

Chapter- 3

THE MOTIONS OF THE EARTH

STUDY NOTES

EVERYTHING IN THE SPACE MOVES

The Sun, the Stars, the Planets and other heavenly objects move in the space. The two main motions of the Earth are Rotation and Revolution. The Earth rotates on its axis and revolves round the Sun. The motions of the Earth cause the occurrence of night and day, the seasons, and the varied climate in different regions.

ROTATION OF THE EARTH

The Earth spins on its axis from west to east. This spinning of the Earth around its own axis is known as rotation. The Earth takes about 24 hours to complete one rotation. One rotation makes an Earth day or Solar day. The axis of the Earth is tilted or inclined at an angle of 66 1/2 degree to the plane of the Earth's orbit around the Sun or the ecliptic.

EFFECTS OF THE EARTH'S ROTATION

The rotation of the Earth causes:-

- Day and night
- Bulging of the Earth at the equator, and flattening at the poles
- The deflection (pushing away from the straight path) of winds and ocean currents
- Tides (the alternate rise and fall of the oceans due to the gravity of the Moon and the Sun, and the rotation of the Earth)
- The apparent movement of all the heavenly bodies from the east to west

DAY AND NIGHT

Day and night are caused by the motion of the Earth. Since the Earth rotates from west to east, the Sun appears to rise in the east. As the Earth is spherical, only one side of the Earth can face the Sun at any time. The side that faces the sun experiences day, and the side that is turned away from the sun experiences night.

The circle of illumination:- It is the line that separates the lighted half from the darker half of the Earth.

Dawn:- it is that time of day just before sunrise, when the eastern horizon starts getting lighter.

Dusk or Twilight:- It is the time just after the Sun sets in the west.

What will happen if the Earth fails to rotate?

It will be disastrous if the Earth fails to rotate:-

- While the side of the Earth facing the Sun will always be lighted, the other side will always remain dark.
- The lighted side of the Earth will become extremely hot and the dark side will be freezing cold.
- Life forms would not be able to exist in such extreme conditions.
- The patterns of tides, ocean currents and wind systems would be very different from what they are now.

REVOLUTION

While the Earth spins on its axis, it also goes around the Sun. This movement of the Earth around the Sun is called revolution. It takes the Earth little over 365 days or one year to complete a revolution around the Sun. The path it takes around the Sun is known as the orbit.

The distance between the Earth and the Sun varies from a minimum of roughly 147 million km in early Jan, called the perihelion, to a maximum of roughly 152 million km in early July, called the aphelion. The plane in which the Earth goes around the Sun is called the ecliptic.

EFFECTS OF THE EARTH'S REVOLUTION

The revolution of the Earth, along with the tilt in the Earth's, causes:-

- Varying lengths of day and night
- Changing seasons

If the Earth's axis were straight and not tilted, there would be no seasons, since every point on the Earth would receive the same amount of light each day of the year.

Varying lengths of day and night:- If you travel to different parts of the world you will notice that the lengths of days and nights can be very different, even at the same time of the year. This variation is due to the inclination of the Earth's axis.

THE CHANGING SEASONS

The axis of the Earth is inclined at an angle of $23\frac{1}{2}$ degree to its perpendicular plane. When this tilt in the axis is combined with the revolution of the Earth, we get the changing seasons. Between 21 March and 23 September, the Northern Hemisphere is inclined towards the Sun and the Southern Hemisphere is turned away from it. As the Northern Pole is inclined towards the Sun during this period, the Northern Hemisphere has longer days and shorter nights. This part gets heated more so summer is here. During this period, the southern Hemisphere faces away from the Sun. It only gets the slanting rays of the Sun and has longer nights and shorter days. It is winter here.

Summer Solstice:- The summer solstice is also known as the Northern solstice. It occurs in 21 June every year. During the summer solstice:-

- The tilt of the North Pole is maximum towards the Sun.
- The Tropic of Cancer to be the closest towards the Sun.
- The Northern Hemisphere gets longer days.
- Days are longer and summer season is at its peak.

Winter Solstice:- The winter solstice is also known as the Southern solstice. It occurs on 22 December each year. During the winter solstice:-

- The tilt of the South Pole is maximum towards the Sun.
- The North Pole is farthest from the Sun.
- The Tropic of Capricorn is closest to the Sun.
- The Southern Hemisphere gets longer days.

EQUINOX

Equinox is the position of the Earth when the axis of the Earth is so positioned that both the poles are at equal distance from the Sun.

The Spring Equinox:- The spring equinox occurs on 21 March every. During the spring equinox:-

- The length of day and night are equal.
- The sunlight falls directly on the Equator.
- It is spring in the Northern Hemisphere and autumn in the Southern Hemisphere.

The Autumn Equinox:- The autumn equinox is also known as the fall equinox. It occurs on 23 September every year. During the autumn equinox:-

- the length of day and night are equal
- the sunlight falls directly on the Equator.
- It is the autumn in the Northern Hemisphere and spring Southern Hemisphere.

SEASONS

The different positions of the Earth during its revolution around the Sun are responsible for the seasons. When the Northern Hemisphere is closer towards the Sun it is summer there. Simultaneously the Southern Hemisphere enjoys the winter season at the same time.

When the Northern Hemisphere is farther from the Sun as compared to the Southern Hemisphere, then it is winter in the Northern Hemisphere and summer in the Southern Hemisphere.

In between the summer and winter when the position is changing we have spring and the autumn season.

LEAP YEARS

The Earth takes $365\frac{1}{4}$ days to complete one revolution around the Sun. The 6 hours($\frac{1}{4}$ day) left are added as one more day($6 \times 4 = 24$ hours) to February every fourth year. Such year has 3666 days, and it is called as leap year.

