

# SEASONS, SOLSTICES, AND EQUINOXES

## THE VERNAL AND AUTUMNAL EQUINOXES

Equinoxes are two times of the year when the Earth's axis is not tilted towards or away from the sun, causing an almost equal amount of daylight and darkness at all latitudes. The term "equinox" originates from the Latin words, "aequus," meaning equal, and "nox", meaning night. The sun is precisely overhead at noon at the equator. The almost equal hours of day and night are due to sunlight refraction, which causes the sun to appear above the horizon even when its actual position is below. Moreover, the days become a bit longer at higher latitudes because the sun takes more time to rise and set. Therefore, during the equinox and for a few days before and after it, the length of the day will vary from approximately 12 hours and 6.5 minutes at the equator to 12 hours and 8 minutes at 30 degrees latitude and 12 hours and 16 minutes at 60 degrees latitude.

The vernal equinox, also known as the spring equinox, occurs around March 20th or 21st in the northern hemisphere. It marks the beginning of spring in the northern hemisphere and the beginning of autumn in the southern hemisphere. The autumnal equinox, or the fall equinox, occurs around September 22nd or 23rd in the northern hemisphere. It marks the beginning of autumn in the northern hemisphere and the beginning of spring in the southern hemisphere.

## SUMMER AND WINTER SOLSTICES

Solstices are astronomical events that occur twice a year, marking the point at which the sun reaches its highest or lowest point in the sky at noon, as seen from the Earth's equator. The two solstices are the summer solstice and the winter solstice.

The summer solstice happens when the Earth is tilted towards or away from the sun to the maximum extent, which causes the sun to be at its highest point in the sky. This position stays mostly the same for a few days before or after the solstice. During this time, the sun is directly over the Tropic of Cancer, located at 23.5° latitude North. For this reason, all places located north of the Tropic of Cancer, such as Mexico, the Bahamas, Egypt, Saudi Arabia, India, and southern China, experience the longest day of the year.

On the other hand, the winter solstice marks the longest night and shortest day of the year. It occurs in the Northern Hemisphere when the sun is directly over the Tropic of Capricorn, which is located at 23.5° south of the equator and passes through countries like Australia, Chile, southern Brazil, and northern South Africa.

## THE SEASONS

The Earth takes 365 days to complete one revolution around the sun. During this journey, the Earth follows an elliptical orbit, which means that the distance between the Earth and the sun varies throughout the year, even though it averages 93 million miles. In the first week of January, the Earth is about 1.6 million miles closer to the sun, called the perihelion. The aphelion, which is the point at which the Earth is about the same distance farther away from the sun, occurs in the first week of July. However, these differences in distance are not significant enough to cause the seasonal changes that we experience in the Northern Hemisphere. Instead, the tilt of the Earth on its axis by 23.5° is responsible for these seasonal changes. The orientation of the Earth's tilt concerning space remains the same throughout the year. Thus, the Northern Hemisphere tilts towards the sun in June, while in December, it tilts away.

## THE RELATIONSHIP BETWEEN LENGTH OF DAY AND TEMPERATURE

Most mid and high-latitude locations experience a delay between the longest day of the year and the warmest average temperatures. For instance, in northern Ohio and northwest Pennsylvania, the maximum daily temperature usually occurs about three weeks later in mid-July. This is because, just like the warmest part of the day is a few hours after noon when the sun is at its highest point, the warmest part of summer also lags behind the summer solstice. The delay occurs because it takes some time for the ground and water to warm up fully, so average temperatures continue to rise until the sun starts to set lower in the sky. This lag can be seen in a daily temperature chart, but it is more noticeable by observing changes in monthly average temperatures. In Cleveland, for example, July is usually 3.3°F degrees warmer than June, and August is warmer than June by 2.8°F, despite having fewer daylight hours than June.

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