



Dr. Bbosa Science

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+256 778 633 682, 753 802709
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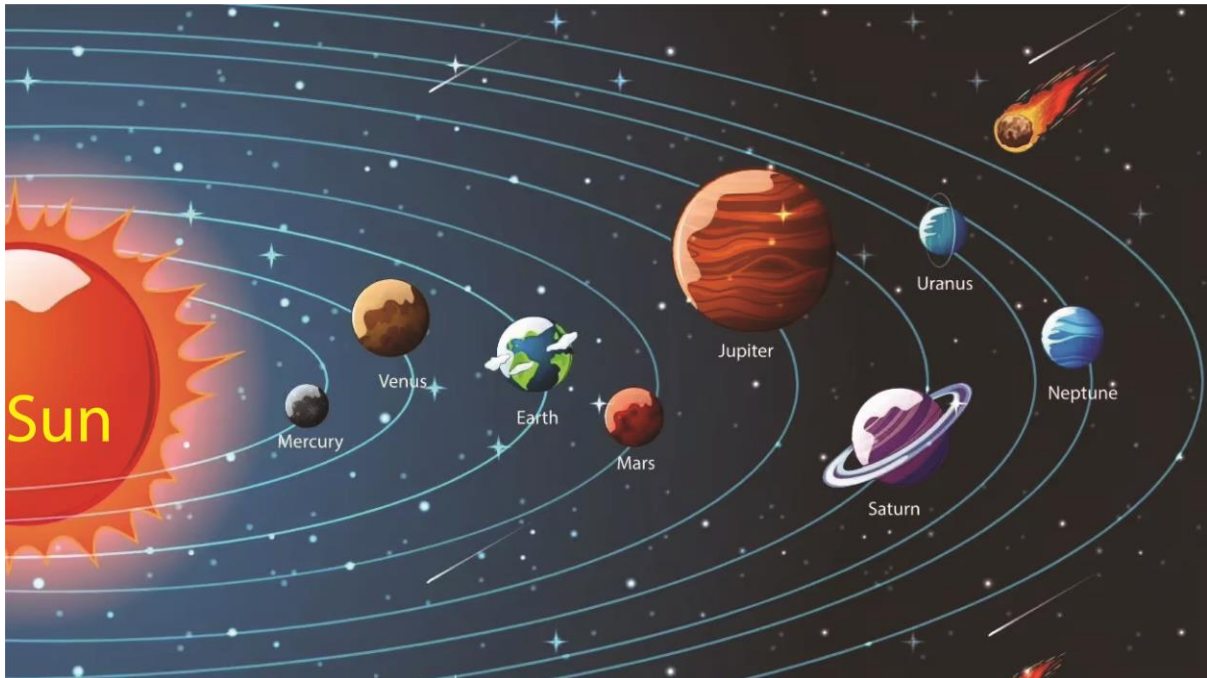


Nurture your dreams

S2 New Curriculum Physics

Theme: Earth and space physics

Chapter 8 – The solar system



The **solar system** is an assemblage of gravitationally bound bodies consisting of the sun, planets, their moons, stars and other interplanetary medium

Planets

Planets are space bodies that move around the sun in defined paths called orbits. The order of planets from the sun is given below

1. **Mercury** – the smallest and fastest planet
2. **Venus** – similar in size to Earth but wrapped in thick clouds
3. **Earth** – our home, with liquid water and life
4. **Mars** – the red planet, with dusty landscapes and giant volcanoes
5. **Jupiter** – the largest planet, a gas giant with a famous Great Red Spot

6. **Saturn** – known for its stunning ring system
7. **Uranus** – rotates on its side and has a bluish hue
8. **Neptune** – the windiest planet, deep blue and farthest from the Sun

If it helps to remember, there's a classic mnemonic: *“My Very Educated Mother Just Served Us Nachos.”*

Note

- Planets are visible if their location and time are known, for example Venus is visible a few hours before sunrise and after sunset in the eastern and western sky respectively.
- All planets may not be visible on a single night.
- Uranus and Neptune can also be visible. However, they are hard to see since they may require instruments or people with sharp eyes.

Motion of planets around the sun

All planets move around the sun. The motion is both rotational and revolution. Rotational motion involves the planets spinning about a fixed axis. And revolution involves a planet moving around the sun.

The revolution movement is governed by gravity and the laws of physics, especially those laid out by Kepler and Newton, i.e.

- **Gravitational pull** from the Sun keeps the planets in orbit, just like a string would keep a ball swinging in a circle. Without gravity, they'd fly off in a straight line.
- The planets don't move in perfect circles—they follow **elliptical (oval-shaped) orbits**, with the Sun slightly off-center.
- Each planet travels at its own speed, depending on how far it is from the Sun—closer planets like Mercury zip around quickly, while distant Neptune takes its sweet time (about 165 Earth years for one orbit).

Note that: One complete rotation is equal to one day and one complete revolution is equal to one year. For instance, one day on Earth is about 24 hours and one year is 365 days.

Days and nights

Days and night occur because the Earth rotates on its axis, the side which faces the sun receives light and heat from it, this side therefore experiences day time and the opposite side experiences night. For this reason, it may be day in Uganda and night in some other countries.

Seasons on earth

Seasons on Earth happen because the earth revolves around the sun in an elliptical orbit and on a **tilted axis which causes** different parts of the planet receive **different amounts of sunlight** at different times of the year. This results into changes in weather and climatic conditions of various regions on earth.

Earth experiences four seasons that is winter, summer autumn and spring in the north and southern hemispheres and two seasons, dry and wet in countries in the equatorial regions which represent summer and winter.

The moon

The moon is the second brightest object in the sky after the sun. It is the closest celestial body to the earth and its only natural satellite.

As the earth orbits the sun, the moon orbits the earth and takes about 29.5days in a complete revolution.

Eclipses

An **eclipse** occurs when one heavenly body such as a moon or planet moves into the shadow of another heavenly body.

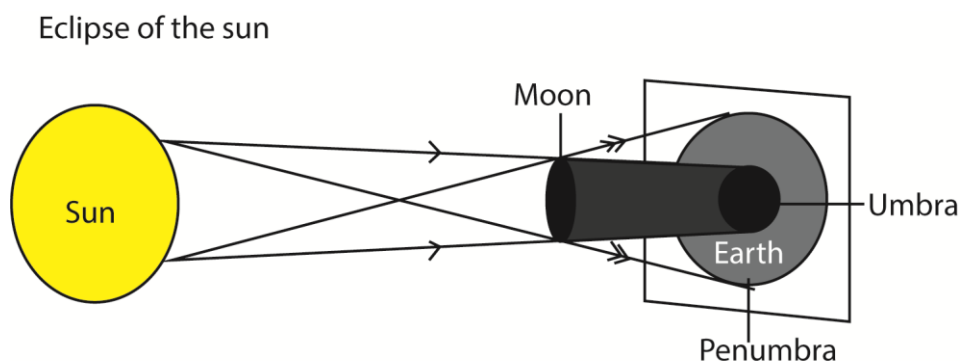
Types of eclipse

Solar eclipse

Solar eclipse also called eclipse of the sun occurs when the moon is between the sun and earth such that both umbra and penumbra reaches the earth.

The area on earth covered by the umbra has total eclipse and the sun cannot be seen at all.

The area covered by penumbra has partial eclipse and only part of the sun is seen.

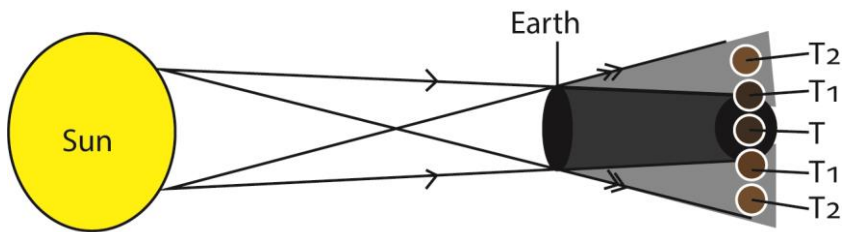


Lunar eclipse

Lunar eclipse is also called eclipse of the moon. Lunar occurs when the earth is between the sun and the moon.

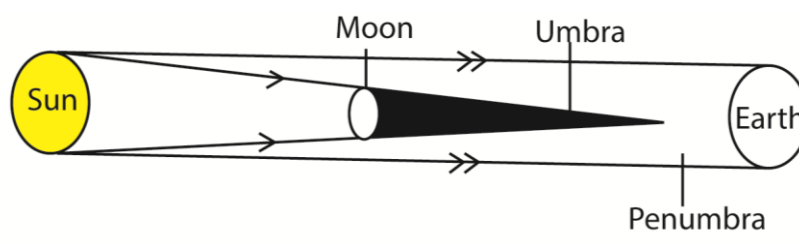
During the eclipse of the moon the earth's shadow is cast on the moon such that when the moon is at position "T," total eclipse occurs, in position "T₁" partial eclipse occurs and when the moon is in position "T₂" no eclipse occurs but the moon is less brighter than usual.

Eclipse of the moon



Annular eclipse

Annular eclipse of the sun occurs when the sun is very far from earth and the moon is between the earth and the sun such that umbra does not reach the earth but only penumbra reaches earth.



Note: Total eclipse of the moon lasts longer than total eclipse of the sun because for total eclipse of moon, the earth which is in the middle is larger than moon in the eclipse of the sun.

Ocean tides

Ocean tides are the regular rise and fall of sea levels caused mainly by the **gravitational pull of the Moon and the Sun** on Earth's oceans.

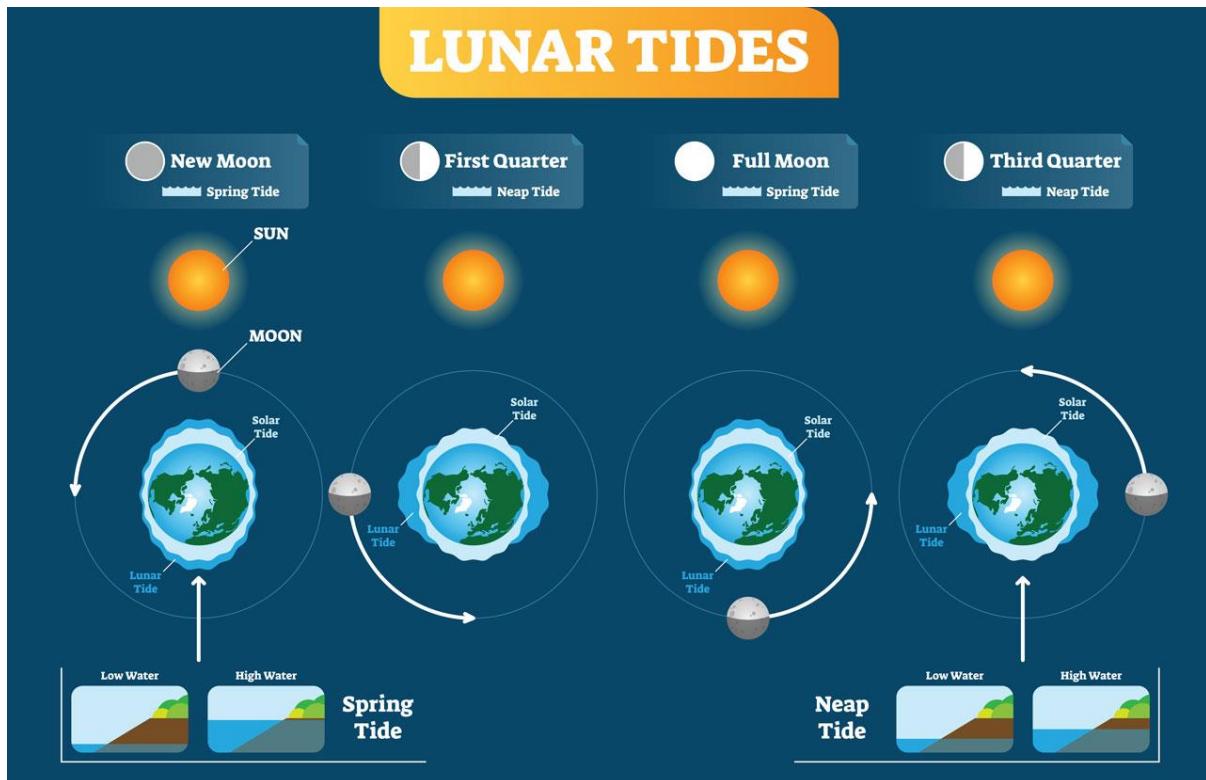
Here's how it works:

- The **Moon's gravity** pulls on Earth's oceans, creating a bulge of water—this is **high tide** on the side of Earth facing the Moon.
- At the same time, another high tide forms on the opposite side due to the **inertia** of the water resisting the Moon's pull.
- The areas between these bulges experience **low tide**.
- As Earth rotates, different places move through these bulges, causing the regular pattern of rising and falling sea levels.

The **Sun also plays a role**, though it's farther away. When the Sun and Moon align (during new and full moons), their combined pull causes **spring tides**—higher highs and lower lows.

When they're at right angles (first and third quarters), we get **neap tides**, which are more moderate.

Tides are like Earth's heartbeat—steady, rhythmic, and deeply connected to the Moon.



Theories of the origin of the earth

- Biblical theory:** This states that god created the Universe and the various processes that drive physical and biological evolution.
- Steady state theory:** This proposes that the Universe is always expanding but maintaining a constant average density. In this case, matter is continuously created to form stars and galaxies at an equal rate as the old ones become unobservable.
- Big bang theory:** This state that the universe was originally more condensed in every small infinite mass. It exploded and is seen expanding at a recessional velocity every day.

Structure of the universe

The structure of the universe is like a vast cosmic web, stretching across unimaginable distances and organized in a hierarchy of scales. It consists of

- **Solar Systems:** In the solar system the sun is located at the centre with planets moving in elliptical orbits around the sun
- **Galaxies:** Huge collections of stars, gas, dust, and dark matter. The Milky Way is our home galaxy.

- **Galaxy Groups and Clusters:** Galaxies tend to clump together. Our Milky Way is part of the **Local Group**, which includes Andromeda and about 50 other galaxies.
- **Superclusters:** These are massive regions containing many galaxy clusters. We belong to the **Laniakea Supercluster**, which spans over 500 million light-years.
- **Filaments and Voids:** On the largest scale, the universe looks like a sponge or web. Galaxies and clusters form **filaments**—thread-like structures—while **voids** are vast, empty spaces between them.

This grand structure is shaped by gravity, dark matter, and the expansion of the universe. It's like a cosmic tapestry, woven over billions of years.

Revision exercise

1. State the element of the solar system
2. Mention the eight planets that make up the solar system in order.
3. Explain how day and night come about
4. Explain the occurrence of seasons on Earth.
5. Name two main eclipse and explain how they are forms

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