

ASTRONOMICAL PHENOMENA

FOR THE YEAR

2021

Prepared Jointly by
The Nautical Almanac Office
United States Naval Observatory

and

Her Majesty's Nautical Almanac Office
United Kingdom Hydrographic Office

WASHINGTON
U.S. Government Publishing Office

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ASTRONOMICAL PHENOMENA

FOR THE YEAR 2021

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The astronomical data in this booklet are expressed in the scale of universal time (UT); this is also known as Greenwich mean time (GMT) and is the standard time of the Greenwich meridian (0° of longitude). A time in UT may be converted to local mean time by the addition of east longitude (or subtraction of west longitude), where the longitude of the place is expressed in time-measure at the rate of 1 hour for every 15° . The differences between standard times and UT are indicated in the chart on page 22; local clock times may, however, differ from these standard times, especially in summer when clocks are often advanced by 1 hour.

PRINCIPAL PHENOMENA OF SUN AND MOON, 2021

THE SUN

Perigee	... Jan.	^{d h} 2 14	Equinoxes	... Mar.	^{d h m} 20 09 37	... Sept.	^{d h m} 22 19 21
Apogee	... July	5 22	Solstices	... June	21 03 32	... Dec.	21 15 59

PHASES OF THE MOON

Lunation	New Moon			First Quarter			Full Moon			Last Quarter		
	d	h	m	d	h	m	d	h	m	d	h	m
1212										Jan.	6	09 37
1213	Jan.	13	05 00	Jan.	20	21 02	Jan.	28	19 16	Feb.	4	17 37
1214	Feb.	11	19 06	Feb.	19	18 47	Feb.	27	08 17	Mar.	6	01 30
1215	Mar.	13	10 21	Mar.	21	14 40	Mar.	28	18 48	Apr.	4	10 02
1216	Apr.	12	02 31	Apr.	20	06 59	Apr.	27	03 32	May	3	19 50
1217	May	11	19 00	May	19	19 13	May	26	11 14	June	2	07 24
1218	June	10	10 53	June	18	03 54	June	24	18 40	July	1	21 11
1219	July	10	01 17	July	17	10 11	July	24	02 37	July	31	13 16
1220	Aug.	8	13 50	Aug.	15	15 20	Aug.	22	12 02	Aug.	30	07 13
1221	Sept.	7	00 52	Sept.	13	20 39	Sept.	20	23 55	Sept.	29	01 57
1222	Oct.	6	11 05	Oct.	13	03 25	Oct.	20	14 57	Oct.	28	20 05
1223	Nov.	4	21 15	Nov.	11	12 46	Nov.	19	08 57	Nov.	27	12 28
1224	Dec.	4	07 43	Dec.	11	01 36	Dec.	19	04 35	Dec.	27	02 24

ECLIPSES

A total eclipse of the Moon	May. 26	Western South America, western North America, Pacific Ocean, Australasia, eastern Asia
An annular eclipse of the Sun	June 10	North and north eastern North America, Greenland, most of Europe, most of Russia, northern and western China
A partial eclipse of the Moon	Nov. 19	North west Europe, the Americas, Oceania, Australasia, most of Asia
A total eclipse of the Sun	Dec. 4	Falkland Islands, southern tip of Africa, Antarctica, south easternmost Australia

For further details see pages 64–79

MOON AT PERIGEE

	d	h		d	h		d	h
Jan.	9	16	May	26	02	Oct.	8	17
Feb.	3	19	June	23	10	Nov.	5	22
Mar.	2	05	July	21	10	Dec.	4	10
Mar.	30	06	Aug.	17	09			
Apr.	27	15	Sept.	11	10			

MOON AT APOGEE

	d	h		d	h		d	h
Jan.	21	13	June	8	02	Oct.	24	15
Feb.	18	10	July	5	15	Nov.	21	02
Mar.	18	05	Aug.	2	08	Dec.	18	02
Apr.	14	18	Aug.	30	02			
May	11	22	Sept.	26	22			

OCCULTATIONS OF PLANETS AND BRIGHT STARS BY THE MOON

Date	Body	Areas of Visibility
d h		
Apr. 17 12	Mars	Most of central and eastern Africa, southern parts of the Middle East, India, South East Asia, Indonesia, most of the Philippines
May 12 22	Venus	Most of New Zealand, eastern Polynesia, Easter Island
Nov. 3 19	Mercury	Canada (except westernmost), north eastern USA, Bermuda
Nov. 8 05	Venus	North eastern Mongolia, north eastern China, south eastern Russia, Japan (except southernmost parts), western Aleutian Islands
Dec. 3 00	Mars	Most of Mongolia, north eastern China, parts of eastern Russia, Japan, most of Micronesia, northernmost Polynesia, Hawaii
Dec. 10 13	Pallas	Central and eastern Africa, southern Arabian Peninsula, south and easternmost Middle East, India, Asia (except south eastern parts), parts of south east Russia
Dec. 31 20	Mars	Parts of southern Australia, Tasmania, Antarctica, South Georgia Island, southernmost tip of South America, Falkland Islands

Maps showing the areas of visibility may be found on AsA-Online.

GEOCENTRIC PHENOMENA

MERCURY

Greatest elongation East	Jan. 24 02 (19°)	May 17 06 (22°)	Sept. 14 04 (27°)
Stationary	Jan. 30 02	May 30 02	Sept. 27 04
Inferior conjunction ...	Feb. 8 14	June 11 01	Oct. 9 16
Stationary	Feb. 20 13	June 22 23	Oct. 18 01
Greatest elongation West	Mar. 6 11 (27°)	July 4 20 (22°)	Oct. 25 06 (18°)
Superior conjunction ...	Apr. 19 02	Aug. 1 14	Nov. 29 05

VENUS

Superior conjunction ...	Mar. 26 07	Greatest illuminated extent	Dec. 4 07
Greatest elongation East	Oct. 29 21 (47°)	Stationary	Dec. 18 11

EARTH

Perihelion ... Jan.	2 14	Equinoxes ... Mar.	20 09 37	Sept.	22 19 21
Aphelion ... July	5 22	Solstices ... June	21 03 32	Dec.	21 15 59

SUPERIOR PLANETS

	Conjunction	Stationary	Opposition	Stationary
	d h	d h	d h	d h
Mars	Oct. 8 04	—	—	—
Jupiter	Jan. 29 02	June 21 05	Aug. 20 00	Oct. 18 11
Saturn	Jan. 24 03	May 23 20	Aug. 2 06	Oct. 11 02
Uranus	Apr. 30 20	Aug. 20 04	Nov. 5 00	Jan. 14 14
Neptune	Mar. 11 00	June 26 10	Sept. 14 09	Dec. 1 22

The vertical bars indicate where the dates for the planet are not in chronological order.

HELIOCENTRIC PHENOMENA

	Perihelion	Aphelion	Ascending Node	Greatest Lat. North	Descending Node	Greatest Lat. South
Mercury	Jan. 29	Mar. 14	Jan. 24	Feb. 8	Mar. 3	Jan. 5
	Apr. 27	June 10	Apr. 22	May 7	May 30	Apr. 3
	July 24	Sept. 6	July 19	Aug. 3	Aug. 26	June 30
	Oct. 19	Dec. 2	Oct. 15	Oct. 30	Nov. 22	Sept. 26
	—	—	—	—	—	Dec. 23
Venus	—	Feb. 20	May 9	July 4	Jan. 16	Mar. 14
	June 12	Oct. 3	Dec. 20	—	Aug. 29	Oct. 25
Mars	—	July 13	—	June 4	Dec. 19	—

Jupiter, Saturn, Uranus, Neptune: None in 2021

VISIBILITY OF PLANETS

MERCURY can only be seen low in the east before sunrise, or low in the west after sunset (about the time of beginning or end of civil twilight). It is visible in the mornings between the following approximate dates: February 15 to April 10, June 20 to July 25 and October 16 to November 13. The planet is brighter at the end of each period, (the best conditions in northern latitudes occur in late October and in southern latitudes in early March). It is visible in the evenings between the following approximate dates: January 5 to February 2, April 27 to June 1, August 10 to October 3 and December 16 to December 31. The planet is brighter at the beginning of each period, (the best conditions in northern latitudes occur in mid-May and in southern latitudes in mid-September).

VENUS is a brilliant object in the morning sky from the beginning of the year until mid-February when it becomes too close to the Sun for observation. In early May it reappears in the evening sky where it stays until the end of the year. Venus is in conjunction with Jupiter on February 11, with Mercury on May 29 and December 29 and with Mars on July 13.

MARS is visible as a reddish object in Pisces in the evening sky at the beginning of the year. Its eastward elongation decreases as it moves through Aries from early January, Taurus from late February (passing 7° N of *Aldebaran* on March 23), into Gemini from late April, Cancer in early June (passing 5° S of *Pollux* on June 2) and then Leo in mid-July (passing 0° 7' N of *Regulus* on July 29). It becomes too close to the Sun for observation in late August. It reappears in the morning sky during late November in Libra, moving into Scorpius in mid-December and then into Ophiuchus in late December (passing 5° N of *Antares* on December 26), where it remains for the rest of the year. Mars is in conjunction with Venus on July 13 and with Mercury on August 19.

JUPITER can be seen in Capricornus until mid-January, when it becomes too close to the Sun for observation. It reappears in the morning sky in the second week of February. Its westward elongation gradually increases, moving into Aquarius in late April. From late May it can be seen for more than half the night. It moves into Capricornus in mid-August and is at opposition on August 20 when it is visible throughout the night. Its eastward elongation then decreases and from mid-November it can only be seen in the evening sky passing into Aquarius in mid-December. Jupiter is in conjunction with Mercury on January 11, February 13 and March 5 and with Venus on February 11.

SATURN can be seen in Capricornus for the first week of January. It then becomes too close to the Sun for observation. It reappears in the morning sky in the second week of February. Its westward elongation gradually increases and from early May it can be seen for more than half the night. It is at opposition on August 2 when it is visible throughout the night. Its eastward elongation then decreases and from late October it can only be seen in the evening sky.

URANUS is visible at the beginning of the year in Aries, in which constellation it remains throughout the year. From late January until the second week of April it can only be seen in the evening sky. It then becomes too close to the Sun for observation reappearing in late May in the morning sky. It is at opposition on November 5 when it is visible throughout the night, after which its eastward elongation gradually decreases.

NEPTUNE is visible at the beginning of the year in the evening sky in Aquarius and remains in this constellation throughout the year. In mid-February it becomes too close to the Sun for observation and reappears in late March in the morning sky. Neptune is at opposition on September 14 and from mid-December can only be seen in the evening sky.

DO NOT CONFUSE (1) Jupiter with Saturn in the early January and with Mercury in mid-January and mid-February to mid-March; on all occasions Jupiter is the brighter object.(2) Venus with Saturn in the second week of February, with Jupiter in mid-February, with Mercury in late May and in late December and with Mars in July; on all occasions Venus is the brighter object. (3) Mercury with Saturn in late February and with Mars in mid-August; on both occasions Mercury is the brighter object.

VISIBILITY OF PLANETS IN MORNING AND EVENING TWILIGHT

	Morning	Evening
Venus	January 1 – February 14	May 5 – December 31
Mars	November 23 – December 31	January 1 – August 23
Jupiter	February 11 – August 20	January 1 – January 16 August 20 – December 31
Saturn	February 10 – August 2	January 1 – January 7 August 2 – December 31

VISIBILITY OF PLANETS

The planet diagram on page 9 shows, in graphical form for any date during the year, the local mean times of meridian passage of the Sun, of the five planets, Mercury, Venus, Mars, Jupiter and Saturn, and of every 2^h of right ascension. Intermediate lines, corresponding to particular stars, may be drawn in by the user if desired. The diagram is intended to provide a general picture of the availability of planets and stars for observation during the year.

On each side of the line marking the time of meridian passage of the Sun, a band 45^m wide is shaded to indicate that planets and most stars crossing the meridian within 45^m of the Sun are generally too close to the Sun for observation.

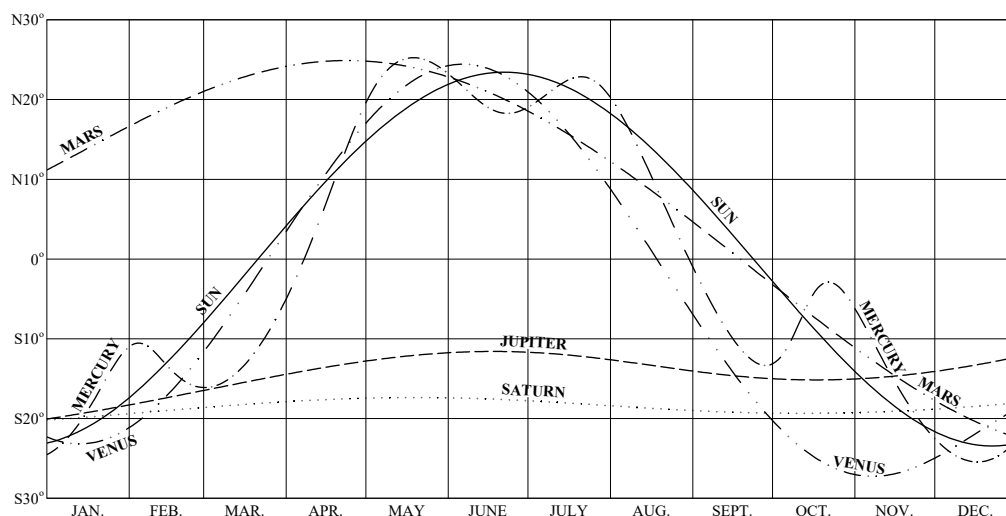
For any date the diagram provides immediately the local mean time of meridian passage of the Sun, planets and stars, and thus the following information:

- whether a planet or star is too close to the Sun for observation;
- visibility of a planet or star in the morning or evening;
- location of a planet or star during twilight;
- proximity of planets to stars or other planets.

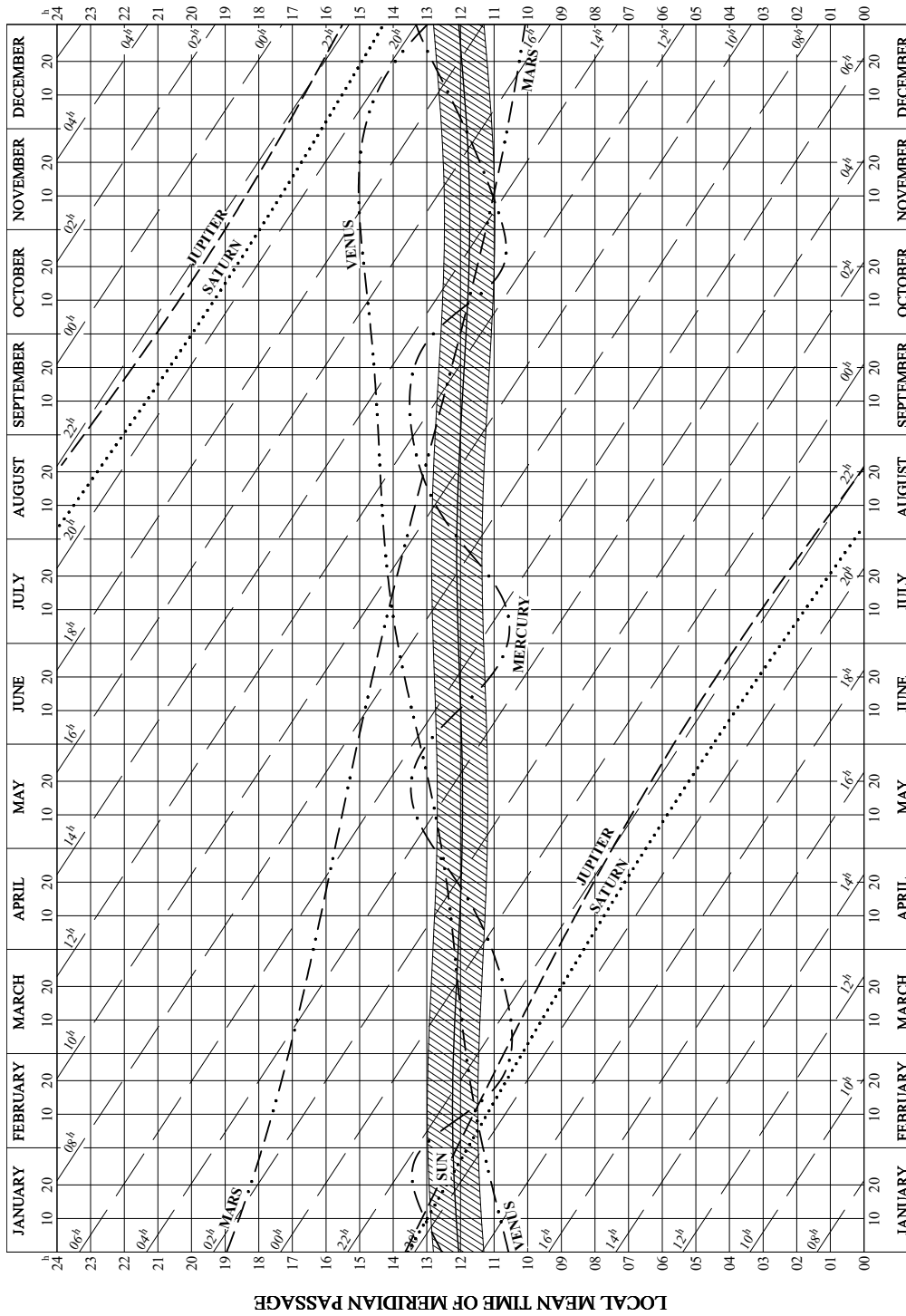
When the meridian passage of a body occurs at midnight, it is close to opposition to the Sun and is visible all night, and may be observed in both morning and evening twilights. As the time of meridian passage decreases, the body ceases to be observable in the morning, but its altitude above the eastern horizon during evening twilight gradually increases until it is on the meridian at evening twilight. From then onwards the body is observable above the western horizon, its altitude at evening twilight gradually decreasing, until it becomes too close to the Sun for observation. When it again becomes visible, it is seen in the morning twilight, low in the east. Its altitude at morning twilight gradually increases until meridian passage occurs at the time of morning twilight, then as the time of meridian passage decreases to 0^h , the body is observable in the west in the morning twilight with a gradually decreasing altitude, until it once again reaches opposition.

Notes on the visibility of the planets are given on page 7. Further information on the visibility of planets may be obtained from the diagram below which shows, in graphical form for any date during the year, the declinations of the bodies plotted on the planet diagram on page 9.

DECLINATION OF SUN AND PLANETS, 2021



LOCAL MEAN TIME OF MERIDIAN PASSAGE



ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h UT

Date	Mercury		Venus		Date	Mercury		Venus	
	Elong.	Mag.	Elong.	Mag.		Elong.	Mag.	Elong.	Mag.
Jan.					June				
−4	E.	4	−1.1	W.	22	−3.9	E.	25	−3.8
1	E.	7	−1.0	W.	20	−3.9	E.	26	−3.9
6	E.	10	−0.9	W.	19	−3.9	E.	28	−3.9
11	E.	13	−0.9	W.	18	−3.9	E.	29	−3.9
16	E.	16	−0.9	W.	17	−3.9	E.	30	−3.9
21	E.	18	−0.8	W.	16	−3.9	E.	31	−3.9
26	E.	18	−0.5	W.	15	−3.9	E.	33	−3.9
31	E.	15	+0.7	W.	13	−3.9	E.	34	−3.9
Feb.					Aug.				
5	E.	8	+3.3	W.	12	−3.9	E.	35	−3.9
10	W.	5	+4.8	W.	11	−3.9	E.	36	−4.0
15	W.	14	+2.2	W.	10	−3.9	E.	37	−4.0
20	W.	21	+0.9	W.	9	−3.9	E.	38	−4.0
25	W.	25	+0.3	W.	7	−3.9	E.	39	−4.0
Mar.					Sept.				
2	W.	27	+0.1	W.	6	−3.9	E.	40	−4.0
7	W.	27	+0.1	W.	5	−3.9	E.	41	−4.1
12	W.	27	0.0	W.	4	−3.9	E.	42	−4.1
17	W.	25	0.0	W.	3	−3.9	E.	43	−4.1
22	W.	23	−0.1	W.	2	−4.0	E.	44	−4.2
27	W.	20	−0.3	E.	1	.	E.	44	−4.2
Apr.					Oct.				
1	W.	17	−0.5	E.	2	−4.0	E.	45	−4.3
6	W.	13	−0.8	E.	3	−3.9	E.	46	−4.3
11	W.	9	−1.2	E.	4	−3.9	E.	46	−4.4
16	W.	4	−1.8	E.	5	−3.9	E.	47	−4.4
21	E.	2	−2.2	E.	7	−3.9	E.	47	−4.5
26	E.	8	−1.6	E.	8	−3.9	E.	47	−4.5
May					Nov.				
1	E.	13	−1.1	E.	9	−3.9	E.	47	−4.6
6	E.	18	−0.7	E.	11	−3.9	E.	47	−4.6
11	E.	21	−0.3	E.	12	−3.9	E.	46	−4.7
16	E.	22	+0.2	E.	13	−3.9	E.	46	−4.7
21	E.	22	+0.8	E.	14	−3.9	E.	45	−4.8
26	E.	19	+1.6	E.	16	−3.9	E.	43	−4.8
31	E.	15	+2.8	E.	17	−3.8	E.	41	−4.9
June					Dec.				
5	E.	9	+4.3	E.	18	−3.8	E.	39	−4.9
10	E.	3	.	E.	20	−3.8	E.	35	−4.9
15	W.	7	+4.9	E.	21	−3.8	E.	31	−4.8
20	W.	13	+3.2	E.	22	−3.8	E.	26	−4.7
25	W.	18	+1.9	E.	24	−3.8	E.	20	−4.5
30	W.	21	+1.0	E.	25	−3.8	E.	13	−4.3
30	W.	21	+1.0	E.	25	−3.8	E.	13	−4.3

SELECTED DWARF AND MINOR PLANETS

	Conjunction	Stationary	Opposition	Stationary
Ceres	Apr. 7	Oct. 8	Nov. 27	—
Pallas	Feb. 9	July 18	Sept. 11	Nov. 1
Juno	—	Apr. 13	June 6	Aug. 5
Vesta	Nov. 28	Jan. 23	Mar. 4	Apr. 22
Pluto	Jan. 14	Apr. 28	July 17	Oct. 6

ELONGATIONS AND MAGNITUDES OF PLANETS AT 0^h UT

Date		Mars		Jupiter		Saturn		Uranus		Neptune	
		Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.	Elong.	Mag.
Jan.	−4	E. 110 [◦]	−0.4	E. 26 [◦]	−2.0	E. 25 [◦]	+0.6	E. 121 [◦]	+5.7	E. 73 [◦]	+7.9
	6	E. 104	−0.1	E. 18	−1.9	E. 16	+0.6	E. 111	+5.7	E. 63	+7.9
	16	E. 98	+0.1	E. 10	−1.9	E. 7	+0.6	E. 101	+5.8	E. 53	+7.9
	26	E. 93	+0.3	E. 2	−1.9	W. 2	+0.6	E. 91	+5.8	E. 43	+7.9
Feb.	5	E. 88	+0.5	W. 5	−1.9	W. 11	+0.6	E. 81	+5.8	E. 33	+7.9
Mar.	15	E. 84	+0.7	W. 13	−2.0	W. 20	+0.7	E. 71	+5.8	E. 23	+8.0
	25	E. 79	+0.9	W. 21	−2.0	W. 29	+0.7	E. 61	+5.8	E. 14	+8.0
	7	E. 75	+1.0	W. 29	−2.0	W. 38	+0.7	E. 51	+5.8	E. 4	+8.0
	17	E. 71	+1.1	W. 36	−2.0	W. 47	+0.7	E. 42	+5.9	W. 6	+8.0
	27	E. 67	+1.2	W. 44	−2.0	W. 56	+0.8	E. 32	+5.9	W. 15	+8.0
Apr.	6	E. 63	+1.3	W. 52	−2.1	W. 65	+0.8	E. 23	+5.9	W. 25	+8.0
	16	E. 59	+1.4	W. 60	−2.1	W. 74	+0.7	E. 14	+5.9	W. 34	+7.9
May	26	E. 56	+1.5	W. 68	−2.2	W. 83	+0.7	E. 4	+5.9	W. 44	+7.9
	6	E. 52	+1.6	W. 77	−2.2	W. 92	+0.7	W. 5	+5.9	W. 53	+7.9
	16	E. 48	+1.7	W. 85	−2.3	W. 102	+0.7	W. 14	+5.9	W. 63	+7.9
June	26	E. 45	+1.7	W. 94	−2.4	W. 111	+0.6	W. 23	+5.9	W. 72	+7.9
	5	E. 41	+1.7	W. 103	−2.5	W. 121	+0.5	W. 32	+5.9	W. 81	+7.9
	15	E. 38	+1.8	W. 112	−2.5	W. 131	+0.5	W. 41	+5.9	W. 91	+7.9
July	25	E. 35	+1.8	W. 122	−2.6	W. 141	+0.4	W. 50	+5.8	W. 100	+7.9
	5	E. 31	+1.8	W. 131	−2.7	W. 151	+0.4	W. 59	+5.8	W. 110	+7.9
Aug.	15	E. 28	+1.8	W. 141	−2.7	W. 161	+0.3	W. 68	+5.8	W. 120	+7.9
	25	E. 25	+1.8	W. 152	−2.8	W. 171	+0.2	W. 78	+5.8	W. 129	+7.8
	4	E. 21	+1.8	W. 163	−2.8	E. 178	+0.2	W. 87	+5.8	W. 139	+7.8
	14	E. 18	+1.8	W. 173	−2.9	E. 168	+0.2	W. 97	+5.8	W. 149	+7.8
	24	E. 15	+1.8	E. 175	−2.9	E. 158	+0.3	W. 106	+5.7	W. 159	+7.8
Sept.	3	E. 12	+1.8	E. 165	−2.8	E. 147	+0.3	W. 116	+5.7	W. 169	+7.8
	13	E. 8	+1.7	E. 154	−2.8	E. 137	+0.4	W. 126	+5.7	W. 178	+7.8
Oct.	23	E. 5	+1.7	E. 143	−2.8	E. 127	+0.4	W. 136	+5.7	E. 171	+7.8
	3	E. 2	+1.7	E. 133	−2.7	E. 117	+0.5	W. 146	+5.7	E. 161	+7.8
Nov.	13	W. 2	+1.6	E. 122	−2.6	E. 107	+0.5	W. 156	+5.7	E. 151	+7.8
	23	W. 5	+1.7	E. 113	−2.6	E. 97	+0.6	W. 166	+5.7	E. 141	+7.8
	2	W. 8	+1.7	E. 103	−2.5	E. 88	+0.6	W. 177	+5.6	E. 131	+7.8
	12	W. 11	+1.6	E. 94	−2.4	E. 78	+0.7	E. 173	+5.7	E. 121	+7.9
	22	W. 15	+1.6	E. 84	−2.4	E. 68	+0.7	E. 162	+5.7	E. 111	+7.9
Dec.	2	W. 18	+1.6	E. 76	−2.3	E. 59	+0.7	E. 152	+5.7	E. 100	+7.9
	12	W. 21	+1.6	E. 67	−2.2	E. 50	+0.7	E. 141	+5.7	E. 90	+7.9
	22	W. 24	+1.6	E. 58	−2.2	E. 41	+0.7	E. 131	+5.7	E. 80	+7.9
	32	W. 27	+1.5	E. 50	−2.1	E. 31	+0.7	E. 120	+5.7	E. 70	+7.9

VISUAL MAGNITUDES OF SELECTED DWARF & MINOR PLANETS

	Jan. 6	Feb. 15	Mar. 27	May 6	June 15	July 25	Sept. 3	Oct. 13	Nov. 22	Dec. 32
Ceres	9.2	9.2	9.0	9.1	9.2	9.1	8.7	8.1	7.1	7.7
Pallas	10.5	10.4	10.5	10.5	10.2	9.6	8.7	9.1	9.7	10.0
Juno	11.5	11.4	11.0	10.5	10.1	10.6	11.0	11.2	11.2	10.9
Vesta	7.2	6.3	6.3	7.1	7.6	7.8	7.9	7.8	7.5	7.7
Pluto	14.7	14.8	14.8	14.8	14.7	14.6	14.7	14.8	14.8	14.8

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h		d	h	
Jan.	2	14	Earth at perihelion	Mar.	17	02 Uranus 3° N. of Moon
	6	10	LAST QUARTER		18	05 Moon at apogee
	9	16	Moon at perigee		19	18 Mars 1°9 N. of Moon
	11	11	Mercury 1°5 S. of Jupiter		20	10 Equinox
	11	20	Venus 1°5 N. of Moon		21	15 FIRST QUARTER
	13	05	NEW MOON		23	00 Mars 7° N. of <i>Aldebaran</i>
	14	01	Jupiter 3° N. of Moon		26	07 Venus in superior conjunction
	14	08	Mercury 2° N. of Moon		28	19 FULL MOON
	14	14	Pluto in conjunction with Sun		30	06 Moon at perigee
	14	14	Uranus stationary	Apr.	4	10 LAST QUARTER
	17	06	Neptune 4° N. of Moon		6	08 Saturn 4° N. of Moon
	20	21	FIRST QUARTER		7	07 Ceres in conjunction with Sun
	21	06	Mars 5° N. of Moon		7	07 Jupiter 4° N. of Moon
	21	06	Uranus 3° N. of Moon		9	11 Neptune 4° N. of Moon
	21	13	Moon at apogee		12	03 NEW MOON
	22	00	Mars 1°7 N. of Uranus		13	02 Juno stationary
	23	22	Vesta stationary		13	12 Uranus 2° N. of Moon
	24	02	Mercury greatest elong. E. (19°)		14	18 Moon at apogee
	24	03	Saturn in conjunction with Sun		17	12 Mars 0°1 N. of Moon Occn.
	28	19	FULL MOON		19	02 Mercury in superior conjunction
	29	02	Jupiter in conjunction with Sun		20	07 FIRST QUARTER
	30	02	Mercury stationary		22	18 Vesta stationary
Feb.	3	19	Moon at perigee		27	04 FULL MOON
	4	18	LAST QUARTER		27	15 Moon at perigee
	8	14	Mercury in inferior conjunction		28	19 Pluto stationary
	9	20	Pallas in conjunction with Sun		30	20 Uranus in conjunction with Sun
	10	11	Saturn 3° N. of Moon	May	3	17 Saturn 4° N. of Moon
	10	20	Venus 3° N. of Moon		3	20 LAST QUARTER
	11	12	Venus 0°4 S. of Jupiter		4	21 Jupiter 5° N. of Moon
	11	19	NEW MOON		6	18 Neptune 4° N. of Moon
	13	17	Neptune 4° N. of Moon		11	03 Mercury 8° N. of <i>Aldebaran</i>
	13	19	Mercury 4° N. of Jupiter		11	19 NEW MOON
	17	16	Uranus 3° N. of Moon		11	22 Moon at apogee
	18	10	Moon at apogee		12	22 Venus 0°7 N. of Moon Occn.
	18	23	Mars 4° N. of Moon		13	18 Mercury 2° N. of Moon
	19	19	FIRST QUARTER		16	05 Mars 1°5 S. of Moon
	20	13	Mercury stationary		17	06 Mercury greatest elong. E. (22°)
	27	08	FULL MOON		17	23 Venus 6° N. of <i>Aldebaran</i>
Mar.	2	05	Moon at perigee		19	19 FIRST QUARTER
	4	18	Vesta at opposition		23	20 Saturn stationary
	5	07	Mercury 0°3 N. of Jupiter		26	02 Moon at perigee
	6	02	LAST QUARTER		26	11 FULL MOON Eclipse
	6	11	Mercury greatest elong. W. (27°)		29	06 Mercury 0°4 S. of Venus
	9	23	Saturn 4° N. of Moon		30	02 Mercury stationary
	10	16	Jupiter 4° N. of Moon		31	01 Saturn 4° N. of Moon
	11	00	Neptune in conjunction with Sun		1	09 Jupiter 5° N. of Moon
	11	01	Mercury 4° N. of Moon			
	13	10	NEW MOON			

CONFIGURATIONS OF SUN, MOON AND PLANETS

	d	h			d	h		
June	2	07	LAST QUARTER		Aug.	10	01	Mars 4° S. of Moon
	2	14	Mars 5° S. of <i>Pollux</i>			11	07	Venus 4° S. of Moon
	3	01	Neptune 4° N. of Moon			11	18	Mercury 1°2 N. of <i>Regulus</i>
	6	22	Juno at opposition			15	15	FIRST QUARTER
	7	06	Uranus 2° N. of Moon			17	09	Moon at perigee
	8	02	Moon at apogee			19	04	Mercury 0°08 S. of Mars
	10	11	NEW MOON	Eclipse		20	00	Jupiter at opposition
	11	01	Mercury in inferior conjunction			20	04	Uranus stationary
	12	07	Venus 1°5 S. of Moon			20	22	Saturn 4° N. of Moon
	13	20	Mars 3° S. of Moon			22	05	Jupiter 4° N. of Moon
	18	04	FIRST QUARTER			22	12	FULL MOON
	21	04	Solstice			24	02	Neptune 4° N. of Moon
	21	05	Jupiter stationary			28	09	Uranus 1°5 N. of Moon
	22	15	Venus 5° S. of <i>Pollux</i>			30	02	Moon at apogee
	22	23	Mercury stationary			30	07	LAST QUARTER
	23	10	Moon at perigee		Sept.	5	06	Venus 1°7 N. of <i>Spica</i>
	24	19	FULL MOON			7	01	NEW MOON
	26	10	Neptune stationary			8	20	Mercury 7° S. of Moon
	27	09	Saturn 4° N. of Moon			10	02	Venus 4° S. of Moon
	28	19	Jupiter 4° N. of Moon			11	02	Pallas at opposition
	30	09	Neptune 4° N. of Moon			11	10	Moon at perigee
July	1	21	LAST QUARTER			13	21	FIRST QUARTER
	4	15	Uranus 2° N. of Moon			14	04	Mercury greatest elong. E. (27°)
	4	20	Mercury greatest elong. W. (22°)			14	09	Neptune at opposition
	5	15	Moon at apogee			17	03	Saturn 4° N. of Moon
	5	22	Earth at aphelion			18	07	Jupiter 4° N. of Moon
	8	05	Mercury 4° S. of Moon			20	09	Neptune 4° N. of Moon
	10	01	NEW MOON			21	00	FULL MOON
	12	09	Venus 3° S. of Moon			22	19	Equinox
	12	10	Mars 4° S. of Moon			23	12	Mercury 1°7 S. of <i>Spica</i>
	13	07	Venus 0°5 N. of Mars			24	16	Uranus 1°3 N. of Moon
	17	10	FIRST QUARTER			26	22	Moon at apogee
	17	23	Pluto at opposition			27	04	Mercury stationary
	18	20	Pallas stationary			29	02	LAST QUARTER
	21	10	Moon at perigee			30	15	Mercury 1°7 S. of <i>Spica</i>
	21	19	Venus 1°2 N. of <i>Regulus</i>		Oct.	6	11	NEW MOON
	24	03	FULL MOON			6	13	Pluto stationary
	24	17	Saturn 4° N. of Moon			8	04	Mars in conjunction with Sun
	26	01	Jupiter 4° N. of Moon			8	17	Moon at perigee
	27	18	Neptune 4° N. of Moon			8	19	Ceres stationary
	29	16	Mars 0°7 N. of <i>Regulus</i>			9	16	Mercury in inferior conjunction
	31	13	LAST QUARTER			9	19	Venus 3° S. of Moon
Aug.	1	00	Uranus 1°8 N. of Moon			11	02	Saturn stationary
	1	14	Mercury in superior conjunction			13	03	FIRST QUARTER
	2	06	Saturn at opposition			14	07	Saturn 4° N. of Moon
	2	08	Moon at apogee			15	10	Jupiter 4° N. of Moon
	5	04	Juno stationary			16	14	Venus 1°5 N. of <i>Antares</i>
	8	14	NEW MOON			17	14	Neptune 4° N. of Moon
						18	01	Mercury stationary
						18	11	Jupiter stationary

CONFIGURATIONS OF SUN, MOON AND PLANETS

d	h		d	h	
Oct. 20	15	FULL MOON	Nov. 27	12	LAST QUARTER
21	22	Uranus 1°3' N. of Moon	28	10	Vesta in conjunction with Sun
24	15	Moon at apogee	29	05	Mercury in superior conjunction
25	06	Mercury greatest elong. W. (18°)	Dec. 1	22	Neptune stationary
28	20	LAST QUARTER	3	00	Mars 0°7' S. of Moon Occn.
29	21	Venus greatest elong. E. (47°)	4	07	Venus greatest illuminated extent
Nov. 1	02	Mercury 4° N. of <i>Spica</i>	4	08	NEW MOON Eclipse
1	02	Pallas stationary	4	10	Moon at perigee
3	19	Mercury 1°2' S. of Moon Occn.	7	01	Venus 1°9' N. of Moon
4	21	NEW MOON	8	02	Saturn 4° N. of Moon
5	00	Uranus at opposition	9	06	Jupiter 4° N. of Moon
5	22	Moon at perigee	10	13	Pallas 0°5' S. of Moon Occn.
8	05	Venus 1°1' S. of Moon Occn.	11	01	Neptune 4° N. of Moon
10	14	Saturn 4° N. of Moon	11	02	FIRST QUARTER
11	13	FIRST QUARTER	15	06	Uranus 1°5' N. of Moon
11	17	Jupiter 4° N. of Moon	18	02	Moon at apogee
13	19	Neptune 4° N. of Moon	18	11	Venus stationary
18	02	Uranus 1°5' N. of Moon	19	05	FULL MOON
19	09	FULL MOON Eclipse	21	16	Solstice
21	02	Moon at apogee	26	18	Mars 5° N. of <i>Antares</i>
27	04	Ceres at opposition	27	02	LAST QUARTER
			29	01	Mercury 4° S. of Venus
			31	20	Mars 0°9' N. of Moon Occn.

PREDICTED PERIHELION PASSAGES OF COMETS, 2021

Periodic comet	Perihelion date	Period distance	Period	Periodic comet	Perihelion date	Period distance	Period
	<i>T</i>	<i>q</i> (au)	<i>P</i> (yr)		<i>T</i>	<i>q</i> (au)	<i>P</i> (yr)
98P/Takamizawa	Jan. 4	1.66	7.4	4P/Faye	Sept. 8	1.62	7.4
323P/SOHO	Jan. 18	0.04	4.1	108P/Ciffreo	Sept. 10	1.66	7.2
102P/Shoemaker	Jan. 22	2.07	7.4	6P/d'Arrest	Sept. 17	1.35	6.5
28P/Neujmin	Mar. 11	1.58	18.4	342P/SOHO	Oct. 18	0.05	5.3
10P/Tempel	Mar. 24	1.41	5.3	110P/Hartley	Oct. 18	2.46	6.8
16P/Brooks	Apr. 18	1.88	6.9	67P/Churyumov-Gerasimenko	Nov. 2	1.21	6.4
142P/Ge-Wang	May 12	2.51	11.1	70P/Kojima	Nov. 3	2.01	7.0
201P/LONEOS	May 26	1.22	6.1	132P/Helin-Roman-Alu	Nov. 13	1.69	7.6
7P/Pons-Winnecke	May 27	1.23	6.3	P/2002 T5 (LINEAR)	Dec. 15	3.94	18.5
15P/Finlay	July 13	0.99	6.5	173P/Mueller	Dec. 16	4.22	13.6
8P/Tuttle	Aug. 27	1.03	13.6				

CHRONOLOGICAL CYCLES AND ERAS

Dominical Letter	 C	Julian Period (year of)	 6734
Epact	 16	Roman Indiction	 14
Golden Number (Lunar Cycle)	... VIII	Solar Cycle	 14

All dates are given in terms of the Gregorian calendar in which
2021 January 14 corresponds to 2021 January 1 of the Julian calendar.

ERA	YEAR	BEGINS	ERA	YEAR	BEGINS
Byzantine	 7530	Sept. 14	Japanese	 2681	Jan. 1
Jewish (A.M.)*	 5782	Sept. 6	Seleucidæ (Grecian)	 2333	Sept. 14
Chinese (xīn chǒu)	...	Feb. 12			(or Oct. 14)
Roman (A.U.C.)	 2774	Jan. 14	Saka (Indian)	 1943	Mar. 22
Nabonassar	 2770	Apr. 18	Diocletian (Coptic)	 1738	Sept. 11
			Islamic (Hegira)*	 1443	Aug. 9

* Year begins at sunset

RELIGIOUS CALENDARS

Epiphany	 Jan. 6	Ascension Day	 May 13
Ash Wednesday	 Feb. 17	Whit Sunday—Pentecost	... May 23
Palm Sunday	 Mar. 28	Trinity Sunday	 May 30
Good Friday	 Apr. 2	First Sunday in Advent	 Nov. 28
Easter Day	 Apr. 4	Christmas Day (Saturday)	... Dec. 25
First Day of Passover (Pesach)	Mar. 28	Day of Atonement (Yom Kippur)	Sept. 16
Feast of Weeks (Shavuot)	... May 17	First day of Tabernacles	
Jewish New Year‡		(Succoth)	 Sept. 21
(Rosh Hashanah)	 Sept. 7	Festival of Lights (Hanukkah)	Nov. 29
First day of Ramadân‡	 Apr. 13	Islamic New Year‡	 Aug. 10
First day of Shawwal‡	 May 13		

‡The Jewish and Islamic dates above are tabular dates, which begin at sunset on the previous evening and end at sunset on the date tabulated. In practice, the dates of Islamic fasts and festivals are determined by an actual sighting of the appropriate new Moon.

CIVIL CALENDAR—UNITED STATES OF AMERICA

New Year's Day	 Jan. 1	Labor Day	 Sept. 6
Martin Luther King's Birthday	Jan. 18	Columbus Day	 Oct. 11
Washington's Birthday	 Feb. 15	Election Day (in certain States)	Nov. 2
Memorial Day	 May 31	Veterans Day	 Nov. 11
Independence Day	 July 4	Thanksgiving Day	 Nov. 25

CIVIL CALENDAR—UNITED KINGDOM

Accession of Queen Elizabeth II	Feb. 6	Birthday of Prince Philip,	
St David (Wales)	 Mar. 1	Duke of Edinburgh	 June 10
Commonwealth Day	 Mar. 8	The Queen's Official Birthday†	June 12
St Patrick (Ireland)	 Mar. 17	Remembrance Sunday	 Nov. 14
Birthday of Queen Elizabeth II	Apr. 21	Birthday of the Prince of Wales	Nov. 14
St George (England)	 Apr. 23	St Andrew (Scotland)	 Nov. 30
Coronation Day	 June 2		

†Date subject to confirmation

CALENDAR, 2021

	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE	
Day of Month	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year
1	Fri.	1	Mon.	32	Mon.	60	Thu.	91	Sat.	121	Tue.	152
2	Sat.	2	Tue.	33	Tue.	61	Fri.	92	Sun.	122	Wed.	153
3	Sun.	3	Wed.	34	Wed.	62	Sat.	93	Mon.	123	Thu.	154
4	Mon.	4	Thu.	35	Thu.	63	Sun.	94	Tue.	124	Fri.	155
5	Tue.	5	Fri.	36	Fri.	64	Mon.	95	Wed.	125	Sat.	156
6	Wed.	6	Sat.	37	Sat.	65	Tue.	96	Thu.	126	Sun.	157
7	Thu.	7	Sun.	38	Sun.	66	Wed.	97	Fri.	127	Mon.	158
8	Fri.	8	Mon.	39	Mon.	67	Thu.	98	Sat.	128	Tue.	159
9	Sat.	9	Tue.	40	Tue.	68	Fri.	99	Sun.	129	Wed.	160
10	Sun.	10	Wed.	41	Wed.	69	Sat.	100	Mon.	130	Thu.	161
11	Mon.	11	Thu.	42	Thu.	70	Sun.	101	Tue.	131	Fri.	162
12	Tue.	12	Fri.	43	Fri.	71	Mon.	102	Wed.	132	Sat.	163
13	Wed.	13	Sat.	44	Sat.	72	Tue.	103	Thu.	133	Sun.	164
14	Thu.	14	Sun.	45	Sun.	73	Wed.	104	Fri.	134	Mon.	165
15	Fri.	15	Mon.	46	Mon.	74	Thu.	105	Sat.	135	Tue.	166
16	Sat.	16	Tue.	47	Tue.	75	Fri.	106	Sun.	136	Wed.	167
17	Sun.	17	Wed.	48	Wed.	76	Sat.	107	Mon.	137	Thu.	168
18	Mon.	18	Thu.	49	Thu.	77	Sun.	108	Tue.	138	Fri.	169
19	Tue.	19	Fri.	50	Fri.	78	Mon.	109	Wed.	139	Sat.	170
20	Wed.	20	Sat.	51	Sat.	79	Tue.	110	Thu.	140	Sun.	171
21	Thu.	21	Sun.	52	Sun.	80	Wed.	111	Fri.	141	Mon.	172
22	Fri.	22	Mon.	53	Mon.	81	Thu.	112	Sat.	142	Tue.	173
23	Sat.	23	Tue.	54	Tue.	82	Fri.	113	Sun.	143	Wed.	174
24	Sun.	24	Wed.	55	Wed.	83	Sat.	114	Mon.	144	Thu.	175
25	Mon.	25	Thu.	56	Thu.	84	Sun.	115	Tue.	145	Fri.	176
26	Tue.	26	Fri.	57	Fri.	85	Mon.	116	Wed.	146	Sat.	177
27	Wed.	27	Sat.	58	Sat.	86	Tue.	117	Thu.	147	Sun.	178
28	Thu.	28	Sun.	59	Sun.	87	Wed.	118	Fri.	148	Mon.	179
29	Fri.	29			Mon.	88	Thu.	119	Sat.	149	Tue.	180
30	Sat.	30			Tue.	89	Fri.	120	Sun.	150	Wed.	181
31	Sun.	31			Wed.	90			Mon.	151		

JULIAN DATE, 2021

0 ^h UT	JD	0 ^h UT	JD	0 ^h UT	JD
Jan. 0	245 9214.5	May 0	245 9334.5	Sept. 0	245 9457.5
Feb. 0	245 9245.5	June 0	245 9365.5	Oct. 0	245 9487.5
Mar. 0	245 9273.5	July 0	245 9395.5	Nov. 0	245 9518.5
Apr. 0	245 9304.5	Aug. 0	245 9426.5	Dec. 0	245 9548.5

400-day date, JD 245 9600.5 = 2022 January 21.0

Standard epoch, 1900 January 0, 12^h UT = JD 241 5020.0

Standard epoch, B1950.0 = 1950 Jan. 0.923 = JD 243 3282.423

B2021.0 = 2021 Jan. 0.120 = JD 245 9214.620

Standard epoch, J2000.0 = 2000 Jan. 1.5 = JD 245 1545.0

J2021.5 = 2021 July 2.375 = JD 245 9397.875

	JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Day of Month	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year	Day of Week	Day of Year
1	Thu.	182	Sun.	213	Wed.	244	Fri.	274	Mon.	305	Wed.	335
2	Fri.	183	Mon.	214	Thu.	245	Sat.	275	Tue.	306	Thu.	336
3	Sat.	184	Tue.	215	Fri.	246	Sun.	276	Wed.	307	Fri.	337
4	Sun.	185	Wed.	216	Sat.	247	Mon.	277	Thu.	308	Sat.	338
5	Mon.	186	Thu.	217	Sun.	248	Tue.	278	Fri.	309	Sun.	339
6	Tue.	187	Fri.	218	Mon.	249	Wed.	279	Sat.	310	Mon.	340
7	Wed.	188	Sat.	219	Tue.	250	Thu.	280	Sun.	311	Tue.	341
8	Thu.	189	Sun.	220	Wed.	251	Fri.	281	Mon.	312	Wed.	342
9	Fri.	190	Mon.	221	Thu.	252	Sat.	282	Tue.	313	Thu.	343
10	Sat.	191	Tue.	222	Fri.	253	Sun.	283	Wed.	314	Fri.	344
11	Sun.	192	Wed.	223	Sat.	254	Mon.	284	Thu.	315	Sat.	345
12	Mon.	193	Thu.	224	Sun.	255	Tue.	285	Fri.	316	Sun.	346
13	Tue.	194	Fri.	225	Mon.	256	Wed.	286	Sat.	317	Mon.	347
14	Wed.	195	Sat.	226	Tue.	257	Thu.	287	Sun.	318	Tue.	348
15	Thu.	196	Sun.	227	Wed.	258	Fri.	288	Mon.	319	Wed.	349
16	Fri.	197	Mon.	228	Thu.	259	Sat.	289	Tue.	320	Thu.	350
17	Sat.	198	Tue.	229	Fri.	260	Sun.	290	Wed.	321	Fri.	351
18	Sun.	199	Wed.	230	Sat.	261	Mon.	291	Thu.	322	Sat.	352
19	Mon.	200	Thu.	231	Sun.	262	Tue.	292	Fri.	323	Sun.	353
20	Tue.	201	Fri.	232	Mon.	263	Wed.	293	Sat.	324	Mon.	354
21	Wed.	202	Sat.	233	Tue.	264	Thu.	294	Sun.	325	Tue.	355
22	Thu.	203	Sun.	234	Wed.	265	Fri.	295	Mon.	326	Wed.	356
23	Fri.	204	Mon.	235	Thu.	266	Sat.	296	Tue.	327	Thu.	357
24	Sat.	205	Tue.	236	Fri.	267	Sun.	297	Wed.	328	Fri.	358
25	Sun.	206	Wed.	237	Sat.	268	Mon.	298	Thu.	329	Sat.	359
26	Mon.	207	Thu.	238	Sun.	269	Tue.	299	Fri.	330	Sun.	360
27	Tue.	208	Fri.	239	Mon.	270	Wed.	300	Sat.	331	Mon.	361
28	Wed.	209	Sat.	240	Tue.	271	Thu.	301	Sun.	332	Tue.	362
29	Thu.	210	Sun.	241	Wed.	272	Fri.	302	Mon.	333	Wed.	363
30	Fri.	211	Mon.	242	Thu.	273	Sat.	303	Tue.	334	Thu.	364
31	Sat.	212	Tue.	243			Sun.	304			Fri.	365

MEAN SIDEREAL TIME, 2021

Greenwich mean sidereal time at 0^h UT

Jan. 0	^h 6.6589	Apr. 0	^h 12.5728	July 0	^h 18.5524	Oct. 0	^h 0.5977
Feb. 0	^h 8.6959	May 0	^h 14.5441	Aug. 0	^h 20.5894	Nov. 0	^h 2.6347
Mar. 0	^h 10.5358	June 0	^h 16.5811	Sept. 0	^h 22.6264	Dec. 0	^h 4.6060

Greenwich mean sidereal time (GMST) on day d of month at hour t UT

$$= \text{GMST at } 0^{\text{h}} \text{ UT on day } 0 + 0^{\text{h}}065\,71\,d + 1^{\text{h}}002\,74\,t$$

$$\text{Local mean sidereal time} = \text{GMST} \begin{matrix} + \text{east} \\ - \text{west} \end{matrix} \text{ longitude}$$

AT 0^h UNIVERSAL TIME

Date	Equation of time	Declin- ation	Date	Equation of time	Declin- ation	Date	Equation of time	Declin- ation	Date	Equation of time	Declin- ation
Jan. 0	^m −02 ^s 58	−23° 05′	Feb. 15	^m −14 ^s 07	−12° 40′	Apr. 1	^m −03 ^s 57	+04° 33′	May 17	^m +03 ^s 36	+19° 20′
1	03 26	23 00	16	14 04	12 20	2	03 39	04 56	18	03 34	19 33
2	03 54	22 55	17	14 00	11 59	3	03 21	05 19	19	03 32	19 46
3	04 22	22 49	18	13 56	11 38	4	03 04	05 42	20	03 28	19 59
4	04 49	22 43	19	13 50	11 16	5	02 46	06 04	21	03 25	20 11
5	−05 16	−22 37	20	−13 44	−10 55	6	−02 29	+06 27	22	+03 21	+20 23
6	05 43	22 30	21	13 38	10 33	7	02 12	06 50	23	03 16	20 35
7	06 09	22 22	22	13 30	10 12	8	01 56	07 12	24	03 11	20 46
8	06 35	22 14	23	13 22	09 50	9	01 39	07 35	25	03 05	20 57
9	07 00	22 06	24	13 14	09 28	10	01 23	07 57	26	02 59	21 08
10	−07 25	−21 57	25	−13 05	−09 05	11	−01 07	+08 19	27	+02 52	+21 18
11	07 49	21 48	26	12 55	08 43	12	00 51	08 41	28	02 45	21 28
12	08 12	21 39	27	12 45	08 20	13	00 36	09 03	29	02 38	21 37
13	08 35	21 28	28	12 34	07 58	14	00 21	09 25	30	02 30	21 46
14	08 57	21 18	Mar. 1	12 22	07 35	15	−00 07	09 46	31	02 21	21 55
15	−09 19	−21 07	2	−12 10	−07 12	16	+00 08	+10 07	June 1	+02 12	+22 03
16	09 40	20 56	3	11 58	06 49	17	00 22	10 29	2	02 03	22 11
17	10 00	20 44	4	11 45	06 26	18	00 35	10 50	3	01 53	22 19
18	10 20	20 32	5	11 32	06 03	19	00 48	11 11	4	01 43	22 26
19	10 39	20 20	6	11 18	05 40	20	01 01	11 31	5	01 33	22 33
20	−10 57	−20 07	7	−11 04	−05 17	21	+01 14	+11 52	6	+01 22	+22 39
21	11 14	19 54	8	10 50	04 53	22	01 26	12 12	7	01 11	22 45
22	11 30	19 40	9	10 35	04 30	23	01 37	12 32	8	00 59	22 51
23	11 46	19 26	10	10 20	04 06	24	01 48	12 52	9	00 48	22 56
24	12 01	19 12	11	10 04	03 43	25	01 59	13 12	10	00 36	23 01
25	−12 15	−18 58	12	−09 49	−03 19	26	+02 09	+13 31	11	+00 24	+23 05
26	12 29	18 43	13	09 33	02 56	27	02 19	13 50	12	+00 11	23 09
27	12 41	18 27	14	09 16	02 32	28	02 28	14 09	13	−00 01	23 13
28	12 53	18 12	15	09 00	02 08	29	02 37	14 28	14	00 14	23 16
29	13 04	17 56	16	08 43	01 44	30	02 45	14 46	15	00 27	23 18
30	−13 14	−17 39	17	−08 26	−01 21	May 1	+02 52	+15 05	16	−00 40	+23 21
31	13 23	17 23	18	08 08	00 57	2	02 59	15 23	17	00 53	23 23
Feb. 1	13 31	17 06	19	07 51	00 33	3	03 06	15 40	18	01 06	23 24
2	13 39	16 49	20	07 33	−00 10	4	03 12	15 58	19	01 19	23 25
3	13 46	16 31	21	07 16	+00 14	5	03 17	16 15	20	01 32	23 26
4	−13 52	−16 13	22	−06 58	+00 38	6	+03 22	+16 32	21	−01 45	+23 26
5	13 57	15 55	23	06 40	01 02	7	03 26	16 49	22	01 58	23 26
6	14 02	15 37	24	06 22	01 25	8	03 30	17 05	23	02 11	23 26
7	14 05	15 18	25	06 04	01 49	9	03 33	17 21	24	02 23	23 25
8	14 08	14 59	26	05 45	02 12	10	03 35	17 37	25	02 36	23 23
9	−14 10	−14 40	27	−05 27	+02 36	11	+03 37	+17 53	26	−02 49	+23 21
10	14 12	14 21	28	05 09	02 59	12	03 38	18 08	27	03 01	23 19
11	14 12	14 01	29	04 51	03 23	13	03 39	18 23	28	03 13	23 17
12	14 12	13 41	30	04 33	03 46	14	03 39	18 38	29	03 26	23 14
13	14 11	13 21	31	04 15	04 09	15	03 39	18 52	30	03 38	23 10
14	−14 10	−13 01	Apr. 1	−03 57	+04 33	16	+03 38	+19 06	July 1	−03 49	+23 06
15	−14 07	−12 40	2	−03 39	+04 56	17	+03 36	+19 20	2	−04 01	+23 02

Equation of time = apparent time − mean time

AT 0^h UNIVERSAL TIME

Date	Equation of time	Declin- ation	Date	Equation of time	Declin- ation	Date	Equation of time	Declin- ation	Date	Equation of time	Declin- ation
July	^m _s	[°] _'	Aug. 16	^m _s	[°] _'	Oct. 1	^m _s	[°] _'	Nov. 16	^m _s	[°] _'
1	-03 49	+23 06	17	-04 21	+13 44	1	+10 16	-03 11	16	+15 18	-18 44
2	04 01	23 02	18	04 08	13 25	2	10 35	03 34	17	15 06	18 59
3	04 12	22 57	19	03 55	13 06	3	10 54	03 58	18	14 54	19 13
4	04 23	22 52	20	03 41	12 46	4	11 13	04 21	19	14 42	19 27
5	04 33	22 47	21	03 27	12 26	5	11 31	04 44	20	14 28	19 41
6	-04 44	+22 41	22	-03 13	+12 07	6	+11 49	-05 07	21	+14 14	-19 55
7	04 54	22 35	23	02 58	11 46	7	12 06	05 30	22	13 58	20 08
8	05 03	22 28	24	02 42	11 26	8	12 23	05 53	23	13 42	20 20
9	05 12	22 21	25	02 26	11 06	9	12 40	06 16	24	13 25	20 33
10	05 21	22 14	26	02 10	10 45	10	12 56	06 39	25	13 08	20 45
11	-05 30	+22 06	27	-01 53	+10 24	11	+13 12	-07 01	26	+12 49	-20 56
12	05 37	21 58	28	01 36	10 04	12	13 27	07 24	27	12 30	21 07
13	05 45	21 49	29	01 18	09 42	13	13 42	07 46	28	12 10	21 18
14	05 52	21 40	30	01 00	09 21	14	13 56	08 09	29	11 50	21 28
15	05 58	21 31	31	00 42	09 00	15	14 10	08 31	30	11 28	21 38
16	-06 04	+21 22	Sept. 1	-00 24	+08 38	16	+14 23	-08 53	Dec. 1	+11 06	-21 48
17	06 10	21 12	2	-00 05	08 17	17	14 36	09 15	2	10 44	21 57
18	06 14	21 01	3	+00 14	07 55	18	14 48	09 37	3	10 20	22 06
19	06 19	20 50	4	00 34	07 33	19	14 59	09 59	4	09 56	22 14
20	06 22	20 39	5	00 53	07 11	20	15 10	10 20	5	09 32	22 22
21	-06 26	+20 28	6	+01 13	+06 49	21	+15 20	-10 42	6	+09 07	-22 29
22	06 28	20 16	7	01 33	06 26	22	15 30	11 03	7	08 41	22 36
23	06 30	20 04	8	01 54	06 04	23	15 39	11 24	8	08 15	22 43
24	06 31	19 52	9	02 14	05 41	24	15 47	11 45	9	07 49	22 49
25	06 32	19 39	10	02 35	05 19	25	15 54	12 06	10	07 22	22 54
26	-06 32	+19 26	11	+02 56	+04 56	26	+16 01	-12 26	11	+06 54	-23 00
27	06 32	19 12	12	03 17	04 33	27	16 07	12 47	12	06 27	23 04
28	06 31	18 59	13	03 38	04 10	28	16 12	13 07	13	05 59	23 09
29	06 29	18 45	14	03 59	03 47	29	16 17	13 27	14	05 30	23 12
30	06 27	18 30	15	04 20	03 24	30	16 21	13 47	15	05 02	23 16
31	-06 24	+18 16	16	+04 42	+03 01	31	+16 23	-14 06	16	+04 33	-23 19
Aug. 1	06 21	18 01	17	05 03	02 38	Nov. 1	16 26	14 26	17	04 04	23 21
2	06 17	17 45	18	05 25	02 15	2	16 27	14 45	18	03 34	23 23
3	06 13	17 30	19	05 46	01 52	3	16 27	15 03	19	03 05	23 25
4	06 08	17 14	20	06 08	01 29	4	16 27	15 22	20	02 35	23 26
5	-06 02	+16 58	21	+06 29	+01 05	5	+16 26	-15 40	21	+02 06	-23 26
6	05 56	16 42	22	06 50	00 42	6	16 24	15 59	22	01 36	23 26
7	05 49	16 25	23	07 12	+00 19	7	16 21	16 16	23	01 06	23 26
8	05 41	16 08	24	07 33	-00 05	8	16 17	16 34	24	00 36	23 25
9	05 33	15 51	25	07 54	00 28	9	16 13	16 51	25	+00 07	23 24
10	-05 25	+15 33	26	+08 15	-00 51	10	+16 07	-17 08	26	-00 23	-23 22
11	05 15	15 16	27	08 36	01 15	11	16 01	17 25	27	00 53	23 20
12	05 06	14 58	28	08 56	01 38	12	15 54	17 41	28	01 22	23 17
13	04 55	14 40	29	09 17	02 01	13	15 46	17 58	29	01 51	23 14
14	04 44	14 21	30	09 37	02 25	14	15 37	18 13	30	02 21	23 10
15	-04 33	+14 03	Oct. 1	+09 56	-02 48	15	+15 28	-18 29	31	-02 49	-23 06
16	-04 21	+13 44	2	+10 16	-03 11	16	+15 18	-18 44	32	-03 18	-23 01

UT of transit = $12^{\text{h}} - \frac{\text{east}}{+ \text{west}}$ longitude - equation of time

AT 0^h UNIVERSAL TIME

Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA	Date	<i>Polaris</i> GHA	σ Oct GHA
Jan. 0	55 05	138 40	Feb. 15	100 46	184 01	Apr. 1	145 25	228 15	May 17	190 47	273 22
1	56 04	139 39	16	101 46	185 00	2	146 24	229 13	18	191 46	274 21
2	57 04	140 38	17	102 45	185 59	3	147 23	230 12	19	192 45	275 19
3	58 04	141 37	18	103 45	186 58	4	148 23	231 11	20	193 44	276 18
4	59 03	142 37	19	104 45	187 57	5	149 22	232 10	21	194 43	277 17
5	60 03	143 36	20	105 44	188 56	6	150 21	233 09	22	195 42	278 16
6	61 02	144 35	21	106 44	189 55	7	151 21	234 08	23	196 41	279 15
7	62 02	145 34	22	107 43	190 54	8	152 20	235 07	24	197 40	280 14
8	63 01	146 34	23	108 43	191 53	9	153 20	236 05	25	198 39	281 12
9	64 01	147 33	24	109 42	192 52	10	154 19	237 04	26	199 38	282 11
10	65 00	148 32	25	110 42	193 51	11	155 18	238 03	27	200 36	283 10
11	66 00	149 31	26	111 42	194 50	12	156 18	239 02	28	201 35	284 09
12	66 59	150 31	27	112 41	195 49	13	157 17	240 01	29	202 34	285 08
13	67 59	151 30	28	113 41	196 48	14	158 16	241 00	30	203 33	286 07
14	68 58	152 29	Mar. 1	114 41	197 47	15	159 15	241 59	31	204 32	287 05
15	69 58	153 28	2	115 40	198 46	16	160 15	242 58	June 1	205 31	288 04
16	70 58	154 27	3	116 40	199 45	17	161 14	243 57	2	206 30	289 03
17	71 57	155 26	4	117 39	200 44	18	162 13	244 55	3	207 29	290 02
18	72 57	156 26	5	118 39	201 43	19	163 12	245 54	4	208 28	291 01
19	73 56	157 25	6	119 38	202 42	20	164 11	246 53	5	209 26	292 00
20	74 56	158 24	7	120 38	203 41	21	165 11	247 52	6	210 25	292 59
21	75 56	159 23	8	121 37	204 40	22	166 10	248 51	7	211 24	293 57
22	76 55	160 22	9	122 37	205 39	23	167 09	249 49	8	212 23	294 56
23	77 55	161 22	10	123 36	206 38	24	168 08	250 48	9	213 22	295 55
24	78 54	162 21	11	124 36	207 37	25	169 08	251 47	10	214 20	296 54
25	79 54	163 20	12	125 36	208 36	26	170 07	252 46	11	215 19	297 53
26	80 53	164 19	13	126 35	209 35	27	171 06	253 45	12	216 18	298 52
27	81 53	165 18	14	127 35	210 34	28	172 05	254 44	13	217 17	299 51
28	82 53	166 17	15	128 34	211 33	29	173 04	255 43	14	218 15	300 49
29	83 52	167 16	16	129 34	212 32	30	174 03	256 42	15	219 14	301 48
30	84 52	168 16	17	130 33	213 31	May 1	175 02	257 40	16	220 13	302 47
31	85 52	169 15	18	131 33	214 30	2	176 01	258 39	17	221 12	303 46
Feb. 1	86 51	170 14	19	132 32	215 29	3	177 00	259 38	18	222 11	304 45
2	87 51	171 13	20	133 32	216 28	4	177 59	260 37	19	223 10	305 44
3	88 51	172 12	21	134 31	217 27	5	178 59	261 36	20	224 08	306 43
4	89 50	173 11	22	135 30	218 25	6	179 58	262 34	21	225 07	307 42
5	90 50	174 10	23	136 30	219 24	7	180 57	263 33	22	226 06	308 41
6	91 49	175 09	24	137 29	220 23	8	181 56	264 32	23	227 04	309 40
7	92 49	176 09	25	138 29	221 22	9	182 55	265 31	24	228 03	310 38
8	93 49	177 08	26	139 28	222 21	10	183 54	266 30	25	229 02	311 37
9	94 48	178 07	27	140 28	223 20	11	184 53	267 29	26	230 00	312 36
10	95 48	179 06	28	141 27	224 19	12	185 52	268 28	27	230 59	313 35
11	96 47	180 05	29	142 27	225 18	13	186 51	269 26	28	231 58	314 34
12	97 47	181 04	30	143 26	226 17	14	187 50	270 25	29	232 57	315 33
13	98 47	182 03	31	144 25	227 16	15	188 49	271 24	30	233 55	316 32
14	99 46	183 02	Apr. 1	145 25	228 15	16	189 48	272 23	July 1	234 54	317 31
15	100 46	184 01	2	146 24	229 13	17	190 47	273 22	2	235 53	318 29

The dates between Jan. 0 and Dec. 32 below are the dates when p changes to the next value.

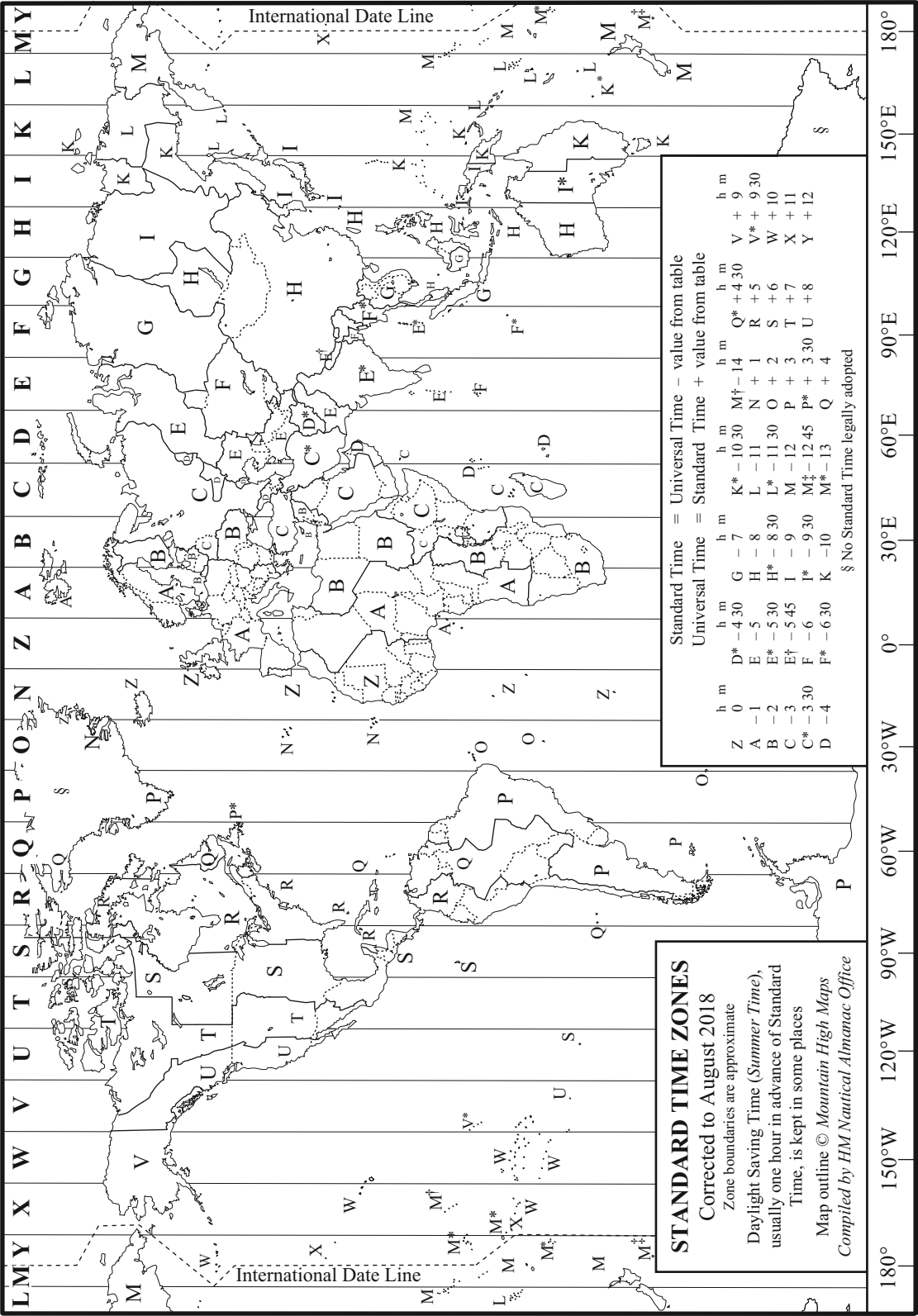
Polar Distance (p) *Polaris*: Jan. 0 39' Dec. 8 38' Dec. 32
 σ Octantis: Jan. 0 68' Dec. 32

AT 0^h UNIVERSAL TIME

	<i>Polaris</i>	σ Oct		<i>Polaris</i>	σ Oct		<i>Polaris</i>	σ Oct		<i>Polaris</i>	σ Oct				
Date	GHA	GHA	Date	GHA	GHA	Date	GHA	GHA	Date	GHA	GHA				
July	1	234 54	317 31	Aug. 16	279 52	2 45	Oct. 1	324 51	48 09	Nov. 16	10 02	93 41			
	2	235 53	318 29		17	280 50		3 44	2		325 50	49 09	17	11 02	94 40
	3	236 52	319 28		18	281 49		4 43	3		326 49	50 08	18	12 01	95 40
	4	237 50	320 27		19	282 47		5 42	4		327 48	51 07	19	13 00	96 39
	5	238 49	321 26		20	283 46		6 41	5		328 47	52 06	20	13 59	97 38
	6	239 48	322 25		21	284 45		7 41	6		329 45	53 06	21	14 58	98 38
	7	240 46	323 24		22	285 43		8 40	7		330 44	54 05	22	15 57	99 37
	8	241 45	324 23		23	286 42		9 39	8		331 43	55 05	23	16 56	100 37
	9	242 43	325 22		24	287 41		10 38	9		332 42	56 04	24	17 55	101 36
	10	243 42	326 21		25	288 39		11 37	10		333 41	57 03	25	18 55	102 35
	11	244 41	327 20		26	289 38		12 36	11		334 39	58 03	26	19 54	103 35
	12	245 39	328 19		27	290 37		13 35	12		335 38	59 02	27	20 53	104 34
	13	246 38	329 18		28	291 35		14 35	13		336 37	60 01	28	21 52	105 33
	14	247 37	330 17		29	292 34		15 34	14		337 36	61 01	29	22 52	106 33
	15	248 36	331 16		30	293 33		16 33	15		338 35	62 00	30	23 51	107 32
16	249 34	332 15	Sept. 1	294 31	17 32	16	339 34	62 59	Dec. 1	24 50	108 32				
17	250 33	333 14		2	295 30	18 31	17	340 33		63 59	2	25 49	109 31		
18	251 32	334 13		3	296 29	19 31	18	341 32		64 58	3	26 49	110 30		
19	252 30	335 12		4	297 27	20 30	19	342 30		65 58	4	27 48	111 30		
20	253 29	336 11		5	298 26	21 29	20	343 29		66 57	5	28 47	112 29		
21	254 27	337 10		6	299 25	22 28	21	344 28		67 56	6	29 46	113 28		
22	255 26	338 09		7	300 23	23 27	22	345 27		68 56	7	30 45	114 28		
23	256 24	339 08		8	301 22	24 27	23	346 26		69 55	8	31 45	115 27		
24	257 23	340 07		9	302 21	25 26	24	347 25		70 55	9	32 44	116 26		
25	258 22	341 06		10	303 19	26 25	25	348 24		71 54	10	33 43	117 26		
26	259 20	342 05		11	304 18	27 24	26	349 23		72 53	11	34 43	118 25		
27	260 19	343 04		12	305 17	28 24	27	350 22		73 53	12	35 42	119 24		
28	261 18	344 03		13	306 15	29 23	28	351 21		74 52	13	36 42	120 24		
29	262 17	345 02		14	307 14	30 22	29	352 20		75 52	14	37 41	121 23		
30	263 15	346 01		15	308 13	31 21	30	353 19		76 51	15	38 40	122 23		
Aug. 1	264 14	347 00	Nov. 1	309 11	32 21	31	354 18	77 50	16	39 40	123 22				
	265 12	347 59		16	310 10	33 20	1	355 17		78 50	17	40 39	124 21		
	266 11	348 58		17	311 09	34 19	2	356 16		79 49	18	41 38	125 21		
	267 10	349 57		18	312 07	35 18	3	357 15		80 48	19	42 38	126 20		
	268 08	350 56		19	313 06	36 18	4	358 14		81 48	20	43 37	127 19		
	269 07	351 55		20	314 05	37 17	5	359 13		82 47	21	44 36	128 19		
	270 05	352 54		21	315 04	38 16	6	0 12		83 47	22	45 36	129 18		
	271 04	353 53		22	316 03	39 15	7	1 11		84 46	23	46 35	130 17		
	272 03	354 52		23	317 01	40 15	8	2 10		85 46	24	47 35	131 16		
	273 01	355 51		24	318 00	41 14	9	3 09		86 45	25	48 34	132 16		
	274 00	356 50		25	318 59	42 13	10	4 08		87 44	26	49 34	133 15		
	274 59	357 49		26	319 58	43 13	11	5 07		88 44	27	50 33	134 14		
	275 57	358 48		27	320 56	44 12	12	6 06		89 43	28	51 33	135 14		
	276 56	359 48		28	321 55	45 11	13	7 05		90 42	29	52 32	136 13		
	277 55	0 47		29	322 54	46 11	14	8 04		91 42	30	53 32	137 12		
278 53	1 46	Oct. 1	323 52	47 10	15	9 03	92 41	31	54 31	138 12					
279 52	2 45		1	324 51	48 09	16	10 02	93 41	32	55 30	139 11				

Form the quantities $C = p \cos(\text{local hour angle})$ and $S = p \sin(\text{local hour angle})$ then
Latitude = $h_0 - C + 0.0087 S^2 \tan h_0$,
Azimuth of *Polaris* = $-S/\cos h_0$ and Azimuth of σ Octantis = $180^\circ + S/\cos h_0$, where p and h_0
are in degrees and h_0 is the observed altitude corrected for atmospheric refraction and instrument error.

WORLD MAP OF TIME ZONES



The times of sunrise and sunset (pages 24–31) and of moonrise and moonset (pages 32–63) are the instants when the upper limbs of the Sun and Moon appear to lie on the horizon for an observer at sea-level. In both cases a fixed allowance of 34' has been made for refraction; a further allowance of 16' has been made for the semidiameter of the Sun, while for the Moon the actual value of semidiameter *minus* horizontal parallax has been used. No allowance has been made for the phase of the Moon. The observed times may differ from the tabular times because of variations in refraction and the relative heights of the observer and horizon.

The tabular values are for the universal time (UT) of the phenomena on the Greenwich meridian (longitude 0°). To a first approximation the UT at another longitude is given by subtracting the longitude, expressed in time-measure, if east of Greenwich, or by adding, if west of Greenwich. Alternatively the tables may be regarded as giving the approximate local mean time on all meridians. These times may be converted to standard time by applying the appropriate differences, as indicated in the note on page 4. Linear interpolation may be used to obtain the times for non-tabular latitudes.

In the case of the Sun it may be necessary to interpolate (mentally) to obtain the UT for an intermediate date, but a further interpolation for longitude is not normally required. In the case of the Moon the values must normally be interpolated for longitude, as well as for latitude, since the changes in the tabular values from one day to the next are usually large. The interpolating factor is equal to one twenty-fourth of the longitude if expressed in hours and decimals of an hour; linear interpolation is usually adequate.

Example

To find the times of sunrise and sunset and of moonrise and moonset on 2021 February 25 at latitude N 38° 55', longitude W 77° 15'. The longitude expressed in time-measure is W 05^h 09^m. The difference between standard time and UT is –5^h in this case.

The relevant tabular values in UT for longitude 0° are as follows:

		Sunrise		Sunset				Moonrise		Moonset	
		+35°	+40°	+35°	+40°			+35°	+40°	+35°	+40°
		d h m	d h m	d h m	d h m			d h m	d h m	d h m	d h m
Feb. 23		06 37	06 42	17 50	17 45	Feb. 25		15 55	15 42	05 36	05 49
	27	06 32	06 36	17 54	17 50		26	17 03	16 53	06 17	06 28

Interpolating factor for latitude is 3° 55' / 5° = 0.78
 for date for Sun is 2^d / 4^d = 0.50
 for long. for Moon is 5^h 15 / 24^h = 0.21

		Sunrise		Sunset	Moonrise		Moonset
		d	h m	h m	d	h m	h m
Interpolation to:	Latitude N 38° 55'	Feb. 23	06 41	17 46	Feb. 25	15 45	05 46
	N 38° 55'	27	06 35	17 51	26	16 55	06 26
	Local mean time	25	06 38	17 49	25	16 00	05 54
Adjustment to:							
Universal time		25	11 47	22 58	25	21 09	11 03
Standard time		25	06 47	17 58	25	16 09	06 03

SUNRISE AND SUNSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. −2	3 23	3 53	4 15	4 33	4 48	5 00	5 22	5 41	5 58	6 16	6 34	6 55	7 07	7 21
2	3 28	3 57	4 18	4 36	4 51	5 03	5 25	5 43	6 00	6 17	6 35	6 56	7 08	7 22
6	3 33	4 01	4 22	4 40	4 54	5 06	5 27	5 45	6 02	6 19	6 37	6 57	7 09	7 22
10	3 39	4 06	4 27	4 44	4 57	5 09	5 30	5 48	6 04	6 20	6 37	6 57	7 08	7 21
14	3 46	4 12	4 32	4 48	5 01	5 13	5 33	5 50	6 05	6 21	6 38	6 57	7 08	7 20
18	3 54	4 18	4 37	4 52	5 05	5 16	5 35	5 52	6 07	6 22	6 38	6 56	7 07	7 19
22	4 02	4 25	4 43	4 57	5 09	5 20	5 38	5 54	6 08	6 22	6 38	6 55	7 05	7 16
26	4 10	4 32	4 48	5 02	5 13	5 23	5 41	5 55	6 09	6 23	6 37	6 53	7 03	7 14
30	4 19	4 38	4 54	5 07	5 18	5 27	5 43	5 57	6 10	6 23	6 36	6 51	7 00	7 10
Feb. 3	4 27	4 46	5 00	5 12	5 22	5 30	5 45	5 58	6 10	6 22	6 35	6 49	6 57	7 06
7	4 36	4 53	5 06	5 17	5 26	5 34	5 48	6 00	6 11	6 22	6 33	6 46	6 54	7 02
11	4 45	5 00	5 12	5 22	5 30	5 37	5 50	6 01	6 11	6 21	6 31	6 43	6 50	6 58
15	4 53	5 07	5 17	5 26	5 34	5 40	5 52	6 02	6 11	6 20	6 29	6 40	6 46	6 53
19	5 02	5 14	5 23	5 31	5 38	5 44	5 54	6 02	6 10	6 18	6 27	6 36	6 41	6 47
23	5 10	5 21	5 29	5 36	5 42	5 47	5 55	6 03	6 10	6 17	6 24	6 32	6 37	6 42
27	5 19	5 28	5 35	5 40	5 45	5 50	5 57	6 03	6 09	6 15	6 21	6 28	6 32	6 36
Mar. 3	5 27	5 34	5 40	5 45	5 49	5 52	5 58	6 04	6 09	6 13	6 18	6 24	6 27	6 30
7	5 35	5 41	5 45	5 49	5 52	5 55	6 00	6 04	6 08	6 11	6 15	6 19	6 21	6 24
11	5 43	5 48	5 51	5 53	5 56	5 58	6 01	6 04	6 07	6 09	6 12	6 14	6 16	6 18
15	5 51	5 54	5 56	5 58	5 59	6 00	6 02	6 04	6 06	6 07	6 08	6 10	6 11	6 11
19	5 59	6 00	6 01	6 02	6 02	6 03	6 04	6 04	6 04	6 05	6 05	6 05	6 05	6 05
23	6 07	6 07	6 06	6 06	6 06	6 05	6 05	6 04	6 03	6 02	6 01	6 00	5 59	5 58
27	6 15	6 13	6 11	6 10	6 09	6 08	6 06	6 04	6 02	6 00	5 58	5 55	5 54	5 52
31	6 23	6 19	6 17	6 14	6 12	6 10	6 07	6 04	6 01	5 58	5 54	5 50	5 48	5 46
Apr. 4	6 30	6 26	6 22	6 18	6 15	6 13	6 08	6 04	6 00	5 55	5 51	5 46	5 43	5 39

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. −2	20 41	20 12	19 49	19 32	19 17	19 04	18 42	18 23	18 06	17 49	17 30	17 09	16 57	16 43
2	20 40	20 11	19 50	19 32	19 18	19 05	18 43	18 25	18 08	17 51	17 33	17 12	17 00	16 46
6	20 38	20 10	19 49	19 32	19 18	19 05	18 44	18 26	18 10	17 53	17 35	17 15	17 03	16 50
10	20 35	20 08	19 48	19 31	19 17	19 05	18 45	18 28	18 11	17 55	17 38	17 18	17 07	16 54
14	20 31	20 05	19 46	19 30	19 17	19 05	18 45	18 29	18 13	17 57	17 41	17 22	17 11	16 58
18	20 26	20 02	19 43	19 28	19 15	19 04	18 45	18 29	18 14	17 59	17 43	17 25	17 15	17 03
22	20 20	19 58	19 40	19 26	19 14	19 03	18 45	18 30	18 15	18 01	17 46	17 29	17 19	17 07
26	20 14	19 53	19 36	19 23	19 11	19 01	18 44	18 30	18 16	18 03	17 48	17 32	17 23	17 12
30	20 07	19 47	19 32	19 19	19 09	18 59	18 43	18 30	18 17	18 04	17 51	17 36	17 27	17 17
Feb. 3	19 59	19 41	19 27	19 15	19 05	18 57	18 42	18 29	18 17	18 06	17 53	17 39	17 31	17 22
7	19 51	19 35	19 22	19 11	19 02	18 54	18 40	18 29	18 18	18 07	17 55	17 42	17 35	17 26
11	19 42	19 28	19 16	19 06	18 58	18 51	18 38	18 28	18 18	18 08	17 57	17 46	17 39	17 31
15	19 34	19 20	19 10	19 01	18 54	18 47	18 36	18 26	18 17	18 09	17 59	17 49	17 43	17 36
19	19 24	19 13	19 03	18 56	18 49	18 43	18 34	18 25	18 17	18 09	18 01	17 52	17 47	17 41
23	19 15	19 05	18 57	18 50	18 44	18 39	18 31	18 23	18 17	18 10	18 03	17 55	17 50	17 45
27	19 05	18 57	18 50	18 44	18 39	18 35	18 28	18 22	18 16	18 10	18 04	17 58	17 54	17 50
Mar. 3	18 55	18 48	18 43	18 38	18 34	18 31	18 25	18 20	18 15	18 11	18 06	18 01	17 58	17 54
7	18 45	18 40	18 36	18 32	18 29	18 26	18 22	18 18	18 14	18 11	18 07	18 03	18 01	17 58
11	18 35	18 31	18 28	18 26	18 24	18 22	18 18	18 16	18 13	18 11	18 08	18 06	18 04	18 03
15	18 25	18 23	18 21	18 19	18 18	18 17	18 15	18 13	18 12	18 11	18 10	18 08	18 08	18 07
19	18 15	18 14	18 13	18 13	18 12	18 12	18 12	18 11	18 11	18 11	18 11	18 11	18 11	18 11
23	18 05	18 05	18 06	18 06	18 07	18 07	18 08	18 09	18 10	18 11	18 12	18 13	18 14	18 15
27	17 55	17 57	17 58	18 00	18 01	18 02	18 05	18 07	18 09	18 11	18 13	18 16	18 17	18 19
31	17 44	17 48	17 51	17 53	17 56	17 58	18 01	18 04	18 07	18 11	18 14	18 18	18 21	18 23
Apr. 4	17 34	17 39	17 44	17 47	17 50	17 53	17 58	18 02	18 06	18 10	18 15	18 21	18 24	18 27

SUNRISE AND SUNSET, 2021

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UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. -2	7 21	7 28	7 34	7 42	7 50	7 58	8 08	8 19	8 32	8 46	9 03	9 24	9 52	10 32
2	7 22	7 28	7 35	7 42	7 50	7 58	8 08	8 19	8 31	8 45	9 02	9 22	9 48	10 25
6	7 22	7 28	7 35	7 41	7 49	7 57	8 07	8 17	8 29	8 43	8 59	9 18	9 43	10 17
10	7 21	7 27	7 34	7 40	7 48	7 56	8 05	8 15	8 26	8 39	8 54	9 13	9 36	10 07
14	7 20	7 26	7 32	7 38	7 45	7 53	8 02	8 11	8 22	8 34	8 49	9 06	9 27	9 55
18	7 19	7 24	7 30	7 36	7 43	7 50	7 58	8 07	8 17	8 29	8 42	8 58	9 18	9 43
22	7 16	7 21	7 27	7 33	7 39	7 46	7 54	8 02	8 12	8 22	8 35	8 50	9 07	9 30
26	7 14	7 18	7 23	7 29	7 35	7 41	7 48	7 56	8 05	8 15	8 27	8 40	8 56	9 16
30	7 10	7 15	7 19	7 25	7 30	7 36	7 43	7 50	7 58	8 07	8 18	8 30	8 45	9 02
Feb. 3	7 06	7 11	7 15	7 20	7 25	7 30	7 36	7 43	7 51	7 59	8 09	8 20	8 33	8 48
7	7 02	7 06	7 10	7 14	7 19	7 24	7 30	7 36	7 42	7 50	7 59	8 09	8 20	8 34
11	6 58	7 01	7 05	7 09	7 13	7 17	7 22	7 28	7 34	7 41	7 48	7 57	8 07	8 19
15	6 53	6 56	6 59	7 02	7 06	7 10	7 15	7 20	7 25	7 31	7 38	7 45	7 54	8 05
19	6 47	6 50	6 53	6 56	6 59	7 03	7 07	7 11	7 16	7 21	7 27	7 33	7 41	7 50
23	6 42	6 44	6 47	6 49	6 52	6 55	6 58	7 02	7 06	7 10	7 15	7 21	7 27	7 35
27	6 36	6 38	6 40	6 42	6 45	6 47	6 50	6 53	6 56	7 00	7 04	7 08	7 14	7 20
Mar. 3	6 30	6 32	6 33	6 35	6 37	6 39	6 41	6 43	6 46	6 49	6 52	6 56	7 00	7 05
7	6 24	6 25	6 26	6 28	6 29	6 31	6 32	6 34	6 36	6 38	6 40	6 43	6 46	6 49
11	6 18	6 19	6 19	6 20	6 21	6 22	6 23	6 24	6 25	6 27	6 28	6 30	6 32	6 34
15	6 11	6 12	6 12	6 13	6 13	6 13	6 14	6 14	6 15	6 16	6 16	6 17	6 18	6 19
19	6 05	6 05	6 05	6 05	6 05	6 05	6 05	6 05	6 05	6 04	6 04	6 04	6 04	6 04
23	5 58	5 58	5 58	5 57	5 57	5 56	5 55	5 55	5 54	5 53	5 52	5 51	5 50	5 48
27	5 52	5 51	5 50	5 49	5 48	5 47	5 46	5 45	5 43	5 42	5 40	5 38	5 36	5 33
31	5 46	5 44	5 43	5 42	5 40	5 39	5 37	5 35	5 33	5 31	5 28	5 25	5 21	5 17
Apr. 4	5 39	5 38	5 36	5 34	5 32	5 30	5 28	5 25	5 22	5 19	5 16	5 12	5 07	5 02

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. -2	16 43	16 37	16 30	16 23	16 15	16 06	15 56	15 45	15 33	15 19	15 01	14 40	14 13	13 33
2	16 46	16 40	16 34	16 26	16 19	16 10	16 01	15 50	15 38	15 24	15 07	14 47	14 20	13 43
6	16 50	16 44	16 38	16 31	16 23	16 15	16 05	15 55	15 43	15 30	15 14	14 54	14 30	13 55
10	16 54	16 48	16 42	16 35	16 28	16 20	16 11	16 01	15 50	15 37	15 21	15 03	14 40	14 09
14	16 58	16 53	16 47	16 40	16 33	16 25	16 17	16 07	15 57	15 44	15 30	15 13	14 52	14 24
18	17 03	16 57	16 52	16 45	16 39	16 31	16 23	16 14	16 04	15 53	15 39	15 23	15 04	14 39
22	17 07	17 02	16 57	16 51	16 45	16 38	16 30	16 22	16 12	16 01	15 49	15 34	15 17	14 54
26	17 12	17 07	17 02	16 57	16 51	16 44	16 37	16 29	16 21	16 11	15 59	15 46	15 30	15 10
30	17 17	17 12	17 08	17 03	16 57	16 51	16 45	16 37	16 29	16 20	16 09	15 57	15 43	15 25
Feb. 3	17 22	17 18	17 13	17 09	17 03	16 58	16 52	16 45	16 38	16 29	16 20	16 09	15 56	15 40
7	17 26	17 23	17 19	17 14	17 10	17 05	16 59	16 53	16 47	16 39	16 31	16 21	16 09	15 55
11	17 31	17 28	17 24	17 20	17 16	17 12	17 07	17 01	16 55	16 49	16 41	16 32	16 22	16 10
15	17 36	17 33	17 30	17 26	17 23	17 19	17 14	17 10	17 04	16 58	16 52	16 44	16 35	16 25
19	17 41	17 38	17 35	17 32	17 29	17 26	17 22	17 18	17 13	17 08	17 02	16 56	16 48	16 39
23	17 45	17 43	17 41	17 38	17 35	17 32	17 29	17 26	17 22	17 17	17 12	17 07	17 01	16 53
27	17 50	17 48	17 46	17 44	17 41	17 39	17 36	17 33	17 30	17 27	17 23	17 18	17 13	17 07
Mar. 3	17 54	17 53	17 51	17 49	17 48	17 46	17 44	17 41	17 39	17 36	17 33	17 29	17 25	17 21
7	17 58	17 57	17 56	17 55	17 54	17 52	17 51	17 49	17 47	17 45	17 43	17 40	17 37	17 34
11	18 03	18 02	18 01	18 01	18 00	17 59	17 58	17 57	17 56	17 54	17 53	17 51	17 49	17 47
15	18 07	18 07	18 06	18 06	18 06	18 05	18 05	18 04	18 04	18 03	18 03	18 02	18 01	18 00
19	18 11	18 11	18 11	18 11	18 11	18 12	18 12	18 12	18 12	18 12	18 13	18 13	18 13	18 14
23	18 15	18 16	18 16	18 17	18 17	18 18	18 19	18 19	18 20	18 21	18 22	18 24	18 25	18 27
27	18 19	18 20	18 21	18 22	18 23	18 24	18 26	18 27	18 28	18 30	18 32	18 34	18 37	18 40
31	18 23	18 25	18 26	18 27	18 29	18 31	18 32	18 34	18 37	18 39	18 42	18 45	18 49	18 53
Apr. 4	18 27	18 29	18 31	18 33	18 35	18 37	18 39	18 42	18 45	18 48	18 52	18 56	19 00	19 06

SUNRISE AND SUNSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	6 23	6 19	6 17	6 14	6 12	6 10	6 07	6 04	6 01	5 58	5 54	5 50	5 48	5 46
Apr. 4	6 30	6 26	6 22	6 18	6 15	6 13	6 08	6 04	6 00	5 55	5 51	5 46	5 43	5 39
8	6 38	6 32	6 27	6 22	6 18	6 15	6 09	6 04	5 58	5 53	5 48	5 41	5 37	5 33
12	6 46	6 38	6 32	6 26	6 21	6 17	6 10	6 04	5 57	5 51	5 44	5 36	5 32	5 27
16	6 53	6 44	6 37	6 30	6 25	6 20	6 11	6 04	5 56	5 49	5 41	5 32	5 27	5 21
20	7 01	6 50	6 41	6 34	6 28	6 22	6 12	6 04	5 56	5 47	5 38	5 28	5 22	5 15
24	7 09	6 56	6 46	6 38	6 31	6 25	6 14	6 04	5 55	5 45	5 35	5 24	5 17	5 09
28	7 16	7 02	6 51	6 42	6 34	6 27	6 15	6 04	5 54	5 44	5 33	5 20	5 12	5 04
May 2	7 24	7 08	6 56	6 46	6 37	6 30	6 16	6 05	5 54	5 42	5 30	5 16	5 08	4 59
6	7 31	7 14	7 01	6 50	6 41	6 32	6 18	6 05	5 53	5 41	5 28	5 13	5 04	4 54
10	7 38	7 20	7 06	6 54	6 44	6 35	6 19	6 06	5 53	5 40	5 26	5 10	5 00	4 50
14	7 45	7 26	7 10	6 58	6 47	6 37	6 21	6 06	5 53	5 39	5 24	5 07	4 57	4 46
18	7 52	7 31	7 15	7 01	6 50	6 40	6 22	6 07	5 53	5 38	5 23	5 05	4 54	4 42
22	7 58	7 36	7 19	7 05	6 53	6 42	6 24	6 08	5 53	5 38	5 22	5 03	4 52	4 39
26	8 04	7 41	7 23	7 08	6 55	6 45	6 26	6 09	5 53	5 38	5 21	5 01	4 50	4 36
30	8 10	7 45	7 26	7 11	6 58	6 47	6 27	6 10	5 54	5 38	5 20	5 00	4 48	4 34
June 3	8 14	7 49	7 30	7 14	7 00	6 49	6 29	6 11	5 55	5 38	5 20	4 59	4 47	4 32
7	8 19	7 53	7 33	7 16	7 03	6 51	6 30	6 12	5 55	5 38	5 20	4 58	4 46	4 31
11	8 22	7 55	7 35	7 19	7 05	6 52	6 31	6 13	5 56	5 39	5 20	4 58	4 45	4 31
15	8 25	7 58	7 37	7 20	7 06	6 54	6 33	6 14	5 57	5 39	5 20	4 59	4 46	4 31
19	8 26	7 59	7 38	7 22	7 07	6 55	6 34	6 15	5 58	5 40	5 21	4 59	4 46	4 31
23	8 27	8 00	7 39	7 22	7 08	6 56	6 35	6 16	5 59	5 41	5 22	5 00	4 47	4 32
27	8 27	8 00	7 40	7 23	7 09	6 56	6 35	6 17	5 59	5 42	5 23	5 01	4 48	4 33
July 1	8 26	7 59	7 39	7 23	7 09	6 57	6 36	6 17	6 00	5 43	5 24	5 03	4 50	4 35
5	8 24	7 58	7 38	7 22	7 08	6 56	6 36	6 18	6 01	5 44	5 26	5 04	4 52	4 37

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	17 44	17 48	17 51	17 53	17 56	17 58	18 01	18 04	18 07	18 11	18 14	18 18	18 21	18 23
Apr. 4	17 34	17 39	17 44	17 47	17 50	17 53	17 58	18 02	18 06	18 10	18 15	18 21	18 24	18 27
8	17 24	17 31	17 36	17 41	17 45	17 48	17 54	18 00	18 05	18 10	18 16	18 23	18 27	18 31
12	17 15	17 23	17 29	17 35	17 39	17 44	17 51	17 58	18 04	18 10	18 17	18 25	18 30	18 36
16	17 05	17 15	17 22	17 29	17 34	17 39	17 48	17 56	18 03	18 11	18 19	18 28	18 33	18 40
20	16 56	17 07	17 16	17 23	17 29	17 35	17 45	17 54	18 02	18 11	18 20	18 30	18 37	18 44
24	16 47	16 59	17 09	17 18	17 25	17 31	17 42	17 52	18 01	18 11	18 21	18 33	18 40	18 48
28	16 38	16 52	17 03	17 12	17 20	17 27	17 40	17 51	18 01	18 11	18 23	18 36	18 43	18 52
May 2	16 30	16 45	16 57	17 07	17 16	17 24	17 37	17 49	18 00	18 12	18 24	18 38	18 46	18 56
6	16 22	16 38	16 52	17 03	17 12	17 21	17 35	17 48	18 00	18 12	18 25	18 41	18 50	19 00
10	16 14	16 32	16 47	16 59	17 09	17 18	17 33	17 47	18 00	18 13	18 27	18 43	18 53	19 04
14	16 07	16 27	16 42	16 55	17 06	17 15	17 32	17 46	18 00	18 14	18 29	18 46	18 56	19 08
18	16 01	16 21	16 38	16 51	17 03	17 13	17 30	17 46	18 00	18 15	18 30	18 48	18 59	19 11
22	15 55	16 17	16 34	16 48	17 00	17 11	17 29	17 45	18 00	18 15	18 32	18 51	19 02	19 15
26	15 50	16 13	16 31	16 46	16 58	17 09	17 28	17 45	18 01	18 16	18 34	18 53	19 05	19 18
30	15 45	16 10	16 28	16 44	16 57	17 08	17 28	17 45	18 01	18 18	18 35	18 56	19 08	19 21
June 3	15 42	16 07	16 26	16 42	16 56	17 07	17 28	17 45	18 02	18 19	18 37	18 58	19 10	19 24
7	15 39	16 05	16 25	16 41	16 55	17 07	17 28	17 46	18 03	18 20	18 38	19 00	19 12	19 27
11	15 37	16 04	16 24	16 41	16 55	17 07	17 28	17 46	18 03	18 21	18 39	19 01	19 14	19 29
15	15 36	16 03	16 24	16 41	16 55	17 07	17 28	17 47	18 04	18 22	18 41	19 03	19 16	19 31
19	15 36	16 04	16 24	16 41	16 55	17 08	17 29	17 48	18 05	18 23	18 42	19 04	19 17	19 32
23	15 37	16 05	16 25	16 42	16 56	17 09	17 30	17 49	18 06	18 24	18 43	19 05	19 18	19 33
27	15 39	16 06	16 27	16 44	16 58	17 10	17 31	17 49	18 07	18 24	18 43	19 05	19 18	19 33
July 1	15 42	16 09	16 29	16 45	16 59	17 11	17 32	17 50	18 08	18 25	18 44	19 05	19 18	19 33
5	15 46	16 11	16 31	16 47	17 01	17 13	17 34	17 51	18 08	18 25	18 44	19 05	19 17	19 32

SUNRISE AND SUNSET, 2021

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UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	5 46	5 44	5 43	5 42	5 40	5 39	5 37	5 35	5 33	5 31	5 28	5 25	5 21	5 17
Apr. 4	5 39	5 38	5 36	5 34	5 32	5 30	5 28	5 25	5 22	5 19	5 16	5 12	5 07	5 02
8	5 33	5 31	5 29	5 27	5 24	5 21	5 19	5 15	5 12	5 08	5 04	4 59	4 53	4 47
12	5 27	5 24	5 22	5 19	5 16	5 13	5 10	5 06	5 02	4 57	4 52	4 46	4 39	4 31
16	5 21	5 18	5 15	5 12	5 09	5 05	5 01	4 57	4 52	4 46	4 40	4 33	4 25	4 15
20	5 15	5 12	5 08	5 05	5 01	4 57	4 52	4 47	4 42	4 35	4 28	4 20	4 11	4 00
24	5 09	5 06	5 02	4 58	4 54	4 49	4 44	4 38	4 32	4 25	4 17	4 08	3 57	3 44
28	5 04	5 00	4 56	4 52	4 47	4 42	4 36	4 30	4 23	4 15	4 06	3 55	3 43	3 29
May 2	4 59	4 55	4 50	4 45	4 40	4 34	4 28	4 21	4 14	4 05	3 55	3 43	3 30	3 13
6	4 54	4 49	4 45	4 39	4 34	4 28	4 21	4 13	4 05	3 55	3 44	3 31	3 16	2 57
10	4 50	4 45	4 40	4 34	4 28	4 21	4 14	4 06	3 57	3 46	3 34	3 20	3 03	2 41
14	4 46	4 40	4 35	4 29	4 22	4 15	4 07	3 59	3 49	3 37	3 24	3 09	2 50	2 25
18	4 42	4 37	4 31	4 24	4 18	4 10	4 02	3 52	3 42	3 29	3 15	2 58	2 37	2 09
22	4 39	4 33	4 27	4 20	4 13	4 05	3 56	3 46	3 35	3 22	3 07	2 48	2 25	1 53
26	4 36	4 30	4 24	4 17	4 09	4 01	3 52	3 41	3 29	3 15	2 59	2 39	2 13	1 37
30	4 34	4 28	4 21	4 14	4 06	3 57	3 48	3 37	3 24	3 09	2 52	2 31	2 02	1 20
June 3	4 32	4 26	4 19	4 12	4 03	3 54	3 44	3 33	3 20	3 05	2 46	2 23	1 53	1 03
7	4 31	4 25	4 18	4 10	4 02	3 52	3 42	3 30	3 17	3 01	2 42	2 17	1 44	0 44
11	4 31	4 24	4 17	4 09	4 00	3 51	3 40	3 28	3 14	2 58	2 38	2 13	1 38	0 20
15	4 31	4 24	4 17	4 09	4 00	3 50	3 39	3 27	3 13	2 56	2 36	2 10	1 33	□
19	4 31	4 24	4 17	4 09	4 00	3 50	3 39	3 27	3 13	2 56	2 36	2 09	1 31	□
23	4 32	4 25	4 18	4 10	4 01	3 51	3 40	3 28	3 14	2 57	2 36	2 10	1 32	□
27	4 33	4 26	4 19	4 11	4 02	3 53	3 42	3 30	3 16	2 59	2 39	2 13	1 35	□
July 1	4 35	4 28	4 21	4 13	4 05	3 55	3 44	3 32	3 18	3 02	2 42	2 17	1 41	0 21
5	4 37	4 31	4 23	4 16	4 07	3 58	3 48	3 36	3 22	3 06	2 47	2 23	1 50	0 48

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 31	18 23	18 25	18 26	18 27	18 29	18 31	18 32	18 34	18 37	18 39	18 42	18 45	18 49	18 53
Apr. 4	18 27	18 29	18 31	18 33	18 35	18 37	18 39	18 42	18 45	18 48	18 52	18 56	19 00	19 06
8	18 31	18 33	18 36	18 38	18 40	18 43	18 46	18 49	18 53	18 57	19 01	19 06	19 12	19 19
12	18 36	18 38	18 40	18 43	18 46	18 49	18 53	18 57	19 01	19 06	19 11	19 17	19 24	19 33
16	18 40	18 42	18 45	18 49	18 52	18 56	19 00	19 04	19 09	19 15	19 21	19 28	19 37	19 46
20	18 44	18 47	18 50	18 54	18 58	19 02	19 07	19 12	19 17	19 24	19 31	19 39	19 49	20 00
24	18 48	18 51	18 55	18 59	19 03	19 08	19 13	19 19	19 26	19 33	19 41	19 50	20 01	20 15
28	18 52	18 56	19 00	19 04	19 09	19 14	19 20	19 27	19 34	19 42	19 51	20 02	20 14	20 29
May 2	18 56	19 00	19 05	19 09	19 15	19 20	19 27	19 34	19 42	19 51	20 01	20 13	20 27	20 44
6	19 00	19 04	19 09	19 15	19 20	19 27	19 33	19 41	19 50	19 59	20 11	20 24	20 40	20 59
10	19 04	19 09	19 14	19 20	19 26	19 33	19 40	19 48	19 58	20 08	20 20	20 35	20 53	21 15
14	19 08	19 13	19 18	19 24	19 31	19 38	19 46	19 55	20 05	20 17	20 30	20 46	21 05	21 31
18	19 11	19 17	19 23	19 29	19 36	19 44	19 52	20 02	20 13	20 25	20 39	20 57	21 18	21 47
22	19 15	19 21	19 27	19 34	19 41	19 49	19 58	20 08	20 20	20 33	20 48	21 07	21 31	22 04
26	19 18	19 24	19 31	19 38	19 46	19 54	20 03	20 14	20 26	20 40	20 57	21 17	21 43	22 21
30	19 21	19 28	19 34	19 42	19 50	19 58	20 08	20 19	20 32	20 47	21 04	21 26	21 55	22 39
June 3	19 24	19 31	19 38	19 45	19 53	20 03	20 13	20 24	20 37	20 53	21 11	21 34	22 06	22 58
7	19 27	19 33	19 40	19 48	19 57	20 06	20 16	20 28	20 42	20 58	21 17	21 42	22 15	23 19
11	19 29	19 36	19 43	19 51	19 59	20 09	20 20	20 32	20 46	21 02	21 22	21 47	22 23	23 51
15	19 31	19 37	19 45	19 53	20 01	20 11	20 22	20 34	20 48	21 05	21 25	21 51	22 29	□
19	19 32	19 39	19 46	19 54	20 03	20 13	20 23	20 36	20 50	21 07	21 27	21 54	22 32	□
23	19 33	19 39	19 47	19 55	20 04	20 13	20 24	20 36	20 51	21 08	21 28	21 54	22 32	□
27	19 33	19 40	19 47	19 55	20 04	20 13	20 24	20 36	20 50	21 07	21 27	21 53	22 30	□
July 1	19 33	19 39	19 47	19 54	20 03	20 12	20 23	20 35	20 49	21 05	21 25	21 50	22 25	23 39
5	19 32	19 38	19 46	19 53	20 02	20 11	20 21	20 33	20 46	21 02	21 21	21 45	22 18	23 16

□ indicates Sun continuously above horizon.

SUNRISE AND SUNSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	8 26	7 59	7 39	7 23	7 09	6 57	6 36	6 17	6 00	5 43	5 24	5 03	4 50	4 35
5	8 24	7 58	7 38	7 22	7 08	6 56	6 36	6 18	6 01	5 44	5 26	5 04	4 52	4 37
9	8 21	7 56	7 37	7 21	7 07	6 56	6 36	6 18	6 02	5 45	5 27	5 06	4 54	4 40
13	8 17	7 53	7 34	7 19	7 06	6 55	6 35	6 18	6 02	5 46	5 28	5 08	4 56	4 42
17	8 13	7 50	7 32	7 17	7 05	6 54	6 35	6 18	6 03	5 47	5 30	5 10	4 59	4 45
21	8 08	7 46	7 28	7 14	7 02	6 52	6 34	6 18	6 03	5 48	5 31	5 13	5 01	4 49
25	8 02	7 41	7 25	7 11	7 00	6 50	6 33	6 17	6 03	5 49	5 33	5 15	5 04	4 52
29	7 55	7 36	7 20	7 08	6 57	6 47	6 31	6 17	6 03	5 49	5 34	5 17	5 07	4 56
Aug. 2	7 48	7 30	7 15	7 04	6 53	6 45	6 29	6 16	6 03	5 50	5 36	5 20	5 10	4 59
6	7 40	7 23	7 10	6 59	6 50	6 42	6 27	6 14	6 02	5 50	5 37	5 22	5 13	5 03
10	7 32	7 17	7 05	6 54	6 46	6 38	6 25	6 13	6 02	5 51	5 39	5 24	5 16	5 07
14	7 23	7 10	6 59	6 49	6 41	6 34	6 22	6 11	6 01	5 51	5 40	5 27	5 19	5 11
18	7 15	7 02	6 52	6 44	6 37	6 31	6 19	6 10	6 00	5 51	5 41	5 29	5 22	5 15
22	7 05	6 54	6 46	6 38	6 32	6 26	6 17	6 08	5 59	5 51	5 42	5 31	5 25	5 18
26	6 56	6 46	6 39	6 32	6 27	6 22	6 13	6 06	5 58	5 51	5 43	5 34	5 28	5 22
30	6 46	6 38	6 32	6 26	6 22	6 17	6 10	6 04	5 57	5 51	5 44	5 36	5 31	5 26
Sept. 3	6 36	6 30	6 25	6 20	6 16	6 13	6 07	6 01	5 56	5 51	5 45	5 38	5 34	5 30
7	6 26	6 21	6 17	6 14	6 11	6 08	6 03	5 59	5 55	5 50	5 46	5 40	5 37	5 33
11	6 16	6 13	6 10	6 07	6 05	6 03	6 00	5 56	5 53	5 50	5 47	5 42	5 40	5 37
15	6 06	6 04	6 02	6 01	5 59	5 58	5 56	5 54	5 52	5 50	5 47	5 45	5 43	5 41
19	5 56	5 55	5 55	5 54	5 54	5 53	5 52	5 51	5 50	5 49	5 48	5 47	5 46	5 45
23	5 46	5 46	5 47	5 47	5 48	5 48	5 49	5 49	5 49	5 49	5 49	5 49	5 49	5 49
27	5 35	5 38	5 39	5 41	5 42	5 43	5 45	5 46	5 48	5 49	5 50	5 51	5 52	5 52
Oct. 1	5 25	5 29	5 32	5 34	5 36	5 38	5 41	5 44	5 46	5 49	5 51	5 53	5 55	5 56
5	5 15	5 20	5 24	5 28	5 31	5 33	5 38	5 42	5 45	5 48	5 52	5 56	5 58	6 00

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	15 42	16 09	16 29	16 45	16 59	17 11	17 32	17 50	18 08	18 25	18 44	19 05	19 18	19 33
5	15 46	16 11	16 31	16 47	17 01	17 13	17 34	17 51	18 08	18 25	18 44	19 05	19 17	19 32
9	15 50	16 15	16 34	16 50	17 03	17 15	17 35	17 52	18 09	18 26	18 43	19 04	19 17	19 31
13	15 55	16 19	16 37	16 53	17 06	17 17	17 36	17 53	18 09	18 26	18 43	19 03	19 15	19 29
17	16 00	16 23	16 41	16 56	17 08	17 19	17 38	17 54	18 10	18 25	18 42	19 02	19 13	19 27
21	16 06	16 28	16 45	16 59	17 11	17 21	17 39	17 55	18 10	18 25	18 41	19 00	19 11	19 24
25	16 12	16 33	16 49	17 02	17 14	17 24	17 41	17 56	18 10	18 24	18 40	18 58	19 08	19 20
29	16 19	16 38	16 53	17 06	17 16	17 26	17 42	17 56	18 10	18 24	18 38	18 55	19 05	19 17
Aug. 2	16 25	16 43	16 58	17 09	17 19	17 28	17 44	17 57	18 10	18 23	18 36	18 52	19 02	19 13
6	16 32	16 49	17 02	17 13	17 22	17 31	17 45	17 57	18 09	18 21	18 34	18 49	18 58	19 08
10	16 39	16 55	17 07	17 17	17 25	17 33	17 46	17 58	18 09	18 20	18 32	18 46	18 54	19 03
14	16 47	17 00	17 11	17 20	17 28	17 35	17 47	17 58	18 08	18 18	18 29	18 42	18 49	18 58
18	16 54	17 06	17 16	17 24	17 31	17 37	17 48	17 58	18 07	18 16	18 26	18 38	18 45	18 52
22	17 01	17 12	17 21	17 28	17 34	17 40	17 49	17 58	18 06	18 14	18 23	18 34	18 40	18 47
26	17 08	17 18	17 25	17 32	17 37	17 42	17 50	17 58	18 05	18 12	18 20	18 29	18 35	18 41
30	17 16	17 24	17 30	17 35	17 40	17 44	17 51	17 58	18 04	18 10	18 17	18 25	18 29	18 34
Sept. 3	17 23	17 29	17 35	17 39	17 43	17 46	17 52	17 57	18 03	18 08	18 13	18 20	18 24	18 28
7	17 30	17 35	17 39	17 43	17 46	17 48	17 53	17 57	18 01	18 05	18 10	18 15	18 18	18 22
11	17 38	17 41	17 44	17 46	17 49	17 50	17 54	17 57	18 00	18 03	18 06	18 10	18 13	18 15
15	17 45	17 47	17 49	17 50	17 51	17 53	17 55	17 56	17 58	18 00	18 03	18 05	18 07	18 09
19	17 53	17 53	17 54	17 54	17 54	17 55	17 55	17 56	17 57	17 58	17 59	18 00	18 01	18 02
23	18 00	17 59	17 58	17 58	17 57	17 57	17 56	17 56	17 56	17 55	17 55	17 55	17 55	17 55
27	18 08	18 05	18 03	18 02	18 00	17 59	17 57	17 56	17 54	17 53	17 52	17 50	17 49	17 49
Oct. 1	18 15	18 11	18 08	18 06	18 03	18 01	17 58	17 55	17 53	17 50	17 48	17 45	17 44	17 42
5	18 23	18 18	18 13	18 10	18 06	18 04	17 59	17 55	17 52	17 48	17 45	17 41	17 38	17 36

SUNRISE AND SUNSET, 2021

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UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	4 35	4 28	4 21	4 13	4 05	3 55	3 44	3 32	3 18	3 02	2 42	2 17	1 41	0 21
5	4 37	4 31	4 23	4 16	4 07	3 58	3 48	3 36	3 22	3 06	2 47	2 23	1 50	0 48
9	4 40	4 33	4 26	4 19	4 11	4 01	3 51	3 40	3 27	3 12	2 53	2 30	1 59	1 09
13	4 42	4 36	4 29	4 22	4 14	4 06	3 56	3 45	3 32	3 18	3 00	2 39	2 10	1 27
17	4 45	4 39	4 33	4 26	4 18	4 10	4 01	3 50	3 38	3 24	3 08	2 48	2 22	1 45
21	4 49	4 43	4 37	4 30	4 23	4 15	4 06	3 56	3 45	3 32	3 16	2 58	2 34	2 02
25	4 52	4 47	4 41	4 34	4 28	4 20	4 12	4 02	3 51	3 39	3 25	3 08	2 46	2 18
29	4 56	4 51	4 45	4 39	4 32	4 25	4 17	4 09	3 59	3 47	3 34	3 18	2 59	2 34
Aug. 2	4 59	4 55	4 49	4 44	4 38	4 31	4 24	4 15	4 06	3 56	3 43	3 29	3 12	2 50
6	5 03	4 59	4 54	4 49	4 43	4 37	4 30	4 22	4 14	4 04	3 53	3 40	3 24	3 05
10	5 07	5 03	4 58	4 53	4 48	4 42	4 36	4 29	4 21	4 13	4 03	3 51	3 37	3 20
14	5 11	5 07	5 03	4 58	4 54	4 48	4 43	4 36	4 29	4 21	4 12	4 02	3 49	3 34
18	5 15	5 11	5 07	5 03	4 59	4 54	4 49	4 43	4 37	4 30	4 22	4 12	4 02	3 49
22	5 18	5 15	5 12	5 08	5 04	5 00	4 56	4 51	4 45	4 39	4 31	4 23	4 14	4 02
26	5 22	5 19	5 16	5 13	5 10	5 06	5 02	4 58	4 53	4 47	4 41	4 34	4 26	4 16
30	5 26	5 24	5 21	5 18	5 15	5 12	5 09	5 05	5 01	4 56	4 50	4 44	4 37	4 29
Sept. 3	5 30	5 28	5 26	5 23	5 21	5 18	5 15	5 12	5 08	5 04	5 00	4 55	4 49	4 42
7	5 33	5 32	5 30	5 28	5 26	5 24	5 22	5 19	5 16	5 13	5 09	5 05	5 01	4 55
11	5 37	5 36	5 35	5 33	5 32	5 30	5 28	5 26	5 24	5 22	5 19	5 16	5 12	5 08
15	5 41	5 40	5 39	5 38	5 37	5 36	5 35	5 33	5 32	5 30	5 28	5 26	5 23	5 20
19	5 45	5 44	5 44	5 43	5 43	5 42	5 41	5 40	5 40	5 39	5 37	5 36	5 35	5 33
23	5 49	5 48	5 48	5 48	5 48	5 48	5 48	5 48	5 47	5 47	5 47	5 47	5 46	5 46
27	5 52	5 53	5 53	5 53	5 54	5 54	5 54	5 55	5 55	5 56	5 56	5 57	5 58	5 58
Oct. 1	5 56	5 57	5 58	5 58	5 59	6 00	6 01	6 02	6 03	6 04	6 06	6 07	6 09	6 11
5	6 00	6 01	6 02	6 04	6 05	6 06	6 08	6 09	6 11	6 13	6 15	6 18	6 21	6 24

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	19 33	19 39	19 47	19 54	20 03	20 12	20 23	20 35	20 49	21 05	21 25	21 50	22 25	23 39
5	19 32	19 38	19 46	19 53	20 02	20 11	20 21	20 33	20 46	21 02	21 21	21 45	22 18	23 16
9	19 31	19 37	19 44	19 51	20 00	20 09	20 19	20 30	20 43	20 58	21 16	21 39	22 09	22 58
13	19 29	19 35	19 42	19 49	19 57	20 05	20 15	20 26	20 38	20 53	21 10	21 31	21 59	22 41
17	19 27	19 32	19 39	19 46	19 53	20 02	20 11	20 21	20 33	20 47	21 03	21 23	21 48	22 24
21	19 24	19 29	19 36	19 42	19 49	19 57	20 06	20 16	20 27	20 40	20 55	21 13	21 36	22 08
25	19 20	19 26	19 32	19 38	19 45	19 52	20 01	20 10	20 20	20 32	20 47	21 03	21 24	21 51
29	19 17	19 22	19 27	19 33	19 40	19 47	19 55	20 03	20 13	20 24	20 37	20 53	21 11	21 35
Aug. 2	19 13	19 17	19 22	19 28	19 34	19 41	19 48	19 56	20 05	20 15	20 27	20 41	20 58	21 19
6	19 08	19 12	19 17	19 22	19 28	19 34	19 41	19 48	19 57	20 06	20 17	20 30	20 45	21 04
10	19 03	19 07	19 12	19 16	19 22	19 27	19 33	19 40	19 48	19 57	20 06	20 18	20 31	20 48
14	18 58	19 02	19 06	19 10	19 15	19 20	19 26	19 32	19 39	19 47	19 55	20 06	20 18	20 32
18	18 52	18 56	18 59	19 03	19 08	19 12	19 17	19 23	19 29	19 36	19 44	19 53	20 04	20 17
22	18 47	18 50	18 53	18 56	19 00	19 04	19 09	19 14	19 19	19 26	19 33	19 41	19 50	20 01
26	18 41	18 43	18 46	18 49	18 53	18 56	19 00	19 05	19 09	19 15	19 21	19 28	19 36	19 45
30	18 34	18 37	18 39	18 42	18 45	18 48	18 51	18 55	18 59	19 04	19 09	19 15	19 22	19 30
Sept. 3	18 28	18 30	18 32	18 34	18 37	18 39	18 42	18 45	18 49	18 53	18 57	19 02	19 08	19 14
7	18 22	18 23	18 25	18 27	18 29	18 31	18 33	18 36	18 38	18 41	18 45	18 49	18 53	18 59
11	18 15	18 16	18 18	18 19	18 20	18 22	18 24	18 26	18 28	18 30	18 33	18 36	18 39	18 43
15	18 09	18 09	18 10	18 11	18 12	18 13	18 14	18 16	18 17	18 19	18 21	18 23	18 25	18 28
19	18 02	18 02	18 03	18 03	18 04	18 04	18 05	18 06	18 07	18 07	18 08	18 10	18 11	18 12
23	17 55	17 55	17 55	17 55	17 56	17 56	17 56	17 56	17 56	17 56	17 56	17 57	17 57	17 57
27	17 49	17 48	17 48	17 48	17 47	17 47	17 46	17 46	17 45	17 45	17 44	17 43	17 43	17 42
Oct. 1	17 42	17 41	17 41	17 41	17 39	17 38	17 37	17 36	17 35	17 34	17 32	17 30	17 29	17 26
5	17 36	17 35	17 33	17 32	17 31	17 29	17 28	17 26	17 24	17 22	17 20	17 18	17 15	17 11

SUNRISE AND SUNSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	5 25	5 29	5 32	5 34	5 36	5 38	5 41	5 44	5 46	5 49	5 51	5 53	5 55	5 56
5	5 15	5 20	5 24	5 28	5 31	5 33	5 38	5 42	5 45	5 48	5 52	5 56	5 58	6 00
9	5 05	5 12	5 17	5 21	5 25	5 29	5 34	5 39	5 44	5 48	5 53	5 58	6 01	6 04
13	4 55	5 03	5 10	5 15	5 20	5 24	5 31	5 37	5 43	5 48	5 54	6 01	6 04	6 08
17	4 45	4 55	5 03	5 09	5 15	5 20	5 28	5 35	5 42	5 49	5 55	6 03	6 08	6 13
21	4 35	4 47	4 56	5 03	5 10	5 15	5 25	5 33	5 41	5 49	5 57	6 06	6 11	6 17
25	4 26	4 39	4 49	4 58	5 05	5 11	5 22	5 32	5 41	5 49	5 58	6 09	6 15	6 21
29	4 17	4 32	4 43	4 53	5 01	5 08	5 20	5 30	5 40	5 50	6 00	6 12	6 18	6 26
Nov. 2	4 08	4 24	4 37	4 48	4 57	5 04	5 18	5 29	5 40	5 51	6 02	6 15	6 22	6 30
6	4 00	4 18	4 32	4 43	4 53	5 01	5 16	5 28	5 40	5 52	6 04	6 18	6 26	6 35
10	3 52	4 12	4 27	4 39	4 49	4 59	5 14	5 28	5 40	5 53	6 06	6 21	6 30	6 39
14	3 45	4 06	4 22	4 35	4 47	4 56	5 13	5 27	5 41	5 54	6 08	6 24	6 34	6 44
18	3 38	4 01	4 18	4 32	4 44	4 54	5 12	5 27	5 42	5 56	6 11	6 28	6 37	6 49
22	3 32	3 56	4 14	4 29	4 42	4 53	5 12	5 28	5 43	5 57	6 13	6 31	6 41	6 53
26	3 27	3 52	4 12	4 27	4 40	4 52	5 11	5 28	5 44	5 59	6 16	6 34	6 45	6 57
30	3 23	3 49	4 09	4 26	4 39	4 51	5 11	5 29	5 45	6 01	6 18	6 37	6 49	7 02
Dec. 4	3 19	3 47	4 08	4 25	4 39	4 51	5 12	5 30	5 47	6 03	6 21	6 41	6 52	7 06
8	3 17	3 45	4 07	4 24	4 39	4 52	5 13	5 31	5 48	6 05	6 23	6 44	6 56	7 09
12	3 16	3 45	4 07	4 25	4 40	4 52	5 14	5 33	5 50	6 07	6 25	6 46	6 59	7 13
16	3 15	3 45	4 08	4 26	4 41	4 54	5 16	5 34	5 52	6 09	6 28	6 49	7 01	7 15
20	3 16	3 46	4 09	4 27	4 42	4 55	5 17	5 36	5 54	6 11	6 30	6 51	7 04	7 18
24	3 18	3 49	4 11	4 29	4 44	4 57	5 19	5 38	5 56	6 13	6 32	6 53	7 05	7 20
28	3 22	3 51	4 14	4 32	4 47	5 00	5 22	5 40	5 58	6 15	6 34	6 55	7 07	7 21
32	3 26	3 55	4 17	4 35	4 50	5 02	5 24	5 43	6 00	6 17	6 35	6 56	7 08	7 22
36	3 31	4 00	4 21	4 38	4 53	5 05	5 26	5 45	6 02	6 18	6 36	6 57	7 08	7 22

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	18 15	18 11	18 08	18 06	18 03	18 01	17 58	17 55	17 53	17 50	17 48	17 45	17 44	17 42
5	18 23	18 18	18 13	18 10	18 06	18 04	17 59	17 55	17 52	17 48	17 45	17 41	17 38	17 36
9	18 31	18 24	18 18	18 14	18 10	18 06	18 00	17 55	17 50	17 46	17 41	17 36	17 33	17 29
13	18 39	18 30	18 23	18 18	18 13	18 09	18 02	17 55	17 49	17 44	17 38	17 31	17 28	17 23
17	18 47	18 37	18 29	18 22	18 16	18 11	18 03	17 55	17 49	17 42	17 35	17 27	17 22	17 17
21	18 55	18 43	18 34	18 26	18 20	18 14	18 04	17 56	17 48	17 40	17 32	17 23	17 18	17 12
25	19 03	18 50	18 40	18 31	18 24	18 17	18 06	17 56	17 47	17 39	17 29	17 19	17 13	17 06
29	19 12	18 57	18 45	18 35	18 27	18 20	18 08	17 57	17 47	17 37	17 27	17 15	17 09	17 01
Nov. 2	19 20	19 04	18 51	18 40	18 31	18 23	18 10	17 58	17 47	17 36	17 25	17 12	17 05	16 56
6	19 29	19 11	18 56	18 45	18 35	18 26	18 12	17 59	17 47	17 35	17 23	17 09	17 01	16 52
10	19 37	19 17	19 02	18 50	18 39	18 30	18 14	18 00	17 47	17 35	17 22	17 07	16 58	16 48
14	19 45	19 24	19 08	18 54	18 43	18 33	18 16	18 02	17 48	17 35	17 20	17 04	16 55	16 44
18	19 53	19 31	19 13	18 59	18 47	18 36	18 19	18 03	17 49	17 35	17 20	17 03	16 53	16 41
22	20 01	19 37	19 19	19 03	18 51	18 40	18 21	18 05	17 50	17 35	17 19	17 01	16 51	16 39
26	20 09	19 43	19 24	19 08	18 55	18 43	18 24	18 07	17 51	17 35	17 19	17 00	16 49	16 37
30	20 16	19 49	19 29	19 12	18 58	18 46	18 26	18 09	17 52	17 36	17 19	17 00	16 48	16 36
Dec. 4	20 22	19 54	19 33	19 16	19 02	18 50	18 29	18 11	17 54	17 37	17 20	17 00	16 48	16 35
8	20 28	19 59	19 37	19 20	19 05	18 53	18 31	18 13	17 56	17 39	17 21	17 00	16 48	16 35
12	20 32	20 03	19 41	19 23	19 08	18 55	18 34	18 15	17 58	17 40	17 22	17 01	16 49	16 35
16	20 36	20 06	19 44	19 26	19 11	18 58	18 36	18 17	17 59	17 42	17 24	17 02	16 50	16 36
20	20 39	20 09	19 46	19 28	19 13	19 00	18 38	18 19	18 01	17 44	17 25	17 04	16 52	16 38
24	20 41	20 11	19 48	19 30	19 15	19 02	18 40	18 21	18 03	17 46	17 27	17 06	16 54	16 40
28	20 41	20 12	19 49	19 31	19 16	19 04	18 42	18 23	18 05	17 48	17 30	17 09	16 56	16 42
32	20 41	20 12	19 50	19 32	19 17	19 05	18 43	18 24	18 07	17 50	17 32	17 11	16 59	16 45
36	20 39	20 11	19 49	19 32	19 18	19 05	18 44	18 26	18 09	17 52	17 35	17 14	17 02	16 49

SUNRISE AND SUNSET, 2021

31

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

SUNRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	5 56	5 57	5 58	5 58	5 59	6 00	6 01	6 02	6 03	6 04	6 06	6 07	6 09	6 11
5	6 00	6 01	6 02	6 04	6 05	6 06	6 08	6 09	6 11	6 13	6 15	6 18	6 21	6 24
9	6 04	6 06	6 07	6 09	6 11	6 13	6 15	6 17	6 19	6 22	6 25	6 28	6 32	6 37
13	6 08	6 10	6 12	6 14	6 16	6 19	6 21	6 24	6 27	6 31	6 35	6 39	6 44	6 50
17	6 13	6 15	6 17	6 20	6 22	6 25	6 28	6 32	6 36	6 40	6 45	6 50	6 56	7 03
21	6 17	6 20	6 22	6 25	6 28	6 32	6 35	6 39	6 44	6 49	6 55	7 01	7 08	7 17
25	6 21	6 24	6 27	6 31	6 34	6 38	6 43	6 47	6 52	6 58	7 05	7 12	7 21	7 31
29	6 26	6 29	6 33	6 36	6 40	6 45	6 50	6 55	7 01	7 07	7 15	7 23	7 33	7 45
Nov. 2	6 30	6 34	6 38	6 42	6 47	6 52	6 57	7 03	7 09	7 17	7 25	7 35	7 46	7 59
6	6 35	6 39	6 43	6 48	6 53	6 58	7 04	7 11	7 18	7 26	7 35	7 46	7 59	8 14
10	6 39	6 44	6 48	6 54	6 59	7 05	7 11	7 18	7 26	7 35	7 46	7 58	8 12	8 29
14	6 44	6 49	6 54	6 59	7 05	7 11	7 18	7 26	7 35	7 45	7 56	8 09	8 25	8 44
18	6 49	6 54	6 59	7 05	7 11	7 18	7 25	7 34	7 43	7 54	8 06	8 20	8 37	8 59
22	6 53	6 58	7 04	7 10	7 17	7 24	7 32	7 41	7 51	8 02	8 15	8 31	8 50	9 14
26	6 57	7 03	7 09	7 15	7 22	7 30	7 38	7 48	7 58	8 10	8 25	8 41	9 02	9 29
30	7 02	7 07	7 14	7 20	7 28	7 36	7 44	7 54	8 05	8 18	8 33	8 51	9 14	9 44
Dec. 4	7 06	7 12	7 18	7 25	7 32	7 41	7 50	8 00	8 12	8 25	8 41	9 00	9 24	9 58
8	7 09	7 15	7 22	7 29	7 37	7 45	7 55	8 05	8 18	8 31	8 48	9 08	9 34	10 10
12	7 13	7 19	7 25	7 33	7 41	7 49	7 59	8 10	8 22	8 37	8 54	9 15	9 42	10 21
16	7 15	7 22	7 29	7 36	7 44	7 53	8 03	8 14	8 26	8 41	8 58	9 20	9 48	10 29
20	7 18	7 24	7 31	7 38	7 47	7 55	8 05	8 16	8 29	8 44	9 01	9 23	9 52	10 34
24	7 20	7 26	7 33	7 40	7 48	7 57	8 07	8 18	8 31	8 46	9 03	9 25	9 53	10 35
28	7 21	7 27	7 34	7 41	7 49	7 58	8 08	8 19	8 32	8 46	9 03	9 25	9 52	10 33
32	7 22	7 28	7 35	7 42	7 50	7 58	8 08	8 19	8 31	8 45	9 02	9 23	9 49	10 28
36	7 22	7 28	7 35	7 42	7 49	7 58	8 07	8 18	8 30	8 43	9 00	9 19	9 45	10 20

SUNSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	17 42	17 41	17 41	17 40	17 39	17 38	17 37	17 36	17 35	17 34	17 32	17 30	17 29	17 26
5	17 36	17 35	17 33	17 32	17 31	17 29	17 28	17 26	17 24	17 22	17 20	17 18	17 15	17 11
9	17 29	17 28	17 26	17 25	17 23	17 21	17 19	17 17	17 14	17 11	17 08	17 05	17 01	16 56
13	17 23	17 21	17 19	17 17	17 15	17 13	17 10	17 07	17 04	17 00	16 56	16 52	16 47	16 41
17	17 17	17 15	17 13	17 10	17 07	17 05	17 01	16 58	16 54	16 50	16 45	16 39	16 33	16 26
21	17 12	17 09	17 06	17 03	17 00	16 57	16 53	16 49	16 44	16 39	16 33	16 27	16 20	16 11
25	17 06	17 03	17 00	16 57	16 53	16 49	16 45	16 40	16 35	16 29	16 22	16 15	16 06	15 56
29	17 01	16 58	16 54	16 50	16 46	16 42	16 37	16 32	16 26	16 19	16 12	16 03	15 53	15 41
Nov. 2	16 56	16 53	16 49	16 44	16 40	16 35	16 29	16 24	16 17	16 09	16 01	15 51	15 40	15 27
6	16 52	16 48	16 44	16 39	16 34	16 28	16 22	16 16	16 09	16 00	15 51	15 40	15 27	15 12
10	16 48	16 44	16 39	16 34	16 28	16 22	16 16	16 09	16 01	15 52	15 41	15 29	15 15	14 58
14	16 44	16 40	16 35	16 29	16 23	16 17	16 10	16 02	15 53	15 44	15 32	15 19	15 03	14 44
18	16 41	16 36	16 31	16 25	16 19	16 12	16 05	15 56	15 47	15 36	15 24	15 10	14 52	14 30
22	16 39	16 34	16 28	16 22	16 15	16 08	16 00	15 51	15 41	15 30	15 16	15 01	14 42	14 17
26	16 37	16 31	16 25	16 19	16 12	16 04	15 56	15 46	15 36	15 24	15 10	14 53	14 32	14 05
30	16 36	16 30	16 24	16 17	16 10	16 02	15 53	15 43	15 32	15 19	15 04	14 46	14 23	13 53
Dec. 4	16 35	16 29	16 22	16 15	16 08	16 00	15 50	15 40	15 28	15 15	14 59	14 40	14 16	13 42
8	16 35	16 28	16 22	16 15	16 07	15 58	15 49	15 38	15 26	15 12	14 56	14 36	14 10	13 33
12	16 35	16 29	16 22	16 15	16 07	15 58	15 48	15 37	15 25	15 11	14 54	14 33	14 06	13 26
16	16 36	16 30	16 23	16 15	16 07	15 59	15 49	15 38	15 25	15 10	14 53	14 32	14 04	13 22
20	16 38	16 31	16 24	16 17	16 09	16 00	15 50	15 39	15 26	15 11	14 54	14 32	14 04	13 21
24	16 40	16 33	16 26	16 19	16 11	16 02	15 52	15 41	15 28	15 14	14 56	14 35	14 06	13 24
28	16 42	16 36	16 29	16 22	16 14	16 05	15 55	15 44	15 32	15 17	15 00	14 39	14 11	13 30
32	16 45	16 39	16 33	16 25	16 17	16 09	15 59	15 48	15 36	15 22	15 05	14 45	14 18	13 40
36	16 49	16 43	16 36	16 29	16 22	16 13	16 04	15 53	15 41	15 28	15 11	14 52	14 27	13 51

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 0	22 08	21 39	21 17	20 59	20 44	20 31	20 09	19 49	19 31	19 13	18 53	18 31	18 17	18 02
1	22 38	22 14	21 56	21 41	21 28	21 17	20 57	20 40	20 25	20 09	19 52	19 32	19 21	19 07
2	23 01	22 43	22 29	22 17	22 07	21 58	21 43	21 29	21 17	21 04	20 50	20 35	20 26	20 15
3	23 18	23 06	22 57	22 48	22 42	22 35	22 25	22 15	22 07	21 58	21 48	21 38	21 31	21 24
4	23 33	23 27	23 22	23 17	23 14	23 11	23 05	23 00	22 55	22 51	22 46	22 40	22 37	22 33
5	23 46	23 46	23 45	23 45	23 45	23 45	23 44	23 44	23 44	23 43	23 43	23 43	23 43	23 43
6	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
7	0 00	0 05	0 09	0 13	0 16	0 19	0 24	0 28	0 33	0 37	0 41	0 47	0 50	0 53
8	0 15	0 26	0 35	0 43	0 50	0 55	1 06	1 15	1 23	1 32	1 41	1 52	1 58	2 05
9	0 34	0 51	1 05	1 17	1 27	1 35	1 51	2 04	2 17	2 29	2 43	2 59	3 08	3 18
10	0 59	1 22	1 41	1 56	2 09	2 21	2 40	2 57	3 13	3 30	3 47	4 07	4 19	4 32
11	1 34	2 03	2 25	2 43	2 59	3 12	3 35	3 54	4 13	4 32	4 52	5 15	5 28	5 44
12	2 23	2 55	3 20	3 39	3 55	4 10	4 34	4 55	5 14	5 34	5 55	6 19	6 33	6 50
13	3 27	3 59	4 23	4 42	4 58	5 12	5 35	5 55	6 14	6 33	6 54	7 17	7 31	7 46
14	4 44	5 11	5 32	5 49	6 03	6 16	6 37	6 55	7 12	7 29	7 47	8 08	8 20	8 33
15	6 05	6 27	6 44	6 57	7 09	7 19	7 36	7 51	8 05	8 19	8 34	8 51	9 01	9 12
16	7 26	7 41	7 54	8 04	8 12	8 20	8 32	8 44	8 54	9 05	9 16	9 28	9 36	9 44
17	8 44	8 53	9 01	9 07	9 13	9 18	9 26	9 33	9 40	9 46	9 53	10 02	10 06	10 11
18	9 59	10 03	10 06	10 09	10 11	10 13	10 16	10 19	10 22	10 25	10 28	10 32	10 34	10 36
19	11 11	11 10	11 09	11 08	11 07	11 07	11 05	11 04	11 04	11 03	11 02	11 01	11 00	10 59
20	12 23	12 16	12 11	12 07	12 03	12 00	11 54	11 49	11 44	11 40	11 35	11 29	11 26	11 22
21	13 35	13 23	13 13	13 05	12 59	12 53	12 42	12 34	12 25	12 17	12 09	11 59	11 53	11 47
22	14 47	14 30	14 16	14 05	13 55	13 47	13 32	13 20	13 08	12 57	12 44	12 30	12 22	12 13
23	16 00	15 37	15 19	15 05	14 53	14 42	14 24	14 08	13 53	13 39	13 23	13 05	12 55	12 43
24	17 12	16 44	16 23	16 05	15 51	15 38	15 17	14 58	14 41	14 24	14 06	13 45	13 33	13 19

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 0	4 14	4 47	5 11	5 30	5 46	6 00	6 23	6 44	7 03	7 22	7 42	8 05	8 19	8 34
1	5 26	5 54	6 15	6 33	6 47	7 00	7 21	7 40	7 57	8 14	8 32	8 53	9 05	9 19
2	6 45	7 08	7 25	7 40	7 52	8 02	8 20	8 35	8 50	9 04	9 19	9 36	9 46	9 58
3	8 09	8 25	8 38	8 48	8 57	9 05	9 18	9 30	9 41	9 51	10 03	10 16	10 23	10 32
4	9 33	9 43	9 51	9 57	10 03	10 08	10 16	10 23	10 30	10 37	10 44	10 52	10 56	11 02
5	10 57	11 01	11 04	11 06	11 08	11 10	11 13	11 16	11 18	11 21	11 23	11 26	11 28	11 30
6	12 23	12 20	12 18	12 16	12 15	12 13	12 11	12 09	12 07	12 05	12 03	12 00	11 59	11 57
7	13 49	13 40	13 33	13 27	13 22	13 17	13 10	13 03	12 56	12 50	12 43	12 35	12 31	12 26
8	15 18	15 02	14 50	14 40	14 31	14 23	14 10	13 59	13 48	13 38	13 26	13 13	13 06	12 58
9	16 48	16 25	16 08	15 54	15 42	15 31	15 13	14 58	14 43	14 29	14 13	13 56	13 46	13 34
10	18 15	17 46	17 24	17 07	16 52	16 39	16 18	15 59	15 41	15 24	15 05	14 44	14 31	14 17
11	19 32	18 59	18 35	18 16	18 00	17 46	17 22	17 01	16 42	16 23	16 02	15 38	15 24	15 08
12	20 33	20 01	19 37	19 17	19 01	18 47	18 23	18 02	17 43	17 24	17 03	16 39	16 24	16 08
13	21 17	20 49	20 27	20 09	19 55	19 42	19 20	19 00	18 42	18 24	18 05	17 42	17 29	17 13
14	21 47	21 25	21 07	20 52	20 40	20 29	20 10	19 53	19 38	19 22	19 05	18 46	18 35	18 22
15	22 09	21 52	21 39	21 27	21 18	21 09	20 54	20 41	20 29	20 17	20 04	19 48	19 39	19 29
16	22 25	22 14	22 05	21 57	21 50	21 44	21 34	21 25	21 16	21 08	20 58	20 48	20 42	20 35
17	22 38	22 32	22 27	22 23	22 19	22 16	22 10	22 05	22 00	21 56	21 50	21 44	21 41	21 37
18	22 50	22 49	22 48	22 47	22 46	22 45	22 44	22 43	22 42	22 41	22 40	22 39	22 38	22 37
19	23 01	23 04	23 07	23 10	23 12	23 14	23 17	23 20	23 23	23 26	23 29	23 32	23 34	23 36
20	23 12	23 21	23 28	23 33	23 38	23 43	23 51	23 57	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
21	23 25	23 38	23 49	23 58	.. ..	.. ..	.. ..	.. ..	0 04	0 10	0 17	0 25	0 30	0 35
22	23 40	23 59	.. ..	.. ..	0 06	0 13	0 25	0 36	0 46	0 56	1 06	1 19	1 26	1 34
23	.. ..	.. ..	0 14	0 27	0 37	0 46	1 02	1 16	1 30	1 43	1 57	2 13	2 23	2 34
24	0 01	0 25	0 44	0 59	1 12	1 23	1 43	2 00	2 16	2 32	2 49	3 09	3 21	3 34

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 0	18 02	17 55	17 48	17 40	17 31	17 21	17 10	16 58	16 44	16 27	16 07	15 41	15 06	13 56
1	19 07	19 01	18 55	18 48	18 41	18 32	18 23	18 13	18 01	17 48	17 32	17 12	16 48	16 14
2	20 15	20 11	20 06	20 00	19 54	19 48	19 41	19 33	19 24	19 15	19 03	18 50	18 33	18 14
3	21 24	21 21	21 18	21 14	21 10	21 06	21 01	20 56	20 50	20 43	20 36	20 28	20 18	20 06
4	22 33	22 32	22 30	22 28	22 26	22 24	22 21	22 19	22 16	22 13	22 09	22 05	22 00	21 54
5	23 43	23 43	23 43	23 42	23 42	23 42	23 42	23 42	23 42	23 42	23 42	23 42	23 41	23 41
6	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
7	0 53	0 55	0 56	0 58	1 00	1 02	1 04	1 07	1 09	1 12	1 16	1 20	1 24	1 30
8	2 05	2 08	2 11	2 15	2 19	2 23	2 28	2 33	2 39	2 45	2 53	3 01	3 11	3 23
9	3 18	3 23	3 28	3 34	3 40	3 46	3 53	4 01	4 10	4 20	4 32	4 46	5 03	5 24
10	4 32	4 39	4 45	4 52	5 00	5 09	5 18	5 29	5 41	5 55	6 12	6 33	6 59	7 37
11	5 44	5 51	5 59	6 07	6 16	6 27	6 38	6 51	7 06	7 24	7 45	8 13	8 54	■
12	6 50	6 57	7 05	7 14	7 24	7 34	7 46	8 00	8 16	8 35	8 58	9 29	10 18	■
13	7 46	7 54	8 01	8 10	8 19	8 29	8 40	8 53	9 07	9 25	9 46	10 12	10 49	12 11
14	8 33	8 40	8 46	8 54	9 01	9 10	9 20	9 30	9 42	9 56	10 13	10 32	10 57	11 31
15	9 12	9 17	9 22	9 28	9 34	9 41	9 49	9 57	10 06	10 16	10 28	10 42	10 59	11 20
16	9 44	9 48	9 52	9 56	10 00	10 05	10 10	10 16	10 23	10 30	10 38	10 48	10 59	11 12
17	10 11	10 14	10 16	10 19	10 22	10 25	10 28	10 32	10 36	10 40	10 45	10 51	10 57	11 05
18	10 36	10 37	10 38	10 39	10 41	10 42	10 43	10 45	10 47	10 48	10 51	10 53	10 56	10 59
19	10 59	10 59	10 59	10 58	10 58	10 58	10 57	10 57	10 56	10 56	10 55	10 55	10 54	10 53
20	11 22	11 21	11 19	11 17	11 16	11 14	11 11	11 09	11 06	11 03	11 00	10 56	10 52	10 47
21	11 47	11 44	11 41	11 38	11 34	11 30	11 26	11 22	11 17	11 12	11 05	10 58	10 50	10 41
22	12 13	12 09	12 05	12 00	11 55	11 50	11 44	11 37	11 30	11 22	11 12	11 02	10 49	10 35
23	12 43	12 38	12 32	12 26	12 20	12 13	12 05	11 56	11 46	11 35	11 23	11 08	10 50	10 27
24	13 19	13 12	13 06	12 58	12 50	12 42	12 32	12 21	12 09	11 55	11 38	11 18	10 52	10 17

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 0	8 34	8 41	8 49	8 57	9 06	9 16	9 27	9 40	9 54	10 11	10 32	10 58	11 34	12 44
1	9 19	9 25	9 32	9 39	9 47	9 56	10 05	10 16	10 28	10 42	10 59	11 19	11 44	12 18
2	9 58	10 03	10 08	10 14	10 21	10 27	10 35	10 43	10 53	11 03	11 16	11 30	11 47	12 08
3	10 32	10 35	10 39	10 43	10 48	10 53	10 58	11 04	11 11	11 18	11 27	11 36	11 47	12 00
4	11 02	11 04	11 06	11 09	11 12	11 15	11 18	11 22	11 26	11 30	11 35	11 40	11 47	11 54
5	11 30	11 31	11 31	11 32	11 33	11 34	11 36	11 37	11 38	11 40	11 41	11 43	11 45	11 48
6	11 57	11 57	11 56	11 55	11 54	11 53	11 52	11 51	11 50	11 49	11 47	11 46	11 44	11 42
7	12 26	12 24	12 22	12 19	12 16	12 13	12 10	12 07	12 03	11 59	11 54	11 49	11 43	11 35
8	12 58	12 54	12 50	12 46	12 41	12 36	12 31	12 25	12 18	12 11	12 02	11 53	11 42	11 28
9	13 34	13 29	13 23	13 17	13 11	13 04	12 56	12 47	12 38	12 27	12 14	11 59	11 42	11 20
10	14 17	14 10	14 04	13 56	13 48	13 39	13 29	13 18	13 05	12 50	12 33	12 12	11 45	11 06
11	15 08	15 01	14 53	14 45	14 35	14 25	14 13	14 00	13 45	13 27	13 05	12 37	11 56	■
12	16 08	16 00	15 52	15 44	15 34	15 23	15 11	14 58	14 42	14 23	14 00	13 29	12 40	■
13	17 13	17 07	16 59	16 51	16 42	16 32	16 21	16 09	15 54	15 37	15 17	14 51	14 14	12 52
14	18 22	18 16	18 09	18 03	17 55	17 47	17 38	17 28	17 16	17 03	16 47	16 28	16 03	15 30
15	19 29	19 25	19 20	19 15	19 09	19 03	18 56	18 48	18 39	18 30	18 18	18 05	17 50	17 30
16	20 35	20 31	20 28	20 24	20 20	20 16	20 12	20 06	20 01	19 54	19 47	19 39	19 29	19 17
17	21 37	21 35	21 33	21 31	21 29	21 27	21 24	21 22	21 19	21 15	21 11	21 07	21 02	20 56
18	22 37	22 37	22 37	22 36	22 36	22 35	22 35	22 34	22 33	22 33	22 32	22 31	22 30	22 29
19	23 36	23 37	23 38	23 39	23 41	23 42	23 43	23 45	23 47	23 49	23 51	23 53	23 56	23 59
20	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
21	0 35	0 37	0 40	0 42	0 45	0 48	0 52	0 55	0 59	1 04	1 09	1 15	1 22	1 30
22	1 34	1 37	1 41	1 45	1 50	1 55	2 00	2 06	2 13	2 20	2 29	2 38	2 50	3 03
23	2 34	2 38	2 44	2 49	2 55	3 02	3 09	3 18	3 27	3 37	3 49	4 04	4 21	4 43
24	3 34	3 40	3 46	3 53	4 01	4 09	4 19	4 29	4 41	4 55	5 11	5 31	5 56	6 30

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 23	16 00	15 37	15 19	15 05	14 53	14 42	14 24	14 08	13 53	13 39	13 23	13 05	12 55	12 43
24	17 12	16 44	16 23	16 05	15 51	15 38	15 17	14 58	14 41	14 24	14 06	13 45	13 33	13 19
25	18 20	17 48	17 24	17 05	16 49	16 35	16 11	15 51	15 32	15 13	14 53	14 30	14 16	14 01
26	19 19	18 46	18 21	18 01	17 45	17 30	17 06	16 45	16 26	16 06	15 45	15 21	15 07	14 51
27	20 05	19 34	19 11	18 52	18 37	18 23	18 00	17 40	17 21	17 02	16 42	16 19	16 05	15 49
28	20 39	20 14	19 53	19 37	19 23	19 11	18 51	18 33	18 16	17 59	17 41	17 20	17 08	16 54
29	21 05	20 45	20 29	20 16	20 05	19 55	19 38	19 24	19 10	18 56	18 41	18 24	18 14	18 02
30	21 24	21 10	20 59	20 50	20 42	20 35	20 23	20 12	20 02	19 52	19 41	19 28	19 21	19 13
31	21 40	21 32	21 26	21 20	21 16	21 11	21 04	20 58	20 52	20 46	20 40	20 33	20 28	20 24
Feb. 1	21 54	21 52	21 50	21 49	21 47	21 46	21 44	21 43	21 41	21 40	21 38	21 36	21 35	21 34
2	22 07	22 11	22 14	22 16	22 19	22 21	22 24	22 27	22 30	22 33	22 37	22 40	22 42	22 45
3	22 22	22 31	22 39	22 46	22 51	22 56	23 05	23 13	23 20	23 28	23 36	23 45	23 50	23 56
4	22 39	22 54	23 07	23 17	23 27	23 34	23 48	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
5	23 01	23 23	23 40	23 54	.. ..	.. ..	.. ..	0 01	0 12	0 24	0 36	0 50	0 59	1 08
6	23 31	23 59	.. ..	.. ..	0 06	0 17	0 35	0 51	1 06	1 22	1 38	1 57	2 08	2 21
7	.. ..	.. ..	0 20	0 37	0 52	1 05	1 27	1 46	2 04	2 22	2 41	3 03	3 16	3 32
8	0 13	0 45	1 09	1 28	1 45	1 59	2 22	2 43	3 03	3 22	3 43	4 07	4 21	4 38
9	1 10	1 43	2 08	2 27	2 43	2 58	3 22	3 42	4 02	4 21	4 42	5 06	5 20	5 36
10	2 22	2 51	3 14	3 32	3 47	4 00	4 22	4 41	4 59	5 17	5 36	5 58	6 11	6 26
11	3 41	4 05	4 24	4 39	4 52	5 03	5 22	5 38	5 54	6 09	6 25	6 44	6 55	7 07
12	5 02	5 20	5 34	5 46	5 56	6 04	6 19	6 32	6 44	6 56	7 09	7 24	7 32	7 42
13	6 22	6 34	6 43	6 51	6 58	7 04	7 14	7 23	7 31	7 40	7 49	7 59	8 04	8 11
14	7 39	7 45	7 50	7 54	7 58	8 01	8 06	8 11	8 16	8 20	8 25	8 30	8 33	8 37
15	8 53	8 54	8 54	8 55	8 55	8 56	8 56	8 57	8 58	8 58	8 59	9 00	9 00	9 01
16	10 06	10 01	9 57	9 54	9 52	9 49	9 45	9 42	9 39	9 36	9 32	9 28	9 26	9 24

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 23	.. ..	.. ..	0 14	0 27	0 37	0 46	1 02	1 16	1 30	1 43	1 57	2 13	2 23	2 34
24	0 01	0 25	0 44	0 59	1 12	1 23	1 43	2 00	2 16	2 32	2 49	3 09	3 21	3 34
25	0 28	0 57	1 20	1 37	1 53	2 06	2 28	2 47	3 05	3 24	3 43	4 06	4 19	4 34
26	1 07	1 40	2 04	2 23	2 40	2 54	3 18	3 38	3 58	4 17	4 38	5 02	5 16	5 32
27	2 00	2 33	2 58	3 17	3 34	3 48	4 12	4 33	4 52	5 11	5 32	5 56	6 10	6 26
28	3 08	3 38	4 01	4 19	4 34	4 47	5 10	5 29	5 47	6 05	6 24	6 46	6 59	7 14
29	4 27	4 51	5 11	5 26	5 39	5 50	6 10	6 26	6 42	6 57	7 14	7 32	7 43	7 56
30	5 51	6 10	6 24	6 36	6 46	6 55	7 10	7 23	7 35	7 47	8 00	8 14	8 22	8 32
31	7 18	7 29	7 39	7 47	7 53	7 59	8 09	8 18	8 26	8 34	8 42	8 52	8 58	9 04
Feb. 1	8 44	8 49	8 54	8 57	9 00	9 03	9 08	9 12	9 16	9 19	9 23	9 28	9 30	9 33
2	10 10	10 09	10 09	10 08	10 07	10 07	10 06	10 05	10 04	10 04	10 03	10 02	10 01	10 01
3	11 37	11 30	11 24	11 19	11 15	11 11	11 05	10 59	10 54	10 49	10 43	10 37	10 33	10 29
4	13 04	12 51	12 40	12 31	12 23	12 16	12 04	11 54	11 45	11 35	11 25	11 13	11 07	10 59
5	14 33	14 12	13 56	13 43	13 32	13 22	13 05	12 51	12 38	12 24	12 10	11 54	11 44	11 33
6	15 59	15 32	15 11	14 55	14 41	14 29	14 08	13 50	13 33	13 17	12 59	12 39	12 27	12 13
7	17 18	16 46	16 23	16 04	15 48	15 34	15 11	14 50	14 32	14 13	13 53	13 29	13 16	13 00
8	18 23	17 51	17 26	17 06	16 50	16 36	16 11	15 51	15 31	15 11	14 50	14 26	14 12	13 55
9	19 13	18 42	18 19	18 01	17 45	17 32	17 09	16 48	16 30	16 11	15 50	15 27	15 13	14 57
10	19 47	19 22	19 02	18 46	18 33	18 21	18 00	17 43	17 26	17 09	16 51	16 30	16 18	16 03
11	20 12	19 52	19 37	19 24	19 13	19 03	18 47	18 32	18 18	18 05	17 50	17 33	17 23	17 11
12	20 30	20 16	20 05	19 56	19 48	19 41	19 28	19 17	19 07	18 57	18 46	18 33	18 26	18 18
13	20 44	20 35	20 29	20 23	20 18	20 14	20 06	19 59	19 53	19 46	19 39	19 32	19 27	19 22
14	20 56	20 53	20 50	20 48	20 46	20 44	20 41	20 38	20 36	20 33	20 31	20 27	20 26	20 24
15	21 07	21 09	21 11	21 12	21 13	21 13	21 15	21 16	21 17	21 19	21 20	21 22	21 23	21 24
16	21 18	21 24	21 30	21 35	21 38	21 42	21 48	21 53	21 59	22 04	22 09	22 15	22 19	22 23

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 23	12 43	12 38	12 32	12 26	12 20	12 13	12 05	11 56	11 46	11 35	11 23	11 08	10 50	10 27
24	13 19	13 12	13 06	12 58	12 50	12 42	12 32	12 21	12 09	11 55	11 38	11 18	10 52	10 17
25	14 01	13 54	13 46	13 38	13 29	13 19	13 08	12 55	12 41	12 24	12 03	11 38	11 02	9 51
26	14 51	14 44	14 36	14 27	14 17	14 07	13 55	13 42	13 26	13 08	12 45	12 15	11 30	□
27	15 49	15 42	15 34	15 26	15 17	15 06	14 55	14 42	14 27	14 10	13 48	13 20	12 40	□
28	16 54	16 47	16 40	16 33	16 25	16 16	16 06	15 55	15 42	15 27	15 10	14 48	14 19	13 37
29	18 02	17 57	17 52	17 46	17 39	17 32	17 24	17 16	17 06	16 55	16 42	16 26	16 07	15 43
30	19 13	19 09	19 05	19 01	18 56	18 51	18 46	18 40	18 33	18 26	18 17	18 07	17 55	17 41
31	20 24	20 21	20 19	20 17	20 14	20 11	20 08	20 05	20 01	19 57	19 52	19 47	19 40	19 33
Feb. 1	21 34	21 34	21 33	21 33	21 32	21 31	21 31	21 30	21 29	21 28	21 27	21 25	21 24	21 22
2	22 45	22 46	22 47	22 48	22 50	22 51	22 53	22 55	22 57	22 59	23 01	23 04	23 07	23 11
3	23 56	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
4	.. ..	.. ..	0 02	0 05	0 08	0 12	0 16	0 20	0 25	0 31	0 37	0 44	0 53	1 02
5	1 08	1 13	1 17	1 22	1 28	1 34	1 40	1 47	1 55	2 04	2 15	2 27	2 41	2 59
6	2 21	2 27	2 33	2 39	2 47	2 55	3 04	3 14	3 25	3 38	3 53	4 11	4 35	5 06
7	3 32	3 38	3 46	3 54	4 03	4 13	4 23	4 36	4 50	5 07	5 27	5 53	6 28	7 40
8	4 38	4 45	4 53	5 02	5 12	5 22	5 34	5 48	6 04	6 23	6 46	7 17	8 07	■
9	5 36	5 44	5 52	6 00	6 10	6 20	6 32	6 45	7 01	7 19	7 42	8 11	8 54	■
10	6 26	6 33	6 40	6 48	6 56	7 06	7 16	7 28	7 41	7 56	8 15	8 37	9 07	9 52
11	7 07	7 13	7 19	7 25	7 32	7 40	7 48	7 58	8 08	8 20	8 34	8 50	9 10	9 35
12	7 42	7 46	7 50	7 55	8 01	8 06	8 13	8 19	8 27	8 36	8 46	8 57	9 10	9 26
13	8 11	8 14	8 17	8 20	8 24	8 28	8 32	8 36	8 41	8 47	8 53	9 01	9 09	9 18
14	8 37	8 38	8 40	8 42	8 44	8 46	8 48	8 50	8 53	8 56	8 59	9 03	9 07	9 12
15	9 01	9 01	9 01	9 01	9 02	9 02	9 02	9 03	9 03	9 03	9 04	9 04	9 05	9 06
16	9 24	9 23	9 22	9 20	9 19	9 18	9 16	9 14	9 13	9 11	9 08	9 06	9 03	9 00

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Jan. 23	2 34	2 38	2 44	2 49	2 55	3 02	3 09	3 18	3 27	3 37	3 49	4 04	4 21	4 43
24	3 34	3 40	3 46	3 53	4 01	4 09	4 19	4 29	4 41	4 55	5 11	5 31	5 56	6 30
25	4 34	4 41	4 48	4 56	5 05	5 15	5 26	5 38	5 52	6 09	6 29	6 55	7 31	8 41
26	5 32	5 39	5 47	5 56	6 05	6 16	6 28	6 41	6 57	7 15	7 37	8 07	8 52	□
27	6 26	6 33	6 41	6 50	6 59	7 09	7 21	7 34	7 49	8 07	8 28	8 56	9 37	□
28	7 14	7 21	7 28	7 35	7 44	7 53	8 03	8 15	8 28	8 43	9 01	9 24	9 52	10 35
29	7 56	8 01	8 07	8 14	8 20	8 28	8 36	8 46	8 56	9 08	9 22	9 38	9 57	10 22
30	8 32	8 36	8 41	8 45	8 50	8 56	9 02	9 09	9 17	9 25	9 35	9 46	9 59	10 14
31	9 04	9 06	9 09	9 12	9 16	9 19	9 23	9 28	9 32	9 38	9 44	9 50	9 58	10 07
Feb. 1	9 33	9 34	9 35	9 37	9 38	9 40	9 42	9 44	9 46	9 48	9 51	9 54	9 57	10 01
2	10 01	10 01	10 00	10 00	10 00	9 59	9 59	9 58	9 58	9 57	9 57	9 56	9 55	9 55
3	10 29	10 27	10 25	10 23	10 21	10 19	10 16	10 13	10 10	10 07	10 03	9 59	9 54	9 48
4	10 59	10 56	10 53	10 49	10 45	10 40	10 35	10 30	10 24	10 18	10 10	10 02	9 52	9 41
5	11 33	11 29	11 23	11 18	11 12	11 06	10 58	10 51	10 42	10 32	10 21	10 07	9 52	9 33
6	12 13	12 07	12 00	11 53	11 46	11 37	11 28	11 17	11 06	10 52	10 36	10 17	9 53	9 21
7	13 00	12 53	12 45	12 37	12 28	12 18	12 07	11 54	11 40	11 23	11 02	10 36	10 00	8 48
8	13 55	13 48	13 39	13 31	13 21	13 10	12 58	12 44	12 28	12 10	11 46	11 15	10 26	■
9	14 57	14 50	14 42	14 34	14 24	14 14	14 02	13 49	13 34	13 16	12 54	12 25	11 41	■
10	16 03	15 57	15 50	15 43	15 35	15 26	15 16	15 04	14 51	14 36	14 18	13 56	13 27	12 43
11	17 11	17 06	17 00	16 54	16 48	16 41	16 33	16 24	16 14	16 03	15 50	15 34	15 15	14 51
12	18 18	18 14	18 10	18 05	18 01	17 56	17 50	17 44	17 37	17 29	17 20	17 10	16 58	16 43
13	19 22	19 19	19 17	19 14	19 11	19 08	19 05	19 01	18 57	18 52	18 47	18 41	18 34	18 25
14	20 24	20 23	20 22	20 21	20 19	20 18	20 17	20 15	20 14	20 12	20 10	20 07	20 05	20 02
15	21 24	21 24	21 25	21 25	21 25	21 26	21 26	21 27	21 28	21 29	21 30	21 31	21 33	21 34
16	22 23	22 25	22 27	22 29	22 31	22 33	22 36	22 39	22 42	22 46	22 50	22 54	22 59	23 06

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	8 53	8 54	8 54	8 55	8 55	8 56	8 56	8 57	8 58	8 58	8 59	9 00	9 00	9 01
16	10 06	10 01	9 57	9 54	9 52	9 49	9 45	9 42	9 39	9 36	9 32	9 28	9 26	9 24
17	11 18	11 08	11 00	10 53	10 48	10 43	10 34	10 27	10 20	10 13	10 06	9 58	9 53	9 47
18	12 30	12 15	12 03	11 53	11 44	11 37	11 24	11 12	11 02	10 52	10 41	10 28	10 21	10 13
19	13 43	13 22	13 06	12 52	12 41	12 31	12 14	12 00	11 46	11 32	11 18	11 01	10 52	10 41
20	14 55	14 29	14 09	13 52	13 39	13 27	13 06	12 49	12 32	12 16	11 58	11 39	11 27	11 14
21	16 05	15 34	15 10	14 52	14 36	14 23	14 00	13 40	13 21	13 03	12 43	12 21	12 08	11 52
22	17 07	16 34	16 09	15 49	15 32	15 18	14 54	14 33	14 13	13 54	13 33	13 09	12 55	12 38
23	17 58	17 26	17 01	16 42	16 26	16 11	15 47	15 27	15 07	14 48	14 27	14 03	13 49	13 32
24	18 37	18 09	17 47	17 29	17 14	17 01	16 39	16 20	16 02	15 44	15 25	15 02	14 49	14 34
25	19 06	18 43	18 25	18 11	17 58	17 47	17 29	17 12	16 57	16 41	16 25	16 06	15 55	15 42
26	19 28	19 11	18 58	18 47	18 38	18 29	18 15	18 02	17 50	17 39	17 26	17 11	17 03	16 53
27	19 45	19 35	19 26	19 19	19 13	19 08	18 59	18 50	18 43	18 35	18 27	18 17	18 12	18 05
28	20 00	19 55	19 52	19 49	19 46	19 44	19 40	19 37	19 34	19 30	19 27	19 23	19 21	19 18
Mar. 1	20 13	20 15	20 16	20 18	20 19	20 20	20 21	20 23	20 24	20 26	20 27	20 29	20 30	20 31
2	20 27	20 35	20 42	20 47	20 52	20 56	21 03	21 09	21 15	21 21	21 28	21 35	21 40	21 45
3	20 44	20 58	21 09	21 18	21 27	21 34	21 46	21 57	22 08	22 18	22 30	22 43	22 50	22 59
4	21 04	21 24	21 41	21 54	22 05	22 15	22 33	22 48	23 02	23 17	23 32	23 50	.. ..	.. ..
5	21 31	21 58	22 18	22 35	22 49	23 02	23 23	23 42	23 59	.. ..	.. ..	.. ..	0 01	0 13
6	22 09	22 41	23 05	23 24	23 40	23 54	.. ..	.. ..	.. ..	0 16	0 35	0 57	1 10	1 25
7	23 01	23 35	.. ..	.. ..	.. ..	.. ..	0 17	0 38	0 57	1 17	1 37	2 02	2 16	2 32
8	.. ..	.. ..	0 00	0 20	0 36	0 51	1 15	1 36	1 56	2 16	2 37	3 01	3 16	3 32
9	0 08	0 39	1 03	1 22	1 37	1 51	2 14	2 34	2 53	3 12	3 32	3 55	4 08	4 24
10	1 24	1 50	2 11	2 27	2 41	2 53	3 13	3 31	3 47	4 04	4 21	4 41	4 53	5 07
11	2 44	3 04	3 20	3 33	3 44	3 54	4 10	4 25	4 38	4 52	5 06	5 22	5 31	5 42

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	21 07	21 09	21 10	21 11	21 12	21 13	21 15	21 16	21 17	21 19	21 20	21 22	21 23	21 24
16	21 18	21 24	21 30	21 35	21 38	21 42	21 48	21 53	21 59	22 04	22 09	22 15	22 19	22 23
17	21 30	21 41	21 51	21 59	22 06	22 12	22 22	22 31	22 40	22 49	22 58	23 09	23 15	23 22
18	21 44	22 01	22 14	22 25	22 35	22 43	22 58	23 11	23 23	23 35	23 48	.. ..	.. ..	.. ..
19	22 02	22 24	22 41	22 56	23 08	23 18	23 37	23 53	.. ..	.. ..	.. ..	0 03	0 11	0 21
20	22 25	22 53	23 14	23 31	23 45	23 58	.. ..	.. ..	0 08	0 23	0 39	0 58	1 09	1 21
21	22 58	23 30	23 54	.. ..	.. ..	.. ..	0 19	0 38	0 56	1 13	1 32	1 54	2 06	2 21
22	23 44	.. ..	.. ..	0 13	0 29	0 43	1 06	1 27	1 46	2 05	2 26	2 49	3 03	3 19
23	.. ..	0 18	0 43	1 03	1 20	1 34	1 58	2 19	2 39	2 59	3 20	3 44	3 58	4 15
24	0 46	1 18	1 42	2 01	2 17	2 31	2 54	3 15	3 34	3 52	4 12	4 36	4 49	5 05
25	2 00	2 28	2 49	3 06	3 20	3 32	3 53	4 12	4 28	4 45	5 03	5 24	5 36	5 49
26	3 24	3 45	4 02	4 15	4 27	4 37	4 54	5 09	5 23	5 36	5 51	6 07	6 17	6 28
27	4 51	5 06	5 18	5 27	5 36	5 43	5 55	6 06	6 15	6 25	6 36	6 47	6 54	7 02
28	6 20	6 28	6 35	6 40	6 45	6 49	6 55	7 01	7 07	7 12	7 18	7 25	7 28	7 33
Mar. 1	7 50	7 51	7 52	7 53	7 54	7 55	7 56	7 57	7 58	7 58	7 59	8 00	8 01	8 02
2	9 19	9 14	9 10	9 06	9 03	9 01	8 56	8 52	8 48	8 44	8 40	8 36	8 33	8 30
3	10 49	10 37	10 28	10 20	10 13	10 07	9 57	9 48	9 40	9 32	9 23	9 13	9 07	9 00
4	12 20	12 01	11 46	11 34	11 24	11 15	10 59	10 46	10 33	10 21	10 08	9 52	9 44	9 34
5	13 48	13 23	13 03	12 47	12 34	12 22	12 02	11 45	11 29	11 13	10 56	10 36	10 25	10 12
6	15 10	14 39	14 16	13 57	13 42	13 28	13 05	12 45	12 27	12 08	11 48	11 25	11 12	10 57
7	16 20	15 46	15 21	15 01	14 45	14 31	14 06	13 45	13 25	13 06	12 44	12 20	12 06	11 49
8	17 13	16 41	16 17	15 58	15 41	15 27	15 04	14 43	14 23	14 04	13 43	13 19	13 05	12 48
9	17 50	17 23	17 02	16 45	16 30	16 18	15 56	15 37	15 19	15 02	14 43	14 20	14 07	13 52
10	18 17	17 55	17 38	17 24	17 12	17 01	16 43	16 27	16 12	15 57	15 41	15 22	15 11	14 59
11	18 36	18 20	18 07	17 57	17 47	17 39	17 25	17 13	17 01	16 50	16 37	16 23	16 14	16 05

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	9 01	9 01	9 01	9 01	9 02	9 02	9 02	9 03	9 03	9 03	9 04	9 04	9 05	9 06
16	9 24	9 23	9 22	9 20	9 19	9 18	9 16	9 14	9 13	9 11	9 08	9 06	9 03	9 00
17	9 47	9 45	9 43	9 40	9 37	9 34	9 31	9 27	9 23	9 18	9 13	9 07	9 01	8 53
18	10 13	10 09	10 05	10 01	9 57	9 52	9 47	9 41	9 35	9 27	9 19	9 10	8 59	8 47
19	10 41	10 36	10 31	10 26	10 20	10 13	10 06	9 58	9 49	9 39	9 28	9 14	8 58	8 39
20	11 14	11 08	11 01	10 55	10 47	10 39	10 30	10 20	10 08	9 55	9 40	9 22	8 59	8 29
21	11 52	11 46	11 38	11 30	11 21	11 12	11 01	10 49	10 35	10 19	10 00	9 36	9 04	8 11
22	12 38	12 31	12 23	12 14	12 05	11 54	11 43	11 29	11 14	10 56	10 33	10 04	9 20	□
23	13 32	13 25	13 17	13 08	12 59	12 48	12 37	12 23	12 08	11 49	11 26	10 56	10 10	□
24	14 34	14 27	14 20	14 12	14 03	13 54	13 43	13 31	13 17	13 00	12 40	12 15	11 41	10 37
25	15 42	15 36	15 30	15 23	15 16	15 08	14 59	14 49	14 38	14 25	14 10	13 51	13 28	12 57
26	16 53	16 49	16 44	16 39	16 33	16 27	16 21	16 14	16 05	15 56	15 46	15 33	15 19	15 01
27	18 05	18 03	18 00	17 56	17 53	17 49	17 45	17 41	17 36	17 30	17 24	17 16	17 08	16 58
28	19 18	19 17	19 16	19 15	19 13	19 12	19 10	19 08	19 06	19 04	19 02	18 59	18 56	18 52
Mar. 1	20 31	20 32	20 33	20 33	20 34	20 35	20 35	20 36	20 37	20 38	20 40	20 41	20 43	20 45
2	21 45	21 47	21 50	21 52	21 55	21 58	22 01	22 05	22 09	22 13	22 18	22 24	22 31	22 39
3	22 59	23 03	23 07	23 11	23 16	23 21	23 27	23 34	23 41	23 49	23 58	.. ..	.. ..	.. ..
4	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 09	0 22	0 37
5	0 13	0 18	0 24	0 30	0 37	0 45	0 53	1 02	1 13	1 25	1 39	1 56	2 16	2 44
6	1 25	1 31	1 38	1 46	1 55	2 04	2 15	2 27	2 40	2 57	3 16	3 40	4 13	5 09
7	2 32	2 40	2 48	2 56	3 06	3 17	3 29	3 42	3 58	4 17	4 40	5 11	6 01	■
8	3 32	3 40	3 48	3 57	4 07	4 17	4 30	4 43	4 59	5 19	5 42	6 14	7 04	■
9	4 24	4 31	4 38	4 47	4 55	5 05	5 16	5 29	5 43	6 00	6 20	6 46	7 20	8 24
10	5 07	5 13	5 19	5 26	5 34	5 42	5 51	6 01	6 13	6 26	6 42	7 00	7 24	7 54
11	5 42	5 47	5 52	5 57	6 03	6 10	6 17	6 25	6 33	6 43	6 55	7 08	7 23	7 42

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Feb. 15	21 24	21 24	21 25	21 25	21 26	21 26	21 27	21 28	21 28	21 29	21 30	21 31	21 33	21 34
16	22 23	22 25	22 27	22 29	22 31	22 33	22 36	22 39	22 42	22 46	22 50	22 54	22 59	23 06
17	23 22	23 25	23 28	23 32	23 36	23 40	23 45	23 50	23 55	.. ..	.. ..	.. ..	.. ..	.. ..
18	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 02	0 09	0 17	0 27	0 38
19	0 21	0 26	0 30	0 36	0 41	0 47	0 54	1 01	1 09	1 19	1 29	1 42	1 57	2 15
20	1 21	1 27	1 33	1 39	1 46	1 54	2 03	2 12	2 23	2 36	2 51	3 08	3 30	3 59
21	2 21	2 28	2 35	2 42	2 51	3 00	3 11	3 22	3 36	3 52	4 10	4 34	5 06	5 58
22	3 19	3 27	3 34	3 43	3 52	4 03	4 14	4 28	4 43	5 01	5 23	5 52	6 36	□
23	4 15	4 22	4 30	4 39	4 48	4 59	5 11	5 24	5 40	5 59	6 22	6 52	7 38	□
24	5 05	5 12	5 19	5 28	5 37	5 46	5 57	6 10	6 24	6 41	7 01	7 27	8 02	9 06
25	5 49	5 55	6 02	6 09	6 17	6 25	6 34	6 45	6 57	7 10	7 26	7 45	8 09	8 40
26	6 28	6 33	6 38	6 43	6 49	6 56	7 03	7 11	7 20	7 30	7 41	7 55	8 10	8 29
27	7 02	7 05	7 09	7 13	7 17	7 21	7 26	7 32	7 38	7 44	7 52	8 00	8 10	8 21
28	7 33	7 34	7 36	7 38	7 41	7 43	7 46	7 49	7 52	7 55	7 59	8 04	8 09	8 14
Mar. 1	8 02	8 02	8 02	8 02	8 03	8 03	8 03	8 04	8 04	8 05	8 05	8 06	8 07	8 08
2	8 30	8 29	8 28	8 26	8 25	8 23	8 21	8 19	8 17	8 14	8 11	8 08	8 05	8 01
3	9 00	8 58	8 55	8 51	8 48	8 44	8 40	8 35	8 30	8 25	8 18	8 11	8 03	7 53
4	9 34	9 29	9 25	9 20	9 14	9 08	9 02	8 54	8 46	8 37	8 27	8 15	8 02	7 45
5	10 12	10 06	10 00	9 53	9 46	9 38	9 29	9 19	9 08	8 55	8 40	8 23	8 01	7 33
6	10 57	10 50	10 42	10 34	10 25	10 16	10 05	9 52	9 38	9 22	9 02	8 38	8 04	7 07
7	11 49	11 41	11 33	11 24	11 15	11 04	10 52	10 38	10 22	10 03	9 40	9 08	8 19	■
8	12 48	12 41	12 33	12 24	12 14	12 04	11 52	11 38	11 22	11 03	10 39	10 08	9 17	■
9	13 52	13 46	13 38	13 30	13 22	13 12	13 01	12 49	12 35	12 19	11 59	11 34	11 00	9 56
10	14 59	14 53	14 47	14 40	14 33	14 25	14 17	14 07	13 56	13 43	13 28	13 10	12 48	12 18
11	16 05	16 00	15 56	15 51	15 45	15 40	15 33	15 26	15 18	15 09	14 58	14 46	14 31	14 14

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 9	0 08	0 39	1 03	1 22	1 37	1 51	2 14	2 34	2 53	3 12	3 32	3 55	4 08	4 24
10	1 24	1 50	2 11	2 27	2 41	2 53	3 13	3 31	3 47	4 04	4 21	4 41	4 53	5 07
11	2 44	3 04	3 20	3 33	3 44	3 54	4 10	4 25	4 38	4 52	5 06	5 22	5 31	5 42
12	4 03	4 18	4 29	4 38	4 46	4 53	5 05	5 16	5 26	5 36	5 46	5 58	6 05	6 12
13	5 21	5 29	5 36	5 42	5 46	5 51	5 58	6 04	6 10	6 16	6 23	6 30	6 34	6 39
14	6 36	6 39	6 41	6 43	6 45	6 46	6 49	6 51	6 53	6 55	6 57	7 00	7 01	7 03
15	7 50	7 47	7 45	7 43	7 42	7 40	7 38	7 36	7 34	7 33	7 31	7 29	7 27	7 26
16	9 02	8 54	8 48	8 43	8 38	8 34	8 27	8 21	8 15	8 10	8 04	7 57	7 54	7 49
17	10 15	10 02	9 51	9 42	9 34	9 28	9 16	9 06	8 57	8 48	8 38	8 27	8 21	8 14
18	11 28	11 09	10 54	10 42	10 31	10 22	10 06	9 53	9 40	9 28	9 14	8 59	8 50	8 40
19	12 41	12 16	11 57	11 41	11 28	11 17	10 58	10 41	10 25	10 10	9 53	9 34	9 24	9 11
20	13 51	13 22	12 59	12 41	12 26	12 12	11 50	11 31	11 13	10 55	10 36	10 14	10 01	9 47
21	14 56	14 23	13 58	13 38	13 22	13 07	12 43	12 22	12 03	11 44	11 23	10 59	10 45	10 29
22	15 51	15 18	14 52	14 32	14 15	14 01	13 36	13 15	12 55	12 35	12 14	11 50	11 35	11 18
23	16 35	16 03	15 40	15 21	15 05	14 51	14 28	14 08	13 49	13 30	13 09	12 46	12 32	12 16
24	17 07	16 41	16 21	16 04	15 50	15 38	15 17	14 59	14 43	14 26	14 07	13 46	13 34	13 20
25	17 31	17 11	16 55	16 42	16 31	16 21	16 04	15 50	15 36	15 22	15 07	14 50	14 40	14 29
26	17 49	17 36	17 25	17 16	17 08	17 01	16 49	16 38	16 28	16 18	16 08	15 56	15 48	15 40
27	18 04	17 57	17 51	17 46	17 42	17 38	17 31	17 26	17 20	17 15	17 09	17 02	16 58	16 54
28	18 18	18 17	18 16	18 15	18 15	18 14	18 13	18 12	18 12	18 11	18 10	18 09	18 09	18 08
29	18 32	18 37	18 41	18 45	18 48	18 51	18 55	19 00	19 04	19 08	19 12	19 17	19 20	19 23
30	18 47	18 59	19 08	19 16	19 23	19 29	19 39	19 48	19 57	20 06	20 15	20 26	20 33	20 40
31	19 06	19 24	19 39	19 51	20 01	20 10	20 26	20 40	20 53	21 06	21 20	21 36	21 46	21 57
Apr. 1	19 31	19 56	20 15	20 31	20 44	20 56	21 16	21 34	21 51	22 08	22 26	22 46	22 59	23 13
2	20 05	20 36	20 59	21 18	21 34	21 48	22 11	22 32	22 51	23 10	23 30	23 54	.. ..	.. ..

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 9	17 50	17 23	17 02	16 45	16 30	16 18	15 56	15 37	15 19	15 02	14 43	14 20	14 07	13 52
10	18 17	17 55	17 38	17 24	17 12	17 01	16 43	16 27	16 12	15 57	15 41	15 22	15 11	14 59
11	18 36	18 20	18 07	17 57	17 47	17 39	17 25	17 13	17 01	16 50	16 37	16 23	16 14	16 05
12	18 51	18 40	18 32	18 25	18 19	18 13	18 04	17 55	17 47	17 40	17 31	17 21	17 16	17 09
13	19 03	18 58	18 53	18 50	18 47	18 44	18 39	18 35	18 31	18 27	18 23	18 18	18 15	18 11
14	19 14	19 14	19 14	19 13	19 13	19 13	19 13	19 13	19 13	19 13	19 13	19 12	19 12	19 12
15	19 24	19 29	19 33	19 37	19 39	19 42	19 46	19 50	19 54	19 58	20 02	20 06	20 09	20 12
16	19 36	19 45	19 54	20 00	20 06	20 11	20 20	20 28	20 35	20 43	20 51	21 00	21 05	21 11
17	19 48	20 04	20 16	20 26	20 34	20 42	20 55	21 07	21 18	21 29	21 40	21 54	22 02	22 11
18	20 04	20 25	20 41	20 54	21 05	21 15	21 33	21 48	22 02	22 16	22 31	22 49	22 59	23 10
19	20 25	20 51	21 11	21 27	21 41	21 53	22 13	22 31	22 48	23 05	23 23	23 44	23 56	.. ..
20	20 53	21 24	21 47	22 06	22 21	22 35	22 58	23 18	23 37	23 56	.. ..	.. ..	.. ..	0 10
21	21 32	22 06	22 31	22 51	23 08	23 22	23 47	.. ..	.. ..	.. ..	0 16	0 39	0 53	1 09
22	22 26	23 00	23 25	23 45	.. ..	.. ..	.. ..	0 08	0 28	0 48	1 09	1 33	1 48	2 04
23	23 34	.. ..	.. ..	.. ..	0 01	0 16	0 40	1 01	1 21	1 40	2 01	2 25	2 39	2 56
24	.. ..	0 04	0 27	0 46	1 01	1 14	1 37	1 56	2 14	2 33	2 52	3 14	3 27	3 42
25	0 53	1 17	1 37	1 52	2 05	2 17	2 36	2 53	3 08	3 24	3 40	3 59	4 10	4 22
26	2 18	2 36	2 51	3 03	3 12	3 21	3 36	3 49	4 01	4 13	4 26	4 40	4 48	4 58
27	3 47	3 58	4 08	4 15	4 21	4 27	4 37	4 45	4 53	5 01	5 09	5 18	5 23	5 29
28	5 17	5 22	5 26	5 29	5 31	5 34	5 38	5 41	5 44	5 48	5 51	5 55	5 57	5 59
29	6 49	6 47	6 45	6 44	6 42	6 41	6 39	6 38	6 36	6 34	6 33	6 31	6 29	6 28
30	8 22	8 13	8 06	8 00	7 54	7 50	7 42	7 35	7 29	7 22	7 15	7 08	7 03	6 58
31	9 56	9 40	9 27	9 17	9 08	9 00	8 46	8 34	8 23	8 12	8 01	7 47	7 40	7 31
Apr. 1	11 30	11 06	10 48	10 33	10 21	10 10	9 51	9 35	9 20	9 05	8 49	8 31	8 20	8 08
2	12 58	12 28	12 06	11 47	11 32	11 19	10 57	10 37	10 19	10 01	9 42	9 20	9 07	8 52

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 9	4 24	4 31	4 38	4 47	4 55	5 05	5 16	5 29	5 43	6 00	6 20	6 46	7 20	8 24
10	5 07	5 13	5 19	5 26	5 34	5 42	5 51	6 01	6 13	6 26	6 42	7 00	7 24	7 54
11	5 42	5 47	5 52	5 57	6 03	6 10	6 17	6 25	6 33	6 43	6 55	7 08	7 23	7 42
12	6 12	6 16	6 19	6 23	6 27	6 32	6 37	6 42	6 49	6 55	7 03	7 12	7 22	7 33
13	6 39	6 41	6 43	6 45	6 48	6 51	6 54	6 57	7 00	7 04	7 09	7 14	7 19	7 26
14	7 03	7 04	7 04	7 05	7 06	7 07	7 08	7 09	7 10	7 12	7 13	7 15	7 17	7 19
15	7 26	7 25	7 25	7 24	7 23	7 23	7 22	7 21	7 20	7 19	7 17	7 16	7 15	7 13
16	7 49	7 47	7 45	7 43	7 41	7 38	7 36	7 33	7 29	7 26	7 22	7 17	7 12	7 06
17	8 14	8 11	8 07	8 04	8 00	7 55	7 51	7 46	7 40	7 34	7 27	7 19	7 10	6 59
18	8 40	8 36	8 31	8 26	8 21	8 15	8 08	8 01	7 53	7 44	7 34	7 22	7 08	6 51
19	9 11	9 05	8 59	8 53	8 46	8 38	8 30	8 20	8 10	7 58	7 44	7 27	7 07	6 41
20	9 47	9 40	9 33	9 25	9 17	9 08	8 57	8 46	8 33	8 18	8 00	7 37	7 08	6 25
21	10 29	10 21	10 14	10 05	9 56	9 45	9 34	9 21	9 05	8 47	8 25	7 57	7 15	□
22	11 18	11 11	11 03	10 54	10 44	10 33	10 21	10 07	9 51	9 32	9 08	8 36	7 45	□
23	12 16	12 09	12 01	11 52	11 43	11 33	11 21	11 08	10 53	10 35	10 13	9 44	9 01	□
24	13 20	13 13	13 07	12 59	12 51	12 42	12 32	12 21	12 08	11 53	11 35	11 13	10 44	10 00
25	14 29	14 23	14 18	14 12	14 06	13 59	13 51	13 42	13 32	13 21	13 08	12 53	12 34	12 10
26	15 40	15 37	15 33	15 29	15 24	15 19	15 14	15 08	15 01	14 54	14 45	14 36	14 24	14 10
27	16 54	16 52	16 50	16 47	16 45	16 42	16 39	16 36	16 33	16 29	16 24	16 19	16 14	16 07
28	18 08	18 08	18 07	18 07	18 07	18 07	18 06	18 06	18 05	18 05	18 04	18 04	18 03	18 02
29	19 23	19 25	19 26	19 28	19 30	19 32	19 34	19 37	19 39	19 42	19 46	19 49	19 54	19 59
30	20 40	20 43	20 47	20 50	20 54	20 59	21 04	21 09	21 15	21 22	21 29	21 38	21 48	22 00
31	21 57	22 02	22 07	22 13	22 19	22 26	22 33	22 42	22 51	23 02	23 14	23 29	23 47	.. ..
Apr. 1	23 13	23 19	23 26	23 34	23 42	23 51	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 09
2	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 01	0 12	0 25	0 40	0 58	1 20	1 49	2 34

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Mar. 9	13 52	13 46	13 38	13 30	13 22	13 12	13 01	12 49	12 35	12 19	11 59	11 34	11 00	9 56
10	14 59	14 53	14 47	14 40	14 33	14 25	14 17	14 07	13 56	13 43	13 28	13 10	12 48	12 18
11	16 05	16 00	15 56	15 51	15 45	15 40	15 33	15 26	15 18	15 09	14 58	14 46	14 31	14 14
12	17 09	17 06	17 03	17 00	16 56	16 52	16 48	16 43	16 38	16 32	16 26	16 18	16 09	15 59
13	18 11	18 10	18 08	18 07	18 05	18 03	18 01	17 58	17 56	17 53	17 50	17 46	17 42	17 37
14	19 12	19 12	19 12	19 12	19 12	19 12	19 12	19 12	19 11	19 11	19 11	19 11	19 11	19 11
15	20 12	20 13	20 15	20 16	20 18	20 19	20 21	20 23	20 26	20 28	20 31	20 35	20 38	20 43
16	21 11	21 14	21 17	21 20	21 23	21 27	21 31	21 35	21 40	21 45	21 51	21 58	22 06	22 16
17	22 11	22 15	22 19	22 24	22 29	22 34	22 40	22 46	22 54	23 02	23 12	23 23	23 36	23 52
18	23 10	23 16	23 21	23 27	23 34	23 41	23 49	23 58	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
19	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 08	0 20	0 33	0 49	1 08	1 33
20	0 10	0 16	0 23	0 31	0 39	0 48	0 58	1 09	1 21	1 36	1 54	2 16	2 44	3 27
21	1 09	1 16	1 23	1 32	1 41	1 51	2 03	2 16	2 31	2 48	3 10	3 38	4 20	□
22	2 04	2 12	2 20	2 29	2 39	2 49	3 02	3 15	3 31	3 51	4 14	4 46	5 38	□
23	2 56	3 03	3 11	3 20	3 29	3 40	3 51	4 05	4 20	4 38	5 01	5 30	6 13	□
24	3 42	3 48	3 56	4 03	4 12	4 21	4 31	4 43	4 56	5 12	5 30	5 53	6 22	7 07
25	4 22	4 28	4 34	4 40	4 47	4 54	5 03	5 12	5 23	5 34	5 48	6 04	6 24	6 49
26	4 58	5 02	5 06	5 11	5 16	5 22	5 28	5 34	5 42	5 50	6 00	6 11	6 23	6 38
27	5 29	5 32	5 35	5 38	5 41	5 45	5 48	5 52	5 57	6 02	6 08	6 14	6 21	6 30
28	5 59	6 00	6 01	6 02	6 04	6 05	6 07	6 08	6 10	6 12	6 14	6 16	6 19	6 22
29	6 28	6 28	6 27	6 26	6 26	6 25	6 24	6 23	6 22	6 21	6 20	6 18	6 17	6 15
30	6 58	6 56	6 54	6 51	6 48	6 45	6 42	6 39	6 35	6 31	6 26	6 20	6 14	6 07
31	7 31	7 27	7 23	7 18	7 14	7 09	7 03	6 57	6 50	6 42	6 34	6 24	6 12	5 58
Apr. 1	8 08	8 03	7 57	7 51	7 44	7 37	7 28	7 19	7 09	6 58	6 45	6 29	6 10	5 47
2	8 52	8 45	8 38	8 30	8 22	8 12	8 02	7 50	7 37	7 21	7 03	6 40	6 10	5 25

□ indicates Moon continuously above horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	19 31	19 56	20 15	20 31	20 44	20 56	21 16	21 34	21 51	22 08	22 26	22 46	22 59	23 13
2	20 05	20 36	20 59	21 18	21 34	21 48	22 11	22 32	22 51	23 10	23 30	23 54	.. ..	.. ..
3	20 54	21 28	21 53	22 13	22 30	22 44	23 09	23 31	23 51	.. ..	.. ..	.. ..	0 08	0 25
4	21 57	22 30	22 55	23 14	23 31	23 45	.. ..	.. ..	.. ..	0 11	0 32	0 57	1 12	1 29
5	23 12	23 40	.. ..	.. ..	.. ..	.. ..	0 09	0 30	0 49	1 08	1 29	1 53	2 07	2 23
6	.. ..	.. ..	0 02	0 19	0 34	0 47	1 08	1 27	1 44	2 02	2 20	2 42	2 54	3 08
7	0 31	0 53	1 11	1 25	1 37	1 48	2 06	2 21	2 36	2 50	3 06	3 23	3 34	3 45
8	1 50	2 07	2 20	2 30	2 39	2 47	3 01	3 13	3 24	3 35	3 47	4 00	4 08	4 16
9	3 08	3 18	3 26	3 33	3 39	3 44	3 53	4 01	4 09	4 16	4 24	4 32	4 37	4 43
10	4 23	4 28	4 31	4 35	4 37	4 40	4 44	4 48	4 51	4 55	4 58	5 02	5 05	5 07
11	5 36	5 36	5 35	5 35	5 34	5 34	5 33	5 33	5 32	5 32	5 31	5 31	5 31	5 30
12	6 49	6 43	6 38	6 34	6 30	6 27	6 22	6 17	6 13	6 09	6 04	5 59	5 56	5 53
13	8 02	7 50	7 41	7 33	7 27	7 21	7 11	7 02	6 54	6 46	6 38	6 28	6 23	6 17
14	9 15	8 58	8 44	8 33	8 23	8 15	8 01	7 48	7 37	7 25	7 13	6 59	6 51	6 42
15	10 29	10 05	9 48	9 33	9 21	9 10	8 52	8 36	8 21	8 07	7 51	7 33	7 23	7 11
16	11 41	11 12	10 50	10 33	10 18	10 05	9 44	9 25	9 08	8 51	8 32	8 11	7 59	7 45
17	12 48	12 15	11 50	11 31	11 14	11 00	10 36	10 16	9 57	9 38	9 17	8 54	8 40	8 24
18	13 46	13 12	12 46	12 26	12 09	11 54	11 29	11 07	10 47	10 28	10 06	9 41	9 27	9 10
19	14 33	14 00	13 35	13 15	12 59	12 45	12 20	11 59	11 40	11 20	10 59	10 34	10 20	10 03
20	15 08	14 40	14 18	14 00	13 45	13 32	13 09	12 50	12 32	12 14	11 54	11 32	11 19	11 03
21	15 34	15 11	14 53	14 38	14 26	14 15	13 56	13 40	13 24	13 09	12 52	12 33	12 22	12 09
22	15 54	15 37	15 24	15 13	15 03	14 55	14 40	14 27	14 15	14 03	13 51	13 36	13 27	13 17
23	16 10	15 59	15 51	15 43	15 37	15 32	15 22	15 14	15 06	14 58	14 50	14 40	14 34	14 28
24	16 23	16 19	16 15	16 12	16 10	16 07	16 03	16 00	15 57	15 53	15 50	15 46	15 43	15 41
25	16 37	16 38	16 40	16 41	16 42	16 43	16 45	16 46	16 48	16 49	16 51	16 53	16 54	16 55

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	11 30	11 06	10 48	10 33	10 21	10 10	9 51	9 35	9 20	9 05	8 49	8 31	8 20	8 08
2	12 58	12 28	12 06	11 47	11 32	11 19	10 57	10 37	10 19	10 01	9 42	9 20	9 07	8 52
3	14 15	13 41	13 16	12 56	12 39	12 25	12 00	11 39	11 19	11 00	10 38	10 14	9 59	9 43
4	15 13	14 40	14 15	13 55	13 39	13 24	13 00	12 39	12 19	11 59	11 38	11 13	10 58	10 41
5	15 55	15 26	15 03	14 45	14 30	14 17	13 54	13 34	13 16	12 57	12 37	12 14	12 01	11 45
6	16 24	16 00	15 42	15 26	15 13	15 02	14 43	14 26	14 09	13 53	13 36	13 16	13 04	12 51
7	16 44	16 26	16 12	16 00	15 50	15 41	15 26	15 12	14 59	14 46	14 33	14 17	14 07	13 57
8	17 00	16 47	16 37	16 29	16 22	16 16	16 05	15 55	15 46	15 36	15 26	15 15	15 08	15 01
9	17 12	17 05	16 59	16 54	16 50	16 47	16 40	16 35	16 29	16 24	16 18	16 11	16 07	16 03
10	17 23	17 21	17 19	17 18	17 17	17 16	17 14	17 13	17 11	17 10	17 08	17 06	17 05	17 04
11	17 33	17 36	17 39	17 41	17 43	17 44	17 47	17 50	17 52	17 54	17 57	18 00	18 01	18 03
12	17 43	17 51	17 58	18 04	18 09	18 13	18 20	18 27	18 33	18 39	18 46	18 53	18 58	19 03
13	17 55	18 08	18 19	18 28	18 36	18 43	18 55	19 05	19 15	19 25	19 35	19 47	19 54	20 02
14	18 09	18 28	18 43	18 55	19 06	19 15	19 31	19 45	19 58	20 11	20 25	20 42	20 51	21 02
15	18 28	18 52	19 11	19 26	19 39	19 51	20 10	20 27	20 43	21 00	21 17	21 37	21 48	22 02
16	18 52	19 22	19 44	20 02	20 17	20 31	20 53	21 13	21 31	21 50	22 09	22 32	22 45	23 01
17	19 27	20 00	20 25	20 45	21 01	21 16	21 40	22 01	22 21	22 41	23 02	23 26	23 41	23 57
18	20 14	20 48	21 14	21 34	21 51	22 06	22 31	22 52	23 12	23 32	23 54	.. ..	.. ..	.. ..
19	21 15	21 47	22 12	22 31	22 47	23 01	23 25	23 46	.. ..	.. ..	.. ..	0 19	0 33	0 50
20	22 28	22 56	23 17	23 34	23 48	.. ..	.. ..	.. ..	0 05	0 24	0 44	1 07	1 21	1 37
21	23 49	.. ..	.. ..	.. ..	.. ..	0 01	0 22	0 40	0 57	1 14	1 32	1 53	2 05	2 18
22	.. ..	0 10	0 27	0 41	0 53	1 03	1 20	1 35	1 49	2 03	2 17	2 34	2 43	2 54
23	1 14	1 29	1 41	1 51	1 59	2 06	2 19	2 30	2 40	2 50	3 00	3 12	3 19	3 27
24	2 42	2 50	2 57	3 02	3 07	3 11	3 18	3 24	3 30	3 36	3 42	3 48	3 52	3 56
25	4 12	4 14	4 15	4 16	4 17	4 17	4 19	4 20	4 21	4 22	4 23	4 24	4 24	4 25

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

41

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	23 13	23 19	23 26	23 34	23 42	23 51	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 09
2	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 01	0 12	0 25	0 40	0 58	1 20	1 49	2 34
3	0 25	0 32	0 40	0 49	0 58	1 09	1 20	1 34	1 50	2 08	2 31	3 02	3 50	■
4	1 29	1 36	1 45	1 54	2 04	2 15	2 27	2 41	2 58	3 18	3 43	4 17	5 17	■
5	2 23	2 31	2 38	2 47	2 56	3 07	3 19	3 32	3 47	4 05	4 27	4 55	5 37	■
6	3 08	3 15	3 22	3 29	3 37	3 46	3 56	4 07	4 20	4 34	4 52	5 13	5 39	6 17
7	3 45	3 51	3 56	4 02	4 09	4 16	4 24	4 32	4 42	4 53	5 06	5 21	5 38	6 01
8	4 16	4 20	4 24	4 29	4 34	4 39	4 45	4 51	4 58	5 06	5 14	5 24	5 36	5 50
9	4 43	4 46	4 48	4 51	4 54	4 58	5 01	5 05	5 10	5 15	5 20	5 26	5 34	5 42
10	5 07	5 09	5 10	5 11	5 13	5 14	5 16	5 18	5 20	5 22	5 25	5 27	5 31	5 34
11	5 30	5 30	5 30	5 30	5 30	5 30	5 29	5 29	5 29	5 29	5 28	5 28	5 28	5 27
12	5 53	5 52	5 50	5 48	5 47	5 45	5 43	5 40	5 38	5 35	5 32	5 29	5 25	5 20
13	6 17	6 14	6 11	6 08	6 05	6 01	5 57	5 53	5 48	5 43	5 37	5 30	5 22	5 13
14	6 42	6 38	6 34	6 29	6 24	6 19	6 13	6 07	5 59	5 51	5 42	5 32	5 19	5 05
15	7 11	7 06	7 00	6 54	6 48	6 41	6 33	6 24	6 14	6 03	5 50	5 35	5 17	4 55
16	7 45	7 38	7 31	7 24	7 16	7 07	6 58	6 47	6 34	6 20	6 03	5 43	5 16	4 40
17	8 24	8 17	8 09	8 01	7 51	7 41	7 30	7 17	7 02	6 45	6 24	5 57	5 19	□
18	9 10	9 02	8 54	8 45	8 35	8 25	8 12	7 58	7 42	7 23	6 59	6 26	5 32	□
19	10 03	9 56	9 48	9 39	9 29	9 18	9 06	8 53	8 36	8 17	7 53	7 22	6 29	□
20	11 03	10 57	10 49	10 41	10 32	10 23	10 12	9 59	9 45	9 28	9 08	8 42	8 06	6 53
21	12 09	12 03	11 57	11 50	11 42	11 34	11 25	11 15	11 04	10 51	10 35	10 17	9 53	9 22
22	13 17	13 13	13 08	13 03	12 57	12 51	12 45	12 37	12 29	12 20	12 09	11 57	11 42	11 23
23	14 28	14 25	14 22	14 19	14 15	14 12	14 07	14 03	13 58	13 52	13 45	13 38	13 29	13 19
24	15 41	15 40	15 38	15 37	15 35	15 34	15 32	15 30	15 28	15 26	15 23	15 20	15 17	15 13
25	16 55	16 56	16 56	16 57	16 58	16 58	16 59	17 00	17 01	17 02	17 03	17 05	17 07	17 08

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 1	8 08	8 03	7 57	7 51	7 44	7 37	7 28	7 19	7 09	6 58	6 45	6 29	6 10	5 47
2	8 52	8 45	8 38	8 30	8 22	8 12	8 02	7 50	7 37	7 21	7 03	6 40	6 10	5 25
3	9 43	9 35	9 27	9 18	9 09	8 58	8 46	8 32	8 16	7 57	7 34	7 03	6 15	■
4	10 41	10 34	10 25	10 16	10 06	9 55	9 43	9 29	9 12	8 52	8 27	7 54	6 54	■
5	11 45	11 38	11 30	11 22	11 12	11 02	10 51	10 38	10 23	10 05	9 44	9 15	8 34	■
6	12 51	12 45	12 38	12 31	12 23	12 15	12 05	11 55	11 42	11 28	11 12	10 51	10 25	9 48
7	13 57	13 52	13 47	13 41	13 35	13 28	13 21	13 13	13 04	12 54	12 42	12 28	12 11	11 50
8	15 01	14 57	14 54	14 50	14 46	14 41	14 36	14 31	14 24	14 17	14 10	14 00	13 50	13 37
9	16 03	16 01	15 59	15 57	15 54	15 52	15 49	15 46	15 42	15 38	15 34	15 29	15 23	15 16
10	17 04	17 03	17 03	17 02	17 01	17 00	17 00	16 59	16 58	16 57	16 55	16 54	16 52	16 51
11	18 03	18 04	18 05	18 06	18 07	18 08	18 09	18 11	18 12	18 14	18 16	18 18	18 20	18 23
12	19 03	19 05	19 07	19 10	19 12	19 15	19 19	19 22	19 26	19 30	19 35	19 41	19 48	19 55
13	20 02	20 06	20 09	20 14	20 18	20 23	20 28	20 34	20 40	20 48	20 56	21 06	21 17	21 30
14	21 02	21 07	21 12	21 18	21 24	21 30	21 38	21 46	21 55	22 06	22 18	22 32	22 49	23 11
15	22 02	22 08	22 14	22 21	22 29	22 38	22 47	22 57	23 09	23 23	23 40	.. ..	.. ..	.. ..
16	23 01	23 08	23 15	23 24	23 32	23 42	23 54	.. ..	.. ..	.. ..	.. ..	0 00	0 25	1 01
17	23 57	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 06	0 21	0 38	0 59	1 25	2 03	□
18	.. ..	0 05	0 13	0 22	0 32	0 43	0 55	1 09	1 25	1 44	2 08	2 40	3 34	□
19	0 50	0 57	1 06	1 15	1 24	1 35	1 47	2 01	2 17	2 37	3 01	3 33	4 25	□
20	1 37	1 44	1 52	2 00	2 09	2 19	2 30	2 43	2 57	3 14	3 35	4 01	4 38	5 51
21	2 18	2 24	2 31	2 38	2 46	2 54	3 04	3 14	3 26	3 40	3 56	4 15	4 39	5 12
22	2 54	2 59	3 05	3 10	3 16	3 23	3 30	3 38	3 47	3 57	4 09	4 22	4 38	4 58
23	3 27	3 30	3 34	3 38	3 42	3 46	3 51	3 57	4 03	4 10	4 17	4 26	4 36	4 48
24	3 56	3 58	4 00	4 02	4 05	4 07	4 10	4 13	4 16	4 20	4 24	4 28	4 33	4 39
25	4 25	4 25	4 25	4 26	4 26	4 27	4 27	4 27	4 28	4 28	4 29	4 30	4 30	4 31

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 24	16 23	16 19	16 15	16 12	16 10	16 07	16 03	16 00	15 57	15 53	15 50	15 46	15 43	15 41
25	16 37	16 38	16 40	16 41	16 42	16 43	16 45	16 46	16 48	16 49	16 51	16 53	16 54	16 55
26	16 51	16 59	17 05	17 11	17 16	17 20	17 28	17 34	17 41	17 47	17 54	18 02	18 06	18 12
27	17 07	17 22	17 34	17 44	17 53	18 00	18 14	18 25	18 36	18 47	18 59	19 13	19 21	19 30
28	17 29	17 51	18 08	18 22	18 35	18 45	19 04	19 20	19 35	19 50	20 07	20 26	20 37	20 50
29	17 59	18 28	18 50	19 08	19 23	19 36	19 58	20 18	20 36	20 55	21 15	21 38	21 51	22 07
30	18 43	19 16	19 42	20 02	20 18	20 33	20 57	21 19	21 39	21 59	22 20	22 45	23 00	23 17
May 1	19 43	20 17	20 42	21 03	21 20	21 34	21 59	22 20	22 40	23 00	23 22	23 46	.. ..	.. ..
2	20 56	21 27	21 50	22 09	22 24	22 38	23 01	23 20	23 39	23 57	.. ..	.. ..	0 01	0 18
3	22 17	22 42	23 01	23 16	23 29	23 41	.. ..	.. ..	.. ..	.. ..	0 17	0 39	0 52	1 08
4	23 38	23 56	.. ..	.. ..	.. ..	.. ..	0 00	0 17	0 33	0 48	1 05	1 24	1 35	1 48
5	.. ..	.. ..	0 11	0 23	0 33	0 41	0 57	1 10	1 22	1 34	1 48	2 02	2 11	2 21
6	0 56	1 09	1 18	1 27	1 33	1 40	1 50	1 59	2 08	2 17	2 26	2 36	2 42	2 49
7	2 12	2 19	2 24	2 28	2 32	2 35	2 41	2 46	2 51	2 56	3 01	3 06	3 10	3 13
8	3 26	3 27	3 27	3 28	3 29	3 29	3 30	3 31	3 32	3 33	3 34	3 35	3 35	3 36
9	4 38	4 34	4 30	4 27	4 25	4 23	4 19	4 16	4 13	4 10	4 06	4 03	4 01	3 58
10	5 50	5 41	5 33	5 26	5 21	5 16	5 08	5 00	4 53	4 47	4 39	4 31	4 27	4 21
11	7 04	6 48	6 36	6 26	6 17	6 10	5 57	5 46	5 35	5 25	5 14	5 01	4 54	4 46
12	8 17	7 56	7 39	7 26	7 14	7 04	6 47	6 33	6 19	6 05	5 51	5 34	5 24	5 14
13	9 30	9 03	8 43	8 26	8 12	8 00	7 39	7 21	7 05	6 48	6 31	6 10	5 59	5 45
14	10 40	10 08	9 44	9 25	9 09	8 55	8 32	8 12	7 53	7 34	7 14	6 51	6 38	6 22
15	11 42	11 07	10 41	10 21	10 04	9 49	9 25	9 03	8 43	8 23	8 02	7 37	7 23	7 06
16	12 32	11 58	11 33	11 12	10 56	10 41	10 16	9 55	9 35	9 15	8 53	8 28	8 14	7 57
17	13 11	12 40	12 17	11 58	11 42	11 29	11 05	10 45	10 26	10 08	9 47	9 24	9 10	8 54
18	13 39	13 14	12 54	12 38	12 24	12 12	11 52	11 34	11 18	11 01	10 43	10 22	10 10	9 56

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 24	2 42	2 50	2 57	3 02	3 07	3 11	3 18	3 24	3 30	3 36	3 42	3 48	3 52	3 56
25	4 12	4 14	4 15	4 16	4 17	4 17	4 19	4 20	4 21	4 22	4 23	4 24	4 24	4 25
26	5 45	5 39	5 35	5 31	5 28	5 25	5 21	5 16	5 12	5 09	5 04	5 00	4 57	4 54
27	7 20	7 07	6 57	6 49	6 42	6 35	6 25	6 15	6 07	5 58	5 49	5 38	5 32	5 25
28	8 57	8 37	8 21	8 08	7 57	7 47	7 31	7 17	7 04	6 50	6 36	6 20	6 11	6 00
29	10 32	10 05	9 44	9 27	9 12	9 00	8 39	8 21	8 04	7 47	7 29	7 08	6 56	6 42
30	11 58	11 25	11 01	10 41	10 25	10 10	9 46	9 25	9 06	8 47	8 26	8 02	7 48	7 32
May 1	13 07	12 33	12 07	11 47	11 30	11 15	10 50	10 29	10 08	9 48	9 27	9 01	8 47	8 29
2	13 57	13 25	13 01	12 42	12 26	12 12	11 49	11 28	11 09	10 49	10 28	10 04	9 50	9 34
3	14 30	14 04	13 44	13 27	13 13	13 01	12 40	12 22	12 05	11 48	11 29	11 08	10 55	10 41
4	14 53	14 33	14 17	14 04	13 53	13 43	13 26	13 11	12 57	12 43	12 28	12 10	12 00	11 48
5	15 09	14 55	14 44	14 34	14 26	14 19	14 06	13 55	13 45	13 34	13 23	13 10	13 02	12 54
6	15 22	15 13	15 06	15 00	14 55	14 50	14 43	14 35	14 29	14 22	14 15	14 07	14 02	13 56
7	15 33	15 29	15 26	15 24	15 22	15 20	15 17	15 14	15 11	15 08	15 05	15 02	15 00	14 57
8	15 43	15 44	15 45	15 46	15 47	15 48	15 49	15 51	15 52	15 53	15 54	15 55	15 56	15 57
9	15 53	15 59	16 04	16 09	16 13	16 16	16 22	16 27	16 32	16 37	16 42	16 48	16 52	16 56
10	16 04	16 15	16 25	16 32	16 39	16 45	16 56	17 05	17 13	17 22	17 31	17 42	17 48	17 55
11	16 17	16 34	16 47	16 58	17 08	17 16	17 31	17 44	17 56	18 08	18 21	18 36	18 45	18 55
12	16 33	16 56	17 13	17 28	17 40	17 51	18 09	18 26	18 41	18 56	19 12	19 31	19 42	19 55
13	16 55	17 23	17 45	18 02	18 17	18 29	18 51	19 10	19 28	19 46	20 05	20 27	20 40	20 55
14	17 26	17 58	18 23	18 42	18 59	19 13	19 37	19 58	20 17	20 36	20 57	21 22	21 36	21 52
15	18 08	18 43	19 09	19 29	19 46	20 01	20 26	20 48	21 08	21 28	21 50	22 14	22 29	22 46
16	19 04	19 38	20 03	20 23	20 40	20 54	21 19	21 40	22 00	22 19	22 40	23 04	23 18	23 35
17	20 13	20 43	21 05	21 23	21 38	21 52	22 14	22 33	22 51	23 09	23 28	23 50	.. ..	.. ..
18	21 29	21 54	22 12	22 27	22 40	22 51	23 10	23 27	23 42	23 57	.. ..	.. ..	0 03	0 17

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 24	15 41	15 40	15 38	15 37	15 35	15 34	15 32	15 30	15 28	15 26	15 23	15 20	15 17	15 13
25	16 55	16 56	16 56	16 57	16 58	16 58	16 59	17 00	17 01	17 02	17 03	17 05	17 07	17 08
26	18 12	18 14	18 17	18 19	18 22	18 25	18 29	18 33	18 37	18 41	18 47	18 53	19 00	19 08
27	19 30	19 34	19 39	19 44	19 49	19 54	20 01	20 07	20 15	20 24	20 34	20 46	20 59	21 16
28	20 50	20 55	21 02	21 08	21 16	21 24	21 33	21 43	21 54	22 07	22 23	22 42	23 05	23 37
29	22 07	22 14	22 21	22 30	22 39	22 49	23 00	23 13	23 28	23 46	.. ..	.. ..	.. ..	■
30	23 17	23 25	23 33	23 43	23 53	.. ..	.. ..	.. ..	.. ..	.. ..	0 07	0 35	1 15	■
May 1	.. ..	.. ..	.. ..	.. ..	.. ..	0 04	0 16	0 31	0 48	1 08	1 33	2 08	3 14	■
2	0 18	0 26	0 34	0 43	0 53	1 03	1 16	1 30	1 46	2 05	2 29	3 01	3 54	■
3	1 08	1 14	1 22	1 30	1 39	1 48	1 59	2 11	2 25	2 41	3 00	3 24	3 56	4 47
4	1 48	1 54	2 00	2 06	2 13	2 21	2 30	2 39	2 50	3 02	3 17	3 33	3 54	4 21
5	2 21	2 25	2 30	2 35	2 40	2 46	2 52	2 59	3 07	3 16	3 26	3 38	3 51	4 08
6	2 49	2 52	2 55	2 58	3 02	3 06	3 10	3 15	3 20	3 26	3 32	3 40	3 48	3 58
7	3 13	3 15	3 17	3 18	3 20	3 23	3 25	3 27	3 30	3 33	3 37	3 41	3 45	3 50
8	3 36	3 36	3 37	3 37	3 37	3 38	3 38	3 39	3 39	3 40	3 40	3 41	3 42	3 43
9	3 58	3 57	3 56	3 55	3 54	3 53	3 51	3 50	3 48	3 46	3 44	3 41	3 39	3 36
10	4 21	4 19	4 17	4 14	4 11	4 08	4 05	4 01	3 57	3 53	3 48	3 42	3 36	3 28
11	4 46	4 42	4 39	4 34	4 30	4 25	4 20	4 14	4 08	4 01	3 53	3 43	3 33	3 20
12	5 14	5 09	5 03	4 58	4 52	4 45	4 38	4 30	4 21	4 11	3 59	3 46	3 30	3 11
13	5 45	5 39	5 33	5 26	5 18	5 10	5 01	4 50	4 39	4 26	4 10	3 51	3 28	2 57
14	6 22	6 15	6 08	6 00	5 51	5 41	5 30	5 18	5 04	4 47	4 27	4 02	3 28	2 27
15	7 06	6 59	6 50	6 42	6 32	6 21	6 09	5 55	5 39	5 20	4 56	4 25	3 34	□
16	7 57	7 49	7 41	7 32	7 22	7 11	6 59	6 45	6 28	6 08	5 44	5 10	4 11	□
17	8 54	8 47	8 39	8 31	8 21	8 11	8 00	7 47	7 31	7 13	6 51	6 23	5 40	□
18	9 56	9 50	9 43	9 36	9 28	9 19	9 09	8 58	8 46	8 31	8 14	7 52	7 25	6 44

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Apr. 24	3 56	3 58	4 00	4 02	4 05	4 07	4 10	4 13	4 16	4 20	4 24	4 28	4 33	4 39
25	4 25	4 25	4 25	4 26	4 26	4 27	4 27	4 27	4 28	4 28	4 29	4 30	4 30	4 31
26	4 54	4 53	4 51	4 50	4 48	4 46	4 44	4 42	4 40	4 37	4 34	4 31	4 27	4 23
27	5 25	5 22	5 19	5 15	5 12	5 08	5 03	4 58	4 53	4 47	4 41	4 33	4 24	4 14
28	6 00	5 56	5 51	5 45	5 40	5 33	5 26	5 19	5 10	5 00	4 49	4 37	4 22	4 03
29	6 42	6 36	6 29	6 22	6 14	6 06	5 56	5 46	5 33	5 20	5 03	4 44	4 19	3 47
30	7 32	7 24	7 16	7 08	6 58	6 48	6 36	6 23	6 08	5 50	5 28	5 00	4 19	■
May 1	8 29	8 22	8 13	8 04	7 54	7 43	7 30	7 16	6 59	6 39	6 13	5 38	4 32	■
2	9 34	9 26	9 18	9 09	9 00	8 49	8 37	8 23	8 07	7 48	7 24	6 52	6 00	■
3	10 41	10 34	10 27	10 20	10 11	10 02	9 52	9 40	9 27	9 11	8 52	8 29	7 58	7 07
4	11 48	11 43	11 37	11 31	11 24	11 17	11 09	11 00	10 50	10 38	10 25	10 09	9 49	9 23
5	12 54	12 50	12 46	12 41	12 36	12 31	12 25	12 19	12 12	12 04	11 55	11 44	11 31	11 16
6	13 56	13 54	13 51	13 49	13 46	13 42	13 39	13 35	13 31	13 26	13 20	13 14	13 07	12 58
7	14 57	14 56	14 55	14 54	14 53	14 51	14 50	14 48	14 47	14 45	14 42	14 40	14 37	14 33
8	15 57	15 57	15 58	15 58	15 59	15 59	16 00	16 00	16 01	16 02	16 02	16 03	16 04	16 06
9	16 56	16 58	16 59	17 01	17 04	17 06	17 09	17 11	17 14	17 18	17 22	17 26	17 31	17 37
10	17 55	17 58	18 01	18 05	18 09	18 13	18 18	18 23	18 28	18 35	18 42	18 50	19 00	19 11
11	18 55	18 59	19 04	19 09	19 15	19 21	19 27	19 35	19 43	19 53	20 03	20 16	20 31	20 50
12	19 55	20 01	20 07	20 13	20 20	20 28	20 37	20 47	20 58	21 11	21 26	21 44	22 06	22 37
13	20 55	21 01	21 08	21 16	21 25	21 35	21 45	21 57	22 11	22 27	22 47	23 11	23 45	.. ..
14	21 52	22 00	22 08	22 16	22 26	22 37	22 49	23 02	23 18	23 37	.. ..	.. ..	.. ..	0 45
15	22 46	22 54	23 02	23 11	23 21	23 32	23 44	23 59	.. ..	.. ..	0 01	0 32	1 22	□
16	23 35	23 42	23 50	23 59	.. ..	.. ..	.. ..	.. ..	0 15	0 35	1 00	1 33	2 33	□
17	.. ..	.. ..	.. ..	.. ..	0 08	0 19	0 30	0 44	0 59	1 17	1 39	2 08	2 51	□
18	0 17	0 24	0 31	0 39	0 47	0 56	1 06	1 18	1 31	1 46	2 04	2 25	2 54	3 35

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May 17	13 11	12 40	12 17	11 58	11 42	11 29	11 05	10 45	10 26	10 08	9 47	9 24	9 10	8 54
18	13 39	13 14	12 54	12 38	12 24	12 12	11 52	11 34	11 18	11 01	10 43	10 22	10 10	9 56
19	14 00	13 40	13 25	13 12	13 02	12 52	12 36	12 21	12 08	11 54	11 40	11 23	11 13	11 02
20	14 16	14 03	13 52	13 43	13 36	13 29	13 17	13 07	12 57	12 47	12 37	12 25	12 18	12 10
21	14 30	14 23	14 17	14 12	14 07	14 04	13 57	13 51	13 46	13 40	13 34	13 28	13 24	13 19
22	14 42	14 41	14 40	14 39	14 38	14 38	14 37	14 36	14 35	14 34	14 33	14 32	14 31	14 30
23	14 55	15 00	15 04	15 07	15 10	15 13	15 17	15 21	15 25	15 29	15 33	15 38	15 41	15 44
24	15 10	15 21	15 30	15 38	15 45	15 50	16 01	16 10	16 18	16 27	16 36	16 47	16 53	17 00
25	15 28	15 47	16 01	16 13	16 23	16 32	16 48	17 02	17 15	17 28	17 42	17 59	18 08	18 19
26	15 54	16 19	16 39	16 55	17 08	17 20	17 41	17 59	18 16	18 33	18 51	19 12	19 24	19 39
27	16 31	17 02	17 26	17 45	18 01	18 15	18 39	19 00	19 19	19 39	20 00	20 24	20 38	20 55
28	17 24	17 58	18 24	18 45	19 02	19 16	19 41	20 03	20 23	20 44	21 06	21 31	21 46	22 03
29	18 34	19 07	19 31	19 51	20 07	20 22	20 46	21 06	21 26	21 45	22 06	22 30	22 44	23 00
30	19 55	20 23	20 44	21 01	21 15	21 27	21 48	22 07	22 24	22 41	22 59	23 19	23 31	23 45
31	21 19	21 40	21 57	22 10	22 21	22 31	22 48	23 03	23 17	23 30	23 45	.. ..	.. ..	.. ..
June 1	22 41	22 56	23 07	23 17	23 25	23 32	23 44	23 55	.. ..	.. ..	.. ..	0 01	0 11	0 22
2	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 05	0 15	0 25	0 37	0 44	0 52
3	.. ..	0 08	0 14	0 20	0 25	0 29	0 37	0 43	0 49	0 55	1 02	1 09	1 13	1 18
4	1 14	1 17	1 19	1 21	1 23	1 24	1 27	1 29	1 31	1 34	1 36	1 38	1 40	1 42
5	2 27	2 24	2 22	2 21	2 19	2 18	2 16	2 14	2 12	2 10	2 09	2 07	2 05	2 04
6	3 39	3 31	3 25	3 20	3 15	3 11	3 04	2 58	2 53	2 47	2 41	2 35	2 31	2 27
7	4 52	4 38	4 28	4 19	4 11	4 05	3 53	3 43	3 34	3 25	3 15	3 04	2 58	2 50
8	6 05	5 46	5 31	5 19	5 08	4 59	4 43	4 30	4 17	4 04	3 51	3 36	3 27	3 17
9	7 19	6 54	6 35	6 19	6 06	5 54	5 35	5 18	5 02	4 46	4 30	4 11	4 00	3 47
10	8 30	8 00	7 37	7 19	7 03	6 50	6 27	6 08	5 50	5 32	5 12	4 50	4 37	4 22

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May 17	20 13	20 43	21 05	21 23	21 38	21 52	22 14	22 33	22 51	23 09	23 28	23 50	.. ..	.. ..
18	21 29	21 54	22 12	22 27	22 40	22 51	23 10	23 27	23 42	23 57	.. ..	.. ..	0 03	0 17
19	22 51	23 09	23 23	23 34	23 44	23 53	.. ..	.. ..	.. ..	0 13	0 31	0 42	0 54	.. ..
20	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 07	0 20	0 31	0 43	0 55	1 10	1 18	1 27
21	0 15	0 27	0 35	0 43	0 49	0 55	1 04	1 13	1 20	1 28	1 36	1 45	1 50	1 56
22	1 41	1 46	1 50	1 53	1 56	1 58	2 02	2 06	2 09	2 12	2 15	2 19	2 21	2 24
23	3 10	3 08	3 06	3 05	3 04	3 03	3 01	3 00	2 58	2 57	2 55	2 54	2 53	2 51
24	4 41	4 33	4 26	4 20	4 15	4 10	4 03	3 56	3 50	3 44	3 37	3 30	3 25	3 20
25	6 17	6 01	5 48	5 37	5 29	5 21	5 07	4 56	4 45	4 34	4 22	4 09	4 01	3 53
26	7 54	7 30	7 12	6 57	6 44	6 33	6 15	5 58	5 43	5 28	5 12	4 54	4 43	4 31
27	9 28	8 57	8 34	8 15	8 00	7 47	7 24	7 04	6 46	6 27	6 08	5 45	5 32	5 17
28	10 49	10 14	9 48	9 28	9 11	8 56	8 32	8 10	7 50	7 30	7 08	6 43	6 29	6 12
29	11 49	11 16	10 51	10 31	10 14	10 00	9 35	9 14	8 54	8 33	8 12	7 47	7 32	7 15
30	12 30	12 02	11 40	11 22	11 07	10 54	10 32	10 12	9 54	9 36	9 16	8 53	8 40	8 24
31	12 58	12 35	12 17	12 03	11 51	11 40	11 21	11 05	10 50	10 34	10 17	9 58	9 47	9 34
June 1	13 17	13 00	12 47	12 36	12 27	12 19	12 05	11 52	11 40	11 28	11 15	11 01	10 52	10 42
2	13 31	13 20	13 11	13 04	12 58	12 53	12 43	12 35	12 27	12 18	12 10	12 00	11 54	11 47
3	13 42	13 37	13 33	13 29	13 26	13 23	13 18	13 14	13 10	13 06	13 01	12 56	12 53	12 50
4	13 52	13 52	13 52	13 52	13 52	13 52	13 51	13 51	13 51	13 51	13 51	13 50	13 50	13 50
5	14 02	14 07	14 11	14 14	14 17	14 20	14 24	14 28	14 32	14 35	14 39	14 44	14 46	14 49
6	14 13	14 23	14 31	14 37	14 43	14 48	14 57	15 05	15 12	15 20	15 28	15 37	15 42	15 48
7	14 25	14 40	14 52	15 02	15 11	15 19	15 32	15 43	15 54	16 05	16 17	16 31	16 39	16 48
8	14 40	15 01	15 17	15 30	15 42	15 52	16 09	16 24	16 38	16 53	17 08	17 26	17 36	17 48
9	15 00	15 26	15 46	16 03	16 17	16 29	16 50	17 08	17 25	17 42	18 00	18 21	18 33	18 48
10	15 27	15 59	16 22	16 41	16 57	17 11	17 34	17 54	18 13	18 33	18 53	19 17	19 30	19 47

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May 17	8 54	8 47	8 39	8 31	8 21	8 11	8 00	7 47	7 31	7 13	6 51	6 23	5 40	□
18	9 56	9 50	9 43	9 36	9 28	9 19	9 09	8 58	8 46	8 31	8 14	7 52	7 25	6 44
19	11 02	10 57	10 52	10 46	10 40	10 33	10 25	10 17	10 07	9 56	9 44	9 29	9 11	8 48
20	12 10	12 06	12 03	11 59	11 54	11 49	11 44	11 38	11 32	11 25	11 16	11 07	10 55	10 42
21	13 19	13 17	13 15	13 13	13 11	13 08	13 05	13 02	12 58	12 55	12 50	12 45	12 39	12 33
22	14 30	14 30	14 30	14 29	14 29	14 29	14 28	14 28	14 27	14 27	14 26	14 25	14 24	14 23
23	15 44	15 45	15 47	15 48	15 50	15 52	15 54	15 56	15 59	16 02	16 05	16 08	16 13	16 17
24	17 00	17 03	17 07	17 10	17 14	17 19	17 23	17 29	17 34	17 41	17 48	17 57	18 07	18 19
25	18 19	18 24	18 29	18 35	18 41	18 48	18 56	19 04	19 13	19 24	19 37	19 51	20 09	20 32
26	19 39	19 45	19 52	20 00	20 08	20 17	20 28	20 39	20 52	21 08	21 26	21 49	22 20	23 08
27	20 55	21 03	21 11	21 20	21 29	21 40	21 52	22 06	22 23	22 42	23 06	23 39	.. ..	■
28	22 03	22 11	22 19	22 28	22 39	22 50	23 02	23 17	23 34	23 54	.. ..	.. ..	0 33	■
29	23 00	23 07	23 15	23 23	23 33	23 43	23 55	.. ..	.. ..	.. ..	0 20	0 55	2 02	■
30	23 45	23 51	23 58	.. ..	.. ..	.. ..	.. ..	0 08	0 23	0 40	1 02	1 30	2 10	■
31	.. ..	.. ..	.. ..	0 05	0 13	0 22	0 31	0 42	0 54	1 08	1 24	1 44	2 09	2 42
June 1	0 22	0 27	0 32	0 38	0 44	0 50	0 58	1 06	1 15	1 25	1 36	1 50	2 06	2 25
2	0 52	0 56	0 59	1 03	1 08	1 12	1 17	1 23	1 29	1 36	1 44	1 52	2 03	2 15
3	1 18	1 20	1 22	1 25	1 27	1 30	1 33	1 36	1 40	1 44	1 49	1 54	1 59	2 06
4	1 42	1 42	1 43	1 44	1 45	1 46	1 47	1 48	1 49	1 51	1 52	1 54	1 56	1 58
5	2 04	2 03	2 03	2 02	2 01	2 01	2 00	1 59	1 58	1 57	1 56	1 54	1 53	1 51
6	2 27	2 25	2 23	2 21	2 18	2 16	2 13	2 10	2 07	2 03	1 59	1 55	1 50	1 44
7	2 50	2 47	2 44	2 40	2 36	2 32	2 27	2 22	2 17	2 11	2 04	1 56	1 46	1 36
8	3 17	3 12	3 08	3 02	2 57	2 51	2 44	2 37	2 29	2 20	2 10	1 58	1 44	1 27
9	3 47	3 41	3 35	3 29	3 22	3 14	3 05	2 56	2 45	2 33	2 19	2 02	1 41	1 15
10	4 22	4 16	4 08	4 01	3 52	3 43	3 32	3 21	3 07	2 52	2 33	2 10	1 40	0 55

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
May 17	.. ..	.. ..	.. ..	.. ..	0 08	0 19	0 30	0 44	0 59	1 17	1 39	2 08	2 51	□
18	0 17	0 24	0 31	0 39	0 47	0 56	1 06	1 18	1 31	1 46	2 04	2 25	2 54	3 35
19	0 54	1 00	1 06	1 12	1 19	1 26	1 34	1 43	1 53	2 05	2 18	2 34	2 53	3 17
20	1 27	1 31	1 35	1 40	1 45	1 50	1 56	2 03	2 10	2 18	2 27	2 38	2 50	3 05
21	1 56	1 59	2 02	2 04	2 08	2 11	2 15	2 19	2 23	2 28	2 34	2 40	2 48	2 56
22	2 24	2 25	2 26	2 27	2 29	2 30	2 32	2 33	2 35	2 37	2 39	2 42	2 45	2 48
23	2 51	2 51	2 50	2 50	2 49	2 48	2 48	2 47	2 46	2 45	2 44	2 43	2 41	2 40
24	3 20	3 18	3 16	3 14	3 11	3 08	3 05	3 02	2 58	2 54	2 49	2 44	2 38	2 31
25	3 53	3 49	3 45	3 41	3 36	3 31	3 25	3 19	3 12	3 05	2 56	2 46	2 35	2 22
26	4 31	4 25	4 20	4 13	4 06	3 59	3 51	3 42	3 32	3 20	3 07	2 51	2 32	2 08
27	5 17	5 10	5 02	4 54	4 46	4 36	4 26	4 14	4 00	3 44	3 25	3 01	2 30	1 41
28	6 12	6 04	5 56	5 47	5 37	5 26	5 13	4 59	4 43	4 23	3 59	3 26	2 31	■
29	7 15	7 07	6 59	6 50	6 40	6 29	6 16	6 02	5 45	5 25	4 59	4 24	3 17	■
30	8 24	8 17	8 09	8 01	7 52	7 42	7 31	7 18	7 03	6 46	6 25	5 57	5 18	■
31	9 34	9 28	9 22	9 15	9 08	9 00	8 51	8 40	8 29	8 16	8 00	7 41	7 17	6 44
June 1	10 42	10 38	10 33	10 28	10 23	10 17	10 10	10 02	9 54	9 45	9 34	9 21	9 06	8 48
2	11 47	11 45	11 41	11 38	11 34	11 30	11 26	11 21	11 16	11 10	11 03	10 56	10 46	10 36
3	12 50	12 48	12 47	12 45	12 43	12 41	12 39	12 37	12 34	12 31	12 28	12 24	12 20	12 14
4	13 50	13 50	13 50	13 50	13 50	13 50	13 49	13 49	13 49	13 49	13 49	13 49	13 48	13 48
5	14 49	14 51	14 52	14 53	14 55	14 57	14 59	15 01	15 03	15 06	15 08	15 12	15 15	15 20
6	15 48	15 51	15 54	15 57	16 00	16 04	16 08	16 12	16 17	16 22	16 28	16 35	16 43	16 53
7	16 48	16 52	16 56	17 01	17 06	17 11	17 17	17 24	17 31	17 39	17 49	18 00	18 13	18 29
8	17 48	17 53	17 59	18 05	18 11	18 19	18 27	18 36	18 46	18 58	19 11	19 27	19 47	20 13
9	18 48	18 54	19 01	19 09	19 17	19 26	19 36	19 47	20 00	20 15	20 33	20 56	21 25	22 10
10	19 47	19 54	20 02	20 10	20 20	20 30	20 42	20 55	21 10	21 28	21 51	22 20	23 05	□

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June 8	6 05	5 46	5 31	5 19	5 08	4 59	4 43	4 30	4 17	4 04	3 51	3 36	3 27	3 17
9	7 19	6 54	6 35	6 19	6 06	5 54	5 35	5 18	5 02	4 46	4 30	4 11	4 00	3 47
10	8 30	8 00	7 37	7 19	7 03	6 50	6 27	6 08	5 50	5 32	5 12	4 50	4 37	4 22
11	9 36	9 02	8 36	8 16	7 59	7 45	7 20	6 59	6 40	6 20	5 59	5 35	5 20	5 04
12	10 31	9 56	9 30	9 09	8 52	8 38	8 13	7 51	7 31	7 11	6 49	6 24	6 10	5 53
13	11 13	10 41	10 16	9 57	9 41	9 27	9 03	8 42	8 23	8 04	7 43	7 19	7 05	6 48
14	11 44	11 16	10 56	10 39	10 24	10 12	9 50	9 32	9 14	8 57	8 38	8 17	8 04	7 49
15	12 06	11 45	11 28	11 14	11 03	10 52	10 35	10 19	10 05	9 50	9 34	9 16	9 06	8 54
16	12 23	12 08	11 56	11 46	11 37	11 29	11 16	11 04	10 53	10 42	10 30	10 17	10 09	10 00
17	12 37	12 28	12 20	12 14	12 09	12 04	11 55	11 48	11 41	11 34	11 26	11 18	11 13	11 07
18	12 50	12 46	12 43	12 41	12 39	12 37	12 34	12 31	12 28	12 25	12 22	12 19	12 17	12 15
19	13 02	13 04	13 06	13 08	13 09	13 10	13 12	13 14	13 16	13 18	13 20	13 22	13 24	13 25
20	13 15	13 23	13 30	13 36	13 41	13 45	13 53	13 59	14 06	14 12	14 19	14 27	14 32	14 37
21	13 31	13 46	13 57	14 07	14 16	14 23	14 37	14 48	14 59	15 10	15 22	15 36	15 44	15 53
22	13 52	14 13	14 30	14 44	14 57	15 07	15 25	15 41	15 56	16 11	16 28	16 47	16 58	17 10
23	14 21	14 50	15 12	15 30	15 45	15 58	16 20	16 39	16 58	17 16	17 36	17 59	18 12	18 28
24	15 06	15 39	16 04	16 24	16 41	16 56	17 20	17 42	18 02	18 22	18 44	19 09	19 23	19 41
25	16 08	16 43	17 08	17 28	17 45	18 00	18 25	18 46	19 06	19 26	19 48	20 13	20 27	20 44
26	17 27	17 57	18 20	18 39	18 54	19 07	19 30	19 50	20 08	20 26	20 45	21 08	21 21	21 36
27	18 53	19 17	19 35	19 50	20 03	20 14	20 33	20 49	21 05	21 20	21 36	21 55	22 06	22 18
28	20 18	20 36	20 49	21 00	21 10	21 18	21 32	21 45	21 56	22 08	22 20	22 34	22 42	22 52
29	21 40	21 51	22 00	22 07	22 13	22 19	22 28	22 36	22 44	22 51	22 59	23 09	23 14	23 20
30	22 58	23 03	23 07	23 11	23 13	23 16	23 20	23 24	23 28	23 31	23 35	23 40	23 42	23 45
July 1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
2	0 13	0 12	0 12	0 12	0 11	0 11	0 10	0 10	0 10	0 09	0 09	0 08	0 08	0 08

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June 8	14 40	15 01	15 17	15 30	15 42	15 52	16 09	16 24	16 38	16 53	17 08	17 26	17 36	17 48
9	15 00	15 26	15 46	16 03	16 17	16 29	16 50	17 08	17 25	17 42	18 00	18 21	18 33	18 48
10	15 27	15 59	16 22	16 41	16 57	17 11	17 34	17 54	18 13	18 33	18 53	19 17	19 30	19 47
11	16 06	16 40	17 06	17 26	17 43	17 58	18 23	18 44	19 04	19 24	19 46	20 11	20 25	20 42
12	16 58	17 33	17 58	18 18	18 35	18 50	19 15	19 36	19 56	20 16	20 37	21 02	21 16	21 33
13	18 03	18 34	18 58	19 17	19 33	19 46	20 09	20 29	20 48	21 06	21 26	21 49	22 02	22 17
14	19 17	19 44	20 04	20 20	20 33	20 45	21 05	21 23	21 39	21 55	22 12	22 31	22 43	22 56
15	20 37	20 57	21 12	21 25	21 36	21 45	22 01	22 15	22 28	22 41	22 55	23 10	23 19	23 29
16	21 59	22 12	22 23	22 32	22 39	22 46	22 57	23 07	23 16	23 25	23 35	23 46	23 52	23 59
17	23 22	23 29	23 35	23 39	23 43	23 47	23 53	23 58	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
18	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 03	0 08	0 13	0 19	0 22	0 26
19	0 46	0 47	0 48	0 48	0 49	0 49	0 50	0 50	0 51	0 51	0 52	0 52	0 52	0 53
20	2 13	2 08	2 03	1 59	1 56	1 53	1 48	1 43	1 39	1 35	1 31	1 26	1 23	1 20
21	3 44	3 31	3 21	3 13	3 06	3 00	2 49	2 39	2 31	2 22	2 13	2 02	1 56	1 49
22	5 18	4 58	4 42	4 29	4 19	4 09	3 53	3 39	3 26	3 13	2 59	2 43	2 34	2 23
23	6 53	6 25	6 04	5 47	5 33	5 21	5 00	4 42	4 25	4 08	3 50	3 30	3 18	3 04
24	8 20	7 47	7 23	7 03	6 47	6 32	6 08	5 47	5 28	5 09	4 48	4 24	4 10	3 54
25	9 32	8 58	8 32	8 12	7 55	7 40	7 15	6 53	6 33	6 12	5 51	5 25	5 10	4 53
26	10 23	9 52	9 28	9 09	8 53	8 40	8 16	7 55	7 36	7 17	6 56	6 32	6 17	6 01
27	10 57	10 32	10 12	9 56	9 43	9 31	9 10	8 52	8 36	8 19	8 00	7 39	7 27	7 13
28	11 20	11 01	10 46	10 34	10 23	10 14	9 58	9 43	9 30	9 16	9 02	8 45	8 35	8 24
29	11 37	11 24	11 14	11 05	10 57	10 51	10 39	10 29	10 20	10 10	10 00	9 48	9 41	9 33
30	11 50	11 42	11 36	11 31	11 27	11 23	11 17	11 11	11 05	11 00	10 53	10 47	10 42	10 38
July 1	12 00	11 58	11 57	11 55	11 54	11 53	11 51	11 50	11 48	11 46	11 45	11 43	11 41	11 40
2	12 10	12 14	12 16	12 18	12 20	12 22	12 24	12 27	12 29	12 32	12 34	12 37	12 39	12 40

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

47

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June 8	3 17	3 12	3 08	3 02	2 57	2 51	2 44	2 37	2 29	2 20	2 10	1 58	1 44	1 27
9	3 47	3 41	3 35	3 29	3 22	3 14	3 05	2 56	2 45	2 33	2 19	2 02	1 41	1 15
10	4 22	4 16	4 08	4 01	3 52	3 43	3 32	3 21	3 07	2 52	2 33	2 10	1 40	0 55
11	5 04	4 57	4 49	4 40	4 30	4 20	4 08	3 55	3 39	3 21	2 58	2 28	1 43	□
12	5 53	5 45	5 37	5 28	5 18	5 07	4 54	4 40	4 24	4 04	3 39	3 05	2 06	□
13	6 48	6 41	6 33	6 24	6 15	6 04	5 52	5 39	5 23	5 04	4 41	4 10	3 22	□
14	7 49	7 43	7 36	7 28	7 19	7 10	7 00	6 48	6 34	6 19	6 00	5 36	5 04	4 12
15	8 54	8 48	8 42	8 36	8 29	8 22	8 13	8 04	7 54	7 41	7 27	7 11	6 50	6 23
16	10 00	9 56	9 51	9 47	9 42	9 36	9 30	9 24	9 16	9 08	8 58	8 47	8 34	8 17
17	11 07	11 04	11 02	10 59	10 56	10 52	10 49	10 45	10 40	10 35	10 29	10 23	10 15	10 06
18	12 15	12 14	12 13	12 12	12 11	12 10	12 08	12 07	12 05	12 03	12 01	11 59	11 56	11 53
19	13 25	13 26	13 27	13 27	13 28	13 29	13 30	13 31	13 32	13 34	13 35	13 37	13 39	13 41
20	14 37	14 40	14 42	14 45	14 48	14 51	14 55	14 59	15 03	15 08	15 13	15 19	15 26	15 35
21	15 53	15 57	16 01	16 06	16 11	16 17	16 23	16 30	16 37	16 46	16 56	17 07	17 21	17 37
22	17 10	17 16	17 22	17 29	17 36	17 44	17 53	18 03	18 14	18 27	18 43	19 01	19 24	19 56
23	18 28	18 35	18 43	18 51	19 00	19 10	19 21	19 34	19 49	20 07	20 28	20 56	21 36	■
24	19 41	19 48	19 57	20 06	20 16	20 27	20 40	20 54	21 11	21 32	21 57	22 32	23 41	■
25	20 44	20 52	21 00	21 09	21 19	21 30	21 42	21 56	22 12	22 32	22 56	23 28	.. ..	■
26	21 36	21 43	21 50	21 58	22 07	22 16	22 27	22 39	22 52	23 08	23 27	23 50	0 20	■
27	22 18	22 23	22 29	22 36	22 42	22 50	22 58	23 07	23 18	23 30	23 43	23 59	0 21	1 08
28	22 52	22 56	23 00	23 05	23 10	23 15	23 21	23 28	23 35	23 43	23 53	.. ..	0 19	0 43
29	23 20	23 23	23 25	23 28	23 32	23 35	23 39	23 43	23 48	23 53	23 58	0 03	0 16	0 30
30	23 45	23 46	23 47	23 49	23 50	23 52	23 54	23 56	23 58	.. ..	.. ..	0 05	0 12	0 21
July 1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 00	0 03	0 06	0 09	0 13
2	0 08	0 08	0 08	0 08	0 07	0 07	0 07	0 07	0 07	0 07	0 06	0 06	0 06	0 05

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
June 8	17 48	17 53	17 59	18 05	18 11	18 19	18 27	18 36	18 46	18 58	19 11	19 27	19 47	20 13
9	18 48	18 54	19 01	19 09	19 17	19 26	19 36	19 47	20 00	20 15	20 33	20 56	21 25	22 10
10	19 47	19 54	20 02	20 10	20 20	20 30	20 42	20 55	21 10	21 28	21 51	22 20	23 05	□
11	20 42	20 50	20 58	21 07	21 17	21 28	21 40	21 55	22 11	22 31	22 56	23 29	.. ..	□
12	21 33	21 40	21 48	21 57	22 07	22 18	22 30	22 43	22 59	23 18	23 42	.. ..	0 29	□
13	22 17	22 24	22 32	22 40	22 48	22 58	23 09	23 21	23 34	23 51	.. ..	0 12	1 01	□
14	22 56	23 02	23 08	23 15	23 22	23 30	23 39	23 48	23 59	.. ..	0 10	0 34	1 06	1 59
15	23 29	23 34	23 39	23 44	23 49	23 55	.. ..	.. ..	.. ..	0 12	0 27	0 44	1 06	1 34
16	23 59	.. ..	.. ..	.. ..	.. ..	.. ..	0 02	0 09	0 18	0 27	0 37	0 50	1 04	1 21
17	.. ..	0 02	0 05	0 09	0 13	0 17	0 21	0 26	0 32	0 38	0 44	0 52	1 01	1 11
18	0 26	0 28	0 29	0 31	0 33	0 35	0 38	0 40	0 43	0 46	0 50	0 54	0 58	1 03
19	0 53	0 53	0 53	0 53	0 53	0 53	0 53	0 54	0 54	0 54	0 54	0 55	0 55	0 55
20	1 20	1 18	1 17	1 15	1 13	1 11	1 09	1 07	1 05	1 02	0 59	0 56	0 52	0 47
21	1 49	1 46	1 43	1 39	1 36	1 32	1 27	1 22	1 17	1 11	1 05	0 57	0 48	0 38
22	2 23	2 18	2 13	2 08	2 02	1 56	1 49	1 42	1 33	1 24	1 13	1 00	0 45	0 27
23	3 04	2 58	2 51	2 44	2 36	2 28	2 18	2 08	1 56	1 42	1 26	1 07	0 43	0 11
24	3 54	3 46	3 38	3 30	3 20	3 10	2 58	2 45	2 30	2 12	1 50	1 22	0 42	■
25	4 53	4 45	4 37	4 28	4 18	4 06	3 54	3 39	3 22	3 02	2 36	2 01	0 52	■
26	6 01	5 54	5 45	5 37	5 27	5 16	5 04	4 50	4 34	4 15	3 51	3 20	2 28	■
27	7 13	7 06	6 59	6 52	6 44	6 34	6 24	6 13	6 00	5 44	5 26	5 03	4 33	3 47
28	8 24	8 19	8 14	8 08	8 01	7 54	7 47	7 38	7 28	7 17	7 05	6 49	6 31	6 07
29	9 33	9 29	9 25	9 21	9 17	9 12	9 07	9 01	8 54	8 47	8 39	8 29	8 18	8 04
30	10 38	10 36	10 34	10 31	10 29	10 26	10 23	10 20	10 16	10 12	10 07	10 02	9 56	9 49
July 1	11 40	11 40	11 39	11 38	11 37	11 36	11 35	11 34	11 34	11 33	11 31	11 30	11 28	11 26
2	12 40	12 41	12 42	12 43	12 44	12 45	12 46	12 48	12 49	12 51	12 53	12 55	12 57	13 00

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
2	0 13	0 12	0 12	0 12	0 11	0 11	0 10	0 10	0 10	0 09	0 09	0 08	0 08	0 08
3	1 26	1 20	1 15	1 11	1 08	1 05	0 59	0 55	0 51	0 46	0 42	0 37	0 34	0 31
4	2 39	2 28	2 18	2 11	2 04	1 58	1 48	1 40	1 32	1 24	1 15	1 06	1 00	0 54
5	3 52	3 35	3 21	3 10	3 01	2 52	2 38	2 26	2 14	2 03	1 50	1 36	1 28	1 19
6	5 06	4 43	4 25	4 10	3 58	3 47	3 29	3 13	2 58	2 44	2 28	2 10	2 00	1 48
7	6 19	5 50	5 28	5 10	4 56	4 43	4 21	4 03	3 45	3 28	3 09	2 48	2 36	2 22
8	7 27	6 53	6 29	6 09	5 53	5 39	5 15	4 54	4 35	4 15	3 55	3 31	3 17	3 01
9	8 26	7 51	7 25	7 04	6 47	6 33	6 08	5 46	5 26	5 06	4 44	4 19	4 05	3 48
10	9 12	8 39	8 14	7 54	7 38	7 24	6 59	6 38	6 18	5 59	5 37	5 13	4 59	4 42
11	9 47	9 18	8 56	8 38	8 23	8 10	7 48	7 29	7 11	6 52	6 33	6 11	5 57	5 42
12	10 12	9 49	9 31	9 16	9 04	8 53	8 34	8 17	8 02	7 46	7 30	7 10	6 59	6 46
13	10 31	10 14	10 00	9 49	9 39	9 31	9 16	9 03	8 51	8 39	8 26	8 11	8 02	7 52
14	10 45	10 34	10 25	10 18	10 11	10 06	9 56	9 47	9 39	9 31	9 22	9 12	9 06	9 00
15	10 58	10 53	10 48	10 45	10 42	10 39	10 34	10 30	10 26	10 22	10 18	10 13	10 10	10 07
16	11 10	11 10	11 10	11 11	11 11	11 11	11 12	11 12	11 13	11 13	11 14	11 14	11 15	11 15
17	11 22	11 28	11 33	11 38	11 41	11 45	11 50	11 56	12 01	12 06	12 11	12 17	12 21	12 25
18	11 36	11 48	11 58	12 07	12 14	12 20	12 32	12 41	12 51	13 00	13 10	13 22	13 29	13 37
19	11 54	12 13	12 28	12 40	12 51	13 00	13 17	13 31	13 45	13 58	14 13	14 30	14 40	14 51
20	12 18	12 44	13 04	13 20	13 34	13 46	14 07	14 25	14 42	14 59	15 18	15 39	15 52	16 06
21	12 55	13 26	13 50	14 09	14 26	14 40	15 04	15 24	15 44	16 03	16 24	16 49	17 03	17 20
22	13 47	14 22	14 48	15 08	15 25	15 40	16 05	16 27	16 47	17 07	17 29	17 54	18 09	18 27
23	14 59	15 31	15 56	16 15	16 32	16 46	17 10	17 30	17 50	18 09	18 30	18 53	19 07	19 23
24	16 22	16 50	17 10	17 27	17 41	17 53	18 14	18 32	18 49	19 06	19 24	19 44	19 56	20 10
25	17 50	18 10	18 26	18 39	18 50	19 00	19 16	19 31	19 44	19 57	20 11	20 28	20 37	20 48

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	12 00	11 58	11 57	11 55	11 54	11 53	11 51	11 50	11 48	11 46	11 45	11 43	11 41	11 40
2	12 10	12 14	12 16	12 18	12 20	12 22	12 24	12 27	12 29	12 32	12 34	12 37	12 39	12 40
3	12 21	12 29	12 36	12 41	12 46	12 50	12 58	13 04	13 10	13 16	13 23	13 31	13 35	13 40
4	12 32	12 46	12 56	13 05	13 13	13 20	13 32	13 42	13 52	14 02	14 12	14 24	14 31	14 39
5	12 46	13 05	13 20	13 32	13 43	13 52	14 08	14 22	14 35	14 48	15 03	15 19	15 28	15 39
6	13 04	13 29	13 48	14 03	14 16	14 28	14 47	15 05	15 21	15 37	15 54	16 14	16 26	16 39
7	13 29	13 59	14 21	14 39	14 55	15 08	15 31	15 50	16 09	16 27	16 47	17 10	17 23	17 39
8	14 04	14 37	15 02	15 22	15 39	15 54	16 18	16 39	16 59	17 19	17 40	18 05	18 19	18 36
9	14 52	15 26	15 52	16 13	16 30	16 45	17 09	17 31	17 51	18 11	18 33	18 57	19 12	19 29
10	15 53	16 26	16 50	17 10	17 26	17 40	18 04	18 24	18 44	19 03	19 23	19 46	20 00	20 16
11	17 06	17 34	17 55	18 12	18 27	18 39	19 00	19 18	19 35	19 52	20 10	20 31	20 43	20 57
12	18 26	18 47	19 04	19 18	19 29	19 39	19 57	20 12	20 26	20 39	20 54	21 11	21 21	21 32
13	19 47	20 03	20 15	20 25	20 33	20 40	20 53	21 04	21 14	21 24	21 35	21 47	21 54	22 02
14	21 10	21 19	21 26	21 32	21 37	21 41	21 49	21 55	22 01	22 08	22 14	22 21	22 25	22 30
15	22 33	22 36	22 38	22 39	22 41	22 42	22 44	22 46	22 48	22 50	22 52	22 54	22 55	22 56
16	23 57	23 54	23 51	23 48	23 46	23 44	23 41	23 38	23 35	23 33	23 30	23 26	23 25	23 22
17	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 56	23 50
18	1 24	1 14	1 05	0 59	0 53	0 48	0 39	0 31	0 24	0 17	0 09	0 01	.. ..	.. ..
19	2 54	2 36	2 23	2 12	2 02	1 54	1 40	1 27	1 16	1 04	0 52	0 38	0 30	0 21
20	4 25	4 01	3 42	3 27	3 14	3 03	2 44	2 27	2 12	1 56	1 40	1 21	1 10	0 57
21	5 54	5 24	5 00	4 42	4 26	4 13	3 50	3 30	3 11	2 53	2 33	2 10	1 57	1 42
22	7 13	6 38	6 13	5 52	5 35	5 20	4 56	4 34	4 14	3 54	3 32	3 07	2 53	2 36
23	8 12	7 39	7 14	6 54	6 38	6 23	5 59	5 37	5 17	4 57	4 36	4 11	3 56	3 39
24	8 54	8 25	8 04	7 46	7 31	7 18	6 56	6 37	6 19	6 00	5 41	5 18	5 05	4 49
25	9 21	8 59	8 42	8 28	8 16	8 05	7 47	7 31	7 16	7 01	6 44	6 25	6 14	6 02

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	0 00	0 03	0 06	0 09	0 13
2	0 08	0 08	0 08	0 08	0 07	0 07	0 07	0 07	0 07	0 07	0 06	0 06	0 06	$\begin{Bmatrix} 00 \\ 23 \end{Bmatrix}$ 58
3	0 31	0 29	0 28	0 26	0 24	0 22	0 20	0 18	0 16	0 13	0 10	0 06	$\begin{Bmatrix} 00 \\ 23 \end{Bmatrix}$ 59	23 50
4	0 54	0 51	0 48	0 45	0 42	0 38	0 34	0 30	0 25	0 20	0 14	0 07	23 56	23 42
5	1 19	1 15	1 11	1 06	1 02	0 56	0 50	0 44	0 37	0 28	0 19	0 09	23 54	23 31
6	1 48	1 43	1 37	1 31	1 25	1 17	1 10	1 01	0 51	0 40	0 27	0 12	23 53	23 16
7	2 22	2 15	2 08	2 01	1 53	1 44	1 34	1 23	1 11	0 56	0 40	0 19	23 54	□
8	3 01	2 54	2 46	2 38	2 29	2 18	2 07	1 54	1 39	1 22	1 00	0 33	.. ..	□
9	3 48	3 40	3 32	3 23	3 13	3 02	2 50	2 36	2 19	2 00	1 36	1 03	0 07	□
10	4 42	4 34	4 26	4 17	4 08	3 57	3 45	3 31	3 15	2 55	2 31	1 59	1 05	□
11	5 42	5 35	5 28	5 20	5 11	5 01	4 50	4 38	4 24	4 07	3 46	3 21	2 44	1 30
12	6 46	6 40	6 34	6 27	6 20	6 12	6 03	5 53	5 42	5 28	5 13	4 54	4 31	3 59
13	7 52	7 48	7 43	7 38	7 33	7 27	7 20	7 12	7 04	6 55	6 44	6 31	6 16	5 57
14	9 00	8 57	8 53	8 50	8 46	8 42	8 38	8 33	8 28	8 22	8 15	8 07	7 58	7 48
15	10 07	10 06	10 04	10 02	10 01	9 59	9 57	9 55	9 52	9 49	9 46	9 43	9 39	9 34
16	11 15	11 15	11 15	11 16	11 16	11 16	11 16	11 17	11 17	11 17	11 18	11 18	11 19	11 20
17	12 25	12 27	12 28	12 31	12 33	12 35	12 38	12 41	12 44	12 48	12 52	12 56	13 02	13 08
18	13 37	13 40	13 44	13 48	13 52	13 57	14 02	14 08	14 14	14 21	14 29	14 39	14 50	15 03
19	14 51	14 56	15 02	15 08	15 14	15 21	15 29	15 38	15 47	15 59	16 12	16 27	16 46	17 10
20	16 06	16 13	16 20	16 28	16 36	16 45	16 56	17 07	17 21	17 36	17 55	18 19	18 50	19 41
21	17 20	17 27	17 35	17 44	17 54	18 05	18 17	18 31	18 47	19 07	19 31	20 04	20 59	■
22	18 27	18 34	18 43	18 52	19 02	19 13	19 26	19 40	19 57	20 18	20 43	21 18	22 25	■
23	19 23	19 31	19 39	19 47	19 56	20 07	20 18	20 31	20 46	21 04	21 25	21 53	22 32	■
24	20 10	20 16	20 23	20 30	20 38	20 46	20 55	21 06	21 18	21 31	21 47	22 07	22 31	23 03
25	20 48	20 52	20 57	21 03	21 09	21 15	21 22	21 30	21 39	21 48	22 00	22 12	22 28	22 46

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 1	11 40	11 40	11 39	11 38	11 38	11 37	11 36	11 35	11 34	11 33	11 31	11 30	11 28	11 26
2	12 40	12 41	12 42	12 43	12 44	12 45	12 46	12 48	12 49	12 51	12 53	12 55	12 57	13 00
3	13 40	13 42	13 44	13 47	13 50	13 53	13 56	13 59	14 03	14 08	14 13	14 18	14 25	14 32
4	14 39	14 43	14 47	14 51	14 55	15 00	15 05	15 11	15 18	15 25	15 33	15 43	15 54	16 08
5	15 39	15 44	15 49	15 55	16 01	16 08	16 15	16 23	16 33	16 43	16 55	17 09	17 27	17 48
6	16 39	16 45	16 52	16 59	17 07	17 15	17 25	17 35	17 47	18 01	18 18	18 38	19 03	19 40
7	17 39	17 46	17 53	18 02	18 11	18 21	18 32	18 45	18 59	19 16	19 37	20 04	20 43	□
8	18 36	18 44	18 52	19 01	19 10	19 21	19 34	19 48	20 04	20 23	20 48	21 20	22 16	□
9	19 29	19 36	19 45	19 54	20 03	20 14	20 27	20 41	20 57	21 16	21 40	22 13	23 07	□
10	20 16	20 23	20 31	20 39	20 48	20 58	21 09	21 22	21 36	21 53	22 14	22 40	23 17	□
11	20 57	21 03	21 09	21 16	21 24	21 33	21 42	21 53	22 04	22 18	22 34	22 53	23 18	$\begin{Bmatrix} 00 \\ 23 \end{Bmatrix}$ 33
12	21 32	21 37	21 42	21 47	21 54	22 00	22 07	22 15	22 24	22 35	22 46	23 00	23 16	23 36
13	22 02	22 06	22 10	22 14	22 18	22 23	22 28	22 33	22 40	22 46	22 54	23 03	23 13	23 26
14	22 30	22 32	22 34	22 37	22 39	22 42	22 45	22 48	22 52	22 56	23 00	23 05	23 10	23 17
15	22 56	22 57	22 57	22 58	22 59	23 00	23 00	23 01	23 02	23 03	23 04	23 06	23 07	23 09
16	23 22	23 21	23 20	23 19	23 18	23 17	23 16	23 14	23 13	23 11	23 09	23 07	23 04	23 01
17	23 50	23 48	23 45	23 42	23 39	23 36	23 32	23 28	23 24	23 19	23 14	23 08	23 01	22 53
18	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 52	23 45	23 38	23 30	23 21	23 10	22 58	22 43
19	0 21	0 17	0 13	0 08	0 03	.. ..	.. ..	.. ..	23 57	23 45	23 31	23 15	22 55	22 30
20	0 57	0 52	0 46	0 39	0 33	0 25	0 16	0 07	.. ..	.. ..	23 49	23 25	22 53	22 01
21	1 42	1 35	1 27	1 19	1 11	1 01	0 50	0 38	0 24	0 08	.. ..	23 50	22 54	■
22	2 36	2 28	2 20	2 11	2 01	1 50	1 37	1 23	1 07	0 47	0 22	.. ..	23 42	■
23	3 39	3 31	3 23	3 14	3 04	2 53	2 40	2 26	2 09	1 49	1 23	0 48	.. ..	■
24	4 49	4 42	4 35	4 26	4 17	4 07	3 56	3 43	3 29	3 12	2 50	2 23	1 45	■
25	6 02	5 56	5 50	5 43	5 36	5 28	5 19	5 09	4 58	4 45	4 29	4 11	3 48	3 16

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 24	16 22	16 50	17 10	17 27	17 41	17 53	18 14	18 32	18 49	19 06	19 24	19 44	19 56	20 10
25	17 50	18 10	18 26	18 39	18 50	19 00	19 16	19 31	19 44	19 57	20 11	20 28	20 37	20 48
26	19 15	19 29	19 40	19 49	19 56	20 03	20 15	20 25	20 34	20 44	20 53	21 05	21 11	21 19
27	20 37	20 44	20 50	20 55	20 59	21 03	21 09	21 15	21 20	21 26	21 31	21 38	21 41	21 45
28	21 55	21 56	21 57	21 58	21 59	22 00	22 02	22 03	22 04	22 05	22 06	22 08	22 09	22 10
29	23 10	23 06	23 02	23 00	22 57	22 55	22 52	22 49	22 46	22 43	22 40	22 37	22 35	22 33
30	.. ..	.. ..	.. ..	.. ..	23 55	23 50	23 41	23 34	23 28	23 21	23 14	23 06	23 01	22 56
31	0 24	0 14	0 06	0 00	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 48	23 36	23 29	23 21
Aug. 1	1 37	1 22	1 10	1 00	0 51	0 44	0 31	0 20	0 10	.. ..	.. ..	.. ..	23 59	23 48
2	2 51	2 30	2 14	2 00	1 49	1 39	1 22	1 07	0 53	0 40	0 25	0 09	.. ..	.. ..
3	4 05	3 38	3 17	3 00	2 46	2 34	2 14	1 56	1 39	1 23	1 05	0 45	0 33	0 20
4	5 15	4 43	4 19	4 00	3 44	3 30	3 07	2 46	2 28	2 09	1 49	1 26	1 12	0 57
5	6 17	5 43	5 17	4 56	4 39	4 25	4 00	3 38	3 18	2 58	2 37	2 12	1 58	1 41
6	7 09	6 34	6 09	5 49	5 32	5 17	4 52	4 31	4 11	3 51	3 29	3 04	2 50	2 33
7	7 48	7 17	6 54	6 35	6 19	6 06	5 42	5 22	5 03	4 45	4 24	4 01	3 47	3 31
8	8 16	7 51	7 31	7 15	7 02	6 50	6 30	6 12	5 56	5 39	5 21	5 01	4 49	4 35
9	8 36	8 17	8 02	7 50	7 39	7 30	7 14	7 00	6 47	6 33	6 19	6 03	5 53	5 42
10	8 52	8 40	8 29	8 21	8 13	8 07	7 55	7 45	7 36	7 26	7 16	7 05	6 58	6 50
11	9 05	8 59	8 53	8 48	8 44	8 41	8 34	8 29	8 24	8 18	8 13	8 06	8 03	7 59
12	9 17	9 16	9 15	9 15	9 14	9 13	9 12	9 12	9 11	9 10	9 09	9 08	9 08	9 07
13	9 29	9 34	9 38	9 41	9 44	9 46	9 51	9 55	9 58	10 02	10 06	10 11	10 14	10 17
14	9 42	9 53	10 02	10 09	10 15	10 21	10 31	10 40	10 48	10 56	11 05	11 15	11 21	11 28
15	9 58	10 15	10 29	10 41	10 50	10 59	11 14	11 27	11 40	11 52	12 06	12 21	12 30	12 41
16	10 20	10 44	11 02	11 18	11 31	11 42	12 02	12 19	12 35	12 51	13 08	13 29	13 41	13 54
17	10 51	11 21	11 44	12 02	12 18	12 31	12 54	13 15	13 33	13 52	14 13	14 37	14 51	15 07

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 24	8 54	8 25	8 04	7 46	7 31	7 18	6 56	6 37	6 19	6 00	5 41	5 18	5 05	4 49
25	9 21	8 59	8 42	8 28	8 16	8 05	7 47	7 31	7 16	7 01	6 44	6 25	6 14	6 02
26	9 41	9 25	9 13	9 02	8 53	8 45	8 32	8 20	8 08	7 57	7 45	7 30	7 22	7 13
27	9 55	9 45	9 38	9 31	9 25	9 20	9 12	9 04	8 57	8 49	8 41	8 32	8 27	8 21
28	10 07	10 03	9 59	9 57	9 54	9 52	9 48	9 45	9 42	9 38	9 35	9 31	9 28	9 26
29	10 17	10 18	10 19	10 20	10 21	10 21	10 22	10 23	10 24	10 25	10 26	10 27	10 27	10 28
30	10 27	10 34	10 39	10 43	10 47	10 50	10 56	11 01	11 06	11 11	11 16	11 22	11 25	11 29
31	10 38	10 50	10 59	11 07	11 14	11 20	11 30	11 39	11 48	11 56	12 05	12 16	12 22	12 29
Aug. 1	10 51	11 08	11 22	11 33	11 43	11 51	12 06	12 18	12 30	12 43	12 56	13 10	13 19	13 29
2	11 08	11 30	11 48	12 02	12 15	12 25	12 44	13 00	13 15	13 30	13 47	14 06	14 17	14 29
3	11 30	11 58	12 19	12 36	12 51	13 04	13 26	13 45	14 02	14 20	14 39	15 01	15 14	15 29
4	12 00	12 33	12 57	13 17	13 33	13 47	14 11	14 32	14 52	15 11	15 32	15 56	16 11	16 27
5	12 43	13 18	13 44	14 05	14 22	14 36	15 02	15 23	15 43	16 04	16 25	16 50	17 05	17 22
6	13 40	14 14	14 40	15 00	15 16	15 31	15 55	16 16	16 36	16 56	17 17	17 41	17 55	18 11
7	14 51	15 21	15 43	16 01	16 16	16 29	16 52	17 11	17 29	17 46	18 05	18 27	18 40	18 54
8	16 09	16 33	16 52	17 07	17 19	17 30	17 49	18 05	18 20	18 35	18 51	19 09	19 20	19 32
9	17 32	17 50	18 03	18 14	18 24	18 32	18 46	18 59	19 10	19 22	19 34	19 47	19 55	20 04
10	18 56	19 07	19 16	19 23	19 29	19 34	19 43	19 51	19 59	20 06	20 14	20 23	20 28	20 33
11	20 21	20 25	20 28	20 31	20 34	20 36	20 40	20 43	20 46	20 49	20 52	20 56	20 58	21 00
12	21 45	21 43	21 42	21 40	21 39	21 38	21 36	21 35	21 33	21 32	21 30	21 28	21 27	21 26
13	23 11	23 03	22 56	22 50	22 46	22 41	22 34	22 28	22 22	22 16	22 09	22 02	21 58	21 53
14	.. ..	.. ..	.. ..	.. ..	23 54	23 46	23 34	23 22	23 12	23 02	22 51	22 38	22 31	22 23
15	0 40	0 24	0 12	0 02	.. ..	.. ..	.. ..	.. ..	.. ..	23 51	23 36	23 18	23 08	22 56
16	2 09	1 47	1 30	1 16	1 04	0 53	0 35	0 20	0 05	.. ..	.. ..	.. ..	23 51	23 37
17	3 38	3 09	2 47	2 29	2 14	2 01	1 39	1 20	1 02	0 45	0 26	0 04	.. ..	.. ..

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

51

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 24	20 10	20 16	20 23	20 30	20 38	20 46	20 55	21 06	21 18	21 31	21 47	22 07	22 31	23 03
25	20 48	20 52	20 57	21 03	21 09	21 15	21 22	21 30	21 39	21 48	22 00	22 12	22 28	22 46
26	21 19	21 22	21 25	21 29	21 33	21 38	21 42	21 47	21 53	22 00	22 07	22 15	22 25	22 36
27	21 45	21 47	21 49	21 51	21 54	21 56	21 59	22 01	22 05	22 08	22 12	22 16	22 21	22 27
28	22 10	22 10	22 11	22 11	22 12	22 12	22 13	22 13	22 14	22 15	22 16	22 17	22 18	22 19
29	22 33	22 32	22 31	22 30	22 29	22 27	22 26	22 25	22 23	22 21	22 19	22 17	22 14	22 12
30	22 56	22 54	22 51	22 49	22 46	22 43	22 40	22 36	22 32	22 28	22 23	22 17	22 11	22 04
31	23 21	23 17	23 13	23 09	23 05	23 00	22 55	22 49	22 43	22 36	22 28	22 19	22 08	21 56
Aug. 1	23 48	23 43	23 38	23 33	23 27	23 20	23 13	23 05	22 56	22 46	22 34	22 21	22 05	21 46
2	.. ..	.. ..	.. ..	.. ..	23 53	23 45	23 35	23 25	23 14	23 00	22 45	22 26	22 03	21 32
3	0 20	0 14	0 07	0 00	.. ..	.. ..	.. ..	23 52	23 38	23 22	23 02	22 37	22 02	21 02
4	0 57	0 50	0 42	0 34	0 25	0 16	0 05	.. ..	.. ..	23 55	23 31	22 59	22 08	□
5	1 41	1 33	1 25	1 16	1 07	0 56	0 44	0 30	0 14	.. ..	.. ..	23 45	22 45	□
6	2 33	2 25	2 17	2 08	1 58	1 47	1 34	1 20	1 04	0 44	0 19	.. ..	.. ..	□
7	3 31	3 24	3 16	3 08	2 59	2 48	2 37	2 24	2 09	1 51	1 29	1 00	0 17	□
8	4 35	4 29	4 22	4 15	4 07	3 58	3 48	3 38	3 25	3 11	2 53	2 32	2 05	1 25
9	5 42	5 37	5 32	5 26	5 20	5 13	5 06	4 57	4 48	4 37	4 25	4 10	3 53	3 31
10	6 50	6 47	6 43	6 39	6 35	6 30	6 25	6 19	6 13	6 06	5 58	5 49	5 38	5 25
11	7 59	7 57	7 55	7 53	7 50	7 48	7 45	7 42	7 39	7 35	7 31	7 26	7 21	7 14
12	9 07	9 07	9 07	9 07	9 06	9 06	9 06	9 05	9 05	9 04	9 04	9 03	9 02	9 02
13	10 17	10 18	10 20	10 21	10 23	10 25	10 27	10 29	10 32	10 34	10 37	10 41	10 45	10 50
14	11 28	11 31	11 34	11 38	11 41	11 45	11 50	11 55	12 00	12 07	12 14	12 22	12 31	12 42
15	12 41	12 45	12 50	12 56	13 01	13 08	13 15	13 23	13 32	13 42	13 53	14 07	14 23	14 43
16	13 54	14 00	14 07	14 14	14 22	14 31	14 40	14 51	15 04	15 18	15 35	15 56	16 23	17 02
17	15 07	15 14	15 22	15 30	15 40	15 50	16 02	16 16	16 31	16 50	17 13	17 43	18 29	■

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
July 24	4 49	4 42	4 35	4 26	4 17	4 07	3 56	3 43	3 29	3 12	2 50	2 23	1 45	■
25	6 02	5 56	5 50	5 43	5 36	5 28	5 19	5 09	4 58	4 45	4 29	4 11	3 48	3 16
26	7 13	7 09	7 04	6 59	6 54	6 48	6 42	6 35	6 27	6 18	6 07	5 55	5 41	5 24
27	8 21	8 18	8 15	8 12	8 09	8 05	8 01	7 57	7 52	7 47	7 41	7 33	7 25	7 16
28	9 26	9 25	9 23	9 22	9 21	9 19	9 17	9 15	9 13	9 11	9 08	9 05	9 02	8 58
29	10 28	10 28	10 29	10 29	10 29	10 30	10 30	10 31	10 31	10 32	10 32	10 33	10 34	10 35
30	11 29	11 31	11 32	11 34	11 36	11 39	11 41	11 44	11 47	11 50	11 54	11 58	12 03	12 09
31	12 29	12 32	12 35	12 39	12 43	12 47	12 51	12 56	13 02	13 08	13 15	13 23	13 33	13 44
Aug. 1	13 29	13 33	13 38	13 43	13 49	13 55	14 01	14 09	14 17	14 27	14 37	14 50	15 05	15 23
2	14 29	14 35	14 41	14 48	14 55	15 03	15 11	15 21	15 32	15 45	16 00	16 18	16 41	17 11
3	15 29	15 36	15 43	15 51	16 00	16 09	16 20	16 32	16 46	17 02	17 21	17 46	18 20	19 20
4	16 27	16 35	16 43	16 51	17 01	17 12	17 24	17 38	17 53	18 13	18 36	19 08	19 59	□
5	17 22	17 30	17 38	17 47	17 57	18 08	18 20	18 35	18 51	19 11	19 36	20 10	21 10	□
6	18 11	18 19	18 27	18 35	18 45	18 55	19 07	19 20	19 36	19 54	20 16	20 45	21 28	□
7	18 54	19 01	19 08	19 16	19 24	19 33	19 43	19 54	20 07	20 22	20 40	21 02	21 30	22 10
8	19 32	19 37	19 43	19 49	19 56	20 03	20 11	20 20	20 30	20 41	20 54	21 10	21 28	21 51
9	20 04	20 08	20 13	20 17	20 22	20 27	20 33	20 39	20 46	20 54	21 03	21 14	21 26	21 40
10	20 33	20 36	20 38	20 41	20 44	20 48	20 51	20 55	20 59	21 04	21 10	21 16	21 23	21 31
11	21 00	21 01	21 02	21 03	21 04	21 06	21 07	21 09	21 10	21 12	21 14	21 17	21 19	21 22
12	21 26	21 26	21 25	21 25	21 24	21 23	21 22	21 22	21 21	21 20	21 19	21 17	21 16	21 14
13	21 53	21 51	21 49	21 47	21 44	21 41	21 38	21 35	21 32	21 28	21 23	21 18	21 12	21 06
14	22 23	22 19	22 15	22 11	22 07	22 02	21 56	21 51	21 44	21 37	21 29	21 20	21 09	20 56
15	22 56	22 51	22 46	22 40	22 33	22 26	22 19	22 10	22 01	21 50	21 37	21 23	21 06	20 44
16	23 37	23 30	23 23	23 16	23 07	22 58	22 48	22 37	22 24	22 09	21 52	21 30	21 02	20 23
17	.. ..	.. ..	.. ..	.. ..	23 52	23 41	23 29	23 15	22 59	22 41	22 17	21 47	21 00	■

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	10 20	10 44	11 02	11 18	11 31	11 42	12 02	12 19	12 35	12 51	13 08	13 29	13 41	13 54
17	10 51	11 21	11 44	12 02	12 18	12 31	12 54	13 15	13 33	13 52	14 13	14 37	14 51	15 07
18	11 36	12 10	12 35	12 56	13 13	13 28	13 53	14 14	14 35	14 55	15 17	15 42	15 57	16 14
19	12 38	13 13	13 38	13 58	14 15	14 30	14 55	15 16	15 36	15 56	16 17	16 42	16 57	17 14
20	13 57	14 27	14 49	15 07	15 23	15 36	15 58	16 18	16 36	16 54	17 13	17 35	17 48	18 03
21	15 22	15 46	16 04	16 19	16 31	16 42	17 01	17 17	17 32	17 47	18 03	18 21	18 31	18 43
22	16 49	17 05	17 19	17 29	17 38	17 47	18 00	18 12	18 24	18 35	18 47	19 00	19 08	19 17
23	18 13	18 23	18 31	18 37	18 43	18 48	18 57	19 04	19 12	19 19	19 26	19 35	19 40	19 45
24	19 33	19 37	19 40	19 43	19 45	19 47	19 50	19 54	19 56	19 59	20 02	20 06	20 08	20 10
25	20 50	20 48	20 47	20 46	20 45	20 44	20 42	20 41	20 40	20 38	20 37	20 36	20 35	20 34
26	22 06	21 58	21 52	21 47	21 43	21 39	21 33	21 27	21 22	21 16	21 11	21 05	21 01	20 57
27	23 20	23 07	22 57	22 48	22 40	22 34	22 23	22 13	22 04	21 55	21 45	21 35	21 28	21 21
28	.. ..	.. ..	.. ..	23 49	23 38	23 29	23 13	23 00	22 47	22 35	22 21	22 06	21 58	21 48
29	0 35	0 16	0 01	.. ..	.. ..	.. ..	.. ..	23 48	23 32	23 17	23 00	22 41	22 30	22 17
30	1 49	1 24	1 05	0 49	0 36	0 25	0 05	.. ..	.. ..	.. ..	23 42	23 20	23 07	22 52
31	3 01	2 30	2 07	1 49	1 33	1 20	0 57	0 38	0 20	0 02	.. ..	.. ..	23 50	23 33
Sept. 1	4 07	3 32	3 07	2 47	2 30	2 15	1 50	1 29	1 09	0 50	0 28	0 04	.. ..	.. ..
2	5 03	4 27	4 01	3 40	3 23	3 08	2 43	2 21	2 01	1 40	1 19	0 53	0 39	0 21
3	5 46	5 13	4 49	4 29	4 12	3 58	3 34	3 13	2 53	2 34	2 13	1 48	1 34	1 17
4	6 18	5 50	5 29	5 12	4 57	4 44	4 22	4 04	3 46	3 28	3 09	2 47	2 34	2 19
5	6 41	6 19	6 02	5 48	5 36	5 26	5 08	4 52	4 38	4 23	4 07	3 48	3 38	3 25
6	6 58	6 43	6 31	6 21	6 12	6 04	5 51	5 39	5 28	5 17	5 05	4 51	4 43	4 34
7	7 12	7 03	6 56	6 50	6 44	6 39	6 31	6 24	6 17	6 10	6 03	5 54	5 50	5 44
8	7 25	7 21	7 19	7 17	7 15	7 13	7 10	7 08	7 05	7 03	7 01	6 58	6 56	6 54
9	7 36	7 39	7 41	7 43	7 45	7 47	7 49	7 52	7 54	7 56	7 59	8 02	8 03	8 05

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	2 09	1 47	1 30	1 16	1 04	0 53	0 35	0 20	0 05	.. ..	.. ..	.. ..	23 51	23 37
17	3 38	3 09	2 47	2 29	2 14	2 01	1 39	1 20	1 02	0 45	0 26	0 04	.. ..	.. ..
18	4 59	4 25	3 59	3 39	3 23	3 08	2 43	2 22	2 02	1 43	1 21	0 57	0 42	0 26
19	6 04	5 29	5 04	4 43	4 26	4 11	3 46	3 24	3 04	2 44	2 22	1 56	1 42	1 24
20	6 51	6 20	5 56	5 38	5 22	5 08	4 44	4 24	4 05	3 46	3 25	3 01	2 47	2 30
21	7 22	6 58	6 38	6 22	6 09	5 57	5 37	5 19	5 03	4 46	4 28	4 08	3 55	3 41
22	7 44	7 26	7 11	6 59	6 49	6 40	6 24	6 10	5 57	5 44	5 30	5 13	5 04	4 53
23	8 00	7 48	7 38	7 30	7 23	7 17	7 06	6 56	6 47	6 38	6 28	6 16	6 10	6 02
24	8 13	8 06	8 01	7 57	7 53	7 49	7 44	7 38	7 33	7 28	7 23	7 17	7 13	7 09
25	8 23	8 23	8 22	8 21	8 20	8 20	8 19	8 18	8 17	8 16	8 15	8 14	8 14	8 13
26	8 34	8 38	8 41	8 44	8 47	8 49	8 53	8 57	9 00	9 03	9 06	9 10	9 13	9 15
27	8 44	8 54	9 02	9 08	9 14	9 19	9 27	9 35	9 42	9 49	9 57	10 06	10 11	10 16
28	8 56	9 11	9 23	9 33	9 42	9 49	10 02	10 14	10 25	10 36	10 47	11 01	11 08	11 17
29	9 11	9 31	9 48	10 01	10 12	10 22	10 40	10 55	11 09	11 23	11 38	11 56	12 06	12 18
30	9 30	9 56	10 16	10 33	10 47	10 59	11 20	11 38	11 55	12 12	12 30	12 51	13 04	13 18
31	9 57	10 28	10 52	11 11	11 26	11 40	12 04	12 24	12 43	13 02	13 23	13 47	14 01	14 17
Sept. 1	10 34	11 09	11 35	11 55	12 12	12 27	12 52	13 14	13 34	13 54	14 16	14 41	14 56	15 13
2	11 25	12 00	12 26	12 47	13 04	13 19	13 44	14 06	14 26	14 46	15 08	15 33	15 47	16 04
3	12 30	13 03	13 27	13 46	14 02	14 16	14 39	15 00	15 19	15 37	15 57	16 21	16 34	16 50
4	13 47	14 14	14 34	14 50	15 04	15 16	15 37	15 54	16 11	16 27	16 44	17 04	17 16	17 29
5	15 09	15 30	15 45	15 58	16 09	16 18	16 35	16 49	17 02	17 15	17 29	17 44	17 53	18 04
6	16 35	16 48	16 59	17 07	17 15	17 21	17 33	17 42	17 51	18 00	18 10	18 21	18 27	18 34
7	18 01	18 08	18 13	18 17	18 21	18 25	18 30	18 35	18 40	18 45	18 50	18 55	18 58	19 02
8	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 29	19 29	19 29	19 29	19 28
9	20 56	20 49	20 44	20 40	20 36	20 33	20 27	20 22	20 17	20 13	20 08	20 02	19 59	19 56

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	13 54	14 00	14 07	14 14	14 22	14 31	14 40	14 51	15 04	15 18	15 35	15 56	16 23	17 02
17	15 07	15 14	15 22	15 30	15 40	15 50	16 02	16 16	16 31	16 50	17 13	17 43	18 29	■
18	16 14	16 22	16 31	16 40	16 50	17 01	17 14	17 29	17 46	18 07	18 33	19 09	20 28	■
19	17 14	17 21	17 29	17 38	17 48	17 59	18 11	18 25	18 41	19 00	19 24	19 56	20 46	■
20	18 03	18 10	18 17	18 25	18 33	18 42	18 53	19 05	19 18	19 33	19 52	20 14	20 44	21 28
21	18 43	18 49	18 55	19 01	19 07	19 15	19 23	19 32	19 42	19 53	20 07	20 22	20 41	21 04
22	19 17	19 21	19 25	19 29	19 34	19 39	19 45	19 51	19 58	20 06	20 15	20 25	20 37	20 51
23	19 45	19 48	19 50	19 53	19 56	19 59	20 03	20 07	20 11	20 15	20 21	20 27	20 34	20 42
24	20 10	20 11	20 12	20 14	20 15	20 16	20 18	20 19	20 21	20 23	20 25	20 27	20 30	20 33
25	20 34	20 34	20 33	20 33	20 32	20 32	20 31	20 30	20 30	20 29	20 28	20 27	20 26	20 25
26	20 57	20 55	20 54	20 52	20 49	20 47	20 45	20 42	20 39	20 35	20 32	20 27	20 23	20 17
27	21 21	21 18	21 15	21 11	21 08	21 03	20 59	20 54	20 49	20 43	20 36	20 28	20 19	20 09
28	21 48	21 43	21 39	21 34	21 28	21 22	21 16	21 08	21 00	20 51	20 41	20 29	20 16	19 59
29	22 17	22 12	22 06	21 59	21 52	21 44	21 36	21 26	21 16	21 04	20 50	20 33	20 12	19 46
30	22 52	22 45	22 38	22 30	22 22	22 13	22 02	21 50	21 37	21 21	21 03	20 40	20 10	19 24
31	23 33	23 26	23 18	23 09	22 59	22 49	22 37	22 23	22 07	21 49	21 26	20 56	20 09	□
Sept. 1	.. ..	.. ..	.. ..	23 56	23 46	23 35	23 22	23 08	22 51	22 31	22 05	21 30	20 22	□
2	0 21	0 14	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	23 50	23 31	23 07	22 34	21 40	□
3	1 17	1 10	1 02	0 53	0 43	0 32	0 20	0 06	.. ..	.. ..	.. ..	.. ..	23 29	22 29
4	2 19	2 12	2 05	1 57	1 49	1 39	1 28	1 16	1 03	0 46	0 27	0 02	.. ..	.. ..
5	3 25	3 20	3 14	3 08	3 01	2 53	2 45	2 35	2 24	2 12	1 58	1 40	1 19	0 51
6	4 34	4 30	4 26	4 21	4 16	4 11	4 04	3 58	3 50	3 42	3 32	3 21	3 07	2 51
7	5 44	5 42	5 39	5 36	5 33	5 30	5 26	5 22	5 18	5 13	5 07	5 01	4 53	4 45
8	6 54	6 53	6 53	6 52	6 51	6 50	6 48	6 47	6 46	6 44	6 42	6 40	6 38	6 35
9	8 05	8 06	8 07	8 08	8 09	8 10	8 12	8 13	8 14	8 16	8 18	8 20	8 23	8 26

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Aug. 16	23 37	23 30	23 23	23 16	23 07	22 58	22 48	22 37	22 24	22 09	21 52	21 30	21 02	20 23	■
17	.. ..	.. ..	.. ..	.. ..	23 52	23 41	23 29	23 15	22 59	22 41	22 17	21 47	21 00	■	■
18	0 26	0 18	0 10	0 01	.. ..	.. ..	.. ..	.. ..	23 52	23 32	23 06	22 29	21 10	■	■
19	1 24	1 16	1 08	0 59	0 48	0 37	0 24	0 10	.. ..	.. ..	.. ..	23 51	23 01	■	■
20	2 30	2 23	2 15	2 06	1 57	1 46	1 34	1 20	1 05	0 46	0 22	.. ..	.. ..	■	■
21	3 41	3 35	3 28	3 21	3 13	3 04	2 54	2 42	2 30	2 15	1 57	1 35	1 06	0 22	■
22	4 53	4 48	4 42	4 37	4 31	4 24	4 16	4 08	3 59	3 48	3 35	3 21	3 03	2 41	■
23	6 02	5 59	5 55	5 51	5 47	5 43	5 38	5 32	5 26	5 19	5 11	5 02	4 51	4 39	■
24	7 09	7 07	7 05	7 03	7 01	6 58	6 56	6 53	6 50	6 46	6 42	6 37	6 32	6 25	■
25	8 13	8 13	8 12	8 12	8 12	8 11	8 11	8 10	8 10	8 09	8 08	8 08	8 07	8 06	■
26	9 15	9 16	9 18	9 19	9 20	9 22	9 24	9 25	9 27	9 30	9 32	9 35	9 38	9 42	■
27	10 16	10 19	10 22	10 25	10 28	10 31	10 35	10 39	10 44	10 49	10 55	11 02	11 09	11 18	■
28	11 17	11 21	11 25	11 30	11 35	11 40	11 46	11 53	12 00	12 08	12 18	12 29	12 41	12 57	■
29	12 18	12 23	12 29	12 35	12 41	12 49	12 57	13 06	13 16	13 27	13 41	13 57	14 17	14 42	■
30	13 18	13 24	13 31	13 39	13 47	13 56	14 06	14 18	14 31	14 46	15 04	15 26	15 56	16 41	■
31	14 17	14 24	14 32	14 41	14 50	15 00	15 12	15 26	15 41	15 59	16 22	16 52	17 38	□	■
Sept. 1	15 13	15 21	15 29	15 38	15 48	15 59	16 12	16 26	16 43	17 03	17 29	18 04	19 11	□	■
2	16 04	16 12	16 20	16 29	16 39	16 50	17 02	17 16	17 32	17 52	18 16	18 48	19 43	□	■
3	16 50	16 57	17 04	17 12	17 21	17 31	17 42	17 54	18 08	18 25	18 45	19 10	19 44	20 44	■
4	17 29	17 35	17 41	17 48	17 56	18 04	18 13	18 23	18 34	18 47	19 02	19 20	19 42	20 11	■
5	18 04	18 08	18 13	18 18	18 24	18 30	18 37	18 44	18 52	19 02	19 12	19 25	19 39	19 57	■
6	18 34	18 37	18 40	18 44	18 48	18 52	18 56	19 01	19 06	19 12	19 19	19 27	19 36	19 46	■
7	19 02	19 03	19 05	19 07	19 09	19 11	19 13	19 15	19 18	19 21	19 24	19 28	19 32	19 37	■
8	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	■
9	19 56	19 54	19 52	19 50	19 48	19 46	19 44	19 42	19 39	19 36	19 32	19 29	19 24	19 19	■

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	7 25	7 21	7 19	7 17	7 15	7 13	7 10	7 08	7 05	7 03	7 01	6 58	6 56	6 54
9	7 36	7 39	7 41	7 43	7 45	7 47	7 49	7 52	7 54	7 56	7 59	8 02	8 03	8 05
10	7 49	7 58	8 05	8 11	8 17	8 21	8 30	8 37	8 44	8 51	8 58	9 07	9 12	9 18
11	8 04	8 19	8 32	8 42	8 51	8 59	9 12	9 24	9 36	9 47	9 59	10 14	10 22	10 31
12	8 23	8 45	9 03	9 17	9 30	9 40	9 59	10 15	10 30	10 46	11 02	11 22	11 33	11 46
13	8 50	9 19	9 41	9 59	10 14	10 28	10 50	11 10	11 28	11 47	12 07	12 30	12 43	12 59
14	9 30	10 04	10 30	10 50	11 07	11 21	11 46	12 08	12 28	12 48	13 10	13 36	13 50	14 08
15	10 27	11 02	11 28	11 49	12 06	12 21	12 46	13 08	13 29	13 49	14 11	14 36	14 51	15 09
16	11 39	12 12	12 36	12 55	13 11	13 25	13 48	14 09	14 28	14 47	15 07	15 31	15 44	16 00
17	13 02	13 28	13 48	14 04	14 18	14 30	14 50	15 08	15 24	15 40	15 58	16 17	16 29	16 42
18	14 27	14 47	15 02	15 14	15 25	15 34	15 50	16 03	16 16	16 29	16 42	16 58	17 07	17 17
19	15 51	16 04	16 14	16 22	16 29	16 36	16 46	16 56	17 05	17 13	17 23	17 33	17 39	17 46
20	17 12	17 18	17 24	17 28	17 32	17 35	17 41	17 46	17 50	17 55	18 00	18 05	18 08	18 12
21	18 30	18 31	18 31	18 32	18 32	18 32	18 33	18 33	18 34	18 34	18 35	18 35	18 35	18 36
22	19 47	19 42	19 37	19 34	19 31	19 28	19 24	19 20	19 16	19 12	19 09	19 04	19 02	18 59
23	21 03	20 51	20 43	20 35	20 29	20 24	20 14	20 06	19 58	19 51	19 43	19 34	19 28	19 23
24	22 18	22 01	21 48	21 37	21 27	21 19	21 05	20 53	20 41	20 30	20 18	20 05	19 57	19 48
25	23 33	23 10	22 52	22 38	22 25	22 15	21 56	21 41	21 26	21 11	20 56	20 38	20 28	20 16
26	.. ..	.. ..	23 56	23 38	23 23	23 10	22 49	22 30	22 12	21 55	21 36	21 15	21 03	20 48
27	0 47	0 18	.. ..	.. ..	.. ..	.. ..	23 41	23 20	23 01	22 41	22 21	21 57	21 43	21 27
28	1 56	1 22	0 57	0 37	0 20	0 06	.. ..	.. ..	23 51	23 31	23 09	22 44	22 29	22 11
29	2 56	2 19	1 53	1 32	1 14	0 59	0 34	0 12	.. ..	.. ..	.. ..	23 36	23 21	23 03
30	3 43	3 08	2 43	2 22	2 05	1 50	1 25	1 03	0 43	0 23	0 01	.. ..	.. ..	.. ..
Oct. 1	4 19	3 48	3 25	3 06	2 51	2 37	2 14	1 54	1 35	1 16	0 55	0 32	0 18	0 02
2	4 45	4 20	4 01	3 45	3 32	3 20	3 00	2 42	2 26	2 10	1 52	1 32	1 20	1 06

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 29	19 29	19 29	19 29	19 28
9	20 56	20 49	20 44	20 40	20 36	20 33	20 27	20 22	20 17	20 13	20 08	20 02	19 59	19 56
10	22 25	22 12	22 01	21 53	21 45	21 38	21 27	21 17	21 08	20 59	20 49	20 38	20 32	20 24
11	23 56	23 36	23 20	23 07	22 56	22 46	22 29	22 15	22 01	21 48	21 34	21 17	21 08	20 57
12	.. ..	.. ..	.. ..	.. ..	.. ..	23 54	23 33	23 15	22 58	22 41	22 22	22 02	21 49	21 35
13	1 27	0 59	0 38	0 21	0 06	.. ..	.. ..	.. ..	23 57	23 37	23 16	22 52	22 38	22 22
14	2 51	2 17	1 52	1 32	1 16	1 01	0 37	0 16	.. ..	.. ..	.. ..	23 49	23 34	23 16
15	4 00	3 25	2 58	2 37	2 20	2 05	1 40	1 18	0 57	0 37	0 15	.. ..	.. ..	.. ..
16	4 51	4 18	3 54	3 34	3 17	3 03	2 38	2 17	1 57	1 37	1 16	0 51	0 36	0 19
17	5 26	4 59	4 38	4 21	4 06	3 53	3 32	3 13	2 55	2 37	2 18	1 56	1 43	1 28
18	5 50	5 29	5 12	4 59	4 47	4 37	4 19	4 04	3 49	3 35	3 19	3 01	2 50	2 38
19	6 07	5 52	5 40	5 31	5 22	5 15	5 02	4 50	4 40	4 29	4 17	4 04	3 56	3 47
20	6 20	6 11	6 04	5 58	5 53	5 48	5 40	5 33	5 27	5 20	5 13	5 04	5 00	4 54
21	6 31	6 28	6 25	6 23	6 21	6 19	6 16	6 14	6 11	6 09	6 06	6 03	6 01	5 59
22	6 41	6 43	6 45	6 46	6 47	6 49	6 51	6 52	6 54	6 56	6 57	6 59	7 00	7 02
23	6 51	6 58	7 04	7 09	7 14	7 18	7 25	7 31	7 36	7 42	7 48	7 55	7 59	8 04
24	7 02	7 15	7 25	7 34	7 41	7 48	7 59	8 09	8 19	8 28	8 39	8 50	8 57	9 05
25	7 15	7 33	7 48	8 00	8 11	8 20	8 36	8 50	9 03	9 16	9 30	9 46	9 55	10 06
26	7 32	7 56	8 15	8 30	8 44	8 55	9 15	9 32	9 48	10 04	10 22	10 42	10 53	11 07
27	7 55	8 25	8 47	9 06	9 21	9 34	9 57	10 17	10 36	10 54	11 14	11 37	11 51	12 06
28	8 27	9 01	9 27	9 47	10 04	10 18	10 43	11 05	11 25	11 45	12 07	12 32	12 46	13 04
29	9 11	9 48	10 14	10 35	10 53	11 08	11 33	11 55	12 16	12 37	12 59	13 24	13 39	13 56
30	10 10	10 45	11 10	11 31	11 48	12 02	12 27	12 48	13 08	13 27	13 49	14 13	14 27	14 44
Oct. 1	11 22	11 52	12 14	12 32	12 47	13 00	13 22	13 42	13 59	14 17	14 36	14 58	15 10	15 25
2	12 42	13 05	13 23	13 38	13 50	14 01	14 20	14 36	14 50	15 05	15 21	15 39	15 49	16 01

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	6 54	6 53	6 53	6 52	6 51	6 50	6 48	6 47	6 46	6 44	6 42	6 40	6 38	6 35
9	8 05	8 06	8 07	8 08	8 09	8 10	8 12	8 13	8 14	8 16	8 18	8 20	8 23	8 26
10	9 18	9 20	9 23	9 26	9 29	9 32	9 36	9 40	9 45	9 50	9 56	10 03	10 10	10 20
11	10 31	10 36	10 40	10 45	10 50	10 56	11 02	11 10	11 17	11 26	11 37	11 49	12 03	12 21
12	11 46	11 52	11 58	12 05	12 12	12 20	12 29	12 39	12 51	13 04	13 20	13 39	14 03	14 36
13	12 59	13 06	13 14	13 22	13 31	13 42	13 53	14 06	14 21	14 39	15 00	15 29	16 10	■
14	14 08	14 16	14 24	14 33	14 44	14 55	15 08	15 23	15 40	16 01	16 27	17 04	■	■
15	15 09	15 17	15 25	15 34	15 44	15 56	16 08	16 23	16 40	17 00	17 26	18 01	19 10	■
16	16 00	16 07	16 15	16 23	16 32	16 42	16 54	17 06	17 21	17 38	17 59	18 25	19 01	20 14
17	16 42	16 48	16 55	17 01	17 09	17 17	17 26	17 36	17 47	18 00	18 16	18 34	18 56	19 25
18	17 17	17 21	17 26	17 31	17 37	17 43	17 50	17 57	18 05	18 15	18 25	18 37	18 52	19 09
19	17 46	17 49	17 53	17 56	18 00	18 04	18 08	18 13	18 18	18 24	18 31	18 39	18 47	18 58
20	18 12	18 14	18 15	18 17	18 19	18 21	18 23	18 26	18 29	18 32	18 35	18 39	18 43	18 48
21	18 36	18 36	18 36	18 36	18 37	18 37	18 37	18 37	18 38	18 38	18 38	18 39	18 39	18 40
22	18 59	18 58	18 56	18 55	18 53	18 52	18 50	18 48	18 46	18 44	18 41	18 38	18 35	18 31
23	19 23	19 20	19 17	19 14	19 11	19 08	19 04	19 00	18 55	18 50	18 45	18 38	18 31	18 22
24	19 48	19 44	19 40	19 35	19 30	19 25	19 19	19 13	19 06	18 58	18 49	18 39	18 27	18 13
25	20 16	20 11	20 05	19 59	19 53	19 46	19 38	19 29	19 19	19 08	18 56	18 41	18 23	18 01
26	20 48	20 42	20 35	20 28	20 20	20 11	20 01	19 50	19 37	19 23	19 06	18 45	18 19	17 41
27	21 27	21 19	21 11	21 03	20 54	20 43	20 32	20 18	20 03	19 45	19 24	18 55	18 14	□
28	22 11	22 04	21 55	21 46	21 36	21 25	21 12	20 57	20 41	20 20	19 55	19 19	18 10	□
29	23 03	22 56	22 47	22 38	22 28	22 17	22 04	21 49	21 32	21 12	20 46	20 10	18 52	□
30	.. ..	23 55	23 47	23 39	23 29	23 19	23 07	22 54	22 39	22 21	21 59	21 30	20 46	□
Oct. 1	0 02	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 57	23 42	23 25	23 05	22 38	21 59
2	1 06	1 00	0 53	0 46	0 38	0 30	0 20	0 09	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Sept. 8	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28	19 28
9	19 56	19 54	19 52	19 50	19 48	19 46	19 44	19 42	19 39	19 36	19 32	19 29	19 24	19 19
10	20 24	20 21	20 18	20 14	20 10	20 06	20 01	19 56	19 51	19 45	19 37	19 29	19 20	19 10
11	20 57	20 52	20 47	20 42	20 36	20 29	20 22	20 14	20 06	19 56	19 45	19 32	19 16	18 57
12	21 35	21 29	21 23	21 15	21 07	20 59	20 49	20 39	20 26	20 13	19 56	19 36	19 12	18 38
13	22 22	22 14	22 06	21 58	21 48	21 38	21 26	21 13	20 57	20 39	20 17	19 48	19 06	■
14	23 16	23 08	23 00	22 51	22 40	22 29	22 16	22 01	21 44	21 23	20 56	20 19	■	■
15	.. ..	.. ..	.. ..	23 54	23 44	23 33	23 20	23 06	22 49	22 29	22 04	21 28	20 20	■
16	0 19	0 12	0 03	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 53	23 33	23 07	22 31	21 19
17	1 28	1 21	1 13	1 05	0 57	0 47	0 36	0 24	0 10	.. ..	.. ..	.. ..	.. ..	.. ..
18	2 38	2 32	2 26	2 20	2 13	2 05	1 57	1 47	1 37	1 24	1 10	0 52	0 31	0 03
19	3 47	3 43	3 39	3 34	3 29	3 24	3 18	3 11	3 04	2 55	2 46	2 34	2 21	2 05
20	4 54	4 52	4 49	4 46	4 43	4 40	4 36	4 32	4 28	4 23	4 17	4 11	4 04	3 55
21	5 59	5 58	5 57	5 56	5 55	5 53	5 52	5 51	5 49	5 47	5 45	5 43	5 40	5 37
22	7 02	7 02	7 03	7 04	7 04	7 05	7 06	7 07	7 08	7 09	7 10	7 11	7 13	7 15
23	8 04	8 06	8 08	8 10	8 13	8 15	8 18	8 21	8 25	8 29	8 34	8 39	8 45	8 52
24	9 05	9 08	9 12	9 16	9 20	9 25	9 30	9 36	9 42	9 49	9 57	10 06	10 17	10 30
25	10 06	10 11	10 16	10 22	10 28	10 34	10 42	10 50	10 59	11 09	11 21	11 35	11 52	12 14
26	11 07	11 13	11 19	11 26	11 34	11 43	11 52	12 03	12 15	12 29	12 45	13 06	13 31	14 08
27	12 06	12 14	12 21	12 30	12 39	12 49	13 00	13 13	13 28	13 45	14 07	14 35	15 15	□
28	13 04	13 11	13 20	13 29	13 39	13 50	14 02	14 17	14 34	14 54	15 19	15 54	17 04	□
29	13 56	14 04	14 13	14 22	14 32	14 43	14 56	15 11	15 28	15 48	16 14	16 51	18 08	□
30	14 44	14 51	14 59	15 08	15 17	15 28	15 40	15 53	16 08	16 27	16 49	17 19	18 03	□
Oct. 1	15 25	15 31	15 38	15 46	15 54	16 03	16 13	16 25	16 37	16 52	17 10	17 31	17 59	18 38
2	16 01	16 06	16 12	16 18	16 24	16 31	16 39	16 48	16 58	17 09	17 22	17 37	17 55	18 17

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	4 19	3 48	3 25	3 06	2 51	2 37	2 14	1 54	1 35	1 16	0 55	0 32	0 18	0 02
2	4 45	4 20	4 01	3 45	3 32	3 20	3 00	2 42	2 26	2 10	1 52	1 32	1 20	1 06
3	5 04	4 45	4 31	4 19	4 08	3 59	3 43	3 30	3 17	3 04	2 50	2 33	2 24	2 13
4	5 19	5 06	4 57	4 49	4 42	4 35	4 24	4 15	4 06	3 57	3 47	3 36	3 30	3 23
5	5 31	5 25	5 20	5 16	5 13	5 10	5 04	4 59	4 55	4 50	4 46	4 40	4 37	4 33
6	5 43	5 43	5 43	5 43	5 43	5 43	5 44	5 44	5 44	5 44	5 44	5 45	5 45	5 45
7	5 55	6 01	6 06	6 11	6 15	6 18	6 24	6 29	6 34	6 39	6 45	6 51	6 55	6 59
8	6 09	6 22	6 32	6 41	6 48	6 55	7 07	7 17	7 27	7 37	7 47	7 59	8 06	8 14
9	6 26	6 46	7 02	7 15	7 26	7 36	7 53	8 08	8 22	8 36	8 52	9 09	9 20	9 31
10	6 51	7 18	7 39	7 56	8 10	8 23	8 44	9 03	9 21	9 38	9 58	10 20	10 33	10 48
11	7 26	8 00	8 25	8 44	9 01	9 16	9 40	10 02	10 22	10 42	11 03	11 28	11 43	12 01
12	8 18	8 54	9 21	9 42	9 59	10 15	10 40	11 03	11 23	11 44	12 06	12 32	12 47	13 05
13	9 27	10 01	10 26	10 47	11 03	11 18	11 42	12 04	12 23	12 43	13 04	13 29	13 43	14 00
14	10 47	11 16	11 38	11 55	12 10	12 22	12 44	13 03	13 20	13 37	13 56	14 17	14 30	14 44
15	12 12	12 34	12 51	13 04	13 16	13 26	13 44	13 59	14 13	14 27	14 42	14 59	15 09	15 20
16	13 36	13 50	14 02	14 12	14 20	14 28	14 40	14 51	15 02	15 12	15 23	15 35	15 42	15 50
17	14 56	15 05	15 12	15 18	15 23	15 27	15 34	15 41	15 47	15 53	16 00	16 07	16 11	16 16
18	16 14	16 17	16 19	16 21	16 23	16 24	16 26	16 28	16 30	16 32	16 35	16 37	16 38	16 40
19	17 31	17 28	17 25	17 23	17 21	17 20	17 17	17 15	17 13	17 10	17 08	17 06	17 04	17 03
20	18 46	18 37	18 30	18 24	18 19	18 15	18 07	18 01	17 54	17 48	17 42	17 34	17 30	17 26
21	20 02	19 47	19 35	19 26	19 17	19 10	18 58	18 47	18 37	18 27	18 16	18 04	17 58	17 50
22	21 18	20 57	20 40	20 27	20 16	20 06	19 49	19 35	19 21	19 07	18 53	18 37	18 27	18 17
23	22 33	22 05	21 45	21 28	21 14	21 02	20 41	20 23	20 07	19 50	19 33	19 12	19 01	18 47
24	23 44	23 11	22 47	22 28	22 11	21 58	21 34	21 13	20 54	20 36	20 15	19 52	19 39	19 23
25	.. ..	.. ..	23 45	23 24	23 07	22 52	22 26	22 04	21 44	21 24	21 02	20 37	20 22	20 05

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	11 22	11 52	12 14	12 32	12 47	13 00	13 22	13 42	13 59	14 17	14 36	14 58	15 10	15 25
2	12 42	13 05	13 23	13 38	13 50	14 01	14 20	14 36	14 50	15 05	15 21	15 39	15 49	16 01
3	14 06	14 22	14 35	14 46	14 55	15 03	15 17	15 29	15 40	15 51	16 03	16 16	16 24	16 32
4	15 32	15 42	15 50	15 56	16 02	16 07	16 15	16 22	16 29	16 36	16 43	16 51	16 56	17 01
5	17 00	17 03	17 05	17 07	17 09	17 11	17 14	17 16	17 18	17 20	17 23	17 25	17 27	17 28
6	18 29	18 25	18 22	18 20	18 18	18 16	18 13	18 10	18 08	18 05	18 02	17 59	17 57	17 55
7	20 01	19 50	19 42	19 35	19 29	19 23	19 14	19 06	18 59	18 51	18 44	18 35	18 29	18 24
8	21 35	21 17	21 03	20 51	20 41	20 32	20 18	20 05	19 53	19 41	19 28	19 13	19 05	18 55
9	23 09	22 44	22 24	22 08	21 55	21 43	21 23	21 06	20 50	20 34	20 16	19 57	19 46	19 33
10	.. ..	.. ..	23 42	23 23	23 07	22 53	22 29	22 09	21 50	21 30	21 10	20 47	20 33	20 17
11	0 39	0 07	.. ..	.. ..	.. ..	23 59	23 34	23 12	22 51	22 30	22 08	21 43	21 28	21 10
12	1 56	1 20	0 53	0 32	0 15	.. ..	.. ..	.. ..	23 52	23 32	23 10	22 44	22 29	22 12
13	2 53	2 18	1 52	1 32	1 15	1 00	0 35	0 13	.. ..	.. ..	.. ..	23 49	23 35	23 19
14	3 32	3 02	2 39	2 21	2 06	1 52	1 30	1 10	0 51	0 32	0 12	.. ..	.. ..	.. ..
15	3 58	3 34	3 16	3 01	2 49	2 37	2 18	2 02	1 46	1 30	1 13	0 53	0 42	0 28
16	4 16	3 59	3 45	3 34	3 25	3 16	3 02	2 49	2 37	2 24	2 11	1 56	1 47	1 37
17	4 29	4 18	4 09	4 02	3 56	3 50	3 40	3 32	3 24	3 15	3 07	2 56	2 51	2 44
18	4 40	4 35	4 31	4 27	4 24	4 21	4 16	4 12	4 08	4 04	4 00	3 55	3 52	3 48
19	4 50	4 50	4 50	4 50	4 50	4 50	4 50	4 51	4 51	4 51	4 51	4 51	4 51	4 51
20	4 59	5 05	5 09	5 13	5 16	5 19	5 24	5 28	5 33	5 37	5 41	5 46	5 49	5 53
21	5 09	5 20	5 29	5 36	5 43	5 48	5 58	6 07	6 15	6 23	6 32	6 42	6 47	6 54
22	5 21	5 38	5 51	6 02	6 11	6 19	6 34	6 46	6 58	7 10	7 22	7 37	7 46	7 55
23	5 36	5 58	6 16	6 30	6 42	6 53	7 12	7 28	7 43	7 58	8 14	8 33	8 44	8 57
24	5 56	6 24	6 46	7 03	7 18	7 31	7 53	8 12	8 30	8 47	9 07	9 29	9 42	9 57
25	6 24	6 57	7 22	7 42	7 58	8 13	8 37	8 58	9 18	9 38	9 59	10 24	10 38	10 55

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	0 02	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 57	23 42	23 25	23 05	22 38	21 59
2	1 06	1 00	0 53	0 46	0 38	0 30	0 20	0 09	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
3	2 13	2 09	2 03	1 58	1 52	1 45	1 38	1 30	1 21	1 10	0 58	0 44	0 27	0 06
4	3 23	3 19	3 16	3 12	3 08	3 04	2 59	2 54	2 48	2 41	2 34	2 25	2 15	2 03
5	4 33	4 32	4 30	4 28	4 26	4 24	4 22	4 19	4 16	4 13	4 10	4 06	4 01	3 55
6	5 45	5 45	5 45	5 46	5 46	5 46	5 46	5 46	5 46	5 47	5 47	5 47	5 47	5 48
7	6 59	7 01	7 03	7 05	7 07	7 10	7 12	7 15	7 19	7 22	7 26	7 31	7 37	7 43
8	8 14	8 18	8 22	8 26	8 31	8 36	8 41	8 47	8 54	9 01	9 10	9 20	9 31	9 45
9	9 31	9 37	9 43	9 49	9 55	10 03	10 11	10 20	10 31	10 43	10 56	11 13	11 33	12 00
10	10 48	10 55	11 02	11 10	11 19	11 29	11 40	11 52	12 06	12 23	12 43	13 08	13 44	14 56
11	12 01	12 08	12 17	12 26	12 36	12 47	13 00	13 15	13 32	13 53	14 19	14 55	16 18	■
12	13 05	13 13	13 22	13 31	13 42	13 53	14 07	14 22	14 39	15 01	15 28	16 07	■	■
13	14 00	14 07	14 15	14 24	14 33	14 44	14 56	15 10	15 25	15 44	16 07	16 37	17 22	■
14	14 44	14 50	14 57	15 05	15 13	15 21	15 31	15 42	15 55	16 09	16 26	16 47	17 13	17 50
15	15 20	15 25	15 30	15 36	15 42	15 49	15 57	16 05	16 14	16 25	16 37	16 51	17 07	17 28
16	15 50	15 54	15 57	16 01	16 06	16 11	16 16	16 22	16 28	16 35	16 43	16 52	17 02	17 15
17	16 16	16 18	16 20	16 23	16 25	16 28	16 31	16 35	16 38	16 42	16 47	16 52	16 58	17 05
18	16 40	16 41	16 41	16 42	16 43	16 44	16 45	16 46	16 47	16 48	16 50	16 51	16 53	16 55
19	17 03	17 02	17 01	17 00	16 59	16 59	16 58	16 56	16 55	16 54	16 52	16 51	16 49	16 47
20	17 26	17 23	17 21	17 19	17 16	17 14	17 11	17 07	17 04	17 00	16 55	16 50	16 44	16 38
21	17 50	17 46	17 43	17 39	17 34	17 30	17 25	17 19	17 13	17 06	16 59	16 50	16 40	16 28
22	18 17	18 12	18 07	18 01	17 55	17 49	17 42	17 34	17 25	17 15	17 04	16 51	16 35	16 16
23	18 47	18 41	18 35	18 28	18 20	18 12	18 03	17 52	17 41	17 28	17 12	16 53	16 30	16 00
24	19 23	19 16	19 08	19 00	18 51	18 41	18 30	18 17	18 03	17 46	17 26	17 00	16 25	15 17
25	20 05	19 57	19 49	19 40	19 30	19 18	19 06	18 52	18 35	18 15	17 50	17 16	16 15	□

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 1	15 25	15 31	15 38	15 46	15 54	16 03	16 13	16 25	16 37	16 52	17 10	17 31	17 59	18 38
2	16 01	16 06	16 12	16 18	16 24	16 31	16 39	16 48	16 58	17 09	17 22	17 37	17 55	18 17
3	16 32	16 36	16 40	16 45	16 49	16 54	17 00	17 06	17 13	17 21	17 29	17 39	17 50	18 04
4	17 01	17 03	17 06	17 08	17 11	17 14	17 17	17 21	17 25	17 29	17 34	17 40	17 46	17 53
5	17 28	17 29	17 30	17 30	17 31	17 32	17 33	17 34	17 36	17 37	17 38	17 40	17 42	17 44
6	17 55	17 54	17 53	17 52	17 51	17 50	17 49	17 47	17 46	17 44	17 42	17 40	17 37	17 35
7	18 24	18 21	18 18	18 16	18 12	18 09	18 05	18 01	17 57	17 52	17 46	17 40	17 33	17 25
8	18 55	18 51	18 47	18 42	18 37	18 31	18 25	18 18	18 10	18 02	17 52	17 41	17 28	17 13
9	19 33	19 27	19 21	19 14	19 07	18 59	18 50	18 40	18 29	18 16	18 02	17 44	17 23	16 55
10	20 17	20 10	20 02	19 54	19 45	19 35	19 23	19 11	18 56	18 39	18 18	17 52	17 16	16 03
11	21 10	21 02	20 54	20 44	20 34	20 22	20 10	19 55	19 38	19 17	18 50	18 14	16 51	■
12	22 12	22 04	21 55	21 46	21 35	21 24	21 11	20 56	20 38	20 17	19 49	19 10	■	■
13	23 19	23 12	23 04	22 55	22 46	22 36	22 24	22 11	21 55	21 37	21 15	20 45	20 00	■
14	.. ..	.. ..	.. ..	.. ..	.. ..	23 53	23 43	23 33	23 21	23 07	22 51	22 31	22 05	21 29
15	0 28	0 22	0 16	0 09	0 01	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 38
16	1 37	1 33	1 28	1 22	1 17	1 11	1 04	0 56	0 48	0 38	0 27	0 14	.. ..	.. ..
17	2 44	2 41	2 38	2 34	2 30	2 26	2 22	2 17	2 12	2 06	1 59	1 51	1 41	1 30
18	3 48	3 47	3 45	3 44	3 42	3 40	3 38	3 35	3 33	3 30	3 26	3 23	3 18	3 13
19	4 51	4 51	4 51	4 51	4 51	4 51	4 51	4 51	4 51	4 51	4 51	4 51	4 51	4 51
20	5 53	5 54	5 56	5 57	5 59	6 01	6 03	6 06	6 08	6 11	6 15	6 18	6 23	6 28
21	6 54	6 57	7 00	7 03	7 07	7 11	7 15	7 20	7 25	7 31	7 38	7 46	7 55	8 05
22	7 55	8 00	8 04	8 09	8 15	8 21	8 27	8 34	8 42	8 52	9 02	9 14	9 29	9 47
23	8 57	9 02	9 08	9 15	9 22	9 30	9 39	9 48	9 59	10 12	10 27	10 45	11 08	11 37
24	9 57	10 04	10 11	10 18	10 28	10 37	10 48	11 00	11 14	11 31	11 51	12 16	12 51	13 58
25	10 55	11 03	11 11	11 20	11 30	11 41	11 53	12 07	12 24	12 43	13 08	13 42	14 43	□

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 24	23 44	23 11	22 47	22 28	22 11	21 58	21 34	21 13	20 54	20 36	20 15	19 52	19 39	19 23
25	.. ..	.. ..	23 45	23 24	23 07	22 52	22 26	22 04	21 44	21 24	21 02	20 37	20 22	20 05
26	0 48	0 12	.. ..	.. ..	23 58	23 43	23 18	22 55	22 35	22 14	21 52	21 26	21 11	20 54
27	1 40	1 04	0 37	0 16	.. ..	.. ..	.. ..	23 46	23 26	23 06	22 45	22 20	22 06	21 49
28	2 20	1 47	1 22	1 02	0 45	0 31	0 07	.. ..	.. ..	23 59	23 40	23 18	23 05	22 50
29	2 48	2 20	1 59	1 42	1 27	1 15	0 53	0 34	0 16	.. ..	.. ..	.. ..	.. ..	23 54
30	3 09	2 47	2 30	2 17	2 05	1 54	1 36	1 21	1 06	0 51	0 35	0 17	0 06	.. ..
31	3 25	3 09	2 57	2 47	2 38	2 31	2 17	2 06	1 55	1 43	1 32	1 18	1 10	1 01
Nov. 1	3 38	3 29	3 21	3 15	3 10	3 05	2 57	2 49	2 43	2 36	2 28	2 20	2 15	2 10
2	3 49	3 46	3 44	3 42	3 40	3 38	3 35	3 33	3 31	3 28	3 26	3 23	3 22	3 20
3	4 01	4 04	4 06	4 08	4 10	4 12	4 15	4 17	4 20	4 22	4 25	4 28	4 30	4 32
4	4 13	4 23	4 30	4 37	4 43	4 48	4 56	5 04	5 11	5 19	5 27	5 36	5 41	5 48
5	4 29	4 45	4 58	5 09	5 19	5 27	5 42	5 54	6 06	6 19	6 32	6 47	6 56	7 06
6	4 50	5 14	5 32	5 48	6 01	6 12	6 32	6 49	7 05	7 22	7 39	8 00	8 12	8 25
7	5 21	5 52	6 15	6 34	6 50	7 04	7 28	7 48	8 08	8 27	8 48	9 12	9 27	9 43
8	6 07	6 43	7 09	7 30	7 48	8 03	8 29	8 51	9 12	9 33	9 55	10 21	10 37	10 54
9	7 12	7 48	8 14	8 35	8 52	9 07	9 33	9 55	10 15	10 35	10 57	11 23	11 38	11 55
10	8 32	9 03	9 26	9 45	10 00	10 14	10 36	10 56	11 15	11 33	11 53	12 15	12 29	12 44
11	9 57	10 22	10 40	10 55	11 08	11 19	11 38	11 54	12 10	12 25	12 41	13 00	13 11	13 23
12	11 22	11 40	11 53	12 04	12 14	12 22	12 36	12 48	13 00	13 11	13 24	13 38	13 46	13 55
13	12 44	12 55	13 03	13 10	13 16	13 22	13 31	13 39	13 46	13 54	14 02	14 11	14 16	14 22
14	14 02	14 07	14 11	14 14	14 16	14 19	14 23	14 26	14 30	14 33	14 37	14 41	14 43	14 46
15	15 18	15 17	15 16	15 16	15 15	15 14	15 13	15 12	15 12	15 11	15 10	15 09	15 09	15 08
16	16 33	16 27	16 16	16 12	16 12	16 09	16 03	15 58	15 53	15 48	15 43	15 37	15 34	15 30
17	17 48	17 36	17 26	17 17	17 10	17 04	16 53	16 44	16 35	16 26	16 17	16 07	16 01	15 54

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 24	5 56	6 24	6 46	7 03	7 18	7 31	7 53	8 12	8 30	8 47	9 07	9 29	9 42	9 57
25	6 24	6 57	7 22	7 42	7 58	8 13	8 37	8 58	9 18	9 38	9 59	10 24	10 38	10 55
26	7 03	7 39	8 06	8 27	8 45	9 00	9 26	9 48	10 08	10 29	10 51	11 17	11 32	11 50
27	7 56	8 32	8 58	9 19	9 37	9 52	10 17	10 39	10 59	11 20	11 41	12 07	12 21	12 38
28	9 01	9 34	9 58	10 17	10 34	10 47	11 11	11 31	11 50	12 09	12 29	12 52	13 06	13 21
29	10 17	10 43	11 04	11 20	11 34	11 46	12 06	12 24	12 40	12 57	13 14	13 34	13 45	13 58
30	11 37	11 57	12 13	12 26	12 37	12 46	13 02	13 16	13 29	13 42	13 56	14 12	14 21	14 31
31	13 01	13 14	13 25	13 34	13 41	13 47	13 59	14 08	14 17	14 26	14 36	14 47	14 53	15 00
Nov. 1	14 26	14 33	14 38	14 43	14 47	14 50	14 56	15 01	15 05	15 10	15 15	15 20	15 23	15 27
2	15 54	15 54	15 54	15 54	15 54	15 54	15 54	15 54	15 54	15 54	15 54	15 53	15 53	15 53
3	17 25	17 18	17 12	17 08	17 04	17 00	16 54	16 49	16 44	16 39	16 34	16 28	16 24	16 21
4	18 59	18 45	18 34	18 24	18 16	18 09	17 57	17 47	17 37	17 27	17 17	17 05	16 58	16 51
5	20 37	20 15	19 57	19 43	19 32	19 21	19 03	18 48	18 34	18 20	18 04	17 47	17 37	17 26
6	22 13	21 43	21 21	21 03	20 47	20 34	20 12	19 53	19 35	19 17	18 57	18 35	18 22	18 08
7	23 40	23 05	22 39	22 18	22 00	21 46	21 20	20 58	20 38	20 18	19 56	19 31	19 16	18 59
8	.. ..	.. ..	23 45	23 24	23 06	22 51	22 25	22 03	21 42	21 21	20 59	20 33	20 17	19 59
9	0 48	0 12	.. ..	.. ..	.. ..	23 48	23 24	23 04	22 44	22 24	22 03	21 39	21 24	21 07
10	1 34	1 02	0 38	0 19	0 03	.. ..	.. ..	23 58	23 42	23 25	23 06	22 45	22 33	22 18
11	2 04	1 39	1 19	1 03	0 49	0 37	0 16	.. ..	.. ..	.. ..	.. ..	23 50	23 40	23 28
12	2 24	2 05	1 50	1 38	1 27	1 18	1 02	0 48	0 34	0 21	0 06	.. ..	.. ..	.. ..
13	2 39	2 26	2 16	2 07	2 00	1 53	1 42	1 32	1 22	1 13	1 03	0 51	0 44	0 36
14	2 50	2 43	2 37	2 33	2 28	2 25	2 18	2 13	2 07	2 02	1 56	1 49	1 46	1 41
15	3 00	2 58	2 57	2 56	2 55	2 54	2 53	2 51	2 50	2 49	2 47	2 46	2 45	2 44
16	3 09	3 13	3 16	3 18	3 20	3 22	3 26	3 29	3 31	3 34	3 37	3 41	3 43	3 45
17	3 18	3 27	3 35	3 41	3 46	3 51	3 59	4 06	4 13	4 20	4 27	4 35	4 40	4 46

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 24	19 23	19 16	19 08	19 00	18 51	18 41	18 30	18 17	18 03	17 46	17 26	17 00	16 25	15 17
25	20 05	19 57	19 49	19 40	19 30	19 18	19 06	18 52	18 35	18 15	17 50	17 16	16 15	□
26	20 54	20 46	20 37	20 28	20 17	20 06	19 53	19 38	19 21	18 59	18 32	17 54	□	□
27	21 49	21 41	21 33	21 24	21 14	21 03	20 51	20 37	20 21	20 01	19 36	19 03	18 04	□
28	22 50	22 43	22 36	22 28	22 19	22 10	21 59	21 47	21 33	21 17	20 57	20 32	19 59	18 58
29	23 54	23 49	23 43	23 36	23 29	23 22	23 13	23 04	22 53	22 41	22 26	22 09	21 48	21 20
30	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 59	23 48	23 34	23 18
31	1 01	0 57	0 53	0 48	0 43	0 37	0 31	0 25	0 17	0 09	.. ..	.. ..	.. ..	.. ..
Nov. 1	2 10	2 07	2 04	2 02	1 59	1 55	1 52	1 48	1 43	1 38	1 33	1 26	1 19	1 10
2	3 20	3 19	3 18	3 17	3 16	3 15	3 14	3 13	3 11	3 10	3 08	3 06	3 04	3 01
3	4 32	4 33	4 34	4 35	4 36	4 38	4 39	4 40	4 42	4 44	4 46	4 48	4 51	4 54
4	5 48	5 50	5 53	5 56	6 00	6 03	6 07	6 12	6 17	6 22	6 29	6 36	6 44	6 54
5	7 06	7 10	7 15	7 20	7 26	7 32	7 39	7 47	7 55	8 05	8 16	8 29	8 45	9 05
6	8 25	8 32	8 38	8 46	8 54	9 02	9 12	9 23	9 36	9 50	10 08	10 29	10 57	11 38
7	9 43	9 51	9 59	10 08	10 18	10 28	10 41	10 55	11 11	11 30	11 55	12 28	13 24	■
8	10 54	11 02	11 11	11 21	11 31	11 43	11 57	12 12	12 30	12 52	13 20	14 02	■	■
9	11 55	12 03	12 11	12 20	12 30	12 42	12 54	13 09	13 25	13 46	14 11	14 45	15 48	■
10	12 44	12 51	12 58	13 06	13 15	13 24	13 35	13 47	14 01	14 17	14 36	14 59	15 31	16 21
11	13 23	13 28	13 34	13 41	13 47	13 55	14 03	14 12	14 23	14 35	14 48	15 04	15 24	15 48
12	13 55	13 59	14 03	14 08	14 13	14 18	14 24	14 30	14 38	14 46	14 55	15 06	15 18	15 33
13	14 22	14 24	14 27	14 30	14 33	14 36	14 40	14 44	14 49	14 54	14 59	15 06	15 13	15 21
14	14 46	14 47	14 48	14 49	14 51	14 52	14 54	14 56	14 58	15 00	15 02	15 05	15 08	15 12
15	15 08	15 08	15 08	15 07	15 07	15 07	15 06	15 06	15 06	15 05	15 05	15 04	15 03	15 03
16	15 30	15 29	15 27	15 25	15 23	15 21	15 19	15 16	15 14	15 10	15 07	15 03	14 59	14 54
17	15 54	15 51	15 48	15 44	15 41	15 37	15 32	15 28	15 22	15 17	15 10	15 03	14 54	14 44

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Oct. 24	9 57	10 04	10 11	10 19	10 28	10 37	10 48	11 00	11 14	11 31	11 51	12 16	12 51	13 58
25	10 55	11 03	11 11	11 20	11 30	11 41	11 53	12 07	12 24	12 43	13 08	13 42	14 43	□
26	11 50	11 58	12 06	12 15	12 26	12 37	12 50	13 05	13 23	13 44	14 11	14 49	□	□
27	12 38	12 46	12 55	13 04	13 14	13 25	13 37	13 51	14 08	14 28	14 53	15 26	16 26	□
28	13 21	13 28	13 36	13 44	13 53	14 03	14 14	14 26	14 40	14 57	15 17	15 42	16 17	17 18
29	13 58	14 04	14 11	14 17	14 25	14 33	14 42	14 52	15 03	15 16	15 31	15 49	16 11	16 40
30	14 31	14 35	14 40	14 45	14 51	14 57	15 04	15 11	15 20	15 29	15 39	15 52	16 06	16 23
31	15 00	15 03	15 06	15 10	15 13	15 18	15 22	15 27	15 32	15 38	15 45	15 53	16 01	16 12
Nov. 1	15 27	15 28	15 30	15 32	15 34	15 36	15 38	15 40	15 43	15 46	15 49	15 53	15 57	16 01
2	15 53	15 53	15 53	15 53	15 53	15 53	15 53	15 53	15 53	15 52	15 52	15 52	15 52	15 52
3	16 21	16 19	16 17	16 15	16 13	16 11	16 08	16 06	16 03	16 00	15 56	15 52	15 47	15 42
4	16 51	16 47	16 44	16 40	16 36	16 31	16 26	16 21	16 15	16 08	16 01	15 52	15 42	15 31
5	17 26	17 21	17 15	17 09	17 03	16 56	16 48	16 40	16 31	16 20	16 08	15 54	15 37	15 16
6	18 08	18 01	17 54	17 46	17 38	17 29	17 18	17 07	16 54	16 38	16 20	15 58	15 29	14 48
7	18 59	18 51	18 43	18 34	18 24	18 13	18 00	17 46	17 29	17 09	16 45	16 11	15 15	■
8	19 59	19 51	19 43	19 33	19 22	19 11	18 57	18 42	18 24	18 02	17 34	16 52	■	■
9	21 07	21 00	20 51	20 42	20 33	20 22	20 09	19 55	19 38	19 19	18 54	18 20	17 18	■
10	22 18	22 12	22 05	21 57	21 49	21 40	21 29	21 18	21 05	20 49	20 31	20 08	19 37	18 48
11	23 28	23 23	23 18	23 12	23 06	22 59	22 51	22 43	22 33	22 22	22 09	21 54	21 35	21 12
12	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 51	23 43	23 34	23 22	23 09
13	0 36	0 33	0 29	0 25	0 21	0 16	0 11	0 05	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
14	1 41	1 39	1 37	1 35	1 32	1 30	1 27	1 24	1 20	1 16	1 12	1 07	1 01	0 54
15	2 44	2 43	2 43	2 42	2 42	2 41	2 40	2 40	2 39	2 38	2 37	2 36	2 34	2 33
16	3 45	3 46	3 47	3 48	3 49	3 51	3 52	3 54	3 55	3 57	4 00	4 02	4 05	4 08
17	4 46	4 48	4 51	4 53	4 57	5 00	5 03	5 07	5 12	5 17	5 22	5 28	5 36	5 44

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	16 33	16 27	16 21	16 16	16 12	16 09	16 03	15 58	15 53	15 48	15 43	15 37	15 34	15 30
17	17 48	17 36	17 26	17 17	17 10	17 04	16 53	16 44	16 35	16 26	16 17	16 07	16 01	15 54
18	19 04	18 45	18 30	18 18	18 08	17 59	17 44	17 30	17 18	17 06	16 53	16 38	16 29	16 19
19	20 19	19 54	19 35	19 19	19 06	18 55	18 35	18 19	18 03	17 47	17 31	17 12	17 01	16 48
20	21 32	21 02	20 38	20 20	20 04	19 51	19 28	19 08	18 50	18 32	18 12	17 50	17 37	17 22
21	22 40	22 04	21 38	21 18	21 01	20 46	20 21	19 59	19 39	19 19	18 58	18 33	18 18	18 02
22	23 36	23 00	22 33	22 11	21 54	21 38	21 12	20 50	20 29	20 09	19 47	19 21	19 06	18 48
23	.. ..	23 45	23 20	22 59	22 42	22 27	22 02	21 40	21 20	21 00	20 38	20 13	19 58	19 41
24	0 20	.. ..	23 59	23 41	23 25	23 12	22 49	22 29	22 10	21 52	21 32	21 09	20 55	20 39
25	0 52	0 22	.. ..	.. ..	.. ..	23 52	23 33	23 15	23 00	22 43	22 26	22 06	21 55	21 41
26	1 14	0 50	0 32	0 16	0 03	.. ..	.. ..	.. ..	23 47	23 34	23 21	23 05	22 56	22 46
27	1 31	1 13	0 59	0 47	0 37	0 29	0 13	0 00	.. ..	.. ..	.. ..	.. ..	23 58	23 51
28	1 45	1 33	1 23	1 15	1 08	1 02	0 52	0 42	0 34	0 25	0 16	0 05	.. ..	.. ..
29	1 56	1 50	1 45	1 41	1 38	1 35	1 29	1 24	1 20	1 15	1 11	1 05	1 02	0 58
30	2 07	2 07	2 07	2 07	2 07	2 07	2 07	2 07	2 07	2 07	2 07	2 07	2 07	2 07
Dec. 1	2 18	2 24	2 29	2 33	2 37	2 40	2 46	2 51	2 56	3 00	3 06	3 12	3 15	3 19
2	2 31	2 44	2 54	3 03	3 10	3 17	3 28	3 38	3 48	3 57	4 08	4 20	4 26	4 34
3	2 49	3 09	3 24	3 37	3 49	3 58	4 15	4 30	4 44	4 58	5 14	5 31	5 41	5 53
4	3 14	3 41	4 03	4 20	4 34	4 47	5 09	5 28	5 45	6 03	6 23	6 45	6 58	7 14
5	3 52	4 26	4 52	5 12	5 29	5 44	6 09	6 30	6 51	7 11	7 33	7 58	8 13	8 31
6	4 50	5 26	5 53	6 15	6 32	6 48	7 14	7 36	7 57	8 18	8 40	9 06	9 21	9 39
7	6 07	6 40	7 05	7 25	7 42	7 56	8 20	8 41	9 01	9 20	9 41	10 05	10 19	10 36
8	7 35	8 02	8 22	8 39	8 53	9 05	9 26	9 44	10 00	10 17	10 35	10 55	11 07	11 20
9	9 04	9 23	9 39	9 51	10 02	10 11	10 27	10 41	10 54	11 07	11 21	11 37	11 46	11 56
10	10 29	10 42	10 52	11 00	11 08	11 14	11 25	11 34	11 43	11 52	12 01	12 12	12 18	12 25

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	3 09	3 13	3 16	3 18	3 20	3 22	3 26	3 29	3 31	3 34	3 37	3 41	3 43	3 45
17	3 18	3 27	3 35	3 41	3 46	3 51	3 59	4 06	4 13	4 20	4 27	4 35	4 40	4 46
18	3 29	3 44	3 55	4 05	4 14	4 21	4 34	4 45	4 55	5 06	5 17	5 30	5 38	5 47
19	3 43	4 03	4 19	4 32	4 44	4 53	5 10	5 25	5 39	5 53	6 09	6 26	6 36	6 48
20	4 01	4 27	4 47	5 03	5 17	5 29	5 50	6 08	6 25	6 42	7 01	7 22	7 34	7 49
21	4 25	4 57	5 21	5 40	5 56	6 10	6 34	6 54	7 14	7 33	7 54	8 18	8 32	8 48
22	5 00	5 36	6 02	6 23	6 40	6 55	7 21	7 43	8 03	8 24	8 46	9 11	9 27	9 44
23	5 48	6 24	6 51	7 13	7 30	7 45	8 11	8 33	8 54	9 15	9 37	10 02	10 17	10 35
24	6 49	7 23	7 48	8 08	8 25	8 39	9 04	9 25	9 45	10 04	10 25	10 49	11 03	11 19
25	8 00	8 29	8 51	9 09	9 23	9 36	9 58	10 17	10 34	10 52	11 10	11 31	11 44	11 58
26	9 17	9 40	9 58	10 12	10 24	10 35	10 53	11 08	11 23	11 37	11 52	12 10	12 20	12 31
27	10 38	10 54	11 07	11 17	11 26	11 34	11 47	11 59	12 10	12 20	12 32	12 45	12 52	13 00
28	11 59	12 09	12 17	12 23	12 29	12 34	12 42	12 49	12 56	13 02	13 09	13 17	13 22	13 27
29	13 23	13 26	13 29	13 31	13 33	13 35	13 37	13 40	13 42	13 44	13 47	13 49	13 51	13 52
30	14 49	14 46	14 43	14 41	14 39	14 37	14 35	14 32	14 30	14 27	14 25	14 22	14 20	14 18
Dec. 1	16 20	16 09	16 01	15 54	15 49	15 43	15 35	15 27	15 20	15 13	15 05	14 56	14 51	14 46
2	17 55	17 37	17 23	17 11	17 02	16 53	16 38	16 26	16 14	16 02	15 49	15 35	15 27	15 17
3	19 33	19 07	18 47	18 31	18 18	18 06	17 46	17 29	17 13	16 57	16 39	16 20	16 08	15 55
4	21 08	20 35	20 10	19 51	19 34	19 20	18 56	18 35	18 16	17 57	17 36	17 12	16 58	16 42
5	22 29	21 52	21 25	21 04	20 46	20 31	20 05	19 43	19 22	19 01	18 39	18 13	17 57	17 40
6	23 27	22 53	22 27	22 07	21 50	21 35	21 10	20 48	20 28	20 07	19 45	19 20	19 04	18 47
7	.. ..	23 37	23 15	22 57	22 43	22 30	22 07	21 48	21 30	21 12	20 52	20 29	20 15	20 00
8	0 05	.. ..	23 51	23 37	23 26	23 15	22 57	22 41	22 27	22 12	21 56	21 37	21 26	21 14
9	0 30	0 08	.. ..	.. ..	.. ..	23 54	23 41	23 29	23 18	23 07	22 55	22 42	22 34	22 25
10	0 46	0 32	0 20	0 10	0 01	.. ..	.. ..	.. ..	.. ..	23 58	23 51	23 43	23 38	23 32

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

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UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	15 30	15 29	15 27	15 25	15 23	15 21	15 19	15 16	15 14	15 10	15 07	15 03	14 59	14 54
17	15 54	15 51	15 48	15 44	15 41	15 37	15 32	15 28	15 22	15 17	15 10	15 03	14 54	14 44
18	16 19	16 15	16 10	16 05	16 00	15 54	15 48	15 41	15 33	15 24	15 14	15 03	14 49	14 33
19	16 48	16 43	16 37	16 30	16 23	16 16	16 07	15 58	15 47	15 35	15 21	15 04	14 44	14 19
20	17 22	17 15	17 08	17 00	16 52	16 42	16 32	16 20	16 07	15 51	15 32	15 09	14 39	13 52
21	18 02	17 54	17 46	17 37	17 27	17 17	17 04	16 51	16 35	16 16	15 52	15 21	14 30	□
22	18 48	18 40	18 32	18 22	18 12	18 00	17 47	17 32	17 15	16 54	16 27	15 49	□	□
23	19 41	19 33	19 25	19 16	19 05	18 54	18 41	18 27	18 10	17 49	17 23	16 47	15 22	□
24	20 39	20 32	20 25	20 16	20 07	19 57	19 45	19 33	19 18	19 00	18 38	18 10	17 29	□
25	21 41	21 35	21 29	21 22	21 14	21 06	20 56	20 46	20 34	20 20	20 04	19 44	19 18	18 43
26	22 46	22 41	22 36	22 31	22 25	22 18	22 11	22 03	21 55	21 45	21 33	21 20	21 03	20 43
27	23 51	23 48	23 45	23 41	23 37	23 33	23 28	23 23	23 17	23 11	23 04	22 55	22 45	22 34
28	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
29	0 58	0 57	0 55	0 53	0 51	0 49	0 47	0 44	0 41	0 38	0 35	0 31	0 26	0 21
30	2 07	2 07	2 07	2 07	2 07	2 08	2 08	2 08	2 08	2 08	2 08	2 08	2 08	2 09
Dec. 1	3 19	3 21	3 23	3 25	3 27	3 29	3 32	3 35	3 38	3 41	3 45	3 50	3 55	4 01
2	4 34	4 38	4 42	4 46	4 50	4 55	5 00	5 06	5 13	5 20	5 28	5 38	5 50	6 03
3	5 53	5 59	6 04	6 11	6 17	6 25	6 33	6 42	6 52	7 04	7 18	7 35	7 55	8 22
4	7 14	7 21	7 28	7 36	7 45	7 55	8 06	8 18	8 33	8 50	9 11	9 37	10 14	11 49
5	8 31	8 39	8 47	8 57	9 07	9 19	9 32	9 47	10 04	10 25	10 53	11 31	■	■
6	9 39	9 47	9 56	10 06	10 16	10 28	10 41	10 56	11 14	11 36	12 03	12 43	■	■
7	10 36	10 43	10 51	11 00	11 09	11 19	11 31	11 44	11 59	12 17	12 39	13 07	13 48	■
8	11 20	11 26	11 33	11 40	11 48	11 56	12 05	12 16	12 27	12 41	12 56	13 15	13 39	14 10
9	11 56	12 01	12 05	12 11	12 16	12 23	12 29	12 37	12 45	12 55	13 05	13 18	13 32	13 50
10	12 25	12 28	12 32	12 35	12 39	12 43	12 47	12 52	12 58	13 04	13 10	13 18	13 27	13 37

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Nov. 16	3 45	3 46	3 47	3 48	3 49	3 51	3 52	3 54	3 55	3 57	4 00	4 02	4 05	4 08
17	4 46	4 48	4 51	4 53	4 57	5 00	5 03	5 07	5 12	5 17	5 22	5 28	5 36	5 44
18	5 47	5 50	5 55	5 59	6 04	6 09	6 15	6 21	6 28	6 36	6 45	6 56	7 08	7 24
19	6 48	6 53	6 59	7 05	7 11	7 18	7 26	7 35	7 45	7 57	8 10	8 26	8 45	9 10
20	7 49	7 55	8 02	8 09	8 18	8 27	8 37	8 48	9 01	9 17	9 35	9 57	10 27	11 14
21	8 48	8 55	9 03	9 12	9 22	9 32	9 44	9 58	10 13	10 32	10 56	11 27	12 16	□
22	9 44	9 52	10 00	10 10	10 20	10 32	10 44	10 59	11 17	11 38	12 05	12 43	□	□
23	10 35	10 43	10 51	11 01	11 11	11 22	11 35	11 50	12 07	12 28	12 54	13 30	14 56	□
24	11 19	11 27	11 35	11 43	11 53	12 03	12 15	12 28	12 43	13 01	13 23	13 52	14 33	□
25	11 58	12 04	12 11	12 19	12 27	12 35	12 45	12 56	13 09	13 23	13 40	14 00	14 27	15 03
26	12 31	12 36	12 42	12 48	12 54	13 01	13 09	13 17	13 26	13 37	13 50	14 04	14 21	14 42
27	13 00	13 04	13 08	13 12	13 17	13 22	13 27	13 33	13 40	13 47	13 56	14 05	14 16	14 29
28	13 27	13 29	13 32	13 34	13 37	13 40	13 43	13 47	13 51	13 55	14 00	14 05	14 11	14 19
29	13 52	13 53	13 54	13 55	13 56	13 57	13 58	13 59	14 00	14 01	14 03	14 05	14 07	14 09
30	14 18	14 17	14 16	14 15	14 14	14 13	14 12	14 11	14 09	14 08	14 06	14 04	14 02	13 59
Dec. 1	14 46	14 43	14 41	14 38	14 35	14 32	14 28	14 24	14 20	14 15	14 10	14 04	13 57	13 49
2	15 17	15 13	15 09	15 04	14 59	14 53	14 47	14 40	14 33	14 25	14 15	14 04	13 52	13 36
3	15 55	15 50	15 43	15 37	15 29	15 21	15 12	15 03	14 51	14 39	14 24	14 07	13 45	13 18
4	16 42	16 35	16 27	16 19	16 09	15 59	15 48	15 35	15 20	15 02	14 41	14 14	13 36	12 01
5	17 40	17 32	17 23	17 13	17 03	16 51	16 38	16 23	16 05	15 44	15 17	14 38	■	■
6	18 47	18 39	18 30	18 21	18 11	17 59	17 46	17 31	17 13	16 52	16 24	15 45	■	■
7	20 00	19 53	19 45	19 37	19 28	19 18	19 07	18 54	18 39	18 21	18 00	17 32	16 52	■
8	21 14	21 08	21 02	20 55	20 48	20 40	20 32	20 22	20 11	19 58	19 43	19 25	19 03	18 33
9	22 25	22 21	22 16	22 12	22 07	22 01	21 55	21 48	21 41	21 32	21 22	21 11	20 57	20 41
10	23 32	23 30	23 27	23 24	23 21	23 18	23 14	23 10	23 06	23 01	22 55	22 49	22 41	22 32

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

MOONRISE AND MOONSET, 2021

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	−55°	−50°	−45°	−40°	−35°	−30°	−20°	−10°	0°	+10°	+20°	+30°	+35°	+40°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	9 04	9 23	9 39	9 51	10 02	10 11	10 27	10 41	10 54	11 07	11 21	11 37	11 46	11 56
10	10 29	10 42	10 52	11 00	11 08	11 14	11 25	11 34	11 43	11 52	12 01	12 12	12 18	12 25
11	11 50	11 56	12 02	12 06	12 10	12 13	12 19	12 24	12 28	12 33	12 38	12 44	12 47	12 50
12	13 07	13 08	13 08	13 09	13 09	13 09	13 10	13 10	13 11	13 11	13 12	13 13	13 13	13 14
13	14 22	14 17	14 13	14 10	14 07	14 04	14 00	13 56	13 52	13 49	13 45	13 41	13 39	13 36
14	15 37	15 26	15 17	15 10	15 04	14 59	14 49	14 41	14 34	14 26	14 19	14 10	14 04	13 59
15	16 52	16 35	16 22	16 11	16 02	15 53	15 40	15 27	15 16	15 05	14 53	14 40	14 32	14 23
16	18 07	17 44	17 26	17 12	16 59	16 49	16 31	16 15	16 00	15 46	15 30	15 13	15 02	14 51
17	19 21	18 52	18 30	18 12	17 57	17 45	17 23	17 04	16 47	16 29	16 11	15 49	15 37	15 23
18	20 31	19 57	19 31	19 11	18 55	18 40	18 16	17 55	17 35	17 16	16 55	16 31	16 17	16 00
19	21 31	20 55	20 28	20 07	19 49	19 34	19 08	18 46	18 25	18 05	17 43	17 17	17 02	16 45
20	22 19	21 44	21 18	20 57	20 39	20 24	19 59	19 37	19 16	18 56	18 34	18 08	17 53	17 36
21	22 55	22 23	21 59	21 40	21 24	21 10	20 47	20 26	20 07	19 48	19 27	19 03	18 49	18 33
22	23 20	22 54	22 34	22 18	22 04	21 52	21 31	21 13	20 56	20 39	20 21	20 00	19 48	19 34
23	23 38	23 18	23 03	22 50	22 39	22 29	22 12	21 58	21 44	21 30	21 15	20 58	20 49	20 37
24	23 52	23 38	23 27	23 18	23 10	23 03	22 51	22 40	22 30	22 20	22 09	21 57	21 50	21 41
25	.. ..	23 56	23 49	23 44	23 39	23 35	23 28	23 21	23 15	23 09	23 03	22 55	22 51	22 46
26	0 04	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	23 58	23 57	23 55	23 53	23 52
27	0 14	0 12	0 10	0 08	0 07	0 06	0 04	0 02	0 00	.. ..	.. ..	.. ..	.. ..	.. ..
28	0 24	0 28	0 31	0 33	0 35	0 37	0 40	0 43	0 46	0 49	0 52	0 55	0 57	1 00
29	0 36	0 46	0 53	1 00	1 06	1 11	1 19	1 27	1 34	1 42	1 50	1 59	2 04	2 10
30	0 51	1 07	1 20	1 31	1 40	1 48	2 02	2 15	2 27	2 39	2 51	3 06	3 15	3 25
31	1 11	1 34	1 53	2 08	2 20	2 32	2 51	3 08	3 24	3 40	3 57	4 17	4 29	4 43
32	1 41	2 11	2 35	2 53	3 09	3 23	3 46	4 07	4 26	4 45	5 06	5 30	5 44	6 01
33	2 27	3 03	3 29	3 50	4 08	4 23	4 49	5 11	5 32	5 53	6 15	6 41	6 56	7 14

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	0 30	0 08	.. ..	.. ..	.. ..	23 54	23 41	23 29	23 18	23 07	22 55	22 42	22 34	22 25
10	0 46	0 32	0 20	0 10	0 01	.. ..	.. ..	.. ..	.. ..	23 58	23 51	23 43	23 38	23 32
11	0 59	0 50	0 43	0 37	0 32	0 27	0 19	0 12	0 05	.. ..	.. ..	.. ..	.. ..	.. ..
12	1 09	1 06	1 03	1 01	0 59	0 57	0 54	0 52	0 49	0 46	0 44	0 40	0 38	0 36
13	1 18	1 20	1 22	1 24	1 25	1 26	1 28	1 29	1 31	1 32	1 34	1 36	1 37	1 38
14	1 28	1 35	1 41	1 46	1 50	1 54	2 01	2 07	2 12	2 18	2 24	2 31	2 34	2 39
15	1 38	1 51	2 01	2 10	2 17	2 23	2 35	2 45	2 54	3 03	3 14	3 25	3 32	3 39
16	1 50	2 09	2 23	2 36	2 46	2 55	3 11	3 24	3 37	3 50	4 04	4 20	4 29	4 40
17	2 07	2 31	2 50	3 05	3 18	3 30	3 49	4 06	4 22	4 39	4 56	5 16	5 28	5 41
18	2 29	2 59	3 21	3 40	3 55	4 09	4 31	4 51	5 10	5 28	5 48	6 12	6 25	6 41
19	3 00	3 34	4 00	4 21	4 38	4 52	5 17	5 39	5 59	6 19	6 41	7 06	7 21	7 38
20	3 43	4 20	4 47	5 08	5 26	5 41	6 07	6 29	6 50	7 11	7 33	7 59	8 14	8 31
21	4 41	5 16	5 42	6 02	6 20	6 34	6 59	7 21	7 41	8 01	8 22	8 47	9 01	9 18
22	5 49	6 20	6 43	7 02	7 17	7 31	7 53	8 13	8 31	8 49	9 08	9 31	9 44	9 58
23	7 05	7 30	7 49	8 04	8 17	8 28	8 47	9 04	9 20	9 35	9 51	10 10	10 21	10 33
24	8 24	8 42	8 56	9 08	9 18	9 27	9 41	9 54	10 06	10 18	10 31	10 45	10 54	11 03
25	9 43	9 55	10 05	10 12	10 19	10 25	10 35	10 44	10 52	11 00	11 08	11 18	11 24	11 30
26	11 04	11 09	11 14	11 18	11 21	11 24	11 28	11 33	11 37	11 40	11 44	11 49	11 52	11 55
27	12 26	12 25	12 25	12 24	12 24	12 23	12 23	12 22	12 22	12 21	12 21	12 20	12 20	12 19
28	13 51	13 43	13 38	13 33	13 29	13 25	13 19	13 14	13 09	13 04	12 58	12 52	12 49	12 45
29	15 20	15 06	14 55	14 45	14 37	14 31	14 19	14 08	13 59	13 49	13 39	13 27	13 21	13 13
30	16 54	16 32	16 15	16 01	15 50	15 40	15 22	15 07	14 53	14 39	14 24	14 07	13 57	13 46
31	18 29	18 00	17 37	17 20	17 05	16 52	16 30	16 10	15 53	15 35	15 16	14 54	14 42	14 27
32	19 58	19 23	18 57	18 36	18 19	18 04	17 39	17 17	16 57	16 37	16 15	15 50	15 35	15 18
33	21 09	20 33	20 06	19 45	19 28	19 12	18 47	18 24	18 03	17 42	17 20	16 54	16 38	16 21

.. .. indicates phenomenon will occur the next day.

UNIVERSAL TIME FOR MERIDIAN OF GREENWICH

MOONRISE

Lat.	+40°	+42°	+44°	+46°	+48°	+50°	+52°	+54°	+56°	+58°	+60°	+62°	+64°	+66°
	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	11 56	12 01	12 05	12 11	12 16	12 23	12 29	12 37	12 45	12 55	13 05	13 18	13 32	13 50
10	12 25	12 28	12 32	12 35	12 39	12 43	12 47	12 52	12 58	13 04	13 10	13 18	13 27	13 37
11	12 50	12 52	12 54	12 56	12 58	13 00	13 02	13 04	13 07	13 10	13 14	13 18	13 22	13 27
12	13 14	13 14	13 14	13 14	13 14	13 15	13 15	13 15	13 16	13 16	13 16	13 17	13 17	13 18
13	13 36	13 35	13 33	13 32	13 31	13 29	13 27	13 25	13 23	13 21	13 19	13 16	13 13	13 09
14	13 59	13 56	13 53	13 50	13 47	13 44	13 40	13 36	13 32	13 27	13 21	13 15	13 08	13 00
15	14 23	14 19	14 15	14 11	14 06	14 01	13 55	13 49	13 42	13 34	13 25	13 15	13 03	12 49
16	14 51	14 46	14 40	14 34	14 28	14 21	14 13	14 04	13 55	13 44	13 31	13 16	12 59	12 37
17	15 23	15 16	15 10	15 02	14 54	14 45	14 35	14 24	14 12	13 57	13 40	13 20	12 53	12 16
18	16 00	15 53	15 45	15 37	15 27	15 17	15 05	14 52	14 37	14 19	13 57	13 28	12 47	□
19	16 45	16 37	16 28	16 19	16 09	15 58	15 45	15 30	15 13	14 52	14 26	13 50	12 29	□
20	17 36	17 28	17 19	17 10	17 00	16 48	16 36	16 21	16 03	15 42	15 16	14 38	□	□
21	18 33	18 25	18 18	18 09	17 59	17 49	17 37	17 23	17 08	16 49	16 26	15 55	15 07	□
22	19 34	19 28	19 21	19 13	19 05	18 56	18 46	18 35	18 22	18 07	17 49	17 27	16 58	16 13
23	20 37	20 32	20 27	20 21	20 14	20 07	19 59	19 51	19 41	19 30	19 17	19 02	18 43	18 19
24	21 41	21 38	21 34	21 30	21 25	21 20	21 15	21 09	21 02	20 54	20 46	20 36	20 24	20 10
25	22 46	22 44	22 42	22 39	22 37	22 34	22 31	22 27	22 23	22 19	22 14	22 09	22 02	21 55
26	23 52	23 51	23 51	23 50	23 49	23 49	23 48	23 47	23 46	23 45	23 43	23 42	23 40	23 38
27	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
28	1 00	1 01	1 02	1 03	1 04	1 06	1 07	1 09	1 11	1 13	1 15	1 18	1 21	1 24
29	2 10	2 13	2 16	2 19	2 23	2 26	2 30	2 35	2 39	2 45	2 51	2 58	3 07	3 16
30	3 25	3 29	3 34	3 39	3 45	3 51	3 58	4 05	4 13	4 23	4 34	4 47	5 02	5 21
31	4 43	4 49	4 55	5 02	5 10	5 19	5 28	5 39	5 51	6 06	6 22	6 43	7 10	7 48
32	6 01	6 08	6 16	6 25	6 35	6 45	6 58	7 11	7 27	7 47	8 10	8 42	9 35	■
33	7 14	7 22	7 31	7 41	7 51	8 03	8 16	8 32	8 50	9 12	9 40	10 21	■	■

MOONSET

	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
Dec. 9	22 25	22 21	22 16	22 12	22 07	22 01	21 55	21 48	21 41	21 32	21 22	21 11	20 57	20 41
10	23 32	23 30	23 27	23 24	23 21	23 18	23 14	23 10	23 06	23 01	22 55	22 49	22 41	22 32
11	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..
12	0 36	0 35	0 34	0 33	0 32	0 31	0 29	0 28	0 26	0 24	0 22	0 20	0 17	0 14
13	1 38	1 39	1 39	1 40	1 41	1 41	1 42	1 43	1 44	1 45	1 46	1 47	1 49	1 51
14	2 39	2 41	2 43	2 45	2 48	2 50	2 53	2 56	3 00	3 04	3 08	3 13	3 19	3 26
15	3 39	3 43	3 46	3 50	3 55	3 59	4 04	4 10	4 16	4 23	4 31	4 40	4 51	5 03
16	4 40	4 45	4 50	4 56	5 02	5 08	5 15	5 23	5 32	5 43	5 55	6 09	6 25	6 47
17	5 41	5 47	5 54	6 01	6 08	6 17	6 26	6 37	6 49	7 03	7 19	7 39	8 05	8 41
18	6 41	6 48	6 56	7 04	7 13	7 23	7 35	7 48	8 03	8 20	8 42	9 10	9 51	□
19	7 38	7 46	7 55	8 04	8 14	8 25	8 38	8 52	9 09	9 30	9 56	10 32	11 52	□
20	8 31	8 39	8 48	8 57	9 07	9 19	9 32	9 47	10 04	10 25	10 52	11 30	□	□
21	9 18	9 26	9 34	9 43	9 52	10 03	10 15	10 29	10 45	11 04	11 27	11 58	12 47	□
22	9 58	10 05	10 12	10 20	10 29	10 38	10 48	11 00	11 13	11 29	11 47	12 10	12 40	13 25
23	10 33	10 39	10 44	10 51	10 58	11 05	11 14	11 23	11 33	11 45	11 59	12 15	12 34	12 59
24	11 03	11 07	11 12	11 16	11 22	11 27	11 33	11 40	11 48	11 56	12 06	12 16	12 29	12 45
25	11 30	11 33	11 35	11 39	11 42	11 46	11 50	11 54	11 59	12 04	12 10	12 17	12 25	12 34
26	11 55	11 56	11 57	11 59	12 00	12 02	12 04	12 06	12 08	12 11	12 13	12 16	12 20	12 24
27	12 19	12 19	12 19	12 19	12 18	12 18	12 18	12 17	12 17	12 17	12 16	12 16	12 15	12 15
28	12 45	12 43	12 41	12 39	12 37	12 35	12 32	12 29	12 26	12 23	12 19	12 15	12 10	12 05
29	13 13	13 10	13 06	13 02	12 58	12 54	12 49	12 43	12 38	12 31	12 24	12 15	12 05	11 54
30	13 46	13 41	13 36	13 30	13 24	13 17	13 10	13 02	12 52	12 42	12 30	12 16	12 00	11 40
31	14 27	14 21	14 14	14 06	13 58	13 49	13 38	13 27	13 14	12 59	12 42	12 20	11 53	11 14
32	15 18	15 10	15 02	14 53	14 43	14 32	14 20	14 06	13 49	13 30	13 05	12 33	11 40	■
33	16 21	16 12	16 04	15 54	15 43	15 32	15 18	15 03	14 45	14 23	13 55	13 13	■	■

□ indicates Moon continuously above horizon.

■ indicates Moon continuously below horizon.

.. .. indicates phenomenon will occur the next day.

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SUMMARY OF ECLIPSES AND TRANSITS FOR 2021

There are four eclipses, two of the Sun and two of the Moon. All times are expressed in Universal Time using $\Delta T = +71^s.0$. There are no transits of Mercury or Venus across the Sun.

I. *A total eclipse of the Moon*, May 26. See map on page 70. The eclipse begins at 08^h 46^m and ends at 13^h 51^m. It is visible from South America, North America, Asia, Australia, Antarctica, the Pacific Ocean and the Indian Ocean.

II. *An annular eclipse of the Sun*, June 10. See map on page 71. The eclipse begins at 08^h 12^m and ends at 13^h 11^m. Maximum duration of annularity is 3^m 48^s. It is visible from northeastern North America, Europe, northern Asia and the north Atlantic Ocean.

III. *A partial eclipse of the Moon*, November 19. See map on page 75. The eclipse begins at 06^h 00^m and ends at 12^h 05^m. Time of maximum eclipse is 09^m 03^s. It is visible from western Africa, western Europe, North America, South America, Asia, Australia, the Atlantic Ocean, and the Pacific Ocean.

IV. *A total eclipse of the Sun*, December 4. See map on page 77. The eclipse begins at 5^h 29^m and ends at 9^h 38^m. Maximum duration of totality is 1^m 57^s. It is visible from Antarctica, extreme south Africa, extreme south Australia, the south Atlantic Ocean, and the south Indian Ocean.

Local circumstances and animations for upcoming eclipses can be found on *The Astronomical Almanac Online* at <http://asa.hmnao.com> or <http://asa.usno.navy.mil>.

Local circumstances and animations for upcoming eclipses can be found on *The Astronomical Almanac Online* at <http://asa.hmnao.com> or <http://asa.usno.navy.mil>.

General Information

The elements and circumstances are computed according to Bessel's method from apparent right ascensions and declinations of the Sun and Moon. Semidiameters of the Sun and Moon used in the calculation of eclipses do not include irradiation. The adopted semidiameter of the Sun at unit distance is $15' 59''.64$ from the IAU (1976) Astronomical Constants. The apparent semidiameter of the Moon is equal to $\arcsin(k \sin \pi)$, where π is the Moon's horizontal parallax and k is an adopted constant. In 1982, the IAU adopted $k = 0.272\,5076$, corresponding to the mean radius of Watts' datum as determined by observations of occultations and to the adopted radius of the Earth.

Standard corrections of $+0''.5$ and $-0''.25$ have been applied to the longitude and latitude of the Moon, respectively, to help correct for the difference between the center of figure and the center of mass.

Refraction is neglected in calculating solar and lunar eclipses. Because the circumstances of eclipses are calculated for the surface of the ellipsoid, refraction is not included in Besselian element polynomials. For local predictions, corrections for refraction are unnecessary; they are required only in precise comparisons of theory with observation in which many other refinements are also necessary.

All time arguments are given provisionally in Universal Time, using $\Delta T(A) = +71^s.0$. Once an updated value of ΔT is known, the data on these pages may be expressed in Universal Time as follows:

Define $\delta T = \Delta T - \Delta T(A)$, in units of seconds of time.

Change the times of circumstances given in preliminary Universal Time by subtracting δT .

Correct the tabulated longitudes, $\lambda(A)$, using $\lambda = \lambda(A) + 0.00417807 \times \delta T$ (longitudes are in degrees).

Leave all other quantities unchanged.

The correction of δT is included in the Besselian elements.

Longitude is positive to the east, and negative to the west.

Explanation of Solar Eclipse Diagram

The solar eclipse diagrams in *The Astronomical Almanac* show the region over which different phases of each eclipse may be seen and the times at which these phases occur. Each diagram has a series of dashed curves that show the outline of the Moon's penumbra on the Earth's surface at one-hour intervals. Short dashes show the leading edge, and long dashes show the trailing edge. Except for certain extreme cases, the shadow outline moves generally from west to east. The Moon's shadow cone first contacts the Earth's surface where "First Contact" is indicated on the diagram. "Last Contact" is where the Moon's shadow cone last contacts the Earth's surface. The path of the central eclipse, whether for a total, annular, or annular-total eclipse, is marked by two closely spaced curves that cut across all of the dashed curves. These two curves mark the extent of the Moon's umbral shadow on the Earth's surface. Viewers within these boundaries will observe a total, annular, or annular-total eclipse, and viewers outside these boundaries will see a partial eclipse.

Solid curves labeled "Northern Limit of Eclipse" and "Southern Limit of Eclipse" represent the furthest extent north or south of the Moon's penumbra on the Earth's surface. Viewers outside of

these boundaries will not experience any eclipse. When only one of these two curves appears, only part of the Moon's penumbra touches the Earth; the other part is projected into space north or south of the Earth. The solid curves labeled "Eclipse begins at Sunset" and "Eclipse ends at Sunrise" define the other limits.

Another set of solid curves appears on some diagrams as two teardrop shapes (or lobes) on either end of the eclipse path, and on other diagrams as a distorted figure eight. These lobes represent in time the intersection of the Moon's penumbra with the Earth's terminator as the eclipse progresses. As time elapses, the Earth's terminator moves east-to-west while the Moon's penumbra moves west-to-east. These lobes connect to form an elongated figure eight on a diagram when part of the Moon's penumbra stays in contact with the Earth's terminator throughout the eclipse. The lobes become two separate teardrop shapes when the Moon's penumbra breaks contact with the Earth's terminator during the beginning of the eclipse and reconnects with it near the end. In the east, the outer portion of the lobe is labeled "Eclipse begins at Sunset" and marks the first contact between the Moon's penumbra and Earth's terminator in the east. Observers on this curve just fail to see the eclipse. The inner part of the lobe is labeled "Eclipse ends at Sunset" and marks the last contact between the Moon's penumbra and the Earth's terminator in the east. Observers on this curve just see the whole eclipse. The curve bisecting this lobe is labeled "Maximum Eclipse at Sunset" and is part of the sunset terminator at maximum eclipse. Viewers in the eastern half of the lobe will see the Sun set before maximum eclipse; *i.e.* see less than half of the eclipse. Viewers in the western half of the lobe will see the Sun set after maximum eclipse; *i.e.* see more than half of the eclipse. A similar description holds for the western lobe except everything occurs at sunrise instead of sunset.

Computing Local Circumstances for Solar Eclipses

The solar eclipse maps show the path of the eclipse, beginning and ending times of the eclipse, and the region of visibility, including restrictions due to rising and setting of the Sun. The short-dash and long-dash lines show, respectively, the progress of the leading and trailing edge of the penumbra; thus, at a given location, the times of the first and last contact may be interpolated. If further precision is desired, Besselian elements can be utilized.

Besselian elements characterize the geometric position of the shadow of the Moon relative to the Earth. The exterior tangents to the surfaces of the Sun and Moon form the umbral cone; the interior tangents form the penumbral cone. The common axis of these two cones is the axis of the shadow. To form a system of geocentric rectangular coordinates, the geocentric plane perpendicular to the axis of the shadow is taken as the xy -plane. This is called the fundamental plane. The x -axis is the intersection of the fundamental plane with the plane of the equator; it is positive toward the east. The y -axis is positive toward the north. The z -axis is parallel to the axis of the shadow and is positive toward the Moon. The tabular values of x and y are the coordinates, in units of the Earth's equatorial radius, of the intersection of the axis of the shadow with the fundamental plane. The direction of the axis of the shadow is specified by the declination d and hour angle μ of the point on the celestial sphere toward which the axis is directed.

The radius of the umbral cone is regarded as positive for an annular eclipse and negative for a total eclipse. The angles f_1 and f_2 are the angles at which the tangents that form the penumbral and umbral cones, respectively, intersect the axis of the shadow.

To predict accurate local circumstances, calculate the geocentric coordinates $\rho \sin \phi'$ and $\rho \cos \phi'$ from the geodetic latitude ϕ and longitude λ , using the relationships given on pages K11-K12 of *The Astronomical Almanac*. Inclusion of the height h in this calculation is all that is necessary to obtain the local circumstances at high altitudes.

Obtain approximate times for the beginning, middle and end of the eclipse from the eclipse map. For each of these three times, compute $|$ from the Besselian element polynomials $|$ the values of x , y , $\sin d$, $\cos d$, μ and l_1 (the radius of the penumbra on the fundamental plane). If the eclipse is central (i.e., total, annular or annular-total), then, at the approximate time of the middle of the eclipse, l_2 (the radius of the umbra on the fundamental plane) is required instead of l_1 . The hourly variations x' , y' of x and y are needed, and may be obtained by evaluating the derivative of the polynomial expressions for x and y . Values of μ' , d' , $\tan f_1$ and $\tan f_2$ are nearly constant throughout the eclipse and are given immediately following the Besselian polynomials.

For each of the three approximate times, calculate the coordinates ξ , η , ζ for the observer and the hourly variations ξ' and η' from

$$\begin{aligned}\xi &= \rho \cos \phi' \sin \theta, \\ \eta &= \rho \sin \phi' \cos d - \rho \cos \phi' \sin d \cos \theta, \\ \zeta &= \rho \sin \phi' \sin d + \rho \cos \phi' \cos d \cos \theta, \\ \xi' &= \mu' \rho \cos \phi' \cos \theta, \\ \eta' &= \mu' \xi \sin d - \zeta d',\end{aligned}$$

where

$$\theta = \mu + \lambda$$

for longitudes measured positive towards the east.

Next, calculate

$$\begin{aligned}u &= x - \xi & u' &= x' - \xi' \\ v &= y - \eta & v' &= y' - \eta' \\ m^2 &= u^2 + v^2 & n^2 &= u'^2 + v'^2 & (m, n > 0) \\ L_i &= l_i - \zeta \tan f_i \\ D &= uu' + vv' \\ \Delta &= \frac{1}{n}(uv' - u'v) \\ \sin \psi &= \frac{\Delta}{L_i},\end{aligned}$$

where $i = 1, 2$.

At the approximate times of the beginning and end of the eclipse, L_1 is required. At the approximate time of the middle of the eclipse, L_2 is required if the eclipse is central; L_1 is required if the eclipse is partial.

Neglecting the variation of L , the correction τ to be applied to the approximate time of the middle of the eclipse to obtain the *Universal Time of greatest phase* (in hours) is

$$\tau = -\frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60. The correction τ to be applied to the approximate times of the beginning and end of the eclipse to obtain the *Universal Times of the penumbral contacts* (in hours) is

$$\tau = \frac{L_1}{n} \cos \psi - \frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

If the eclipse is central, use the approximate time for the middle of the eclipse as a first approximation to the times of umbral contact. The correction τ to be applied to obtain the *Universal Times of the umbral contacts* is

$$\tau = \frac{L_2}{n} \cos \psi - \frac{D}{n^2},$$

which may be expressed in minutes by multiplying by 60.

In the last two equations, the ambiguity in the quadrant of ψ is removed by noting that $\cos \psi$ must be *negative* for the beginning of the eclipse, for the beginning of the annular phase, or for the end of the total phase; $\cos \psi$ must be *positive* for the end of the eclipse, the end of the annular phase, or the beginning of the total phase.

For greater accuracy, the times resulting from the calculation outlined above should be used in place of the original approximate times, and the entire procedure repeated at least once. The calculations for each of the contact times and the time of greatest phase should be performed separately.

The *magnitude of greatest partial eclipse*, in units of the solar diameter is

$$M_1 = \frac{L_1 - m}{(2L_1 - 0.5459)},$$

where the value of m at the time of greatest phase is used. If the magnitude is negative at the time of greatest phase, no eclipse is visible from the location.

The *magnitude of the central phase*, in the same units is

$$M_2 = \frac{L_1 - L_2}{(L_1 + L_2)}.$$

The *position angle of a point of contact* measured eastward (counterclockwise) from the north point of the solar limb is given by

$$\tan P = \frac{u}{v},$$

where u and v are evaluated at the times of contacts computed in the final approximation. The quadrant of P is determined by noting that $\sin P$ has the algebraic sign of u , except for the contacts of the total phase, for which $\sin P$ has the opposite sign to u .

The position angle of the point of contact measured eastward from the vertex of the solar limb is given by

$$V = P - C,$$

where C , the parallactic angle, is obtained with sufficient accuracy from

$$\tan C = \frac{\xi}{\eta},$$

with $\sin C$ having the same algebraic sign as ξ , and the results of the final approximation again being used. The vertex point of the solar limb lies on a great circle arc drawn from the zenith to the center of the solar disk.

Lunar Eclipses

A calculator to produce local circumstances of recent and upcoming lunar eclipses is provided at <http://aa.usno.navy.mil/data/docs/LunarEclipse.php>

In calculating lunar eclipses, the radius of the geocentric shadow of the Earth is increased by one-fiftieth part to allow for the effect of the atmosphere. Refraction is neglected in calculating solar and lunar eclipses. Standard corrections of $+0''.5$ and $-0''.25$ have been applied to the longitude and latitude of the Moon, respectively, to help correct for the difference between the center of figure and the center of mass.

Explanation of Lunar Eclipse Diagram

Information on lunar eclipses is presented in the form of a diagram consisting of two parts. The upper panel shows the path of the Moon relative to the penumbral and umbral shadows of the Earth. The lower panel shows the visibility of the eclipse from the surface of the Earth. The title of the upper panel includes the type of eclipse, its place in the sequence of eclipses for the year and the Greenwich calendar date of the eclipse. The inner darker circle is the umbral shadow of the Earth and the outer lighter circle is that of the penumbra. The axis of the shadow of the Earth is denoted by (+) with the ecliptic shown for reference purposes. A 30-arcminute scale bar is provided on the right hand side of the diagram and the orientation is given by the cardinal points displayed on the small graphic on the left hand side of the diagram. The position angle (PA) is measured from North point of the lunar disk along the limb of the Moon to the point of contact. It is shown on the graphic by the use of an arc extending anti-clockwise (eastwards) from North terminated with an arrow head.

Moon symbols are plotted at the principal phases of the eclipse to show its position relative to the umbral and penumbral shadows. The UT times of the different phases of the eclipse to the nearest tenth of a minute are printed above or below the Moon symbols as appropriate. P1 and P4 are the first and last external contacts of the penumbra respectively and denote the beginning and end of the penumbral eclipse respectively. U1 and U4 are the first and last external contacts of the umbra denoting the beginning and end of the partial phase of the eclipse respectively. U2 and U3 are the first and last internal contacts of the umbra and denote the beginning and end of the total phase respectively. MID is the middle of the eclipse. The position angle is given for P1 and P4 for penumbral eclipses and U1 and U4 for partial and total eclipses. The UT time of the geocentric opposition in right ascension of the Sun and Moon and the magnitude of the eclipse are given above or below the Moon symbols as appropriate.

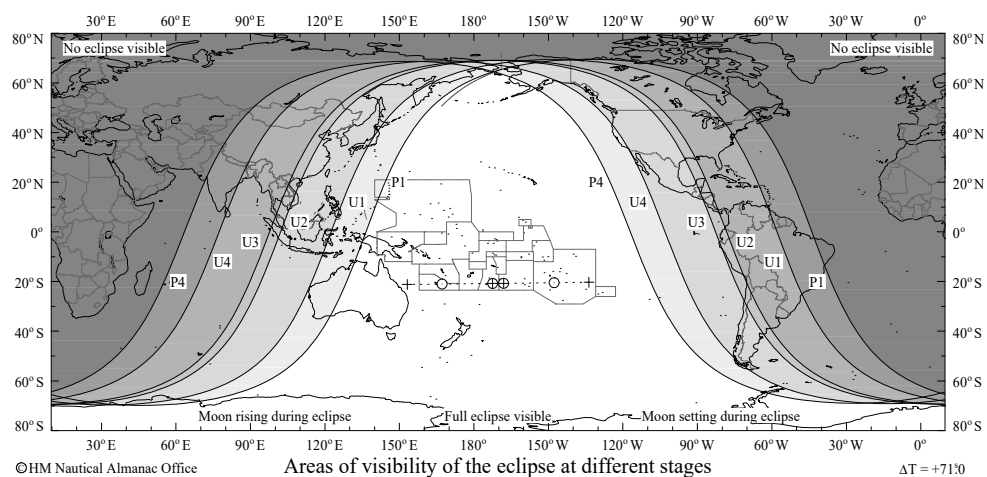
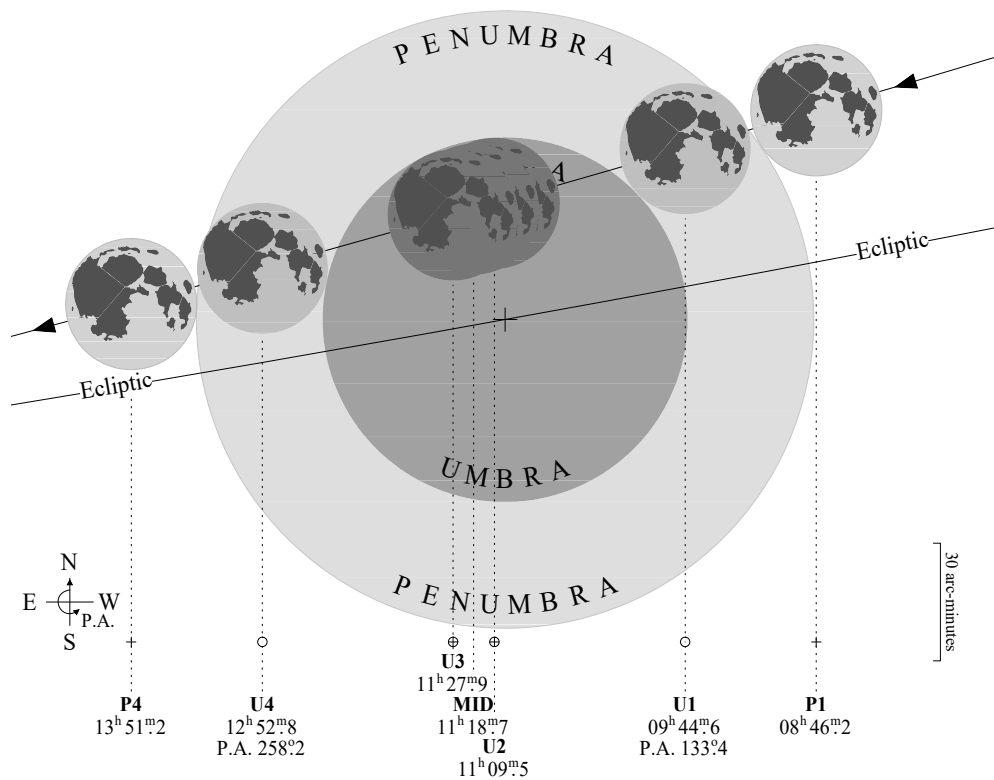
The lower panel is a cylindrical equidistant map projection showing the Earth centered on the longitude at which the Moon is in the zenith at the middle of the eclipse. The visibility of the eclipse is displayed by plotting the Moon rise/set terminator for the principal phases of the eclipse for which timing information is provided in the upper panel. The terminator for the middle of the eclipse is not plotted for the sake of clarity.

The unshaded area indicates the region of the Earth from which all the eclipse is visible, whereas the darkest shading indicates the area from which the eclipse is invisible. The different shades of gray indicate regions where the Moon is either rising or setting during the principal phases of the eclipse. The Moon is rising on the left hand side of the diagram after the eclipse has started and is setting on the right hand side of the diagram before the eclipse ends. Labels are provided to this effect.

Symbols are plotted showing the locations for which the Moon is in the zenith at the principal phases of the eclipse. The points at which the Moon is in the zenith at P1 and P4 are denoted by (+), at U1 and U4 by (⊙) and at U2 and U3 by (⊕). These symbols are also plotted on the upper panel where appropriate. The value of ΔT used for the calculation of the eclipse circumstances is given below the diagram. Country boundaries are also provided to assist the user in determining the visibility of the eclipse at a particular location.

I. - Total Eclipse of the MoonUT of geocentric opposition in RA: May 26^d 11^h 4^m 44^s.472**2021 May 26**

Umbral magnitude of the eclipse: 1.015



II. –Annular Eclipse of the Sun, 2021 June 10

CIRCUMSTANCES OF THE ECLIPSE

Universal Time of geocentric conjunction in right ascension, June 10^d 11^h 01^m 3^s.335

Julian Date = 2459375.9590663747

	UT	Longitude	Latitude
	d h m	° ′	° ′
Eclipse begins	June 10 08 12.3	– 43 56.3	+23 38.6
Beginning of southern limit of umbra	10 09 50.2	– 86 04.0	+48 11.6
Beginning of center line; central eclipse begins	10 09 55.0	– 89 31.5	+50 10.2
Beginning of northern limit of umbra	10 10 00.3	– 93 36.6	+52 18.7
Central eclipse at local apparent midnight	10 11 01.1	–165 23.4	+88 08.2
End of northern limit of umbra	10 11 23.3	+163 32.5	+64 46.0
End of center line; central eclipse ends	10 11 28.7	+156 33.8	+63 34.4
End of southern limit of umbra	10 11 33.4	+150 43.3	+62 19.6
Eclipse ends	10 13 11.3	+ 94 07.0	+41 27.4

BESSELIAN ELEMENTS

Let $t = (\text{UT} - 8^{\text{h}}) + \delta T/3600$ in units of hours.

These equations are valid over the range $0^{\text{h}}125 \leq t \leq 5^{\text{h}}358$. Do not use t outside the given range, and do not omit any terms in the series. If μ is greater than 360° , then subtract 360° from its computed value

Intersection of the axis of shadow with the fundamental plane:

$$\begin{aligned} x &= -1.51205063 + 0.50087318 t + 0.00008521 t^2 - 0.00000570 t^3 \\ y &= +0.65995854 + 0.08981772 t - 0.00016960 t^2 - 0.00000113 t^3 \end{aligned}$$

Direction of the axis of shadow:

$$\begin{aligned} \sin d &= +0.39127351 + 0.00004616 t - 0.00000009 t^2 \\ \cos d &= +0.92027446 - 0.00001966 t + 0.00000005 t^2 \\ \mu &= 300^\circ.12848553 + 14.99920389 t - 0.00000095 t^2 + 0.00000006 t^3 - 0.00417807 \delta T \end{aligned}$$

Radius of the shadow on the fundamental plane:

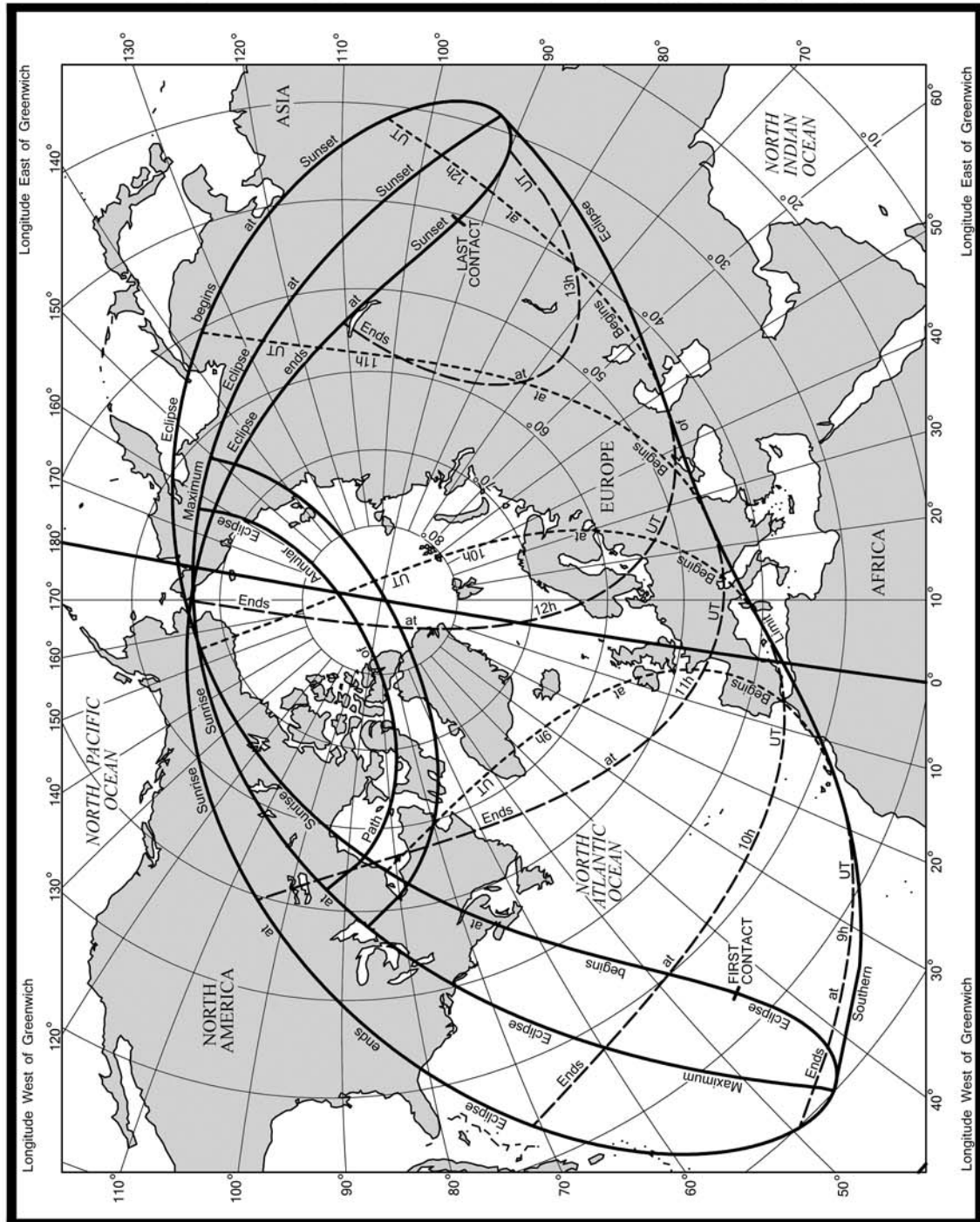
$$\begin{aligned} \text{penumbra } (l_1) &= +0.56447980 + 0.00000312 t - 0.00000974 t^2 - 0.00000001 t^3 \\ \text{umbra } (l_2) &= +0.01800394 + 0.00000342 t - 0.00000979 t^2 \end{aligned}$$

Other important quantities:

$$\begin{aligned} \tan f_1 &= +0.004606 \\ \tan f_2 &= +0.004583 \\ \mu' &= +0.261785 \text{ radians per hour} \\ d' &= +0.000050 \text{ radians per hour} \end{aligned}$$

All time arguments are given provisionally in Universal Time, using $\Delta T(A) = 71^{\text{s}}.0$.

ANNULAR SOLAR ECLIPSE OF 2021 JUNE 10



PATH OF CENTRAL PHASE: ANNULAR SOLAR ECLIPSE OF JUNE 10

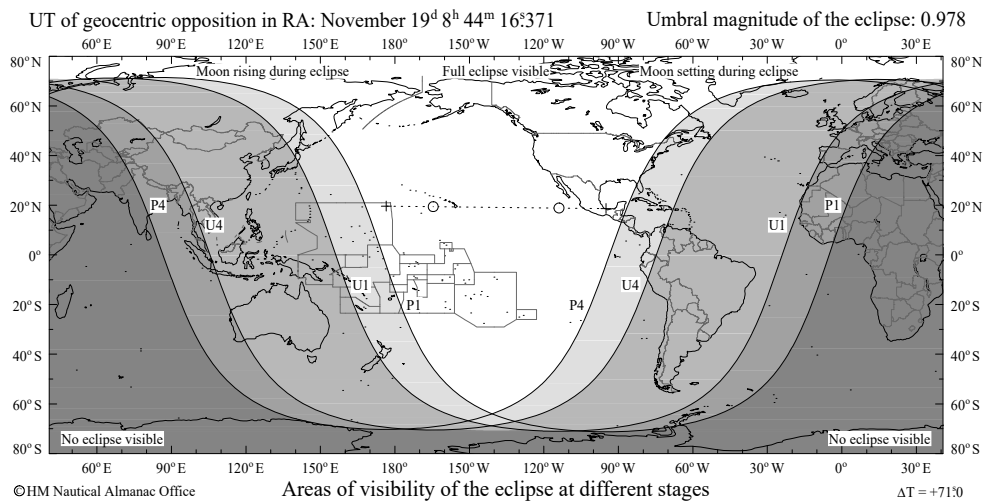
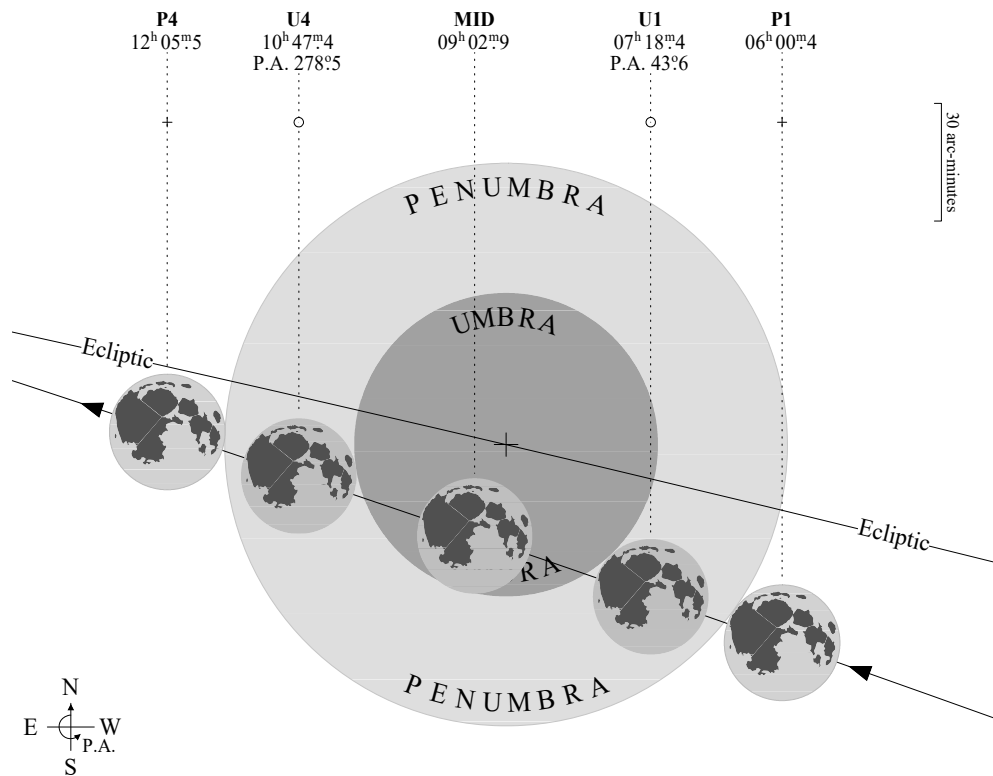
U.T.	Northern Limit		Central Line		Southern Limit		Central Line	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Duration	Alt.
Limits	$+52^{\circ} 18.7'$	$-93^{\circ} 36.6'$	$+50^{\circ} 10.2'$	$-89^{\circ} 31.5'$	$+48^{\circ} 11.6'$	$-86^{\circ} 04.0'$	$3^{\text{m}} 34.2^{\text{s}}$	$..^{\circ}$
h m								
10 01	+54 52.7	- 89 01.8	+58 28.3	- 77 11.1	+59 48.5	- 69 44.5	3 40.2	11
10 02	+56 26.4	- 86 43.1	+59 14.7	- 76 21.2	+60 26.7	- 69 06.4	3 40.7	12
10 03	+57 37.4	- 85 09.6	+59 58.8	- 75 36.1	+61 03.9	- 68 30.3	3 41.1	13
10 04	+58 38.2	- 83 56.7	+60 41.0	- 74 54.7	+61 40.2	- 67 56.0	3 41.6	14
10 05	+59 32.8	- 82 56.2	+61 21.7	- 74 16.5	+62 15.7	- 67 23.2	3 42.0	14
10 06	+60 23.3	- 82 04.4	+62 01.1	- 73 41.0	+62 50.4	- 66 51.7	3 42.3	15
10 07	+61 10.6	- 81 19.1	+62 39.4	- 73 07.9	+63 24.6	- 66 21.5	3 42.7	15
10 08	+61 55.4	- 80 38.9	+63 16.7	- 72 36.9	+63 58.1	- 65 52.4	3 43.0	16
10 09	+62 38.3	- 80 03.0	+63 53.2	- 72 07.8	+64 31.2	- 65 24.3	3 43.4	16
10 10	+63 19.7	- 79 30.6	+64 28.8	- 71 40.3	+65 03.7	- 64 57.1	3 43.7	17
10 11	+63 59.6	- 79 01.3	+65 03.9	- 71 14.3	+65 35.9	- 64 30.7	3 44.0	17
10 12	+64 38.4	- 78 34.8	+65 38.3	- 70 49.7	+66 07.6	- 64 05.0	3 44.2	18
10 13	+65 16.2	- 78 10.7	+66 12.2	- 70 26.4	+66 39.0	- 63 40.0	3 44.5	18
10 14	+65 53.2	- 77 48.9	+66 45.6	- 70 04.3	+67 10.1	- 63 15.6	3 44.7	19
10 15	+66 29.3	- 77 29.2	+67 18.5	- 69 43.4	+67 40.8	- 62 51.8	3 45.0	19
10 16	+67 04.8	- 77 11.3	+67 51.1	- 69 23.4	+68 11.3	- 62 28.4	3 45.2	19
10 17	+67 39.7	- 76 55.4	+68 23.3	- 69 04.5	+68 41.6	- 62 05.6	3 45.4	20
10 18	+68 14.0	- 76 41.2	+68 55.1	- 68 46.6	+69 11.6	- 61 43.1	3 45.7	20
10 19	+68 47.8	- 76 28.7	+69 26.7	- 68 29.5	+69 41.3	- 61 21.0	3 45.8	20
10 20	+69 21.2	- 76 17.9	+69 58.0	- 68 13.4	+70 10.9	- 60 59.2	3 46.0	21
10 21	+69 54.1	- 76 08.7	+70 29.0	- 67 58.2	+70 40.3	- 60 37.7	3 46.2	21
10 22	+70 26.7	- 76 01.2	+70 59.8	- 67 43.8	+71 09.6	- 60 16.5	3 46.4	21
10 23	+70 59.0	- 75 55.3	+71 30.4	- 67 30.2	+71 38.6	- 59 55.5	3 46.6	21
10 24	+71 30.9	- 75 51.2	+72 00.8	- 67 17.6	+72 07.6	- 59 34.7	3 46.7	21
10 25	+72 02.5	- 75 48.7	+72 31.0	- 67 05.7	+72 36.4	- 59 14.1	3 46.8	22
10 26	+72 33.9	- 75 48.0	+73 01.0	- 66 54.8	+73 05.1	- 58 53.6	3 47.0	22
10 27	+73 05.1	- 75 49.2	+73 31.0	- 66 44.7	+73 33.7	- 58 33.1	3 47.1	22
10 28	+73 36.0	- 75 52.3	+74 00.8	- 66 35.6	+74 02.2	- 58 12.7	3 47.2	22
10 29	+74 06.6	- 75 57.5	+74 30.4	- 66 27.4	+74 30.7	- 57 52.4	3 47.3	22
10 30	+74 37.1	- 76 04.8	+75 00.0	- 66 20.1	+74 59.0	- 57 32.0	3 47.4	23
10 31	+75 07.4	- 76 14.5	+75 29.5	- 66 13.9	+75 27.3	- 57 11.6	3 47.5	23
10 32	+75 37.5	- 76 26.6	+75 58.9	- 66 08.9	+75 55.6	- 56 51.1	3 47.6	23
10 33	+76 07.5	- 76 41.5	+76 28.2	- 66 05.0	+76 23.8	- 56 30.4	3 47.7	23
10 34	+76 37.3	- 76 59.3	+76 57.5	- 66 02.4	+76 52.0	- 56 09.6	3 47.8	23
10 35	+77 06.9	- 77 20.4	+77 26.7	- 66 01.1	+77 20.1	- 55 48.5	3 47.8	23
10 36	+77 36.3	- 77 45.0	+77 55.9	- 66 01.5	+77 48.3	- 55 27.2	3 47.9	23
10 37	+78 05.6	- 78 13.7	+78 25.0	- 66 03.4	+78 16.4	- 55 05.5	3 47.9	23
10 38	+78 34.7	- 78 46.7	+78 54.2	- 66 07.3	+78 44.5	- 54 43.3	3 48.0	23
10 39	+79 03.6	- 79 24.8	+79 23.3	- 66 13.3	+79 12.7	- 54 20.7	3 48.0	23
10 40	+79 32.3	- 80 08.5	+79 52.4	- 66 21.7	+79 40.8	- 53 57.5	3 48.0	23
10 41	+80 00.8	- 80 58.6	+80 21.4	- 66 32.9	+80 09.0	- 53 33.6	3 48.0	23
10 42	+80 29.1	- 81 55.9	+80 50.5	- 66 47.2	+80 37.2	- 53 08.8	3 48.0	23
10 43	+80 57.1	- 83 01.7	+81 19.6	- 67 05.2	+81 05.5	- 52 43.1	3 48.0	23
10 44	+81 24.8	- 84 17.1	+81 48.7	- 67 27.6	+81 33.8	- 52 16.1	3 48.0	23
10 45	+81 52.1	- 85 43.8	+82 17.7	- 67 55.2	+82 02.1	- 51 47.8	3 48.0	23
10 46	+82 19.0	- 87 23.6	+82 46.8	- 68 28.9	+82 30.5	- 51 17.8	3 47.9	23
10 47	+82 45.3	- 89 18.7	+83 15.8	- 69 10.3	+82 59.0	- 50 45.7	3 47.9	23

PATH OF CENTRAL PHASE: ANNULAR SOLAR ECLIPSE OF JUNE 10

U.T.	Northern Limit		Central Line		Southern Limit		Central Line	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Duration	Alt.
^h ^m	[°] [']	[°] [']	[°] [']	[°] [']	[°] [']	[°] [']	^m ^s	[°]
10 48	+83 10.9	− 91 31.8	+83 44.8	− 70 01.1	+83 27.6	− 50 11.1	3 47.9	23
10 49	+83 35.8	− 94 06.0	+84 13.8	− 71 03.7	+83 56.2	− 49 33.4	3 47.8	23
10 50	+83 59.6	− 97 04.9	+84 42.6	− 72 21.3	+84 24.9	− 48 51.6	3 47.7	23
10 51	+84 22.1	− 100 32.6	+85 11.3	− 73 58.4	+84 53.7	− 48 04.8	3 47.7	23
10 52	+84 43.1	− 104 33.4	+85 39.7	− 76 01.5	+85 22.7	− 47 11.2	3 47.6	23
10 53	+85 02.0	− 109 11.4	+86 07.8	− 78 40.0	+85 51.7	− 46 08.5	3 47.5	23
10 54	+85 18.5	− 114 29.8	+86 35.2	− 82 07.7	+86 20.8	− 44 52.9	3 47.4	22
10 55	+85 32.0	− 120 29.4	+87 01.6	− 86 45.7	+86 50.0	− 43 18.5	3 47.3	22
10 56	+85 42.0	− 127 07.3	+87 26.4	− 93 05.7	+87 19.2	− 41 14.9	3 47.2	22
10 57	+85 47.8	− 134 15.6	+87 48.6	− 101 53.2	+87 48.3	− 38 22.6	3 47.1	22
10 58	+85 49.0	− 141 41.2	+88 06.2	− 114 00.3	+88 17.2	− 34 00.3	3 46.9	22
10 59	+85 45.6	− 149 07.5	+88 16.9	− 129 45.6	+88 45.4	− 26 25.8	3 46.8	22
11 00	+85 37.4	− 156 17.6	+88 18.0	− 147 36.3	+89 11.2	− 10 31.7	3 46.6	21
11 01	+85 24.7	− 162 58.0	+88 09.1	− 164 18.4	+89 27.3	+ 28 02.6	3 46.5	21
11 02	+85 08.0	− 169 00.0	+87 52.0	− 177 36.3	+89 19.3	+ 76 52.3	3 46.3	21
11 03	+84 47.6	− 174 20.1	+87 29.2	+ 172 39.2	+88 55.2	+ 99 33.5	3 46.1	21
11 04	+84 24.1	− 178 58.9	+87 02.6	+ 165 39.8	+88 26.4	+ 109 29.2	3 45.9	20
11 05	+83 57.8	+ 177 00.9	+86 33.6	+ 160 36.2	+87 55.9	+ 114 51.5	3 45.7	20
11 06	+83 29.1	+ 173 35.1	+86 02.7	+ 156 52.5	+87 24.6	+ 118 15.1	3 45.5	20
11 07	+82 58.2	+ 170 39.5	+85 30.4	+ 154 04.5	+86 52.5	+ 120 38.0	3 45.3	20
11 08	+82 25.3	+ 168 10.1	+84 57.0	+ 151 56.4	+86 19.9	+ 122 26.1	3 45.1	19
11 09	+81 50.4	+ 166 03.3	+84 22.5	+ 150 17.7	+85 46.8	+ 123 52.6	3 44.8	19
11 10	+81 13.8	+ 164 16.0	+83 47.0	+ 149 01.3	+85 13.2	+ 125 04.9	3 44.5	18
11 11	+80 35.2	+ 162 45.6	+83 10.6	+ 148 02.0	+84 39.0	+ 126 07.5	3 44.3	18
11 12	+79 54.8	+ 161 29.9	+82 33.3	+ 147 16.4	+84 04.3	+ 127 03.1	3 44.0	18
11 13	+79 12.4	+ 160 27.4	+81 54.9	+ 146 41.9	+83 29.0	+ 127 53.9	3 43.7	17
11 14	+78 27.9	+ 159 36.5	+81 15.5	+ 146 16.7	+82 53.1	+ 128 41.1	3 43.4	17
11 15	+77 40.9	+ 158 56.4	+80 35.0	+ 145 59.3	+82 16.5	+ 129 25.7	3 43.0	16
11 16	+76 51.2	+ 158 26.3	+79 53.2	+ 145 48.8	+81 39.1	+ 130 08.5	3 42.7	16
11 17	+75 58.2	+ 158 05.9	+79 10.0	+ 145 44.4	+81 00.9	+ 130 50.1	3 42.3	15
11 18	+75 01.2	+ 157 55.1	+78 25.3	+ 145 45.6	+80 21.9	+ 131 31.0	3 41.9	15
11 19	+73 59.1	+ 157 54.5	+77 38.8	+ 145 52.1	+79 41.9	+ 132 11.5	3 41.5	14
11 20	+72 50.0	+ 158 05.6	+76 50.3	+ 146 03.9	+79 00.8	+ 132 52.2	3 41.0	13
11 21	+71 30.6	+ 158 31.4	+75 59.4	+ 146 20.9	+78 18.5	+ 133 33.3	3 40.6	13
11 22	+69 53.1	+ 159 19.7	+75 05.6	+ 146 43.5	+77 34.8	+ 134 15.3	3 40.1	12
11 23	+67 26.9	+ 161 02.1	+74 08.2	+ 147 12.2	+76 49.5	+ 134 58.4	3 39.5	11
Limits	+64 46.0	+ 163 32.5	+63 34.4	+ 156 33.8	+62 19.6	+ 150 43.3	3 33.2	..

III. - Partial Eclipse of the Moon

2021 November 19



IV. –Total Eclipse of the Sun, 2021 December 4

CIRCUMSTANCES OF THE ECLIPSE

Universal Time of geocentric conjunction in right ascension, December 4^d 07^h 56^m 9^s.335

Julian Date = 2459552.8306635940

		UT			Longitude		Latitude	
		d	h	m	°	'	°	'
Eclipse begins	December	4	05	29.3	–	4 56.2	–23	19.3
Beginning of northern limit of umbra		4	07	00.1	–	48 54.2	–51	50.8
Beginning of center line; central eclipse begins		4	07	02.9	–	51 12.1	–53	05.0
Beginning of southern limit of umbra		4	07	05.9	–	53 50.4	–54	24.9
Central eclipse at local apparent midnight		4	07	56.2	–	121 29.4	–78	59.2
End of southern limit of umbra		4	08	00.7	–	128 55.9	–67	36.2
End of center line; central eclipse ends		4	08	03.8	–	134 10.4	–67	21.9
End of northern limit of umbra		4	08	06.5	–	138 50.8	–67	02.5
Eclipse ends		4	09	37.5	+	148 40.0	–46	23.6

BESSELIAN ELEMENTS

Let $t = (\text{UT} - 5^{\text{h}}) + \delta T / 3600$ in units of hours.

These equations are valid over the range $0^{\text{h}}375 \leq t \leq 4^{\text{h}}792$. Do not use t outside the given range, and do not omit any terms in the series.

Intersection of the axis of shadow with the fundamental plane:

$$x = -1.66789261 + 0.56781246 t + 0.00012549 t^2 - 0.00000966 t^3$$

$$y = -0.58980819 - 0.13276947 t + 0.00019983 t^2 + 0.00000240 t^3$$

Direction of the axis of shadow:

$$\sin d = -0.37879778 - 0.00008416 t + 0.00000009 t^2$$

$$\cos d = +0.92547951 - 0.00003449 t + 0.00000005 t^2$$

$$\mu = 257.45946529 + 14.99729174 t - 0.00000161 t^2 - 0.00000003 t^3 - 0.00417807 \delta T$$

Radius of the shadow on the fundamental plane:

$$\text{penumbra } (l_1) = +0.53775870 + 0.00006216 t - 0.00001311 t^2$$

$$\text{umbra } (l_2) = -0.00858412 + 0.00006190 t - 0.00001307 t^2$$

Other important quantities:

$$\tan f_1 = +0.004743$$

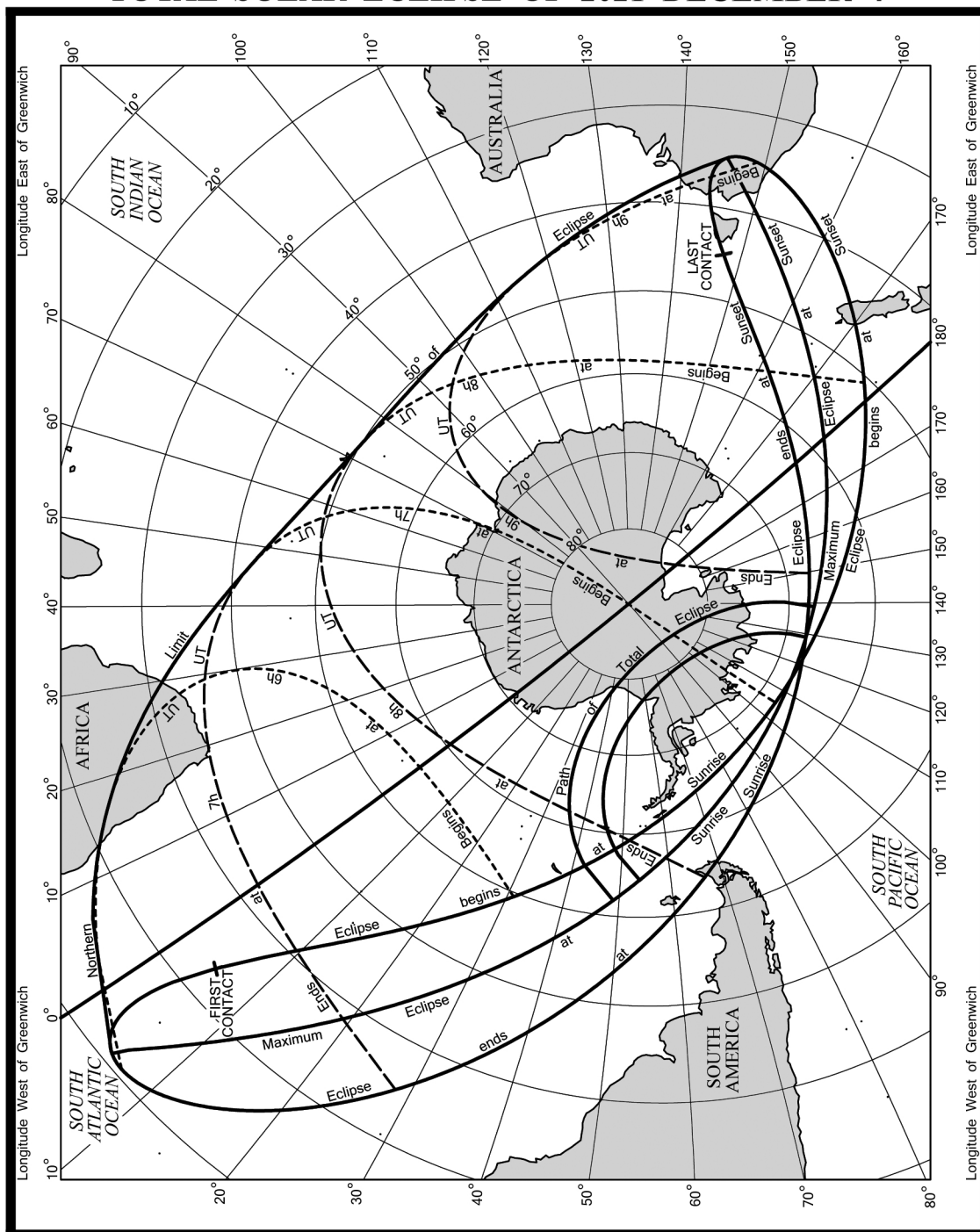
$$\tan f_2 = +0.004720$$

$$\mu' = +0.261752 \text{ radians per hour}$$

$$d' = -0.000090 \text{ radians per hour}$$

All time arguments are given provisionally in Universal Time, using $\Delta T(A) = 71^{\text{s}}.0$.

TOTAL SOLAR ECLIPSE OF 2021 DECEMBER 4



PATH OF CENTRAL PHASE: TOTAL SOLAR ECLIPSE OF DECEMBER 4

U.T.	Northern Limit		Central Line		Southern Limit		Central Line	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Duration	Alt.
Limits	$^{\circ}$ $'$ $''$ -51 50.8 - 48 54.2	$^{\circ}$ $'$ $''$ -53 05.0 - 51 12.1	$^{\circ}$ $'$ $''$ -54 24.9 - 53 50.4	$^{\circ}$ $'$ $''$ 1 30.2 ..				
h m								
7 06	-60 17.8 - 36 58.8	-58 47.9 - 42 47.5	-55 09.9 - 52 28.3	1 41.3 7				
7 07	-61 07.1 - 36 17.0	-59 47.8 - 41 49.2	-57 23.8 - 49 09.7	1 42.9 9				
7 08	-61 54.1 - 35 40.6	-60 42.7 - 41 02.0	-58 45.4 - 47 35.2	1 44.3 9				
7 09	-62 39.3 - 35 08.8	-61 34.0 - 40 22.9	-59 52.7 - 46 30.0	1 45.6 10				
7 10	-63 23.0 - 34 41.0	-62 22.7 - 39 50.3	-60 52.3 - 45 41.0	1 46.7 11				
7 11	-64 05.5 - 34 16.7	-63 09.2 - 39 23.0	-61 46.9 - 45 03.1	1 47.7 12				
7 12	-64 46.8 - 33 55.5	-63 54.0 - 39 00.4	-62 38.0 - 44 33.4	1 48.7 12				
7 13	-65 27.3 - 33 37.4	-64 37.4 - 38 42.0	-63 26.3 - 44 10.5	1 49.5 13				
7 14	-66 06.9 - 33 22.0	-65 19.5 - 38 27.3	-64 12.5 - 43 53.3	1 50.3 13				
7 15	-66 45.8 - 33 09.4	-66 00.5 - 38 16.2	-64 56.9 - 43 41.2	1 51.1 14				
7 16	-67 24.0 - 32 59.3	-66 40.6 - 38 08.5	-65 39.8 - 43 33.6	1 51.8 14				
7 17	-68 01.7 - 32 51.7	-67 19.9 - 38 04.1	-66 21.4 - 43 30.4	1 52.4 14				
7 18	-68 38.8 - 32 46.8	-67 58.4 - 38 02.9	-67 01.9 - 43 31.3	1 53.0 15				
7 19	-69 15.5 - 32 44.3	-68 36.3 - 38 04.9	-67 41.4 - 43 36.3	1 53.5 15				
7 20	-69 51.8 - 32 44.5	-69 13.5 - 38 10.1	-68 20.0 - 43 45.3	1 54.0 15				
7 21	-70 27.6 - 32 47.4	-69 50.2 - 38 18.7	-68 57.7 - 43 58.3	1 54.4 16				
7 22	-71 03.1 - 32 53.0	-70 26.4 - 38 30.7	-69 34.7 - 44 15.4	1 54.9 16				
7 23	-71 38.3 - 33 01.6	-71 02.0 - 38 46.3	-70 11.0 - 44 36.7	1 55.2 16				
7 24	-72 13.1 - 33 13.2	-71 37.2 - 39 05.7	-70 46.6 - 45 02.4	1 55.6 16				
7 25	-72 47.6 - 33 28.2	-72 12.0 - 39 29.0	-71 21.5 - 45 32.6	1 55.9 16				
7 26	-73 21.8 - 33 46.6	-72 46.2 - 39 56.5	-71 55.7 - 46 07.7	1 56.1 17				
7 27	-73 55.8 - 34 08.9	-73 20.1 - 40 28.5	-72 29.3 - 46 47.9	1 56.4 17				
7 28	-74 29.4 - 34 35.2	-73 53.5 - 41 05.5	-73 02.3 - 47 33.6	1 56.6 17				
7 29	-75 02.8 - 35 06.1	-74 26.4 - 41 47.8	-73 34.5 - 48 25.1	1 56.7 17				
7 30	-75 35.9 - 35 41.9	-74 58.8 - 42 35.8	-74 06.1 - 49 22.8	1 56.9 17				
7 31	-76 08.7 - 36 23.2	-75 30.8 - 43 30.1	-74 36.8 - 50 27.4	1 57.0 17				
7 32	-76 41.1 - 37 10.6	-76 02.2 - 44 31.4	-75 06.8 - 51 39.2	1 57.0 17				
7 33	-77 13.2 - 38 04.8	-76 33.0 - 45 40.3	-75 36.0 - 52 58.9	1 57.0 17				
7 34	-77 44.9 - 39 06.5	-77 03.1 - 46 57.5	-76 04.1 - 54 27.0	1 57.0 17				
7 35	-78 16.1 - 40 16.9	-77 32.5 - 48 24.0	-76 31.3 - 56 04.3	1 57.0 17				
7 36	-78 46.9 - 41 36.9	-78 01.1 - 50 00.8	-76 57.2 - 57 51.5	1 56.9 17				
7 37	-79 17.0 - 43 07.8	-78 28.8 - 51 48.7	-77 21.9 - 59 49.1	1 56.9 17				
7 38	-79 46.5 - 44 51.1	-78 55.3 - 53 49.1	-77 45.1 - 61 57.9	1 56.7 17				
7 39	-80 15.1 - 46 48.5	-79 20.7 - 56 02.9	-78 06.8 - 64 18.4	1 56.6 17				
7 40	-80 42.7 - 49 01.7	-79 44.6 - 58 31.4	-78 26.5 - 66 51.0	1 56.4 17				
7 41	-81 09.2 - 51 32.9	-80 06.8 - 61 15.5	-78 44.3 - 69 36.1	1 56.1 17				
7 42	-81 34.2 - 54 24.1	-80 27.2 - 64 16.3	-78 59.7 - 72 33.6	1 55.9 16				
7 43	-81 57.6 - 57 37.5	-80 45.3 - 67 34.3	-79 12.6 - 75 43.2	1 55.6 16				
7 44	-82 18.9 - 61 14.9	-81 00.9 - 71 09.5	-79 22.6 - 79 03.9	1 55.2 16				
7 45	-82 37.8 - 65 17.9	-81 13.7 - 75 01.4	-79 29.6 - 82 34.7	1 54.8 16				
7 46	-82 53.8 - 69 46.8	-81 23.3 - 79 08.5	-79 33.1 - 86 13.6	1 54.4 16				
7 47	-83 06.4 - 74 40.6	-81 29.3 - 83 28.5	-79 32.9 - 89 58.4	1 54.0 15				
7 48	-83 15.2 - 79 56.5	-81 31.4 - 87 58.0	-79 28.8 - 93 46.5	1 53.5 15				
7 49	-83 19.7 - 85 29.4	-81 29.3 - 92 32.8	-79 20.5 - 97 34.8	1 52.9 15				
7 50	-83 19.5 - 91 12.2	-81 22.8 - 97 08.3	-79 07.8 -101 20.5	1 52.3 14				
7 51	-83 14.3 - 96 56.5	-81 11.8 -101 39.6	-78 50.6 -105 00.6	1 51.7 14				
7 52	-83 04.0 -102 33.7	-80 56.0 -106 02.1	-78 28.5 -108 32.4	1 51.0 13				

PATH OF CENTRAL PHASE: TOTAL SOLAR ECLIPSE OF DECEMBER 4

U.T.	Northern Limit		Central Line		Southern Limit		Central Line	
	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Duration	Alt.
^h ^m	[°] [']	[°] [']	[°] [']	[°] [']	[°] [']	[°] [']	^m ^s	[°]
7 53	-82 48.6	-107 55.7	-80 35.6	-110 12.0	-78 01.3	-111 53.8	1 50.2	13
7 54	-82 28.3	-112 56.5	-80 10.3	-114 06.3	-77 28.7	-115 03.0	1 49.4	13
7 55	-82 03.0	-117 32.1	-79 40.2	-117 42.8	-76 50.1	-117 58.5	1 48.5	12
7 56	-81 33.2	-121 40.3	-79 05.1	-121 00.4	-76 04.8	-120 39.3	1 47.5	11
7 57	-80 58.7	-125 20.9	-78 24.8	-123 58.6	-75 11.3	-123 04.6	1 46.4	11
7 58	-80 19.8	-128 34.7	-77 38.7	-126 37.2	-74 07.2	-125 13.5	1 45.3	10
7 59	-79 36.3	-131 23.0	-76 46.2	-128 56.4	-72 47.2	-127 04.2	1 43.9	9
8 00	-78 47.9	-133 47.5	-75 45.9	-130 56.4	-70 55.6	-128 32.0	1 42.5	8
Limits	-67 02.5	-138 50.8	-67 21.9	-134 10.4	-67 36.2	-128 55.9	1 30.2	..

Joint publications of HM Nautical Almanac Office (UKHO) and the United States Naval Observatory

These publications are available from UKHO Distributors and the Superintendent of Documents, U.S. Government Publishing Office (USGPO) except where noted.

The Astronomical Almanac (AsA) and *The Astronomical Almanac Online* (AsA Online) contain ephemerides of the Sun, Moon, planets and their natural satellites, as well as data on eclipses and other astronomical phenomena. The AsA is an annual volume while AsA Online is updated annually. The data are calculated cooperatively by the British and American offices. A full list of contributors is given on page vii of the AsA (UKHO GP100) and on AsA Online.

The Nautical Almanac contains ephemerides at an interval of one hour and auxiliary astronomical data for marine navigation. (UKHO NP314)

The Air Almanac contains ephemerides at an interval of ten minutes and auxiliary astronomical data for air navigation. This publication is now distributed solely on CD-ROM and is only available from USGPO.

Rapid Sight Reduction Tables for Navigation (AP 3270 / NP 303), 3 volumes, formerly entitled *Sight Reduction Tables for Air Navigation*. Volume 1, selected stars for epoch 2020.0, containing the altitude to 1' and true azimuth to 1° for the seven stars most suitable for navigation, for all latitudes and hour angles of Aries.

Other publications of HM Nautical Almanac Office (UKHO)

The Star Almanac for Land Surveyors (NP 321) contains the Greenwich hour angle of Aries and the position of the Sun, tabulated for every six hours, and represented by monthly polynomial coefficients. Positions of all stars brighter than magnitude 4.0 are tabulated monthly to a precision of 0.1 in right ascension and 1" in declination. A CD-ROM is included which contains the electronic edition plus coefficients, in ASCII format, representing the data.

NavPac and Compact Data for 2016–2020 (DP 330) contains software, algorithms and data, which are mainly in the form of polynomial coefficients, for calculating the positions of the Sun, Moon, navigational planets and bright stars. It enables navigators to compute their position at sea from sextant observations using Windows OS XP/Vista/7/8/10 for the period 1986–2020. The tabular data are also supplied as ASCII files on the CD-ROM. Upgrades and updates are available from <http://astro.ukho.gov.uk/nao/navpacfour/>.

Planetary and Lunar Coordinates, 2001–2020 provides low-precision astronomical data and phenomena for use well in advance of the annual ephemerides. It contains heliocentric, geocentric, spherical and rectangular coordinates of the Sun, Moon and planets, eclipse maps and auxiliary data. All the tabular ephemerides are supplied solely on CD-ROM as ASCII and Adobe's portable document format files. The full printed edition is published in the United States by Willmann-Bell Inc, PO Box 35025, Richmond VA 23235, USA.

Rapid Sight Reduction Tables for Navigation (AP 3270 / NP 303), 3 volumes, formerly entitled *Sight Reduction Tables for Air Navigation*. Volumes 2 and 3 contain altitudes to 1' and azimuths to 1° for integral degrees of declination from N 29° to S 29°, for relevant latitudes and all hour angles at which the zenith distance is less than 95° providing for sights of the Sun, Moon and planets.

The UK Air Almanac (AP1602) contains data useful in the planning of activities where the level of illumination is important, particularly aircraft movements, and is produced to the general requirements of the Royal Air Force. It may be downloaded from the website <http://astro.ukho.gov.uk/nao/publicat/ukaa.html>.

NAO Technical Notes are issued irregularly to disseminate astronomical data concerning ephemerides or astronomical phenomena.

Other publications of the United States Naval Observatory

Astronomical Papers of the American Ephemeris[†] are issued irregularly and contain reports of research in celestial mechanics with particular relevance to ephemerides.

U.S. Naval Observatory Circulars[†] are issued irregularly to disseminate astronomical data concerning ephemerides or astronomical phenomena.

U.S. Naval Observatory Circular No. 179, The IAU Resolutions on Astronomical Reference Systems, Time Scales, and Earth Rotation Models explains resolutions and their effects on the data (see Web Links).

Explanatory Supplement to The Astronomical Almanac, (3rd edition). This book is an authoritative source on the basis and derivation of information contained in *The Astronomical Almanac*. It contains material that is relevant to positional and dynamical astronomy and to chronology. The publication is a collaborative work with authors from the U.S. Naval Observatory, H.M. Nautical Almanac Office, the Jet Propulsion Laboratory, and others. It is published by, and available from University Science Books, Mill Valley, California, whose UK distributor is Macmillan Distribution.

MICA is an interactive astronomical almanac for professional applications. Software for both PC systems with Intel processors and Apple Macintosh computers is provided on a single CD-ROM. *MICA* allows a user to compute, to full precision, much of the tabular data contained in *The Astronomical Almanac*, as well as data for specific times and locations. All calculations are made in real time and data are not interpolated from tables. *MICA* is a product of the U.S. Naval Observatory; it is published by and available from Willmann-Bell Inc. The latest version covers the interval 1800-2050.

[†] Many of these publications are available from the Nautical Almanac Office, U.S. Naval Observatory, Washington, DC 20392-5420, see Web Links on the next page for availability.

Publications of other countries

Apparent Places of Fundamental Stars is prepared by the Astronomisches Rechen-Institut, Zentrum fuer Astronomie der Universitaet Heidelberg (<http://www.ari.uni-heidelberg.de>). The printed version of APFS gives the data for a few fundamental stars only, together with the explanation and examples. The apparent places of stars using the FK6 or Hipparcos catalogues are provided by the on-line database ARIAPFS (<http://www.ari.uni-heidelberg.de/ariapfs>). The printed booklet also contains the so-called '10-Day-Stars' and the 'Circumpolar Stars' and is available from dpunkt.verlag GmbH, Wieblinger Weg 17, 69123 Heidelberg, Germany.

Ephemerides of Minor Planets is prepared annually by the Institute of Applied Astronomy (<http://www.iaaras.ru>). Included in this volume are elements, opposition dates and opposition ephemerides of all numbered minor planets. This volume is available from the Institute of Applied Astronomy, Naberezhnaya Kutuzova 10, St. Petersburg, 191187 Russia and can be downloaded from <http://iaaras.ru/html/emp2018/emp2018.html>.

Electronic Publications

The Astronomical Almanac Online: The companion publication of *The Astronomical Almanac*, providing data best presented in machine-readable form. It typically does not duplicate the data from the book. It does, in some cases, provide additional information or greater precision than the printed data. Examples of data found on *The Astronomical Almanac Online* are searchable databases, eclipse and occultation maps, errata found in the printed publication, and a searchable glossary. It is available at

<http://asa.usno.navy.mil> —  — <http://asa.hmnao.com>

Please refer to the relevant World Wide Web address for further details about the publications and services provided by the following organisations.

U.S. Naval Observatory

- U.S. Naval Observatory portal at <http://www.usno.navy.mil/USNO>
- USNO Astronomical Applications Department portal at <http://aa.usno.navy.mil/>
- USNO Data Services at <http://aa.usno.navy.mil/data/>
- NOVAS astrometry software at <http://aa.usno.navy.mil/software/novas/>
- *USNO Circular 179* at http://aa.usno.navy.mil/publications/docs/Circular_179.php
- *The Astronomical Almanac Online*—*WWW*— at <http://asa.usno.navy.mil>

H.M. Nautical Almanac Office

- General information at <http://astro.ukho.gov.uk> or <http://www.gov.uk/HMNAO>
- *The Astronomical Almanac Online*—*WWW*— at <http://asa.hmnao.com/>
- Eclipses Online at <http://astro.ukho.gov.uk/eclipse/>
- Online data services at <http://astro.ukho.gov.uk/websurf2/>
- Crescent MoonWatch at <http://astro.ukho.gov.uk/moonwatch/>

International Astronomical Organizations

- IAU: International Astronomical Union at <http://www.iau.org>
- IERS: International Earth Rotation and Reference Systems Service at <http://www.iers.org>
- SOFA: IAU Standards of Fundamental Astronomy at <http://www.iausofa.org>
- NSFA: IAU Working Group on Numerical Standards at <http://maia.usno.navy.mil/NSFA/>
- CDS: Centre de Données astronomiques de Strasbourg at <http://cdsweb.u-strasbg.fr>

Publishers and Suppliers

- The UK Hydrographic Office (UKHO) at <http://www.gov.uk/UKHO>
- U.S. Government Printing Office (USGPO) at <https://bookstore.gpo.gov>
- University Science Books at <http://www.uscibooks.com>
- Willmann-Bell at <http://www.willbell.com>
- Macmillan Distribution at <http://www.palgrave.com>