

RESOURCE

ENCYCLOPEDIC ENTRY

Equinox

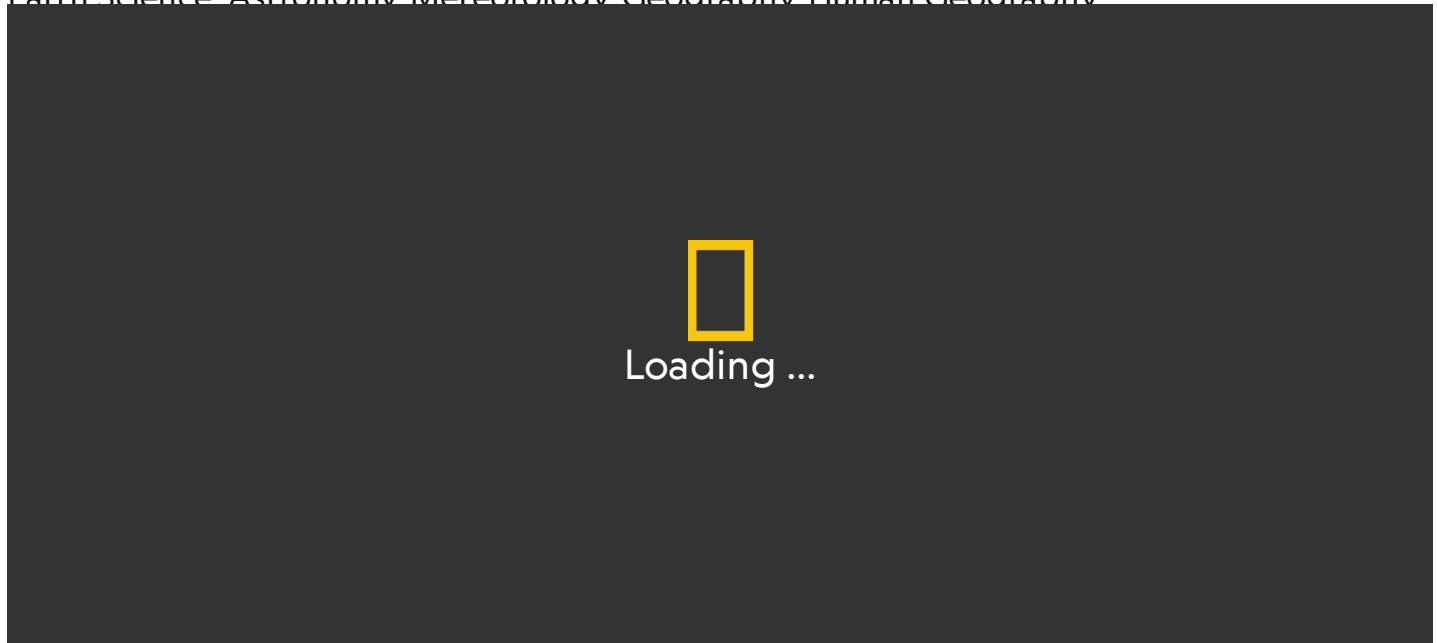
An equinox is an event in which a planet's subsolar point passes through its Equator.

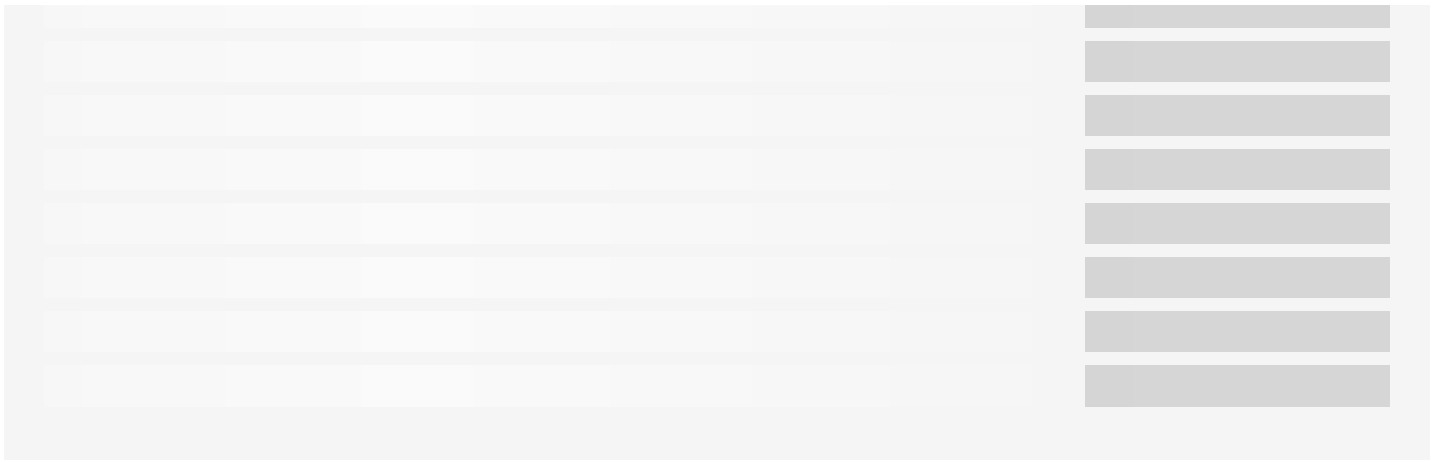
GRADES

9 - 12+

SUBJECTS

Earth Science Astronomy Meteorology Geography Human Geography





ARTICLE

VOCABULARY

An equinox is an event in which a planet's subsolar point passes through its Equator. The equinoxes are the only time when both the Northern and Southern Hemispheres experience roughly equal amounts of daytime and nighttime.

On Earth, there are two equinoxes every year: one around March 21 and another around September 22. Sometimes, the equinoxes are nicknamed the "vernal equinox" (spring equinox) and the "autumnal equinox" (fall equinox), although these have different dates in the Northern and Southern Hemispheres.

The March equinox is the vernal equinox in the Northern Hemisphere, and the autumnal equinox in the Southern. The September equinox is the autumnal equinox in the Northern Hemisphere and the vernal in the Southern.

The Science of the Equinoxes

During the equinoxes, solar declination is 0° . Solar declination describes the latitude of Earth where the sun is directly overhead at noon. (The Equator, of course, is 0° latitude.) So, equinoxes are the only times of the year when the subsolar point is directly on the Equator.

The subsolar point is an area where the sun's rays shine perpendicular to Earth's surface—a right angle. Only during an equinox is Earth's 23.5° axis *not* tilting toward or away from the sun: the perceived center of the Sun's disk is in the same plane as the Equator.

Before and after the equinox, the subsolar point migrates north or south. After the March equinox, the subsolar point migrates north as the Northern Hemisphere tilts toward the sun. Around June 21, the subsolar point hits the Tropic of Cancer, (23.5°N). This is the June solstice, after which the subsolar point begins to migrate south. After the September equinox, the subsolar point continues to move south as the Southern Hemisphere tilts toward the sun. Around December 21, the subsolar point hits the Tropic of Capricorn (23.5°S). This is the December solstice.

As its name suggests, an equinox indicates equally illuminated hemispheres, with the solar terminator equally dividing Earth from north to south. (The solar terminator is the shadowed line indicating daylight and sunlight on a globe.) A true equinox would indicate 12 hours of both day and night.

Although the equinoxes are as close to this phenomenon as happens on Earth, even during the equinoxes day and night aren't exactly equal. This is largely due to atmospheric refraction. Atmospheric refraction describes the way light seems to bend or deviate from a straight line as it passes through Earth's atmosphere. Atmospheric refraction is a result of increasing air

density, which decreases the velocity of light through the air. Due to atmospheric refraction, we are able to see the sun minutes before it actually rises and sets.

Equatorial Regions

The Equator, at 0° latitude, receives a maximum intensity of the sun's rays all year. As a result, areas near Earth's Equator experience relatively constant sunlight and little equinoctial variation. Equinoxes and celestial seasons generally have less impact than climate-driven patterns such as precipitation (rainy seasons and dry seasons).

Midlatitudes

Seasonal variation increases with latitude. Atmospheric refraction also increases the disparity in the "equinox" length of day and night. At about 30° latitude, day is about eight minutes longer than night.

Polar Regions

Atmospheric refraction is most dramatic in the Arctic and Antarctic, with daylight extending about 12 hours and 16 minutes. In this way, the equinoxes in polar regions signal the slow change from "midnight sun" to "polar night." "Midnight sun" describes the phenomenon in which the sun never dips below the horizon, keeping the region bathed in sunlight 24 hours a day. "Polar night" describes the opposite phenomenon, a time in which the sun never rises, keeping the region dark for 24-hour periods.

Equinoctial Disruptions

Satellites are vulnerable to disruptions in the days before and after an equinox. "Sun outages" describe this disruption. In the Northern Hemisphere, sun outages occur in the days before the March equinox and after the September equinox. In the Southern Hemisphere, sun outages occur after the March equinox and before the September equinox.

During an equinox, the sun is aligned directly behind satellites in geostationary orbit at the Equator. Situated directly above the subsolar point, the satellites are flooded with direct solar radiation. This solar radiation can interfere with and even stop satellites from transmitting signals. Many communications satellites orbit around the Equator, and consumers may experience slow Internet connections, radio static, or frozen television screens during equinoctial sun outages.

Extraterrestrial Equinoxes

Most planets experience equinoxes. The timing of equinoxes is determined by the planet's axial tilt and orbital characteristics. On the gas giant Saturn, for example, equinoxes are particularly dramatic. About 15 years separate the equinoxes on Saturn, and the equinoxes last about four days.

Saturn's spectacular ring system orbits in the same plane as the planet's equator. Although the rings extend thousands of kilometers into space, they are actually very thin, only about a kilometer wide. During Saturn's equinoxes, the rings (and Saturn's equator) line up perfectly with the sun. Photos taken from the solar perspective reveal the rings as a razor-thin line.

The Culture of the Equinoxes

Like the solstices, equinoxes are historic markers of seasonal change.

March Equinox

The March equinox, unofficially marking the spring season, is traditionally observed as a time of rebirth and renewal. For this reason, many cultures have celebrated the March equinox as the first day of the new year. The ancient Babylonian calendar began on the first full moon after the March equinox, and today, many cultural and religious calendars continue to celebrate new year in the spring.

Perhaps the most widespread and well-known equinoctial new year is Nowruz, the first day of the year in the Persian calendar. For more than 3,000 years, Nowruz has been a religious holiday in Zoroastrianism, but today it is marked by secular celebrations throughout Eastern Europe and Central Asia. The Nowruz holiday includes mythical figures (such as Amu Nowruz, sometimes nicknamed the “Iranian Santa Claus”), traditional family gatherings, and the items of “haft-sin.”

Haft-sin are seven symbolic foods associated with Nowruz, all beginning with the Arabic or Persian letter *sin*: *sabze* (sprouts, symbolizing rebirth); *samanu* (sweet pudding, symbolizing wealth); *senjed* (dried, date-like fruits, symbolizing love); *seer* (garlic, symbolizing health); *seeb* (apples, symbolizing beauty); *somac* (red sumac fruit, symbolizing the color of sunrise); and *serkeh* (vinegar, symbolizing age and wisdom).

Outside new year celebrations, the March equinox is celebrated in holidays all over the world. Vernal Equinox Day is a national holiday in Japan. The

Jewish festival of Passover begins the night of a full moon after the March equinox. The date of Easter, one of the most important holidays in the Christian calendar, is calculated using the March equinox.

September Equinox

Fewer events mark the September equinox. Perhaps the most familiar of these are Rosh Hashanah and Yom Kippur, Judaism's "High Holy Days." Rosh Hashanah is the Jewish new year, marked around the September equinox. Rosh Hashanah is calculated as 163 days after the first day of Passover (which itself is calculated by the March equinox.) The sounding of the shofar, a ram's horn used as a trumpet for thousands of years of Jewish ritual, welcomes Rosh Hashanah.

Yom Kippur, the holiest day in the Jewish calendar, falls about 10 days after Rosh Hashanah. Yom Kippur is a solemn holiday known as the "Day of Atonement." It is traditionally observed with a daylong fast and prayers for forgiveness.

Most cultural events associated with the September equinox are tied to autumnal harvest festivals. Chuseok, celebrated over a three-day period in the Koreas, is one of the most familiar of these folk festivals. Sometimes nicknamed "Korean Thanksgiving," Chuseok is a celebration of family and Korea's rich agricultural heritage.

FAST FACT

Chuseok Spam

FAST FACT

Shadowy Snake

Ancient Mayan architects may have honored the equinoxes in the design of the enormous stone pyramid nicknamed "El Castillo" at Chichen-Itza,

Mexico. Every equinox, the light of the sun casts shadows down the steps of the pyramid, making it look like a slithering serpent. "El Castillo" is a temple honoring the serpent god Kukulcan.

Archaeologists and anthropologists have not determined if this phenomenon was intentional or a happy accident.

FAST FACT

Burning of the Socks

Not all festivals surrounding the equinox are ancient. Annapolis, Maryland, celebrates The Burning of the Socks every March equinox. Chesapeake Bay boaters traditionally only wear socks between winter and spring. The Burning of the Socks signifies the warmer, sock-less spring season.

FAST FACT

Songpyeon

Songpyeon are an iconic food associated with Chuseok, the Korean holiday around the September equinox. Songpyeon are rice cakes made with freshly harvested rice and filled with sesame seeds, chestnuts, or red bean paste. The treats are steamed and traditionally served on layers of pine needles. Songpyeon symbolize important elements of Chuseok. The bite-sized food encourages sharing, and the rice and fillings are all harvested in late summer and autumn. Finally, the scent of pine, a sturdy evergreen, symbolizes autumn and the slow onset of the cold season on the Korean peninsula.

Reference

NASA Science: Interplanetary Seasons

NASA: The Seasons of the Year

Maps

Satellite Calculations: Sun Outage / Sun Interference Prediction for Geostationary Orbit Satellites

Images

NASA: Visible Earth—Seeing Equinoxes and Solstices from Space

website

NASA: Celestial Geometry—Equinoxes and Solstices

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ARTICLE

Solstice

A solstice is an event in which a planet's poles are most extremely inclined toward or away from the star it orbits.



ENCYCLOPEDIA ENTRY

Season

A season is a period of the year that is distinguished by special climate conditions



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