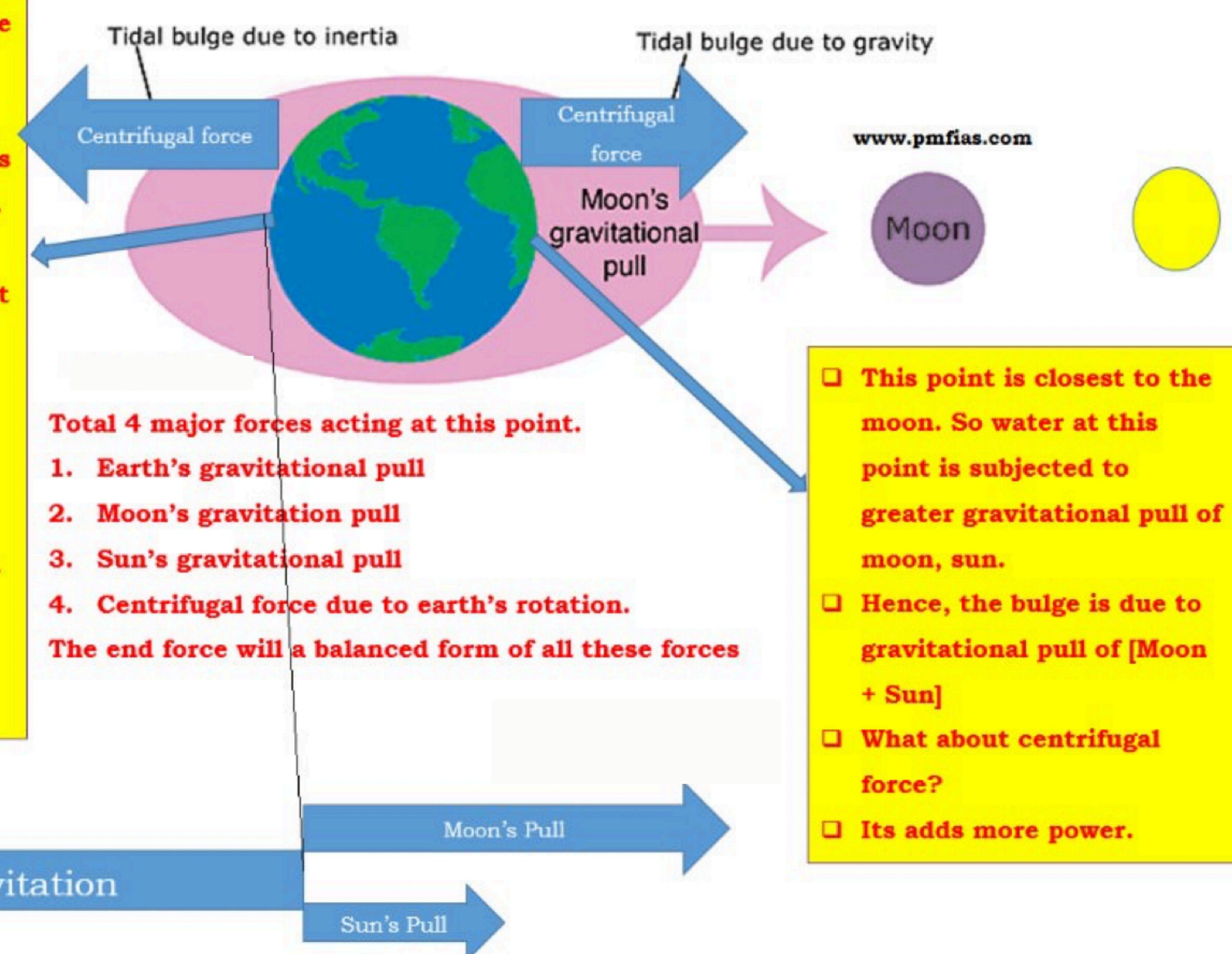


Tides and Eclipses

Tides

- The periodical rise and fall of the sea level, once or twice a day, mainly due to the attraction of the sun and the moon, is called a tide.
- Movement of water caused by meteorological effects (winds and atmospheric pressure changes) are called surges (storm surge during cyclones).
- The study of tides is very complex, spatially and temporally, as it has great variations in frequency, magnitude and height.
- The moon's gravitational pull to a great extent and to a lesser extent the sun's gravitational pull, are the major causes for the occurrence of tides.
- Another factor is centrifugal force which acts opposite to gravitational pull of earth.
- Tides occur due to a balance between all these forces.

- This point is farthest from the moon.
- So, the gravitational pull of moon and sun are least at this point due to greater distance.
- Hence, the resultant gravitational pull at this point is the least. www.pmfias.com
- Gravitational force counter balances centrifugal force.
- So, decreased resultant gravitational force strengthens centrifugal force.
- Hence, the bulge here is created due to increased centrifugal force



TIDES - TYPES

1) BASED ON FREQUENCY

- **SEMI DIURNAL** - The most common tidal pattern, featuring two high tides and two low tides each day. The successive high or low tides are approximately of the same height.
- **DIURNAL** - There is only one high tide and one low tide during each day. The successive high and low tides are approximately of the same height.
- **MIXED** - Tides having variations in height are known as mixed tides. These tides generally occur along the west coast of North America and on many islands of the Pacific Ocean.

2) BASED ON THE POSITION OF THE SUN, MOON AND EARTH

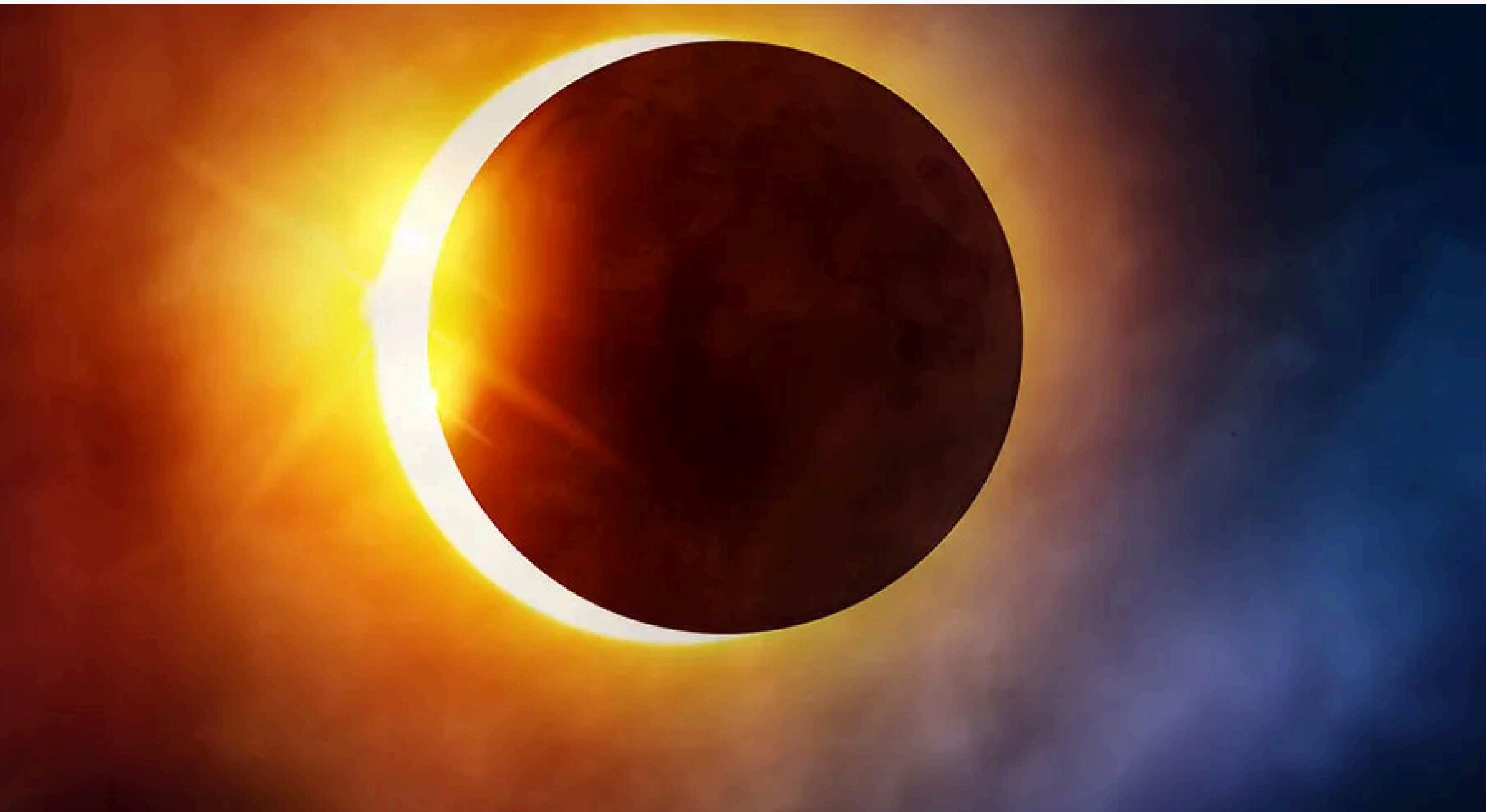
- Spring tides
- The position of both the sun and the moon in relation to the earth has direct bearing on tide height.
- When the sun, the moon and the earth are in a straight line, the height of the tide will be higher.
- These are called spring tides and they occur twice a month, one on full moon period and another during new moon period.
- Neap tides
- Normally, there is a seven day interval between the spring tides and neap tides.
- At this time the sun and moon are at right angles to each other and the forces of the sun and moon tend to counteract one another.
- The Moon's attraction, though more than twice as strong as the sun's, is diminished by the counteracting force of the sun's gravitational pull.
- Like spring tides, these tides also occur twice a month.

Importance of Tides:

- **Ecosystem Health:** Tides play a crucial role in maintaining the health of coastal ecosystems by influencing nutrient circulation, sediment transport, and habitat diversity.
- **Navigation and Transportation:** Tides are essential for safe navigation of ships, boats, and vessels in harbors, estuaries, and coastal areas. Understanding tidal patterns helps in planning routes and timing arrivals and departures.
- **Fishing and Aquaculture:** Tides affect the movement and behavior of marine life, influencing fishing patterns and aquaculture operations. Fishermen often target specific tidal conditions for optimal catches.
- **Coastal Engineering:** Engineers consider tidal effects when designing coastal infrastructure such as ports, jetties, and sea walls to ensure they can withstand tidal forces and protect against erosion and flooding.
- **Renewable Energy:** Tidal energy, harnessed from the rise and fall of tides, offers a renewable and predictable source of power. Tidal power plants contribute to sustainable energy production.

Importance of Tides:

- Recreation and Tourism: Tidal environments attract tourists for activities such as beachcombing, surfing, birdwatching, and tidepool exploration. Tidal variations create dynamic coastal landscapes that enhance recreational experiences.
- Climate Regulation: Tides contribute to ocean circulation, which plays a crucial role in regulating global climate patterns. Tidal mixing helps distribute heat and nutrients, influencing weather systems and climate stability.
- Erosion and Sedimentation: Tidal action contributes to coastal erosion and sedimentation processes, shaping shorelines, estuaries, and deltas. Understanding these processes is essential for coastal management and land-use planning.
- Biological Rhythms: Tidal cycles influence the behavior and reproductive patterns of marine organisms, including spawning, feeding, and migration. Many species synchronize their life cycles with tidal fluctuations.
- Cultural Significance: Tides hold cultural and spiritual significance in coastal communities worldwide, shaping traditions, folklore, and livelihoods. They are often central to cultural practices and ceremonies.

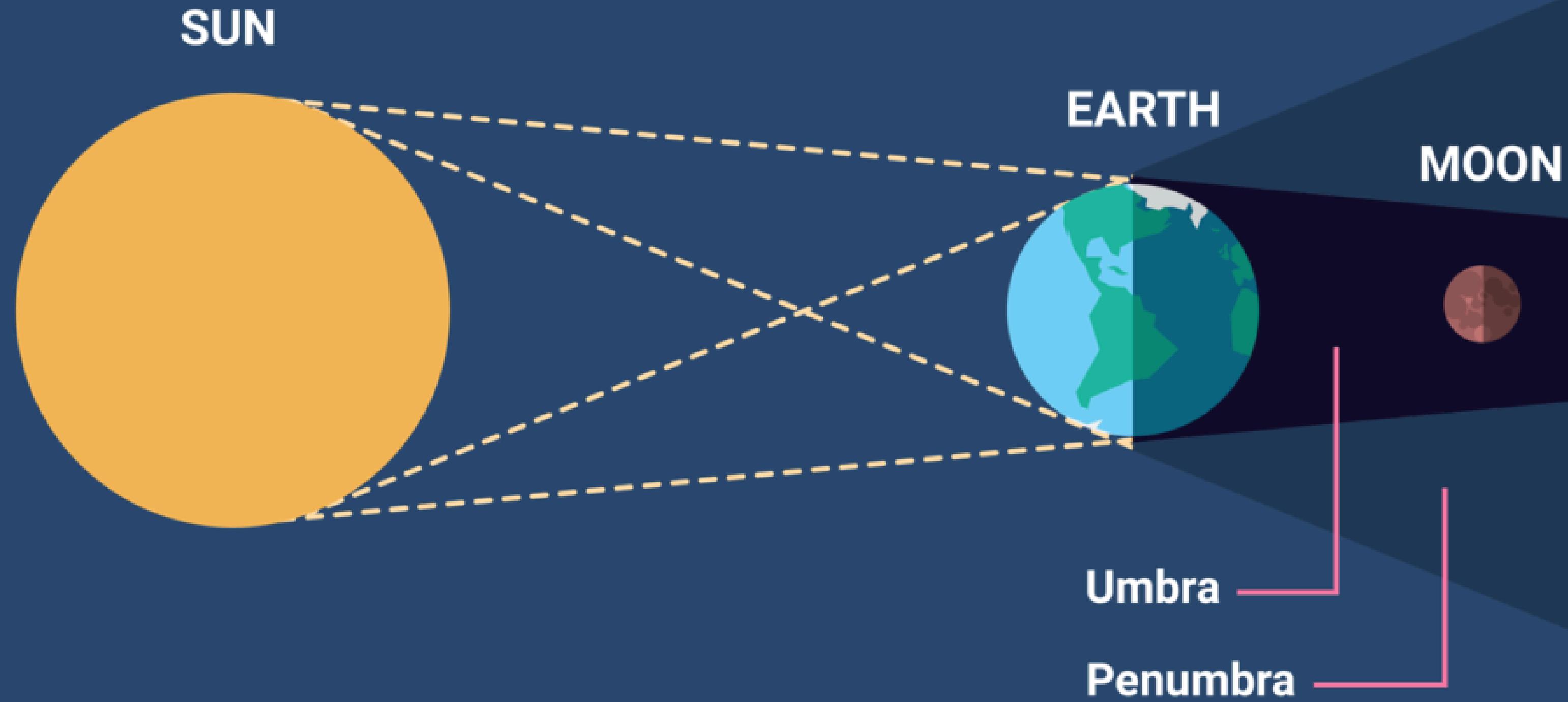


Eclipses

What is an Eclipse?

An eclipse occurs when one celestial body moves into the shadow of another celestial body, resulting in a temporary darkening or obscuring of the light from the obscured body. There are two main types of eclipses observed from Earth:

1. **Solar Eclipse**: This occurs when the Moon moves between the Earth and the Sun, blocking out the sunlight. It can result in partial or total darkness, depending on the observer's location relative to the path of totality. There are three types of solar eclipses: total, partial, and annular.
2. **Lunar Eclipse**: This occurs when the Earth moves between the Sun and the Moon, casting its shadow onto the lunar surface. Lunar eclipses can be either partial, where only part of the Moon is obscured, or total, where the entire Moon passes through the Earth's shadow and may appear red or copper-colored due to atmospheric scattering of sunlight.



Cause of Solar Eclipse

- A solar eclipse happens when the Moon passes between the Earth and the Sun.
- This blocks the Sun's light and casts a shadow on the Earth's surface.
- It occurs during a new moon when the Moon is directly between the Earth and the Sun.
- The Moon's shadow has two parts: the umbra (center) and the penumbra (outer).
- In the umbra, the Sun is completely blocked, causing a total solar eclipse.
- In the penumbra, the Sun is partially blocked, causing a partial solar eclipse.
- Total solar eclipses occur when the Moon's apparent size matches that of the Sun.
- Solar eclipses are rare events and can only be observed from specific regions on Earth where the alignment is perfect.

Cause of Lunar Eclipse

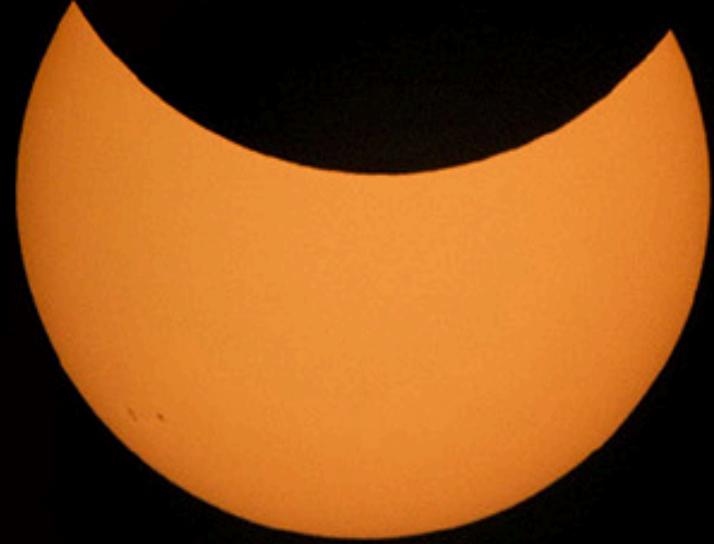
- A lunar eclipse occurs when the Earth passes between the Sun and the Moon.
- Earth's shadow falls on the Moon, blocking sunlight from reaching it.
- This happens only during a full moon when the Earth is positioned directly between the Sun and the Moon.
- Lunar eclipses occur because the Earth's shadow has two parts: the umbra (center) and the penumbra (outer).
- In the umbra, the Sun's light is completely blocked, causing a total lunar eclipse.
- In the penumbra, the Sun's light is partially blocked, causing a partial lunar eclipse.
- During a total lunar eclipse, the Moon may appear red or copper-colored due to light bending in Earth's atmosphere.
- Lunar eclipses are visible from anywhere on Earth where the Moon is above the horizon during the event.

Recap:

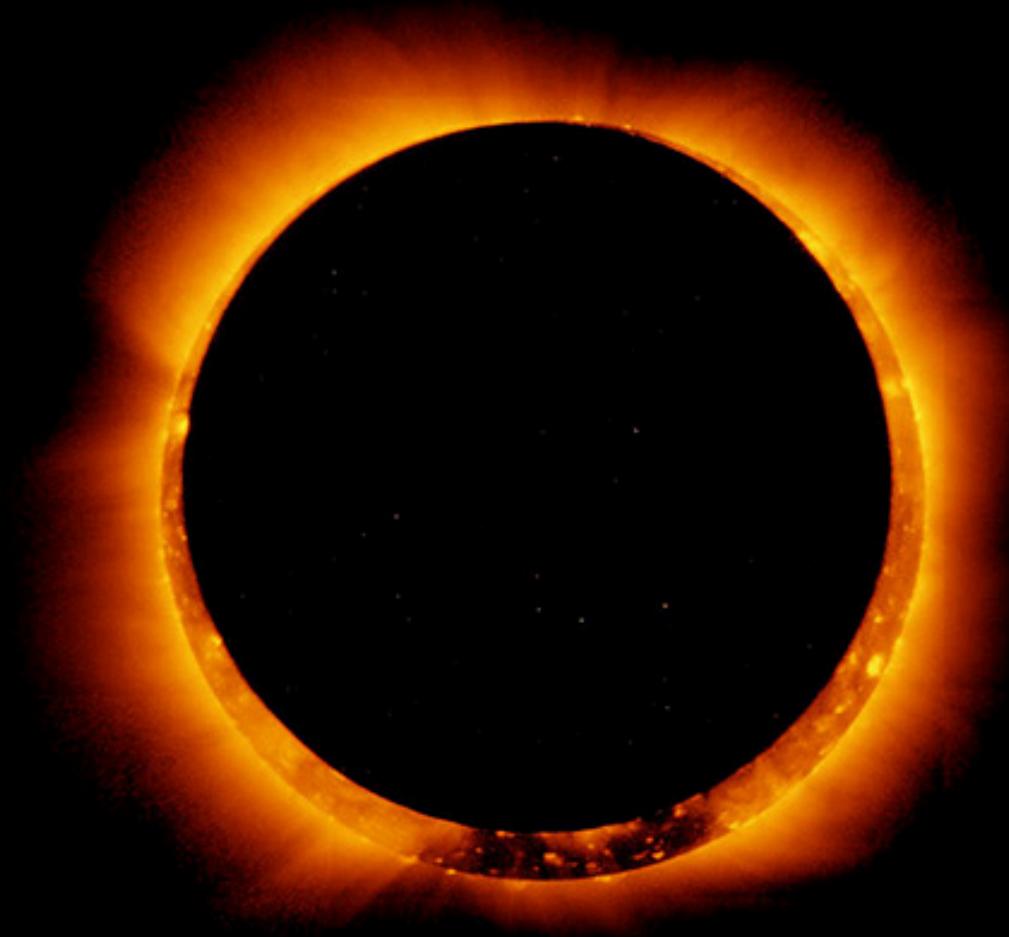
- **Solar Eclipse:** When the Moon passes between the Earth and the Sun, blocking sunlight and casting a shadow on the Earth. There are three types: total, partial, and annular.
- **Lunar Eclipse:** When the Earth passes between the Sun and the Moon, casting its shadow onto the lunar surface. There are two types: total and partial.
- **Umbra:** The darkest, central part of a shadow where the light source is completely obscured, such as during a total eclipse.
- **Penumbra:** The outer part of a shadow where the light source is only partially obscured, resulting in a partial eclipse.
- **Total Eclipse:** When the entire light source is blocked by the intervening object, resulting in complete darkness or totality.
- **Partial Eclipse:** When only part of the light source is blocked, resulting in partial darkness or partiality.
- **Annular Eclipse:** A type of solar eclipse where the Moon's apparent size is smaller than the Sun's, leaving a ring of sunlight visible around the Moon.

Recap:

- **Path of Totality:** The track or corridor across the Earth's surface where a total eclipse is visible.
- **Magnitude:** The fraction of the Sun's diameter covered by the Moon during an eclipse, expressed as a percentage.
- **Solar Corona:** The outer atmosphere of the Sun, visible during a total solar eclipse as a glowing halo around the Moon.



Partial Eclipse



Annular Eclipse



Total Eclipse

Test Yourself

1. What primarily causes the occurrence of tides on Earth?

- a) Gravitational attraction between the Earth and the Moon
- b) Gravitational attraction between the Earth and the Sun
- c) Earth's rotation on its axis
- d) Atmospheric pressure changes

2. How many high tides and low tides typically occur in a 24-hour period?

- a) One high tide and one low tide
- b) Two high tides and two low tides
- c) Three high tides and three low tides
- d) Four high tides and four low tides

Test Yourself

3. What is the difference between spring tides and neap tides?
- a) Spring tides occur in spring, while neap tides occur in autumn.
 - b) Spring tides have higher high tides and lower low tides, while neap tides have lower high tides and higher low tides.
 - c) Spring tides occur during the day, while neap tides occur at night.
 - d) Spring tides occur when the Moon is full or new, while neap tides occur when the Moon is at first or last quarter.
4. What type of tide occurs when the Sun, Moon, and Earth are aligned, causing the highest high tides and lowest low tides?
- a) Neap tide
 - b) Ebb tide
 - c) Flood tide
 - d) Spring tide

Test Yourself

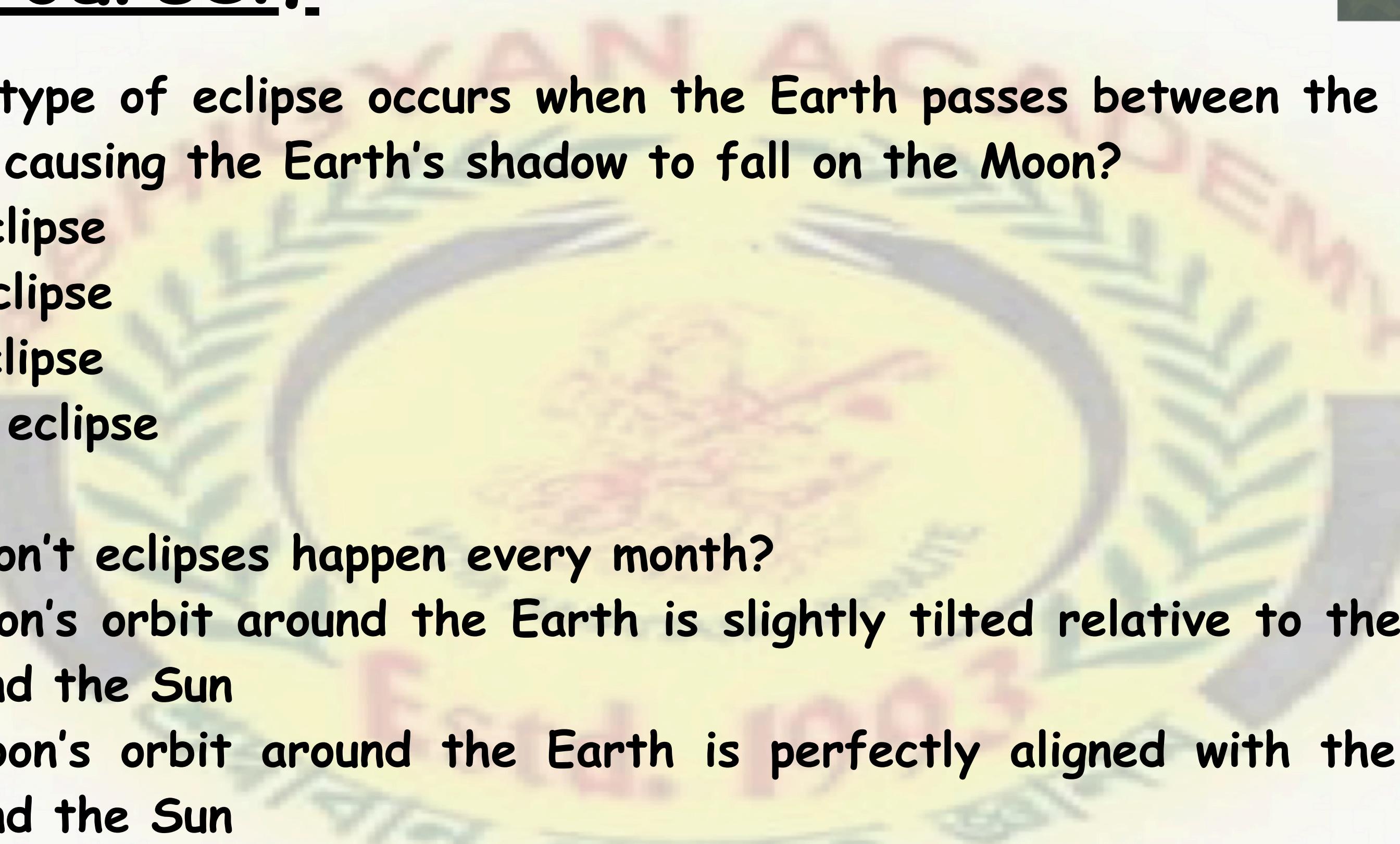
1. What causes a solar eclipse?

 - a) The Moon passing between the Earth and the Sun, blocking sunlight
 - b) The Earth passing between the Moon and the Sun, casting a shadow on the Moon
 - c) The Sun passing between the Earth and the Moon, casting a shadow on the Earth
 - d) The alignment of the Earth, Moon, and Sun in a straight line

2. During a total solar eclipse, what is visible from Earth?

 - a) The entire Sun is obscured by the Moon's shadow
 - b) A ring of sunlight around the edges of the Moon
 - c) A partial darkening of the Sun's disk
 - d) The Moon appearing as a dark disk against the Sun's surface

Test Yourself

- 
3. What type of eclipse occurs when the Earth passes between the Sun and the Moon, causing the Earth's shadow to fall on the Moon?
- a) Solar eclipse
 - b) Lunar eclipse
 - c) Total eclipse
 - d) Annular eclipse
4. Why don't eclipses happen every month?
- a) The Moon's orbit around the Earth is slightly tilted relative to the Earth's orbit around the Sun
 - b) The Moon's orbit around the Earth is perfectly aligned with the Earth's orbit around the Sun
 - c) Eclipses only occur during certain times of the year
 - d) The Sun's brightness prevents the occurrence of eclipses