# CHAPTER 3

# MOTIONS OF THE EARTH

## 2Marks Questions:

**1.What is the angle of inclination of the earth's axis with its orbital plane?**

**Answers:**
(a) The angle of inclination of the earth's axis with its orbital plane is 66 1/2.

**2.Define rotation and revolution.**

**Answers:**The movement of the earth on its axis is known as rotation.
' Revolution. The movement of the earth around the sun in a fixed path or orbit is known as revolution.

**3.What is a leap year?**

**Answers:**The year in which February is of 29 days instead of 28 days is called a leap year. Thus a leap year is of 366 days instead of 365 days.(d) Differentiate between the summer solstice and winter solstice.

| Summer solstice | Winter solstice |
|---|---|
| • In the Northern Hemisphere the longest day and the shortest night occur on 21st June. At this time in the Southern Hemisphere it occurs the shortest day and the longest night. This position of the earth is called summer solstice. | • In the Northern Hemisphere the shortest day and the longest night occur on 22nd December. At this time in the Southern Hemisphere it occurs the longest day and the shortest night. This position of the earth is known as winter solstice. |

**4. What is an equinox?**

**Answers:**Equinox is the position of the Earth on 21st March and 23rd September. Both the hemispheres experience equal days and nights.

- On 21st March in the Northern hemisphere, this position is the spring equinox. Autumn equinox is in the Southern hemisphere.

**5.Why does the Southern Hemisphere experience winter and summer solstice in different times than that of the Northern Hemisphere?**

**Answers:** The Southern hemisphere experiences winter and summer solstice in different times than, that of the Northern hemisphere because of the following reasons:

- The southern hemisphere is tilted towards the Sun on 22nd December, hence summer solstice is there in the Southern hemisphere. At that time winter solstice is in the Northern hemisphere when it is away from the Sun.
- On the contrary, on 21 June the Northern hemisphere is tilted towards the Sun.
  Hence summer solstice is in the Northern hemisphere and winter solstice is in the Southern hemisphere.

**6. Why do the poles experience about six months' day and six months' night?**

**Answers:**

The poles experience six months' day and six months' night because of the following reasons:

- When the Northern hemisphere is tilted towards the Sun, the North Pole remains in the light for the whole of the day (24 hours). This position remains for six months (from 21st March to 23rd September).

## 4Marks questions:

**1.What would happen if the earth did not rotate?**
**Answer:**

In such a condition the portion of the earth facing the sun would always experience day, and thus there would be continuous warmth in the region. At the same time, the other half would always remain dark and be freezing cold all the time. These are extreme conditions which are not suitable for life.Thus, we can say that if the earth did not rotate life would not have been possible.

**2. How does leap year occur?**
**Answer:**

The earth takes 36514 days Le. one year to complete one revolution around the sun. We consider a year as consisting of 365 days only and ignore six hours for our convenience. Six hours saved every year are added to make one day Le. 24 hours over a span of four years. This surplus day is added to the month of February. Thus every fourth year, February of 29 days instead of 28 days. Such a year with 366 days is called a leap year.

**3 . Explain the concept of the circle of illumination and its significance in relation to day and night on Earth.**

**Answer:**

The circle of illumination is the imaginary circle that divides the illuminated, daytime side of the Earth from the dark, nighttime side. It is formed due to the spherical shape of the Earth and the presence of sunlight. As the Earth rotates on its axis, only the half facing the Sun receives sunlight, experiencing day, while the other half away from the Sun remains in darkness, experiencing night. The circle of illumination represents the boundary between these illuminated and dark portions. This concept helps explain the occurrence of day and night as the Earth rotates, and it is a crucial factor in understanding the daily motion of the Earth.

**4. Explain the concept of a leap year and describe how it is determined. When will the next leap year occur?**

**Answer:**A leap year is a year that contains an extra day, making it 366 days instead of the usual 365 days. This additional day is added to the month of February. Leap years are introduced to compensate for the fact that Earth's revolution around the Sun takes approximately 365.25 days.

To determine a leap year, the rule is that a year divisible by 4 is a leap year, except for years divisible by 100 but not divisible by 400. This means that years like 2000 are leap years because they are divisible by 400, but years like 1900 are not leap years despite being divisible by 4.To find the next leap year, we need to consider the current year. For example, if the current year is 2023, the next leap year would be 2024 since it is divisible by 4.

**5. Why does the Southern Hemisphere experience the Winter and Summer Solstice at different times than that of the Northern Hemisphere?**

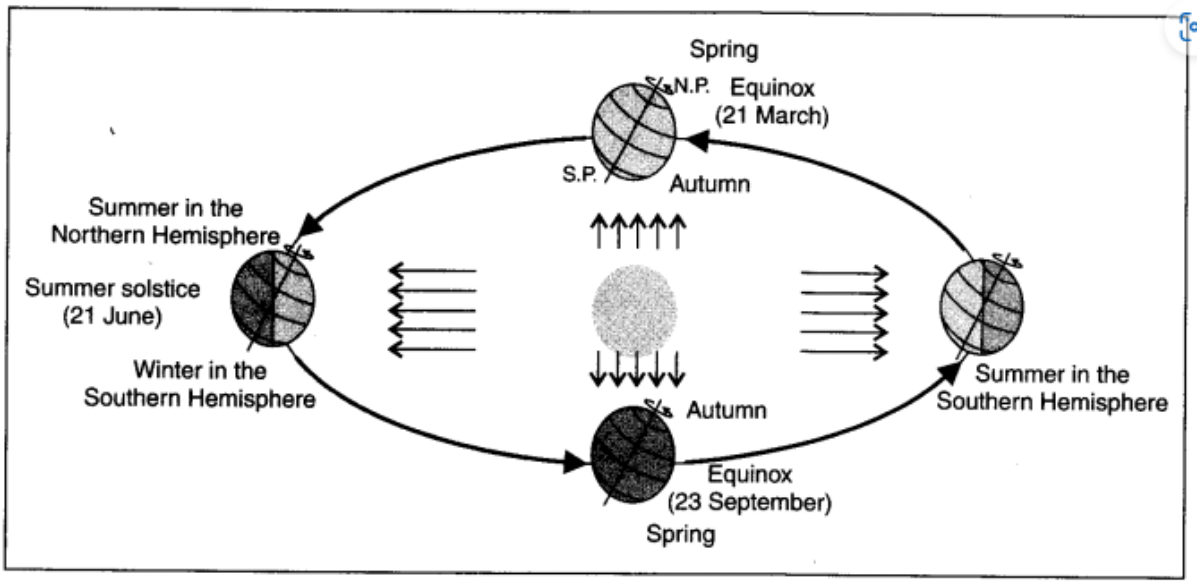
**Answer:** The earth's orbit makes an angle of 66 ½ º with the orbital plane. As a result, the poles of the earth are tilted in opposite directions. When one pole inclines towards the sun, the other pole remains tilted in the opposite direction. When the North Pole is tilted towards the sun, the Northern Hemisphere receives the maximum heat, and summer in the Northern Hemisphere. . On the other hand, the South Pole is tilted in the opposite direction from the sun. So, the southern hemisphere receives less heat, and winter in the Southern Hemisphere. . So, when the summer solstice occurs in the Northern hemisphere on the 21st of June, it is winter in the Southern Hemisphere and becomes the winter solstice. . Similarly, the winter solstice in the Northern Hemisphere on the 22nd of December. It is summer at this time in the Southern Hemisphere. So, it becomes the Summer solstice in the Southern Hemisphere.

**6. Why do the poles experience about six months day and six months night?**

**Answer** : Due to the earth's inclined axis, the circle of illumination doesn't coincide with the axis. From 22nd December to 21st June, the North Pole remains inclined towards the sun. As a result, the North Pole receives maximum heat and cuts the other half which stays out of the circle of illumination. So, it never experiences night for six months. At the same time, the South Pole is tilted in the opposite direction from the sun. So, it never receives any sunlight and experiences six months of nights. From 21st June to 22nd December, the South Pole is tilted towards the sun. So, it receives maximum heat and six

## 7Marks Questions:

**3. Explain the following with a diagram:**
**(a) Summer solstice (b) Winter solstice (c) Equinox.**




**Answer:** (a) Summer solstice. The Northern Hemisphere is tilted towards the sun on 21st June. As the rays of the sun fall directly on the Tropic of Cancer, these areas receive more heat. But the size of the area to the poles receives less heat due to the slanting rays of the sun. The North Pole is inclined towards the sun the places beyond the Arctic Circle experience continuous daylight for about six months.Since a large area of the Northern Hemisphere is getting light from the sun, it is summer in the regions north of the equator. The longest day and the shortest night at these places occur on 21st June. These conditions are reversed in the Southern Hemisphere at this time. It is winter season there having longer nights and shorter days. This position of the earth is known as the summer solstice.

(b) Winter solstice. On 22nd December, the Tropic of Capricorn receives direct rays of the sun as the South Pole tilts towards it. As the sun's rays fall vertically at the Tropic of Capricorn, a larger portion of the Southern Hemisphere gets light. Hence, the Southern Hemisphere enjoys summer having longer days and shorter nights. This position of the earth is called the winter solstice.

(c) On 21st March and 23rd September direct rays of the sun fall on the equator. At this position, neither of the poles is tilted towards the sun. As a result.

**2. Describe the two motions of the Earth—rotation and revolution. Explain how these motions contribute to the occurrence of day and night, as well as the changing seasons.**

**Answer:**The Earth has two main motions: rotation and revolution. Rotation is the Earth's movement on its axis, causing day and night. As the Earth rotates, different parts experience daylight when facing the Sun and darkness when turned away. This daily motion is responsible for the alternation of day and night.

Revolution refers to the Earth's orbit around the Sun. It takes approximately 365.25 days for the Earth to complete one revolution, forming the basis for a year. The Earth's axis is tilted at an angle of 23.5 degrees, leading to variations in sunlight intensity at different latitudes during the year.

This tilt, combined with revolution, causes the changing seasons. For example, during the Summer Solstice, one hemisphere is tilted toward the Sun, leading to summer, while the opposite occurs during the Winter Solstice, resulting in winter. Equinoxes, occurring on March 21st and September 23rd, mark periods of equal day and night due to the direct rays of the Sun falling on the equator.

## Multiple Choice Questions

**1) The axis of the earth is a/an……..**
(a) imaginary line (b) straight line
(c) curved line (d) real line.

**2) The earth receives light from the ……**
(a) Moon (b) Stars
(c) Meteors (d) Sun.

**3) The time taken by the earth to complete one rotation around its axis is……**
(a) 24 hours (b) 12 hours
(c) 36 hours (d) 18 hours.

**4) The earth completes one revolution in ……**
(a) 366 days (b) 370 days
(c) 365 1/4 days (d) 366 1/4 days.

**5) It is spring in the Northern Hemisphere and autumn in the Southern Hemisphere on …….**
(a) 23rd September (b) 21st March
(c) 22nd December (d) 21st June.

Answer:

**1)**—(a),

**2)**—(d),

**3)**—(a),

**4)**—(c),

**5)**—(b)

## Fill in the Blanks

1. Days and nights occur due to …… of the earth.
2. Only half of the earth gets light from the sun at a time due to its……. shape.
3. The period of rotation is known as the ……..
4. The sun's rays fall vertically at the Tropic of…….. on 22nd December.
5. On …… it is autumn season in the Northern Hemisphere and spring in the Southern Hemisphere.
6. The Earth has two main motions: .....and .....
7. The Earth's axis is an imaginary line that runs from the .....Pole to the .....pole.
8. The Earth completes one full rotation approximately every ..... hours.

**Answer:**

1. rotation
2. spherical
3. earth day
4. Capricorn
5. 23rd September.
6. Rotation, Revolution
7. North, South
8. 24 hours

## **Summary**:

The motions of the Earth refer to the various ways in which our planet moves and rotates in space. There are several key motions that contribute to Earth's dynamic behavior:

Rotation:Earth rotates on its axis, an imaginary line that runs from the North Pole to the South Pole.

This rotation takes approximately 24 hours to complete, causing day and night cycles.

The rotation is counterclockwise when viewed from above the North Pole.

Revolution:Earth revolves around the Sun in an elliptical orbit.

The time it takes for Earth to complete one orbit is approximately 365.25 days, defining a year.

The tilt of Earth's axis relative to its orbit is responsible for the changing seasons.

Axial Tilt:Earth's axis is tilted at an angle of about 23.5 degrees relative to its orbital plane.

This tilt is responsible for the variation in the intensity and duration of sunlight at different latitudes, leading to the seasons.

Precession:Earth's axis undergoes a slow, cyclic wobbling motion known as precession.

This movement causes the orientation of Earth's axis to change over time, completing a full cycle approximately every 26,000 years.

Axial Nutation:Axial nutation is a smaller, periodic oscillation of the Earth's axial tilt.

It results from the gravitational forces exerted by the Moon and the Sun on Earth's equatorial bulge.