

## THE NAUTICAL ALMANAC

from 27.6.2021

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# June 27, 28, 29 UT (Sun., Mon., Tue.)

h	Aries			Venus		Mars		Jupiter		Saturn		Stars		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec	
0	275°19.5	153°01.2	N21°44.4	143°00.0	N19°04.8	300°51.2	S11°38.7	320°03.5	S17°42.6			Alpheratz	357°37.7 29°12.3	
1	290°21.9	168°00.4	43.8	158°00.9	04.3	315°53.7	38.7	335°06.1	42.7			Ankaa	353°10.1 -42°11.2	
2	305°24.4	182°59.7	43.2	173°01.8	03.9	330°56.2	38.8	350°08.7	42.7			Schedar	349°34.3 56°38.9	
3	320°26.9	197°59.0	· · 42.6	188°02.7	· · 03.5	345°58.7	· · 38.8	5°11.3	· · 42.8			Diphda	348°50.2 -17°52.1	
4	335°29.3	212°58.3	42.0	203°03.6	03.1	1°01.2	38.8	20°13.9	42.8			Achernar	335°22.6 -57°07.5	
5	350°31.8	227°57.5	41.4	218°04.5	02.6	16°03.7	38.8	35°16.5	42.8			Hamal	327°54.6 23°33.6	
6	5°34.2	242°56.8	N21°40.8	233°05.4	N19°02.2	31°06.3	S11°38.9	50°19.1	S17°42.9			Polaris	315°39.0 89°20.9	
7	20°36.7	257°56.1	40.1	248°06.2	01.8	46°08.8	38.9	65°21.7	42.9			Acamar	315°14.3 -40°13.0	
8	35°39.2	272°55.3	39.5	263°07.1	01.4	61°11.3	38.9	80°24.2	43.0			Menkar	314°09.4 4°10.3	
9	50°41.6	287°54.6	· · 38.9	278°08.0	· · 00.9	76°13.8	· · 39.0	95°26.8	· · 43.0			Mirfak	308°32.7 49°56.0	
10	65°44.1	302°53.9	38.3	293°08.9	00.5	91°16.3	39.0	110°29.4	43.0			Aldebaran	290°43.2 16°33.0	
11	80°46.6	317°53.1	37.7	308°09.8	19°00.1	106°18.8	39.0	125°32.0	43.1			Rigel	281°07.0 -8°10.6	
12	95°49.0	332°52.4	N21°37.0	323°10.7	N18°59.6	121°21.3	S11°39.1	140°34.6	S17°43.1			Capella	280°26.6 46°01.0	
13	110°51.5	347°51.7	36.4	338°11.6	59.2	136°23.8	39.1	155°37.2	43.2			Bellatrix	278°26.3 6°22.1	
14	125°54.0	2°51.0	35.8	353°12.5	58.8	151°26.3	39.1	170°39.8	43.2			Elnath	278°05.9 28°37.4	
15	140°56.4	17°50.2	· · 35.2	8°13.4	· · 58.4	166°28.9	· · 39.2	185°42.4	· · 43.2			Alnilam	275°41.0 -1°11.3	
16	155°58.9	32°49.5	34.5	23°14.3	57.9	181°31.4	39.2	200°45.0	43.3			Betelgeuse	270°55.5 7°24.6	
17	171°01.4	47°48.8	33.9	38°15.2	57.5	196°33.9	39.2	215°47.6	43.3			Canopus	263°54.2 -52°42.4	
18	186°03.8	62°48.1	N21°33.3	53°16.1	N18°57.1	211°36.4	S11°39.2	230°50.2	S17°43.4			Sirius	258°29.1 -16°44.7	
19	201°06.3	77°47.3	32.7	68°16.9	56.6	226°38.9	39.3	245°52.8	43.4			Adhara	255°08.5 -29°00.1	
20	216°08.7	92°46.6	32.0	83°17.8	56.2	241°41.4	39.3	260°55.4	43.5			Procyon	244°54.2 5°10.2	
21	231°11.2	107°45.9	· · 31.4	98°18.7	· · 55.8	256°43.9	· · 39.3	275°58.0	· · 43.5			Pollux	243°21.2 27°58.5	
22	246°13.7	122°45.2	30.8	113°19.6	55.4	271°46.5	39.4	291°00.5	43.5			Avior	234°16.4 -59°34.8	
23	261°16.1	137°44.4	30.1	128°20.5	54.9	286°49.0	39.4	306°03.1	43.6			Suhail	222°48.7 -43°31.2	
Mer.pass.:05:38		v-0.7 d-0.6 m-3.8			v0.9 d-0.4 m1.8		v2.5 d-0.0 m-2.5		v2.6 d-0.0 m0.4					
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	276°18.6	152°43.7	N21°29.5	143°21.4	N18°54.5	301°51.5	S11°39.4	321°05.7	S17°43.6			Miaplacidus	221°39.5 -69°48.5	
1	291°21.1	167°43.0	28.9	158°22.3	54.1	316°54.0	39.5	336°08.3	43.7			Alphard	217°50.8 -8°45.1	
2	306°23.5	182°42.3	28.2	173°23.2	53.6	331°56.5	39.5	351°10.9	43.7			Regulus	207°37.7 11°51.9	
3	321°26.0	197°41.6	· · 27.6	188°24.1	· · 53.2	346°59.0	· · 39.5	6°13.5	· · 43.8			Dubhe	193°44.9 61°38.5	
4	336°28.5	212°40.8	27.0	203°25.0	52.8	2°01.6	39.6	21°16.1	43.8			Denebola	182°28.0 14°27.3	
5	351°30.9	227°40.1	26.3	218°25.9	52.3	17°04.1	39.6	36°18.7	43.8			Gienah	175°46.5 -17°39.7	
6	6°33.4	242°39.4	N21°25.7	233°26.8	N18°51.9	32°06.6	S11°39.6	51°21.3	S17°43.9			Acrux	173°03.2 -63°13.3	
7	21°35.9	257°38.7	25.0	248°27.7	51.5	47°09.1	39.7	66°23.9	43.9			Gacrux	171°54.7 -57°14.2	
8	36°38.3	272°38.0	24.4	263°28.6	51.1	62°11.6	39.7	81°26.5	44.0			Alioth	166°15.5 55°51.0	
9	51°40.8	287°37.3	· · 23.7	278°29.4	· · 50.6	77°14.1	· · 39.7	96°29.1	· · 44.0			Spica	158°25.2 -11°16.3	
10	66°43.2	302°36.5	23.1	293°30.3	50.2	92°16.7	39.8	111°31.7	44.0			Alkaid	152°54.2 49°12.7	
11	81°45.7	317°35.8	22.5	308°31.2	49.8	107°19.2	39.8	126°34.3	44.1			Hadar	148°39.7 -60°28.7	
12	96°48.2	332°35.1	N21°21.8	323°32.1	N18°49.3	122°21.7	S11°39.8	141°36.9	S17°44.1			Menkent	148°00.8 -36°28.6	
13	111°50.6	347°34.4	21.2	338°33.0	48.9	137°24.2	39.9	156°39.5	44.2			Arcturus	145°50.4 19°04.5	
14	126°53.1	2°33.7	20.5	353°33.9	48.5	152°26.7	39.9	171°42.1	44.2			Rigel Kent.	139°43.8 -60°55.5	
15	141°55.6	17°33.0	· · 19.9	8°34.8	· · 48.0	167°29.3	· · 39.9	186°44.7	· · 44.3			Kochab	137°19.2 74°04.4	
16	156°58.0	32°32.3	19.2	23°35.7	47.6	182°31.8	40.0	201°47.3	44.3			Zuben'ubi	136°59.0 -16°07.8	
17	172°00.5	47°31.5	18.6	38°36.6	47.2	197°34.3	40.0	216°49.9	44.3			Alphecca	126°05.9 26°38.7	
18	187°03.0	62°30.8	N21°17.9	53°37.5	N18°46.7	212°36.8	S11°40.0	231°52.4	S17°44.4			Antares	112°19.0 -26°28.7	
19	202°05.4	77°30.1	17.3	68°38.4	46.3	227°39.4	40.1	246°55.0	44.4			Atria	107°15.3 -69°04.0	
20	217°07.9	92°29.4	16.6	83°39.3	45.9	242°41.9	40.1	261°57.6	44.5			Sabik	102°05.8 -15°45.0	
21	232°10.4	107°28.7	· · 15.9	98°40.2	· · 45.4	257°44.4	· · 40.1	277°00.2	· · 44.5			Shaula	96°13.9 -37°07.1	
22	247°12.8	122°28.0	15.3	113°41.1	45.0	272°46.9	40.2	292°02.8	44.6			Rasalhague	96°00.9 12°32.8	
23	262°15.3	137°27.3	14.6	128°42.0	44.6	287°49.4	40.2	307°05.4	44.6			Eltanin	90°43.0 51°29.2	
Mer.pass.:05:34		v-0.7 d-0.6 m-3.8			v0.9 d-0.4 m1.8		v2.5 d-0.0 m-2.5		v2.6 d-0.0 m0.4					
Tue	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec			
0	277°17.7	152°26.6	N21°14.0	143°42.9	N18°44.1	302°52.0	S11°40.2	322°08.0	S17°44.6			Kaus Aust.	83°35.9 -34°22.4	
1	292°20.2	167°25.9	13.3	158°43.8	43.7	317°54.5	40.3	337°10.6	44.7			Vega	80°34.7 38°48.2	
2	307°22.7	182°25.2	12.6	173°44.7	43.3	332°57.0	40.3	352°13.2	44.7			Nunki	75°51.0 -26°16.1	
3	322°25.1	197°24.4	· · 12.0	188°45.6	· · 42.8	347°59.5	· · 40.3	7°15.8	· · 44.8			Altair	62°02.4 8°55.5	
4	337°27.6	212°23.7	11.3	203°46.5	42.4	3°02.1	40.4	22°18.4	44.8			Peacock	53°09.8 -56°39.8	
5	352°30.1	227°23.0	10.7	218°47.3	41.9	18°04.6	40.4	37°21.0	44.9			Deneb	49°27.3 45°21.3	
6	7°32.5	242°22.3	N21°10.0	233°48.2	N18°41.5	33°07.1	S11°40.4	52°23.6	S17°44.9			Enif	33°41.4 9°58.3	
7	22°35.0	257°21.6	09.3	248°49.1	41.1	48°09.6	40.5	67°26.2	44.9			Al Na'ir	27°36.3 -46°51.3	
8	37°37.5	272°20.9	08.7	263°50.0	40.6	63°12.2	40.5	82°28.8	45.0			Fomalhaut	15°17.6 -29°30.4	
9	52°39.9	287°20.2	· · 08.0	278°50.9	· · 40.2	78°14.7	· · 40.5	97°31.4	· · 45.0			Scheat	13°47.8 28°11.7	
10	67°42.4	302°19.5	07.3	293°51.8	39.8	93°17.2	40.6	112°34.0	45.1			Markab	13°32.6 15°19.1	
11	82°44.8	317°18.8	06.6	308°52.7	39.3	108°19.7	40.6	127°36.6	45.1					
12	97°47.3	332°18.1	N21°06.0	323°53.6	N18°38.9	123°22.3	S11°40.7	142°39.2	S17°45.2			Jun 27 Sun	SHA Mer.pass	
13	112°49.8	347°17.4	05.3	338°54.5	38.4	138°24.8	40.7	157°41.8	45.2			Venus	237°41.7 13:49	
14	127°52.2	2°16.7	04.6	353°55.4	38.0	153°27.3	40.7	172°44.4	45.2			Mars	227°40.5 14:27	
15	142°54.7	17°16.0	· · 04.0	8°56.3	· · 37.6	168°29.9	· · 40.8	187°47.0	· · 45.3			Jupiter	25°31.7 03:56	
16	157°57.2	32°15.3	03.3	23°57.2	37.1	183°32.4	40.8	202°49.6	45.3			Saturn	44°44.1 02:39	
17	172°59.6	47°14.6	02.6	38°58.1	36.7	198°34.9	40.8	217°52.2	45.4					
18><														

h		Sun		Moon			
Sun	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°14.7	N23°19.2	325°55.9	5.7'	S22°58.6	7.2'	59.2'
1	194°14.6	19.1	340°20.7	5.9'	22°51.3	7.3'	59.2'
2	209°14.4	19.0	354°45.6	6.0'	22°43.9	7.5'	59.1'
3	224°14.3	18.9	9°10.6	6.1'	22°36.4	7.6'	59.1'
4	239°14.2	18.8	23°35.7	6.2'	22°28.7	7.7'	59.1'
5	254°14.1	18.7	38°01.0	6.3'	22°21.0	7.9'	59.0'
6	269°13.9	N23°18.6	52°26.4	6.4'	S22°13.0	8.0'	59.0'
7	284°13.8	18.4	66°51.9	6.6'	22°05.0	8.1'	59.0'
8	299°13.7	18.3	81°17.5	6.7'	21°56.8	8.2'	58.9'
9	314°13.5	18.2	95°43.2	6.8'	21°48.5	8.4'	58.9'
10	329°13.4	18.1	110°09.1	6.9'	21°40.0	8.5'	58.8'
11	344°13.3	18.0	124°35.0	7.0'	21°31.5	8.6'	58.8'
12	359°13.2	N23°17.9	139°01.1	7.2'	S21°22.8	8.7'	58.8'
13	14°13.0	17.8	153°27.3	7.3'	21°14.0	8.9'	58.7'
14	29°12.9	17.7	167°53.7	7.4'	21°05.1	9.0'	58.7'
15	44°12.8	17.6	182°20.1	7.5'	20°56.1	9.1'	58.7'
16	59°12.6	17.5	196°46.7	7.6'	20°46.9	9.2'	58.6'
17	74°12.5	17.4	211°13.4	7.8'	20°37.7	9.3'	58.6'
18	89°12.4	N23°17.2	225°40.2	7.9'	S20°28.3	9.4'	58.5'
19	104°12.3	17.1	240°07.1	8.0'	20°18.9	9.5'	58.5'
20	119°12.1	17.0	254°34.2	8.1'	20°09.3	9.6'	58.5'
21	134°12.0	16.9	269°01.4	8.2'	19°59.6	9.7'	58.4'
22	149°11.9	16.8	283°28.7	8.4'	19°49.8	9.8'	58.4'
23	164°11.8	16.7	297°56.1	8.5'	19°39.9	9.9'	58.4'
SD.=15.7		d=-0.1	S.D.=16.0				
Mon	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°11.6	N23°16.6	312°23.7	8.6'	S19°29.9	10.0'	58.3'
1	194°11.5	16.4	326°51.3	8.7'	19°19.9	10.1'	58.3'
2	209°11.4	16.3	341°19.1	8.8'	19°09.7	10.2'	58.2'
3	224°11.2	16.2	355°47.0	9.0'	18°59.4	10.3'	58.2'
4	239°11.1	16.1	10°15.0	9.1'	18°49.1	10.4'	58.2'
5	254°11.0	16.0	24°43.2	9.2'	18°38.6	10.5'	58.1'
6	269°10.9	N23°15.8	39°11.4	9.3'	S18°28.1	10.6'	58.1'
7	284°10.7	15.7	53°39.8	9.4'	18°17.4	10.7'	58.0'
8	299°10.6	15.6	68°08.3	9.6'	18°06.7	10.8'	58.0'
9	314°10.5	15.5	82°36.9	9.7'	17°55.9	10.8'	58.0'
10	329°10.4	15.3	97°05.6	9.8'	17°45.0	10.9'	57.9'
11	344°10.2	15.2	111°34.5	9.9'	17°34.1	11.0'	57.9'
12	359°10.1	N23°15.1	126°03.4	10.0'	S17°23.0	11.1'	57.9'
13	14°10.0	15.0	140°32.5	10.1'	17°11.9	11.2'	57.8'
14	29°09.9	14.8	155°01.7	10.2'	17°00.7	11.2'	57.8'
15	44°09.7	14.7	169°31.0	10.4'	16°49.4	11.3'	57.7'
16	59°09.6	14.6	184°00.4	10.5'	16°38.1	11.4'	57.7'
17	74°09.5	14.5	198°29.9	10.6'	16°26.7	11.4'	57.7'
18	89°09.4	N23°14.3	212°59.6	10.7'	S16°15.2	11.5'	57.6'
19	104°09.2	14.2	227°29.3	10.8'	16°03.7	11.6'	57.6'
20	119°09.1	14.1	241°59.2	10.9'	15°52.0	11.6'	57.5'
21	134°09.0	13.9	256°29.1	11.0'	15°40.4	11.7'	57.5'
22	149°08.8	13.8	270°59.2	11.1'	15°28.6	11.8'	57.5'
23	164°08.7	13.7	285°29.4	11.2'	15°16.8	11.8'	57.4'
SD.=15.7		d=-0.1	S.D.=15.8				
Tue	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°08.6	N23°13.5	299°59.7	11.3'	S15°04.9	11.9'	57.4'
1	194°08.5	13.4	314°30.1	11.4'	14°53.0	12.0'	57.4'
2	209°08.3	13.3	329°00.5	11.5'	14°41.0	12.0'	57.3'
3	224°08.2	13.1	343°31.1	11.6'	14°29.0	12.1'	57.3'
4	239°08.1	13.0	358°01.8	11.7'	14°16.9	12.1'	57.2'
5	254°08.0	12.9	12°32.6	11.8'	14°04.8	12.2'	57.2'
6	269°07.8	N23°12.7	27°03.5	11.9'	S13°52.6	12.2'	57.2'
7	284°07.7	12.6	41°34.5	12.0'	13°40.3	12.3'	57.1'
8	299°07.6	12.4	56°05.6	12.1'	13°28.0	12.3'	57.1'
9	314°07.5	12.3	70°36.8	12.2'	13°15.7	12.4'	57.1'
10	329°07.4	12.2	85°08.1	12.3'	13°03.3	12.4'	57.0'
11	344°07.2	12.0	99°39.5	12.4'	12°50.8	12.5'	57.0'
12	359°07.1	N23°11.9	114°10.9	12.5'	S12°38.3	12.5'	56.9'
13	14°07.0	11.7	128°42.5	12.6'	12°25.8	12.5'	56.9'
14	29°06.9	11.6	143°14.2	12.7'	12°13.2	12.6'	56.9'
15	44°06.7	11.4	157°45.9	12.8'	12°00.6	12.6'	56.8'
16	59°06.6	11.3	172°17.7	12.9'	11°48.0	12.7'	56.8'
17	74°06.5	11.1	186°49.7	13.0'	11°35.3	12.7'	56.8'
18	89°06.4	N23°11.0	201°21.7	13.1'	S11°22.6	12.7'	56.7'
19	104°06.2	10.9	215°53.8	13.1'	11°09.8	12.8'	56.7'
20	119°06.1	10.7	230°25.9	13.2'	10°57.0	12.8'	56.7'
21	134°06.0	10.6	244°58.2	13.3'	10°44.2	12.8'	56.6'
22	149°05.9	10.4	259°30.5	13.4'	10°31.4	12.9'	56.6'
23	164°05.7	10.3	274°03.0	13.5'	10°18.5	12.9'	56.6'
SD.=15.7		d=-0.1	S.D.=15.5				

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

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

Day	Sun			Moon		
	Eqn. of Time 00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss	Mer. Pass hh:mm	Mer. Pass. Upper hh:mm	Lower hh:mm	Age 17-19 90-73%
27	03:01	03:07	12:03	02:22	14:50	
28	03:13	03:20	12:03	03:17	15:43	
29	03:26	03:32	12:04	04:08	16:32	

	Aries			Venus			Mars			Jupiter			Saturn			Stars		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	SHA	Dec			
0	278°16.9	152°09.7	N20°57.8	144°04.4	N18°33.6	303°52.6	S11°41.1	323°10.4	S17°45.7	Alpheratz	357°37.7	29°12.3						
1	293°19.3	167°09.0	57.2	159°05.3	33.2	318°55.2	41.1	338°13.0	45.7	Ankaa	353°10.0	-42°11.2						
2	308°21.8	182°08.3	56.5	174°06.2	32.7	333°57.7	41.2	353°15.6	45.8	Schedar	349°34.2	56°38.9						
3	323°24.3	197°07.6	•• 55.8	180°07.1	•• 32.3	349°00.2	•• 41.2	8°18.2	•• 45.8	Diphda	348°50.2	-17°52.1						
4	338°26.7	212°06.9	55.1	204°08.0	31.9	4°02.8	41.3	23°20.8	45.9	Achernar	335°22.6	-57°07.5						
5	353°29.2	227°06.2	54.4	219°08.9	31.4	19°05.3	41.3	38°23.4	45.9	Hamal	327°54.6	23°33.6						
6	8°31.7	242°05.5	N20°53.7	234°09.8	N18°31.0	34°07.8	S11°41.3	53°26.0	S17°45.9	Polaris	315°37.9	89°20.9						
7	23°34.1	257°04.9	53.0	249°10.7	30.5	49°10.4	41.4	68°28.6	46.0	Acamar	315°14.3	-40°13.0						
8	38°36.6	272°04.2	52.3	264°11.6	30.1	64°12.9	41.4	83°31.2	46.0	Menkar	314°09.4	4°10.3						
9	53°39.1	287°03.5	•• 51.6	279°12.5	•• 29.7	79°15.4	•• 41.4	98°33.8	•• 46.1	Mirfak	308°32.7	49°56.0						
10	68°41.5	302°02.8	51.0	294°13.4	29.2	94°18.0	41.5	113°36.4	46.1	Aldebaran	290°43.2	16°33.3						
11	83°44.0	317°02.1	50.3	309°14.3	28.8	109°20.5	41.5	128°39.0	46.2	Rigel	281°07.0	-8°10.6						
12	98°46.5	332°01.4	N20°49.6	324°15.2	N18°28.3	124°23.0	S11°41.6	143°41.6	S17°46.2	Capella	280°26.6	46°01.0						
13	113°48.9	347°00.7	48.9	339°16.1	27.9	139°25.6	41.6	158°44.2	46.3	Bellatrix	278°26.3	6°22.1						
14	128°51.4	2°00.0	48.2	354°17.0	27.4	154°28.1	41.6	173°46.8	46.3	Elnath	278°05.9	28°37.4						
15	143°53.8	16°59.3	•• 47.5	9°17.9	•• 27.0	169°30.6	•• 41.7	188°49.4	•• 46.3	Alnilam	275°41.0	-1°11.3						
16	158°56.3	31°58.6	46.8	24°18.8	26.6	184°33.2	41.7	203°52.0	46.4	Betelgeuse	270°55.5	7°24.6						
17	173°58.8	46°58.0	46.1	39°19.7	26.1	199°35.7	41.8	218°54.6	46.4	Canopus	263°54.2	-52°42.4						
18	189°01.2	61°57.3	N20°45.4	54°20.6	N18°25.7	214°38.2	S11°41.8	233°57.2	S17°46.5	Sirius	258°29.1	-16°44.7						
19	204°03.7	76°56.6	44.7	69°21.5	25.2	229°40.8	41.8	248°59.8	46.5	Adhara	255°08.5	-29°00.1						
20	219°06.2	91°55.9	44.0	84°22.4	24.8	244°43.3	41.9	264°02.4	46.6	Procyon	244°54.2	5°10.2						
21	234°08.6	106°55.2	•• 43.3	99°23.3	•• 24.3	259°45.8	•• 41.9	279°05.0	•• 46.6	Pollux	243°21.2	27°58.5						
22	249°11.1	121°54.5	42.6	114°24.2	23.9	274°48.4	42.0	294°07.6	46.6	Avior	234°16.4	-59°34.8						
23	264°13.6	136°53.9	41.8	129°25.1	23.4	289°50.9	42.0	309°10.2	46.7	Suhail	222°48.7	-43°31.2						
Mer.pass.:05:26			v-0.7 d-0.7 m-3.8			v0.9 d-0.4 m1.8			v2.5 d-0.0 m-2.5			v2.6 d-0.0 m0.4			Miaplacidus 221°39.5 -69°48.4			
															Alphard 217°50.8 -8°45.1			
															Regulus 207°37.7 11°51.9			
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Dubhe 193°44.9 61°38.5				
0	279°16.0	151°53.2	N20°41.1	144°26.0	N18°23.0	304°53.5	S11°42.0	324°12.8	S17°46.7	Denebola	182°28.0	14°27.3						
1	294°18.5	166°52.5	40.4	159°26.9	22.6	319°56.0	42.1	339°15.4	46.8	Gienah	175°46.6	-17°39.7						
2	309°20.9	181°51.8	39.7	174°27.8	22.1	334°58.5	42.1	354°18.0	46.8	Acrux	173°03.2	-63°13.3						
3	324°23.4	196°51.1	•• 39.0	189°28.7	•• 21.7	350°01.1	•• 42.2	9°20.6	•• 46.9	Gacrux	171°54.8	-57°14.2						
4	339°25.9	211°50.4	38.3	204°29.6	21.2	5°03.6	42.2	24°23.2	46.9	Alioth	166°15.5	55°51.0						
5	354°28.3	226°49.8	37.6	219°30.5	20.8	20°06.2	42.2	39°25.8	47.0	Spica	158°25.3	-11°16.3						
6	9°30.8	241°49.1	N20°36.9	234°31.4	N18°20.3	35°08.7	S11°42.3	54°28.4	S17°47.0	Alkaid	152°54.2	49°12.7						
7	24°33.3	256°48.4	36.2	249°32.3	19.9	50°11.2	42.3	69°31.0	47.0	Hadar	148°39.7	-60°28.7						
8	39°35.7	271°47.7	35.4	264°33.2	19.4	65°13.8	42.4	84°33.6	47.1	Menkent	148°00.8	-36°28.6						
9	54°38.2	286°47.0	•• 34.7	279°34.1	•• 19.0	80°16.3	•• 42.4	99°36.2	•• 47.1	Arcturus	145°50.4	19°04.5						
10	69°40.7	301°46.4	34.0	294°35.0	18.5	95°18.9	42.4	114°38.9	47.2	Rigel Kent.	139°43.8	-60°55.6						
11	84°43.1	316°45.7	33.3	309°35.9	18.1	110°21.4	42.5	129°41.5	47.2	Kochab	137°19.2	74°04.4						
12	99°45.6	331°45.0	N20°32.6	324°36.8	N18°17.6	125°24.0	S11°42.5	144°44.1	S17°47.3	Zuben'ubi	136°59.0	-16°07.8						
13	114°48.1	346°44.3	31.9	339°37.7	17.2	140°26.5	42.6	159°46.7	47.3	Alphecca	126°05.9	26°38.8						
14	129°50.5	1°43.7	31.1	354°38.6	16.7	155°29.0	42.6	174°49.3	47.4	Antares	112°19.0	-26°28.7						
15	144°53.0	16°43.0	•• 30.4	9°39.5	•• 16.3	170°31.6	•• 42.7	189°51.9	•• 47.4	Atria	107°15.3	-69°04.0						
16	159°55.4	31°42.3	29.7	24°40.4	15.8	185°34.1	42.7	204°54.5	47.4	Sabik	102°05.8	-15°45.0						
17	174°57.9	46°41.6	29.0	39°41.3	15.4	200°36.7	42.7	219°57.1	47.5	Shaula	96°13.9	-37°07.1						
18	190°00.4	61°41.0	N20°28.2	54°42.2	N18°15.0	215°39.2	S11°42.8	234°59.7	S17°47.5	Rasalhague	96°00.9	12°32.8						
19	205°02.8	76°40.3	27.5	69°43.1	14.5	230°41.8	42.8	250°02.3	47.6	Eltanin	90°43.0	51°29.2						
20	220°05.3	91°39.6	26.8	84°44.0	14.1	245°44.3	42.9	265°04.9	47.6	Kaus Aust.	83°35.9	-34°22.4						
21	235°07.8	106°38.9	•• 26.1	99°44.9	•• 13.6	260°46.8	•• 42.9	280°07.5	•• 47.7	Vega	80°34.7	38°48.2						
22	250°10.2	121°38.3	25.3	114°45.8	13.2	275°49.4	43.0	295°10.1	47.7	Nunki	75°51.0	-26°16.1						
23	265°12.7	136°37.6	24.6	129°46.7	12.7	290°51.9	43.0	310°12.7	47.8	Altair	62°02.4	8°55.5						
Mer.pass.:05:22			v-0.7 d-0.7 m-3.8			v0.9 d-0.4 m1.8			v2.5 d-0.0 m-2.5			v2.6 d-0.0 m0.4			Peacock 53°09.8 -56°39.8			
															Deneb 49°27.3 45°21.3			
															Enif 33°41.4 9°58.3			
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Al Na'ir 27°36.3 -46°51.3				
0	280°15.2	151°36.9	N20°23.9	144°47.6	N18°12.3	305°54.5	S11°43.0	325°15.3	S17°47.8	Fomalhaut	15°17.6	-29°30.4						
1	295°17.6	166°36.3	23.1	159°48.5	11.8	320°57.0	43.1	340°17.9	47.9	Scheat	13°47.8	28°11.7						
2	310°20.1	181°35.6	22.4	174°49.4	11.4	335°59.6	43.1	355°20.5	47.9	Markab	13°32.6	15°19.1						
3	325°22.5	196°34.9	•• 21.7	189°50.3	•• 10.9	351°02.1	•• 43.2	10°23.1	•• 47.9									
4	340°25.0	211°34.3	20.9	204°51.2	10.5	6°04.7	43.2	25°25.7	48.0									
5	355°27.5	226°33.6	20.2	219°52.1	10.0	21°07.2	43.3	40°28.3	48.0									
6	10°29.9	241°32.9	N20°19.5	234°53.0	N18°09.6	36°09.8	S11°43.3	55°31.0	S17°48.1									
7	25°32.4	256°32.3	18.7	249°53.9	09.1	51°12.3	43.3	70°33.6	48.1									
8	40°34.9	271°31.6	18.0	264°54.8	08.6	66°14.9	43.4	85°36.2	48.2									
9	55°37.3	286°30.9	•• 17.2	279°55.7	•• 08.2	81°17.4	•• 43.4	100°38.8	•• 48.2									
10	70°39.8	301°30.3	16.5	294°56.7	07.7	96°20.0	43.5	115°41.4	48.3									
11	85°42.3	316°29.6	15.8	309°57.6	07.3	111°22.5	43.5	130°44.0	48.3									
12	100°44.7	331°28.9	N20°15.0	324°58.5	N18°06.8	126°25.1	S11°43.6	145°46.6	S17°48.3									
13	115°47.2	346°28.3	14.3	339°59.4	06.4	141°27.6	43.6	160°49.2	48.4									
14	130°49.7	1°27.6	13.5	355°00.3	05.9	156°30.2	43.7	175°51.8	48.4									
15	145°52.1	16°27.0	•• 12.8	10°01.2	•• 05.5	171°32.7	•• 43.7	190°54.4	•• 48.5									
16	160°54.6	31°26.3	12.0	25°02.1	05.0	186°35.3	43.7	205°57.0	48.5									
17	175°57.0	46°25.6	11.3	40°03.0	04.6	201°37.8	43.8	220°59.6	48.6									
18	190°59.5	61°25.0	N20°10.5	55°03.9	N18°04.1	216°40.4	S11°43.8	236°02.2	S17°48.6									
19	206°02.0	76°24.3	09.8	70°04.8	03.7	231°42.9	43.9	251°04.8	48.7									
20	221°04.4	91°23.7	09.0	85°05.7	03.2	246°45.5	43.9	266°07.4	48.7									
21	236°06.9	106°23.0	•• 08.3	100°06.6	•• 02.8	261°48.0	•• 44.0	281°10.1	•• 48.8									
22	251°09.4	121°22.3	07.5	115°07.5	02.3	276°50.6	44.0	296°12.7	48.8									
23	266°11.8	136°21.7	06.8	130°08.4	01.8	291°53.1	44.1	311°15.3	48.8									
Mer.pass.:05:18			v-0.7 d-0.7 m-3.8			v0.9 d-0.5 m1.8			v2.5 d-0.0 m-2.5			v2.6 d-0.0 m0.4						
															Horizontal parallax			
															Venus: 0.1			
															Mars: 0.1			




h	Sun		Moon				
	GHA	Dec	GHA	$\nu$	Dec	d	HP
Wed							
0	179°05.6	N23°10.1	288°35.5	13.5'	S10°05.6	12.9'	56.5'
1	194°05.5	10.0	303°08.1	13.6'	09°52.6	13.0'	56.5'
2	209°05.4	09.8	317°40.7	13.7'	09°39.7	13.0'	56.5'
3	224°05.2	· · 09.6	332°13.5	13.8'	09°26.7	13.0'	56.4'
4	239°05.1	09.5	346°46.3	13.8'	09°13.6	13.0'	56.4'
5	254°05.0	09.3	1°19.2	13.9'	09°00.6	13.1'	56.3'
6	269°04.9	N23°09.2	15°52.1	14.0'	S08°47.5	13.1'	56.3'
7	284°04.8	09.0	30°25.1	14.1'	08°34.4	13.1'	56.3'
8	299°04.6	08.9	44°58.2	14.1'	08°21.3	13.1'	56.2'
9	314°04.5	· · 08.7	59°31.4	14.2'	08°08.2	13.1'	56.2'
10	329°04.4	08.6	74°04.7	14.3'	07°55.0	13.2'	56.2'
11	344°04.3	08.4	88°38.0	14.3'	07°41.9	13.2'	56.1'
12	359°04.1	N23°08.2	103°11.3	14.4'	S07°28.7	13.2'	56.1'
13	14°04.0	08.1	117°44.8	14.5'	07°15.5	13.2'	56.1'
14	29°03.9	07.9	132°18.3	14.5'	07°02.3	13.2'	56.1'
15	44°03.8	· · 07.8	146°51.8	14.6'	06°49.0	13.2'	56.0'
16	59°03.7	07.6	161°25.4	14.6'	06°35.8	13.2'	56.0'
17	74°03.5	07.4	175°59.1	14.7'	06°22.5	13.3'	56.0'
18	89°03.4	N23°07.3	190°32.8	14.8'	S06°09.3	13.3'	55.9'
19	104°03.3	07.1	205°06.6	14.8'	05°56.0	13.3'	55.9'
20	119°03.2	06.9	219°40.5	14.9'	05°42.7	13.3'	55.9'
21	134°03.1	· · 06.8	234°14.4	14.9'	05°29.4	13.3'	55.8'
22	149°02.9	06.6	248°48.4	15.0'	05°16.1	13.3'	55.8'
23	164°02.8	06.4	263°22.4	15.0'	05°02.8	13.3'	55.8'
SD.=15.7    d=-0.2    S.D.=15.3							

Thu	Sun		Moon				
	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	179°02.7	N23°06.3	277°56.4	15.1'	S04°49.5	13.3'	55.7'
1	194°02.6	06.1	292°30.5	15.1'	04°36.2	13.3'	55.7'
2	209°02.5	05.9	307°04.7	15.2'	04°22.9	13.3'	55.7'
3	224°02.3	· · 05.8	321°38.9	15.2'	04°09.5	13.3'	55.7'
4	239°02.2	05.6	336°13.2	15.3'	03°56.2	13.3'	55.6'
5	254°02.1	05.4	350°47.5	15.3'	03°42.9	13.3'	55.6'
6	269°02.0	N23°05.2	5°21.8	15.4'	S03°29.5	13.3'	55.6'
7	284°01.9	05.1	19°56.2	15.4'	03°16.2	13.3'	55.5'
8	299°01.7	04.9	34°30.6	15.4'	03°02.9	13.3'	55.5'
9	314°01.6	· · 04.7	49°05.1	15.5'	02°49.5	13.3'	55.5'
10	329°01.5	04.6	63°39.6	15.5'	02°36.2	13.3'	55.5'
11	344°01.4	04.4	78°14.1	15.6'	02°22.9	13.3'	55.4'
12	359°01.3	N23°04.2	92°48.7	15.6'	S02°09.6	13.3'	55.4'
13	14°01.1	04.0	107°23.3	15.6'	01°56.3	13.3'	55.4'
14	29°01.0	03.8	121°58.0	15.7'	01°42.9	13.3'	55.3'
15	44°00.9	· · 03.7	136°32.6	15.7'	01°29.6	13.3'	55.3'
16	59°00.8	03.5	151°07.4	15.7'	01°16.3	13.3'	55.3'
17	74°00.7	03.3	165°42.1	15.8'	01°03.0	13.3'	55.3'
18	89°00.5	N23°03.1	180°16.9	15.8'	S00°49.8	13.3'	55.2'
19	104°00.4	02.9	194°51.7	15.8'	00°36.5	13.3'	55.2'
20	119°00.3	02.8	209°26.5	15.8'	00°23.2	13.3'	55.2'
21	134°00.2	· · 02.6	224°01.4	15.9'	S00°10.0	13.2'	55.2'
22	149°00.1	02.4	238°36.3	15.9'	N00°03.3	13.2'	55.1'
23	163°59.9	02.2	253°11.2	15.9'	00°16.5	13.2'	55.1'
SD.=15.7    d=-0.2    S.D.=15.1							

Fri	Sun		Moon				
	GHA	Dec	GHA	$\nu$	Dec	d	HP
0	178°59.8	N23°02.0	267°46.1	15.9'	N00°29.7	13.2'	55.1'
1	193°59.7	01.8	282°21.0	16.0'	00°42.9	13.2'	55.1'
2	208°59.6	01.7	296°56.0	16.0'	00°56.1	13.2'	55.0'
3	223°59.5	· · 01.5	311°31.0	16.0'	01°09.3	13.2'	55.0'
4	238°59.4	01.3	326°06.0	16.0'	01°22.4	13.2'	55.0'
5	253°59.2	01.1	340°41.0	16.0'	01°35.6	13.1'	55.0'
6	268°59.1	N23°00.9	355°16.1	16.1'	N01°48.7	13.1'	55.0'
7	283°59.0	00.7	9°51.1	16.1'	02°01.8	13.1'	54.9'
8	298°58.9	00.5	24°26.2	16.1'	02°14.9	13.1'	54.9'
9	313°58.8	· · 00.3	39°01.3	16.1'	02°28.0	13.1'	54.9'
10	328°58.7	00.1	53°36.4	16.1'	02°41.1	13.0'	54.9'
11	343°58.5	23°00.0	68°11.5	16.1'	02°54.1	13.0'	54.9'
12	358°58.4	N22°59.8	82°46.6	16.1'	N03°07.1	13.0'	54.8'
13	13°58.3	59.6	97°21.7	16.1'	03°20.1	13.0'	54.8'
14	28°58.2	59.4	111°56.9	16.1'	03°33.1	13.0'	54.8'
15	43°58.1	· · 59.2	126°32.0	16.1'	03°46.0	12.9'	54.8'
16	58°58.0	59.0	141°07.2	16.1'	03°58.9	12.9'	54.8'
17	73°57.8	58.8	155°42.3	16.1'	04°11.8	12.9'	54.7'
18	88°57.7	N22°58.6	170°17.5	16.2'	N04°24.7	12.9'	54.7'
19	103°57.6	58.4	184°52.6	16.2'	04°37.6	12.8'	54.7'
20	118°57.5	58.2	199°27.8	16.2'	04°50.4	12.8'	54.7'
21	133°57.4	· · 58.0	214°02.9	16.2'	05°03.2	12.8'	54.7'
22	148°57.3	57.8	228°38.1	16.2'	05°16.0	12.8'	54.6'
23	163°57.1	57.6	243°13.2	16.1'	05°28.7	12.7'	54.6'
SD.=15.7    d=-0.2    S.D.=14.9							

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

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

Day	Sun			Moon		
	Eqn.of Time		Mer. Pass	Mer.Pass.		Age 20-22 64-44%
	00 <sup>h</sup>	12 <sup>h</sup>		Upper	Lower	
	mm:ss	mm:ss	hh:mm	hh:mm	hh:mm	
30	03:38	03:43	12:04	04:55	17:17	
01	03:49	03:55	12:04	05:38	17:59	
02	04:01	04:06	12:04	06:19	18:40	