Chapter 10

GRAVITATION

Multiple Choice Questions

1. Two objects of different masses falling freely near the surface of moon would
(a) have same velocities at any instant
(b) have different accelerations
(c) experience forces of same magnitude
(d) undergo a change in their inertia

2. The value of acceleration due to gravity
(a) is same on equator and poles
(b) is least on poles
(c) is least on equator
(d) increases from pole to equator

3. The gravitational force between two objects is F. If masses of both objects are halved without changing distance between them, then the gravitational force would become
(a) $F/4$ (b) $F/2$ (c) F (d) $2F$

4. A boy is whirling a stone tied with a string in an horizontal circular path. If the string breaks, the stone
(a) will continue to move in the circular path
(b) will move along a straight line towards the centre of the circular path
(c) will move along a straight line tangential to the circular path
(d) will move along a straight line perpendicular to the circular path away from the boy

5. An object is put one by one in three liquids having different densities. The object floats with $\frac{1}{9}, \frac{2}{11}$ and $\frac{3}{7}$ parts of their volumes outside the liquid surface in liquids of densities d_1, d_2 and d_3 respectively. Which of the following statement is correct?
(a) $d_1 > d_2 > d_3$
(b) $d_1 > d_2 < d_3$
(c) $d_1 < d_2 > d_3$
(d) $d_1 < d_2 < d_3$

6. In the relation $F = G\,M\,m/d^2$, the quantity G
   (a) depends on the value of g at the place of observation
   (b) is used only when the earth is one of the two masses
   (c) is greatest at the surface of the earth
   (d) is universal constant of nature

7. Law of gravitation gives the gravitational force between
   (a) the earth and a point mass only
   (b) the earth and Sun only
   (c) any two bodies having some mass
   (d) two charged bodies only

8. The value of quantity G in the law of gravitation
   (a) depends on mass of earth only
   (b) depends on radius of earth only
   (c) depends on both mass and radius of earth
   (d) is independent of mass and radius of the earth

9. Two particles are placed at some distance. If the mass of each of the two particles is doubled, keeping the distance between them unchanged, the value of gravitational force between them will be

   (a) $\frac{1}{4}$ times (b) 4 times (c) $\frac{1}{2}$ times (d) unchanged

10. The atmosphere is held to the earth by
   (a) gravity
   (b) wind
   (c) clouds
   (d) earth's magnetic field

11. The force of attraction between two unit point masses separated by a unit distance is called
   (a) gravitational potential
   (b) acceleration due to gravity
   (c) gravitational field
   (d) universal gravitational constant

12. The weight of an object at the centre of the earth of radius R is
   (a) zero
   (b) infinite
   (c) R times the weight at the surface of the earth
   (d) $1/R^2$ times the weight at surface of the earth

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13. An object weighs 10 N in air. When immersed fully in water, it weighs only 8 N. The weight of the liquid displaced by the object will be

(a) 2 N

(b) 8 N

(c) 10 N

(d) 12 N

14. A girl stands on a box having 60 cm length, 40 cm breadth and 20 cm width in three ways. In which of the following cases, pressure exerted by the brick will be

(a) maximum when length and breadth form the base

(b) maximum when breadth and width form the base

(c) maximum when width and length form the base

(d) the same in all the above three cases

15. An apple falls from a tree because of gravitational attraction between the earth and apple. If F_1 is the magnitude of force exerted by the earth on the apple and F_2 is the magnitude of force exerted by apple on earth, then

(a) F_1 is very much greater than F_2

(b) F_2 is very much greater than F_1

(c) F_1 is only a little greater than F_2

(d) F_1 and F_2 are equal

Short Answer Questions

16. What is the source of centripetal force that a planet requires to revolve around the Sun? On what factors does that force depend?

17. On the earth, a stone is thrown from a height in a direction parallel to the earth's surface while another stone is simultaneously dropped from the same height. Which stone would reach the ground first and why?

18. Suppose gravity of earth suddenly becomes zero, then in which direction will the moon begin to move if no other celestial body affects it?

19. Identical packets are dropped from two aeroplanes, one above the equator and the other above the north pole, both at height h. Assuming all conditions are identical, will those packets take same time to reach the surface of earth. Justify your answer.

20. The weight of any person on the moon is about 1/6 times that on the earth. He can lift a mass of 15 kg on the earth. What will be the maximum mass, which can be lifted by the same force applied by the person on the moon?

21. Calculate the average density of the earth in terms of g, G and R.

22. The earth is acted upon by gravitation of Sun, even though it does not fall into the Sun. Why?

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Long Answer Questions

23. How does the weight of an object vary with respect to mass and radius of the earth. In a hypothetical case, if the diameter of the earth becomes half of its present value and its mass becomes four times of its present value, then how would the weight of any object on the surface of the earth be affected?

24. How does the force of attraction between the two bodies depend upon their masses and distance between them? A student thought that two bricks tied together would fall faster than a single one under the action of gravity. Do you agree with his hypothesis or not? Comment.

25. Two objects of masses m_1 and m_2 having the same size are dropped simultaneously from heights h_1 and h_2 respectively. Find out the ratio of time they would take in reaching the ground. Will this ratio remain the same if (i) one of the objects is hollow and the other one is solid and (ii) both of them are hollow, size remaining the same in each case. Give reason.

26. (a) A cube of side 5 cm is immersed in water and then in saturated salt solution. In which case will it experience a greater buoyant force. If each side of the cube is reduced to 4 cm and then immersed in water, what will be the effect on the buoyant force experienced by the cube as compared to the first case for water. Give reason for each case.

(b) A ball weighing 4 kg of density 4000 kg m^{-3} is completely immersed in water of density 10^3 kg m^{-3} Find the force of buoyancy on it. (Given $g = 10$ m s^{-2}.)

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