

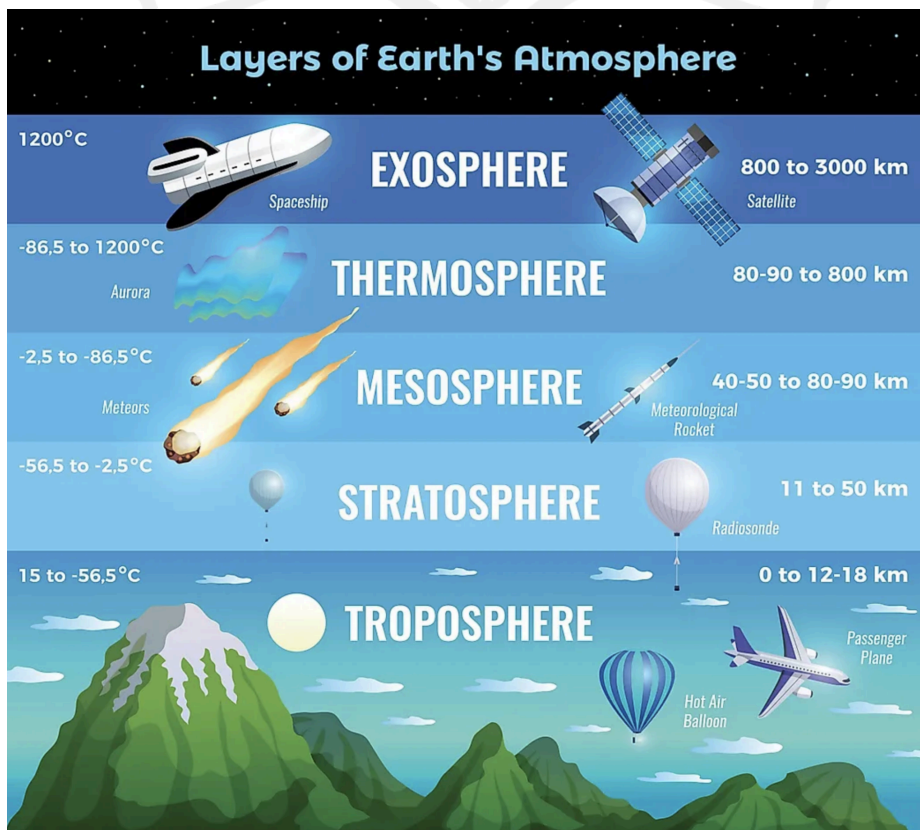
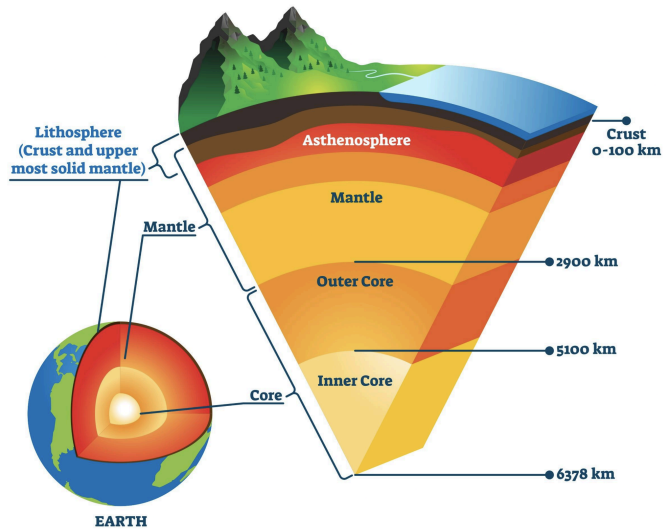
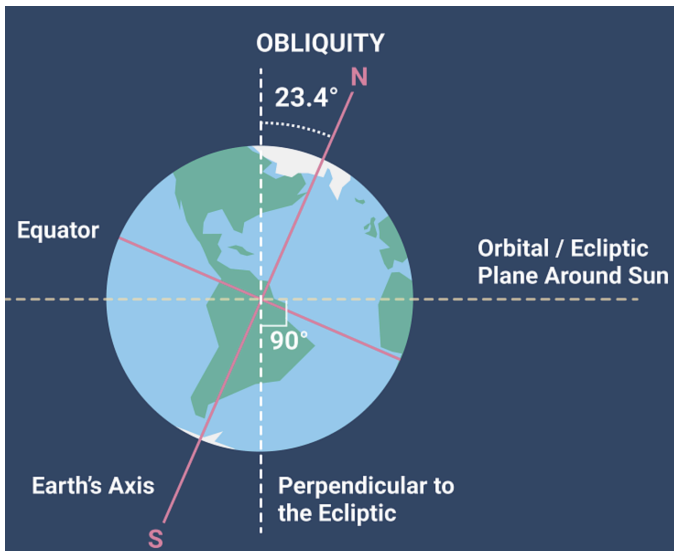
Chapter 9: Shape of Earth & Gravitation

Earth is the third planet from the Sun in our solar system. It is the only known planet to support life, with a diverse range of environments including oceans, mountains, forests, and deserts.

Structure: Earth has several layers:

- **Crust:** The outermost layer where we live, consisting of land and ocean floors.
- **Mantle:** The layer beneath the crust, composed of semi-solid rock that moves slowly.
- **Core:** The innermost layer, made up of a solid inner core and a liquid outer core, primarily composed of iron and nickel.

Earth's atmosphere is a layer of gases surrounding the planet, including oxygen and nitrogen, which is essential for life.



Round Shape of the Earth

Explanation of Earth's Shape:

- **Oblate Spheroid:** Earth is not a perfect sphere but an oblate spheroid. This means it is slightly flattened at the poles and bulging at the equator. The equatorial diameter is slightly larger than the polar diameter.
- **Reasons for Shape:** The flattening at the poles and bulging at the equator is due to the Earth's rotation. As Earth spins, the centrifugal force pushes outward at the equator, causing it to bulge.

Importance of Earth's Shape:

- **Impact on Gravity:** Gravity is slightly weaker at the equator compared to the poles due to the centrifugal force from Earth's rotation. This affects how objects weigh slightly less at the equator.
- **Climate:** The shape of Earth influences climate patterns. The equatorial bulge affects the distribution of sunlight and thus climate zones around the world.
- **Day/Night Cycle:** The shape and rotation of Earth are crucial in determining the length of day and night and the cycle of seasons.

Evidence of Earth's Shape

Ship's Hull Disappearance:

- **Observation:** When a ship moves away from shore, the hull (bottom part) disappears from view before the mast (top part). This happens because the Earth's surface curves downward, so the bottom of the ship is obscured by the curve of the Earth.
- **Significance:** This observation supports the idea that Earth is round, as it would not occur on a flat surface.

Circumnavigation:

- **Definition:** Travelling around the world in a continuous path.
- **Example:** Ferdinand Magellan's expedition (1519-1522) was the first known successful circumnavigation of the Earth. This voyage demonstrated that Earth is round because they returned to their starting point after travelling continuously westward.

Gravitation

Gravitation is a natural force that attracts objects towards the centre of the Earth (or any other massive body). It is the force that keeps us and everything else on the ground, and it affects all objects with mass.

Importance of Gravity:

- **Keeping Objects Grounded:** Gravity pulls objects toward the Earth's centre, which is why we don't float off the ground. It keeps us, water, and other objects anchored to the surface.
- **Everyday Effects:** Without gravity, there would be no atmosphere, water wouldn't stay in oceans or rivers, and everyday activities like walking or dropping objects wouldn't occur as we know them.

Pull Towards the Center:

- **Explanation:** Gravity pulls everything towards the centre of the Earth because Earth is a massive object. This force is due to Earth's mass and is what causes objects to fall when dropped.
- **Gravity's Consistency:** Gravity acts uniformly on Earth's surface, pulling objects towards the centre. However, the force of gravity can feel different depending on your altitude (height above sea level). For example, gravity is slightly weaker at higher altitudes compared to sea level because you are further from Earth's centre.

Effects of Gravitation

Weight:

- **Definition of Weight:** Weight is the force exerted by gravity on an object. It depends on both the mass of the object and the strength of the gravitational pull.
- **Example:** An object will weigh less on the Moon than on Earth because the Moon's gravitational pull is weaker. Weight changes with the strength of gravity, which varies with altitude.

Tides:

- **Explanation of Tides:** The gravitational pull of the Moon (and to a lesser extent, the Sun) causes the rise and fall of ocean tides. This is because the Moon's gravity pulls on Earth's oceans, creating bulges (high tides) on the side closest to and farthest from the Moon.
- **Impact on Oceans:** Tides affect coastal ecosystems, navigation, and marine life.

Free Fall:

- **Definition:** Free fall occurs when an object is falling under the influence of gravity alone, with no other forces (like air resistance) acting on it.
- **Demonstration:** When you drop an object, it accelerates towards the ground due to gravity. In a vacuum (where there is no air resistance), all objects fall at the same rate, regardless of their mass. This demonstrates the universal effect of gravity on all objects.

Satellites & Orbit

A satellite is any object that orbits around a planet or other celestial body.

- **Natural Satellites:** These are celestial bodies that naturally orbit planets, such as the Moon, which orbits Earth.
- **Artificial Satellites:** Man-made objects launched into space to orbit Earth or other celestial bodies. Examples include communication satellites, weather satellites, and GPS satellites.

Orbits and Gravity

- **Explanation of Orbits:** An orbit is the curved path that an object follows as it revolves around another object in space. Satellites orbit Earth in various paths, including circular and elliptical orbits.
- **Role of Gravity:** Gravity is the force that keeps satellites in orbit. It pulls the satellite toward Earth, while the satellite's forward motion keeps it from falling straight down. This balance creates a stable orbit around the planet.

Uses of Artificial Satellites

- **Communication:** Satellites enable global communication by transmitting television, radio, and internet signals. They help in making phone calls and sending data across the world.
- **Weather Forecasting:** Weather satellites monitor weather patterns, track storms, and provide data for accurate weather forecasting. They help in predicting hurricanes, rain, and other weather phenomena.
- **Navigation (GPS):** Global Positioning System (GPS) satellites provide location information for navigation. They help people find directions, track vehicles, and assist in various location-based services.
- **Earth Observation:** Satellites capture images and data of Earth's surface, including land use, natural disasters, and environmental changes. This information is crucial for scientific research, environmental monitoring, and disaster management.

Q1. Which of the following best describes the Earth's shape?

- a) Perfectly round
- b) Slightly oblate spheroid
- c) Completely flat
- d) Cuboidal

Q2. What causes the Earth to have a slightly flattened shape at the poles?

- a) Gravitational pull
- b) Rotation on its axis
- c) Earth's magnetic field
- d) Atmospheric pressure

Q3. Who was the first explorer to circumnavigate (sail around) the Earth?

- a) Ferdinand Magellan
- b) Christopher Columbus
- c) Vasco da Gama
- d) Marco Polo

Q4. Which imaginary line divides the Earth into the Northern and Southern Hemispheres?

- a) Equator
- b) Tropic of Cancer
- c) Prime Meridian
- d) Arctic Circle

Q5. What is the name of the line perpendicular to the Equator that divides the Earth into Eastern and Western Hemispheres?

- a) Tropic of Capricorn
- b) Prime Meridian
- c) International Date Line
- d) Greenwich Meridian

Q6. What is the Lehmann Discontinuity associated with?

- a) Separation of the lithosphere and asthenosphere
- b) Boundary between the Earth's crust and mantle
- c) Transition between the outer core and inner core
- d) Separation of the upper and lower mantle

Q7. What is the approximate circumference of the Earth at the Equator?

- a) 20,000 miles (32,000 kilometres)
- b) 24,901 miles (40,075 kilometres)
- c) 15,000 miles (24,140 kilometres)
- d) 30,000 miles (48,280 kilometres)

Q8. Which layer of the Earth is the thinnest?

- a) Crust
- b) Mantle
- c) Outer core
- d) Inner core

Q9. Which layer of the Earth is primarily composed of solid iron and nickel?

- a) Crust
- b) Mantle
- c) Outer core
- d) Inner core

Q10. Which layer of the Earth is subdivided into the lithosphere and asthenosphere?

- a) Crust
- b) Mantle

- c) Outer core
- d) Inner core

Q11. The tectonic plates are found in which layer of the Earth?

- a) Crust
- b) Mantle
- c) Outer core
- d) Inner core

Q12. Which layer of the Earth is responsible for generating the magnetic field?

- a) Crust
- b) Mantle
- c) Outer core
- d) Inner core

Q13. What is the main composition of the Earth's crust?

- a) Iron and nickel
- b) Silicates and oxides
- c) Liquid iron
- d) Solid gold

Q14. Which layer of the Earth is the hottest?

- a) Crust
- b) Mantle
- c) Outer core
- d) Inner core

Q15. The movement of molten metal in the outer core causes which phenomenon?

- a) Earthquakes
- b) Volcanic eruptions
- c) Magnetic field generation
- d) Formation of mountains

Q16. What is the thickness of the Earth's mantle compared to the crust?

- a) Thinner than the crust
- b) About the same as the crust
- c) Thicker than the crust
- d) Nonexistent

Q17. Which layer of the Earth is where we live and where landforms exist?

- a) Crust
- b) Mantle
- c) Outer core
- d) Inner core

Q18. What percentage of the Earth's surface is covered by water?

- a) 50%
- b) 60%
- c) 70%
- d) 80%

Q19. Which component of the Earth consists of all the water found on or around the planet?

- a) Atmosphere
- b) Biosphere
- c) Hydrosphere
- d) Lithosphere

Q20. Which layer of the Earth contains various gases essential for supporting life?

- a) Lithosphere
- b) Biosphere
- c) Hydrosphere
- d) Atmosphere

Q21. What force keeps the planets in orbit around the Sun?

- a) Magnetism
- b) Gravitational force
- c) Centrifugal force
- d) Electrostatic force

Q22. The layer of gases surrounding the Earth is primarily composed of which elements?

- a) Oxygen and nitrogen
- b) Carbon dioxide and methane
- c) Helium and hydrogen
- d) Argon and neon

Q23. Which component of the Earth includes oceans, rivers, lakes, and other bodies of water?

- a) Atmosphere
- b) Biosphere
- c) Hydrosphere
- d) Lithosphere

Q24. Which layer of the Earth contains various minerals and rocks that form the Earth's crust and upper mantle?

- a) Lithosphere
- b) Biosphere
- c) Hydrosphere
- d) Atmosphere

Q25. Which component of the Earth involves the interaction between living organisms and their environments?

- a) Lithosphere
- b) Biosphere
- c) Hydrosphere
- d) Atmosphere

Q26. What is the force that pulls objects towards the centre of the Earth called?

- a) Friction
- b) Magnetism
- c) Gravity
- d) Elasticity

Q27. What determines the strength of the gravitational force between two objects?

- a) The mass of the objects and the distance between them
- b) The colour of the objects
- c) The temperature of the objects
- d) The speed of the objects

Q28. What happens to the force of gravity between two objects if the distance between them increases?

- a) Increases
- b) Decreases

- c) Remains the same
- d) Becomes unpredictable

Q29. What unit is used to measure gravitational force?

- a) Joule
- b) Newton
- c) Watt
- d) Volt

Q30. Which boundary separates the Earth's crust from the underlying mantle?

- a) Convergent boundary
- b) Divergent boundary
- c) Mohorovičić discontinuity (Moho)
- d) Gutenberg Discontinuity

Q31. Who formulated the law of universal gravitation?

- a) Isaac Newton
- b) Albert Einstein
- c) Galileo Galilei
- d) Johannes Kepler

Q32. Which of the following objects will experience the strongest gravitational pull towards the Earth?

- a) A feather
- b) A book
- c) A coin
- d) They all experience the same pull

Q33. Why do astronauts float in space instead of falling to the ground?

- a) There is no gravity in space
- b) The gravitational force in space is weaker
- c) They are in constant free fall
- d) They wear special suits

Q34. At which point on the Earth's surface is the gravitational pull the strongest?

- a) At the equator
- b) At the poles
- c) At sea level
- d) At higher altitudes

Q35. What happens to an object's weight if it is taken to the Moon?

- a) Increases
- b) Decreases
- c) Remains the same
- d) Becomes zero

Answers

Q1. b	Q2. b	Q3. a	Q4. a	Q5. b
Q6. c	Q7. b	Q8. a	Q9. d	Q10. b
Q11. a	Q12. c	Q13. b	Q14. d	Q15. c
Q16. c	Q17. a	Q18. c	Q19. c	Q20. d
Q21. b	Q22. a	Q23. c	Q24. a	Q25. B
Q26. c	Q27. a	Q28. b	Q29. b	Q30. c
Q31. a	Q32. d	Q33. a	Q34. b	Q35. b

