

NATURAL SCIENCES GRADE 7

TEACHER GUIDE



EARTH AND BEYOND

RELATIONSHIP OF THE SUN TO THE EARTH

New terms

Rotate – to move around the centre

Revolve – move around another object

Orbit – the path that an object takes as it moves around another object.

Tilt – When something is slanted or leaning at an angle rather than being perfectly upright or horizontal.

Axial tilting - refers to the fact that a planet's axis—the imaginary line running through its North and South Poles—is slanted and not perfectly vertical.

Equinox is the date at which the Sun crosses the celestial equator.

Celestial equator is the great circle of the celestial sphere.

On equinox, the day and night are of equal length (20 March and 22 September)

Solar energy and the Earth's seasons

(a) Heat Radiation from the Sun

- **Radiation:** The Sun emits energy in the form of electromagnetic waves.
- This energy travels through space and is distributed in all directions.
- When this radiation reaches Earth, it warms the planet and it causes different weather patterns.

(b) Earth's Rotation

- **Rotation:** Earth takes **24 hours** to complete one full rotation on its axis.
- This spinning motion causes day and night, with the side of the Earth facing the Sun experiencing day, and the opposite side experiencing night.

(c) Earth's Axis Tilt

- **Axial Tilt:** The Earth's axis is tilted at an angle of **23.5°** from the vertical relative to its orbit around the Sun.
- The tilting of the Earth leads to the different **seasons** as it affects how sunlight hits different parts of Earth throughout the year.

(d) Sunlight and Seasons

- **Sunlight Intensity:** The amount of **light intensity** (or solar radiation) that reaches the Northern and Southern Hemispheres affects the temperature and climate.
- It creates the **four seasons** (spring, summer, autumn, and winter).
- The different amounts of light reaching different parts of the Earth is due to Earth's axial tilt.

(e) Seasons in Hemispheres

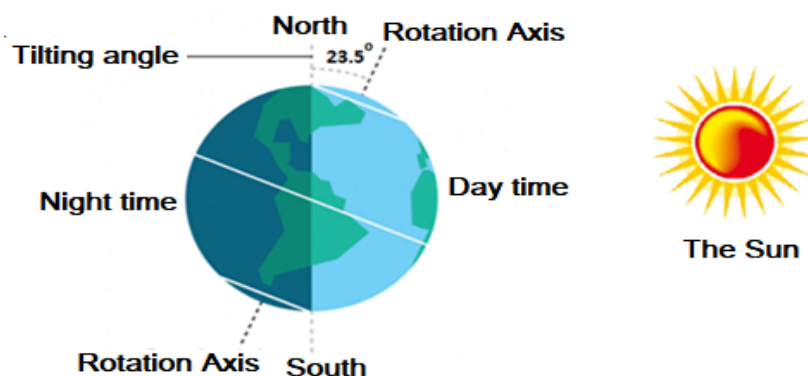
- **Hemisphere Tilting:**

During **June**, the **Northern Hemisphere** is tilted towards the Sun, resulting in summer, while the **Southern Hemisphere** is tilted away, leading to winter.

- This change in position relative to the Sun is due to Earth's orbit and axial tilt.

(f) Winter and Daylight

- **Day Length Variation:** In **winter**, the nights are **longer** and the days are **shorter** due to the Earth's axial tilting.
- The hemisphere experiencing winter is tilted away from the Sun, receiving less direct sunlight, thus shortening the length of the day.



ANSWER THE FOLLOWING QUESTIONS:

1. What form of energy does the Sun emit?

- Radiant energy

2. How does the Sun's energy travel through space?

- It travels in the form of electromagnetic waves.

3. What happens when the Sun's radiation reaches Earth?

- When this radiation reaches Earth, it warms the planet and it causes different weather patterns.

4. How long does it take Earth to complete one full rotation?

- Earth takes **24 hours** to complete one full rotation on its axis.

5. What does Earth's rotation cause?

- The rotation causes day and night.

6. Which part of Earth experiences day?

- The side of the Earth facing the Sun experiencing day.

7. What is the angle of Earth's axial tilt?

The Earth's axis is tilted at an angle of **23.5°** from the vertical.

8. How does Earth's axial tilt affect sunlight?

-
- The tilting of the Earth leads to the different **seasons** as it affects how sunlight hits different parts of Earth throughout the year.

9. Discuss what affects the temperature and climate on Earth.

-
- The amount of **light intensity** (or solar radiation) that reaches the Northern and Southern Hemispheres affects the temperature and climate.

10. What does the variation in sunlight cause?

-
- It creates the **four seasons** (spring, summer, autumn, and winter).

11. Which hemisphere is tilted towards the Sun in June?

-
- During **June**, the **Northern Hemisphere** is tilted towards the Sun, resulting in summer, while the **Southern Hemisphere** is tilted away, leading to winter.

12. What season does the Southern Hemisphere experience in June?

-
- Winter

13. Discuss why are days shorter in winter.

-
- **Day Length Variation:** In **winter**, the nights are **longer** and the days are **shorter** due to the Earth's axial tilting.
 - The hemisphere experiencing winter is tilted away from the Sun, receiving less direct sunlight, thus shortening the length of the day.

Activity:

- A. Place a globe (Styrofoam ball) on a desk representing the Earth.
- B. Set up a flashlight or lamp (to represent the Sun) to shine onto the globe.
- C. Mark the globe with a marker or sticker to represent different continents.
- D. Position the ball or globe in an upright position (not tilting) and shine the on the ball or globe.
- E. Explain to the learners that when the globe is not tilted, there are no seasons forming since the same amount of light reaching the Earth.
- F. Now tilt the ball by 23.5 and rotate it around the Sun.
- G. Mark the positions where the Earth experiences the four seasons.
- H. Emphasize to the learners that the tilting leads to the four seasons.

LIFE ON EARTH

- (a) Plants benefit from the light coming from the Sun.
- (b) Plants use the light to manufacture their own food.
- (c) The food manufactured by plants benefit all organisms.

SOLAR STORED ENERGY: COAL FORMATION

(a) Plants and Sunlight

- Plants use **sunlight** to grow through **photosynthesis**, but after their life cycle, they die.

(b) Large Plants and Animals Died Long Ago

- Many **giant plants and animals** that lived millions of years ago eventually **died** and began to decay.

(c) Dead Plants and Animals Buried

- Over time, the dead plants and animals got **buried** under layers of **water** and **dirt**.

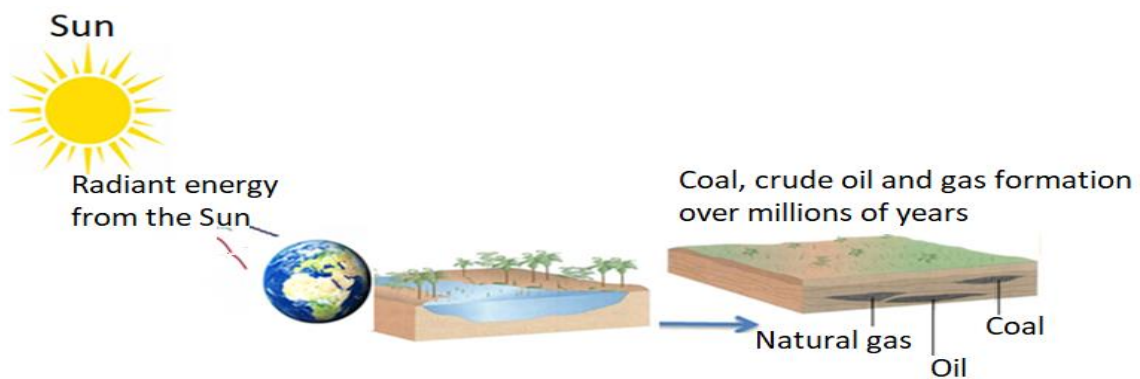
(d) Heat and Pressure Caused Changes

- The weight of the dirt and the pressure from layers of earth above **squeezed** the dead plants and animals buried below the surface of the Earth.

- Over time, this **squeezing** caused **heat** and **changes** in the plants and animals causing physical and chemical changes.

(e) Carbon-Rich Remains Turned into Coal

- After millions of years, these changes turned the remains of plants and animals which were rich in carbon into coal.
- Coal, crude oil and natural gas do not form at the speed they are being consumed and are not sustainable.



Answer the following questions:

Knowledge (Low order)

1. What do plants use to grow?

-
- Sunlight

2. What process do plants use to convert sunlight into food?

-
- Photosynthesis

3. What happens to plants after their life cycles?

-
- They die after their life cycles

Understanding Concepts (Middle order)

4. Why do plants need sunlight to grow?

-
- Sunlight enables plants to manufacture their own food.

5. What happens to the remains of plants and animals that died millions of years ago?

-
- After millions of years, these changes turned the remains of plants and animals which were rich in carbon into coal.

6. How do heat and pressure affect the remains of buried plants and animals?

-
- Heat and pressure cause physical and chemical changes in the buried plants and animals.

Application (High order)

7. What might happen to a plant if it doesn't get enough sunlight?

-
- The plant might not be able to manufacture its own food.

8. How do the remains of ancient plants and animals eventually turn into coal?

-
- They are squeezed and heated changing them into coal over time.

9. Can photosynthesis occur without sunlight? Why or why not?

-
- No, sunlight is required by plants for photosynthesis to take place.

10. What role does heat play in the formation of coal from dead plants and animals?

-
- Heat changes the chemical and physical composition of the plants and animals remains.

12. What is the relationship between the carbon content of dead plants and the formation of coal? _____

- Coal is another form of carbon so plants and animals rich in carbon favour the formation of coal.

13. If plants rely on sunlight to survive, what might happen to the planet's ecosystems if sunlight were blocked for an extended period? _____

- All organisms will die or cease to exist.

Crude oil and natural gas

(a) Crude Oil and Natural Gas Formation

- Like coal, crude oil and natural gas formed millions of years ago from the remains of plants and animals.

(b) Sea Plants and Animals on the Ocean Floor

- Dead sea animals and plants sank and were deposited on the ocean floor.

(c) Layers of Sediment Covered the Remains

- Over time, layers of sand and silt covered these remains, forming thick deposits.

(d) Heat and Pressure Made Oil and Gas

- The weight of the layers caused heat and pressure, which transformed the remains into crude oil and natural gas.

(e) Oil and Gas Trapped in Rock

- Rock layers formed above, trapping the oil and gas. These resources need to be drilled and pumped out of the Earth.

(f) Mossel Bay's Gas Fields

- Mossel Bay, in the Southern Cape, is home to some of South Africa's gas fields.

Answer the following questions:

Knowledge (Low order)

1. What natural resources are formed from the remains of plants and animals?

- Coal, crude oil and natural gases.

2. Where were the remains of dead sea plants and animals deposited?

- On the ocean floor.

3. What covered the remains of plants and animals on the ocean floor?

-
- Layers of sand and silt covered the remains.

4. What caused the transformation of plant and animal remains into crude oil and natural gas? _____

- Heat and pressure

5. Where is crude oil and natural gas trapped after formation?

-
- Rock layers trapped the oil and gas.

Comprehension (Middle order)

6. How are crude oil and natural gas similar to coal in their formation process?

-
- They are all formed over millions of years from remains of plants and animals.

7. Why did layers of sand and silt build up over the remains of sea plants and animals?

-
- The layers of sand and silt were deposited over the remains of plants and animals.

8. Why is it necessary to drill and pump crude oil and natural gas out of the Earth?

-
- To pump out the oil and gas trapped underneath.

Application (Applying Concepts to Real Situations)

10. How could the discovery of oil in a new location impact that area's economy?

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- It will create employment and there will be economical growth in the area as a result.

11. How might the process of oil and gas formation differ in regions with different climates or geographical conditions?

- Different climates and geographical conditions will produce varying types and quantities, and at different rates due to differences in temperatures and rock formation.

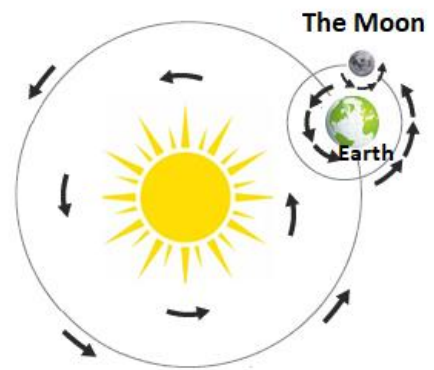
12. Why do certain areas like Mossel Bay have gas fields while others do not?

- It is due to sedimentation processes, organic material deposition, and tectonic activity which are in specific areas.

RELATIONSHIP OF THE MOON TO THE EARTH

Relative positions

- A. The Moon is a natural satellite that orbits around the Earth.
- B. The Moon revolves on its orbit around the Earth and around the Sun.
- C. We always see the same side of the Moon because the period of rotation of the Moon around the Earth is the same as the period it spins (27.3 days) on its axis.
- D. The side of the Moon we see we call it the near side and the one we do not see the far side.
- E. The effect of the gravity of the Moon's gravity results in the formation of tides.



Activity:

- A. Divide your class into 3 groups: 1 learner will be the Moon, 3 learners will be Earth, and the remaining learners will be the Sun.
- B. Have the learners who are modeling the Sun hold hands and form a large circle.
- C. Direct them to rotate their circle counterclockwise. Let them rest in place while you set up the Earth model.
- D. Next, have learners who are modeling Earth hold hands and form a circle. Direct them to rotate counterclockwise and then have them continue to rotate while moving as a group to revolve around the Sun. Let them rest in place while you set up the Moon model.
- E. Then, direct the learner who is modeling the Moon to rotate counterclockwise while revolving counterclockwise around Earth.
- F. Finally, have the class do all the movements together so that the Sun is rotating in place, the Earth is rotating while revolving around the Sun, and the Moon is rotating while revolving around the Earth.

Answer the following questions:

1. What is a Moon?

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- The Moon is a natural satellite that orbits around the Earth or a planet.

2. Discuss the movement of the Moon.

-
- The Moon revolves on its orbit around the Earth and around the Sun.

3. Explain why do we always see one side of the Moon.

-
- We always see the same side of the Moon because the period of rotation of the Moon around the Earth is the same as the period it spins (27.3 days) on its axis.

4. What is the period of rotation of the Moon in days?

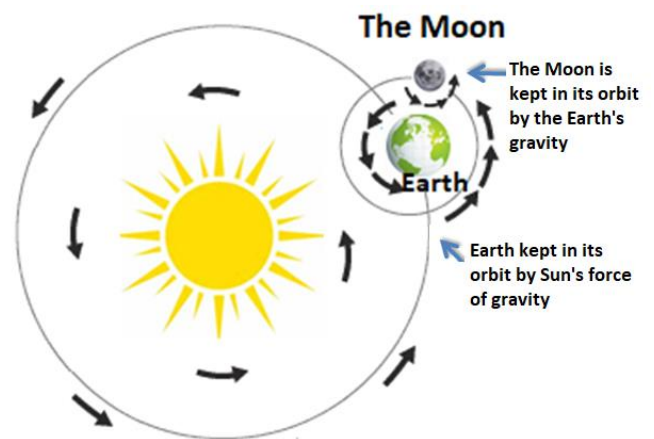
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- The period of rotation is 27.3 days.

5. What is the effect of the Moon's gravity on the Earth?

-
- The effect of the gravity of the Moon's gravity results in the formation of tides

GRAVITY

- (a) The force that makes objects attract each other is called gravity.
- (b) All objects pull on each other with a gravitational force.
- (c) The strength of gravity depends on the mass of the objects and the distance between them.
- (d) The larger the objects' masses, the stronger the pull, but the force decreases as the distance increases.
- (e) The Earth is held in its orbit around the Sun by the Sun's gravity.
- (f) The Moon is kept in its orbit around the Earth by Earth's gravity.
- (g) The Moon orbits both the Earth and the Sun.
- (h) The Moon also has its own gravitational pull on the Earth.



Answer the following questions:

1. What is gravity?

- The force with which objects in the universe attract each other.

2. Which factors does gravity depend on?

- Mass and distance

3. What is the relationship between the mass of an object and the force of attraction?

- The bigger the masses of the objects the more the pull.

4. How is the Earth held in its orbit?

- The Earth is held in its orbit as it revolves around the Sun by the Sun's pull or gravity.

5. How is the Moon kept in its orbit as it moves around the Sun?

-
- The Moon is also kept in its orbit as it moves around the Sun by the Earth's pulling force or gravity.

6. Does the Moon move around the Sun?

-
- The Moon moves around the Sun and at the same time around the Earth.

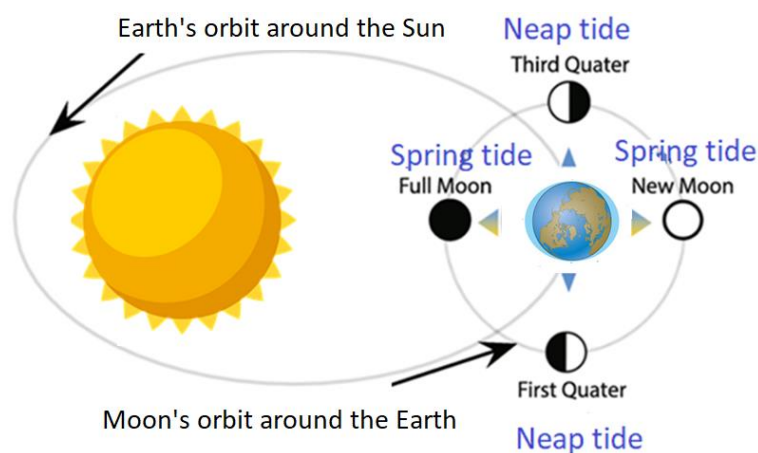
7. Explain if the Moon has a pull on the Earth.

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- The Moon also has its own gravity or pull on the Earth

TIDES

What are tides?

- (a) Tides are the regular rise and fall of large bodies of water, especially in seas and oceans.
- (b) Tides are caused by the gravitational pull between the Earth, the Moon, and the Sun.
- (c) All bodies of water experience gravitational forces that result in tides.
- (d) Tides are more noticeable in larger bodies of water.
- (e) Water moves as the Earth responds to gravitational pulls.
- (f) The Moon is 360 times closer to the Earth than the Sun and has a stronger gravitational pull.
- (g) Tides play an important role in maintaining shoreline ecosystems.
- (h) Tides affect marine ecosystems by determining which organisms can survive in and out of water and endure waves.
- (i) Most coastal areas experience two high tides and two low tides every lunar day (24 hours and 50 minutes), but at different times.
- (j) High tides occur 12 hours and 25 minutes apart.
- (k) A lunar day is the time it takes the Moon to rotate once on its axis, which is 24 hours and 50 minutes.
- (l) There are two types of tides: spring tides and neap tides.



Activity:

- A.** Fill a large clear container with water.
- B.** Add a small object (golf ball size) to one end.
- C.** Let the learners observe what happens as the weight pulls on the water and creates a “tidal bulge.”
- D.** Repeat the experiment with different weights to see how that impacts the size of the tidal bulge.

Answer the following questions:

1. What are tides?

-
- Tides are periodic rise and fall of large bodies of water especially in the seas and oceans.

2. What are the three factors that cause the formation of tides?

-
- The gravitational pull between the Earth, the Moon and the Sun.

3. Discuss if tides occur in all bodies of water.

-
- All bodies of water experience a force of gravity resulting in tides but the effect is more on large bodies of water.

4. What makes the water to move?

-
- The water moves as the Earth responds to the gravitational pulls.

5. Why are tides noticeable in large bodies of water?

-
- It is because the movement is massive or big compared to small bodies of water which may not even be observed.

6. How far is the Moon to the Earth when compared to the Sun?

-
- The Moon is 360 times closer to the Earth and it has a greater pull (force pulling) than that of the Sun.

7. Why is it expected that the Moon should have a greater pull on the Earth than the Sun?

-
- It is because it is 360 times closer to the Earth when compared to the Sun.

8. How often do tides occur in coastal areas?

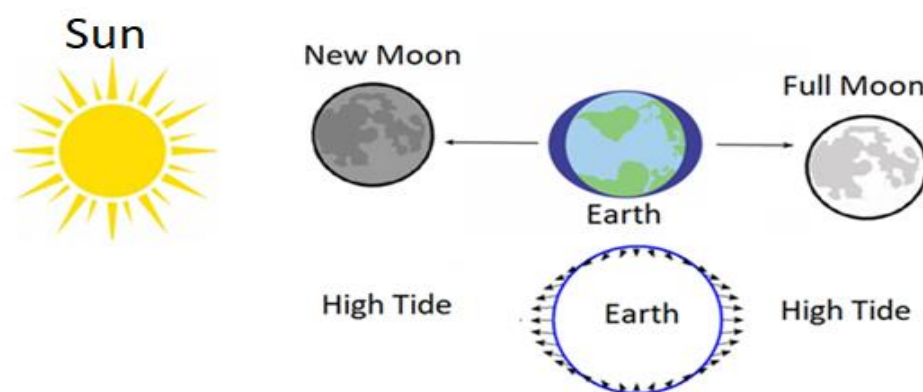
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- Most coastal areas, with a few exceptions, have two high tides and two low tides every lunar (moon) day every 24 hours 50 minutes but at different points.

9. What are the two types of tides?

-
- High and low tides

HIGH TIDES

- (a) A high tide is the rise of a body of water to its highest level.
- (b) The word “tide” comes from Latin meaning a “wave.”
- (c) When the Sun and the Moon are in a straight line spring tides (high tides) are formed.
- (d) High tides are known as **spring** tides because the water springs to a higher level than normal.
- (e) High tides are caused by the position of the Sun and Moon in relation to the Earth.
- (f) The Moon and the Sun are in straight line during full Moon and New Moon.
- (g) High tides are experienced twice a month which is during full and new Moons.



Answer the following questions:

1. What is a high tide?

-
- A high tide is the rise of a body of water to its highest level.

2. What is the origin of the word tide?

-
- The word “tide” comes from Latin meaning a “wave.”

3. What is another name for a high tide?

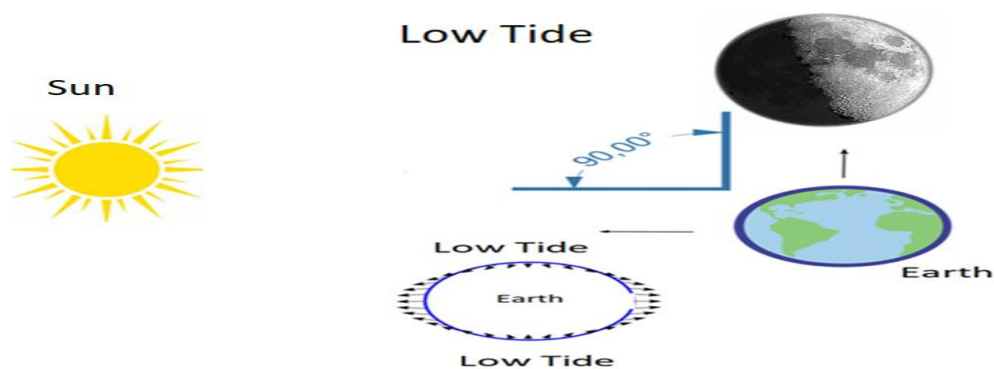
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- High tides are known as **spring**

4. Discuss what leads to the formation of a high tide?

-
- High tides are caused by the position of the Sun and Moon in relation to the Earth. This occurs when the Moon and the Sun are in straight line which is during full Moon and New Moons. New Moons and Full Moons are observed twice in a month.

LOW TIDES

1. Low tide occurs when the ocean's water level is at its lowest.
2. During low tide, the water is lower than usual.
3. Neap tides, which are weaker low tides, happen when the Moon and the Sun are at an angle to each other.
4. Low tides occur during quarter Moon phases.
5. During quarter Moons, the Sun and Moon are positioned at an angle of 90° relative to the Earth.
6. Low tides are good for fishing because the water is clearer, and fish swim closer to shore.
7. It's safer to swim when the currents are weakest, which is about an hour after high or low tide.
8. During this time, the water is calmer and less dangerous.
9. Rip currents, which appear darker and muddier, create dangerous swimming conditions.
10. You can spot rip currents more easily from a higher vantage point.



Answer the following questions:

1. What is a low tide?

- Low tide is when a tide is at its lowest level.

2. What happens during a low tide?

- During a low tide, water moves away from the shore away from you.

3. Discuss the position of the Moon and Sun during low tides.

-
- During low tides the Moon and the Sun are at an angle with each other,

4. During which phases of the Moon do we experience low tides?

-
- This occurs during the quarter phases.

5. Discuss why is it suitable to fish during low tides.

-
- Low tides are good for fishing since the water is clear and the fish swim closer to the shore.

6. Discuss when is it safer to swim in the sea and why?

-
- It is safer to swim when the currents are the weakest which happens an hour after a high or low tide.

7. How can we identify a reap tide?

-
- Reap tides are darker and muddy and can be observed when standing at a higher position.

Solar System Model:

Create a scale model of the solar system, emphasizing the relative sizes and distances of the Sun and Earth. This hands-on activity helps learners visualize the vastness of space.

Use a flashlight and a globe to demonstrate how Earth's rotation causes day and night. Shine the flashlight on the globe, and have learners observe how different parts of the Earth are in sunlight or darkness as it rotates.

Day and Night Demonstration

Use a flashlight and a globe to demonstrate how Earth's rotation causes day and night.

Shine the flashlight on the globe, and have learners observe how different parts of the Earth are in sunlight or darkness as it rotates.

Day and Night Demonstration

Use a flashlight and a globe to demonstrate how Earth's rotation causes day and night.

Shine the flashlight on the globe, and have learners observe how different parts of the Earth are in sunlight or darkness as it rotation.

Seasons Demonstration

Use a flashlight and a globe to demonstrate how Earth's rotation causes day and night.

Shine the flashlight on the globe, and have learners observe how different parts of the Earth are in sunlight or darkness as it rotation.

Solar Eclipse Simulation

Use a lamp and a smaller object (representing the Moon) to simulate a solar eclipse. Move the "Moon" between the lamp and the "Earth" to show how eclipses occur.