

SEASONS AND THE SUN

The terms below apply to the Northern Hemisphere. South of the equator, the seasons are reversed.



**SPRING
EQUINOX**

MAR 19

9:31 PM PDT



**SUMMER
SOLSTICE**

JUN 20

3:35 PM PDT



**AUTUMN
EQUINOX**

SEP 22

7:21 AM PDT



**WINTER
SOLSTICE**

DEC 21

2:44 AM PST

PERIHELION (Earth closest to the Sun):

JAN 2-0.983276 AU

APHELION (Earth farthest from the Sun):

JUL 4-1.016684 AU

AU=Astronomical Unit, the average distance from Earth to the Sun, or 93,000,000 miles

DAYLIGHT SAVING TIME (clocks set 1 hour ahead of Standard Time):

MAR 13-NOV 6

Times & dates given in this Pocket Almanac are for the Pacific Time Zone. Calendars using anything other than Pacific Time may list certain events as occurring on the following day, because the conversion to other time zones occasionally crosses midnight, thus advancing the date.

DIGITAL POCKET ALMANAC is downloadable at:
www.calacademy.org.

SKYWATCHING TIPS, call 415.379.5759 (415.379.5SKY)

QUARTERLY SKYGUIDE, visit:
calacademy.org/exhibits/morrison-planetarium

MORRISON PLANETARIUM DAILY SKYWATCHING INFORMATION is provided in many publications nationwide and sponsors the *StarDate* radio program locally on KCBS 740 AM.

THE BENJAMIN DEAN LECTURE SERIES presents monthly talks for the general public by noted scientists in the fields of astronomy and space science, including leading cosmologists, astrobiologists, planet hunters, and principal investigators for NASA space missions. For information, please visit: calacademy.org/events/benjamin-dean-astronomy-lectures or call 415.379.8000.



**CALIFORNIA
ACADEMY OF
SCIENCES**

55 Music Concourse Drive
Golden Gate Park
San Francisco, California 94118
415.379.8000
www.calacademy.org

Printed on 100% post-consumer recycled paper.

MORRISON PLANETARIUM



2016

POCKET ALMANAC

Seasons and the Sun
Eclipses
Phases of the Moon
Planet Watching
Meteor Showers



ALEXANDER F. MORRISON PLANETARIUM

Since 1952, the Academy's Morrison Planetarium has served the community as a valuable resource for astronomy education and skywatching information. It was the first major planetarium in the U.S. to build its own star projector, considered the world's finest simulator of the night sky for its time. Now redesigned for the 21st century, the Planetarium uses state-of-the-art digital technology to immerse audiences in full-dome imagery based on actual scientific data, from the smallest flowers to the surfaces of distant planets and immense clusters of galaxies.

CALIFORNIA ACADEMY OF SCIENCES

Home to Steinhart Aquarium, Kimball Natural History Museum, Osher Rainforest, and Morrison Planetarium, and world-class research and education programs, the California Academy of Sciences is one of San Francisco's "must-see" destinations. Explore the depths of a Philippine coral reef, climb into the canopy of a Costa Rican rainforest, and fly to the outer reaches of the Universe, all under one living roof. Daily interactions with animals, educators, and biologists within immersive, hands-on exhibits offer discovery and wonder for visitors of all ages.

ECLIPSES

Earth, the Sun, and the Moon align four times this year, resulting in two eclipses of the Sun and two of the Moon. The two solar eclipses feature one of each kind—total and annular—but neither is visible from the contiguous states of the U.S. The two lunar eclipses are penumbral and barely perceptible.

MARCH 8—The new Moon moves between Earth and the Sun, casting its shadow onto Earth’s surface and blocking the Sun from view along a narrow path that falls mostly over the Pacific Ocean, including parts of Malaysia and Indonesia. From locations on the path, the Sun’s outer atmosphere, or corona, is visible for a maximum of about four minutes. Observers in most of Southeast Asia, Southern China, Japan, Australia, Hawaii, and Alaska will not be directly in line with the Moon’s shadow and will see (with proper eye protection) only a partial eclipse, with “bites” of varying size taken out of the solar disk, depending on how far they are from the path of totality.

MARCH 23—The full Moon passes through only the outer portion of Earth’s shadow, or penumbra. Unlike a total lunar eclipse, during which the Moon is bathed in deep, reddish-brown light, a penumbral eclipse lightly shades the Moon’s face—in this case the southern half—and its subtle effect is best captured photographically. The entire event takes about four hours and is centered over the mid-Pacific Ocean.

SEPTEMBER 1—The Moon again passes between Earth and the Sun, but this time, it’s too far away to completely cover our star as seen from Earth. Appearing slightly smaller than the Sun, the Moon at maximum eclipse is surrounded by a bright ring of the Sun’s visible disk. This ring, or “annulus,” is visible for about three minutes and is bright enough to wash the Sun’s corona from view. For this reason, an annular solar eclipse is not as quite as spectacular as a total solar eclipse. Observers throughout a wide area covering Africa and the Indian Ocean will see a partial eclipse.

SEPTEMBER 16—The year’s second lunar eclipse and 2016’s last eclipse of either the Sun or the Moon is another penumbral lunar eclipse, too subtle for most people to notice during the four hours of its progress, centered over the Indian Ocean. It might be noticed by observers in Europe, Africa, the Middle East, and Asia.

PLANET WATCHING

Five planets can be seen in the heavens with the unaided eye. They are generally brighter than most stars and typically don’t twinkle. Over time, they can be seen to slowly change their positions against the constellations.

PLANET	MORNING SKY	EVENING SKY
Mercury	JAN 15–MAR 23 MAY 10–JUL 6 SEP 13–OCT 27 DEC 28–DEC 31	JAN 1–JAN 14 MAR 24–MAY 9 JUL 7–SEP 12 OCT 28–DEC 28
Venus	JAN 1–JUN 6	JUN 7–DEC 31
Mars	JAN 1–MAY 22	MAY 23–DEC 31
Jupiter	JAN 1–MAR 8 SEP 27–DEC 31	MAR 9–SEP 26
Saturn	JAN 1–JUN 3 DEC 11–DEC 31	JUN 4–DEC 10

OPPOSITIONS: Jupiter (MAR 8), Mars (MAY 22), Saturn (JUN 2)—opposition is the best time to observe an outer planet, when it’s opposite the Sun in the sky. This means it rises at sunset and is visible all night.

This is also when the planet appears largest and brightest. Being inside Earth’s orbit, Mercury and Venus are never opposite the Sun in the sky.

CLOSEST CONJUNCTIONS OF THE YEAR:

JAN 9: Venus and Saturn .08° apart in the predawn sky.

AUG 27: Jupiter and Venus .07° apart, with Mercury 5° to their south (challenging: only 22° from the Sun, low in the west in the glow of sunset).

PLANET-WATCHER’S ALERTS:

LATE JAN–EARLY FEB: All five naked-eye planets are visible at the same time in the predawn sky, spread out in a line from east to west, joined by the Moon from January 25–February 6.

MAY 9: Mercury passes in front of the Sun, looking like a tiny dot crossing our star’s face from 4:12 AM–11:42 AM PST. For observers in the western U.S., the event will already be in progress at sunrise. Use proper eye protection when observing!

PHASES OF THE MOON

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
 New Moon	9	8	8	7	6	4	4	2	1/30	30	29	28
 First Quarter	16	14	15	13	13	12	11	10	9	8	7	7
 Full Moon	23	22	23	21	21	20	19	18	16	15	14	13
 Last Quarter	1/31	—	1/31	29	29	27	26	24	23	22	21	20

Some dates may differ by one day from those in calendars which do not correct for Pacific Time.

MAJOR METEOR SHOWERS

On any given night, at least four to six sporadic meteors can be seen per hour as tiny particles of space dust burn up in Earth’s atmosphere. When Earth passes through the dust trail left behind by a passing comet, more of these particles rain through the atmosphere, causing a meteor shower. Showers are named after the constellation from which meteors appear to radiate. Visibility can be affected by the brightness of the Moon.

SHOWER	PEAK DATE*	APPROX. RATE PER HOUR	MOON PHASE
Quadrantids	JAN 4	20–80	Waning crescent
Lyrids	APR 21	15–20	Full
Eta Aquarids	MAY 4	20	Waning crescent
Delta Aquarids	JUL 27	35	Waning crescent
Perseids	AUG 12	60	Waxing gibbous
Orionids	OCT 20	35	Waning gibbous
Leonids	NOV 17	20	Waning gibbous
Geminids	DEC 13	50–80	Full
Ursids	DEC 22	10	Waning crescent

* The peak date of a meteor shower is when the maximum rate of meteors is expected to be observed, but it is not the only date to watch for them. Moonlight-permitting, better-than-usual rates may also be seen during the midnight-to-dawn hours a day or two before and after the peak date. Rates given are for dark observing locations and night-adapting vision.