

## THEME: EARTH AND SPACE SYSTEM

### TOPIC: THE SOLAR SYSTEM

#### What to you should know.

- How the Earth orbits around the sun and the moon around the Earth and the time taken for these orbits.
- The cause of day and night.
- Why the shape of the moon appears to change over a period of time when viewed from the Earth.
- How the tilt of the Earth gives rise to seasons in some parts of the world.
- The implications of the above for activities on Earth.
- Use a model to explain how the earth and moon move relative to the sun and use it to explain eclipses.
- The connection between the moon and ocean tides.
- The components of the solar system, and make a scale model of the planets and place them in order showing their relative distance from the Sun.
- The main characteristics of the inner four and outer four planets.
- Why the Earth is the only planet which supports life.
- The asteroid belt and where it is found in the Solar System.
- The origin and structure of the universe.

#### The Earths' orbit about the sun & Moons' orbit about the earth.

The Earth revolves in an orbit around the Sun in **365.25 days**, with reference to the stars, at a speed ranging from 29.29 to 30.29 kms<sup>-1</sup>. The 6 hours, 9 minutes (0.25 days) adds up to about an extra day every fourth year, which is designated in a leap year, an extra day added as February 29th.

The Moon takes **about one month** to orbit the Earth (27.3 days to complete a revolution, but 29.5 days to change from the present Moon to New Moon). As the Moon completes each 27.3-day orbit around Earth, both Earth and the Moon are moving around the Sun. The Earth and the Moon's orbits are maintained by a gravitational force that attracts and keeps them in the orbit.

#### Day and night

Day and night are due to **the Earth rotating on its axis**, not its orbiting around the sun. The term 'one day' is determined by the time the Earth takes to rotate once on its axis and includes both day time and night time. When the Earth rotates a given part facing the sun, that part experiences day and when that Earth's part faces away from the sun, then that part experiences night.

Daytime is when you can see the sun from where you are, and its light and heat can reach you. Nighttime is when the sun is on the other side of the Earth from you, and its light and heat don't get to you.

We get day and night because the Earth spins (or rotates) on an imaginary line called its axis and different parts of the planet are facing towards the Sun or away from it.

It takes 24 hours for the world to turn all the way around, and we call this a day. Over a year, the length of the daytime in the part of the Earth where you live changes. Days are longer in the summer and shorter in the winter. It's summarized as below;

1. It takes 24 hours for the Earth to turn all the way around (rotation). That makes one day and one night.
2. At any moment, half of the world is in daytime and half is in nighttime.
3. The world is like a ball. We call the top half the Northern hemisphere and the bottom half the Southern hemisphere. The (imaginary) line between them is called the equator.
4. In the Northern hemisphere, we have summer in June, July and August and winter is in December, January and February.
5. In summer the days are longer than they are in winter. **In London, the longest day is about 16 hours and 39 minutes and the shortest is 7 hours and 45 minutes.**
6. In the Southern hemisphere the seasons are the other way around. When it is summer in Europe, it is winter in Australia. Imagine celebrating Christmas on a long, hot summer day.
7. The (imaginary) line between the Eastern and Western hemispheres is called the 'Prime Meridian' and it goes through Greenwich Royal Observatory in London.
8. The world is split into time zones. Continental Europe is in the time zone to the east of Britain, so time is one hour ahead there; when it is 1pm in Britain it is 2pm in France.

### Changes in the shape of the Moon

The Moon doesn't emit (give off) light itself, the 'moonlight' we see is actually the Sun's light reflected off the lunar surface. So, **as the Moon orbits the Earth, the Sun lights up different parts of it**, making it seem as if the Moon is changing shape. In actual fact, it's just our view of it that's altering...

1. It is a universal fact the Moon does not produce light itself. It is the Sun who produces the light and the Moon brights from the Sun's light.
2. Because of the Moon's changing position as it orbits our planet, the Sun's light focus on different parts of it, giving the illusion that the Moon is changing shape over time.
3. But the fact is that the Moon never changes its shape. The shape of the Moon that appears at night, is the only part of the Moon which is facing us and in sunlight.
4. There are eight total phases of the moon cycle, four primary phases, and four secondary phases.
5. The primary phases are the new moon, first quarter, full moon, and last quarter.
6. The secondary phases are waxing crescent, waxing gibbous, waning crescent, and waning gibbous. The term waxing refers to the growth of the moon's image, while the term waning refers to a shrinking image.
7. The moon changes its shape every day. The day on which the whole of the moon is visible is known as the full moon day. Thereafter every night the size of the bright part of the moon appears to become thinner day by day.
8. On the fifteenth day, the moon is not visible. This day is known as the "new moon day". On most days only a small portion of the moon appears in the sky. This is known as the crescent moon. Then again moon grows larger every day.
9. On the fifteenth day, once again we get a full view of the moon. The time period between one full moon to the next full moon is slightly longer than 29 days (~29.5 days). The various shapes of the bright part of the moon as seen during a month are called phases of the moon.

### Seasons in some parts of the earth

As the earth spins on its axis, producing night and day, it also moves about the sun in an elliptical (elongated circle) orbit that requires about 365 1/4 days to complete. The earth's spin axis is tilted with respect to its orbital plane. This is what causes the seasons. When the earth's axis points towards the sun, it is summer for that hemisphere. When the earth's axis points away, winter can be expected.

Throughout the year, different parts of Earth receive the Sun's most direct rays. So, when the North Pole tilts toward the Sun, it's summer in the Northern Hemisphere. And when the South Pole tilts toward the Sun, it's winter in the Northern Hemisphere.

### **Implication of season on activities on earth.**

The season on earth affects the various activities conducted by human beings. This ranges from human activities, agricultural activities and human life. These activities are all affected by the seasons which arises from the changes in seasons.

### **Question.**

Asses the impact and implications of changing seasons to the human and other activities on Earth.

### **Relative motion of the sun and moon and eclipse.**

The Sun is the largest of the sun, Earth and Moon. The earth rotates about the sun and revolves about its own axis. The moon rotates about the Earth and the sun concurrently. When the Sun, Earth and the Moon are in a straight line, the shadow of the sun is cast either on the Earth or the Moon. This is referred to as an eclipse.

During a solar eclipse, the moon moves between the Earth and the sun and blocks the sunlight. The shadow is formed on Earth.

During a lunar eclipse, the Earth blocks the sun's light from reaching the moon. The shadow is formed on the moon as the Earth blocks light from reaching the moon. Since we are standing on Earth, what we see is that the moon gets dark. Other kinds of eclipses happen too.

### **Characteristics of inner and outer planets.**

Density: Inner planets are denser than outer planets.

Composition: Outer planets are made of gas, ice, and rocks, whereas the inner planets are made of iron, nickel, and silicates.

Moons: Inner planets have very few to no moons around them, whereas the outer planets have dozens of moons orbiting them.

### **Why earth is the only planet that supports life.**

The Earth has the right distance from the Sun, it is protected from harmful solar radiation by its magnetic field. It is also kept warm by an insulating atmosphere, and it has the right chemical ingredients for life, including water and carbon.

Earth is able to support life because it has a suitable temperature for living organisms along with the presence of oxygen and water that is required for the survival of all life forms

The Earth appears to be the only planet in the solar system with living creatures. In the solar system, the planets orbit around the Sun. Earth is the third planet from the Sun. It is one of the inner planets. As far as we know, Earth is also the only planet that has liquid water. Earth's atmosphere has oxygen. The water and oxygen are crucial to life as we know it. Therefore the Earth is able to support life in it.

### **Asteroid belt and where it's found**

The asteroid belt is a region within the solar system occupied by asteroids that are sparsely held together by gravity and occupying a region taking the shape of a gradient ring orbiting the Sun. Asteroids are small rocky bodies sometimes composed of iron and nickel, which orbit the Sun. The asteroid belt exists between the orbits of Mars and Jupiter, between 330 million and 480 million kilometers from the Sun.

Is the asteroid belt a failed planet?

Astronomers once thought that the asteroid belt was a failed planet that fragmented during the solar system's development. However, this hypothesis has largely been abandoned. Astronomers now believe the asteroid belt never gravitationally accreted into a planet, but was kept from doing so because of the massive gravity from Jupiter's mass.

### **Origin and structure universe**

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The universe appears to have an infinite number of galaxies and solar systems and our solar system occupies a small section of this vast entirety. The origins of the universe and solar system set the context for conceptualizing the Earth's origin and early history.

The mysterious details of events prior to and during the origin of the universe are subject to great scientific debate. The prevailing idea about how the universe was created is called the **big-bang theory**. Although the ideas behind the big-bang theory feel almost mystical, they are supported by Einstein's theory of general relativity.

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