Chapter-10

GRAVITATION

Sub-Topic Name: Universal Law of Gravitation, Free Fall, Acceleration Due to Gravity (g), Difference between G and g, Mass and Weight, Weight of an Object on the Surface of Moon.

Multiple Choice Question [MCQS]

1. A body of mass 1kg is attracted by the earth with a force which is equal to
   a. 9.8 N
   b. 6.67×10^{11}
   c. 1 N
   d. 9.8 m/s
2. What is the gravitational force between two objects?
   a. attractive at large distances only
   b. attractive at small distances only
   c. attractive at all distances
   d. attractive at large distances but repulsive at small distances
3. The value of 'g'
   a. Increases as we go above the earth's surface
   b. Decreases as we go to the centre of the earth
   c. Remains constant
   d. Is more at equator and less at poles
4. The ball is thrown up, the value of 'g' will be
   a. Zero
   b. positive
   c. negative
   d. negligible

5. The gravitational force causes
   a. Tides
   b. Motion of moon
   c. None of them
   d. Both a and b

Very Short Answer Type Questions

1. State the significance of universal law of gravitation.
2. The value of gravitational constant G on earth is 6.67×10^{-11} Nm^2/kg^2 .What is its value on the surface of moon?
3. Two objects of masses m_1 and m_2 are dropped in vacuum from a height above the surface of earth (m_1 is greater than m_2). Which one will reach the ground first and why?
4. Suppose gravity of earth suddenly becomes zero, then which direction will the moon begin to move if no other celestial body affects it?
5. State the name and type of force which is responsible for holding the solar system together.
6. The factors associated with the motion of an object are: Force, Velocity, Acceleration and Momentum. Out of these four factors which one remains constant for all bodies large or small undergoing a free fall?
7. Which force is responsible for acceleration of a body in free fall?
8. What will be the acceleration of free fall?
9. A cricket ball thrown vertically upwards, reaches a maximum height of 5 meters. Find the initial speed of the ball. ($g=9.8$ m/s^2)
10. What will be the mass of a body at the center of the earth as compared to other places on the earth?

Short Answer Type Questions
1. A stone and the earth attract each other with an equal and opposite force. Why then we see only the stone falling towards the earth but not the earth rising towards the stone?
2. Give reasons:
(a) Moon does not have atmosphere
(b) If you jump on the moon, you will rise much higher than if you jump on the earth.

3. The mass of sun is 2×10^{30} kg and the mass of earth is 6×10^{24} kg. if the average distance between the sun and the earth be 1.5×10^8 km calculate the force of gravitation between them. (Take G = 6.7×10^{-11} Nm^2/kg^2)

4. Your mass on earth is 50 kg. Planet m has two times force of gravity of that on earth. What will be your mass and weight on planet m?

5. All the planets are moving in circular orbits. What provides the necessary force for this motion and what is the direction of this force? Write the name of this force. What will happen if this force disappears suddenly?

Long Answer Type Questions

1. (a) Differentiate between acceleration due to gravity and universal gravitational constant. Derive a relation between 'g' and 'G'.

(b) State universal law of Gravitation.

2. A planet has mass five times of earth and radius three times that of earth. Calculate its acceleration due to gravity, if the value of 'g' on earth is 10 ms^{-2}.

3. Derive the formula for the gravitational force using the factors on which it depends.