

Motions of the Earth – Rotation and Revolution

The Earth revolves round the Sun in an elliptical orbit. While revolving around the Sun, the Earth also rotates on its axis.

Rotation

The spinning of the Earth on its axis from west to east once in 24 hours is known as **rotation**.

Some facts about the rotation of the Earth are

- The Earth completes one rotation from west to east on its axis in 23 hours, 56 minutes and 4.09 seconds.
- The Earth is tilted in the same direction as it moves around the Sun.
- The speed of rotation of the Earth decreases towards the poles.

Effects of Rotation of the Earth

Rotation of the Earth is an important phenomenon. Effects of the rotation of the Earth are

- The rotation of the Earth causes day and night. The part of the Earth facing the Sun experiences day, while the part which does not face the Sun experiences night.
- The speed of the Earth's rotation has affected the shape of the Earth. Because of the speed of rotation, a centrifugal force is created which leads to the flattening of the Earth at the poles and bulging at the centre.
- The Earth's rotation affects the movement of water in the oceans. The tides are deflected because of rotation.
- The speed of rotation also affects the movement of the wind. Because of rotation, winds and ocean currents deflect to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.
- It causes a difference in time at various places on the Earth. The difference in time of each longitude is 4 minutes.

Inclination of the Earth's Axis

The Earth is tilted on its axis. This tilting of the Earth on its axis is known as the inclination of the Earth's axis. Significance of inclination of the Earth's axis:

- Days and nights are of different duration because of the inclined axis of the Earth. If the Earth's axis would not have been inclined, then the days and nights would have been of equal duration throughout the world.
- The inclined axis of the Earth helps us to determine the time of the day by the height of the Sun in the sky.
- Seasons are also caused by the inclination of the Earth. If the axis of the Earth would have been vertical, then all the places on the Earth would have experienced only one season throughout the year.

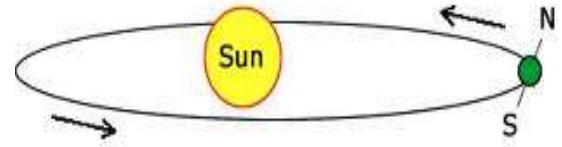
Revolution of the Earth

The revolution of the Earth around the Sun in an elliptical orbit is known as revolution.

Some facts about the revolution of the Earth:

- The Earth revolves at an average speed of 29.8 km per second.
- The Earth revolves round the Sun in an elliptical path. The position of the Earth when it is closest to the Sun is known as perihelion. The position when the Earth is farthest from the Sun is known as aphelion.

- The Earth does not revolve around the Sun in uniform speed. The gravitational pull makes the Earth revolve faster when it is closest to the Sun than when it is away from the Sun.
- The Earth takes 365 days, 5 hours, 48 minutes and 45.51 seconds to complete one revolution. To keep the equation simple, we take 365 days in a year. The remaining quarter of the day or six hours are added to one day or 24 hours over the span of four years to February. Thus, February has 29 days in a leap year which comes once in four years.



The Earth revolves round the Sun in an elliptical orbit.

Effects of the Revolution of the Earth

- Changes in Season: The revolution of the Earth results in changing the seasons. Seasons change because of the change in the position of the Earth around the Sun.
- Creation of Heat Zones: Because of the spherical shape of the Earth, the Sun's rays fall over it at different angles. This results in uneven distribution of the Sun's heat. This results in the creation of different heat zones on the Earth's surface. The three heat zones of the Earth are
 - Torrid Zone: This zone receives vertical rays of the Sun and thus experiences warm climate throughout the year.
 - Temperate Zone: The places located in this zone receive vertical rays of the Sun, and thus, they experience moderate climate.
 - Frigid Zone: This zone experiences extreme slanting rays of the Sun and hence experiences extremely cold climate.
- Perihelion and Aphelion Positions: The orbit of the Earth is elliptical. Perihelion is the minimum distance between the Earth and the Sun. Aphelion is the maximum distance between the Earth and the Sun.

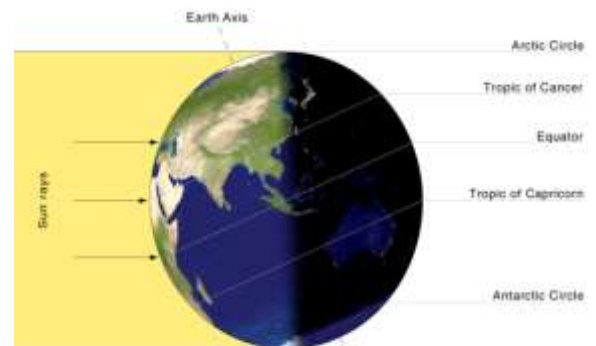
Circle of Illumination

Circle of illumination is an imaginary line which separates light from darkness and day from night.

Solstices and Equinoxes

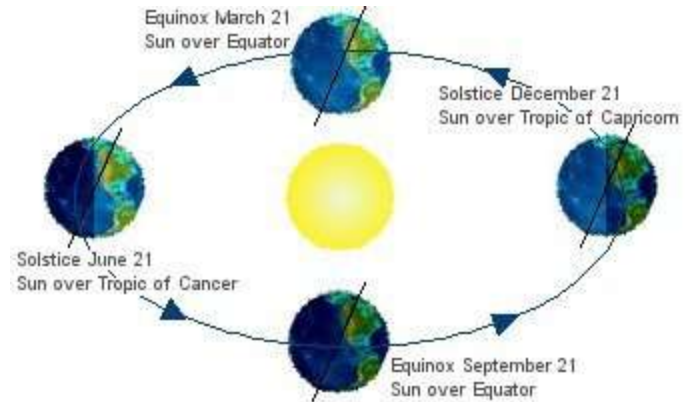
The solstices and equinoxes are caused by the position of the Earth with respect to the Sun during fixed days. The seasons change on the Earth because of its revolution around the Sun.

- On March 21 and September 23, the sunrays are directly above the Equator. On these two days, the days and the nights are of equal duration, i.e. of twelve hours each. This is known as equinoxes.
- On June 21, the Northern Hemisphere is tilted towards the Sun. Because the direct rays of the Sun fall on the Tropic of Cancer, these areas receive more heat. The areas near the poles get the slanting rays of the Sun, and thus, they receive less heat of the Sun. Because the greater part of the Northern Hemisphere receives light from the Sun, it is summer in the places lying to the north of the Equator (Northern Hemisphere).
- On June 21, the day is longest and the night is shortest in the Northern Hemisphere.
- The conditions are reversed at the Southern Hemisphere as it is tilted away from the Sun. The Sun's rays do not reach the south Polar Regions beyond the Antarctic Circle. This marks the winter in the South Hemisphere. This is called the summer solstice.



The imaginary line of a circle which divides the day and night on the globe is called the circle of illumination.

- On December 22, the Sun is directly above the Tropic of Capricorn. Because the South Pole is inclined towards the Sun, it is summer in the places lying south to the Equator (southern hemisphere).
- The conditions are reversed in the North Pole. Because it is tilted away from the Sun, it is winter. December 22 has the longest night and shortest day in the Northern Hemisphere. It is known as the winter solstice.
- On September 23, the Sun is vertically overhead at the Equator. The days and nights are of equal duration at the Equator. It is autumn in the Northern Hemisphere, and hence, it is called Autumnal Equinox. It is spring in the Southern Hemisphere at this time.
- On March 21, it is spring in the Northern Hemisphere, and hence, it is known as the Vernal Equinox.



Angle of Incidence

The angle of incidence is measured in degrees. It is calculated by subtracting the value of the latitude in degrees from 90°, as this is the maximum reached at the Equator.

Effects on Seasons in Low and High Latitudes

- During sunrise and sunset, the Sun is below the horizon and the light received from the Sun is diffused. The period of diffused sunlight received before morning is called **dawn**. Similarly, diffused light of the Sun received just before the sunset is known as **dusk** or **twilight**.
- This phenomenon is experienced more in the temperate regions.
- In latitudes beyond 50°, the duration of twilight increases. In Polar Regions, twilight lasts for about seven weeks at a stretch.
- This is because twilight is refracted light. The duration of twilight is short at the Equator because the Sun rises and sets in a vertical path. On the other hand, the duration of twilight is longer at the Polar Regions because the region receives slanting rays of the Sun.