3	3°14.5	3.5 - 0.8    9.5 - 2.1    15.5 - 3.5	35	3°38.8	3°39.3	3°28.8	3.5 - 0.8    9.5 - 2.3    15.5 - 3.7
36	3°09.0	3°09.5	3°00.4	3.6 - 0.8    9.6 - 2.0    15.6 - 3.3	36	3°24.0	3°24.6	3°14.7	3.6 - 0.8    9.6 - 2.2    15.6 - 3.5	36	3°39.0	3°39.6	3°29.0	3.6 - 0.9    9.6 - 2.3    15.6 - 3.8
37	3°09.3	3°09.8	3°00.6	3.7 - 0.8    9.7 - 2.0    15.7 - 3.3	37	3°24.3	3°24.8	3°14.9	3.7 - 0.8    9.7 - 2.2    15.7 - 3.5	37	3°39.3	3°39.8	3°29.3	3.7 - 0.9    9.7 - 2.3    15.7 - 3.8
38	3°09.5	3°10.0	3°00.9	3.8 - 0.8    9.8 - 2.0    15.8 - 3.3	38	3°24.5	3°25.1	3°15.2	3.8 - 0.9    9.8 - 2.2    15.8 - 3.6	38	3°39.5	3°40.1	3°29.5	3.8 - 0.9    9.8 - 2.4    15.8 - 3.8
39	3°09.8	3°10.3	3°01.1	3.9 - 0.8    9.9 - 2.1    15.9 - 3.3	39	3°24.8	3°25.3	3°15.4	3.9 - 0.9    9.9 - 2.2    15.9 - 3.6	39	3°39.8	3°40.4	3°29.7	3.9 - 0.9    9.9 - 2.4    15.9 - 3.8
40	3°10.0	3°10.5	3°01.3	4.0 - 0.8    10.0 - 2.1    16.0 - 3.3	40	3°25.0	3°25.6	3°15.7	4.0 - 0.9    10.0 - 2.3    16.0 - 3.6	40	3°40.0	3°40.6	3°30.0	4.0 - 1.0    10.0 - 2.4    16.0 - 3.9
41	3°10.3	3°10.8	3°01.6	4.1 - 0.9    10.1 - 2.1    16.1 - 3.4	41	3°25.3	3°25.8	3°15.9	4.1 - 0.9    10.1 - 2.3    16.1 - 3.6	41	3°40.3	3°40.9	3°30.2	4.1 - 1.0    10.1 - 2.4    16.1 - 3.9
42	3°10.5	3°11.0	3°01.8	4.2 - 0.9    10.2 - 2.1    16.2 - 3.4	42	3°25.5	3°26.1	3°16.1	4.2 - 0.9    10.2 - 2.3    16.2 - 3.6	42	3°40.5	3°41.1	3°30.5	4.2 - 1.0    10.2 - 2.5    16.2 - 3.9
43	3°10.8	3°11.3	3°02.1	4.3 - 0.9    10.3 - 2.1    16.3 - 3.4	43	3°25.8	3°26.3	3°16.4	4.3 - 1.0    10.3 - 2.3    16.3 - 3.7	43	3°40.8	3°41.4	3°30.7	4.3 - 1.0    10.3 - 2.5    16.3 - 3.9
44	3°11.0	3°11.5	3°02.3	4.4 - 0.9    10.4 - 2.2    16.4 - 3.4	44	3°26.0	3°26.6	3°16.6	4.4 - 1.0    10.4 - 2.3    16.4 - 3.7	44	3°41.0	3°41.6	3°30.9	4.4 - 1.1    10.4 - 2.5    16.4 - 4.0
45	3°11.3	3°11.8	3°02.5	4.5 - 0.9    10.5 - 2.2    16.5 - 3.4	45	3°26.3	3°26.8	3°16.9	4.5 - 1.0    10.5 - 2.4    16.5 - 3.7	45	3°41.3	3°41.9	3°31.2	4.5 - 1.1    10.5 - 2.5    16.5 - 4.0
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## Increments and Corrections

m 15	Sun Plan.	Aries	Moon	v and d corr			m 16	Sun Plan.	Aries	Moon	v and d corr			m 17	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	0	4°00.0	4°00.7	3°49.1	0.0 - 0.0	6.0 - 1.7	12.0 - 3.3	0	4°15.0	4°15.7	4°03.4	0.0 - 0.0	6.0 - 1.8	12.0 - 3.5
1	3°45.2	3°45.9	3°35.0	0.1 - 0.0	6.1 - 1.6	12.1 - 3.1	1	4°00.2	4°00.9	3°49.3	0.1 - 0.0	6.1 - 1.7	12.1 - 3.3	1	4°15.2	4°15.9	4°03.6	0.1 - 0.0	6.1 - 1.8	12.1 - 3.5
2	3°45.5	3°46.1	3°35.2	0.2 - 0.1	6.2 - 1.6	12.2 - 3.2	2	4°00.5	4°01.2	3°49.5	0.2 - 0.1	6.2 - 1.7	12.2 - 3.4	2	4°15.5	4°16.2	4°03.9	0.2 - 0.1	6.2 - 1.8	12.2 - 3.6
3	3°45.8	3°46.4	3°35.5	0.3 - 0.1	6.3 - 1.6	12.3 - 3.2	3	4°00.8	4°01.4	3°49.8	0.3 - 0.1	6.3 - 1.7	12.3 - 3.4	3	4°15.8	4°16.4	4°04.1	0.3 - 0.1	6.3 - 1.8	12.3 - 3.6
4	3°46.0	3°46.6	3°35.7	0.4 - 0.1	6.4 - 1.7	12.4 - 3.2	4	4°01.0	4°01.7	3°50.0	0.4 - 0.1	6.4 - 1.8	12.4 - 3.4	4	4°16.0	4°16.7	4°04.3	0.4 - 0.1	6.4 - 1.9	12.4 - 3.6
5	3°46.2	3°46.9	3°35.9	0.5 - 0.1	6.5 - 1.7	12.5 - 3.2	5	4°01.2	4°01.9	3°50.3	0.5 - 0.1	6.5 - 1.8	12.5 - 3.4	5	4°16.2	4°17.0	4°04.6	0.5 - 0.1	6.5 - 1.9	12.5 - 3.6
6	3°46.5	3°47.1	3°36.2	0.6 - 0.2	6.6 - 1.7	12.6 - 3.3	6	4°01.5	4°02.2	3°50.5	0.6 - 0.2	6.6 - 1.8	12.6 - 3.5	6	4°16.5	4°17.2	4°04.8	0.6 - 0.2	6.6 - 1.9	12.6 - 3.7
7	3°46.8	3°47.4	3°36.4	0.7 - 0.2	6.7 - 1.7	12.7 - 3.3	7	4°01.8	4°02.4	3°50.7	0.7 - 0.2	6.7 - 1.8	12.7 - 3.5	7	4°16.8	4°17.5	4°05.1	0.7 - 0.2	6.7 - 2.0	12.7 - 3.7
8	3°47.0	3°47.6	3°36.7	0.8 - 0.2	6.8 - 1.8	12.8 - 3.3	8	4°02.0	4°02.7	3°51.0	0.8 - 0.2	6.8 - 1.9	12.8 - 3.5	8	4°17.0	4°17.7	4°05.3	0.8 - 0.2	6.8 - 2.0	12.8 - 3.7
9	3°47.3	3°47.9	3°36.9	0.9 - 0.2	6.9 - 1.8	12.9 - 3.3	9	4°02.2	4°02.9	3°51.2	0.9 - 0.2	6.9 - 1.9	12.9 - 3.5	9	4°17.2	4°18.0	4°05.5	0.9 - 0.3	6.9 - 2.0	12.9 - 3.8
10	3°47.5	3°48.1	3°37.1	1.0 - 0.3	7.0 - 1.8	13.0 - 3.4	10	4°02.5	4°03.2	3°51.5	1.0 - 0.3	7.0 - 1.9	13.0 - 3.6	10	4°17.5	4°18.2	4°05.8	1.0 - 0.3	7.0 - 2.0	13.0 - 3.8
11	3°47.7	3°48.4	3°37.4	1.1 - 0.3	7.1 - 1.8	13.1 - 3.4	11	4°02.8	4°03.4	3°51.7	1.1 - 0.3	7.1 - 2.0	13.1 - 3.6	11	4°17.8	4°18.5	4°06.0	1.1 - 0.3	7.1 - 2.1	13.1 - 3.8
12	3°48.0	3°48.6	3°37.6	1.2 - 0.3	7.2 - 1.9	13.2 - 3.4	12	4°03.0	4°03.7	3°51.9	1.2 - 0.3	7.2 - 2.0	13.2 - 3.6	12	4°18.0	4°18.7	4°06.2	1.2 - 0.4	7.2 - 2.1	13.2 - 3.9
13	3°48.3	3°48.9	3°37.9	1.3 - 0.3	7.3 - 1.9	13.3 - 3.4	13	4°03.2	4°03.9	3°52.2	1.3 - 0.4	7.3 - 2.0	13.3 - 3.7	13	4°18.2	4°19.0	4°06.5	1.3 - 0.4	7.3 - 2.1	13.3 - 3.9
14	3°48.5	3°49.1	3°38.1	1.4 - 0.4	7.4 - 1.9	13.4 - 3.5	14	4°03.5	4°04.2	3°52.4	1.4 - 0.4	7.4 - 2.0	13.4 - 3.7	14	4°18.5	4°19.2	4°06.7	1.4 - 0.4	7.4 - 2.2	13.4 - 3.9
15	3°48.8	3°49.4	3°38.3	1.5 - 0.4	7.5 - 1.9	13.5 - 3.5	15	4°03.8	4°04.4	3°52.6	1.5 - 0.4	7.5 - 2.1	13.5 - 3.7	15	4°18.8	4°19.5	4°07.0	1.5 - 0.4	7.5 - 2.2	13.5 - 3.9
16	3°49.0	3°49.6	3°38.6	1.6 - 0.4	7.6 - 2.0	13.6 - 3.5	16	4°04.0	4°04.7	3°52.9	1.6 - 0.4	7.6 - 2.1	13.6 - 3.7	16	4°19.0	4°19.7	4°07.2	1.6 - 0.5	7.6 - 2.2	13.6 - 4.0
17	3°49.3	3°49.9	3°38.8	1.7 - 0.4	7.7 - 2.0	13.7 - 3.5	17	4°04.3	4°04.9	3°53.1	1.7 - 0.5	7.7 - 2.1	13.7 - 3.8	17	4°19.3	4°20.0	4°07.4	1.7 - 0.5	7.7 - 2.2	13.7 - 4.0
18	3°49.5	3°50.1	3°39.0	1.8 - 0.5	7.8 - 2.0	13.8 - 3.6	18	4°04.5	4°05.2	3°53.4	1.8 - 0.5	7.8 - 2.1	13.8 - 3.8	18	4°19.5	4°20.2	4°07.7	1.8 - 0.5	7.8 - 2.3	13.8 - 4.0
19	3°49.8	3°50.4	3°39.3	1.9 - 0.5	7.9 - 2.0	13.9 - 3.6	19	4°04.7	4°05.4	3°53.6	1.9 - 0.5	7.9 - 2.2	13.9 - 3.8	19	4°19.7	4°20.5	4°07.9	1.9 - 0.6	7.9 - 2.3	13.9 - 4.1
20	3°50.0	3°50.6	3°39.5	2.0 - 0.5	8.0 - 2.1	14.0 - 3.6	20	4°05.0	4°05.7	3°53.8	2.0 - 0.6	8.0 - 2.2	14.0 - 3.9	20	4°20.0	4°20.7	4°08.2	2.0 - 0.6	8.0 - 2.3	14.0 - 4.1
21	3°50.2	3°50.9	3°39.8	2.1 - 0.5	8.1 - 2.1	14.1 - 3.6	21	4°05.3	4°05.9	3°54.1	2.1 - 0.6	8.1 - 2.2	14.1 - 3.9	21	4°20.3	4°21.0	4°08.4	2.1 - 0.6	8.1 - 2.4	14.1 - 4.1
22	3°50.5	3°51.1	3°40.0	2.2 - 0.6	8.2 - 2.1	14.2 - 3.7	22	4°05.5	4°06.2	3°54.3	2.2 - 0.6	8.2 - 2.3	14.2 - 3.9	22	4°20.5	4°21.2	4°08.6	2.2 - 0.6	8.2 - 2.4	14.2 - 4.1
23	3°50.7	3°51.4	3°40.2	2.3 - 0.6	8.3 - 2.1	14.3 - 3.7	23	4°05.7	4°06.4	3°54.6	2.3 - 0.6	8.3 - 2.3	14.3 - 3.9	23	4°20.7	4°21.5	4°08.9	2.3 - 0.7	8.3 - 2.4	14.3 - 4.2
24	3°51.0	3°51.6	3°40.5	2.4 - 0.6	8.4 - 2.2	14.4 - 3.7	24	4°06.0	4°06.7	3°54.8	2.4 - 0.7	8.4 - 2.3	14.4 - 4.0	24	4°21.0	4°21.7	4°09.1	2.4 - 0.7	8.4 - 2.5	14.4 - 4.2
25	3°51.2	3°51.9	3°40.7	2.5 - 0.6	8.5 - 2.2	14.5 - 3.7	25	4°06.3	4°06.9	3°55.0	2.5 - 0.7	8.5 - 2.3	14.5 - 4.0	25	4°21.3	4°22.0	4°09.3	2.5 - 0.7	8.5 - 2.5	14.5 - 4.2
26	3°51.5	3°52.1	3°41.0	2.6 - 0.7	8.6 - 2.2	14.6 - 3.8	26	4°06.5	4°07.2	3°55.3	2.6 - 0.7	8.6 - 2.4	14.6 - 4.0	26	4°21.5	4°22.2	4°09.6	2.6 - 0.8	8.6 - 2.5	14.6 - 4.3
27	3°51.8	3°52.4	3°41.2	2.7 - 0.7	8.7 - 2.2	14.7 - 3.8	27	4°06.7	4°07.4	3°55.5	2.7 - 0.7	8.7 - 2.4	14.7 - 4.0	27	4°21.7	4°22.5	4°09.8	2.7 - 0.8	8.7 - 2.5	14.7 - 4.3
28	3°52.0	3°52.6	3°41.4	2.8 - 0.7	8.8 - 2.3	14.8 - 3.8	28	4°07.0	4°07.7	3°55.7	2.8 - 0.8	8.8 - 2.4	14.8 - 4.1	28	4°22.0	4°22.7	4°10.1	2.8 - 0.8	8.8 - 2.6	14.8 - 4.3
29	3°52.2	3°52.9	3°41.7	2.9 - 0.7	8.9 - 2.3	14.9 - 3.8	29	4°07.3	4°07.9	3°56.0	2.9 - 0.8	8.9 - 2.4	14.9 - 4.1	29	4°22.3	4°23.0	4°10.3	2.9 - 0.8	8.9 - 2.6	14.9 - 4.3
30	3°52.5	3°53.1	3°41.9	3.0 - 0.8	9.0 - 2.3	15.0 - 3.9	30	4°07.5	4°08.2	3°56.2	3.0 - 0.8	9.0 - 2.5	15.0 - 4.1	30	4°22.5	4°23.2	4°10.5	3.0 - 0.9	9.0 - 2.6	15.0 - 4.4
31	3°52.8	3°53.4	3°42.1	3.1 - 0.8	9.1 - 2.4	15.1 - 3.9	31	4°07.7	4°08.4	3°56.5	3.1 - 0.9	9.1 - 2.5	15.1 - 4.2	31	4°22.7	4°23.5	4°10.8	3.1 - 0.9	9.1 - 2.7	15.1 - 4.4
32	3°53.0	3°53.6	3°42.4	3.2 - 0.8	9.2 - 2.4	15.2 - 3.9	32	4°08.0	4°08.7	3°56.7	3.2 - 0.9	9.2 - 2.5	15.2 - 4.2	32	4°23.0	4°23.7	4°11.0	3.2 - 0.9	9.2 - 2.7	15.2 - 4.4
33	3°53.2	3°53.9	3°42.6	3.3 - 0.9	9.3 - 2.4	15.3 - 4.0	33	4°08.3	4°08.9	3°56.9	3.3 - 0.9	9.3 - 2.6	15.3 - 4.2	33	4°23.3	4°24.0	4°11.3	3.3 - 1.0	9.3 - 2.7	15.3 - 4.5
34	3°53.5	3°54.1	3°42.9	3.4 - 0.9	9.4 - 2.4	15.4 - 4.0	34	4°08.5	4°09.2	3°57.2	3.4 - 0.9	9.4 - 2.6	15.4 - 4.2	34	4°23.5	4°24.2	4°11.5	3.4 - 1.0	9.4 - 2.7	15.4 - 4.5
35	3°53.8	3°54.4	3°43.1	3.5 - 0.9	9.5 - 2.5	15.5 - 4.0	35	4°08.7	4°09.4	3°57.4	3.5 - 1.0	9.5 - 2.6	15.5 - 4.3	35	4°23.7	4°24.5	4°11.7	3.5 - 1.0	9.5 - 2.8	15.5 - 4.5
36	3°54.0	3°54.6	3°43.3	3.6 - 0.9	9.6 - 2.5	15.6 - 4.0	36	4°09.0	4°09.7	3°57.7	3.6 - 1.0	9.6 - 2.6	15.6 - 4.3	36	4°24.0	4°24.7	4°12.0	3.6 - 1.1	9.6 - 2.8	15.6 - 4.5
37	3°54.3	3°54.9	3°43.6	3.7 - 1.0	9.7 - 2.5	15.7 - 4.1	37	4°09.3	4°09.9	3°57.9	3.7 - 1.0	9.7 - 2.7	15.7 - 4.3	37	4°24.3	4°25.0	4°12.2	3.7 - 1.1	9.7 - 2.8	15.7 - 4.6
38	3°54.5	3°55.1	3°43.8	3.8 - 1.0	9.8 - 2.5	15.8 - 4.1	38	4°09.5	4°10.2	3°58.1	3.8 - 1.0	9.8 - 2.7	15.8 - 4.3	38	4°24.5	4°25.2	4°12.5	3.8 - 1.1	9.8 - 2.9	15.8 - 4.6
39	3°54.8	3°55.4	3°44.1	3.9 - 1.0	9.9 - 2.6	15.9 - 4.1	39	4°09.7	4°10.4	3°58.4	3.9 - 1.1	9.9 - 2.7	15.9 - 4.4	39	4°24.7	4°25.5	4°12.7	3.9 - 1.1	9.9 - 2.9	15.9 - 4.6
40	3°55.0	3°55.6	3°44.3	4.0 - 1.0	10.0 - 2.6	16.0 - 4.1	40	4°10.0	4°10.7	3°58.6	4.0 - 1.1	10.0 - 2.8	16.0 - 4.4	40	4°25.0	4°25.7	4°12.9	4.0 - 1.2	10.0 - 2.9	16.0 - 4.7
41	3°55.3	3°55.9	3°44.5	4.1 - 1.1	10.1 - 2.6	16.1 - 4.2	41	4°10.3	4°10.9	3°58.8	4.1 - 1.1	10.1 - 2.8	16.1 - 4.4	41	4°25.3	4°26.0	4°13.2	4.1 - 1.2	10.1 - 2.9	16.1 - 4.7
42	3°55.5	3°56.1	3°44.8	4.2 - 1.1	10.2 - 2.6	16.2 - 4.2	42	4°10.5	4°11.2	3°59.1	4.2 - 1.2	10.2 - 2.8	16.2 - 4.5	42	4°25.5	4°26.2	4°13.4	4.2 - 1.2	10.2 - 3.0	16.2 - 4.7
43	3°55.7	3°56.4	3°45.0	4.3 - 1.1	10.3 - 2.7	16.3 - 4.2	43	4°10.7	4°11											

## Increments and Corrections

m 18	Sun Plan.	Aries	Moon	v and d corr
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 19	Sun Plan.	Aries	Moon	v and d corr
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 20	Sun Plan.	Aries	Moon	v and d corr
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.	

## Increments and Corrections

m 21	Sun Plan.	Aries	Moon	v and d corr			m 22	Sun Plan.	Aries	Moon	v and d corr			m 23	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	0	5°30.0	5°30.9	5°15.0	0.0 - 0.0	6.0 - 2.3	12.0 - 4.5	0	5°45.0	5°45.9	5°29.3	0.0 - 0.0	6.0 - 2.4	12.0 - 4.7
1	5°15.2	5°16.1	5°00.9	0.1 - 0.0	6.1 - 2.2	12.1 - 4.3	1	5°30.2	5°31.2	5°15.2	0.1 - 0.0	6.1 - 2.3	12.1 - 4.5	1	5°45.2	5°46.2	5°29.5	0.1 - 0.0	6.1 - 2.4	12.1 - 4.7
2	5°15.5	5°16.4	5°01.1	0.2 - 0.1	6.2 - 2.2	12.2 - 4.4	2	5°30.5	5°31.4	5°15.4	0.2 - 0.1	6.2 - 2.3	12.2 - 4.6	2	5°45.5	5°46.4	5°29.8	0.2 - 0.1	6.2 - 2.4	12.2 - 4.8
3	5°15.8	5°16.6	5°01.4	0.3 - 0.1	6.3 - 2.3	12.3 - 4.4	3	5°30.8	5°31.7	5°15.7	0.3 - 0.1	6.3 - 2.4	12.3 - 4.6	3	5°45.8	5°46.7	5°30.0	0.3 - 0.1	6.3 - 2.5	12.3 - 4.8
4	5°16.0	5°16.9	5°01.6	0.4 - 0.1	6.4 - 2.3	12.4 - 4.4	4	5°31.0	5°31.9	5°15.9	0.4 - 0.2	6.4 - 2.4	12.4 - 4.7	4	5°46.0	5°46.9	5°30.2	0.4 - 0.2	6.4 - 2.5	12.4 - 4.9
5	5°16.2	5°17.1	5°01.8	0.5 - 0.2	6.5 - 2.3	12.5 - 4.5	5	5°31.2	5°32.2	5°16.2	0.5 - 0.2	6.5 - 2.4	12.5 - 4.7	5	5°46.2	5°47.2	5°30.5	0.5 - 0.2	6.5 - 2.5	12.5 - 4.9
6	5°16.5	5°17.4	5°02.1	0.6 - 0.2	6.6 - 2.4	12.6 - 4.5	6	5°31.5	5°32.4	5°16.4	0.6 - 0.2	6.6 - 2.5	12.6 - 4.7	6	5°46.5	5°47.4	5°30.7	0.6 - 0.2	6.6 - 2.6	12.6 - 4.9
7	5°16.8	5°17.6	5°02.3	0.7 - 0.3	6.7 - 2.4	12.7 - 4.6	7	5°31.8	5°32.7	5°16.6	0.7 - 0.3	6.7 - 2.5	12.7 - 4.8	7	5°46.8	5°47.7	5°31.0	0.7 - 0.3	6.7 - 2.6	12.7 - 5.0
8	5°17.0	5°17.9	5°02.6	0.8 - 0.3	6.8 - 2.4	12.8 - 4.6	8	5°32.0	5°32.9	5°16.9	0.8 - 0.3	6.8 - 2.5	12.8 - 4.8	8	5°47.0	5°47.9	5°31.2	0.8 - 0.3	6.8 - 2.7	12.8 - 5.0
9	5°17.2	5°18.1	5°02.8	0.9 - 0.3	6.9 - 2.5	12.9 - 4.6	9	5°32.2	5°33.2	5°17.1	0.9 - 0.3	6.9 - 2.6	12.9 - 4.8	9	5°47.2	5°48.2	5°31.4	0.9 - 0.4	6.9 - 2.7	12.9 - 5.1
10	5°17.5	5°18.4	5°03.0	1.0 - 0.4	7.0 - 2.5	13.0 - 4.7	10	5°32.5	5°33.4	5°17.4	1.0 - 0.4	7.0 - 2.6	13.0 - 4.9	10	5°47.5	5°48.4	5°31.7	1.0 - 0.4	7.0 - 2.7	13.0 - 5.1
11	5°17.8	5°18.6	5°03.3	1.1 - 0.4	7.1 - 2.5	13.1 - 4.7	11	5°32.8	5°33.7	5°17.6	1.1 - 0.4	7.1 - 2.7	13.1 - 4.9	11	5°47.8	5°48.7	5°31.9	1.1 - 0.4	7.1 - 2.8	13.1 - 5.1
12	5°18.0	5°18.9	5°03.5	1.2 - 0.4	7.2 - 2.6	13.2 - 4.7	12	5°33.0	5°33.9	5°17.8	1.2 - 0.5	7.2 - 2.7	13.2 - 4.9	12	5°48.0	5°49.0	5°32.1	1.2 - 0.5	7.2 - 2.8	13.2 - 5.2
13	5°18.2	5°19.1	5°03.8	1.3 - 0.5	7.3 - 2.6	13.3 - 4.8	13	5°33.2	5°34.2	5°18.1	1.3 - 0.5	7.3 - 2.7	13.3 - 5.0	13	5°48.2	5°49.2	5°32.4	1.3 - 0.5	7.3 - 2.9	13.3 - 5.2
14	5°18.5	5°19.4	5°04.0	1.4 - 0.5	7.4 - 2.7	13.4 - 4.8	14	5°33.5	5°34.4	5°18.3	1.4 - 0.5	7.4 - 2.8	13.4 - 5.0	14	5°48.5	5°49.5	5°32.6	1.4 - 0.5	7.4 - 2.9	13.4 - 5.2
15	5°18.8	5°19.6	5°04.2	1.5 - 0.5	7.5 - 2.7	13.5 - 4.8	15	5°33.8	5°34.7	5°18.5	1.5 - 0.6	7.5 - 2.8	13.5 - 5.1	15	5°48.8	5°49.7	5°32.9	1.5 - 0.6	7.5 - 2.9	13.5 - 5.3
16	5°19.0	5°19.9	5°04.5	1.6 - 0.6	7.6 - 2.7	13.6 - 4.9	16	5°34.0	5°34.9	5°18.8	1.6 - 0.6	7.6 - 2.8	13.6 - 5.1	16	5°49.0	5°50.0	5°33.1	1.6 - 0.6	7.6 - 3.0	13.6 - 5.3
17	5°19.3	5°20.1	5°04.7	1.7 - 0.6	7.7 - 2.8	13.7 - 4.9	17	5°34.3	5°35.2	5°19.0	1.7 - 0.6	7.7 - 2.9	13.7 - 5.1	17	5°49.3	5°50.2	5°33.3	1.7 - 0.7	7.7 - 3.0	13.7 - 5.4
18	5°19.5	5°20.4	5°04.9	1.8 - 0.6	7.8 - 2.8	13.8 - 4.9	18	5°34.5	5°35.4	5°19.3	1.8 - 0.7	7.8 - 2.9	13.8 - 5.2	18	5°49.5	5°50.5	5°33.6	1.8 - 0.7	7.8 - 3.1	13.8 - 5.4
19	5°19.7	5°20.6	5°05.2	1.9 - 0.7	7.9 - 2.8	13.9 - 5.0	19	5°34.8	5°35.7	5°19.5	1.9 - 0.7	7.9 - 3.0	13.9 - 5.2	19	5°49.8	5°50.7	5°33.8	1.9 - 0.7	7.9 - 3.1	13.9 - 5.4
20	5°20.0	5°20.9	5°05.4	2.0 - 0.7	8.0 - 2.9	14.0 - 5.0	20	5°35.0	5°35.9	5°19.7	2.0 - 0.8	8.0 - 3.0	14.0 - 5.3	20	5°50.0	5°51.0	5°34.1	2.0 - 0.8	8.0 - 3.1	14.0 - 5.5
21	5°20.3	5°21.1	5°05.7	2.1 - 0.8	8.1 - 2.9	14.1 - 5.1	21	5°35.3	5°36.2	5°20.0	2.1 - 0.8	8.1 - 3.0	14.1 - 5.3	21	5°50.3	5°51.2	5°34.3	2.1 - 0.8	8.1 - 3.2	14.1 - 5.5
22	5°20.5	5°21.4	5°05.9	2.2 - 0.8	8.2 - 2.9	14.2 - 5.1	22	5°35.5	5°36.4	5°20.2	2.2 - 0.8	8.2 - 3.1	14.2 - 5.3	22	5°50.5	5°51.5	5°34.5	2.2 - 0.9	8.2 - 3.2	14.2 - 5.6
23	5°20.7	5°21.6	5°06.1	2.3 - 0.8	8.3 - 3.0	14.3 - 5.1	23	5°35.7	5°36.7	5°20.5	2.3 - 0.9	8.3 - 3.1	14.3 - 5.4	23	5°50.7	5°51.7	5°34.8	2.3 - 0.9	8.3 - 3.3	14.3 - 5.6
24	5°21.0	5°21.9	5°06.4	2.4 - 0.9	8.4 - 3.0	14.4 - 5.2	24	5°36.0	5°36.9	5°20.7	2.4 - 0.9	8.4 - 3.2	14.4 - 5.4	24	5°51.0	5°52.0	5°35.0	2.4 - 0.9	8.4 - 3.3	14.4 - 5.6
25	5°21.3	5°22.1	5°06.6	2.5 - 0.9	8.5 - 3.0	14.5 - 5.2	25	5°36.3	5°37.2	5°20.9	2.5 - 0.9	8.5 - 3.2	14.5 - 5.4	25	5°51.3	5°52.2	5°35.2	2.5 - 1.0	8.5 - 3.3	14.5 - 5.7
26	5°21.5	5°22.4	5°06.9	2.6 - 0.9	8.6 - 3.1	14.6 - 5.2	26	5°36.5	5°37.4	5°21.2	2.6 - 1.0	8.6 - 3.2	14.6 - 5.5	26	5°51.5	5°52.5	5°35.5	2.6 - 1.0	8.6 - 3.4	14.6 - 5.7
27	5°21.7	5°22.6	5°07.1	2.7 - 1.0	8.7 - 3.1	14.7 - 5.3	27	5°36.7	5°37.7	5°21.4	2.7 - 1.0	8.7 - 3.3	14.7 - 5.5	27	5°51.7	5°52.7	5°35.7	2.7 - 1.1	8.7 - 3.4	14.7 - 5.8
28	5°22.0	5°22.9	5°07.3	2.8 - 1.0	8.8 - 3.2	14.8 - 5.3	28	5°37.0	5°37.9	5°21.6	2.8 - 1.1	8.8 - 3.3	14.8 - 5.6	28	5°52.0	5°53.0	5°36.0	2.8 - 1.1	8.8 - 3.4	14.8 - 5.8
29	5°22.3	5°23.1	5°07.6	2.9 - 1.0	8.9 - 3.2	14.9 - 5.3	29	5°37.3	5°38.2	5°21.9	2.9 - 1.1	8.9 - 3.3	14.9 - 5.6	29	5°52.3	5°53.2	5°36.2	2.9 - 1.1	8.9 - 3.5	14.9 - 5.8
30	5°22.5	5°23.4	5°07.8	3.0 - 1.1	9.0 - 3.2	15.0 - 5.4	30	5°37.5	5°38.4	5°22.1	3.0 - 1.1	9.0 - 3.4	15.0 - 5.6	30	5°52.5	5°53.5	5°36.4	3.0 - 1.2	9.0 - 3.5	15.0 - 5.9
31	5°22.7	5°23.6	5°08.0	3.1 - 1.1	9.1 - 3.3	15.1 - 5.4	31	5°37.7	5°38.7	5°22.4	3.1 - 1.2	9.1 - 3.4	15.1 - 5.7	31	5°52.7	5°53.7	5°36.7	3.1 - 1.2	9.1 - 3.6	15.1 - 5.9
32	5°23.0	5°23.9	5°08.3	3.2 - 1.1	9.2 - 3.3	15.2 - 5.4	32	5°38.0	5°38.9	5°22.6	3.2 - 1.2	9.2 - 3.4	15.2 - 5.7	32	5°53.0	5°54.0	5°36.9	3.2 - 1.3	9.2 - 3.6	15.2 - 6.0
33	5°23.3	5°24.1	5°08.5	3.3 - 1.2	9.3 - 3.3	15.3 - 5.5	33	5°38.3	5°39.2	5°22.8	3.3 - 1.2	9.3 - 3.5	15.3 - 5.7	33	5°53.3	5°54.2	5°37.2	3.3 - 1.3	9.3 - 3.6	15.3 - 6.0
34	5°23.5	5°24.4	5°08.8	3.4 - 1.2	9.4 - 3.4	15.4 - 5.5	34	5°38.5	5°39.4	5°23.1	3.4 - 1.3	9.4 - 3.5	15.4 - 5.8	34	5°53.5	5°54.5	5°37.4	3.4 - 1.3	9.4 - 3.7	15.4 - 6.0
35	5°23.7	5°24.6	5°09.0	3.5 - 1.3	9.5 - 3.4	15.5 - 5.6	35	5°38.7	5°39.7	5°23.3	3.5 - 1.3	9.5 - 3.6	15.5 - 5.8	35	5°53.7	5°54.7	5°37.6	3.5 - 1.4	9.5 - 3.7	15.5 - 6.1
36	5°24.0	5°24.9	5°09.2	3.6 - 1.3	9.6 - 3.4	15.6 - 5.6	36	5°39.0	5°39.9	5°23.6	3.6 - 1.4	9.6 - 3.6	15.6 - 5.8	36	5°54.0	5°55.0	5°37.9	3.6 - 1.4	9.6 - 3.8	15.6 - 6.1
37	5°24.3	5°25.1	5°09.5	3.7 - 1.3	9.7 - 3.5	15.7 - 5.6	37	5°39.3	5°40.2	5°23.8	3.7 - 1.4	9.7 - 3.6	15.7 - 5.9	37	5°54.3	5°55.2	5°38.1	3.7 - 1.4	9.7 - 3.8	15.7 - 6.1
38	5°24.5	5°25.4	5°09.7	3.8 - 1.4	9.8 - 3.5	15.8 - 5.7	38	5°39.5	5°40.4	5°24.0	3.8 - 1.4	9.8 - 3.7	15.8 - 5.9	38	5°54.5	5°55.5	5°38.4	3.8 - 1.5	9.8 - 3.8	15.8 - 6.2
39	5°24.7	5°25.6	5°10.0	3.9 - 1.4	9.9 - 3.5	15.9 - 5.7	39	5°39.7	5°40.7	5°24.3	3.9 - 1.5	9.9 - 3.7	15.9 - 6.0	39	5°54.7	5°55.7	5°38.6	3.9 - 1.5	9.9 - 3.9	15.9 - 6.2
40	5°25.0	5°25.9	5°10.2	4.0 - 1.4	10.0 - 3.6	16.0 - 5.7	40	5°40.0	5°40.9	5°24.5	4.0 - 1.5	10.0 - 3.8	16.0 - 6.0	40	5°55.0	5°56.0	5°38.8	4.0 - 1.6	10.0 - 3.9	16.0 - 6.3
41	5°25.3	5°26.1	5°10.4	4.1 - 1.5	10.1 - 3.6	16.1 - 5.8	41	5°40.3	5°41.2	5°24.7	4.1 - 1.5	10.1 - 3.8	16.1 - 6.0	41	5°55.3	5°56.2	5°39.1	4.1 - 1.6	10.1 - 4.0	16.1 - 6.3
42	5°25.5	5°26.4	5°10.7	4.2 - 1.5	10.2 - 3.7	16.2 - 5.8	42	5°40.5	5°41.4	5°25.0	4.2 - 1.6	10.2 - 3.8	16.2 - 6.1	42	5°55.5	5°56.5	5°39.3	4.2 - 1.6	10.2 - 4.0	16.2 - 6.3
43	5°25.7	5°26.6	5°10.9	4.3 - 1.5	10.3 - 3.7	16.3 - 5.8	43	5°40.7	5°41											

## 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				

## Increments and Corrections

<sup>m</sup> 27	Sun Plan.	Aries	Moon	v and d corr				<sup>m</sup> 28	Sun Plan.	Aries	Moon	v and d corr				<sup>m</sup> 29	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		0	7°00.0	7°01.1	6°40.9	0.0 - 0.0	6.0 - 2.8	12.0 - 5.7		0	7°15.0	7°16.2	6°55.2	0.0 - 0.0	6.0 - 2.9	12.0 - 5.9	
1	6°45.2	6°46.4	6°26.8	0.1 - 0.0	6.1 - 2.8	12.1 - 5.5		1	7°00.2	7°01.4	6°41.1	0.1 - 0.0	6.1 - 2.9	12.1 - 5.7		1	7°15.2	7°16.4	6°55.4	0.1 - 0.0	6.1 - 3.0	12.1 - 5.9	
2	6°45.5	6°46.6	6°27.0	0.2 - 0.1	6.2 - 2.8	12.2 - 5.6		2	7°00.5	7°01.6	6°41.3	0.2 - 0.1	6.2 - 2.9	12.2 - 5.8		2	7°15.5	7°16.7	6°55.7	0.2 - 0.1	6.2 - 3.0	12.2 - 6.0	
3	6°45.8	6°46.9	6°27.3	0.3 - 0.1	6.3 - 2.9	12.3 - 5.6		3	7°00.8	7°01.9	6°41.6	0.3 - 0.1	6.3 - 3.0	12.3 - 5.8		3	7°15.8	7°16.9	6°55.9	0.3 - 0.1	6.3 - 3.1	12.3 - 6.0	
4	6°46.0	6°47.1	6°27.5	0.4 - 0.2	6.4 - 2.9	12.4 - 5.7		4	7°01.0	7°02.2	6°41.8	0.4 - 0.2	6.4 - 3.0	12.4 - 5.9		4	7°16.0	7°17.2	6°56.1	0.4 - 0.2	6.4 - 3.1	12.4 - 6.1	
5	6°46.2	6°47.4	6°27.7	0.5 - 0.2	6.5 - 3.0	12.5 - 5.7		5	7°01.2	7°02.4	6°42.1	0.5 - 0.2	6.5 - 3.1	12.5 - 5.9		5	7°16.2	7°17.4	6°56.4	0.5 - 0.2	6.5 - 3.2	12.5 - 6.1	
6	6°46.5	6°47.6	6°28.0	0.6 - 0.3	6.6 - 3.0	12.6 - 5.8		6	7°01.5	7°02.7	6°42.3	0.6 - 0.3	6.6 - 3.1	12.6 - 6.0		6	7°16.5	7°17.7	6°56.6	0.6 - 0.3	6.6 - 3.2	12.6 - 6.2	
7	6°46.8	6°47.9	6°28.2	0.7 - 0.3	6.7 - 3.1	12.7 - 5.8		7	7°01.8	7°02.9	6°42.5	0.7 - 0.3	6.7 - 3.2	12.7 - 6.0		7	7°16.8	7°17.9	6°56.9	0.7 - 0.3	6.7 - 3.3	12.7 - 6.2	
8	6°47.0	6°48.1	6°28.5	0.8 - 0.4	6.8 - 3.1	12.8 - 5.9		8	7°02.0	7°03.2	6°42.8	0.8 - 0.4	6.8 - 3.2	12.8 - 6.1		8	7°17.0	7°18.2	6°57.1	0.8 - 0.4	6.8 - 3.3	12.8 - 6.3	
9	6°47.2	6°48.4	6°28.7	0.9 - 0.4	6.9 - 3.2	12.9 - 5.9		9	7°02.2	7°03.4	6°43.0	0.9 - 0.4	6.9 - 3.3	12.9 - 6.1		9	7°17.2	7°18.4	6°57.3	0.9 - 0.4	6.9 - 3.4	12.9 - 6.3	
10	6°47.5	6°48.6	6°28.9	1.0 - 0.5	7.0 - 3.2	13.0 - 6.0		10	7°02.5	7°03.7	6°43.3	1.0 - 0.5	7.0 - 3.3	13.0 - 6.2		10	7°17.5	7°18.7	6°57.6	1.0 - 0.5	7.0 - 3.4	13.0 - 6.4	
11	6°47.8	6°48.9	6°29.2	1.1 - 0.5	7.1 - 3.3	13.1 - 6.0		11	7°02.8	7°03.9	6°43.5	1.1 - 0.5	7.1 - 3.4	13.1 - 6.2		11	7°17.8	7°18.9	6°57.8	1.1 - 0.5	7.1 - 3.5	13.1 - 6.4	
12	6°48.0	6°49.1	6°29.4	1.2 - 0.6	7.2 - 3.3	13.2 - 6.0		12	7°03.0	7°04.2	6°43.7	1.2 - 0.6	7.2 - 3.4	13.2 - 6.3		12	7°18.0	7°19.2	6°58.0	1.2 - 0.6	7.2 - 3.5	13.2 - 6.5	
13	6°48.2	6°49.4	6°29.7	1.3 - 0.6	7.3 - 3.3	13.3 - 6.1		13	7°03.2	7°04.4	6°44.0	1.3 - 0.6	7.3 - 3.5	13.3 - 6.3		13	7°18.2	7°19.4	6°58.3	1.3 - 0.6	7.3 - 3.6	13.3 - 6.5	
14	6°48.5	6°49.6	6°29.9	1.4 - 0.6	7.4 - 3.4	13.4 - 6.1		14	7°03.5	7°04.7	6°44.2	1.4 - 0.7	7.4 - 3.5	13.4 - 6.4		14	7°18.5	7°19.7	6°58.5	1.4 - 0.7	7.4 - 3.6	13.4 - 6.6	
15	6°48.8	6°49.9	6°30.1	1.5 - 0.7	7.5 - 3.4	13.5 - 6.2		15	7°03.8	7°04.9	6°44.4	1.5 - 0.7	7.5 - 3.6	13.5 - 6.4		15	7°18.8	7°19.9	6°58.8	1.5 - 0.7	7.5 - 3.7	13.5 - 6.6	
16	6°49.0	6°50.1	6°30.4	1.6 - 0.7	7.6 - 3.5	13.6 - 6.2		16	7°04.0	7°05.2	6°44.7	1.6 - 0.8	7.6 - 3.6	13.6 - 6.5		16	7°19.0	7°20.2	6°59.0	1.6 - 0.8	7.6 - 3.7	13.6 - 6.7	
17	6°49.3	6°50.4	6°30.6	1.7 - 0.8	7.7 - 3.5	13.7 - 6.3		17	7°04.3	7°05.4	6°44.9	1.7 - 0.8	7.7 - 3.7	13.7 - 6.5		17	7°19.3	7°20.5	6°59.2	1.7 - 0.8	7.7 - 3.8	13.7 - 6.7	
18	6°49.5	6°50.6	6°30.8	1.8 - 0.8	7.8 - 3.6	13.8 - 6.3		18	7°04.5	7°05.7	6°45.2	1.8 - 0.9	7.8 - 3.7	13.8 - 6.6		18	7°19.5	7°20.7	6°59.5	1.8 - 0.9	7.8 - 3.8	13.8 - 6.8	
19	6°49.8	6°50.9	6°31.1	1.9 - 0.9	7.9 - 3.6	13.9 - 6.4		19	7°04.7	7°05.9	6°45.4	1.9 - 0.9	7.9 - 3.8	13.9 - 6.6		19	7°19.7	7°21.0	6°59.7	1.9 - 0.9	7.9 - 3.9	13.9 - 6.8	
20	6°50.0	6°51.1	6°31.3	2.0 - 0.9	8.0 - 3.7	14.0 - 6.4		20	7°05.0	7°06.2	6°45.6	2.0 - 0.9	8.0 - 3.8	14.0 - 6.6		20	7°20.0	7°21.2	7°00.0	2.0 - 1.0	8.0 - 3.9	14.0 - 6.9	
21	6°50.3	6°51.4	6°31.6	2.1 - 1.0	8.1 - 3.7	14.1 - 6.5		21	7°05.3	7°06.4	6°45.9	2.1 - 1.0	8.1 - 3.8	14.1 - 6.7		21	7°20.3	7°21.5	7°00.2	2.1 - 1.0	8.1 - 4.0	14.1 - 6.9	
22	6°50.5	6°51.6	6°31.8	2.2 - 1.0	8.2 - 3.8	14.2 - 6.5		22	7°05.5	7°06.7	6°46.1	2.2 - 1.0	8.2 - 3.9	14.2 - 6.7		22	7°20.5	7°21.7	7°00.4	2.2 - 1.1	8.2 - 4.0	14.2 - 7.0	
23	6°50.7	6°51.9	6°32.0	2.3 - 1.1	8.3 - 3.8	14.3 - 6.6		23	7°05.7	7°06.9	6°46.4	2.3 - 1.1	8.3 - 3.9	14.3 - 6.8		23	7°20.7	7°22.0	7°00.7	2.3 - 1.1	8.3 - 4.1	14.3 - 7.0	
24	6°51.0	6°52.1	6°32.3	2.4 - 1.1	8.4 - 3.9	14.4 - 6.6		24	7°06.0	7°07.2	6°46.6	2.4 - 1.1	8.4 - 4.0	14.4 - 6.8		24	7°21.0	7°22.2	7°00.9	2.4 - 1.2	8.4 - 4.1	14.4 - 7.1	
25	6°51.3	6°52.4	6°32.5	2.5 - 1.1	8.5 - 3.9	14.5 - 6.6		25	7°06.3	7°07.4	6°46.8	2.5 - 1.2	8.5 - 4.0	14.5 - 6.9		25	7°21.3	7°22.5	7°01.1	2.5 - 1.2	8.5 - 4.2	14.5 - 7.1	
26	6°51.5	6°52.6	6°32.8	2.6 - 1.2	8.6 - 3.9	14.6 - 6.7		26	7°06.5	7°07.7	6°47.1	2.6 - 1.2	8.6 - 4.1	14.6 - 6.9		26	7°21.5	7°22.7	7°01.4	2.6 - 1.3	8.6 - 4.2	14.6 - 7.2	
27	6°51.7	6°52.9	6°33.0	2.7 - 1.2	8.7 - 4.0	14.7 - 6.7		27	7°06.7	7°07.9	6°47.3	2.7 - 1.3	8.7 - 4.1	14.7 - 7.0		27	7°21.7	7°23.0	7°01.6	2.7 - 1.3	8.7 - 4.3	14.7 - 7.2	
28	6°52.0	6°53.1	6°33.2	2.8 - 1.3	8.8 - 4.0	14.8 - 6.8		28	7°07.0	7°08.2	6°47.5	2.8 - 1.3	8.8 - 4.2	14.8 - 7.0		28	7°22.0	7°23.2	7°01.9	2.8 - 1.4	8.8 - 4.3	14.8 - 7.3	
29	6°52.3	6°53.4	6°33.5	2.9 - 1.3	8.9 - 4.1	14.9 - 6.8		29	7°07.3	7°08.4	6°47.8	2.9 - 1.4	8.9 - 4.2	14.9 - 7.1		29	7°22.3	7°23.5	7°02.1	2.9 - 1.4	8.9 - 4.4	14.9 - 7.3	
30	6°52.5	6°53.6	6°33.7	3.0 - 1.4	9.0 - 4.1	15.0 - 6.9		30	7°07.5	7°08.7	6°48.0	3.0 - 1.4	9.0 - 4.3	15.0 - 7.1		30	7°22.5	7°23.7	7°02.3	3.0 - 1.5	9.0 - 4.4	15.0 - 7.4	
31	6°52.7	6°53.9	6°33.9	3.1 - 1.4	9.1 - 4.2	15.1 - 6.9		31	7°07.7	7°08.9	6°48.3	3.1 - 1.5	9.1 - 4.3	15.1 - 7.2		31	7°22.7	7°24.0	7°02.6	3.1 - 1.5	9.1 - 4.5	15.1 - 7.4	
32	6°53.0	6°54.1	6°34.2	3.2 - 1.5	9.2 - 4.2	15.2 - 7.0		32	7°08.0	7°09.2	6°48.5	3.2 - 1.5	9.2 - 4.4	15.2 - 7.2		32	7°23.0	7°24.2	7°02.8	3.2 - 1.6	9.2 - 4.5	15.2 - 7.5	
33	6°53.3	6°54.4	6°34.4	3.3 - 1.5	9.3 - 4.3	15.3 - 7.0		33	7°08.3	7°09.4	6°48.7	3.3 - 1.6	9.3 - 4.4	15.3 - 7.3		33	7°23.3	7°24.5	7°03.1	3.3 - 1.6	9.3 - 4.6	15.3 - 7.5	
34	6°53.5	6°54.6	6°34.7	3.4 - 1.6	9.4 - 4.3	15.4 - 7.1		34	7°08.5	7°09.7	6°49.0	3.4 - 1.6	9.4 - 4.5	15.4 - 7.3		34	7°23.5	7°24.7	7°03.3	3.4 - 1.7	9.4 - 4.6	15.4 - 7.6	
35	6°53.7	6°54.9	6°34.9	3.5 - 1.6	9.5 - 4.4	15.5 - 7.1		35	7°08.7	7°09.9	6°49.2	3.5 - 1.7	9.5 - 4.5	15.5 - 7.4		35	7°23.7	7°25.0	7°03.5	3.5 - 1.7	9.5 - 4.7	15.5 - 7.6	
36	6°54.0	6°55.1	6°35.1	3.6 - 1.6	9.6 - 4.4	15.6 - 7.1		36	7°09.0	7°10.2	6°49.5	3.6 - 1.7	9.6 - 4.6	15.6 - 7.4		36	7°24.0	7°25.2	7°03.8	3.6 - 1.8	9.6 - 4.7	15.6 - 7.7	
37	6°54.3	6°55.4	6°35.4	3.7 - 1.7	9.7 - 4.4	15.7 - 7.2		37	7°09.3	7°10.4	6°49.7	3.7 - 1.8	9.7 - 4.6	15.7 - 7.5		37	7°24.3	7°25.5	7°04.0	3.7 - 1.8	9.7 - 4.8	15.7 - 7.7	
38	6°54.5	6°55.6	6°35.6	3.8 - 1.7	9.8 - 4.5	15.8 - 7.2		38	7°09.5	7°10.7	6°49.9	3.8 - 1.8	9.8 - 4.7	15.8 - 7.5		38	7°24.5	7°25.7	7°04.3	3.8 - 1.9	9.8 - 4.8	15.8 - 7.8	
39	6°54.7	6°55.9	6°35.9	3.9 - 1.8	9.9 - 4.5	15.9 - 7.3		39	7°09.7	7°10.9	6°50.2	3.9 - 1.9	9.9 - 4.7	15.9 - 7.6		39	7°24.7	7°26.0	7°04.5	3.9 - 1.9	9.9 - 4.9	15.9 - 7.8	
40	6°55.0	6°56.1	6°36.1	4.0 - 1.8	10.0 - 4.6	16.0 - 7.3		40	7°10.0	7°11.2	6°50.4	4.0 - 1.9	10.0 - 4.8	16.0 - 7.6		40	7°25.0	7°26.2	7°04.7	4.0 - 2.0	10.0 - 4.9	16.0 - 7.9	
41	6°55.3	6°56.4	6°36.3	4.1 - 1.9	10.1 - 4.6	16.1 - 7.4		41	7°10.3	7°11.4	6°50.6	4.1 - 1.9	10.1 - 4.8	16.1 - 7.6		41	7°25.3	7°26.5	7°05.0	4.1 -			

## Increments and Corrections

m 30	Sun Plan.	Aries	Moon	v and d corr	m 31	Sun Plan.	Aries	Moon	v and d corr	m 32	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	0	7°45.0	7°46.3	7°23.8	0.0 - 0.0    6.0 - 3.2    12.0 - 6.3	0	8°00.0	8°01.3	7°38.1	0.0 - 0.0    6.0 - 3.3    12.0 - 6.5
1	7°30.2	7°31.5	7°09.7	0.1 - 0.1    6.1 - 3.1    12.1 - 6.2	1	7°45.2	7°46.5	7°24.1	0.1 - 0.1    6.1 - 3.2    12.1 - 6.4	1	8°00.2	8°01.6	7°38.4	0.1 - 0.1    6.1 - 3.3    12.1 - 6.6
2	7°30.5	7°31.7	7°10.0	0.2 - 0.1    6.2 - 3.2    12.2 - 6.2	2	7°45.5	7°46.8	7°24.3	0.2 - 0.1    6.2 - 3.3    12.2 - 6.4	2	8°00.5	8°01.8	7°38.6	0.2 - 0.1    6.2 - 3.4    12.2 - 6.6
3	7°30.8	7°32.0	7°10.2	0.3 - 0.2    6.3 - 3.2    12.3 - 6.3	3	7°45.7	7°47.0	7°24.5	0.3 - 0.2    6.3 - 3.3    12.3 - 6.5	3	8°00.7	8°02.1	7°38.8	0.3 - 0.2    6.3 - 3.4    12.3 - 6.7
4	7°31.0	7°32.2	7°10.5	0.4 - 0.2    6.4 - 3.3    12.4 - 6.3	4	7°46.0	7°47.3	7°24.8	0.4 - 0.2    6.4 - 3.4    12.4 - 6.5	4	8°01.0	8°02.3	7°39.1	0.4 - 0.2    6.4 - 3.5    12.4 - 6.7
5	7°31.2	7°32.5	7°10.7	0.5 - 0.3    6.5 - 3.3    12.5 - 6.4	5	7°46.2	7°47.5	7°25.0	0.5 - 0.3    6.5 - 3.4    12.5 - 6.6	5	8°01.3	8°02.6	7°39.3	0.5 - 0.3    6.5 - 3.5    12.5 - 6.8
6	7°31.5	7°32.7	7°10.9	0.6 - 0.3    6.6 - 3.4    12.6 - 6.4	6	7°46.5	7°47.8	7°25.2	0.6 - 0.3    6.6 - 3.5    12.6 - 6.6	6	8°01.5	8°02.8	7°39.6	0.6 - 0.3    6.6 - 3.6    12.6 - 6.8
7	7°31.7	7°33.0	7°11.2	0.7 - 0.4    6.7 - 3.4    12.7 - 6.5	7	7°46.8	7°48.0	7°25.5	0.7 - 0.4    6.7 - 3.5    12.7 - 6.7	7	8°01.8	8°03.1	7°39.8	0.7 - 0.4    6.7 - 3.6    12.7 - 6.9
8	7°32.0	7°33.2	7°11.4	0.8 - 0.4    6.8 - 3.5    12.8 - 6.5	8	7°47.0	7°48.3	7°25.7	0.8 - 0.4    6.8 - 3.6    12.8 - 6.7	8	8°02.0	8°03.3	7°40.0	0.8 - 0.4    6.8 - 3.7    12.8 - 6.9
9	7°32.2	7°33.5	7°11.6	0.9 - 0.5    6.9 - 3.5    12.9 - 6.6	9	7°47.2	7°48.5	7°26.0	0.9 - 0.5    6.9 - 3.6    12.9 - 6.8	9	8°02.2	8°03.6	7°40.3	0.9 - 0.5    6.9 - 3.7    12.9 - 7.0
10	7°32.5	7°33.7	7°11.9	1.0 - 0.5    7.0 - 3.6    13.0 - 6.6	10	7°47.5	7°48.8	7°26.2	1.0 - 0.5    7.0 - 3.7    13.0 - 6.8	10	8°02.5	8°03.8	7°40.5	1.0 - 0.5    7.0 - 3.8    13.0 - 7.0
11	7°32.8	7°34.0	7°12.1	1.1 - 0.6    7.1 - 3.6    13.1 - 6.7	11	7°47.7	7°49.0	7°26.4	1.1 - 0.6    7.1 - 3.7    13.1 - 6.9	11	8°02.7	8°04.1	7°40.8	1.1 - 0.6    7.1 - 3.8    13.1 - 7.1
12	7°33.0	7°34.2	7°12.4	1.2 - 0.6    7.2 - 3.7    13.2 - 6.7	12	7°48.0	7°49.3	7°26.7	1.2 - 0.6    7.2 - 3.8    13.2 - 6.9	12	8°03.0	8°04.3	7°41.0	1.2 - 0.7    7.2 - 3.9    13.2 - 7.1
13	7°33.3	7°34.5	7°12.6	1.3 - 0.7    7.3 - 3.7    13.3 - 6.8	13	7°48.2	7°49.5	7°26.9	1.3 - 0.7    7.3 - 3.8    13.3 - 7.0	13	8°03.3	8°04.6	7°41.2	1.3 - 0.7    7.3 - 4.0    13.3 - 7.2
14	7°33.5	7°34.7	7°12.8	1.4 - 0.7    7.4 - 3.8    13.4 - 6.8	14	7°48.5	7°49.8	7°27.2	1.4 - 0.7    7.4 - 3.9    13.4 - 7.0	14	8°03.5	8°04.8	7°41.5	1.4 - 0.8    7.4 - 4.0    13.4 - 7.3
15	7°33.8	7°35.0	7°13.1	1.5 - 0.8    7.5 - 3.8    13.5 - 6.9	15	7°48.8	7°50.0	7°27.4	1.5 - 0.8    7.5 - 3.9    13.5 - 7.1	15	8°03.8	8°05.1	7°41.7	1.5 - 0.8    7.5 - 4.1    13.5 - 7.3
16	7°34.0	7°35.2	7°13.3	1.6 - 0.8    7.6 - 3.9    13.6 - 6.9	16	7°49.0	7°50.3	7°27.6	1.6 - 0.8    7.6 - 4.0    13.6 - 7.1	16	8°04.0	8°05.3	7°42.0	1.6 - 0.9    7.6 - 4.1    13.6 - 7.4
17	7°34.3	7°35.5	7°13.6	1.7 - 0.9    7.7 - 3.9    13.7 - 7.0	17	7°49.3	7°50.5	7°27.9	1.7 - 0.9    7.7 - 4.0    13.7 - 7.2	17	8°04.2	8°05.6	7°42.2	1.7 - 0.9    7.7 - 4.2    13.7 - 7.4
18	7°34.5	7°35.7	7°13.8	1.8 - 0.9    7.8 - 4.0    13.8 - 7.0	18	7°49.5	7°50.8	7°28.1	1.8 - 0.9    7.8 - 4.1    13.8 - 7.2	18	8°04.5	8°05.8	7°42.4	1.8 - 1.0    7.8 - 4.2    13.8 - 7.5
19	7°34.8	7°36.0	7°14.0	1.9 - 1.0    7.9 - 4.0    13.9 - 7.1	19	7°49.8	7°51.0	7°28.4	1.9 - 1.0    7.9 - 4.1    13.9 - 7.3	19	8°04.8	8°06.1	7°42.7	1.9 - 1.0    7.9 - 4.3    13.9 - 7.5
20	7°35.0	7°36.2	7°14.3	2.0 - 1.0    8.0 - 4.1    14.0 - 7.1	20	7°50.0	7°51.3	7°28.6	2.0 - 1.1    8.0 - 4.2    14.0 - 7.4	20	8°05.0	8°06.3	7°42.9	2.0 - 1.1    8.0 - 4.3    14.0 - 7.6
21	7°35.3	7°36.5	7°14.5	2.1 - 1.1    8.1 - 4.1    14.1 - 7.2	21	7°50.3	7°51.5	7°28.8	2.1 - 1.1    8.1 - 4.3    14.1 - 7.4	21	8°05.3	8°06.6	7°43.1	2.1 - 1.1    8.1 - 4.4    14.1 - 7.6
22	7°35.5	7°36.7	7°14.7	2.2 - 1.1    8.2 - 4.2    14.2 - 7.2	22	7°50.5	7°51.8	7°29.1	2.2 - 1.2    8.2 - 4.3    14.2 - 7.5	22	8°05.5	8°06.8	7°43.4	2.2 - 1.2    8.2 - 4.4    14.2 - 7.7
23	7°35.7	7°37.0	7°15.0	2.3 - 1.2    8.3 - 4.2    14.3 - 7.3	23	7°50.7	7°52.0	7°29.3	2.3 - 1.2    8.3 - 4.4    14.3 - 7.5	23	8°05.7	8°07.1	7°43.6	2.3 - 1.2    8.3 - 4.5    14.3 - 7.7
24	7°36.0	7°37.2	7°15.2	2.4 - 1.2    8.4 - 4.3    14.4 - 7.3	24	7°51.0	7°52.3	7°29.5	2.4 - 1.3    8.4 - 4.4    14.4 - 7.6	24	8°06.0	8°07.3	7°43.9	2.4 - 1.3    8.4 - 4.5    14.4 - 7.8
25	7°36.2	7°37.5	7°15.5	2.5 - 1.3    8.5 - 4.3    14.5 - 7.4	25	7°51.3	7°52.5	7°29.8	2.5 - 1.3    8.5 - 4.5    14.5 - 7.6	25	8°06.2	8°07.6	7°44.1	2.5 - 1.4    8.5 - 4.6    14.5 - 7.9
26	7°36.5	7°37.7	7°15.7	2.6 - 1.3    8.6 - 4.4    14.6 - 7.4	26	7°51.5	7°52.8	7°30.0	2.6 - 1.4    8.6 - 4.5    14.6 - 7.7	26	8°06.5	8°07.8	7°44.3	2.6 - 1.4    8.6 - 4.7    14.6 - 7.9
27	7°36.7	7°38.0	7°15.9	2.7 - 1.4    8.7 - 4.4    14.7 - 7.5	27	7°51.7	7°53.0	7°30.3	2.7 - 1.4    8.7 - 4.6    14.7 - 7.7	27	8°06.8	8°08.1	7°44.6	2.7 - 1.5    8.7 - 4.7    14.7 - 8.0
28	7°37.0	7°38.2	7°16.2	2.8 - 1.4    8.8 - 4.5    14.8 - 7.5	28	7°52.0	7°53.3	7°30.5	2.8 - 1.5    8.8 - 4.6    14.8 - 7.8	28	8°07.0	8°08.3	7°44.8	2.8 - 1.5    8.8 - 4.8    14.8 - 8.0
29	7°37.3	7°38.5	7°16.4	2.9 - 1.5    8.9 - 4.5    14.9 - 7.6	29	7°52.2	7°53.5	7°30.7	2.9 - 1.5    8.9 - 4.7    14.9 - 7.8	29	8°07.3	8°08.6	7°45.1	2.9 - 1.6    8.9 - 4.8    14.9 - 8.1
30	7°37.5	7°38.8	7°16.7	3.0 - 1.5    9.0 - 4.6    15.0 - 7.6	30	7°52.5	7°53.8	7°31.0	3.0 - 1.6    9.0 - 4.7    15.0 - 7.9	30	8°07.5	8°08.8	7°45.3	3.0 - 1.6    9.0 - 4.9    15.0 - 8.1
31	7°37.7	7°39.0	7°16.9	3.1 - 1.6    9.1 - 4.6    15.1 - 7.7	31	7°52.7	7°54.0	7°31.2	3.1 - 1.6    9.1 - 4.8    15.1 - 7.9	31	8°07.7	8°09.1	7°45.5	3.1 - 1.7    9.1 - 4.9    15.1 - 8.2
32	7°38.0	7°39.3	7°17.1	3.2 - 1.6    9.2 - 4.7    15.2 - 7.7	32	7°53.0	7°54.3	7°31.5	3.2 - 1.7    9.2 - 4.8    15.2 - 8.0	32	8°08.0	8°09.3	7°45.8	3.2 - 1.7    9.2 - 5.0    15.2 - 8.2
33	7°38.3	7°39.5	7°17.4	3.3 - 1.7    9.3 - 4.7    15.3 - 7.8	33	7°53.3	7°54.5	7°31.7	3.3 - 1.7    9.3 - 4.9    15.3 - 8.0	33	8°08.2	8°09.6	7°46.0	3.3 - 1.8    9.3 - 5.0    15.3 - 8.3
34	7°38.5	7°39.8	7°17.6	3.4 - 1.7    9.4 - 4.8    15.4 - 7.8	34	7°53.5	7°54.8	7°31.9	3.4 - 1.8    9.4 - 4.9    15.4 - 8.1	34	8°08.5	8°09.8	7°46.2	3.4 - 1.8    9.4 - 5.1    15.4 - 8.3
35	7°38.7	7°40.0	7°17.9	3.5 - 1.8    9.5 - 4.8    15.5 - 7.9	35	7°53.8	7°55.0	7°32.2	3.5 - 1.8    9.5 - 5.0    15.5 - 8.1	35	8°08.8	8°10.1	7°46.5	3.5 - 1.9    9.5 - 5.1    15.5 - 8.4
36	7°39.0	7°40.3	7°18.1	3.6 - 1.8    9.6 - 4.9    15.6 - 7.9	36	7°54.0	7°55.3	7°32.4	3.6 - 1.9    9.6 - 5.0    15.6 - 8.2	36	8°09.0	8°10.3	7°46.7	3.6 - 1.9    9.6 - 5.2    15.6 - 8.4
37	7°39.3	7°40.5	7°18.3	3.7 - 1.9    9.7 - 4.9    15.7 - 8.0	37	7°54.3	7°55.5	7°32.6	3.7 - 1.9    9.7 - 5.1    15.7 - 8.2	37	8°09.3	8°10.6	7°47.0	3.7 - 2.0    9.7 - 5.3    15.7 - 8.5
38	7°39.5	7°40.8	7°18.6	3.8 - 1.9    9.8 - 5.0    15.8 - 8.0	38	7°54.5	7°55.8	7°32.9	3.8 - 2.0    9.8 - 5.1    15.8 - 8.3	38	8°09.5	8°10.8	7°47.2	3.8 - 2.1    9.8 - 5.3    15.8 - 8.6
39	7°39.8	7°41.0	7°18.8	3.9 - 2.0    9.9 - 5.0    15.9 - 8.1	39	7°54.7	7°56.0	7°33.1	3.9 - 2.0    9.9 - 5.2    15.9 - 8.3	39	8°09.7	8°11.1	7°47.4	3.9 - 2.1    9.9 - 5.4    15.9 - 8.6
40	7°40.0	7°41.3	7°19.0	4.0 - 2.0    10.0 - 5.1    16.0 - 8.1	40	7°55.0	7°56.3	7°33.4	4.0 - 2.1    10.0 - 5.3    16.0 - 8.4	40	8°10.0	8°11.3	7°47.7	4.0 - 2.2    10.0 - 5.4    16.0 - 8.7
41	7°40.3	7°41.5	7°19.3	4.1 - 2.1    10.1 - 5.1    16.1 - 8.2	41	7°55.3	7°56.5	7°33.6	4.1 - 2.2    10.1 - 5.3    16.1 - 8.5	41	8°10.2	8°11.6	7°47.9	4.1 - 2.2    10.1 - 5.5    16.1 - 8.7
42	7°40.5	7°41.8	7°19.5	4.2 - 2.1    10.2 - 5.2    16.2 - 8.2	42	7°55.5	7°56.8	7°33.8	4.2 - 2.2    10.2 - 5.4    16.2 - 8.5	42	8°10.5	8°11.8	7°48.2	4.2 - 2.3    10.2 - 5.5    16.2 - 8.8
43	7°40.7	7°42.0	7°19.8	4.3 - 2.2    10.3 - 5.2    16.3 - 8.3	43	7°55.7	7°57.1	7°34.1	4.3 - 2.3    10.3 - 5.4    16.3 - 8.6	43	8°10.8	8°12.1	7°48.4	4.3 - 2.3    10.3 - 5.6    16.3 - 8.8
44	7°41.0	7°42.3	7°20.0	4.4 - 2.2    10.4 - 5.3    16.4 - 8.3	44	7°56.0	7°57.3	7°34.3	4.4 - 2.3    10.4 - 5.5    16.4 - 8.6	44	8°11.0	8°12.3	7°48.6	4.4 - 2.4    10.4 - 5.6    16.4 - 8.9
45	7°41.2	7°42.5	7°20.2	4.5 - 2.3    10.5 - 5.3    16.5 - 8.4	45	7°56.3	7°57.6	7°34.6	4.5 - 2.4    10.5 - 5.5    16.5 - 8.7	45	8°11.3	8°12.6	7°48.9	4.5 - 2.4    10.5 - 5.7    16.5 - 8.9
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## Increments and Corrections

m 33	Sun Plan.	Aries	Moon	v and d corr	m 34	Sun Plan.	Aries	Moon	v and d corr	m 35	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	0	8°30.0	8°31.4	8°06.8	0.0 - 0.0    6.0 - 3.4    12.0 - 6.9	0	8°45.0	8°46.4	8°21.1	0.0 - 0.0    6.0 - 3.5    12.0 - 7.1
1	8°15.2	8°16.6	7°52.7	0.1 - 0.1    6.1 - 3.4    12.1 - 6.8	1	8°30.2	8°31.6	8°07.0	0.1 - 0.1    6.1 - 3.5    12.1 - 7.0	1	8°45.2	8°46.7	8°21.3	0.1 - 0.1    6.1 - 3.6    12.1 - 7.2
2	8°15.5	8°16.9	7°52.9	0.2 - 0.1    6.2 - 3.5    12.2 - 6.8	2	8°30.5	8°31.9	8°07.2	0.2 - 0.1    6.2 - 3.6    12.2 - 7.0	2	8°45.5	8°46.9	8°21.6	0.2 - 0.1    6.2 - 3.7    12.2 - 7.2
3	8°15.7	8°17.1	7°53.2	0.3 - 0.2    6.3 - 3.5    12.3 - 6.9	3	8°30.7	8°32.1	8°07.5	0.3 - 0.2    6.3 - 3.6    12.3 - 7.1	3	8°45.7	8°47.2	8°21.8	0.3 - 0.2    6.3 - 3.7    12.3 - 7.3
4	8°16.0	8°17.4	7°53.4	0.4 - 0.2    6.4 - 3.6    12.4 - 6.9	4	8°31.0	8°32.4	8°07.7	0.4 - 0.2    6.4 - 3.7    12.4 - 7.1	4	8°46.0	8°47.4	8°22.0	0.4 - 0.2    6.4 - 3.8    12.4 - 7.3
5	8°16.3	8°17.6	7°53.6	0.5 - 0.3    6.5 - 3.6    12.5 - 7.0	5	8°31.3	8°32.6	8°08.0	0.5 - 0.3    6.5 - 3.7    12.5 - 7.2	5	8°46.3	8°47.7	8°22.3	0.5 - 0.3    6.5 - 3.8    12.5 - 7.4
6	8°16.5	8°17.9	7°53.9	0.6 - 0.3    6.6 - 3.7    12.6 - 7.0	6	8°31.5	8°32.9	8°08.2	0.6 - 0.3    6.6 - 3.8    12.6 - 7.2	6	8°46.5	8°47.9	8°22.5	0.6 - 0.4    6.6 - 3.9    12.6 - 7.5
7	8°16.8	8°18.1	7°54.1	0.7 - 0.4    6.7 - 3.7    12.7 - 7.1	7	8°31.8	8°33.1	8°08.4	0.7 - 0.4    6.7 - 3.9    12.7 - 7.3	7	8°46.8	8°48.2	8°22.8	0.7 - 0.4    6.7 - 4.0    12.7 - 7.5
8	8°17.0	8°18.4	7°54.4	0.8 - 0.4    6.8 - 3.8    12.8 - 7.1	8	8°32.0	8°33.4	8°08.7	0.8 - 0.5    6.8 - 3.9    12.8 - 7.4	8	8°47.0	8°48.4	8°23.0	0.8 - 0.5    6.8 - 4.0    12.8 - 7.6
9	8°17.2	8°18.6	7°54.6	0.9 - 0.5    6.9 - 3.9    12.9 - 7.2	9	8°32.2	8°33.7	8°08.9	0.9 - 0.5    6.9 - 4.0    12.9 - 7.4	9	8°47.2	8°48.7	8°23.2	0.9 - 0.5    6.9 - 4.1    12.9 - 7.6
10	8°17.5	8°18.9	7°54.8	1.0 - 0.6    7.0 - 3.9    13.0 - 7.3	10	8°32.5	8°33.9	8°09.2	1.0 - 0.6    7.0 - 4.0    13.0 - 7.5	10	8°47.5	8°48.9	8°23.5	1.0 - 0.6    7.0 - 4.1    13.0 - 7.7
11	8°17.7	8°19.1	7°55.1	1.1 - 0.6    7.1 - 4.0    13.1 - 7.3	11	8°32.7	8°34.2	8°09.4	1.1 - 0.6    7.1 - 4.1    13.1 - 7.5	11	8°47.7	8°49.2	8°23.7	1.1 - 0.7    7.1 - 4.2    13.1 - 7.8
12	8°18.0	8°19.4	7°55.3	1.2 - 0.7    7.2 - 4.0    13.2 - 7.4	12	8°33.0	8°34.4	8°09.6	1.2 - 0.7    7.2 - 4.1    13.2 - 7.6	12	8°48.0	8°49.4	8°23.9	1.2 - 0.7    7.2 - 4.3    13.2 - 7.8
13	8°18.3	8°19.6	7°55.6	1.3 - 0.7    7.3 - 4.1    13.3 - 7.4	13	8°33.3	8°34.7	8°09.9	1.3 - 0.7    7.3 - 4.2    13.3 - 7.6	13	8°48.3	8°49.7	8°24.2	1.3 - 0.8    7.3 - 4.3    13.3 - 7.9
14	8°18.5	8°19.9	7°55.8	1.4 - 0.8    7.4 - 4.1    13.4 - 7.5	14	8°33.5	8°34.9	8°10.1	1.4 - 0.8    7.4 - 4.3    13.4 - 7.7	14	8°48.5	8°49.9	8°24.4	1.4 - 0.8    7.4 - 4.4    13.4 - 7.9
15	8°18.8	8°20.1	7°56.0	1.5 - 0.8    7.5 - 4.2    13.5 - 7.5	15	8°33.8	8°35.2	8°10.3	1.5 - 0.9    7.5 - 4.3    13.5 - 7.8	15	8°48.8	8°50.2	8°24.7	1.5 - 0.9    7.5 - 4.4    13.5 - 8.0
16	8°19.0	8°20.4	7°56.3	1.6 - 0.9    7.6 - 4.2    13.6 - 7.6	16	8°34.0	8°35.4	8°10.6	1.6 - 0.9    7.6 - 4.4    13.6 - 7.8	16	8°49.0	8°50.4	8°24.9	1.6 - 0.9    7.6 - 4.5    13.6 - 8.0
17	8°19.2	8°20.6	7°56.5	1.7 - 0.9    7.7 - 4.3    13.7 - 7.6	17	8°34.2	8°35.7	8°10.8	1.7 - 1.0    7.7 - 4.4    13.7 - 7.9	17	8°49.2	8°50.7	8°25.1	1.7 - 1.0    7.7 - 4.6    13.7 - 8.1
18	8°19.5	8°20.9	7°56.7	1.8 - 1.0    7.8 - 4.4    13.8 - 7.7	18	8°34.5	8°35.9	8°11.1	1.8 - 1.0    7.8 - 4.5    13.8 - 7.9	18	8°49.5	8°50.9	8°25.4	1.8 - 1.1    7.8 - 4.6    13.8 - 8.2
19	8°19.8	8°21.1	7°57.0	1.9 - 1.1    7.9 - 4.4    13.9 - 7.8	19	8°34.8	8°36.2	8°11.3	1.9 - 1.1    7.9 - 4.5    13.9 - 8.0	19	8°49.8	8°51.2	8°25.6	1.9 - 1.1    7.9 - 4.7    13.9 - 8.2
20	8°20.0	8°21.4	7°57.2	2.0 - 1.1    8.0 - 4.5    14.0 - 7.8	20	8°35.0	8°36.4	8°11.5	2.0 - 1.1    8.0 - 4.6    14.0 - 8.0	20	8°50.0	8°51.4	8°25.9	2.0 - 1.2    8.0 - 4.7    14.0 - 8.3
21	8°20.3	8°21.6	7°57.5	2.1 - 1.2    8.1 - 4.5    14.1 - 7.9	21	8°35.3	8°36.7	8°11.8	2.1 - 1.2    8.1 - 4.7    14.1 - 8.1	21	8°50.3	8°51.7	8°26.1	2.1 - 1.2    8.1 - 4.8    14.1 - 8.3
22	8°20.5	8°21.9	7°57.7	2.2 - 1.2    8.2 - 4.6    14.2 - 7.9	22	8°35.5	8°36.9	8°12.0	2.2 - 1.3    8.2 - 4.7    14.2 - 8.2	22	8°50.5	8°52.0	8°26.3	2.2 - 1.3    8.2 - 4.9    14.2 - 8.4
23	8°20.7	8°22.1	7°57.9	2.3 - 1.3    8.3 - 4.6    14.3 - 8.0	23	8°35.7	8°37.2	8°12.3	2.3 - 1.3    8.3 - 4.8    14.3 - 8.2	23	8°50.7	8°52.2	8°26.6	2.3 - 1.4    8.3 - 4.9    14.3 - 8.5
24	8°21.0	8°22.4	7°58.2	2.4 - 1.3    8.4 - 4.7    14.4 - 8.0	24	8°36.0	8°37.4	8°12.5	2.4 - 1.4    8.4 - 4.8    14.4 - 8.3	24	8°51.0	8°52.5	8°26.8	2.4 - 1.4    8.4 - 5.0    14.4 - 8.5
25	8°21.2	8°22.6	7°58.4	2.5 - 1.4    8.5 - 4.7    14.5 - 8.1	25	8°36.2	8°37.7	8°12.7	2.5 - 1.4    8.5 - 4.9    14.5 - 8.3	25	8°51.2	8°52.7	8°27.0	2.5 - 1.5    8.5 - 5.0    14.5 - 8.6
26	8°21.5	8°22.9	7°58.7	2.6 - 1.5    8.6 - 4.8    14.6 - 8.2	26	8°36.5	8°37.9	8°13.0	2.6 - 1.5    8.6 - 4.9    14.6 - 8.4	26	8°51.5	8°53.0	8°27.3	2.6 - 1.5    8.6 - 5.1    14.6 - 8.6
27	8°21.8	8°23.1	7°58.9	2.7 - 1.5    8.7 - 4.9    14.7 - 8.2	27	8°36.8	8°38.2	8°13.2	2.7 - 1.6    8.7 - 5.0    14.7 - 8.5	27	8°51.8	8°53.2	8°27.5	2.7 - 1.6    8.7 - 5.1    14.7 - 8.7
28	8°22.0	8°23.4	7°59.1	2.8 - 1.6    8.8 - 4.9    14.8 - 8.3	28	8°37.0	8°38.4	8°13.4	2.8 - 1.6    8.8 - 5.1    14.8 - 8.5	28	8°52.0	8°53.5	8°27.8	2.8 - 1.7    8.8 - 5.2    14.8 - 8.8
29	8°22.3	8°23.6	7°59.4	2.9 - 1.6    8.9 - 5.0    14.9 - 8.3	29	8°37.3	8°38.7	8°13.7	2.9 - 1.7    8.9 - 5.1    14.9 - 8.6	29	8°52.3	8°53.7	8°28.0	2.9 - 1.7    8.9 - 5.3    14.9 - 8.8
30	8°22.5	8°23.9	7°59.6	3.0 - 1.7    9.0 - 5.0    15.0 - 8.4	30	8°37.5	8°38.9	8°13.9	3.0 - 1.7    9.0 - 5.2    15.0 - 8.6	30	8°52.5	8°54.0	8°28.2	3.0 - 1.8    9.0 - 5.3    15.0 - 8.9
31	8°22.7	8°24.1	7°59.8	3.1 - 1.7    9.1 - 5.1    15.1 - 8.4	31	8°37.7	8°39.2	8°14.2	3.1 - 1.8    9.1 - 5.2    15.1 - 8.7	31	8°52.7	8°54.2	8°28.5	3.1 - 1.8    9.1 - 5.4    15.1 - 8.9
32	8°23.0	8°24.4	8°00.1	3.2 - 1.8    9.2 - 5.1    15.2 - 8.5	32	8°38.0	8°39.4	8°14.4	3.2 - 1.8    9.2 - 5.3    15.2 - 8.7	32	8°53.0	8°54.5	8°28.7	3.2 - 1.9    9.2 - 5.4    15.2 - 9.0
33	8°23.2	8°24.6	8°00.3	3.3 - 1.8    9.3 - 5.2    15.3 - 8.5	33	8°38.2	8°39.7	8°14.6	3.3 - 1.9    9.3 - 5.3    15.3 - 8.8	33	8°53.2	8°54.7	8°29.0	3.3 - 2.0    9.3 - 5.5    15.3 - 9.1
34	8°23.5	8°24.9	8°00.6	3.4 - 1.9    9.4 - 5.2    15.4 - 8.6	34	8°38.5	8°39.9	8°14.9	3.4 - 2.0    9.4 - 5.4    15.4 - 8.9	34	8°53.5	8°55.0	8°29.2	3.4 - 2.0    9.4 - 5.6    15.4 - 9.1
35	8°23.8	8°25.1	8°00.8	3.5 - 2.0    9.5 - 5.3    15.5 - 8.7	35	8°38.8	8°40.2	8°15.1	3.5 - 2.0    9.5 - 5.5    15.5 - 8.9	35	8°53.8	8°55.2	8°29.4	3.5 - 2.1    9.5 - 5.6    15.5 - 9.2
36	8°24.0	8°25.4	8°01.0	3.6 - 2.0    9.6 - 5.4    15.6 - 8.7	36	8°39.0	8°40.4	8°15.4	3.6 - 2.1    9.6 - 5.5    15.6 - 9.0	36	8°54.0	8°55.5	8°29.7	3.6 - 2.1    9.6 - 5.7    15.6 - 9.2
37	8°24.3	8°25.6	8°01.3	3.7 - 2.1    9.7 - 5.4    15.7 - 8.8	37	8°39.3	8°40.7	8°15.6	3.7 - 2.1    9.7 - 5.6    15.7 - 9.0	37	8°54.3	8°55.7	8°29.9	3.7 - 2.2    9.7 - 5.7    15.7 - 9.3
38	8°24.5	8°25.9	8°01.5	3.8 - 2.1    9.8 - 5.5    15.8 - 8.8	38	8°39.5	8°40.9	8°15.8	3.8 - 2.2    9.8 - 5.6    15.8 - 9.1	38	8°54.5	8°56.0	8°30.2	3.8 - 2.2    9.8 - 5.8    15.8 - 9.3
39	8°24.7	8°26.1	8°01.8	3.9 - 2.2    9.9 - 5.5    15.9 - 8.9	39	8°39.7	8°41.2	8°16.1	3.9 - 2.2    9.9 - 5.7    15.9 - 9.1	39	8°54.7	8°56.2	8°30.4	3.9 - 2.3    9.9 - 5.9    15.9 - 9.4
40	8°25.0	8°26.4	8°02.0	4.0 - 2.2    10.0 - 5.6    16.0 - 8.9	40	8°40.0	8°41.4	8°16.3	4.0 - 2.3    10.0 - 5.8    16.0 - 9.2	40	8°55.0	8°56.5	8°30.6	4.0 - 2.4    10.0 - 5.9    16.0 - 9.5
41	8°25.2	8°26.6	8°02.2	4.1 - 2.3    10.1 - 5.6    16.1 - 9.0	41	8°40.2	8°41.7	8°16.5	4.1 - 2.4    10.1 - 5.8    16.1 - 9.3	41	8°55.2	8°56.7	8°30.9	4.1 - 2.4    10.1 - 6.0    16.1 - 9.5
42	8°25.5	8°26.9	8°02.5	4.2 - 2.3    10.2 - 5.7    16.2 - 9.0	42	8°40.5	8°41.9	8°16.8	4.2 - 2.4    10.2 - 5.9    16.2 - 9.3	42	8°55.5	8°57.0	8°31.1	4.2 - 2.5    10.2 - 6.0    16.2 - 9.6
43	8°25.8	8°27.1	8°02.7	4.3 - 2.4    10.3 - 5.8    16.3 - 9.1	43	8°40.8	8°42.2	8°17.0	4.3 - 2.5    10.3 - 5.9    16.3 - 9.4	43	8°55.8	8°57.2	8°31.3	4.3 - 2.5    10.3 - 6.1    16.3 - 9.6
44	8°26.0	8°27.4	8°02.9	4.4 - 2.5    10.4 - 5.8    16.4 - 9.2	44	8°41.0	8°42.4	8°17.3	4.4 - 2.5    10.4 - 6.0    16.4 - 9.4	44	8°56.0	8°57.5	8°31.6	4.4 - 2.6    10.4 - 6.2    16.4 - 9.7
45	8°26.3	8°27.6	8°03.2	4.5 - 2.5    10.5 - 5.9    16.5 - 9.2	45	8°41.3	8°42.7	8°17.5	4.5 - 2.6    10.5 - 6.0    16.5 - 9.5	45	8°56.3	8°57.7	8°31.8	4.5 - 2.7    10.5 - 6.2    16.5 - 9.8
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## Increments and Corrections

m 36	Sun Plan.	Aries	Moon	v and d corr	m 37	Sun Plan.	Aries	Moon	v and d corr	m 38	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	0	9°15.0	9°16.5	8°49.7	0.0 - 0.0    6.0 - 3.8    12.0 - 7.5	0	9°30.0	9°31.6	9°04.0	0.0 - 0.0    6.0 - 3.9    12.0 - 7.7
1	9°00.2	9°01.7	8°35.6	0.1 - 0.1    6.1 - 3.7    12.1 - 7.4	1	9°15.2	9°16.8	8°50.0	0.1 - 0.1    6.1 - 3.8    12.1 - 7.6	1	9°30.2	9°31.8	9°04.3	0.1 - 0.1    6.1 - 3.9    12.1 - 7.8
2	9°00.5	9°02.0	8°35.9	0.2 - 0.1    6.2 - 3.8    12.2 - 7.4	2	9°15.5	9°17.0	8°50.2	0.2 - 0.1    6.2 - 3.9    12.2 - 7.6	2	9°30.5	9°32.1	9°04.5	0.2 - 0.1    6.2 - 4.0    12.2 - 7.8
3	9°00.7	9°02.2	8°36.1	0.3 - 0.2    6.3 - 3.8    12.3 - 7.5	3	9°15.7	9°17.3	8°50.4	0.3 - 0.2    6.3 - 3.9    12.3 - 7.7	3	9°30.7	9°32.3	9°04.7	0.3 - 0.2    6.3 - 4.0    12.3 - 7.9
4	9°01.0	9°02.5	8°36.4	0.4 - 0.2    6.4 - 3.9    12.4 - 7.5	4	9°16.0	9°17.5	8°50.7	0.4 - 0.3    6.4 - 4.0    12.4 - 7.8	4	9°31.0	9°32.6	9°05.0	0.4 - 0.3    6.4 - 4.1    12.4 - 8.0
5	9°01.3	9°02.7	8°36.6	0.5 - 0.3    6.5 - 4.0    12.5 - 7.6	5	9°16.3	9°17.8	8°50.9	0.5 - 0.3    6.5 - 4.1    12.5 - 7.8	5	9°31.3	9°32.8	9°05.2	0.5 - 0.3    6.5 - 4.2    12.5 - 8.0
6	9°01.5	9°03.0	8°36.8	0.6 - 0.4    6.6 - 4.0    12.6 - 7.7	6	9°16.5	9°18.0	8°51.1	0.6 - 0.4    6.6 - 4.1    12.6 - 7.9	6	9°31.5	9°33.1	9°05.5	0.6 - 0.4    6.6 - 4.2    12.6 - 8.1
7	9°01.8	9°03.2	8°37.1	0.7 - 0.4    6.7 - 4.1    12.7 - 7.7	7	9°16.8	9°18.3	8°51.4	0.7 - 0.4    6.7 - 4.2    12.7 - 7.9	7	9°31.8	9°33.3	9°05.7	0.7 - 0.4    6.7 - 4.3    12.7 - 8.1
8	9°02.0	9°03.5	8°37.3	0.8 - 0.5    6.8 - 4.1    12.8 - 7.8	8	9°17.0	9°18.5	8°51.6	0.8 - 0.5    6.8 - 4.3    12.8 - 8.0	8	9°32.0	9°33.6	9°05.9	0.8 - 0.5    6.8 - 4.4    12.8 - 8.2
9	9°02.2	9°03.7	8°37.5	0.9 - 0.5    6.9 - 4.2    12.9 - 7.8	9	9°17.2	9°18.8	8°51.9	0.9 - 0.6    6.9 - 4.3    12.9 - 8.1	9	9°32.2	9°33.8	9°06.2	0.9 - 0.6    6.9 - 4.4    12.9 - 8.3
10	9°02.5	9°04.0	8°37.8	1.0 - 0.6    7.0 - 4.3    13.0 - 7.9	10	9°17.5	9°19.0	8°52.1	1.0 - 0.6    7.0 - 4.4    13.0 - 8.1	10	9°32.5	9°34.1	9°06.4	1.0 - 0.6    7.0 - 4.5    13.0 - 8.3
11	9°02.7	9°04.2	8°38.0	1.1 - 0.7    7.1 - 4.3    13.1 - 8.0	11	9°17.7	9°19.3	8°52.3	1.1 - 0.7    7.1 - 4.4    13.1 - 8.2	11	9°32.7	9°34.3	9°06.7	1.1 - 0.7    7.1 - 4.6    13.1 - 8.4
12	9°03.0	9°04.5	8°38.3	1.2 - 0.7    7.2 - 4.4    13.2 - 8.0	12	9°18.0	9°19.5	8°52.6	1.2 - 0.8    7.2 - 4.5    13.2 - 8.3	12	9°33.0	9°34.6	9°06.9	1.2 - 0.8    7.2 - 4.6    13.2 - 8.5
13	9°03.3	9°04.7	8°38.5	1.3 - 0.8    7.3 - 4.4    13.3 - 8.1	13	9°18.3	9°19.8	8°52.8	1.3 - 0.8    7.3 - 4.6    13.3 - 8.3	13	9°33.3	9°34.8	9°07.1	1.3 - 0.8    7.3 - 4.7    13.3 - 8.5
14	9°03.5	9°05.0	8°38.7	1.4 - 0.9    7.4 - 4.5    13.4 - 8.2	14	9°18.5	9°20.0	8°53.1	1.4 - 0.9    7.4 - 4.6    13.4 - 8.4	14	9°33.5	9°35.1	9°07.4	1.4 - 0.9    7.4 - 4.7    13.4 - 8.6
15	9°03.8	9°05.2	8°39.0	1.5 - 0.9    7.5 - 4.6    13.5 - 8.2	15	9°18.8	9°20.3	8°53.3	1.5 - 0.9    7.5 - 4.7    13.5 - 8.4	15	9°33.8	9°35.3	9°07.6	1.5 - 1.0    7.5 - 4.8    13.5 - 8.7
16	9°04.0	9°05.5	8°39.2	1.6 - 1.0    7.6 - 4.6    13.6 - 8.3	16	9°19.0	9°20.5	8°53.5	1.6 - 1.0    7.6 - 4.8    13.6 - 8.5	16	9°34.0	9°35.6	9°07.9	1.6 - 1.0    7.6 - 4.9    13.6 - 8.7
17	9°04.2	9°05.7	8°39.5	1.7 - 1.0    7.7 - 4.7    13.7 - 8.3	17	9°19.2	9°20.8	8°53.8	1.7 - 1.1    7.7 - 4.8    13.7 - 8.6	17	9°34.2	9°35.8	9°08.1	1.7 - 1.1    7.7 - 4.9    13.7 - 8.8
18	9°04.5	9°06.0	8°39.7	1.8 - 1.1    7.8 - 4.7    13.8 - 8.4	18	9°19.5	9°21.0	8°54.0	1.8 - 1.1    7.8 - 4.9    13.8 - 8.6	18	9°34.5	9°36.1	9°08.3	1.8 - 1.2    7.8 - 5.0    13.8 - 8.9
19	9°04.8	9°06.2	8°39.9	1.9 - 1.2    7.9 - 4.8    13.9 - 8.5	19	9°19.8	9°21.3	8°54.3	1.9 - 1.2    7.9 - 4.9    13.9 - 8.7	19	9°34.8	9°36.3	9°08.6	1.9 - 1.2    7.9 - 5.1    13.9 - 8.9
20	9°05.0	9°06.5	8°40.2	2.0 - 1.2    8.0 - 4.9    14.0 - 8.5	20	9°20.0	9°21.5	8°54.5	2.0 - 1.3    8.0 - 5.0    14.0 - 8.8	20	9°35.0	9°36.6	9°08.8	2.0 - 1.3    8.0 - 5.1    14.0 - 9.0
21	9°05.3	9°06.7	8°40.4	2.1 - 1.3    8.1 - 4.9    14.1 - 8.6	21	9°20.3	9°21.8	8°54.7	2.1 - 1.3    8.1 - 5.1    14.1 - 8.8	21	9°35.3	9°36.8	9°09.0	2.1 - 1.3    8.1 - 5.2    14.1 - 9.0
22	9°05.5	9°07.0	8°40.6	2.2 - 1.3    8.2 - 5.0    14.2 - 8.6	22	9°20.5	9°22.0	8°55.0	2.2 - 1.4    8.2 - 5.1    14.2 - 8.9	22	9°35.5	9°37.1	9°09.3	2.2 - 1.4    8.2 - 5.3    14.2 - 9.1
23	9°05.7	9°07.2	8°40.9	2.3 - 1.4    8.3 - 5.0    14.3 - 8.7	23	9°20.7	9°22.3	8°55.2	2.3 - 1.4    8.3 - 5.2    14.3 - 8.9	23	9°35.7	9°37.3	9°09.5	2.3 - 1.5    8.3 - 5.3    14.3 - 9.2
24	9°06.0	9°07.5	8°41.1	2.4 - 1.5    8.4 - 5.1    14.4 - 8.8	24	9°21.0	9°22.5	8°55.4	2.4 - 1.5    8.4 - 5.3    14.4 - 9.0	24	9°36.0	9°37.6	9°09.8	2.4 - 1.5    8.4 - 5.4    14.4 - 9.2
25	9°06.2	9°07.7	8°41.4	2.5 - 1.5    8.5 - 5.2    14.5 - 8.8	25	9°21.2	9°22.8	8°55.7	2.5 - 1.6    8.5 - 5.3    14.5 - 9.1	25	9°36.2	9°37.8	9°10.0	2.5 - 1.6    8.5 - 5.5    14.5 - 9.3
26	9°06.5	9°08.0	8°41.6	2.6 - 1.6    8.6 - 5.2    14.6 - 8.9	26	9°21.5	9°23.0	8°55.9	2.6 - 1.6    8.6 - 5.4    14.6 - 9.1	26	9°36.5	9°38.1	9°10.2	2.6 - 1.7    8.6 - 5.5    14.6 - 9.4
27	9°06.8	9°08.2	8°41.8	2.7 - 1.6    8.7 - 5.3    14.7 - 8.9	27	9°21.8	9°23.3	8°56.2	2.7 - 1.7    8.7 - 5.4    14.7 - 9.2	27	9°36.8	9°38.3	9°10.5	2.7 - 1.7    8.7 - 5.6    14.7 - 9.4
28	9°07.0	9°08.5	8°42.1	2.8 - 1.7    8.8 - 5.4    14.8 - 9.0	28	9°22.0	9°23.5	8°56.4	2.8 - 1.8    8.8 - 5.5    14.8 - 9.3	28	9°37.0	9°38.6	9°10.7	2.8 - 1.8    8.8 - 5.6    14.8 - 9.5
29	9°07.3	9°08.7	8°42.3	2.9 - 1.8    8.9 - 5.4    14.9 - 9.1	29	9°22.3	9°23.8	8°56.6	2.9 - 1.8    8.9 - 5.6    14.9 - 9.3	29	9°37.3	9°38.8	9°11.0	2.9 - 1.9    8.9 - 5.7    14.9 - 9.6
30	9°07.5	9°09.0	8°42.6	3.0 - 1.8    9.0 - 5.5    15.0 - 9.1	30	9°22.5	9°24.0	8°56.9	3.0 - 1.9    9.0 - 5.6    15.0 - 9.4	30	9°37.5	9°39.1	9°11.2	3.0 - 1.9    9.0 - 5.8    15.0 - 9.6
31	9°07.7	9°09.2	8°42.8	3.1 - 1.9    9.1 - 5.5    15.1 - 9.2	31	9°22.7	9°24.3	8°57.1	3.1 - 1.9    9.1 - 5.7    15.1 - 9.4	31	9°37.7	9°39.3	9°11.4	3.1 - 2.0    9.1 - 5.8    15.1 - 9.7
32	9°08.0	9°09.5	8°43.0	3.2 - 1.9    9.2 - 5.6    15.2 - 9.2	32	9°23.0	9°24.5	8°57.4	3.2 - 2.0    9.2 - 5.8    15.2 - 9.5	32	9°38.0	9°39.6	9°11.7	3.2 - 2.1    9.2 - 5.9    15.2 - 9.8
33	9°08.2	9°09.7	8°43.3	3.3 - 2.0    9.3 - 5.7    15.3 - 9.3	33	9°23.2	9°24.8	8°57.6	3.3 - 2.1    9.3 - 5.8    15.3 - 9.6	33	9°38.2	9°39.8	9°11.9	3.3 - 2.1    9.3 - 6.0    15.3 - 9.8
34	9°08.5	9°10.0	8°43.5	3.4 - 2.1    9.4 - 5.7    15.4 - 9.4	34	9°23.5	9°25.0	8°57.8	3.4 - 2.1    9.4 - 5.9    15.4 - 9.6	34	9°38.5	9°40.1	9°12.1	3.4 - 2.2    9.4 - 6.0    15.4 - 9.9
35	9°08.8	9°10.2	8°43.8	3.5 - 2.1    9.5 - 5.8    15.5 - 9.4	35	9°23.8	9°25.3	8°58.1	3.5 - 2.2    9.5 - 5.9    15.5 - 9.7	35	9°38.8	9°40.3	9°12.4	3.5 - 2.2    9.5 - 6.1    15.5 - 9.9
36	9°09.0	9°10.5	8°44.0	3.6 - 2.2    9.6 - 5.8    15.6 - 9.5	36	9°24.0	9°25.5	8°58.3	3.6 - 2.3    9.6 - 6.0    15.6 - 9.8	36	9°39.0	9°40.6	9°12.6	3.6 - 2.3    9.6 - 6.2    15.6 - 10.0
37	9°09.3	9°10.8	8°44.2	3.7 - 2.3    9.7 - 5.9    15.7 - 9.6	37	9°24.3	9°25.8	8°58.5	3.7 - 2.3    9.7 - 6.1    15.7 - 9.8	37	9°39.3	9°40.8	9°12.9	3.7 - 2.4    9.7 - 6.2    15.7 - 10.1
38	9°09.5	9°11.0	8°44.5	3.8 - 2.3    9.8 - 6.0    15.8 - 9.6	38	9°24.5	9°26.0	8°58.8	3.8 - 2.4    9.8 - 6.1    15.8 - 9.9	38	9°39.5	9°41.1	9°13.1	3.8 - 2.4    9.8 - 6.3    15.8 - 10.1
39	9°09.7	9°11.3	8°44.7	3.9 - 2.4    9.9 - 6.0    15.9 - 9.7	39	9°24.7	9°26.3	8°59.0	3.9 - 2.4    9.9 - 6.2    15.9 - 9.9	39	9°39.7	9°41.3	9°13.3	3.9 - 2.5    9.9 - 6.4    15.9 - 10.2
40	9°10.0	9°11.5	8°44.9	4.0 - 2.4    10.0 - 6.1    16.0 - 9.7	40	9°25.0	9°26.5	8°59.3	4.0 - 2.5    10.0 - 6.3    16.0 - 10.0	40	9°40.0	9°41.6	9°13.6	4.0 - 2.6    10.0 - 6.4    16.0 - 10.3
41	9°10.2	9°11.8	8°45.2	4.1 - 2.5    10.1 - 6.1    16.1 - 9.8	41	9°25.2	9°26.8	8°59.5	4.1 - 2.6    10.1 - 6.3    16.1 - 10.1	41	9°40.2	9°41.8	9°13.8	4.1 - 2.6    10.1 - 6.5    16.1 - 10.3
42	9°10.5	9°12.0	8°45.4	4.2 - 2.6    10.2 - 6.2    16.2 - 9.9	42	9°25.5	9°27.0	8°59.7	4.2 - 2.6    10.2 - 6.4    16.2 - 10.1	42	9°40.5	9°42.1	9°14.1	4.2 - 2.7    10.2 - 6.5    16.2 - 10.4
43	9°10.8	9°12.3	8°45.7	4.3 - 2.6    10.3 - 6.3    16.3 - 9.9	43	9°25.8	9°27.3	9°00.0	4.3 - 2.7    10.3 - 6.4    16.3 - 10.2	43	9°40.8	9°42.3	9°14.3	4.3 - 2.8    10.3 - 6.6    16.3 - 10.5
44	9°11.0	9°12.5	8°45.9	4.4 - 2.7    10.4 - 6.3    16.4 - 10.0	44	9°26.0	9°27.5	9°00.2	4.4 - 2.8    10.4 - 6.5    16.4 - 10.3	44	9°41.0	9°42.6	9°14.5	4.4 - 2.8    10.4 - 6.7    16.4 - 10.5
45	9°11.3	9°12.8	8°46.1	4.5 - 2.7    10.5 - 6.4    16.5 - 10.0	45	9°26.3	9°27.8	9°00.5	4.5 - 2.8    10.5 - 6.6    16.5 - 10.3	45	9°41.3	9°42.8	9°14.8	4.5 - 2.9    10.5 - 6.7    16.5 - 10

## Increments and Corrections

m 39	Sun Plan.	Aries	Moon	v and d corr			m 40	Sun Plan.	Aries	Moon	v and d corr			m 41	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	0	10°00.0	10°01.6	9°32.7	0.0 - 0.0	6.0 - 4.1	12.0 - 8.1	0	10°15.0	10°16.7	9°47.0	0.0 - 0.0	6.0 - 4.2	12.0 - 8.3
1	9°45.2	9°46.8	9°18.6	0.1 - 0.1	6.1 - 4.0	12.1 - 8.0	1	10°00.2	10°01.9	9°32.9	0.1 - 0.1	6.1 - 4.1	12.1 - 8.2	1	10°15.2	10°16.9	9°47.2	0.1 - 0.1	6.1 - 4.2	12.1 - 8.4
2	9°45.5	9°47.1	9°18.8	0.2 - 0.1	6.2 - 4.1	12.2 - 8.0	2	10°00.5	10°02.1	9°33.1	0.2 - 0.1	6.2 - 4.2	12.2 - 8.2	2	10°15.5	10°17.2	9°47.5	0.2 - 0.1	6.2 - 4.3	12.2 - 8.4
3	9°45.7	9°47.4	9°19.1	0.3 - 0.2	6.3 - 4.1	12.3 - 8.1	3	10°00.7	10°02.4	9°33.4	0.3 - 0.2	6.3 - 4.3	12.3 - 8.3	3	10°15.7	10°17.4	9°47.7	0.3 - 0.2	6.3 - 4.4	12.3 - 8.5
4	9°46.0	9°47.6	9°19.3	0.4 - 0.3	6.4 - 4.2	12.4 - 8.2	4	10°01.0	10°02.6	9°33.6	0.4 - 0.3	6.4 - 4.3	12.4 - 8.4	4	10°16.0	10°17.7	9°47.9	0.4 - 0.3	6.4 - 4.4	12.4 - 8.6
5	9°46.3	9°47.9	9°19.5	0.5 - 0.3	6.5 - 4.3	12.5 - 8.2	5	10°01.3	10°02.9	9°33.9	0.5 - 0.3	6.5 - 4.4	12.5 - 8.4	5	10°16.3	10°17.9	9°48.2	0.5 - 0.3	6.5 - 4.5	12.5 - 8.6
6	9°46.5	9°48.1	9°19.8	0.6 - 0.4	6.6 - 4.3	12.6 - 8.3	6	10°01.5	10°03.1	9°34.1	0.6 - 0.4	6.6 - 4.5	12.6 - 8.5	6	10°16.5	10°18.2	9°48.4	0.6 - 0.4	6.6 - 4.6	12.6 - 8.7
7	9°46.8	9°48.4	9°20.0	0.7 - 0.5	6.7 - 4.4	12.7 - 8.4	7	10°01.8	10°03.4	9°34.3	0.7 - 0.5	6.7 - 4.5	12.7 - 8.6	7	10°16.8	10°18.4	9°48.7	0.7 - 0.5	6.7 - 4.6	12.7 - 8.8
8	9°47.0	9°48.6	9°20.3	0.8 - 0.5	6.8 - 4.5	12.8 - 8.4	8	10°02.0	10°03.6	9°34.6	0.8 - 0.5	6.8 - 4.6	12.8 - 8.6	8	10°17.0	10°18.7	9°48.9	0.8 - 0.6	6.8 - 4.7	12.8 - 8.9
9	9°47.2	9°48.9	9°20.5	0.9 - 0.6	6.9 - 4.5	12.9 - 8.5	9	10°02.2	10°03.9	9°34.8	0.9 - 0.6	6.9 - 4.7	12.9 - 8.7	9	10°17.2	10°18.9	9°49.1	0.9 - 0.6	6.9 - 4.8	12.9 - 8.9
10	9°47.5	9°49.1	9°20.7	1.0 - 0.7	7.0 - 4.6	13.0 - 8.6	10	10°02.5	10°04.1	9°35.1	1.0 - 0.7	7.0 - 4.7	13.0 - 8.8	10	10°17.5	10°19.2	9°49.4	1.0 - 0.7	7.0 - 4.8	13.0 - 9.0
11	9°47.7	9°49.4	9°21.0	1.1 - 0.7	7.1 - 4.7	13.1 - 8.6	11	10°02.7	10°04.4	9°35.3	1.1 - 0.7	7.1 - 4.8	13.1 - 8.8	11	10°17.7	10°19.4	9°49.6	1.1 - 0.8	7.1 - 4.9	13.1 - 9.1
12	9°48.0	9°49.6	9°21.2	1.2 - 0.8	7.2 - 4.7	13.2 - 8.7	12	10°03.0	10°04.6	9°35.5	1.2 - 0.8	7.2 - 4.9	13.2 - 8.9	12	10°18.0	10°19.7	9°49.8	1.2 - 0.8	7.2 - 5.0	13.2 - 9.1
13	9°48.3	9°49.9	9°21.5	1.3 - 0.9	7.3 - 4.8	13.3 - 8.8	13	10°03.3	10°04.9	9°35.8	1.3 - 0.9	7.3 - 4.9	13.3 - 9.0	13	10°18.3	10°19.9	9°50.1	1.3 - 0.9	7.3 - 5.0	13.3 - 9.2
14	9°48.5	9°50.1	9°21.7	1.4 - 0.9	7.4 - 4.9	13.4 - 8.8	14	10°03.5	10°05.1	9°36.0	1.4 - 0.9	7.4 - 5.0	13.4 - 9.0	14	10°18.5	10°20.2	9°50.3	1.4 - 1.0	7.4 - 5.1	13.4 - 9.3
15	9°48.8	9°50.4	9°21.9	1.5 - 1.0	7.5 - 4.9	13.5 - 8.9	15	10°03.8	10°05.4	9°36.2	1.5 - 1.0	7.5 - 5.1	13.5 - 9.1	15	10°18.8	10°20.4	9°50.6	1.5 - 1.0	7.5 - 5.2	13.5 - 9.3
16	9°49.0	9°50.6	9°22.2	1.6 - 1.1	7.6 - 5.0	13.6 - 9.0	16	10°04.0	10°05.7	9°36.5	1.6 - 1.1	7.6 - 5.1	13.6 - 9.2	16	10°19.0	10°20.7	9°50.8	1.6 - 1.1	7.6 - 5.3	13.6 - 9.4
17	9°49.2	9°50.9	9°22.4	1.7 - 1.1	7.7 - 5.1	13.7 - 9.0	17	10°04.2	10°05.9	9°36.7	1.7 - 1.1	7.7 - 5.2	13.7 - 9.2	17	10°19.2	10°20.9	9°51.0	1.7 - 1.2	7.7 - 5.3	13.7 - 9.5
18	9°49.5	9°51.1	9°22.6	1.8 - 1.2	7.8 - 5.1	13.8 - 9.1	18	10°04.5	10°06.2	9°37.0	1.8 - 1.2	7.8 - 5.3	13.8 - 9.3	18	10°19.5	10°21.2	9°51.3	1.8 - 1.2	7.8 - 5.4	13.8 - 9.5
19	9°49.8	9°51.4	9°22.9	1.9 - 1.3	7.9 - 5.2	13.9 - 9.2	19	10°04.8	10°06.4	9°37.2	1.9 - 1.3	7.9 - 5.3	13.9 - 9.4	19	10°19.8	10°21.4	9°51.5	1.9 - 1.3	7.9 - 5.5	13.9 - 9.6
20	9°50.0	9°51.6	9°23.1	2.0 - 1.3	8.0 - 5.3	14.0 - 9.2	20	10°05.0	10°06.7	9°37.4	2.0 - 1.4	8.0 - 5.4	14.0 - 9.5	20	10°20.0	10°21.7	9°51.8	2.0 - 1.4	8.0 - 5.5	14.0 - 9.7
21	9°50.3	9°51.9	9°23.4	2.1 - 1.4	8.1 - 5.3	14.1 - 9.3	21	10°05.3	10°06.9	9°37.7	2.1 - 1.4	8.1 - 5.5	14.1 - 9.5	21	10°20.3	10°21.9	9°52.0	2.1 - 1.5	8.1 - 5.6	14.1 - 9.8
22	9°50.5	9°52.1	9°23.6	2.2 - 1.4	8.2 - 5.4	14.2 - 9.3	22	10°05.5	10°07.2	9°37.9	2.2 - 1.5	8.2 - 5.5	14.2 - 9.6	22	10°20.5	10°22.2	9°52.2	2.2 - 1.5	8.2 - 5.7	14.2 - 9.8
23	9°50.7	9°52.4	9°23.8	2.3 - 1.5	8.3 - 5.5	14.3 - 9.4	23	10°05.7	10°07.4	9°38.2	2.3 - 1.6	8.3 - 5.6	14.3 - 9.7	23	10°20.7	10°22.4	9°52.5	2.3 - 1.6	8.3 - 5.7	14.3 - 9.9
24	9°51.0	9°52.6	9°24.1	2.4 - 1.6	8.4 - 5.5	14.4 - 9.5	24	10°06.0	10°07.7	9°38.4	2.4 - 1.6	8.4 - 5.7	14.4 - 9.7	24	10°21.0	10°22.7	9°52.7	2.4 - 1.7	8.4 - 5.8	14.4 - 10.0
25	9°51.2	9°52.9	9°24.3	2.5 - 1.6	8.5 - 5.6	14.5 - 9.5	25	10°06.2	10°07.9	9°38.6	2.5 - 1.7	8.5 - 5.7	14.5 - 9.8	25	10°21.2	10°22.9	9°52.9	2.5 - 1.7	8.5 - 5.9	14.5 - 10.0
26	9°51.5	9°53.1	9°24.6	2.6 - 1.7	8.6 - 5.7	14.6 - 9.6	26	10°06.5	10°08.2	9°38.9	2.6 - 1.8	8.6 - 5.8	14.6 - 9.9	26	10°21.5	10°23.2	9°53.2	2.6 - 1.8	8.6 - 5.9	14.6 - 10.1
27	9°51.8	9°53.4	9°24.8	2.7 - 1.8	8.7 - 5.7	14.7 - 9.7	27	10°06.8	10°08.4	9°39.1	2.7 - 1.8	8.7 - 5.9	14.7 - 9.9	27	10°21.8	10°23.4	9°53.4	2.7 - 1.9	8.7 - 6.0	14.7 - 10.2
28	9°52.0	9°53.6	9°25.0	2.8 - 1.8	8.8 - 5.8	14.8 - 9.7	28	10°07.0	10°08.7	9°39.3	2.8 - 1.9	8.8 - 5.9	14.8 - 10.0	28	10°22.0	10°23.7	9°53.7	2.8 - 1.9	8.8 - 6.1	14.8 - 10.2
29	9°52.3	9°53.9	9°25.3	2.9 - 1.9	8.9 - 5.9	14.9 - 9.8	29	10°07.3	10°08.9	9°39.6	2.9 - 2.0	8.9 - 6.0	14.9 - 10.1	29	10°22.3	10°24.0	9°53.9	2.9 - 2.0	8.9 - 6.2	14.9 - 10.3
30	9°52.5	9°54.1	9°25.5	3.0 - 2.0	9.0 - 5.9	15.0 - 9.9	30	10°07.5	10°09.2	9°39.8	3.0 - 2.0	9.0 - 6.1	15.0 - 10.1	30	10°22.5	10°24.2	9°54.1	3.0 - 2.1	9.0 - 6.2	15.0 - 10.4
31	9°52.7	9°54.4	9°25.7	3.1 - 2.0	9.1 - 6.0	15.1 - 9.9	31	10°07.7	10°09.4	9°40.1	3.1 - 2.1	9.1 - 6.1	15.1 - 10.2	31	10°22.7	10°24.5	9°54.4	3.1 - 2.1	9.1 - 6.3	15.1 - 10.4
32	9°53.0	9°54.6	9°26.0	3.2 - 2.1	9.2 - 6.1	15.2 - 10.0	32	10°08.0	10°09.7	9°40.3	3.2 - 2.2	9.2 - 6.2	15.2 - 10.3	32	10°23.0	10°24.7	9°54.6	3.2 - 2.2	9.2 - 6.4	15.2 - 10.5
33	9°53.2	9°54.9	9°26.2	3.3 - 2.2	9.3 - 6.1	15.3 - 10.1	33	10°08.2	10°09.9	9°40.5	3.3 - 2.2	9.3 - 6.3	15.3 - 10.3	33	10°23.2	10°25.0	9°54.9	3.3 - 2.3	9.3 - 6.4	15.3 - 10.6
34	9°53.5	9°55.1	9°26.5	3.4 - 2.2	9.4 - 6.2	15.4 - 10.1	34	10°08.5	10°10.2	9°40.8	3.4 - 2.3	9.4 - 6.3	15.4 - 10.4	34	10°23.5	10°25.2	9°55.1	3.4 - 2.4	9.4 - 6.5	15.4 - 10.7
35	9°53.8	9°55.4	9°26.7	3.5 - 2.3	9.5 - 6.3	15.5 - 10.2	35	10°08.8	10°10.4	9°41.0	3.5 - 2.4	9.5 - 6.4	15.5 - 10.5	35	10°23.8	10°25.5	9°55.3	3.5 - 2.4	9.5 - 6.6	15.5 - 10.7
36	9°54.0	9°55.6	9°26.9	3.6 - 2.4	9.6 - 6.3	15.6 - 10.3	36	10°09.0	10°10.7	9°41.3	3.6 - 2.4	9.6 - 6.5	15.6 - 10.5	36	10°24.0	10°25.7	9°55.6	3.6 - 2.5	9.6 - 6.6	15.6 - 10.8
37	9°54.3	9°55.9	9°27.2	3.7 - 2.4	9.7 - 6.4	15.7 - 10.3	37	10°09.3	10°10.9	9°41.5	3.7 - 2.5	9.7 - 6.5	15.7 - 10.6	37	10°24.3	10°26.0	9°55.8	3.7 - 2.6	9.7 - 6.7	15.7 - 10.9
38	9°54.5	9°56.1	9°27.4	3.8 - 2.5	9.8 - 6.5	15.8 - 10.4	38	10°09.5	10°11.2	9°41.7	3.8 - 2.6	9.8 - 6.6	15.8 - 10.7	38	10°24.5	10°26.2	9°56.1	3.8 - 2.6	9.8 - 6.8	15.8 - 10.9
39	9°54.7	9°56.4	9°27.7	3.9 - 2.6	9.9 - 6.5	15.9 - 10.5	39	10°09.7	10°11.4	9°42.0	3.9 - 2.6	9.9 - 6.7	15.9 - 10.7	39	10°24.7	10°26.5	9°56.3	3.9 - 2.7	9.9 - 6.8	15.9 - 11.0
40	9°55.0	9°56.6	9°27.9	4.0 - 2.6	10.0 - 6.6	16.0 - 10.5	40	10°10.0	10°11.7	9°42.2	4.0 - 2.7	10.0 - 6.8	16.0 - 10.8	40	10°25.0	10°26.7	9°56.5	4.0 - 2.8	10.0 - 6.9	16.0 - 11.1
41	9°55.2	9°56.9	9°28.1	4.1 - 2.7	10.1 - 6.6	16.1 - 10.6	41	10°10.2	10°11.9	9°42.4	4.1 - 2.8	10.1 - 6.8	16.1 - 10.9	41	10°25.2	10°27.0	9°56.8	4.1 - 2.8	10.1 - 7.0	16.1 - 11.1
42	9°55.5	9°57.1	9°28.4	4.2 - 2.8	10.2 - 6.7	16.2 - 10.7	42	10°10.5	10°12.2	9°42.7	4.2 - 2.8	10.								

## Increments and Corrections

m 42	Sun Plan.	Aries	Moon	v and d corr	m 43	Sun Plan.	Aries	Moon	v and d corr	m 44	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	0	10°45.0	10°46.8	10°15.6	0.0 - 0.0	6.0 - 4.3	12.0 - 8.7	0	11°00.0	11°01.8	10°29.9	0.0 - 0.0	6.0 - 4.5	12.0 - 8.9
1	10°30.2	10°32.0	10°01.5	0.1 - 0.1	6.1 - 4.3	12.1 - 8.6	1	10°45.2	10°47.0	10°15.9	0.1 - 0.1	6.1 - 4.4	12.1 - 8.8	1	11°00.2	11°02.1	10°30.2	0.1 - 0.1	6.1 - 4.5	12.1 - 9.0
2	10°30.5	10°32.2	10°01.8	0.2 - 0.1	6.2 - 4.4	12.2 - 8.6	2	10°45.5	10°47.3	10°16.1	0.2 - 0.1	6.2 - 4.5	12.2 - 8.8	2	11°00.5	11°02.3	10°30.4	0.2 - 0.1	6.2 - 4.6	12.2 - 9.0
3	10°30.7	10°32.5	10°02.0	0.3 - 0.2	6.3 - 4.5	12.3 - 8.7	3	10°45.7	10°47.5	10°16.3	0.3 - 0.2	6.3 - 4.6	12.3 - 8.9	3	11°00.7	11°02.6	10°30.6	0.3 - 0.2	6.3 - 4.7	12.3 - 9.1
4	10°31.0	10°32.7	10°02.3	0.4 - 0.3	6.4 - 4.5	12.4 - 8.8	4	10°46.0	10°47.8	10°16.6	0.4 - 0.3	6.4 - 4.6	12.4 - 9.0	4	11°01.0	11°02.8	10°30.9	0.4 - 0.3	6.4 - 4.7	12.4 - 9.2
5	10°31.3	10°33.0	10°02.5	0.5 - 0.4	6.5 - 4.6	12.5 - 8.9	5	10°46.3	10°48.0	10°16.8	0.5 - 0.4	6.5 - 4.7	12.5 - 9.1	5	11°01.3	11°03.1	10°31.1	0.5 - 0.4	6.5 - 4.8	12.5 - 9.3
6	10°31.5	10°33.2	10°02.7	0.6 - 0.4	6.6 - 4.7	12.6 - 8.9	6	10°46.5	10°48.3	10°17.0	0.6 - 0.4	6.6 - 4.8	12.6 - 9.1	6	11°01.5	11°03.3	10°31.4	0.6 - 0.4	6.6 - 4.9	12.6 - 9.3
7	10°31.8	10°33.5	10°03.0	0.7 - 0.5	6.7 - 4.7	12.7 - 9.0	7	10°46.8	10°48.5	10°17.3	0.7 - 0.5	6.7 - 4.9	12.7 - 9.2	7	11°01.8	11°03.6	10°31.6	0.7 - 0.5	6.7 - 5.0	12.7 - 9.4
8	10°32.0	10°33.7	10°03.2	0.8 - 0.6	6.8 - 4.8	12.8 - 9.1	8	10°47.0	10°48.8	10°17.5	0.8 - 0.6	6.8 - 4.9	12.8 - 9.3	8	11°02.0	11°03.8	10°31.8	0.8 - 0.6	6.8 - 5.0	12.8 - 9.5
9	10°32.2	10°34.0	10°03.4	0.9 - 0.6	6.9 - 4.9	12.9 - 9.1	9	10°47.2	10°49.0	10°17.8	0.9 - 0.7	6.9 - 5.0	12.9 - 9.4	9	11°02.2	11°04.1	10°32.1	0.9 - 0.7	6.9 - 5.1	12.9 - 9.6
10	10°32.5	10°34.2	10°03.7	1.0 - 0.7	7.0 - 5.0	13.0 - 9.2	10	10°47.5	10°49.3	10°18.0	1.0 - 0.7	7.0 - 5.1	13.0 - 9.4	10	11°02.5	11°04.3	10°32.3	1.0 - 0.7	7.0 - 5.2	13.0 - 9.6
11	10°32.7	10°34.5	10°03.9	1.1 - 0.8	7.1 - 5.0	13.1 - 9.3	11	10°47.7	10°49.5	10°18.2	1.1 - 0.8	7.1 - 5.1	13.1 - 9.5	11	11°02.7	11°04.6	10°32.6	1.1 - 0.8	7.1 - 5.3	13.1 - 9.7
12	10°33.0	10°34.7	10°04.2	1.2 - 0.9	7.2 - 5.1	13.2 - 9.3	12	10°48.0	10°49.8	10°18.5	1.2 - 0.9	7.2 - 5.2	13.2 - 9.6	12	11°03.0	11°04.8	10°32.8	1.2 - 0.9	7.2 - 5.3	13.2 - 9.8
13	10°33.3	10°35.0	10°04.4	1.3 - 0.9	7.3 - 5.2	13.3 - 9.4	13	10°48.3	10°50.0	10°18.7	1.3 - 0.9	7.3 - 5.3	13.3 - 9.6	13	11°03.3	11°05.1	10°33.0	1.3 - 1.0	7.3 - 5.4	13.3 - 9.9
14	10°33.5	10°35.2	10°04.6	1.4 - 1.0	7.4 - 5.2	13.4 - 9.5	14	10°48.5	10°50.3	10°19.0	1.4 - 1.0	7.4 - 5.4	13.4 - 9.7	14	11°03.5	11°05.3	10°33.3	1.4 - 1.0	7.4 - 5.5	13.4 - 9.9
15	10°33.8	10°35.5	10°04.9	1.5 - 1.1	7.5 - 5.3	13.5 - 9.6	15	10°48.8	10°50.5	10°19.2	1.5 - 1.1	7.5 - 5.4	13.5 - 9.8	15	11°03.8	11°05.6	10°33.5	1.5 - 1.1	7.5 - 5.6	13.5 - 10.0
16	10°34.0	10°35.7	10°05.1	1.6 - 1.1	7.6 - 5.4	13.6 - 9.6	16	10°49.0	10°50.8	10°19.4	1.6 - 1.2	7.6 - 5.5	13.6 - 9.9	16	11°04.0	11°05.8	10°33.8	1.6 - 1.2	7.6 - 5.6	13.6 - 10.1
17	10°34.2	10°36.0	10°05.4	1.7 - 1.2	7.7 - 5.5	13.7 - 9.7	17	10°49.2	10°51.0	10°19.7	1.7 - 1.2	7.7 - 5.6	13.7 - 9.9	17	11°04.2	11°06.1	10°34.0	1.7 - 1.3	7.7 - 5.7	13.7 - 10.2
18	10°34.5	10°36.2	10°05.6	1.8 - 1.3	7.8 - 5.5	13.8 - 9.8	18	10°49.5	10°51.3	10°19.9	1.8 - 1.3	7.8 - 5.7	13.8 - 10.0	18	11°04.5	11°06.3	10°34.2	1.8 - 1.3	7.8 - 5.8	13.8 - 10.2
19	10°34.8	10°36.5	10°05.8	1.9 - 1.3	7.9 - 5.6	13.9 - 9.8	19	10°49.8	10°51.5	10°20.2	1.9 - 1.4	7.9 - 5.7	13.9 - 10.1	19	11°04.8	11°06.6	10°34.5	1.9 - 1.4	7.9 - 5.9	13.9 - 10.3
20	10°35.0	10°36.7	10°06.1	2.0 - 1.4	8.0 - 5.7	14.0 - 9.9	20	10°50.0	10°51.8	10°20.4	2.0 - 1.4	8.0 - 5.8	14.0 - 10.2	20	11°05.0	11°06.8	10°34.7	2.0 - 1.5	8.0 - 5.9	14.0 - 10.4
21	10°35.3	10°37.0	10°06.3	2.1 - 1.5	8.1 - 5.7	14.1 - 10.0	21	10°50.3	10°52.0	10°20.6	2.1 - 1.5	8.1 - 5.9	14.1 - 10.2	21	11°05.3	11°07.1	10°34.9	2.1 - 1.6	8.1 - 6.0	14.1 - 10.5
22	10°35.5	10°37.2	10°06.5	2.2 - 1.6	8.2 - 5.8	14.2 - 10.1	22	10°50.5	10°52.3	10°20.9	2.2 - 1.6	8.2 - 5.9	14.2 - 10.3	22	11°05.5	11°07.3	10°35.2	2.2 - 1.6	8.2 - 6.1	14.2 - 10.5
23	10°35.7	10°37.5	10°06.8	2.3 - 1.6	8.3 - 5.9	14.3 - 10.1	23	10°50.7	10°52.5	10°21.1	2.3 - 1.7	8.3 - 6.0	14.3 - 10.4	23	11°05.7	11°07.6	10°35.4	2.3 - 1.7	8.3 - 6.2	14.3 - 10.6
24	10°36.0	10°37.7	10°07.0	2.4 - 1.7	8.4 - 6.0	14.4 - 10.2	24	10°51.0	10°52.8	10°21.3	2.4 - 1.7	8.4 - 6.1	14.4 - 10.4	24	11°06.0	11°07.8	10°35.7	2.4 - 1.8	8.4 - 6.2	14.4 - 10.7
25	10°36.2	10°38.0	10°07.3	2.5 - 1.8	8.5 - 6.0	14.5 - 10.3	25	10°51.2	10°53.0	10°21.6	2.5 - 1.8	8.5 - 6.2	14.5 - 10.5	25	11°06.2	11°08.1	10°35.9	2.5 - 1.9	8.5 - 6.3	14.5 - 10.8
26	10°36.5	10°38.2	10°07.5	2.6 - 1.8	8.6 - 6.1	14.6 - 10.3	26	10°51.5	10°53.3	10°21.8	2.6 - 1.9	8.6 - 6.2	14.6 - 10.6	26	11°06.5	11°08.3	10°36.1	2.6 - 1.9	8.6 - 6.4	14.6 - 10.8
27	10°36.8	10°38.5	10°07.7	2.7 - 1.9	8.7 - 6.2	14.7 - 10.4	27	10°51.8	10°53.5	10°22.1	2.7 - 2.0	8.7 - 6.3	14.7 - 10.7	27	11°06.8	11°08.6	10°36.4	2.7 - 2.0	8.7 - 6.5	14.7 - 10.9
28	10°37.0	10°38.7	10°08.0	2.8 - 2.0	8.8 - 6.2	14.8 - 10.5	28	10°52.0	10°53.8	10°22.3	2.8 - 2.0	8.8 - 6.4	14.8 - 10.7	28	11°07.0	11°08.8	10°36.6	2.8 - 2.1	8.8 - 6.5	14.8 - 11.0
29	10°37.3	10°39.0	10°08.2	2.9 - 2.1	8.9 - 6.3	14.9 - 10.6	29	10°52.3	10°54.0	10°22.5	2.9 - 2.1	8.9 - 6.5	14.9 - 10.8	29	11°07.3	11°09.1	10°36.9	2.9 - 2.2	8.9 - 6.6	14.9 - 11.1
30	10°37.5	10°39.2	10°08.5	3.0 - 2.1	9.0 - 6.4	15.0 - 10.6	30	10°52.5	10°54.3	10°22.8	3.0 - 2.2	9.0 - 6.5	15.0 - 10.9	30	11°07.5	11°09.3	10°37.1	3.0 - 2.2	9.0 - 6.7	15.0 - 11.1
31	10°37.7	10°39.5	10°08.7	3.1 - 2.2	9.1 - 6.4	15.1 - 10.7	31	10°52.7	10°54.5	10°23.0	3.1 - 2.2	9.1 - 6.6	15.1 - 10.9	31	11°07.7	11°09.6	10°37.3	3.1 - 2.3	9.1 - 6.7	15.1 - 11.2
32	10°38.0	10°39.7	10°08.9	3.2 - 2.3	9.2 - 6.5	15.2 - 10.8	32	10°53.0	10°54.8	10°23.3	3.2 - 2.3	9.2 - 6.7	15.2 - 11.0	32	11°08.0	11°09.8	10°37.6	3.2 - 2.4	9.2 - 6.8	15.2 - 11.3
33	10°38.2	10°40.0	10°09.2	3.3 - 2.3	9.3 - 6.6	15.3 - 10.8	33	10°53.2	10°55.0	10°23.5	3.3 - 2.4	9.3 - 6.7	15.3 - 11.1	33	11°08.2	11°10.1	10°37.8	3.3 - 2.4	9.3 - 6.9	15.3 - 11.3
34	10°38.5	10°40.2	10°09.4	3.4 - 2.4	9.4 - 6.7	15.4 - 10.9	34	10°53.5	10°55.3	10°23.7	3.4 - 2.5	9.4 - 6.8	15.4 - 11.2	34	11°08.5	11°10.3	10°38.0	3.4 - 2.5	9.4 - 7.0	15.4 - 11.4
35	10°38.8	10°40.5	10°09.7	3.5 - 2.5	9.5 - 6.7	15.5 - 11.0	35	10°53.8	10°55.5	10°24.0	3.5 - 2.5	9.5 - 6.9	15.5 - 11.2	35	11°08.8	11°10.6	10°38.3	3.5 - 2.6	9.5 - 7.0	15.5 - 11.5
36	10°39.0	10°40.7	10°09.9	3.6 - 2.6	9.6 - 6.8	15.6 - 11.1	36	10°54.0	10°55.8	10°24.2	3.6 - 2.6	9.6 - 7.0	15.6 - 11.3	36	11°09.0	11°10.8	10°38.5	3.6 - 2.7	9.6 - 7.1	15.6 - 11.6
37	10°39.3	10°41.0	10°10.1	3.7 - 2.6	9.7 - 6.9	15.7 - 11.1	37	10°54.3	10°56.0	10°24.4	3.7 - 2.7	9.7 - 7.0	15.7 - 11.4	37	11°09.3	11°11.1	10°38.8	3.7 - 2.7	9.7 - 7.2	15.7 - 11.6
38	10°39.5	10°41.2	10°10.4	3.8 - 2.7	9.8 - 6.9	15.8 - 11.2	38	10°54.5	10°56.3	10°24.7	3.8 - 2.8	9.8 - 7.1	15.8 - 11.5	38	11°09.5	11°11.3	10°39.0	3.8 - 2.8	9.8 - 7.3	15.8 - 11.7
39	10°39.7	10°41.5	10°10.6	3.9 - 2.8	9.9 - 7.0	15.9 - 11.3	39	10°54.7	10°56.5	10°24.9	3.9 - 2.8	9.9 - 7.2	15.9 - 11.5	39	11°09.7	11°11.6	10°39.2	3.9 - 2.9	9.9 - 7.3	15.9 - 11.8
40	10°40.0	10°41.7	10°10.8	4.0 - 2.8	10.0 - 7.1	16.0 - 11.3	40	10°55.0	10°56.8	10°25.2	4.0 - 2.9	10.0 - 7.3	16.0 - 11.6	40	11°10.0	11°11.8	10°39.5	4.0 - 3.0	10.0 - 7.4	16.0 - 11.9
41	10°40.2	10°42.0	10°11.1	4.1 - 2.9	10.1 - 7.2	16.1 - 11.4	41	10°55.2	10°57.0	10°25.4	4.1 - 3.0	10.1 - 7.3	16.1 - 11.7	41	11°10.2	11°12.1	10°39.7	4.1 - 3.0	10.1 - 7.5	16.1 - 11.9</td

## Increments and Corrections

m 45	Sun Plan.	Aries	Moon	v and d corr	m 46	Sun Plan.	Aries	Moon	v and d corr	m 47	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	0	11°30.0	11°31.9	10°58.6	0.0 - 0.0	6.0 - 4.7	12.0 - 9.3	0	11°45.0	11°46.9	11°12.9	0.0 - 0.0	6.0 - 4.8	12.0 - 9.5
1	11°15.2	11°17.1	10°44.5	0.1 - 0.1	6.1 - 4.6	12.1 - 9.2	1	11°30.2	11°32.1	10°58.8	0.1 - 0.1	6.1 - 4.7	12.1 - 9.4	1	11°45.2	11°47.2	11°13.1	0.1 - 0.1	6.1 - 4.8	12.1 - 9.6
2	11°15.5	11°17.3	10°44.7	0.2 - 0.2	6.2 - 4.7	12.2 - 9.3	2	11°30.5	11°32.4	10°59.0	0.2 - 0.2	6.2 - 4.8	12.2 - 9.5	2	11°45.5	11°47.4	11°13.4	0.2 - 0.2	6.2 - 4.9	12.2 - 9.7
3	11°15.7	11°17.6	10°45.0	0.3 - 0.2	6.3 - 4.8	12.3 - 9.3	3	11°30.7	11°32.6	10°59.3	0.3 - 0.2	6.3 - 4.9	12.3 - 9.5	3	11°45.7	11°47.7	11°13.6	0.3 - 0.2	6.3 - 5.0	12.3 - 9.7
4	11°16.0	11°17.8	10°45.2	0.4 - 0.3	6.4 - 4.9	12.4 - 9.4	4	11°31.0	11°32.9	10°59.5	0.4 - 0.3	6.4 - 5.0	12.4 - 9.6	4	11°46.0	11°47.9	11°13.8	0.4 - 0.3	6.4 - 5.1	12.4 - 9.8
5	11°16.3	11°18.1	10°45.4	0.5 - 0.4	6.5 - 4.9	12.5 - 9.5	5	11°31.3	11°33.1	10°59.8	0.5 - 0.4	6.5 - 5.0	12.5 - 9.7	5	11°46.3	11°48.2	11°14.1	0.5 - 0.4	6.5 - 5.1	12.5 - 9.9
6	11°16.5	11°18.3	10°45.7	0.6 - 0.5	6.6 - 5.0	12.6 - 9.6	6	11°31.5	11°33.4	11°00.0	0.6 - 0.5	6.6 - 5.1	12.6 - 9.8	6	11°46.5	11°48.4	11°14.3	0.6 - 0.5	6.6 - 5.2	12.6 - 10.0
7	11°16.8	11°18.6	10°45.9	0.7 - 0.5	6.7 - 5.1	12.7 - 9.6	7	11°31.8	11°33.6	11°00.2	0.7 - 0.5	6.7 - 5.2	12.7 - 9.8	7	11°46.8	11°48.7	11°14.6	0.7 - 0.6	6.7 - 5.3	12.7 - 10.1
8	11°17.0	11°18.9	10°46.2	0.8 - 0.6	6.8 - 5.2	12.8 - 9.7	8	11°32.0	11°33.9	11°00.5	0.8 - 0.6	6.8 - 5.3	12.8 - 9.9	8	11°47.0	11°48.9	11°14.8	0.8 - 0.6	6.8 - 5.4	12.8 - 10.1
9	11°17.2	11°19.1	10°46.4	0.9 - 0.7	6.9 - 5.2	12.9 - 9.8	9	11°32.2	11°34.1	11°00.7	0.9 - 0.7	6.9 - 5.3	12.9 - 10.0	9	11°47.2	11°49.2	11°15.0	0.9 - 0.7	6.9 - 5.5	12.9 - 10.2
10	11°17.5	11°19.4	10°46.6	1.0 - 0.8	7.0 - 5.3	13.0 - 9.9	10	11°32.5	11°34.4	11°01.0	1.0 - 0.8	7.0 - 5.4	13.0 - 10.1	10	11°47.5	11°49.4	11°15.3	1.0 - 0.8	7.0 - 5.5	13.0 - 10.3
11	11°17.7	11°19.6	10°46.9	1.1 - 0.8	7.1 - 5.4	13.1 - 9.9	11	11°32.7	11°34.6	11°01.2	1.1 - 0.9	7.1 - 5.5	13.1 - 10.2	11	11°47.7	11°49.7	11°15.5	1.1 - 0.9	7.1 - 5.6	13.1 - 10.4
12	11°18.0	11°19.9	10°47.1	1.2 - 0.9	7.2 - 5.5	13.2 - 10.0	12	11°33.0	11°34.9	11°01.4	1.2 - 0.9	7.2 - 5.6	13.2 - 10.2	12	11°48.0	11°49.9	11°15.7	1.2 - 1.0	7.2 - 5.7	13.2 - 10.4
13	11°18.3	11°20.1	10°47.4	1.3 - 1.0	7.3 - 5.5	13.3 - 10.1	13	11°33.3	11°35.1	11°01.7	1.3 - 1.0	7.3 - 5.7	13.3 - 10.3	13	11°48.3	11°50.2	11°16.0	1.3 - 1.0	7.3 - 5.8	13.3 - 10.5
14	11°18.5	11°20.4	10°47.6	1.4 - 1.1	7.4 - 5.6	13.4 - 10.2	14	11°33.5	11°35.4	11°01.9	1.4 - 1.1	7.4 - 5.7	13.4 - 10.4	14	11°48.5	11°50.4	11°16.2	1.4 - 1.1	7.4 - 5.9	13.4 - 10.6
15	11°18.8	11°20.6	10°47.8	1.5 - 1.1	7.5 - 5.7	13.5 - 10.2	15	11°33.8	11°35.6	11°02.1	1.5 - 1.2	7.5 - 5.8	13.5 - 10.5	15	11°48.8	11°50.7	11°16.5	1.5 - 1.2	7.5 - 5.9	13.5 - 10.7
16	11°19.0	11°20.9	10°48.1	1.6 - 1.2	7.6 - 5.8	13.6 - 10.3	16	11°34.0	11°35.9	11°02.4	1.6 - 1.2	7.6 - 5.9	13.6 - 10.5	16	11°49.0	11°50.9	11°16.7	1.6 - 1.3	7.6 - 6.0	13.6 - 10.8
17	11°19.2	11°21.1	10°48.3	1.7 - 1.3	7.7 - 5.8	13.7 - 10.4	17	11°34.2	11°36.1	11°02.6	1.7 - 1.3	7.7 - 6.0	13.7 - 10.6	17	11°49.2	11°51.2	11°16.9	1.7 - 1.3	7.7 - 6.1	13.7 - 10.8
18	11°19.5	11°21.4	10°48.5	1.8 - 1.4	7.8 - 5.9	13.8 - 10.5	18	11°34.5	11°36.4	11°02.9	1.8 - 1.4	7.8 - 6.0	13.8 - 10.7	18	11°49.5	11°51.4	11°17.2	1.8 - 1.4	7.8 - 6.2	13.8 - 10.9
19	11°19.8	11°21.6	10°48.8	1.9 - 1.4	7.9 - 6.0	13.9 - 10.5	19	11°34.8	11°36.6	11°03.1	1.9 - 1.5	7.9 - 6.1	13.9 - 10.8	19	11°49.8	11°51.7	11°17.4	1.9 - 1.5	7.9 - 6.3	13.9 - 11.0
20	11°20.0	11°21.9	10°49.0	2.0 - 1.5	8.0 - 6.1	14.0 - 10.6	20	11°35.0	11°36.9	11°03.3	2.0 - 1.6	8.0 - 6.2	14.0 - 10.8	20	11°50.0	11°51.9	11°17.7	2.0 - 1.6	8.0 - 6.3	14.0 - 11.1
21	11°20.3	11°22.1	10°49.3	2.1 - 1.6	8.1 - 6.1	14.1 - 10.7	21	11°35.3	11°37.2	11°03.6	2.1 - 1.6	8.1 - 6.3	14.1 - 10.9	21	11°50.3	11°52.2	11°17.9	2.1 - 1.7	8.1 - 6.4	14.1 - 11.2
22	11°20.5	11°22.4	10°49.5	2.2 - 1.7	8.2 - 6.2	14.2 - 10.8	22	11°35.5	11°37.4	11°03.8	2.2 - 1.7	8.2 - 6.4	14.2 - 11.0	22	11°50.5	11°52.4	11°18.1	2.2 - 1.7	8.2 - 6.5	14.2 - 11.2
23	11°20.7	11°22.6	10°49.7	2.3 - 1.7	8.3 - 6.3	14.3 - 10.8	23	11°35.7	11°37.7	11°04.1	2.3 - 1.8	8.3 - 6.4	14.3 - 11.1	23	11°50.7	11°52.7	11°18.4	2.3 - 1.8	8.3 - 6.6	14.3 - 11.3
24	11°21.0	11°22.9	10°50.0	2.4 - 1.8	8.4 - 6.4	14.4 - 10.9	24	11°36.0	11°37.9	11°04.3	2.4 - 1.9	8.4 - 6.5	14.4 - 11.2	24	11°51.0	11°52.9	11°18.6	2.4 - 1.9	8.4 - 6.7	14.4 - 11.4
25	11°21.2	11°23.1	10°50.2	2.5 - 1.9	8.5 - 6.4	14.5 - 11.0	25	11°36.2	11°38.2	11°04.5	2.5 - 1.9	8.5 - 6.6	14.5 - 11.2	25	11°51.2	11°53.2	11°18.8	2.5 - 2.0	8.5 - 6.7	14.5 - 11.5
26	11°21.5	11°23.4	10°50.5	2.6 - 2.0	8.6 - 6.5	14.6 - 11.1	26	11°36.5	11°38.4	11°04.8	2.6 - 2.0	8.6 - 6.7	14.6 - 11.3	26	11°51.5	11°53.4	11°19.1	2.6 - 2.1	8.6 - 6.8	14.6 - 11.6
27	11°21.8	11°23.6	10°50.7	2.7 - 2.0	8.7 - 6.6	14.7 - 11.1	27	11°36.8	11°38.7	11°05.0	2.7 - 2.1	8.7 - 6.7	14.7 - 11.4	27	11°51.8	11°53.7	11°19.3	2.7 - 2.1	8.7 - 6.9	14.7 - 11.6
28	11°22.0	11°23.9	10°50.9	2.8 - 2.1	8.8 - 6.7	14.8 - 11.2	28	11°37.0	11°38.9	11°05.2	2.8 - 2.2	8.8 - 6.8	14.8 - 11.5	28	11°52.0	11°53.9	11°19.6	2.8 - 2.2	8.8 - 7.0	14.8 - 11.7
29	11°22.3	11°24.1	10°51.2	2.9 - 2.2	8.9 - 6.7	14.9 - 11.3	29	11°37.3	11°39.2	11°05.5	2.9 - 2.2	8.9 - 6.9	14.9 - 11.5	29	11°52.3	11°54.2	11°19.8	2.9 - 2.3	8.9 - 7.0	14.9 - 11.8
30	11°22.5	11°24.4	10°51.4	3.0 - 2.3	9.0 - 6.8	15.0 - 11.4	30	11°37.5	11°39.4	11°05.7	3.0 - 2.3	9.0 - 7.0	15.0 - 11.6	30	11°52.5	11°54.4	11°20.0	3.0 - 2.4	9.0 - 7.1	15.0 - 11.9
31	11°22.7	11°24.6	10°51.6	3.1 - 2.4	9.1 - 6.9	15.1 - 11.5	31	11°37.7	11°39.7	11°06.0	3.1 - 2.4	9.1 - 7.1	15.1 - 11.7	31	11°52.7	11°54.7	11°20.3	3.1 - 2.5	9.1 - 7.2	15.1 - 12.0
32	11°23.0	11°24.9	10°51.9	3.2 - 2.4	9.2 - 7.0	15.2 - 11.5	32	11°38.0	11°39.9	11°06.2	3.2 - 2.5	9.2 - 7.1	15.2 - 11.8	32	11°53.0	11°54.9	11°20.5	3.2 - 2.5	9.2 - 7.3	15.2 - 12.0
33	11°23.2	11°25.1	10°52.1	3.3 - 2.5	9.3 - 7.1	15.3 - 11.6	33	11°38.2	11°40.2	11°06.4	3.3 - 2.6	9.3 - 7.2	15.3 - 11.9	33	11°53.2	11°55.2	11°20.8	3.3 - 2.6	9.3 - 7.4	15.3 - 12.1
34	11°23.5	11°25.4	10°52.4	3.4 - 2.6	9.4 - 7.1	15.4 - 11.7	34	11°38.5	11°40.4	11°06.7	3.4 - 2.6	9.4 - 7.3	15.4 - 11.9	34	11°53.5	11°55.5	11°21.0	3.4 - 2.7	9.4 - 7.4	15.4 - 12.2
35	11°23.8	11°25.6	10°52.6	3.5 - 2.7	9.5 - 7.2	15.5 - 11.8	35	11°38.8	11°40.7	11°06.9	3.5 - 2.7	9.5 - 7.4	15.5 - 12.0	35	11°53.8	11°55.7	11°21.2	3.5 - 2.8	9.5 - 7.5	15.5 - 12.3
36	11°24.0	11°25.9	10°52.8	3.6 - 2.7	9.6 - 7.3	15.6 - 11.8	36	11°39.0	11°40.9	11°07.2	3.6 - 2.8	9.6 - 7.4	15.6 - 12.1	36	11°54.0	11°56.0	11°21.5	3.6 - 2.9	9.6 - 7.6	15.6 - 12.3
37	11°24.3	11°26.1	10°53.1	3.7 - 2.8	9.7 - 7.4	15.7 - 11.9	37	11°39.3	11°41.2	11°07.4	3.7 - 2.9	9.7 - 7.5	15.7 - 12.2	37	11°54.3	11°56.2	11°21.7	3.7 - 2.9	9.7 - 7.7	15.7 - 12.4
38	11°24.5	11°26.4	10°53.3	3.8 - 2.9	9.8 - 7.4	15.8 - 12.0	38	11°39.5	11°41.4	11°07.6	3.8 - 2.9	9.8 - 7.6	15.8 - 12.2	38	11°54.5	11°56.5	11°22.0	3.8 - 3.0	9.8 - 7.8	15.8 - 12.5
39	11°24.7	11°26.6	10°53.6	3.9 - 3.0	9.9 - 7.5	15.9 - 12.1	39	11°39.7	11°41.7	11°07.9	3.9 - 3.0	9.9 - 7.7	15.9 - 12.3	39	11°54.7	11°56.7	11°22.2	3.9 - 3.1	9.9 - 7.8	15.9 - 12.6
40	11°25.0	11°26.9	10°53.8	4.0 - 3.0	10.0 - 7.6	16.0 - 12.1	40	11°40.0	11°41.9	11°08.1	4.0 - 3.1	10.0 - 7.8	16.0 - 12.4	40	11°55.0	11°57.0	11°22.4	4.0 - 3.2	10.0 - 7.9	16.0 - 12.7
41	11°25.2	11°27.1	10°54.0	4.1 - 3.1	10.1 - 7.7	16.1 - 12.2	41	11°40.2	11°42.2	11°08.3	4.1 - 3.2	10.1 - 7.8	16.1 - 12.5	41	11°55.2	11°57.2	11°22.7	4.1 - 3.2		

## Increments and Corrections

m 48	Sun Plan.	Aries	Moon	v and d corr			m 49	Sun Plan.	Aries	Moon	v and d corr			m 50	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	0	12°15.0	12°17.0	11°41.5	0.0 - 0.0	6.0 - 4.9	12.0 - 9.9	0	12°30.0	12°32.1	11°55.8	0.0 - 0.0	6.0 - 5.0	12.0 - 10.1
1	12°00.2	12°02.2	11°27.4	0.1 - 0.1	6.1 - 4.9	12.1 - 9.8	1	12°15.2	12°17.3	11°41.8	0.1 - 0.1	6.1 - 5.0	12.1 - 10.0	1	12°30.2	12°32.3	11°56.1	0.1 - 0.1	6.1 - 5.1	12.1 - 10.2
2	12°00.5	12°02.5	11°27.7	0.2 - 0.2	6.2 - 5.0	12.2 - 9.9	2	12°15.5	12°17.5	11°42.0	0.2 - 0.2	6.2 - 5.1	12.2 - 10.1	2	12°30.5	12°32.6	11°56.3	0.2 - 0.2	6.2 - 5.2	12.2 - 10.3
3	12°00.7	12°02.7	11°27.9	0.3 - 0.2	6.3 - 5.1	12.3 - 9.9	3	12°15.7	12°17.8	11°42.2	0.3 - 0.2	6.3 - 5.2	12.3 - 10.1	3	12°30.7	12°32.8	11°56.5	0.3 - 0.3	6.3 - 5.3	12.3 - 10.4
4	12°01.0	12°03.0	11°28.2	0.4 - 0.3	6.4 - 5.2	12.4 - 10.0	4	12°16.0	12°18.0	11°42.5	0.4 - 0.3	6.4 - 5.3	12.4 - 10.2	4	12°31.0	12°33.1	11°56.8	0.4 - 0.3	6.4 - 5.4	12.4 - 10.4
5	12°01.3	12°03.2	11°28.4	0.5 - 0.4	6.5 - 5.3	12.5 - 10.1	5	12°16.3	12°18.3	11°42.7	0.5 - 0.4	6.5 - 5.4	12.5 - 10.3	5	12°31.3	12°33.3	11°57.0	0.5 - 0.4	6.5 - 5.5	12.5 - 10.5
6	12°01.5	12°03.5	11°28.6	0.6 - 0.5	6.6 - 5.3	12.6 - 10.2	6	12°16.5	12°18.5	11°42.9	0.6 - 0.5	6.6 - 5.4	12.6 - 10.4	6	12°31.5	12°33.6	11°57.3	0.6 - 0.5	6.6 - 5.6	12.6 - 10.6
7	12°01.8	12°03.7	11°28.9	0.7 - 0.6	6.7 - 5.4	12.7 - 10.3	7	12°16.8	12°18.8	11°43.2	0.7 - 0.6	6.7 - 5.5	12.7 - 10.5	7	12°31.8	12°33.8	11°57.5	0.7 - 0.6	6.7 - 5.6	12.7 - 10.7
8	12°02.0	12°04.0	11°29.1	0.8 - 0.6	6.8 - 5.5	12.8 - 10.3	8	12°17.0	12°19.0	11°43.4	0.8 - 0.7	6.8 - 5.6	12.8 - 10.6	8	12°32.0	12°34.1	11°57.7	0.8 - 0.7	6.8 - 5.7	12.8 - 10.8
9	12°02.2	12°04.2	11°29.3	0.9 - 0.7	6.9 - 5.6	12.9 - 10.4	9	12°17.2	12°19.3	11°43.7	0.9 - 0.7	6.9 - 5.7	12.9 - 10.6	9	12°32.2	12°34.3	11°58.0	0.9 - 0.8	6.9 - 5.8	12.9 - 10.9
10	12°02.5	12°04.5	11°29.6	1.0 - 0.8	7.0 - 5.7	13.0 - 10.5	10	12°17.5	12°19.5	11°43.9	1.0 - 0.8	7.0 - 5.8	13.0 - 10.7	10	12°32.5	12°34.6	11°58.2	1.0 - 0.8	7.0 - 5.9	13.0 - 10.9
11	12°02.7	12°04.7	11°29.8	1.1 - 0.9	7.1 - 5.7	13.1 - 10.6	11	12°17.7	12°19.8	11°44.1	1.1 - 0.9	7.1 - 5.9	13.1 - 10.8	11	12°32.7	12°34.8	11°58.5	1.1 - 0.9	7.1 - 6.0	13.1 - 11.0
12	12°03.0	12°05.0	11°30.1	1.2 - 1.0	7.2 - 5.8	13.2 - 10.7	12	12°18.0	12°20.0	11°44.4	1.2 - 1.0	7.2 - 5.9	13.2 - 10.9	12	12°33.0	12°35.1	11°58.7	1.2 - 1.0	7.2 - 6.1	13.2 - 11.1
13	12°03.3	12°05.2	11°30.3	1.3 - 1.1	7.3 - 5.9	13.3 - 10.8	13	12°18.3	12°20.3	11°44.6	1.3 - 1.1	7.3 - 6.0	13.3 - 11.0	13	12°33.3	12°35.3	11°58.9	1.3 - 1.1	7.3 - 6.1	13.3 - 11.2
14	12°03.5	12°05.5	11°30.5	1.4 - 1.1	7.4 - 6.0	13.4 - 10.8	14	12°18.5	12°20.5	11°44.9	1.4 - 1.2	7.4 - 6.1	13.4 - 11.1	14	12°33.5	12°35.6	11°59.2	1.4 - 1.2	7.4 - 6.2	13.4 - 11.3
15	12°03.8	12°05.7	11°30.8	1.5 - 1.2	7.5 - 6.1	13.5 - 10.9	15	12°18.8	12°20.8	11°45.1	1.5 - 1.2	7.5 - 6.2	13.5 - 11.1	15	12°33.8	12°35.8	11°59.4	1.5 - 1.3	7.5 - 6.3	13.5 - 11.4
16	12°04.0	12°06.0	11°31.0	1.6 - 1.3	7.6 - 6.1	13.6 - 11.0	16	12°19.0	12°21.0	11°45.3	1.6 - 1.3	7.6 - 6.3	13.6 - 11.2	16	12°34.0	12°36.1	11°59.7	1.6 - 1.3	7.6 - 6.4	13.6 - 11.4
17	12°04.2	12°06.2	11°31.3	1.7 - 1.4	7.7 - 6.2	13.7 - 11.1	17	12°19.2	12°21.3	11°45.6	1.7 - 1.4	7.7 - 6.4	13.7 - 11.3	17	12°34.2	12°36.3	11°59.9	1.7 - 1.4	7.7 - 6.5	13.7 - 11.5
18	12°04.5	12°06.5	11°31.5	1.8 - 1.5	7.8 - 6.3	13.8 - 11.2	18	12°19.5	12°21.5	11°45.8	1.8 - 1.5	7.8 - 6.4	13.8 - 11.4	18	12°34.5	12°36.6	12°00.1	1.8 - 1.5	7.8 - 6.6	13.8 - 11.6
19	12°04.8	12°06.7	11°31.7	1.9 - 1.5	7.9 - 6.4	13.9 - 11.2	19	12°19.8	12°21.8	11°46.1	1.9 - 1.6	7.9 - 6.5	13.9 - 11.5	19	12°34.8	12°36.8	12°00.4	1.9 - 1.6	7.9 - 6.6	13.9 - 11.7
20	12°05.0	12°07.0	11°32.0	2.0 - 1.6	8.0 - 6.5	14.0 - 11.3	20	12°20.0	12°22.0	11°46.3	2.0 - 1.6	8.0 - 6.6	14.0 - 11.5	20	12°35.0	12°37.1	12°00.6	2.0 - 1.7	8.0 - 6.7	14.0 - 11.8
21	12°05.3	12°07.2	11°32.2	2.1 - 1.7	8.1 - 6.5	14.1 - 11.4	21	12°20.3	12°22.3	11°46.5	2.1 - 1.7	8.1 - 6.7	14.1 - 11.6	21	12°35.3	12°37.3	12°00.8	2.1 - 1.8	8.1 - 6.8	14.1 - 11.9
22	12°05.5	12°07.5	11°32.4	2.2 - 1.8	8.2 - 6.6	14.2 - 11.5	22	12°20.5	12°22.5	11°46.8	2.2 - 1.8	8.2 - 6.8	14.2 - 11.7	22	12°35.5	12°37.6	12°01.1	2.2 - 1.9	8.2 - 6.9	14.2 - 12.0
23	12°05.7	12°07.7	11°32.7	2.3 - 1.9	8.3 - 6.7	14.3 - 11.6	23	12°20.7	12°22.8	11°47.0	2.3 - 1.9	8.3 - 6.8	14.3 - 11.8	23	12°35.7	12°37.8	12°01.3	2.3 - 1.9	8.3 - 7.0	14.3 - 12.0
24	12°06.0	12°08.0	11°32.9	2.4 - 1.9	8.4 - 6.8	14.4 - 11.6	24	12°21.0	12°23.0	11°47.2	2.4 - 2.0	8.4 - 6.9	14.4 - 11.9	24	12°36.0	12°38.1	12°01.6	2.4 - 2.0	8.4 - 7.1	14.4 - 12.1
25	12°06.2	12°08.2	11°33.2	2.5 - 2.0	8.5 - 6.9	14.5 - 11.7	25	12°21.2	12°23.3	11°47.5	2.5 - 2.1	8.5 - 7.0	14.5 - 12.0	25	12°36.2	12°38.3	12°01.8	2.5 - 2.1	8.5 - 7.2	14.5 - 12.2
26	12°06.5	12°08.5	11°33.4	2.6 - 2.1	8.6 - 7.0	14.6 - 11.8	26	12°21.5	12°23.5	11°47.7	2.6 - 2.1	8.6 - 7.1	14.6 - 12.0	26	12°36.5	12°38.6	12°02.0	2.6 - 2.2	8.6 - 7.2	14.6 - 12.3
27	12°06.8	12°08.7	11°33.6	2.7 - 2.2	8.7 - 7.0	14.7 - 11.9	27	12°21.8	12°23.8	11°48.0	2.7 - 2.2	8.7 - 7.2	14.7 - 12.1	27	12°36.8	12°38.8	12°02.3	2.7 - 2.3	8.7 - 7.3	14.7 - 12.4
28	12°07.0	12°09.0	11°33.9	2.8 - 2.3	8.8 - 7.1	14.8 - 12.0	28	12°22.0	12°24.0	11°48.2	2.8 - 2.3	8.8 - 7.3	14.8 - 12.2	28	12°37.0	12°39.1	12°02.5	2.8 - 2.4	8.8 - 7.4	14.8 - 12.5
29	12°07.3	12°09.2	11°34.1	2.9 - 2.3	8.9 - 7.2	14.9 - 12.0	29	12°22.3	12°24.3	11°48.4	2.9 - 2.4	8.9 - 7.3	14.9 - 12.3	29	12°37.3	12°39.3	12°02.8	2.9 - 2.4	8.9 - 7.5	14.9 - 12.5
30	12°07.5	12°09.5	11°34.4	3.0 - 2.4	9.0 - 7.3	15.0 - 12.1	30	12°22.5	12°24.5	11°48.7	3.0 - 2.5	9.0 - 7.4	15.0 - 12.4	30	12°37.5	12°39.6	12°03.0	3.0 - 2.5	9.0 - 7.6	15.0 - 12.6
31	12°07.7	12°09.7	11°34.6	3.1 - 2.5	9.1 - 7.4	15.1 - 12.2	31	12°22.7	12°24.8	11°48.9	3.1 - 2.6	9.1 - 7.5	15.1 - 12.5	31	12°37.7	12°39.8	12°03.2	3.1 - 2.6	9.1 - 7.7	15.1 - 12.7
32	12°08.0	12°10.0	11°34.8	3.2 - 2.6	9.2 - 7.4	15.2 - 12.3	32	12°23.0	12°25.0	11°49.2	3.2 - 2.6	9.2 - 7.6	15.2 - 12.5	32	12°38.0	12°40.1	12°03.5	3.2 - 2.7	9.2 - 7.7	15.2 - 12.8
33	12°08.2	12°10.2	11°35.1	3.3 - 2.7	9.3 - 7.5	15.3 - 12.4	33	12°23.2	12°25.3	11°49.4	3.3 - 2.7	9.3 - 7.7	15.3 - 12.6	33	12°38.2	12°40.3	12°03.7	3.3 - 2.8	9.3 - 7.8	15.3 - 12.9
34	12°08.5	12°10.5	11°35.3	3.4 - 2.7	9.4 - 7.6	15.4 - 12.4	34	12°23.5	12°25.5	11°49.6	3.4 - 2.8	9.4 - 7.8	15.4 - 12.7	34	12°38.5	12°40.6	12°03.9	3.4 - 2.9	9.4 - 7.9	15.4 - 13.0
35	12°08.8	12°10.7	11°35.6	3.5 - 2.8	9.5 - 7.7	15.5 - 12.5	35	12°23.8	12°25.8	11°49.9	3.5 - 2.9	9.5 - 7.8	15.5 - 12.8	35	12°38.8	12°40.8	12°04.2	3.5 - 2.9	9.5 - 8.0	15.5 - 13.0
36	12°09.0	12°11.0	11°35.8	3.6 - 2.9	9.6 - 7.8	15.6 - 12.6	36	12°24.0	12°26.0	11°50.1	3.6 - 3.0	9.6 - 7.9	15.6 - 12.9	36	12°39.0	12°41.1	12°04.4	3.6 - 3.0	9.6 - 8.1	15.6 - 13.1
37	12°09.3	12°11.2	11°36.0	3.7 - 3.0	9.7 - 7.8	15.7 - 12.7	37	12°24.3	12°26.3	11°50.3	3.7 - 3.1	9.7 - 8.0	15.7 - 13.0	37	12°39.3	12°41.3	12°04.7	3.7 - 3.1	9.7 - 8.2	15.7 - 13.2
38	12°09.5	12°11.5	11°36.3	3.8 - 3.1	9.8 - 7.9	15.8 - 12.8	38	12°24.5	12°26.5	11°50.6	3.8 - 3.1	9.8 - 8.1	15.8 - 13.0	38	12°39.5	12°41.6	12°04.9	3.8 - 3.2	9.8 - 8.2	15.8 - 13.3
39	12°09.7	12°11.7	11°36.5	3.9 - 3.2	9.9 - 8.0	15.9 - 12.9	39	12°24.7	12°26.8	11°50.8	3.9 - 3.2	9.9 - 8.2	15.9 - 13.1	39	12°39.7	12°41.8	12°05.1	3.9 - 3.3	9.9 - 8.3	15.9 - 13.4
40	12°10.0	12°12.0	11°36.7	4.0 - 3.2	10.0 - 8.1	16.0 - 12.9	40	12°25.0	12°27.0	11°51.1	4.0 - 3.3	10.0 - 8.3	16.0 - 13.2	40	12°40.0	12°42.1	12°05.4	4.0 - 3.4	10.0 - 8.4	16.0 - 13.5
41	12°10.2	12°12.2	11°37.0	4.1 - 3.3	10.1 - 8.2	16.1 - 13.0	41	12°25.2	12°27.											

## 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			

## Increments and Corrections

m 54	Sun Plan.	Aries	Moon	v and d corr	m 55	Sun Plan.	Aries	Moon	v and d corr	m 56	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	0	13°45.0	13°47.3	13°07.4	0.0 - 0.0	6.0 - 5.6	12.0 - 11.1	0	14°00.0	14°02.3	13°21.7	0.0 - 0.0	6.0 - 5.7	12.0 - 11.3
1	13°30.2	13°32.5	12°53.3	0.1 - 0.1	6.1 - 5.5	12.1 - 11.0	1	13°45.2	13°47.5	13°07.7	0.1 - 0.1	6.1 - 5.6	12.1 - 11.2	1	14°00.2	14°02.5	13°22.0	0.1 - 0.1	6.1 - 5.7	12.1 - 11.4
2	13°30.5	13°32.7	12°53.6	0.2 - 0.2	6.2 - 5.6	12.2 - 11.1	2	13°45.5	13°47.8	13°07.9	0.2 - 0.2	6.2 - 5.7	12.2 - 11.3	2	14°00.5	14°02.8	13°22.2	0.2 - 0.2	6.2 - 5.8	12.2 - 11.5
3	13°30.7	13°33.0	12°53.8	0.3 - 0.3	6.3 - 5.7	12.3 - 11.2	3	13°45.7	13°48.0	13°08.1	0.3 - 0.3	6.3 - 5.8	12.3 - 11.4	3	14°00.7	14°03.0	13°22.4	0.3 - 0.3	6.3 - 5.9	12.3 - 11.6
4	13°31.0	13°33.2	12°54.1	0.4 - 0.4	6.4 - 5.8	12.4 - 11.3	4	13°46.0	13°48.3	13°08.4	0.4 - 0.4	6.4 - 5.9	12.4 - 11.5	4	14°01.0	14°03.3	13°22.7	0.4 - 0.4	6.4 - 6.0	12.4 - 11.7
5	13°31.3	13°33.5	12°54.3	0.5 - 0.5	6.5 - 5.9	12.5 - 11.4	5	13°46.3	13°48.5	13°08.6	0.5 - 0.5	6.5 - 6.0	12.5 - 11.6	5	14°01.3	14°03.5	13°22.9	0.5 - 0.5	6.5 - 6.1	12.5 - 11.8
6	13°31.5	13°33.7	12°54.5	0.6 - 0.5	6.6 - 6.0	12.6 - 11.4	6	13°46.5	13°48.8	13°08.8	0.6 - 0.6	6.6 - 6.1	12.6 - 11.7	6	14°01.5	14°03.8	13°23.2	0.6 - 0.6	6.6 - 6.2	12.6 - 11.9
7	13°31.8	13°34.0	12°54.8	0.7 - 0.6	6.7 - 6.1	12.7 - 11.5	7	13°46.8	13°49.0	13°09.1	0.7 - 0.6	6.7 - 6.2	12.7 - 11.7	7	14°01.8	14°04.1	13°23.4	0.7 - 0.7	6.7 - 6.3	12.7 - 12.0
8	13°32.0	13°34.2	12°55.0	0.8 - 0.7	6.8 - 6.2	12.8 - 11.6	8	13°47.0	13°49.3	13°09.3	0.8 - 0.7	6.8 - 6.3	12.8 - 11.8	8	14°02.0	14°04.3	13°23.6	0.8 - 0.8	6.8 - 6.4	12.8 - 12.1
9	13°32.2	13°34.5	12°55.2	0.9 - 0.8	6.9 - 6.3	12.9 - 11.7	9	13°47.2	13°49.5	13°09.6	0.9 - 0.8	6.9 - 6.4	12.9 - 11.9	9	14°02.2	14°04.6	13°23.9	0.9 - 0.8	6.9 - 6.5	12.9 - 12.1
10	13°32.5	13°34.7	12°55.5	1.0 - 0.9	7.0 - 6.4	13.0 - 11.8	10	13°47.5	13°49.8	13°09.8	1.0 - 0.9	7.0 - 6.5	13.0 - 12.0	10	14°02.5	14°04.8	13°24.1	1.0 - 0.9	7.0 - 6.6	13.0 - 12.2
11	13°32.7	13°35.0	12°55.7	1.1 - 1.0	7.1 - 6.4	13.1 - 11.9	11	13°47.7	13°50.0	13°10.0	1.1 - 1.0	7.1 - 6.6	13.1 - 12.1	11	14°02.7	14°05.1	13°24.4	1.1 - 1.0	7.1 - 6.7	13.1 - 12.3
12	13°33.0	13°35.2	12°56.0	1.2 - 1.1	7.2 - 6.5	13.2 - 12.0	12	13°48.0	13°50.3	13°10.3	1.2 - 1.1	7.2 - 6.7	13.2 - 12.2	12	14°03.0	14°05.3	13°24.6	1.2 - 1.1	7.2 - 6.8	13.2 - 12.4
13	13°33.3	13°35.5	12°56.2	1.3 - 1.2	7.3 - 6.6	13.3 - 12.1	13	13°48.3	13°50.5	13°10.5	1.3 - 1.2	7.3 - 6.8	13.3 - 12.3	13	14°03.3	14°05.6	13°24.8	1.3 - 1.2	7.3 - 6.9	13.3 - 12.5
14	13°33.5	13°35.7	12°56.4	1.4 - 1.3	7.4 - 6.7	13.4 - 12.2	14	13°48.5	13°50.8	13°10.8	1.4 - 1.3	7.4 - 6.8	13.4 - 12.4	14	14°03.5	14°05.8	13°25.1	1.4 - 1.3	7.4 - 7.0	13.4 - 12.6
15	13°33.8	13°36.0	12°56.7	1.5 - 1.4	7.5 - 6.8	13.5 - 12.3	15	13°48.8	13°51.0	13°11.0	1.5 - 1.4	7.5 - 6.9	13.5 - 12.5	15	14°03.8	14°06.1	13°25.3	1.5 - 1.4	7.5 - 7.1	13.5 - 12.7
16	13°34.0	13°36.2	12°56.9	1.6 - 1.5	7.6 - 6.9	13.6 - 12.4	16	13°49.0	13°51.3	13°11.2	1.6 - 1.5	7.6 - 7.0	13.6 - 12.6	16	14°04.0	14°06.3	13°25.6	1.6 - 1.5	7.6 - 7.2	13.6 - 12.8
17	13°34.2	13°36.5	12°57.2	1.7 - 1.5	7.7 - 7.0	13.7 - 12.4	17	13°49.2	13°51.5	13°11.5	1.7 - 1.6	7.7 - 7.1	13.7 - 12.7	17	14°04.2	14°06.6	13°25.8	1.7 - 1.6	7.7 - 7.3	13.7 - 12.9
18	13°34.5	13°36.7	12°57.4	1.8 - 1.6	7.8 - 7.1	13.8 - 12.5	18	13°49.5	13°51.8	13°11.7	1.8 - 1.7	7.8 - 7.2	13.8 - 12.8	18	14°04.5	14°06.8	13°26.0	1.8 - 1.7	7.8 - 7.3	13.8 - 13.0
19	13°34.8	13°37.0	12°57.6	1.9 - 1.7	7.9 - 7.2	13.9 - 12.6	19	13°49.8	13°52.0	13°12.0	1.9 - 1.8	7.9 - 7.3	13.9 - 12.9	19	14°04.8	14°07.1	13°26.3	1.9 - 1.8	7.9 - 7.4	13.9 - 13.1
20	13°35.0	13°37.2	12°57.9	2.0 - 1.8	8.0 - 7.3	14.0 - 12.7	20	13°50.0	13°52.3	13°12.2	2.0 - 1.9	8.0 - 7.4	14.0 - 13.0	20	14°05.0	14°07.3	13°26.5	2.0 - 1.9	8.0 - 7.5	14.0 - 13.2
21	13°35.3	13°37.5	12°58.1	2.1 - 1.9	8.1 - 7.4	14.1 - 12.8	21	13°50.3	13°52.5	13°12.4	2.1 - 1.9	8.1 - 7.5	14.1 - 13.0	21	14°05.3	14°07.6	13°26.7	2.1 - 2.0	8.1 - 7.6	14.1 - 13.3
22	13°35.5	13°37.7	12°58.3	2.2 - 2.0	8.2 - 7.4	14.2 - 12.9	22	13°50.5	13°52.8	13°12.7	2.2 - 2.0	8.2 - 7.6	14.2 - 13.1	22	14°05.5	14°07.8	13°27.0	2.2 - 2.1	8.2 - 7.7	14.2 - 13.4
23	13°35.7	13°38.0	12°58.6	2.3 - 2.1	8.3 - 7.5	14.3 - 13.0	23	13°50.7	13°53.0	13°12.9	2.3 - 2.1	8.3 - 7.7	14.3 - 13.2	23	14°05.7	14°08.1	13°27.2	2.3 - 2.2	8.3 - 7.8	14.3 - 13.5
24	13°36.0	13°38.2	12°58.8	2.4 - 2.2	8.4 - 7.6	14.4 - 13.1	24	13°51.0	13°53.3	13°13.1	2.4 - 2.2	8.4 - 7.8	14.4 - 13.3	24	14°06.0	14°08.3	13°27.5	2.4 - 2.3	8.4 - 7.9	14.4 - 13.6
25	13°36.2	13°38.5	12°59.1	2.5 - 2.3	8.5 - 7.7	14.5 - 13.2	25	13°51.2	13°53.5	13°13.4	2.5 - 2.3	8.5 - 7.9	14.5 - 13.4	25	14°06.2	14°08.6	13°27.7	2.5 - 2.4	8.5 - 8.0	14.5 - 13.7
26	13°36.5	13°38.7	12°59.3	2.6 - 2.4	8.6 - 7.8	14.6 - 13.3	26	13°51.5	13°53.8	13°13.6	2.6 - 2.4	8.6 - 8.0	14.6 - 13.5	26	14°06.5	14°08.8	13°27.9	2.6 - 2.4	8.6 - 8.1	14.6 - 13.7
27	13°36.8	13°39.0	12°59.5	2.7 - 2.5	8.7 - 7.9	14.7 - 13.4	27	13°51.8	13°54.0	13°13.9	2.7 - 2.5	8.7 - 8.0	14.7 - 13.6	27	14°06.8	14°09.1	13°28.2	2.7 - 2.5	8.7 - 8.2	14.7 - 13.8
28	13°37.0	13°39.2	12°59.8	2.8 - 2.5	8.8 - 8.0	14.8 - 13.4	28	13°52.0	13°54.3	13°14.1	2.8 - 2.6	8.8 - 8.1	14.8 - 13.7	28	14°07.0	14°09.3	13°28.4	2.8 - 2.6	8.8 - 8.3	14.8 - 13.9
29	13°37.3	13°39.5	13°00.0	2.9 - 2.6	8.9 - 8.1	14.9 - 13.5	29	13°52.3	13°54.5	13°14.3	2.9 - 2.7	8.9 - 8.2	14.9 - 13.8	29	14°07.3	14°09.6	13°28.7	2.9 - 2.7	8.9 - 8.4	14.9 - 14.0
30	13°37.5	13°39.7	13°00.3	3.0 - 2.7	9.0 - 8.2	15.0 - 13.6	30	13°52.5	13°54.8	13°14.6	3.0 - 2.8	9.0 - 8.3	15.0 - 13.9	30	14°07.5	14°09.8	13°28.9	3.0 - 2.8	9.0 - 8.5	15.0 - 14.1
31	13°37.7	13°40.0	13°00.5	3.1 - 2.8	9.1 - 8.3	15.1 - 13.7	31	13°52.7	13°55.0	13°14.8	3.1 - 2.9	9.1 - 8.4	15.1 - 14.0	31	14°07.7	14°10.1	13°29.1	3.1 - 2.9	9.1 - 8.6	15.1 - 14.2
32	13°38.0	13°40.2	13°00.7	3.2 - 2.9	9.2 - 8.4	15.2 - 13.8	32	13°53.0	13°55.3	13°15.1	3.2 - 3.0	9.2 - 8.5	15.2 - 14.1	32	14°08.0	14°10.3	13°29.4	3.2 - 3.0	9.2 - 8.7	15.2 - 14.3
33	13°38.2	13°40.5	13°01.0	3.3 - 3.0	9.3 - 8.4	15.3 - 13.9	33	13°53.2	13°55.5	13°15.3	3.3 - 3.1	9.3 - 8.6	15.3 - 14.2	33	14°08.2	14°10.6	13°29.6	3.3 - 3.1	9.3 - 8.8	15.3 - 14.4
34	13°38.5	13°40.7	13°01.2	3.4 - 3.1	9.4 - 8.5	15.4 - 14.0	34	13°53.5	13°55.8	13°15.5	3.4 - 3.1	9.4 - 8.7	15.4 - 14.2	34	14°08.5	14°10.8	13°29.8	3.4 - 3.2	9.4 - 8.9	15.4 - 14.5
35	13°38.8	13°41.0	13°01.5	3.5 - 3.2	9.5 - 8.6	15.5 - 14.1	35	13°53.8	13°56.0	13°15.8	3.5 - 3.2	9.5 - 8.8	15.5 - 14.3	35	14°08.8	14°11.1	13°30.1	3.5 - 3.3	9.5 - 8.9	15.5 - 14.6
36	13°39.0	13°41.2	13°01.7	3.6 - 3.3	9.6 - 8.7	15.6 - 14.2	36	13°54.0	13°56.3	13°16.0	3.6 - 3.3	9.6 - 8.9	15.6 - 14.4	36	14°09.0	14°11.3	13°30.3	3.6 - 3.4	9.6 - 9.0	15.6 - 14.7
37	13°39.3	13°41.5	13°01.9	3.7 - 3.4	9.7 - 8.8	15.7 - 14.3	37	13°54.3	13°56.5	13°16.2	3.7 - 3.4	9.7 - 9.0	15.7 - 14.5	37	14°09.3	14°11.6	13°30.6	3.7 - 3.5	9.7 - 9.1	15.7 - 14.8
38	13°39.5	13°41.7	13°02.2	3.8 - 3.5	9.8 - 8.9	15.8 - 14.4	38	13°54.5	13°56.8	13°16.5	3.8 - 3.5	9.8 - 9.1	15.8 - 14.6	38	14°09.5	14°11.8	13°30.8	3.8 - 3.6	9.8 - 9.2	15.8 - 14.9
39	13°39.7	13°42.0	13°02.4	3.9 - 3.5	9.9 - 9.0	15.9 - 14.4	39	13°54.7	13°57.0	13°16.7	3.9 - 3.6	9.9 - 9.2	15.9 - 14.7	39	14°09.7	14°12.1	13°31.0	3.9 - 3.7	9.9 - 9.3	15.9 - 15.0
40	13°40.0	13°42.2	13°02.6	4.0 - 3.6	10.0 - 9.1	16.0 - 14.5	40	13°55.0	13°57.3	13°17.0	4.0 - 3.7	10.0 - 9.3	16.0 - 14.8	40	14°10.0	14°12.3	13°31.3	4.0 - 3.8	10.0 - 9.4	16.0 - 15.1
41	13°40.2	13°42.5	13°02.9	4.1 - 3.7	10.1 - 9.2	16.1 - 14.6	41	13°55.2	13°57.5	13°17.2	4.1 - 3.8	10.1 - 9.3	16.1 - 14.9	41	14°10.2	14°12.6</td				

## Increments and Corrections

m 57	Sun Plan.	Aries	Moon	v and d corr	m 58	Sun Plan.	Aries	Moon	v and d corr	m 59	Sun Plan.	Aries	Moon	v and d corr						
0	14°15.0	14°17.3	13°36.0	0.0 - 0.0	6.0 - 5.8	12.0 - 11.5	0	14°30.0	14°32.4	13°50.4	0.0 - 0.0	6.0 - 5.8	12.0 - 11.7	0	14°45.0	14°47.4	14°04.7	0.0 - 0.0	6.0 - 6.0	12.0 - 11.9
1	14°15.2	14°17.6	13°36.3	0.1 - 0.1	6.1 - 5.8	12.1 - 11.6	1	14°30.2	14°32.6	13°50.6	0.1 - 0.1	6.1 - 5.9	12.1 - 11.8	1	14°45.2	14°47.7	14°04.9	0.1 - 0.1	6.1 - 6.0	12.1 - 12.0
2	14°15.5	14°17.8	13°36.5	0.2 - 0.2	6.2 - 5.9	12.2 - 11.7	2	14°30.5	14°32.9	13°50.8	0.2 - 0.2	6.2 - 6.0	12.2 - 11.9	2	14°45.5	14°47.9	14°05.2	0.2 - 0.2	6.2 - 6.1	12.2 - 12.1
3	14°15.7	14°18.1	13°36.8	0.3 - 0.3	6.3 - 6.0	12.3 - 11.8	3	14°30.7	14°33.1	13°51.1	0.3 - 0.3	6.3 - 6.1	12.3 - 12.0	3	14°45.7	14°48.2	14°05.4	0.3 - 0.3	6.3 - 6.2	12.3 - 12.2
4	14°16.0	14°18.3	13°37.0	0.4 - 0.4	6.4 - 6.1	12.4 - 11.9	4	14°31.0	14°33.4	13°51.3	0.4 - 0.4	6.4 - 6.2	12.4 - 12.1	4	14°46.0	14°48.4	14°05.6	0.4 - 0.4	6.4 - 6.3	12.4 - 12.3
5	14°16.3	14°18.6	13°37.2	0.5 - 0.5	6.5 - 6.2	12.5 - 12.0	5	14°31.3	14°33.6	13°51.6	0.5 - 0.5	6.5 - 6.3	12.5 - 12.2	5	14°46.3	14°48.7	14°05.9	0.5 - 0.5	6.5 - 6.4	12.5 - 12.4
6	14°16.5	14°18.8	13°37.5	0.6 - 0.6	6.6 - 6.3	12.6 - 12.1	6	14°31.5	14°33.9	13°51.8	0.6 - 0.6	6.6 - 6.4	12.6 - 12.3	6	14°46.5	14°48.9	14°06.1	0.6 - 0.6	6.6 - 6.5	12.6 - 12.5
7	14°16.8	14°19.1	13°37.7	0.7 - 0.7	6.7 - 6.4	12.7 - 12.2	7	14°31.8	14°34.1	13°52.0	0.7 - 0.7	6.7 - 6.5	12.7 - 12.4	7	14°46.8	14°49.2	14°06.4	0.7 - 0.7	6.7 - 6.6	12.7 - 12.6
8	14°17.0	14°19.3	13°38.0	0.8 - 0.8	6.8 - 6.5	12.8 - 12.3	8	14°32.0	14°34.4	13°52.3	0.8 - 0.8	6.8 - 6.6	12.8 - 12.5	8	14°47.0	14°49.4	14°06.6	0.8 - 0.8	6.8 - 6.7	12.8 - 12.7
9	14°17.2	14°19.6	13°38.2	0.9 - 0.9	6.9 - 6.6	12.9 - 12.4	9	14°32.2	14°34.6	13°52.5	0.9 - 0.9	6.9 - 6.7	12.9 - 12.6	9	14°47.2	14°49.7	14°06.8	0.9 - 0.9	6.9 - 6.8	12.9 - 12.8
10	14°17.5	14°19.8	13°38.4	1.0 - 1.0	7.0 - 6.7	13.0 - 12.5	10	14°32.5	14°34.9	13°52.8	1.0 - 1.0	7.0 - 6.8	13.0 - 12.7	10	14°47.5	14°49.9	14°07.1	1.0 - 1.0	7.0 - 6.9	13.0 - 12.9
11	14°17.7	14°20.1	13°38.7	1.1 - 1.1	7.1 - 6.8	13.1 - 12.6	11	14°32.7	14°35.1	13°53.0	1.1 - 1.1	7.1 - 6.9	13.1 - 12.8	11	14°47.7	14°50.2	14°07.3	1.1 - 1.1	7.1 - 7.0	13.1 - 13.0
12	14°18.0	14°20.3	13°38.9	1.2 - 1.2	7.2 - 6.9	13.2 - 12.7	12	14°33.0	14°35.4	13°53.2	1.2 - 1.2	7.2 - 7.0	13.2 - 12.9	12	14°48.0	14°50.4	14°07.5	1.2 - 1.2	7.2 - 7.1	13.2 - 13.1
13	14°18.3	14°20.6	13°39.2	1.3 - 1.2	7.3 - 7.0	13.3 - 12.7	13	14°33.3	14°35.6	13°53.5	1.3 - 1.3	7.3 - 7.1	13.3 - 13.0	13	14°48.3	14°50.7	14°07.8	1.3 - 1.3	7.3 - 7.2	13.3 - 13.2
14	14°18.5	14°20.8	13°39.4	1.4 - 1.3	7.4 - 7.1	13.4 - 12.8	14	14°33.5	14°35.9	13°53.7	1.4 - 1.4	7.4 - 7.2	13.4 - 13.1	14	14°48.5	14°50.9	14°08.0	1.4 - 1.4	7.4 - 7.3	13.4 - 13.3
15	14°18.8	14°21.1	13°39.6	1.5 - 1.4	7.5 - 7.2	13.5 - 12.9	15	14°33.8	14°36.1	13°53.9	1.5 - 1.5	7.5 - 7.3	13.5 - 13.2	15	14°48.8	14°51.2	14°08.3	1.5 - 1.5	7.5 - 7.4	13.5 - 13.4
16	14°19.0	14°21.3	13°39.9	1.6 - 1.5	7.6 - 7.3	13.6 - 13.0	16	14°34.0	14°36.4	13°54.2	1.6 - 1.6	7.6 - 7.4	13.6 - 13.3	16	14°49.0	14°51.4	14°08.5	1.6 - 1.6	7.6 - 7.5	13.6 - 13.5
17	14°19.2	14°21.6	13°40.1	1.7 - 1.6	7.7 - 7.4	13.7 - 13.1	17	14°34.2	14°36.6	13°54.4	1.7 - 1.7	7.7 - 7.5	13.7 - 13.4	17	14°49.2	14°51.7	14°08.7	1.7 - 1.7	7.7 - 7.6	13.7 - 13.6
18	14°19.5	14°21.8	13°40.3	1.8 - 1.7	7.8 - 7.5	13.8 - 13.2	18	14°34.5	14°36.9	13°54.7	1.8 - 1.8	7.8 - 7.6	13.8 - 13.5	18	14°49.5	14°51.9	14°09.0	1.8 - 1.8	7.8 - 7.7	13.8 - 13.7
19	14°19.8	14°22.1	13°40.6	1.9 - 1.8	7.9 - 7.6	13.9 - 13.3	19	14°34.8	14°37.1	13°54.9	1.9 - 1.9	7.9 - 7.7	13.9 - 13.6	19	14°49.8	14°52.2	14°09.2	1.9 - 1.9	7.9 - 7.8	13.9 - 13.8
20	14°20.0	14°22.4	13°40.8	2.0 - 1.9	8.0 - 7.7	14.0 - 13.4	20	14°35.0	14°37.4	13°55.1	2.0 - 1.9	8.0 - 7.8	14.0 - 13.7	20	14°50.0	14°52.4	14°09.5	2.0 - 2.0	8.0 - 7.9	14.0 - 13.9
21	14°20.3	14°22.6	13°41.1	2.1 - 2.0	8.1 - 7.8	14.1 - 13.5	21	14°35.3	14°37.6	13°55.4	2.1 - 2.0	8.1 - 7.9	14.1 - 13.7	21	14°50.3	14°52.7	14°09.7	2.1 - 2.1	8.1 - 8.0	14.1 - 14.0
22	14°20.5	14°22.9	13°41.3	2.2 - 2.1	8.2 - 7.9	14.2 - 13.6	22	14°35.5	14°37.9	13°55.6	2.2 - 2.1	8.2 - 8.0	14.2 - 13.8	22	14°50.5	14°52.9	14°09.9	2.2 - 2.2	8.2 - 8.1	14.2 - 14.1
23	14°20.7	14°23.1	13°41.5	2.3 - 2.2	8.3 - 8.0	14.3 - 13.7	23	14°35.7	14°38.1	13°55.9	2.3 - 2.2	8.3 - 8.1	14.3 - 13.9	23	14°50.7	14°53.2	14°10.2	2.3 - 2.3	8.3 - 8.2	14.3 - 14.2
24	14°21.0	14°23.4	13°41.8	2.4 - 2.3	8.4 - 8.1	14.4 - 13.8	24	14°36.0	14°38.4	13°56.1	2.4 - 2.3	8.4 - 8.2	14.4 - 14.0	24	14°51.0	14°53.4	14°10.4	2.4 - 2.4	8.4 - 8.3	14.4 - 14.3
25	14°21.2	14°23.6	13°42.0	2.5 - 2.4	8.5 - 8.1	14.5 - 13.9	25	14°36.2	14°38.6	13°56.3	2.5 - 2.4	8.5 - 8.3	14.5 - 14.1	25	14°51.2	14°53.7	14°10.6	2.5 - 2.5	8.5 - 8.4	14.5 - 14.4
26	14°21.5	14°23.9	13°42.3	2.6 - 2.5	8.6 - 8.2	14.6 - 14.0	26	14°36.5	14°38.9	13°56.6	2.6 - 2.5	8.6 - 8.4	14.6 - 14.2	26	14°51.5	14°53.9	14°10.9	2.6 - 2.6	8.6 - 8.5	14.6 - 14.5
27	14°21.8	14°24.1	13°42.5	2.7 - 2.6	8.7 - 8.3	14.7 - 14.1	27	14°36.8	14°39.1	13°56.8	2.7 - 2.6	8.7 - 8.5	14.7 - 14.3	27	14°51.8	14°54.2	14°11.1	2.7 - 2.7	8.7 - 8.6	14.7 - 14.6
28	14°22.0	14°24.4	13°42.7	2.8 - 2.7	8.8 - 8.4	14.8 - 14.2	28	14°37.0	14°39.4	13°57.0	2.8 - 2.7	8.8 - 8.6	14.8 - 14.4	28	14°52.0	14°54.4	14°11.4	2.8 - 2.8	8.8 - 8.7	14.8 - 14.7
29	14°22.3	14°24.6	13°43.0	2.9 - 2.8	8.9 - 8.5	14.9 - 14.3	29	14°37.3	14°39.6	13°57.3	2.9 - 2.8	8.9 - 8.7	14.9 - 14.5	29	14°52.3	14°54.7	14°11.6	2.9 - 2.9	8.9 - 8.8	14.9 - 14.8
30	14°22.5	14°24.9	13°43.2	3.0 - 2.9	9.0 - 8.6	15.0 - 14.4	30	14°37.5	14°39.9	13°57.5	3.0 - 2.9	9.0 - 8.8	15.0 - 14.6	30	14°52.5	14°54.9	14°11.8	3.0 - 3.0	9.0 - 8.9	15.0 - 14.9
31	14°22.7	14°25.1	13°43.4	3.1 - 3.0	9.1 - 8.7	15.1 - 14.5	31	14°37.7	14°40.1	13°57.8	3.1 - 3.0	9.1 - 8.9	15.1 - 14.7	31	14°52.7	14°55.2	14°12.1	3.1 - 3.1	9.1 - 9.0	15.1 - 15.0
32	14°23.0	14°25.4	13°43.7	3.2 - 3.1	9.2 - 8.8	15.2 - 14.6	32	14°38.0	14°40.4	13°58.0	3.2 - 3.1	9.2 - 9.0	15.2 - 14.8	32	14°53.0	14°55.4	14°12.3	3.2 - 3.2	9.2 - 9.1	15.2 - 15.1
33	14°23.2	14°25.6	13°43.9	3.3 - 3.2	9.3 - 8.9	15.3 - 14.7	33	14°38.2	14°40.7	13°58.2	3.3 - 3.2	9.3 - 9.1	15.3 - 14.9	33	14°53.2	14°55.7	14°12.6	3.3 - 3.3	9.3 - 9.2	15.3 - 15.2
34	14°23.5	14°25.9	13°44.2	3.4 - 3.3	9.4 - 9.0	15.4 - 14.8	34	14°38.5	14°40.9	13°58.5	3.4 - 3.3	9.4 - 9.2	15.4 - 15.0	34	14°53.5	14°55.9	14°12.8	3.4 - 3.4	9.4 - 9.3	15.4 - 15.3
35	14°23.8	14°26.1	13°44.4	3.5 - 3.4	9.5 - 9.1	15.5 - 14.9	35	14°38.8	14°41.2	13°58.7	3.5 - 3.4	9.5 - 9.3	15.5 - 15.1	35	14°53.8	14°56.2	14°13.0	3.5 - 3.5	9.5 - 9.4	15.5 - 15.4
36	14°24.0	14°26.4	13°44.6	3.6 - 3.5	9.6 - 9.2	15.6 - 15.0	36	14°39.0	14°41.4	13°59.0	3.6 - 3.5	9.6 - 9.4	15.6 - 15.2	36	14°54.0	14°56.4	14°13.3	3.6 - 3.6	9.6 - 9.5	15.6 - 15.5
37	14°24.3	14°26.6	13°44.9	3.7 - 3.5	9.7 - 9.3	15.7 - 15.0	37	14°39.3	14°41.7	13°59.2	3.7 - 3.6	9.7 - 9.5	15.7 - 15.3	37	14°54.3	14°56.7	14°13.5	3.7 - 3.7	9.7 - 9.6	15.7 - 15.6
38	14°24.5	14°26.9	13°45.1	3.8 - 3.6	9.8 - 9.4	15.8 - 15.1	38	14°39.5	14°41.9	13°59.4	3.8 - 3.7	9.8 - 9.6	15.8 - 15.4	38	14°54.5	14°56.9	14°13.8	3.8 - 3.8	9.8 - 9.7	15.8 - 15.7
39	14°24.7	14°27.1	13°45.4	3.9 - 3.7	9.9 - 9.5	15.9 - 15.2	39	14°39.7	14°42.2	13°59.7	3.9 - 3.8	9.9 - 9.7	15.9 - 15.5	39	14°54.7	14°57.2	14°14.0	3.9 - 3.9	9.9 - 9.8	15.9 - 15.8
40	14°25.0	14°27.4	13°45.6	4.0 - 3.8	10.0 - 9.6	16.0 - 15.3	40	14°40.0	14°42.4	13°59.9	4.0 - 3.9	10.0 - 9.8	16.0 - 15.6	40	14°55.0	14°57.4	14°14.2	4.0 - 4.0	10.0 - 9.9	16.0 - 15.9
41	14°25.2	14°27.6	13°45.8	4.1 - 3.9	10.1 - 9.7	16.1 - 15.4	41	14°40.2	14°42.7	14°00.1	4.1 - 4.0	10.1 - 9.8	16.1 - 15.7	41	14°55.2	14°57.7</td				

### Conversion of Arc to Time

0° - 59°			60° - 119°			120° - 179°			180° - 239°			240° - 299°			300° - 360°			0' - 59'			0" - 59"	
°	h	m	°	h	m	°	h	m	°	h	m	°	h	m	°	h	m	'	m	s	"	s
0	0	00	60	4	00	120	8	00	180	12	00	240	16	00	300	20	00	0	0	00	0	0.00
1	0	04	61	4	04	121	8	04	181	12	04	241	16	04	301	20	04	1	0	04	1	0.07
2	0	08	62	4	08	122	8	08	182	12	08	242	16	08	302	20	08	2	0	08	2	0.13
3	0	12	63	4	12	123	8	12	183	12	12	243	16	12	303	20	12	3	0	12	3	0.20
4	0	16	64	4	16	124	8	16	184	12	16	244	16	16	304	20	16	4	0	16	4	0.27
5	0	20	65	4	20	125	8	20	185	12	20	245	16	20	305	20	20	5	0	20	5	0.33
6	0	24	66	4	24	126	8	24	186	12	24	246	16	24	306	20	24	6	0	24	6	0.40
7	0	28	67	4	28	127	8	28	187	12	28	247	16	28	307	20	28	7	0	28	7	0.47
8	0	32	68	4	32	128	8	32	188	12	32	248	16	32	308	20	32	8	0	32	8	0.53
9	0	36	69	4	36	129	8	36	189	12	36	249	16	36	309	20	36	9	0	36	9	0.60
10	0	40	70	4	40	130	8	40	190	12	40	250	16	40	310	20	40	10	0	40	10	0.67
11	0	44	71	4	44	131	8	44	191	12	44	251	16	44	311	20	44	11	0	44	11	0.73
12	0	48	72	4	48	132	8	48	192	12	48	252	16	48	312	20	48	12	0	48	12	0.80
13	0	52	73	4	52	133	8	52	193	12	52	253	16	52	313	20	52	13	0	52	13	0.87
14	0	56	74	4	56	134	8	56	194	12	56	254	16	56	314	20	56	14	0	56	14	0.93
15	1	00	75	5	00	135	9	00	195	13	00	255	17	00	315	21	00	15	1	00	15	1.00
16	1	04	76	5	04	136	9	04	196	13	04	256	17	04	316	21	04	16	1	04	16	1.07
17	1	08	77	5	08	137	9	08	197	13	08	257	17	08	317	21	08	17	1	08	17	1.13
18	1	12	78	5	12	138	9	12	198	13	12	258	17	12	318	21	12	18	1	12	18	1.20
19	1	16	79	5	16	139	9	16	199	13	16	259	17	16	319	21	16	19	1	16	19	1.27
20	1	20	80	5	20	140	9	20	200	13	20	260	17	20	320	21	20	20	1	20	20	1.33
21	1	24	81	5	24	141	9	24	201	13	24	261	17	24	321	21	24	21	1	24	21	1.40
22	1	28	82	5	28	142	9	28	202	13	28	262	17	28	322	21	28	22	1	28	22	1.47
23	1	32	83	5	32	143	9	32	203	13	32	263	17	32	323	21	32	23	1	32	23	1.53
24	1	36	84	5	36	144	9	36	204	13	36	264	17	36	324	21	36	24	1	36	24	1.60
25	1	40	85	5	40	145	9	40	205	13	40	265	17	40	325	21	40	25	1	40	25	1.67
26	1	44	86	5	44	146	9	44	206	13	44	266	17	44	326	21	44	26	1	44	26	1.73
27	1	48	87	5	48	147	9	48	207	13	48	267	17	48	327	21	48	27	1	48	27	1.80
28	1	52	88	5	52	148	9	52	208	13	52	268	17	52	328	21	52	28	1	52	28	1.87
29	1	56	89	5	56	149	9	56	209	13	56	269	17	56	329	21	56	29	1	56	29	1.93
30	2	00	90	6	00	150	10	00	210	14	00	270	18	00	330	22	00	30	2	00	30	2.00
31	2	04	91	6	04	151	10	04	211	14	04	271	18	04	331	22	04	31	2	04	31	2.07
32	2	08	92	6	08	152	10	08	212	14	08	272	18	08	332	22	08	32	2	08	32	2.13
33	2	12	93	6	12	153	10	12	213	14	12	273	18	12	333	22	12	33	2	12	33	2.20
34	2	16	94	6	16	154	10	16	214	14	16	274	18	16	334	22	16	34	2	16	34	2.27
35	2	20	95	6	20	155	10	20	215	14	20	275	18	20	335	22	20	35	2	20	35	2.33
36	2	24	96	6	24	156	10	24	216	14	24	276	18	24	336	22	24	36	2	24	36	2.40
37	2	28	97	6	28	157	10	28	217	14	28	277	18	28	337	22	28	37	2	28	37	2.47
38	2	32	98	6	32	158	10	32	218	14	32	278	18	32	338	22	32	38	2	32	38	2.53
39	2	36	99	6	36	159	10	36	219	14	36	279	18	36	339	22	36	39	2	36	39	2.60
40	2	40	100	6	40	160	10	40	220	14	40	280	18	40	340	22	40	40	2	40	40	2.67
41	2	44	101	6	44	161	10	44	221	14	44	281	18	44	341	22	44	41	2	44	41	2.73
42	2	48	102	6	48	162	10	48	222	14	48	282	18	48	342	22	48	42	2	48	42	2.80
43	2	52	103	6	52	163	10	52	223	14	52	283	18	52	343	22	52	43	2	52	43	2.87
44	2	56	104	6	56	164	10	56	224	14	56	284	18	56	344	22	56	44	2	56	44	2.93
45	3	00	105	7	00	165	11	00	225	15	00	285	19	00	345	23	00	45	3	00	45	3.00
46	3	04	106	7	04	166	11	04	226	15	04	286	19	04	346	23	04	46	3	04	46	3.07
47	3	08	107	7	08	167	11	08	227	15	08	287	19	08	347	23	08	47	3	08	47	3.13
48	3	12	108	7	12	168	11	12	228	15	12	288	19	12	348	23	12	48	3	12	48	3.20
49	3	16	109	7	16	169	11	16	229	15	16	289	19	16	349	23	16	49	3	16	49	3.27
50	3	20	110	7	20	170	11	20	230	15	20	290	19	20	350	23	20	50	3	20	50	3.33
51	3	24	111	7	24	171	11	24	231	15	24	291	19	24	351	23	24	51	3	24	51	3.40
52	3	28	112	7	28	172	11	28	232	15	28	292	19	28	352	23	28	52	3	28	52	3.47
53	3	32	113	7	32	173	11	32	233	15	32	293	19	32	353	23	32	53	3	32	53	3.53
54	3	36	114	7	36	174	11	36	234	15	36	294	19	36	354	23	36	54	3	36	54	3.60
55	3	40	115	7	40	175	11	40	235	15	40	295	19	40	355	23	40	55	3	40	55	3.67
56	3	44	116	7	44	176	11	44	236	15	44	296	19	44	356	23	44	56	3	44	56	3.73
57	3	48	117	7	48	177	11	48	237	15	48	297	19	48	357	23	48	57	3	48	57	3.80
58	3	52	118	7	52	178	11	52	238	15	52	298	19	52	358	23	52	58	3	52	58	3.87
59	3	56	119	7	56	179	11	56	239	15	56	299	19	56	359	23	56	59	3	56	59	3.93
60	4	00	120	8	00	180	12	00	240	16	00	300	20	00	360	24	00	60	4	00	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			SUN			Stars & Planets		Additional Altitude Correction for Mars & Venus		Refraction		DIP always subtracted from Hs											
October – March			April – September			App. Alt.	Lower Limb	Upper Limb	App. Alt.	Corr	°	'	App. Alt.	Corr	Ht. of Eye	Corr	Ht. of Eye	Corr	meters	'	feet	meters	'
•	‘	‘	•	‘	‘	9 39	‘	‘	9 55	‘	5.5	-9.1	2.4	-2.8	8.0	1.0	-1.8	2.4	-2.8	8.0	1.0	-1.8	
9 33	‘	‘	9 39	‘	‘	9 50	+10.6	-21.2	10 07	-5.3	6.0	-8.5	2.6	-2.9	8.6	1.5	-2.2	2.6	-2.9	8.6	1.5	-2.2	
9 45	+10.8	-21.5	9 50	+10.7	-21.1	10 02	+10.8	-21.0	10 20	-5.2	6.5	-7.9	2.8	-3.0	9.2	2.0	-2.5	3.0	-3.1	9.8	2.5	-2.8	
9 56	+10.9	-21.4	10 02	+10.8	-21.0	10 14	+10.9	-20.9	10 32	-5.1	7.0	-7.5	3.2	-3.2	10.5	3.0	-3.0	3.4	-3.3	11.2	3.0	-3.0	
10 08	+11.0	-21.3	10 14	+11.0	-20.8	10 27	+11.0	-20.8	10 46	-4.9	7.5	-7.0	3.6	-3.4	11.9	See table ←		3.8	-3.5	12.6	See table ←		
10 20	+11.1	-21.2	10 40	+11.1	-20.7	10 53	+11.2	-20.6	11 14	-4.8	8.0	-6.6	4.0	-3.6	13.3			4.0	-3.6	13.3			
10 33	+11.2	-21.1	11 07	+11.3	-20.5	11 07	+11.3	-20.5	11 29	-4.7	8.5	-6.3	4.3	-3.7	14.1			4.3	-3.7	14.1			
10 46	+11.3	-21.0	11 22	+11.4	-20.4	11 37	+11.5	-20.3	12 00	-4.4	9.0	-5.9	4.5	-3.8	14.9			4.5	-3.8	14.9			
11 00	+11.4	-20.9	11 37	+11.5	-20.3	11 53	+11.6	-20.2	12 17	-4.3	9.5	-5.7	4.7	-3.9	15.7			4.7	-3.9	15.7			
11 15	+11.5	-20.8	12 10	+11.7	-20.1	12 27	+11.8	-20.0	12 35	-4.2	10.0	-5.4	5.0	-4.0	16.5			5.0	-4.0	16.5			
11 30	+11.6	-20.7	12 27	+11.8	-20.0	14 45	+11.9	-19.9	13 12	-4.1	10.5	-5.1	5.2	-4.1	17.4			5.2	-4.1	17.4			
11 45	+11.7	-20.6	13 04	+12.0	-19.8	13 24	+12.1	-19.7	13 32	-3.9	11.0	-4.9	5.5	-4.2	18.3			5.5	-4.2	18.3			
12 01	+11.8	-20.5	13 24	+12.2	-19.7	13 44	+12.2	-19.6	14 16	-3.8	11.5	-4.7	5.8	-4.3	19.1			5.8	-4.3	19.1			
12 18	+11.9	-20.4	13 44	+12.2	-19.6	14 06	+12.3	-19.5	14 39	-3.7	12.0	-4.5	6.1	-4.0	20.1			6.1	-4.0	20.1			
12 36	+12.0	-20.3	14 29	+12.4	-19.4	14 53	+12.5	-19.3	15 29	-3.4	12.5	-4.4	6.3	-4.4	21.0			6.3	-4.4	21.0			
12 54	+12.1	-20.2	15 03	+12.6	-19.2	15 18	+12.6	-19.2	15 56	-3.3	13.0	-4.2	6.6	-4.5	21.8			6.6	-4.5	21.8			
13 14	+12.2	-20.1	15 18	+12.5	-19.3	15 45	+12.7	-19.1	16 25	-3.2	13.5	-4.0	6.9	-4.7	22.9			6.9	-4.7	22.9			
13 34	+12.3	-20.0	15 45	+12.6	-19.2	16 13	+12.8	-19.0	16 55	-3.1	14.0	-3.9	7.2	-4.8	23.9			7.2	-4.8	23.9			
13 55	+12.4	-19.9	16 27	+12.8	-18.9	16 43	+12.9	-18.9	17 27	-3.0	14.5	-3.8	7.5	-4.9	24.9			7.5	-4.9	24.9			
14 17	+12.5	-19.8	17 14	+13.0	-18.8	17 47	+13.1	-18.7	18 37	-2.9	17.0	-3.2	7.9	-5.0	26.0			7.9	-5.0	26.0			
14 41	+12.6	-19.7	18 23	+13.2	-18.6	19 00	+13.3	-18.5	19 16	-2.8	17.5	-3.1	8.2	-5.1	27.1			8.2	-5.1	27.1			
15 05	+12.7	-19.6	19 41	+13.4	-18.4	20 24	+13.5	-18.3	20 40	-2.5	18 01	-3.0	8.5	-5.2	28.1			8.5	-5.2	28.1			
15 31	+12.8	-19.5	20 40	+13.6	-18.2	21 10	+13.6	-18.2	21 27	-2.4	21 17	-2.3	22.0	-2.4	36.3			22.0	-2.4	36.3			
15 59	+12.9	-19.4	21 17	+13.7	-18.1	21 59	+13.7	-18.1	23 11	-2.2	22.0	-2.3	11.0	-5.9	37.6			11.0	-5.9	37.6			
16 27	+13.0	-19.3	22 52	+13.8	-18.0	23 49	+13.9	-17.9	25 12	-2.0	23.0	-2.3	11.4	-6.0	38.9			11.4	-6.0	38.9			
16 58	+13.1	-19.2	24 51	+14.0	-17.8	25 58	+14.0	-17.8	26 20	-1.9	24.0	-2.2	11.8	-6.1	40.1			11.8	-6.1	40.1			
17 30	+13.2	-19.1	27 11	+14.1	-17.7	28 31	+14.2	-17.6	30 22	-1.7	25.0	-2.1	12.2	-6.2	41.5			12.2	-6.2	41.5			
18 05	+13.3	-19.0	28 31	+14.3	-17.5	29 58	+14.3	-17.4	31 58	-1.6	26.0	-2.0	12.6	-6.3	42.8			12.6	-6.3	42.8			
18 41	+13.4	-18.9	31 33	+14.5	-17.3	33 18	+14.6	-17.2	35 38	-1.3	27.0	-1.9	13.0	-6.4	44.2			13.0	-6.4	44.2			
19 20	+13.5	-18.8	33 18	+14.6	-17.2	35 15	+14.7	-17.1	37 45	-1.2	28.0	-1.9	13.4	-6.5	45.5			13.4	-6.5	45.5			
20 02	+13.6	-18.7	35 15	+14.7	-17.1	37 24	+14.8	-17.0	40 06	-1.1	29.0	-1.8	13.8	-6.6	46.9			13.8	-6.6	46.9			
20 46	+13.7	-18.6	37 24	+14.8	-17.0	39 48	+14.9	-16.9	42 42	-1.0	30.0	-1.7	14.2	-6.7	48.4			14.2	-6.7	48.4			
21 34	+13.8	-18.5	40 06	+15.0	-16.8	42 28	+15.0	-16.8	45 34	-0.9	31.0	-1.7	14.7	-6.8	50.8			14.7	-6.8	50.8			
22 25	+13.9	-18.4	45 29	+15.1	-16.7	45 52	+15.2	-16.6	51 14	-0.7	32.0	-1.6	15.1	-6.9	52.8			15.1	-6.9	52.8			
23 20	+14.0	-18.3	51 41	+15.3	-16.5	56 09	+15.3	-16.5	56 09	-0.6	33.0	-1.5	15.5	-7.0	54.3			15.5	-7.0	54.3			
24 20	+14.1	-18.2	56 59	+15.4	-16.4	60 26	+15.4	-16.4	65 06	-0.5	34.0	-1.5	16.0	-7.1	56.4			16.0	-7.1	56.4			
25 24	+14.2	-18.1	61 50	+15.5	-16.3	67 15	+15.6	-16.2	70 09	-0.4	35.0	-1.4	16.5	-7.2	58.8			16.5	-7.2	58.8			
26 34	+14.3	-18.0	73 14	+15.7	-16.1	75 32	+15.7	-16.1	81 12	-0.3	36.0	-1.4	16.9	-7.3	60.4			16.9	-7.3	60.4			
27 50	+14.4	-17.9	79 42	+15.8	-16.0	86 21	+15.9	-15.9	87 03	-0.1	37.0	-1.3	17.4	-7.4	62.1			17.4	-7.4	62.1			
29 13	+14.5	-17.8	90 00	+15.9	-15.9	90 00	0.0	0.0			38.0	-1.3	17.9	-7.5	63.8			17.9	-7.5	63.8			
30 44	+14.6	-17.7									39.0	-1.2	18.4	-7.6	65.4			18.4	-7.6	65.4			
32 24	+14.7	-17.6									40.0	-1.2	18.8	-7.7	67.1			18.8	-7.7	67.1			
34 15	+14.8	-17.5									45.0	-1.0	19.3	-7.8	68.8			19.3	-7.8	68.8			
36 17	+14.9	-17.4									50.0	-0.8	19.8	-7.9	70.5			19.8	-7.9	70.5			
38 34	+15.0	-17.3									55.0	-0.7	20.4	-8.0	72.1			20.4	-8.0	72.1			
41 06	+15.1	-17.2									60.0	-0.6	20.9	-8.1	73.8			20.9	-8.1	73.8			
43 56	+15.2	-17.1									65.0	-0.5	21.4	-8.1	75.5			21.4	-8.1	75.5			
47 07	+15.3	-17.0									70.0	-0.4											
50 43	+15.4	-16.9									75.0	-0.3											
54 46	+15.5	-16.8									80.0	-0.2											
59 21	+15.6	-16.7									85.0	-0.1											
64 28	+15.7	-16.6																					
70 10	+15.8	-16.5																					
76 24	+15.9	-16.4																					
83 05	+16.0	-16.3																					
90 00	+16.1	-16.2																					

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

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**Altitude Correction Tables for 0° to 10° — Sun, Stars, Planets**

App. Alt.	Sun		Stars & Planets	App. Alt.	Sun		Sun	Sun		Stars & Planets				
	October – March				April – September			April – September						
	Lower Limb	Upper Limb			Lower Limb	Upper Limb		Lower Limb	Upper Limb					
0 . .	-	-	-	0 . .	-	-	0 . .	-	-	-				
0 00	- 17.5	- 49.8	- 17.8	0 00	- 49.6	- 33.8	3 30	+ 3.4	- 28.9	+ 3.1	- 28.7	- 12.9		
0 03	16.9	49.2	17.2	0 03	49.0	33.2	3 35	3.6	28.7	3.3	28.5	12.7		
0 06	16.3	48.6	16.6	0 06	48.4	32.6	3 40	3.8	28.5	3.6	28.2	12.5		
0 09	15.7	48.0	16.0	0 09	47.8	32.0	3 45	4.0	28.3	3.8	28.0	12.3		
0 12	15.2	47.5	15.4	0 12	47.2	31.5	3 50	4.2	28.1	4.0	27.8	12.1		
0 15	14.6	46.9	14.8	0 15	46.6	30.9	3 55	4.4	27.9	4.1	27.7	11.9		
0 18	- 14.1	- 46.4	- 14.3	0 18	- 46.1	- 30.4	4 00	+ 4.6	- 27.7	+ 4.3	- 27.5	- 11.7		
0 21	13.5	45.8	13.8	0 21	33.8	29.8	4 05	4.8	27.5	4.5	27.3	11.5		
0 24	13.0	45.3	13.3	0 24	45.1	29.3	4 10	4.9	27.4	4.7	27.1	11.4		
0 27	12.5	44.8	12.8	0 27	44.6	28.8	4 15	5.1	27.2	4.9	26.9	11.2		
0 30	12.0	44.3	12.3	0 30	44.1	28.3	4 20	5.3	27.0	5.0	26.8	11.0		
0 33	11.6	43.9	11.8	0 33	43.6	27.9	4 25	5.4	26.9	5.2	26.6	10.9		
0 36	- 11.1	- 10.0	- 11.3	0 36	- 43.1	- 27.4	4 30	+ 5.6	- 26.7	+ 5.3	- 26.5	- 10.7		
0 39	10.6	42.9	10.9	0 39	42.7	26.9	4 35	5.7	26.6	5.5	26.3	10.6		
0 42	10.2	42.5	10.5	0 42	42.3	26.5	4 40	5.9	26.4	5.6	26.2	10.4		
0 45	9.8	42.1	10.0	0 45	41.8	26.1	4 45	6.0	26.3	5.8	26.0	10.3		
0 48	9.4	41.7	9.6	0 48	41.4	25.7	4 50	6.2	26.1	5.9	25.9	10.1		
0 51	9.0	41.3	9.2	0 51	41.0	25.3	4 55	6.3	26.0	6.1	25.7	10.0		
0 54	- 8.6	- 40.9	- 8.8	0 54	- 40.6	- 24.9	5 00	+ 6.4	- 25.9	+ 6.2	- 25.6	- 9.9		
0 57	8.2	40.5	8.4	0 57	40.2	24.5	5 05	6.6	25.7	6.3	25.5	9.7		
1 00	7.8	40.1	8.0	1 00	39.8	24.1	5 10	6.7	25.6	6.5	25.3	9.6		
1 03	7.4	39.7	7.7	1 03	39.5	23.7	5 15	6.8	25.5	6.6	25.2	9.5		
1 06	7.1	39.4	7.3	1 06	39.1	23.4	5 20	7.0	25.3	6.7	25.1	9.3		
1 09	6.7	39.0	7.0	1 09	38.8	23.0	5 25	7.1	25.2	6.8	25.0	9.2		
1 12	- 6.4	- 38.7	- 6.6	1 12	- 38.4	- 22.7	5 30	+ 7.2	- 25.1	+ 6.9	- 24.9	- 9.1		
1 15	6.0	38.3	6.3	1 15	38.1	22.3	5 35	7.3	25.0	7.1	24.7	9.0		
1 18	5.7	38.0	6.0	1 18	37.8	22.0	5 40	7.4	24.9	7.2	24.6	8.9		
1 21	5.4	37.7	5.7	1 21	37.5	21.7	5 45	7.5	24.8	7.3	24.5	8.8		
1 24	5.1	37.4	5.3	1 24	37.1	21.4	5 50	7.6	24.7	7.4	24.4	8.7		
1 27	4.8	37.1	5.0	1 27	33.8	21.1	5 55	7.7	24.6	7.5	24.3	8.6		
1 30	- 4.5	- 36.8	- 4.7	1 30	- 36.5	- 20.8	6 00	+ 7.8	- 24.5	+ 7.6	- 24.2	- 8.5		
1 35	4.0	36.3	4.3	1 35	36.1	20.3	6 10	8.0	24.3	7.8	24.0	8.3		
1 40	3.6	35.9	3.8	1 40	35.6	19.9	6 20	8.2	24.1	8.0	23.8	8.1		
1 45	3.1	35.4	3.4	1 45	35.2	19.4	6 30	8.4	23.9	8.2	23.6	7.9		
1 50	2.7	35.0	2.9	1 50	34.7	19.0	6 40	8.6	23.7	8.3	23.5	7.7		
1 55	2.3	34.6	2.5	1 55	34.3	18.6	6 50	8.7	23.6	8.5	23.3	7.6		
2 00	- 1.9	- 34.2	- 2.1	2 00	- 33.9	- 18.2	7 00	+ 8.9	- 23.4	+ 8.7	- 23.1	- 7.4		
2 05	1.5	33.8	1.7	2 05	33.5	17.8	7 10	9.1	23.2	8.8	23.0	7.2		
2 10	1.1	33.4	1.4	2 10	33.2	17.4	7 20	9.2	23.1	9.0	22.8	7.1		
2 15	0.8	33.1	1.0	2 15	32.8	17.1	7 30	9.3	23.0	9.1	22.7	6.9		
2 20	0.4	32.7	0.7	2 20	32.5	16.7	7 40	9.5	22.8	9.2	22.6	6.8		
2 25	- 0.1	32.4	- 0.3	2 25	32.1	16.4	7 50	9.6	22.7	9.4	22.4	6.7		
2 30	+ 0.2	- 32.1	0.0	2 30	- 31.8	- 16.1	8 00	+ 9.7	- 22.6	+ 9.5	- 22.3	- 6.6		
2 35	0.5	31.8	+ 0.3	2 35	31.5	15.8	8 10	9.9	22.4	9.6	22.2	6.4		
2 40	0.8	31.5	0.6	2 40	31.2	15.4	8 20	10.0	22.3	9.7	22.1	6.3		
2 45	1.1	31.2	0.9	2 45	30.9	15.2	8 30	10.1	22.2	9.9	21.9	6.2		
2 50	1.4	30.9	1.2	2 50	30.6	14.9	8 40	10.2	22.1	10.0	21.8	6.1		
2 55	1.7	30.6	1.4	2 55	30.4	14.9	8 50	10.3	22.0	10.1	21.7	6.0		
3 00	+ 2.0	- 30.3	+ 1.7	3 00	- 30.1	- 14.3	9 00	+ 10.4	- 21.9	+ 10.2	- 21.6	- 5.9		
3 05	2.2	30.1	2.0	3 05	29.8	14.1	9 10	10.5	21.8	10.3	21.5	5.8		
3 10	2.5	29.8	2.2	3 10	29.6	13.8	9 20	10.6	21.7	10.4	21.4	5.7		
3 15	2.7	29.6	2.5	3 15	29.3	13.6	9 30	10.7	21.6	10.5	21.3	5.6		
3 20	2.9	29.4	2.7	3 20	29.1	13.4	9 40	10.8	21.5	10.6	21.2	5.5		
3 25	3.2	29.1	2.9	3 25	28.9	13.4	9 50	10.9	21.4	10.6	21.2	5.4		
3 30	3.4	- 28.9	+ 3.1	3 30	- 28.7	- 12.9	10 00	+ 11.0	- 21.3	+ 10.7	- 21.1	- 5.3		

For bubble sextant observations- ignore dip and use star corrections for the Sun, planets and stars.

# ALTITUDE CORRECTION TABLES 0° – 35° — MOON

App. Alt.	0° – 4°		5° – 9°		10° – 14°		15° – 19°		20° – 24°		25° – 29°		30° – 34°		App. Alt.
	Corr <sup>n</sup>														
'	0°	5°	10°	15°	20°	25°	30°								
<b>00</b>	34.5	58.2	62.1	62.8	62.2	60.8	58.9	<b>00</b>							
<b>10</b>	36.5	58.5	62.2	62.8	62.2	60.8	58.8	<b>10</b>							
<b>20</b>	38.3	58.7	62.2	62.8	62.1	60.7	58.8	<b>20</b>							
<b>30</b>	40.0	58.9	62.3	62.8	62.1	60.7	58.7	<b>30</b>							
<b>40</b>	41.5	59.1	62.3	62.8	62.0	60.6	58.6	<b>40</b>							
<b>50</b>	42.9	59.3	62.4	62.7	62.0	60.6	58.5	<b>50</b>							
	<b>1°</b>	<b>6°</b>	<b>11°</b>	<b>16°</b>	<b>21°</b>	<b>26°</b>	<b>31°</b>								
<b>00</b>	44.2	59.5	62.4	62.7	62.0	60.5	58.5	<b>00</b>							
<b>10</b>	45.4	59.7	62.4	62.7	61.9	60.4	58.4	<b>10</b>							
<b>20</b>	46.5	59.9	62.5	62.7	61.9	60.4	58.3	<b>20</b>							
<b>30</b>	47.5	60.0	62.5	62.7	61.9	60.3	58.2	<b>30</b>							
<b>40</b>	48.4	60.2	62.5	62.7	61.8	60.3	58.2	<b>40</b>							
<b>50</b>	49.3	60.3	62.6	62.7	61.8	60.2	58.1	<b>50</b>							
	<b>2°</b>	<b>7°</b>	<b>12°</b>	<b>17°</b>	<b>22°</b>	<b>27°</b>	<b>32°</b>								
<b>00</b>	50.1	60.5	62.6	62.7	61.7	60.1	58.0	<b>00</b>							
<b>10</b>	50.8	60.6	62.6	62.6	61.7	60.1	57.9	<b>10</b>							
<b>20</b>	51.5	60.7	62.6	62.6	61.6	60.0	57.8	<b>20</b>							
<b>30</b>	52.2	60.9	62.7	62.6	61.6	59.9	57.8	<b>30</b>							
<b>40</b>	52.8	61.0	62.7	62.6	61.6	59.9	57.7	<b>40</b>							
<b>50</b>	53.4	61.1	62.7	62.6	61.5	59.8	57.6	<b>50</b>							
	<b>3°</b>	<b>8°</b>	<b>13°</b>	<b>18°</b>	<b>23°</b>	<b>28°</b>	<b>33°</b>								
<b>00</b>	53.9	61.2	62.7	62.5	61.5	59.7	57.5	<b>00</b>							
<b>10</b>	54.4	61.3	62.7	62.5	61.4	59.7	57.4	<b>10</b>							
<b>20</b>	54.9	61.4	62.7	62.5	61.4	59.6	57.4	<b>20</b>							
<b>30</b>	55.3	61.5	62.8	62.5	61.3	59.5	57.3	<b>30</b>							
<b>40</b>	55.7	61.6	62.8	62.4	61.3	59.5	57.2	<b>40</b>							
<b>50</b>	56.1	61.6	62.8	62.4	61.2	59.4	57.1	<b>50</b>							
	<b>4°</b>	<b>9°</b>	<b>14°</b>	<b>19°</b>	<b>24°</b>	<b>29°</b>	<b>34°</b>								
<b>00</b>	56.4	61.7	62.8	62.4	61.2	59.3	57.0	<b>00</b>							
<b>10</b>	56.8	61.8	62.8	62.4	61.1	59.3	56.9	<b>10</b>							
<b>20</b>	57.1	61.9	62.8	62.3	61.1	59.2	56.9	<b>20</b>							
<b>30</b>	57.4	61.9	62.8	62.3	61.0	59.1	56.8	<b>30</b>							
<b>40</b>	57.7	62.0	62.8	62.3	61.0	59.1	56.7	<b>40</b>							
<b>50</b>	58.0	62.1	62.8	62.2	60.9	59.0	56.6	<b>50</b>							
HP	L	U	L	U	L	U	L	U	L	U	L	U	L	U	HP
'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
<b>54.0</b>	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	<b>54.0</b>
<b>54.3</b>	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	<b>54.3</b>
<b>54.6</b>	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	<b>54.6</b>
<b>54.9</b>	1.4	1.6	1.4	1.6	1.5	1.6	1.7	1.6	1.6	1.8	1.8	1.9	2.0	2.0	<b>54.9</b>
<b>55.2</b>	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	<b>55.2</b>
<b>55.5</b>	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	<b>55.5</b>
<b>55.8</b>	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	<b>55.8</b>
<b>56.1</b>	3.0	2.4	3.0	2.5	3.0	2.5	3.1	2.6	3.1	2.6	3.2	2.7	3.2	2.7	<b>56.1</b>
<b>56.4</b>	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	<b>56.4</b>
<b>56.7</b>	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	<b>56.7</b>
<b>57.0</b>	4.1	3.1	4.1	3.1	4.1	3.1	4.2	3.2	4.2	3.2	4.2	3.2	4.2	3.2	<b>57.0</b>
<b>57.3</b>	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.3	4.5	3.4	4.6	3.4	4.6	3.4	<b>57.3</b>
<b>57.6</b>	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.5	4.9	3.6	4.9	3.6	<b>57.6</b>
<b>57.9</b>	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	<b>57.9</b>
<b>58.2</b>	5.6	4.0	5.6	4.0	5.6	4.0	5.6	3.9	5.6	3.9	5.6	3.9	5.6	3.9	<b>58.2</b>
<b>58.5</b>	6.0	4.2	6.0	4.2	6.0	4.2	6.0	4.1	5.9	4.1	5.9	4.1	5.9	4.1	<b>58.5</b>
<b>58.8</b>	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	<b>58.8</b>
<b>59.1</b>	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	<b>59.1</b>
<b>59.4</b>	7.2	4.8	7.1	4.8	7.1	4.8	7.0	4.7	7.0	4.7	6.9	4.6	6.9	4.6	<b>59.4</b>
<b>59.7</b>	7.5	5.1	7.5	5.0	7.5	5.0	7.4	4.9	7.3	4.8	7.2	4.8	7.2	4.8	<b>59.7</b>
<b>60.0</b>	7.9	5.3	7.9	5.3	7.9	5.2	7.8	5.1	7.7	5.0	7.6	4.9	7.6	4.9	<b>60.0</b>
<b>60.3</b>	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	<b>60.3</b>
<b>60.6</b>	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	<b>60.6</b>
<b>60.9</b>	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	<b>60.9</b>
<b>61.2</b>	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	<b>61.2</b>
<b>61.5</b>	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	<b>61.5</b>

DIP					
Ht. of Eye	Corr <sup>n</sup>	Ht. of Eye	Corr <sup>n</sup>	Ht. of Eye	Corr <sup>n</sup>
m	'	ft		m	'
2.4	-2.8	7.9		9.5	-5.5
2.6	-2.9	8.5		9.9	-5.6
2.8	-3.0	9.2		10.3	-5.7
3.0	-3.1	9.8		10.6	-5.8
3.2	-3.2	10.5		11.0	-5.9
3.4	-3.3	11.2		11.4	-6.0
3.6	-3.4	11.8		11.8	-6.1
3.8	-3.5	12.5		12.2	-6.2
4.0	-3.6	13.1		12.6	-6.3
4.3	-3.7	14.1		13.0	-6.4
4.5	-3.8	14.8		13.4	-6.5
4.7	-3.9	15.4		13.8	-6.6
5.0	-4.0	16.4		14.2	-6.7
5.2	-4.1	17.1		14.7	-6.8
5.5	-4.2	18.0		15.1	-6.9
5.8	-4.3	19.0		15.5	-7.0
6.1	-4.4	20.0		16.0	-7.1
6.3	-4.5	20.7		16.5	-7.2
6.6	-4.6	21.7		16.9	-7.3
6.9	-4.7	22.6		17.4	-7.4
7.2	-4.8	23.6		17.9	-7.5
7.5	-4.9	24.6		18.4	-7.6
7.9	-5.0	25.9		18.8	-7.7
8.2	-5.1	26.9		19.3	-7.8
8.5	-5.2	27.9		19.8	-7.9
8.8	-5.3	28.9		20.4	-8.0
9.2	-5.4	30.2		20.9	-8.1
9.5	-5.5	31.2		21.4	-7.0.2

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.

# 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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>					Corr <sup>n</sup>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
'	35°	40°	45°	50°	55°	60°	65°	70°	75°	80°	85°	86°	87°	88°	89°	90°	91°	92°	93°	94°	95°	96°	97°	98°	99°	100°	101°	102°	103°	104°	105°	106°	107°	108°	109°	110°	111°	112°	113°	114°	115°	116°	117°	118°	119°	120°	121°	122°	123°	124°	125°	126°	127°	128°	129°	130°	131°	132°	133°	134°	135°	136°	137°	138°	139°	140°	141°	142°	143°	144°	145°	146°	147°	148°	149°	150°	151°	152°	153°	154°	155°	156°	157°	158°	159°	160°	161°	162°	163°	164°	165°	166°	167°	168°	169°	170°	171°	172°	173°	174°	175°	176°	177°	178°	179°	180°	181°	182°	183°	184°	185°	186°	187°	188°	189°	190°	191°	192°	193°	194°	195°	196°	197°	198°	199°	200°	201°	202°	203°	204°	205°	206°	207°	208°	209°	210°	211°	212°	213°	214°	215°	216°	217°	218°	219°	220°	221°	222°	223°	224°	225°	226°	227°	228°	229°	230°	231°	232°	233°	234°	235°	236°	237°	238°	239°	240°	241°	242°	243°	244°	245°	246°	247°	248°	249°	250°	251°	252°	253°	254°	255°	256°	257°	258°	259°	260°	261°	262°	263°	264°	265°	266°	267°	268°	269°	270°	271°	272°	273°	274°	275°	276°	277°	278°	279°	280°	281°	282°	283°	284°	285°	286°	287°	288°	289°	290°	291°	292°	293°	294°	295°	296°	297°	298°	299°	300°	301°	302°	303°	304°	305°	306°	307°	308°	309°	310°	311°	312°	313°	314°	315°	316°	317°	318°	319°	320°	321°	322°	323°	324°	325°	326°	327°	328°	329°	330°	331°	332°	333°	334°	335°	336°	337°	338°	339°	340°	341°	342°	343°	344°	345°	346°	347°	348°	349°	350°	351°	352°	353°	354°	355°	356°	357°	358°	359°	360°	361°	362°	363°	364°	365°	366°	367°	368°	369°	370°	371°	372°	373°	374°	375°	376°	377°	378°	379°	380°	381°	382°	383°	384°	385°	386°	387°	388°	389°	390°	391°	392°	393°	394°	395°	396°	397°	398°	399°	400°	401°	402°	403°	404°	405°	406°	407°	408°	409°	410°	411°	412°	413°	414°	415°	416°	417°	418°	419°	420°	421°	422°	423°	424°	425°	426°	427°	428°	429°	430°	431°	432°	433°	434°	435°	436°	437°	438°	439°	440°	441°	442°	443°	444°	445°	446°	447°	448°	449°	450°	451°	452°	453°	454°	455°	456°	457°	458°	459°	460°	461°	462°	463°	464°	465°	466°	467°	468°	469°	470°	471°	472°	473°	474°	475°	476°	477°	478°	479°	480°	481°	482°	483°	484°	485°	486°	487°	488°	489°	490°	491°	492°	493°	494°	495°	496°	497°	498°	499°	500°	501°	502°	503°	504°	505°	506°	507°	508°	509°	510°	511°	512°	513°	514°	515°	516°	517°	518°	519°	520°	521°	522°	523°	524°	525°	526°	527°	528°	529°	530°	531°	532°	533°	534°	535°	536°	537°	538°	539°	540°	541°	542°	543°	544°	545°	546°	547°	548°	549°	550°	551°	552°	553°	554°	555°	556°	557°	558°	559°	560°	561°	562°	563°	564°	565°	566°	567°	568°	569°	570°	571°	572°	573°	574°	575°	576°	577°	578°	579°	580°	581°	582°	583°	584°	585°	586°	587°	588°	589°	590°	591°	592°	593°	594°	595°	596°	597°	598°	599°	600°	601°	602°	603°	604°	605°	606°	607°	608°	609°	610°	611°	612°	613°	614°	615°	616°	617°	618°	619°	620°	621°	622°	623°	624°	625°	626°	627°	628°	629°	630°	631°	632°	633°	634°	635°	636°	637°	638°	639°	640°	641°	642°	643°	644°	645°	646°	647°	648°	649°	650°	651°	652°	653°	654°	655°	656°	657°	658°	659°	660°	661°	662°	663°	664°	665°	666°	667°	668°	669°	670°	671°	672°	673°	674°	675°	676°	677°	678°	679°	680°	681°	682°	683°	684°	685°	686°	687°	688°	689°	690°	691°	692°	693°	694°	695°	696°	697°	698°	699°	700°	701°	702°	703°	704°	705°	706°	707°	708°	709°	710°	711°	712°	713°	714°	715°	716°	717°	718°	719°	720°	721°	722°	723°	724°	725°	726°	727°	728°	729°	730°	731°	732°	733°	734°	735°	736°	737°	738°	739°	740°	741°	742°	743°	744°	745°	746°	747°	748°	749°	750°	751°	752°	753°	754°	755°	756°	757°	758°	759°	760°	761°	762°	763°	764°	765°	766°	767°	768°	769°	770°	771°	772°	773°	774°	775°	776°	777°	778°	779°	780°	781°	782°	783°	784°	785°	786°	787°	788°	789°	790°	791°	792°	793°	794°	795°	796°	797°	798°	799°	800°	801°	802°	803°	804°	805°	806°	807°	808°	809°	810°	811°	812°	813°	814°	815°	816°	817°	818°	819°	820°	821°	822°	823°	824°	825°	826°	827°	828°	829°	830°	831°	832°	833°	834°	835°	836°	837°	838°	839°	840°	841°	842°	843°	844°	845°	846°	847°	848°	849°	850°	851°	852°	853°	854°	855°	856°	857°	858°	859°	860°	861°	862°	863°	864°	865°	866°	867°	868°	869°	870°	871°	872°	873°	874°	875°	876°	877°	878°	879°	880°	881°	882°	883°	884°	885°	886°	887°	888°	889°	890°	891°	892°	893°	894°	895°	896°	897°	898°	899°	900°	901°	902°	903°	904°	905°	906°	907°	908°	909°	910°	911°	912°	913°	914°	915°	916°	917°	918°	919°	920°	921°	922°	923°	924°	925°	926°	927°	928°	929°	930°	931°	932°	933°	934°	935°	936°	937°	938°	939°	940°	941°	942°	943°	944°	945°	946°	947°	948°	949°	950°	951°	952°	953°	954°	955°	956°	957°	958°	959°	960°	961°	962°	963°	964°	965°	966°	967°	968°	969°	970°	971°	972°	973°	974°	975°	976°	977°	978°	979°	980°	981°	982°	983°	984°	985°	986°	987°	988°	989°	990°	991°	992°	993°	994°	995°	996°	997°	998°	999°	1000°

# NAVIGATIONAL STAR CHART

