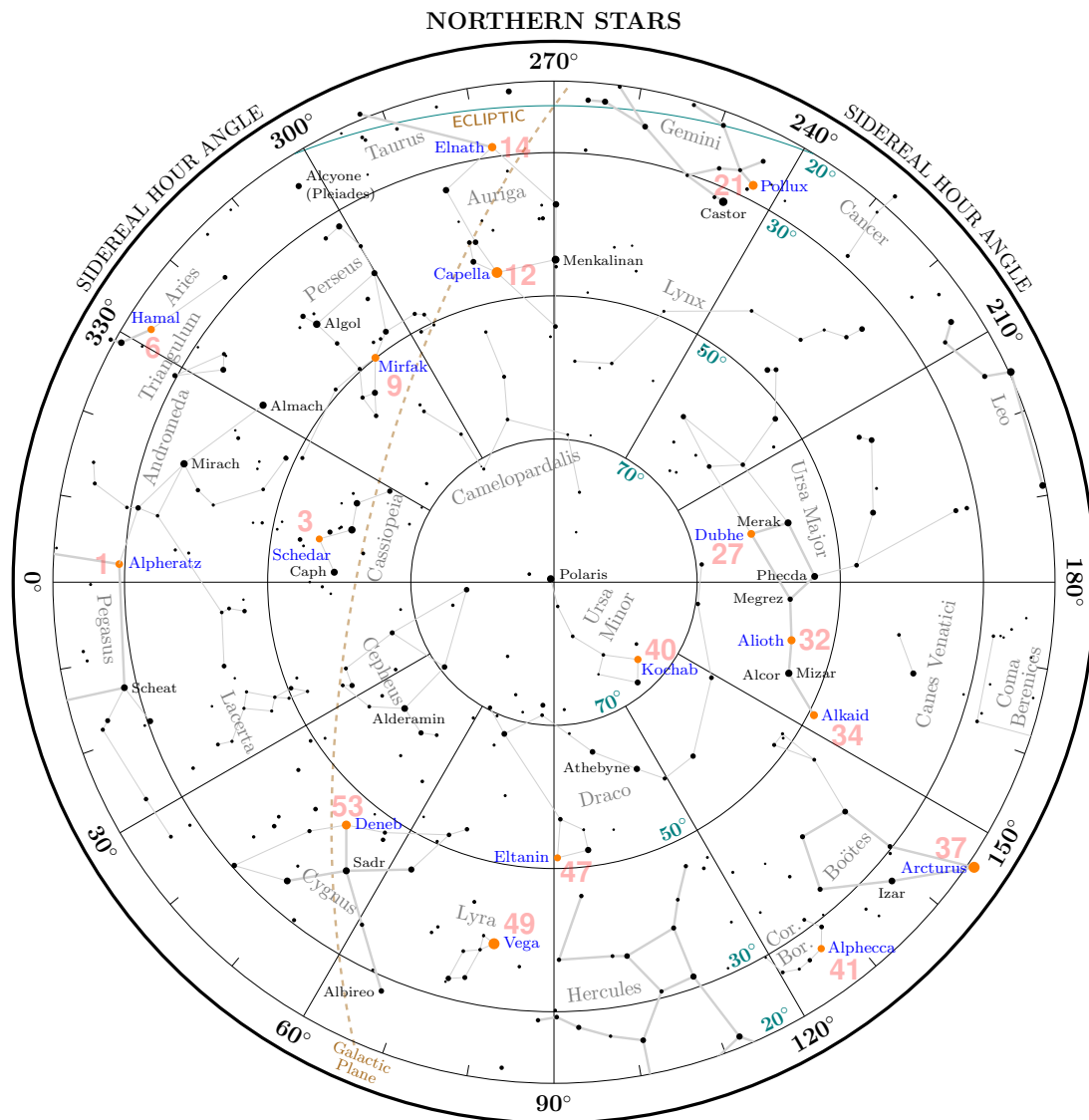


GENERATED USING EPHEM



## THE NAUTICAL ALMANAC

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13.07.2022 - 18.07.2022

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*Original concept from:* Enno RODEGERDTS

September 5, 2022

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# July 13, 14, 15 (Wed., Thu., Fri.)

h	Aries			Venus			Mars			Jupiter			Saturn		
Wed	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	290°51.4	207°27.3	N22°24.4	257°09.8	N11°37.5	282°41.6	N02°03.2	323°59.4	S14°38.6						
1	305°53.9	222°26.6	24.6	272°10.6	38.1	297°43.9	03.2	339°02.0	38.7						
2	320°56.3	237°25.8	24.9	287°11.4	38.7	312°46.3	03.3	354°04.6	38.7						
3	335°58.8	252°25.0	· · 25.1	302°12.2	· · 39.3	327°48.6	· · 03.3	9°07.2	· · 38.8						
4	351°01.3	267°24.2	25.4	317°13.1	39.8	342°51.0	03.4	24°09.7	38.8						
5	6°03.7	282°23.4	25.6	332°13.9	40.4	357°53.3	03.4	39°12.3	38.9						
6	21°06.2	297°22.7	N22°25.9	347°14.7	N11°41.0	12°55.6	N02°03.4	54°14.9	S14°38.9						
7	36°08.7	312°21.9	26.1	2°15.5	41.6	27°58.0	03.5	69°17.5	39.0						
8	51°11.1	327°21.1	26.3	17°16.3	42.1	43°00.3	03.5	84°20.1	39.0						
9	66°13.6	342°20.3	· · 26.6	32°17.1	· · 42.7	58°02.7	· · 03.6	99°22.7	· · 39.1						
10	81°16.1	357°19.5	26.8	47°17.9	43.3	73°05.0	03.6	114°25.3	39.1						
11	96°18.5	12°18.7	27.0	62°18.7	43.9	88°07.4	03.6	129°27.9	39.2						
12	111°21.0	27°18.0	N22°27.3	77°19.6	N11°44.4	103°09.7	N02°03.7	144°30.5	S14°39.2						
13	126°23.5	42°17.2	27.5	92°20.4	45.0	118°12.1	03.7	159°33.1	39.3						
14	141°25.9	57°16.4	27.7	107°21.2	45.6	133°14.4	03.7	174°35.7	39.3						
15	156°28.4	72°15.6	· · 27.9	122°22.0	· · 46.2	148°16.8	· · 03.8	189°38.3	· · 39.4						
16	171°30.8	87°14.8	28.2	137°22.8	46.7	163°19.1	03.8	204°40.9	39.4						
17	186°33.3	102°14.0	28.4	152°23.6	47.3	178°21.4	03.9	219°43.5	39.5						
18	201°35.8	117°13.3	N22°28.6	167°24.4	N11°47.9	193°23.8	N02°03.9	234°46.1	S14°39.5						
19	216°38.2	132°12.5	28.9	182°25.3	48.5	208°26.1	03.9	249°48.7	39.6						
20	231°40.7	147°11.7	29.1	197°26.1	49.0	223°28.5	04.0	264°51.3	39.7						
21	246°43.2	162°10.9	· · 29.3	212°26.9	· · 49.6	238°30.8	· · 04.0	279°53.9	· · 39.7						
22	261°45.6	177°10.1	29.5	227°27.7	50.2	253°33.2	04.0	294°56.5	39.8						
23	276°48.1	192°09.3	29.7	242°28.5	50.7	268°35.5	04.1	309°59.1	39.8						
Mer.pass. 04:35		ν-0.8' d0.2' m-3.8			ν0.8' d0.6' m0.3			ν2.3' d0.0' m-2.4			ν2.6' d-0.1' m0.5				
Thu	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	291°50.6	207°08.6	N22°30.0	257°29.3	N11°51.3	283°37.9	N02°04.1	325°01.7	S14°39.9						
1	306°53.0	222°07.8	30.2	272°30.1	51.9	298°40.2	04.1	340°04.3	39.9						
2	321°55.5	237°07.0	30.4	287°30.9	52.5	313°42.6	04.2	355°06.9	40.0						
3	336°58.0	252°06.2	· · 30.6	302°31.8	· · 53.0	328°44.9	· · 04.2	10°09.5	· · 40.0						
4	352°00.4	267°05.4	30.8	317°32.6	53.6	343°47.3	04.3	25°12.1	40.1						
5	7°02.9	282°04.6	31.0	332°33.4	54.2	358°49.6	04.3	40°14.7	40.1						
6	22°05.3	297°03.8	N22°31.2	347°34.2	N11°54.7	13°52.0	N02°04.3	55°17.3	S14°40.2						
7	37°07.8	312°03.1	31.5	2°35.0	55.3	28°54.3	04.4	70°19.9	40.2						
8	52°10.3	327°02.3	31.7	17°35.8	55.9	43°56.7	04.4	85°22.5	40.3						
9	67°12.7	342°01.5	· · 31.9	32°36.6	· · 56.5	58°59.0	· · 04.4	100°25.1	· · 40.3						
10	82°15.2	357°00.7	32.1	47°37.5	57.0	74°01.4	04.5	115°27.7	40.4						
11	97°17.7	11°59.9	32.3	62°38.3	57.6	89°03.7	04.5	130°30.3	40.4						
12	112°20.1	26°59.1	N22°32.5	77°39.1	N11°58.2	104°06.1	N02°04.5	145°32.9	S14°40.5						
13	127°22.6	41°58.3	32.7	92°39.9	58.7	119°08.4	04.6	160°35.5	40.6						
14	142°25.1	56°57.5	32.9	107°40.7	59.3	134°10.8	04.6	175°38.1	40.6						
15	157°27.5	71°56.8	· · 33.1	122°41.5	11°59.9	149°13.2	· · 04.6	190°40.7	· · 40.7						
16	172°30.0	86°56.0	33.3	137°42.3	12°00.4	164°15.5	04.7	205°43.3	40.7						
17	187°32.5	101°55.2	33.5	152°43.2	01.0	179°17.9	04.7	220°45.9	40.8						
18	202°34.9	116°54.4	N22°33.7	167°44.0	N12°01.6	194°20.2	N02°04.7	235°48.5	S14°40.8						
19	217°37.4	131°53.6	33.9	182°44.8	02.1	209°22.6	04.8	250°51.1	40.9						
20	232°39.8	146°52.8	34.1	197°45.6	02.7	224°24.9	04.8	265°53.7	40.9						
21	247°42.3	161°52.0	· · 34.3	212°46.4	· · 03.3	239°27.3	· · 04.8	280°56.3	· · 41.0						
22	262°44.8	176°51.2	34.5	227°47.2	03.8	254°29.6	04.9	295°58.9	41.0						
23	277°47.2	191°50.4	34.7	242°48.1	04.4	269°32.0	04.9	311°01.5	41.1						
Mer.pass. 04:31		ν-0.8' d0.2' m-3.8			ν0.8' d0.6' m0.3			ν2.3' d0.0' m-2.4			ν2.6' d-0.1' m0.5				
Fri	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
0	292°49.7	206°49.6	N22°34.9	257°48.9	N12°05.0	284°34.3	N02°04.9	326°04.1	S14°41.1						
1	307°52.2	221°48.9	35.1	272°49.7	05.5	299°36.7	05.0	341°06.7	41.2						
2	322°54.6	236°48.1	35.3	287°50.5	06.1	314°39.1	05.0	356°09.3	41.3						
3	337°57.1	251°47.3	· · 35.5	302°51.3	· · 06.7	329°41.4	· · 05.0	11°12.0	· · 41.3						
4	352°59.6	266°46.5	35.6	317°52.1	07.2	344°43.8	05.1	26°14.6	41.4						
5	8°02.0	281°45.7	35.8	332°52.9	07.8	359°46.1	05.1	41°17.2	41.4						
6	23°04.5	296°44.9	N22°36.0	347°53.8	N12°08.4	14°48.5	N02°05.1	56°19.8	S14°41.5						
7	38°06.9	311°44.1	36.2	2°54.6	08.9	29°50.9	05.2	71°22.4	41.5						
8	53°09.4	326°43.3	36.4	17°55.4	09.5	44°53.2	05.2	86°25.0	41.6						
9	68°11.9	341°42.5	· · 36.6	32°56.2	· · 10.1	59°55.6	· · 05.2	101°27.6	· · 41.6						
10	83°14.3	356°41.7	36.7	47°57.0	10.6	74°57.9	05.3	116°30.2	41.7						
11	98°16.8	11°40.9	36.9	62°57.8	11.2	90°00.3	05.3	131°32.8	41.7						
12	113°19.3	26°40.1	N22°37.1	77°58.7	N12°11.8	105°02.6	N02°05.3	146°35.4	S14°41.8						
13	128°21.7	41°39.3	37.3	92°59.5	12.3	120°05.0	05.4	161°38.0	41.8						
14	143°24.2	56°38.5	37.5	108°00.3	12.9	135°07.4	05.4	176°40.6	41.9						
15	158°26.7	71°37.8	· · 37.6	123°01.1	· · 13.4	150°09.7	· · 05.4	191°43.2	· · 42.0						
16	173°29.1	86°37.0	37.8	138°01.9	14.0	165°12.1	05.4	206°45.8	42.0						
17	188°31.6	101°36.2	38.0	153°02.7	14.6	180°14.4	05.5	221°48.4	42.1						
18	203°34.1	116°35.4	N22°38.2	168°03.6	N12°15.1	195°16.8	N02°05.5	236°51.0	S14°42.1						
19	218°36.5	131°34.6	38.3	183°04.4	15.7	210°19.2	05.5	251°53.6	42.2						
20	233°39.0	146°33.8	38.5	198°05.2	16.3	225°21.5	05.6	266°56.2	42.2						
21	248°41.4	161°33.0	· · 38.7	213°06.0	· · 16.8	240°23.9	· · 05.6	281°58.8	· · 42.3						
22	263°43.9	176°32.2	38.8	228°06.8	17.4	255°26.3	05.6	297°01.4	42.3						
23	278°46.4	191°31.4	39.0	243°07.6	17.9	270°28.6	05.7	312°04.0	42.4						
Mer.pass. 04:27		ν-0.8' d0.2' m-3.8			ν0.8' d0.6' m0.3			ν2.4' d0.0' m-2.4			ν2.6' d-0.1' m0.5				

	SHA	Dec
Alpheratz	357°36.8	29°12.7
Ankaa	353°09.1	-42°10.8
Schedar	349°33.2	56°39.3
Diphda	348°49.3	-17°51.7
Achernar	335°21.8	-57°07.1
Hamal	327°53.6	23°34.0
Polaris	315°11.9	89°21.2
Acamar	315°13.5	-40°12.7
Menkar	314°08.4	4°10.7
Mirfak	308°31.4	49°56.2
Aldebaran	290°42.2	16°33.2
Rigel	281°06.1	-8°10.5
Capella	280°25.3	46°01.1
Bellatrix	278°25.4	6°22.2
Elnath	278°04.8	28°37.5
Alnilam	275°40.1	-1°11.2
Betelgeuse	270°54.6	7°24.7
Canopus	263°53.8	-52°42.3
Sirius	258°28.4	-16°44.7
Adhara	255°07.9	-29°00.1
Procyon	244°53.3	5°10.1
Pollux	243°20.2	27°58.4
Avior	234°16.2	-59°34.9
Suhail	222°48.2	-43°31.4
Miaplacidus	221°39.5	-69°48.6
Alphard	217°50.1	-8°45.3
Regulus	207°36.9	11°51.6

h	Sun			Moon			
	GHA	Dec		GHA	$\nu$	Dec	$d$
Wed							HP
0	178°33.8	N21°51.4		10°13.1	0.7'	S26°54.4	0.7'
1	193°33.7	51.0		24°32.8	0.7'	26°53.7	0.9'
2	208°33.6	50.7		38°52.6	0.7'	26°52.8	1.1'
3	223°33.6	50.3		53°12.3	0.7'	26°51.7	1.3'
4	238°33.5	50.0		67°32.0	0.7'	26°50.3	1.5'
5	253°33.4	49.6		81°51.8	0.8'	26°48.8	1.8'
6	268°33.3	N21°49.2		96°11.5	0.8'	S26°47.0	2.0'
7	283°33.3	48.9		110°31.3	0.8'	26°45.1	2.2'
8	298°33.2	48.5		124°51.1	0.8'	26°42.9	2.4'
9	313°33.1	48.1		139°11.0	0.9'	26°40.5	2.6'
10	328°33.1	47.8		153°30.8	0.9'	26°37.9	2.8'
11	343°33.0	47.4		167°50.7	0.9'	26°35.0	3.0'
12	358°32.9	N21°47.0		182°10.7	1.0'	S26°32.0	3.2'
13	13°32.8	46.7		196°30.7	1.0'	26°28.7	3.5'
14	28°32.8	46.3		210°50.7	1.1'	26°25.3	3.7'
15	43°32.7	45.9		225°10.8	1.1'	26°21.6	3.9'
16	58°32.6	45.6		239°30.9	1.2'	26°17.7	4.1'
17	73°32.6	45.2		253°51.1	1.2'	26°13.7	4.3'
18	88°32.5	N21°44.8		268°11.3	1.3'	S26°09.4	4.5'
19	103°32.4	44.4		282°31.6	1.4'	26°04.9	4.7'
20	118°32.3	44.1		296°51.9	1.4'	26°00.2	4.9'
21	133°32.3	43.7		311°12.4	1.5'	25°55.3	5.1'
22	148°32.2	43.3		325°32.9	1.6'	25°50.2	5.3'
23	163°32.1	43.0		339°53.4	1.6'	25°44.9	5.5'
SD = 15.7' $d = -0.4'$				SD = 16.7'			

Thu	Sun			Moon			
	GHA	Dec		GHA	$\nu$	Dec	$d$
0	178°32.1	N21°42.6		354°14.1	1.7'	S25°39.4	5.7'
1	193°32.0	42.2		8°34.8	1.8'	25°33.7	5.9'
2	208°31.9	41.8		22°55.6	1.9'	25°27.8	6.1'
3	223°31.9	41.4		37°16.4	2.0'	25°21.8	6.3'
4	238°31.8	41.1		51°37.4	2.1'	25°15.5	6.5'
5	253°31.7	40.7		65°58.5	2.1'	25°09.0	6.7'
6	268°31.7	N21°40.3		80°19.6	2.2'	S25°02.4	6.8'
7	283°31.6	39.9		94°40.8	2.3'	24°55.5	7.0'
8	298°31.5	39.6		109°02.2	2.4'	24°48.5	7.2'
9	313°31.5	39.2		123°23.6	2.5'	24°41.3	7.4'
10	328°31.4	38.8		137°45.1	2.6'	24°33.9	7.6'
11	343°31.3	38.4		152°06.7	2.7'	24°26.3	7.8'
12	358°31.3	N21°38.0		166°28.5	2.8'	S24°18.6	7.9'
13	13°31.2	37.6		180°50.3	2.9'	24°10.6	8.1'
14	28°31.1	37.3		195°12.3	3.1'	24°02.5	8.3'
15	43°31.1	36.9		209°34.3	3.2'	23°54.2	8.4'
16	58°31.0	36.5		223°56.5	3.3'	23°45.8	8.6'
17	73°30.9	36.1		238°18.7	3.4'	23°37.2	8.8'
18	88°30.9	N21°35.7		252°41.1	3.5'	S23°28.4	9.0'
19	103°30.8	35.3		267°03.6	3.6'	23°19.4	9.1'
20	118°30.7	34.9		281°26.3	3.7'	23°10.3	9.3'
21	133°30.7	34.6		295°49.0	3.9'	23°01.1	9.4'
22	148°30.6	34.2		310°11.9	4.0'	22°51.6	9.6'
23	163°30.5	33.8		324°34.8	4.1'	22°42.0	9.7'
SD = 15.7' $d = -0.4'$				SD = 16.7'			

Fri	Sun			Moon			
	GHA	Dec		GHA	$\nu$	Dec	$d$
0	178°30.5	N21°33.4		338°57.9	4.2'	S22°32.3	9.9'
1	193°30.4	33.0		353°21.2	4.3'	22°22.4	10.0'
2	208°30.3	32.6		7°44.5	4.5'	22°12.3	10.2'
3	223°30.3	32.2		22°08.0	4.6'	22°02.2	10.3'
4	238°30.2	31.8		36°31.6	4.7'	21°51.8	10.5'
5	253°30.2	31.4		50°55.3	4.8'	21°41.3	10.6'
6	268°30.1	N21°31.0		65°19.1	5.0'	S21°30.7	10.8'
7	283°30.0	30.6		79°43.1	5.1'	21°19.9	10.9'
8	298°30.0	30.2		94°07.2	5.2'	21°09.0	11.0'
9	313°29.9	29.9		108°31.4	5.4'	20°58.0	11.2'
10	328°29.8	29.5		122°55.8	5.5'	20°46.8	11.3'
11	343°29.8	29.1		137°20.3	5.6'	20°35.6	11.4'
12	358°29.7	N21°28.7		151°44.9	5.7'	S20°24.1	11.5'
13	13°29.7	28.3		166°09.6	5.9'	20°12.6	11.7'
14	28°29.6	27.9		180°34.5	6.0'	20°00.9	11.8'
15	43°29.5	27.5		194°59.5	6.1'	19°49.1	11.9'
16	58°29.5	27.1		209°24.7	6.3'	19°37.2	12.0'
17	73°29.4	26.7		223°49.9	6.4'	19°25.2	12.1'
18	88°29.4	N21°26.3		238°15.3	6.5'	S19°13.0	12.3'
19	103°29.3	25.9		252°40.8	6.7'	19°00.8	12.4'
20	118°29.2	25.5		267°06.5	6.8'	18°48.4	12.5'
21	133°29.2	25.1		281°32.3	6.9'	18°36.0	12.6'
22	148°29.1	24.6		295°58.2	7.0'	18°23.4	12.7'
23	163°29.1	24.2		310°24.2	7.2'	18°10.7	12.8'
SD = 15.7' $d = -0.4'$				SD = 16.6'			

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

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

Day	Sun		Mer. Pass hh:mm	Moon		Age
	Eqn. of Time 00 <sup>h</sup> mm:ss	12 <sup>h</sup> mm:ss		Mer. Pass. Upper hh:mm	Lower hh:mm	
13	05:45	05:48	12:06	—	11:51	14(99%)
14	05:52	05:55	12:06	00:24	12:56	15(100%)
15	05:58	06:01	12:06	01:28	13:58	16(98%)

# July 16, 17, 18 (Sat., Sun., Mon.)

h	Aries			Venus			Mars			Jupiter			Saturn		
Sat	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec		
0	293°48.8	206°30.6	N22°39.2	258°08.5	N12°18.5	285°31.0	N02°05.7	327°06.6	S14°42.4						
1	308°51.3	221°29.8	39.3	273°09.3	19.1	300°33.3	05.7	342°09.2	42.5						
2	323°53.8	236°29.0	39.5	288°10.1	19.6	315°35.7	05.7	357°11.8	42.6						
3	338°56.2	251°28.2	· · 39.7	303°10.9	· · 20.2	330°38.1	· · 05.8	12°14.4	· · 42.6						
4	353°58.7	266°27.4	39.8	318°11.7	20.7	345°40.4	05.8	27°17.1	42.7						
5	9°01.2	281°26.6	40.0	333°12.5	21.3	0°42.8	05.8	42°19.7	42.7						
6	24°03.6	296°25.8	N22°40.2	348°13.4	N12°21.9	15°45.2	N02°05.9	57°22.3	S14°42.8						
7	39°06.1	311°25.0	40.3	3°14.2	22.4	30°47.5	05.9	72°24.9	42.8						
8	54°08.6	326°24.2	40.5	18°15.0	23.0	45°49.9	05.9	87°27.5	42.9						
9	69°11.0	341°23.4	· · 40.6	33°15.8	· · 23.5	60°52.3	· · 05.9	102°30.1	· · 42.9						
10	84°13.5	356°22.6	40.8	48°16.6	24.1	75°54.6	06.0	117°32.7	43.0						
11	99°15.9	11°21.8	40.9	63°17.5	24.7	90°57.0	06.0	132°35.3	43.0						
12	114°18.4	26°21.0	N22°41.1	78°18.3	N12°25.2	105°59.4	N02°06.0	147°37.9	S14°43.1						
13	129°20.9	41°20.2	41.2	93°19.1	25.8	121°01.7	06.1	162°40.5	43.2						
14	144°23.3	56°19.4	41.4	108°19.9	26.3	136°04.1	06.1	177°43.1	43.2						
15	159°25.8	71°18.6	· · 41.5	123°20.7	· · 26.9	151°06.5	· · 06.1	192°45.7	· · 43.3						
16	174°28.3	86°17.8	41.7	138°21.5	27.4	166°08.8	06.1	207°48.3	43.3						
17	189°30.7	101°17.0	41.8	153°22.4	28.0	181°11.2	06.2	222°50.9	43.4						
18	204°33.2	116°16.2	N22°42.0	168°23.2	N12°28.6	196°13.6	N02°06.2	237°53.5	S14°43.4						
19	219°35.7	131°15.4	42.1	183°24.0	29.1	211°15.9	06.2	252°56.1	43.5						
20	234°38.1	146°14.6	42.3	198°24.8	29.7	226°18.3	06.3	267°58.8	43.5						
21	249°40.6	161°13.8	· · 42.4	213°25.6	· · 30.2	241°20.7	· · 06.3	283°01.4	· · 43.6						
22	264°43.0	176°13.0	42.6	228°26.5	30.8	256°23.1	06.3	298°04.0	43.7						
23	279°45.5	191°12.2	42.7	243°27.3	31.3	271°25.4	06.3	313°06.6	43.7						
Mer.pass. 04:24				ν-0.8' d0.2' m-3.8			ν0.8' d0.6' m0.3			ν2.4' d0.0' m-2.4			ν2.6' d-0.1' m0.5		
Sun	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	294°48.0	206°11.4	N22°42.8	258°28.1	N12°31.9	286°27.8	N02°06.4	328°09.2	S14°43.8						
1	309°50.4	221°10.6	43.0	273°28.9	32.4	301°30.2	06.4	343°11.8	43.8						
2	324°52.9	236°09.8	43.1	288°29.7	33.0	316°32.5	06.4	358°14.4	43.9						
3	339°55.4	251°09.0	· · 43.3	303°30.5	· · 33.6	331°34.9	· · 06.4	13°17.0	· · 43.9						
4	354°57.8	266°08.2	43.4	318°31.4	34.1	346°37.3	06.5	28°19.6	44.0						
5	10°00.3	281°07.4	43.5	333°32.2	34.7	1°39.7	06.5	43°22.2	44.0						
6	25°02.8	296°06.6	N22°43.7	348°33.0	N12°35.2	16°42.0	N02°06.5	58°24.8	S14°44.1						
7	40°05.2	311°05.8	43.8	3°33.8	35.8	31°44.4	06.5	73°27.4	44.2						
8	55°07.7	326°05.0	43.9	18°34.6	36.3	46°46.8	06.6	88°30.0	44.2						
9	70°10.2	341°04.2	· · 44.0	33°35.5	· · 36.9	61°49.1	· · 06.6	103°32.7	· · 44.3						
10	85°12.6	356°03.4	44.2	48°36.3	37.4	76°51.5	06.6	118°35.3	44.3						
11	100°15.1	11°02.6	44.3	63°37.1	38.0	91°53.9	06.6	133°37.9	44.4						
12	115°17.5	26°01.8	N22°44.4	78°37.9	N12°38.5	106°56.3	N02°06.7	148°40.5	S14°44.4						
13	130°20.0	41°01.0	44.6	93°38.7	39.1	121°58.6	06.7	163°43.1	44.5						
14	145°22.5	56°00.2	44.7	108°39.6	39.6	137°01.0	06.7	178°45.7	44.5						
15	160°24.9	70°59.4	· · 44.8	123°40.4	· · 40.2	152°03.4	· · 06.7	193°48.3	· · 44.6						
16	175°27.4	85°58.6	44.9	138°41.2	40.7	167°05.8	06.8	208°50.9	44.7						
17	190°29.9	100°57.8	45.0	153°42.0	41.3	182°08.1	06.8	223°53.5	44.7						
18	205°32.3	115°57.0	N22°45.2	168°42.8	N12°41.8	197°10.5	N02°06.8	238°56.1	S14°44.8						
19	220°34.8	130°56.2	45.3	183°43.7	42.4	212°12.9	06.8	253°58.7	44.8						
20	235°37.3	145°55.4	45.4	198°44.5	42.9	227°15.3	06.9	269°01.4	44.9						
21	250°39.7	160°54.6	· · 45.5	213°45.3	· · 43.5	242°17.6	· · 06.9	284°04.0	· · 44.9						
22	265°42.2	175°53.8	45.6	228°46.1	44.0	257°20.0	06.9	299°06.6	45.0						
23	280°44.7	190°52.9	45.7	243°46.9	44.6	272°22.4	06.9	314°09.2	45.0						
Mer.pass. 04:20				ν-0.8' d0.1' m-3.8			ν0.8' d0.6' m0.3			ν2.4' d0.0' m-2.4			ν2.6' d-0.1' m0.5		
Mon	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec				
0	295°47.1	205°52.1	N22°45.9	258°47.8	N12°45.1	287°24.8	N02°07.0	329°11.8	S14°45.1						
1	310°49.6	220°51.3	46.0	273°48.6	45.7	302°27.2	07.0	344°14.4	45.2						
2	325°52.0	235°50.5	46.1	288°49.4	46.2	317°29.5	07.0	359°17.0	45.2						
3	340°54.5	250°49.7	· · 46.2	303°50.2	· · 46.8	332°31.9	· · 07.0	14°19.6	· · 45.3						
4	355°57.0	265°48.9	46.3	318°51.0	47.3	347°34.3	07.1	29°22.2	45.3						
5	10°59.4	280°48.1	46.4	333°51.9	47.9	2°36.7	07.1	44°24.8	45.4						
6	26°01.9	295°47.3	N22°46.5	348°52.7	N12°48.4	17°39.0	N02°07.1	59°27.5	S14°45.4						
7	41°04.4	310°46.5	46.6	3°53.5	49.0	32°41.4	07.1	74°30.1	45.5						
8	56°06.8	325°45.7	46.7	18°54.3	49.5	47°43.8	07.1	89°32.7	45.6						
9	71°09.3	340°44.9	· · 46.8	33°55.2	· · 50.1	62°46.2	· · 07.2	104°35.3	· · 45.6						
10	86°11.8	355°44.1	46.9	48°56.0	50.6	77°48.6	07.2	119°37.9	45.7						
11	101°14.2	10°43.3	47.0	63°56.8	51.2	92°51.0	07.2	134°40.5	45.7						
12	116°16.7	25°42.5	N22°47.1	78°57.6	N12°51.7	107°53.3	N02°07.2	149°43.1	S14°45.8						
13	131°19.1	40°41.7	47.2	93°58.4	52.3	122°55.7	07.3	164°45.7	45.8						
14	146°21.6	55°40.8	47.3	108°59.3	52.8	137°58.1	07.3	179°48.3	45.9						
15	161°24.1	70°40.0	· · 47.4	124°00.1	· · 53.4	153°00.5	· · 07.3	194°51.0	· · 45.9						
16	176°26.5	85°39.2	47.5	139°00.9	53.9	168°02.9	07.3	209°53.6	46.0						
17	191°29.0	100°38.4	47.6	154°01.7	54.5	183°05.2	07.3	224°56.2	46.1						
18	206°31.5	115°37.6	N22°47.7	169°02.5	N12°55.0	198°07.6	N02°07.4	239°58.8	S14°46.1						
19	221°33.9	130°36.8	47.8	184°03.4	55.5	213°10.0	07.4	255°01.4	46.2						
20	236°36.4	145°36.0	47.9	199°04.2	56.1	228°12.4	07.4	270°04.0	46.2						
21	251°38.9	160°35.2	· · 48.0	214°05.0	· · 56.6	243°14.8	· · 07.4	285°06.6	· · 46.3						
22	266°41.3	175°34.4	48.1	229°05.8	57.2	258°17.2	07.4	300°09.2	46.3						
23	281°43.8	190°33.6	48.2	244°06.7	57.7	273°19.5	07.5	315°11.9	46.4						
Mer.pass. 04:16				ν-0.8' d0.1' m-3.8			ν0.8' d0.5' m0.3			ν2.4' d0.0' m-2.4			ν2.6' d-0.1' m0.5		

	SHA	Dec
Alpheratz	357°36.7	29°12.7
Ankaa	353°09.0	-42°10.8
Schedar	349°33.2	56°39.3
Diphda	348°49.3	-17°51.7
Achernar	335°21.8	-57°07.1
Hamal	327°53.5	23°34.0
Polaris	315°10.5	89°21.2
Acamar	315°13.5	-40°12.7
Menkar	314°08.4	4°10.7
Mirfak	308°31.4	49°56.2
Aldebaran	290°42.2	16°33.2
Rigel	281°06.1	-8°10.5
Capella	280°25.3	46°01.1
Bellatrix	278°25.4	6°22.2
Elnath	278°04.8	28°37.5
Alnilam	275°40.1	-1°11.2
Betelgeuse	270°54.6	7°24.7
Canopus	263°53.8	-52°42.3
Sirius	258°28.4	-16°44.7
Adhara	255°07.8	-29°00.1
Procyon	244°53.3	5°10.1
Pollux	243°20.2	27°58.4
Avior	234°16.2	-59°34.9
Suhail	222°48.2	-43°31.4
Miaplacidus	221°39.5	-69°48.6
Alphard	217°50.1	-8°45.3
Regulus	207°36.9	11°51.6
Dubhe	193°44.0	61°38.1
Denebola	182°27.2	14°27.0
Gienah	175°45.8	-17°40.0
Acrux	173°02.6	-63°13.6
Gacrux	171°54.0	-57°14.5
Alioth	166°14.9	55°50.6
Spica	158°24.5	-11°16.7
Alkaid	152°53.6	49°12.4
Hadar	148°38.8	-60°29.1
Menkent	147°59.9	-36°28.9
Arcturus	145°49.7	19°04.1
Rigil Kent.	139°42.9	-60°55.9
Kochab	137°19.4	74°04.1
Zuben'ubi	136°58.1	-16°08.1
Alphecca	126°05.3	26°38.5
Antares	112°18.1	-26°28.9
Atria	107°13.7	-69°04.2
Sabik	102°04.8	-15°45.1
Shaula	96°12.8	-37°07.2
Rasalhague	96°00.1	12°32.7
Eltanin	90°42.6	51°29.3
Kaus Aust.	83°34.8	-34°22.4
Vega	80°34.2	38°48.3
Nunki	75°49.9	-26°16.1
Altair	62°01.6	8°55.7
Peacock	53°08.3	-56°39.7
Deneb	49°26.7	45°21.6
Enif	33°40.5	9°58.7
Al Na'ir	27°35.1	-46°51.0
Fomalhaut	15°16.5	-29°30.1
Scheat	13°46.9	28°12.2
Markab	13°31.7	15°19.5
Jul 16 Sat	SHA	Mer.pass
Venus	272°41.8	10:15
Mars	324°19.6	06:47
Jupiter	351°42.1	04:57
Saturn	33°17.8	02:11
Jul 17 Sun	SHA	Mer.pass
Venus	271°23.4	10:16
Mars	323°40.1	06:46
Jupiter	351°39.8	04:53
Saturn	33°21.2	02:07
Jul 18 Mon	SHA	Mer.pass
Venus	270°05.0	10:17
Mars	323°00.6	06:44
Jupiter	351°37.7	04:50
Saturn	33°24.7	02:03
Horizontal parallax		
Venus:	0.1	
Mars:	0.1	



h		Sun		Moon			
Sat		GHA	Dec	GHA	$\nu$	Dec	$d$ HP
0		178°29.0	N21°23.8	324°50.4	7.3'	S17°57.9	12.9' 60.3'
1		193°28.9	23.4	339°16.7	7.4'	17°45.1	13.0' 60.3'
2		208°28.9	23.0	353°43.1	7.6'	17°32.1	13.1' 60.2'
3		223°28.8	· · 22.6	8°09.7	7.7'	17°19.0	13.2' 60.2'
4		238°28.8	22.2	22°36.3	7.8'	17°05.9	13.2' 60.2'
5		253°28.7	21.8	37°03.1	7.9'	16°52.6	13.3' 60.1'
6		268°28.6	N21°21.4	51°30.1	8.1'	S16°39.3	13.4' 60.1'
7		283°28.6	21.0	65°57.1	8.2'	16°25.9	13.5' 60.1'
8		298°28.5	20.6	80°24.3	8.3'	16°12.4	13.6' 60.0'
9		313°28.5	· · 20.2	94°51.6	8.4'	15°58.8	13.7' 60.0'
10		328°28.4	19.7	109°19.0	8.5'	15°45.1	13.7' 60.0'
11		343°28.4	19.3	123°46.6	8.7'	15°31.4	13.8' 59.9'
12		358°28.3	N21°18.9	138°14.2	8.8'	S15°17.6	13.9' 59.9'
13		13°28.2	18.5	152°42.0	8.9'	15°03.7	14.0' 59.9'
14		28°28.2	18.1	167°09.9	9.0'	14°49.8	14.0' 59.8'
15		43°28.1	· · 17.7	181°37.9	9.1'	14°35.7	14.1' 59.8'
16		58°28.1	17.3	196°06.1	9.3'	14°21.6	14.2' 59.8'
17		73°28.0	16.9	210°34.3	9.4'	14°07.5	14.2' 59.7'
18		88°28.0	N21°16.4	225°02.7	9.5'	S13°53.3	14.3' 59.7'
19		103°27.9	16.0	239°31.2	9.6'	13°39.0	14.3' 59.6'
20		118°27.9	15.6	253°59.8	9.7'	13°24.7	14.4' 59.6'
21		133°27.8	· · 15.2	268°28.5	9.8'	13°10.3	14.4' 59.6'
22		148°27.8	14.8	282°57.3	9.9'	12°55.8	14.5' 59.5'
23		163°27.7	14.3	297°26.2	10.0'	12°41.3	14.5' 59.5'
		SD = 15.7' $d = -0.4'$		SD = 16.5'			

Sun		GHA	Dec	GHA	$\nu$	Dec	$d$ HP
0		178°27.6	N21°13.9	311°55.2	10.1'	S12°26.8	14.6' 59.5'
1		193°27.6	13.5	326°24.4	10.2'	12°12.2	14.6' 59.4'
2		208°27.5	13.1	340°53.6	10.4'	11°57.5	14.7' 59.4'
3		223°27.5	· · 12.7	355°23.0	10.5'	11°42.9	14.7' 59.3'
4		238°27.4	12.2	9°52.4	10.6'	11°28.1	14.8' 59.3'
5		253°27.4	11.8	24°22.0	10.7'	11°13.3	14.8' 59.3'
6		268°27.3	N21°11.4	38°51.6	10.8'	S10°58.5	14.9' 59.2'
7		283°27.3	11.0	53°21.4	10.9'	10°43.7	14.9' 59.2'
8		298°27.2	10.5	67°51.3	11.0'	10°28.8	14.9' 59.2'
9		313°27.2	· · 10.1	82°21.2	11.1'	10°13.9	15.0' 59.1'
10		328°27.1	09.7	96°51.3	11.1'	09°58.9	15.0' 59.1'
11		343°27.1	09.3	111°21.4	11.2'	09°43.9	15.0' 59.0'
12		358°27.0	N21°08.8	125°51.7	11.3'	S09°28.9	15.0' 59.0'
13		13°27.0	08.4	140°22.0	11.4'	09°13.8	15.1' 59.0'
14		28°26.9	08.0	154°52.4	11.5'	08°58.8	15.1' 58.9'
15		43°26.9	· · 07.5	169°22.9	11.6'	08°43.7	15.1' 58.9'
16		58°26.8	07.1	183°53.5	11.7'	08°28.6	15.1' 58.8'
17		73°26.8	06.7	198°24.2	11.8'	08°13.4	15.2' 58.8'
18		88°26.7	N21°06.2	212°55.0	11.9'	S07°58.3	15.2' 58.8'
19		103°26.7	05.8	227°25.9	11.9'	07°43.1	15.2' 58.7'
20		118°26.6	05.4	241°56.8	12.0'	07°27.9	15.2' 58.7'
21		133°26.6	· · 04.9	256°27.8	12.1'	07°12.7	15.2' 58.6'
22		148°26.5	04.5	270°58.9	12.2'	06°57.4	15.2' 58.6'
23		163°26.5	04.1	285°30.1	12.3'	06°42.2	15.3' 58.6'
		SD = 15.7' $d = -0.4'$		SD = 16.2'			

Mon		GHA	Dec	GHA	$\nu$	Dec	$d$ HP
0		178°26.4	N21°03.6	300°01.4	12.3'	S06°26.9	15.3' 58.5'
1		193°26.4	03.2	314°32.7	12.4'	06°11.7	15.3' 58.5'
2		208°26.3	02.8	329°04.1	12.5'	05°56.4	15.3' 58.4'
3		223°26.3	· · 02.3	343°35.6	12.6'	05°41.1	15.3' 58.4'
4		238°26.2	01.9	358°07.2	12.6'	05°25.8	15.3' 58.4'
5		253°26.2	01.5	12°38.8	12.7'	05°10.6	15.3' 58.3'
6		268°26.1	N21°01.0	27°10.5	12.8'	S04°55.3	15.3' 58.3'
7		283°26.1	00.6	41°42.2	12.8'	04°40.0	15.3' 58.2'
8		298°26.0	21°00.1	56°14.1	12.9'	04°24.7	15.3' 58.2'
9		313°26.0	20°59.7	70°46.0	13.0'	04°09.4	15.3' 58.2'
10		328°26.0	59.3	85°17.9	13.0'	03°54.1	15.3' 58.1'
11		343°25.9	58.8	99°49.9	13.1'	03°38.8	15.3' 58.1'
12		358°25.9	N20°58.4	114°22.0	13.1'	S03°23.5	15.3' 58.0'
13		13°25.8	57.9	128°54.2	13.2'	03°08.3	15.3' 58.0'
14		28°25.8	57.5	143°26.4	13.3'	02°53.0	15.3' 58.0'
15		43°25.7	· · 57.0	157°58.6	13.3'	02°37.7	15.3' 57.9'
16		58°25.7	56.6	172°30.9	13.4'	02°22.5	15.2' 57.9'
17		73°25.6	56.2	187°03.3	13.4'	02°07.2	15.2' 57.8'
18		88°25.6	N20°55.7	201°35.7	13.5'	S01°52.0	15.2' 57.8'
19		103°25.5	55.3	216°08.2	13.5'	01°36.8	15.2' 57.8'
20		118°25.5	54.8	230°40.7	13.6'	01°21.6	15.2' 57.7'
21		133°25.5	· · 54.4	245°13.3	13.6'	01°06.4	15.2' 57.7'
22		148°25.4	53.9	259°45.9	13.7'	00°51.2	15.2' 57.6'
23		163°25.4	53.5	274°18.6	13.7'	00°36.1	15.1' 57.6'
		SD = 15.7' $d = -0.4'$		SD = 16.0'			

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

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

Day	Sun		Mer. Pass	Moon		Age
	Eqn. of 00 <sup>h</sup>	Time 12 <sup>h</sup>		Mer. Pass. Upper	Mer. Pass. Lower	
16	06:04	06:07	12:06	02:26	14:53	17(93%)
17	06:09	06:12	12:06	03:19	15:44	18(85%)
18	06:14	06:17	12:06	04:08	16:31	19(76%)