GRAVITATION

1. If the earth shrinks in its radius by 6% mass remaining constant, the value of *'g'* on its surface will :

   a) decrease b) increase c) remains the same d) reduced to zero

2. The weight of the body at earth's surface is W. At a depth half way to the centre of earth its weight will be (Density of earth is uniform):

   a) W b) $\frac{W}{2}$ c) $\frac{W}{4}$ d) $\frac{W}{8}$

3. A satellite is moving in a circular orbit around the earth. If gravitational pull suddenly disappears, then it:

   a) continues to move with same speed along the same path

   b) moves with same velocity tangential to original orbit

   c) falls down with increasing velocity
   d) none of these.

4. If the gravitational force is assumed to vary as the nth power of the distance, then the time period of a planet round the sun will be proportional to :

   a) Rn b) R – n c) $R^{\frac{n+1}{2}}$ d) $(R)^{\frac{n-1}{2}}$

5. The earth retain its atmosphere because :

   a) the earth is a sphere. b) the earth has population.

   c) the velocity of escape is less than the mean velocity of its molecules.

   d) The velocity of escape is more than the mean speed of molecules.

6. Two satellites of masses m_1 and m_2 $(m_1 > m_2)$ are revolving around the earth in circular orbits of radius r_1 and r_2 $(r_1 > r_2)$ respectively, which of the following is true regarding their speeds V_1 and V_2 ?

   a) $V_1 = V_2$ b) $V_1 < V_2$ c) $V_1 > V_2$ d) $\frac{V_1}{r_1} = \frac{V_2}{r_2}$

7. If the earth suddenly stops rotating about its axis the value of g at the equator will:

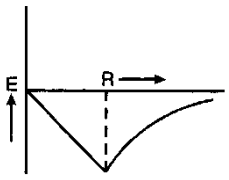
   a) remains same b) decrease by ω^2 R factor

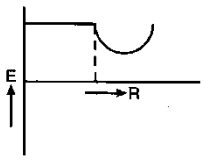
   c) Increase by ω^2 R factor d) Increase by ω R factor

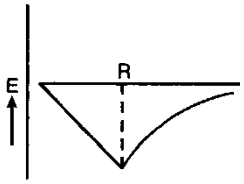
8. If radius of earth is reduced by 1%, the escape velocity will (If mass of earth remains same):

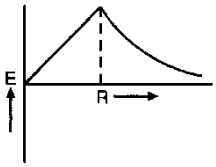
a) increase by 0-5% b) decrease by 11% c) no change d) decrease by 5%.

9. The variation of gravitational field intensity (E) due to the earth is represented by curve in Fig. (R is radius of earth):

a) 

b) 

c) 

d) 

10. A satellite is moving round the earth. In order to make it move to infinity, its velocity must be increased by :

a) 82.8% b) 41.4% c) 20.7%

d) It is not possible to do so.

11. A light planet is revolving around a very massive star in a circular orbit of radius R with a period of revolution T, if the gravitational force of attraction between the two varies as $R^{-5/2}$, then T^2 is proportional to :

a) R^3 b) $R^{\frac{7}{2}}$ c) $R^{\frac{3}{2}}$ d) $R^{\frac{5}{2}}$

12. Infinite number of masses each of 3.0 kg are placed along x-axis at distance 1 m, 2 m, 4 m, 8 m …. From the origin O, on the axis, if G is the gravitational constant. The magnitude of gravitational field is :

a) G b) 2G c) 3G d) 4G

13. The orbital velocity of a satellite in a circular orbit just above the earth's surface is v_0. The orbital velocity for a satellite orbiting in a circular orbit at an altitude of half of the earth's radius is :

a) $\sqrt{\frac{3}{2}}v_0$ b) $\sqrt{\frac{2}{3}}v_0$ c) $\frac{2}{3}v_0$ d) $\left(\frac{2}{3}\right)v_0$

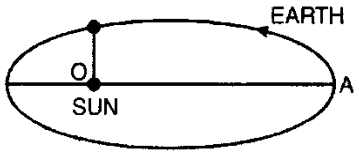
14. A body is thrown up with a velocity 10% more than the escape velocity v_e. When the body escapes the gravitational pull of the earth the velocity still left in the body is :

a) $0.1\,v_e$ b) $0.229 v_e$ c) $0.458\,v_e$ d) 0-20 v_e.

15. A planet has twice the density of earth but the acceleration due to gravity on the surface is same as on the surface of earth. Its radius in terms of the radius R of earth is :

a) $\frac{R}{64}$ b) $\frac{R}{8}$ c) $\frac{R}{4}$ d) $\frac{R}{2}$

16. The earth moves around the sun in an elliptical orbit as shown in fig. The ratio of $\frac{OA}{OB} = K$. The ratio of the speed of the earth at B and at A is nearly :



a) $\sqrt{K}$ b) K c) K^2 d) $K^{\frac{3}{2}}$

17. The ratio of the acceleration due to gravity on two planets P_1 and P_2 is k_1. The ratio of their respective radii is k_2. The ratio of their respective escape velocities is :

a) $\sqrt{\frac{k_2}{k_1}}$ b) $\sqrt{2k_1k_2}$ c) $\sqrt{k_1k_2}$ d) $\sqrt{\frac{k_1}{k_2}}$

18. A man weighs W on the surface of earth. What is his weight at a height equal to R ?

a)W b) $\frac{W}{2}$ c) $\frac{W}{4}$ d) $\frac{W}{8}$

19. Masses of 200 g and 800 g are 12 cm apart. At which point from the 200 g mass, the intensity of the gravitational field due to the two masses would be zero ?

a) 8 cm b) 6 cm c) 4 cm d) *2* cm

20. A satellite revolves round the sun in an elliptical orbit of minor axis 'a' and major axis *'b'* respectively. Then the square of time period T^2 is proportional to :

a) a^3 b) b^3 c) $\left(\frac{a-b}{2}\right)^3$ d) $\left(\frac{a+b}{2}\right)^3$

21. Energy required to move a body of mass *m* from an orbital of radius 2R to 3R is (where M = mass or earth, R = radius of earth)

a) $\frac{GMm}{12R^2}$ b) $\frac{GMm}{8R}$ c) $\frac{GMm}{3R^2}$ d) $\frac{GMm}{6R}$

22. The time period of a satellite of earth is 5 hours. If the separation between the earth and the satellite is increased to 4 times the previous value, the new time period will become

a) 10 hours b) 80 hours c) 40 hours d) *20* hours

23. Two spherical bodies of mass M and 5M and radii R and 2R respectively are released in free space with initial separation between their centres equal to 12 R. If they attract each other due to gravitational force only then the distance covered by the smaller body just before collision is

a) 2.5 R b) 4.5 R c) 7.5 R d) 1.5 R

24. The escape velocity for a body projected vertically upwards from the surface of earth is 11 km/s. If the body is projected at angle of 45° with the vertical, the escape velocity will be

a) $11\sqrt{2} km/s$ b) $22\ km/s$ c) $11\ km/s$ d) $\frac{11}{\sqrt{2}} km/s$

25. A satellite of mass m revolves around the earth of radius R at a height x from its surface. If g is the acceleration due to gravity on the surface of the earth, orbital speed of the satellite is

a) gX b) $\left(\frac{gR^2}{R+X}\right)^{1/2}$ c) $\frac{gR^2}{R+X}$ d) $\frac{gR}{R-X}$

26. Average density of the earth

a) does not depend on g b) is a complex function of g

c) is directly proportional to g d) is inversly proportional to g

27. The change in the value of g at a height 'h' above the surface of earth is the same as at a depth 'd' below the surface of earth. When both d and h are much smaller than the radius of earth, then which one of the following is correct ?

a) d = $\frac{h}{2}$ b) d = $\frac{3h}{2}$ c) d = 2h d) d = h

28. A particle of mass 10 g is kept on the surface of uniform sphere of mass 100 kg and radius 10 cm. Find the work done against the gravitational force between them to take the particle far away from the sphere.

a) 13.34×10^{-10} J b) 3.33×10^{-10} J

c) 6.67×10^{-9} J d) 6.67×10^{-10} J

29. Two bodies A and B of masses m and 4m respectively are placed at a distance d. Where should we place a body along the line joining them so that on it the gravitational force due to A and B are equal and opposite ?

a) At a distance $\frac{d}{4}$ from A b) At a distance $\frac{d}{3}$ from B

c) At a distance $\frac{d}{3}$ from A d) At a distance $\frac{d}{4}$ from B.

30. The inertial and gravitational mass of a body are :

a) unequal b) exactly equal

c) unrelated d) approximately equal

31. If a spoon is dropped by an astronant in an artificial satellite :

a) the spoon will fly away due to centrifugal force

b) the spoon will fall on earth due to gravitational attraction

c) the spoon will move with same orbitals velocity as that of the satellite.

d) None of the these.

32. The diameter of the moon is $\frac{1}{4}$ th of the earth's diameter and the value of 'g' on the moon is $\frac{1}{6}$ th of the earth's value, then the ratio of escape velocities at the moon and the earth will be :

a) 1:2 b) 1:8 c) 1 : 6 (d) 1 : 4.9.

33. The period of a simple pendulum at one place is 1.4s and at another place it is 1.6s. The ratio of the acceleration due to gravity at the two places is :

a) 7 : 8 b) 8 : 7 c) 49 : 64 d) 64 : 49.

34. A body is projected vertically from the surface of earth with a velocity equal to half of escape velocity. The maximum height reached by the body is :

a) R b) $\frac{R}{2}$ c) $\frac{R}{3}$ d) $\frac{R}{4}$

35. An earth satellite is moved from one stable circular orbit to a farther stable circular orbit. Which one of the following quantities increases ?

a) Gravitational potential energy b) Gravitational force

c) Centripetal acceleration d) Linear orbit speed.

36. The gravitational potential difference between the surface of a planet and a point 20m above it is 16 J/ kg. The work done in moving a 2.0kg. mass by 8.0 m on a slope 30° from the horizontal is:

a) 19.6 J b) 6.4 J c) 20.3 J d) 113.2 J

37. Two satellites A and B go round a planet in circular orbits of radii 4R and R respectively. If speed of satellite A is 3*v*. the speed of satellite B would be :

a) 12*v* b) 6*v* c) $4\frac{v}{3}$ d) $3\frac{v}{2}$

38. The kinetic energy required to project a body from earth's surface to infinity is:

a) ∞ b) 2 mg R c) $\frac{1}{2}$ **mg R** d) mg R

39. A thief stole a box full of valueables of weight W and while carrying it on his head, he jumped down from a wall of height 11m from the ground. Before he reached the ground, he experiences a load of:

a) 2W b) W c) $\frac{W}{2}$ d) zero

40. If the radius of earth were to decrease by 1%, its mass remaining the same, the acceleration due to gravity on the surface will:

a) increases by 1% b) decreases by *2%* c) decreases by 1% d) increases by *2%.*

41. A body of mass m rises to a height $h = \frac{R}{5}$ from the earth's surface where R is the radius of earth. If g is acceleration due to gravity it the earth's surface, then the increase in RE. is :

a) mg h b) $\frac{4}{5}$ **mg h** c) $\frac{5}{6}$ **mg h** d) $\frac{6}{7}$ **mg h**

42. At what height above the surface of the earth of radius R is the acceleration due to gravity *4%* of its value at the surface ?

a) $\frac{R}{4}$ b) R c) 4 R d) 8 R

43. The change in the gravitational potential energy when a body of mass m is raised to a height nR above the surface of the earth where R is the radius of the earth is :

a) $\left(\frac{n}{n+1}\right)mg\ R$ b) $\left(\frac{n}{n-1}\right)mg\ R$ c) n mg R d) $\frac{mg\ R}{n}$

44. Two planets of radii R_1 and R_2 are made from the same material. The ratio of the accelerations due to gravity $\frac{g_1}{g_2}$ at the surface of the planets is :

a) $\frac{R_1}{R_2}$ b) $\frac{R_2}{R_1}$ c) $\left(\frac{R_1}{R_2}\right)^2$ d) $\left(\frac{R_2}{R_1}\right)^3$

45. If the change in the value of g at a height h above the surface of the earth is the same as that at a depth b below it, then (both h and d are much smaller than the radius of the earth) the ratio $\frac{d}{h}$ s : is

a) 1 b) 2 c) 3 d) 4