Only one option correct

1. A body of mass M is to be divided into two fragments so that the gravitational force is the maximum between the two fragments when they are placed at a certain distance. Masses of fragments should be
1. $M/10$, $M\,9/10$ 2. $\sqrt{2}M$, $M/\sqrt{2}$ 3. $M/4$, $M\,3/4$ 4. $M/2$, $M/2$

2. Four identical particles each of mass 1 kg are placed at four corners of a square of side length 1m. The resultant gravitational force on any one of the masses is
1. $\frac{5G}{2}$ 2. $G(2+\sqrt{2})$ 3. $G\left(\sqrt{2}+\frac{1}{2}\right)$ 4. $\frac{G}{2}\left(\sqrt{2}+1\right)$

3. If earth is assumed to be a sphere of radius R, (g is acceleration due to gravity and G is universal gravitational constant) then mass of the earth is
1. $\frac{gR^2}{G}$ 2. $\frac{GR^2}{g}$ 3. $R\sqrt{\frac{G}{g}}$ 4. $R\sqrt{\frac{g}{G}}$

4. Acceleration due to gravity on earth and moon are g_E and g_M respectively. The radius of earth and moon are R_E and R_M respectively. Ratio of mass of earth to that of the moon is
1. $\frac{g_E}{g_M}\sqrt{\frac{R_E}{R_M}}$ 2. $\frac{g_E}{g_M}\frac{R_E}{R_M}$ 3. $\frac{g_E}{g_M}\left(\frac{R_E}{R_M}\right)^2$ 4. $\left(\frac{g_E}{g_M}\right)^2\frac{R_E}{R_M}$

5. Two planets A and B have same density. If radius of A is twice that of B, the ratio of escape velocity from A to that from B is
1. 4:1 2. 2:1 3. 1:$\sqrt{2}$ 4. 1:1

6. Assuming the earth to be a uniform sphere of radius R, the altitude at which the acceleration due to gravity will be half the value at the surface (g) is
1. $R/2$ 2. $R/\sqrt{2}$ 3. $(\sqrt{2}+1)R$ 4. $(\sqrt{2}-1)R$

7. Altitude at which acceleration due to gravity is 25% of that on the earth's surface is (R is radius of earth)
1. $R/4$ 2. R 3. $3R/8$ 4. $R/2$

8. Acceleration due to gravity at a height $R/2$ from the surface of the earth of radius R is
1. $4g/9$ 2. $\sqrt{3}g/2$ 3. $g/\sqrt{2}$ 4. Zero

9. Acceleration due to gravity at a depth of $R/2$ from the surface of the earth is (R is radius of the earth)
1. $g/8$ 2. $g/4$ 3. $g/2$ 4. $g\sqrt{2}$

10. At what height above the earth's surface does the acceleration due to gravity fall to 1% of its value at the earth's surface?
1. $9R$ 2. $10R$ 3. $99R$ 4. $100R$

11. At what depth inside the earth, from the surface, would the weight of a body becomes one fourth of its weight at a height R above the surface of earth?
1. $R/4$ 2. $15R/16$ 3. $3R/4$ 4. $R/2$

12. If radius of the earth is assumed to be increased by a factor of 5, by what factor should its density change so that the value of acceleration due to gravity remains unaltered?
1. 1/25 2. 1/5 3. 1/$\sqrt{5}$ 4. 5

13. Let ω be the angular velocity of the earth's rotation about its axis. An object weighed at the equator gives the same reading as a reading taken at a depth d below earth's surface at a pole ($d << R$). The value of d is
1. $\frac{\omega^2R^2}{g}$ 2. $\frac{\omega^2R^2}{2g}$ 3. $\frac{2\omega^2R^2}{g}$ 4. $\frac{2\omega^2R^2}{5g}$

14. Angular velocity of the earth's spin so that a body lying at a latitude of 30° may become weightless is (R is radius of earth and g is acceleration due to gravity on the surface of the earth)
1. $\sqrt{\frac{2g}{3R}}$ 2. $\sqrt{\frac{4g}{R}}$ 3. $\sqrt{\frac{g}{3R}}$ 4. $\sqrt{\frac{4g}{3R}}$

15. Radius of a planet is R. A satellite revolves around it in a circle of radius r with angular velocity ω_o. Acceleration due to gravity on the planet's surface is
1. $\frac{\omega_o r^3}{2R^2}$ 2. $\omega_o r$ 3. $\frac{\omega_o^2 r^2}{R}$ 4. $\frac{\omega_o^2 r^3}{R^2}$

16. Two satellites S_1 and S_2 describe circular orbits of radius r and $2r$ respectively around a planet. If the orbital angular velocity of S_1 is ω then that of S_2 is
1. $\frac{\omega}{2\sqrt{2}}$ 2. $\frac{\omega\sqrt{2}}{3}$ 3. $\frac{\omega}{2}$ 4. $\frac{\omega}{\sqrt{2}}$

17. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius $1.02R$. Time period of second satellite is larger than the first one by approximately

1. 1.5% 2. 3% 3. 1% 4. 2%

18. Escape velocity from the surface of earth is v_e. Escape velocity from a planet of mass twice that of the earth and radius half that of the earth is

1. $v_e/\sqrt{2}$ 2. $v_e/2$ 3. $2v_e$ 4. $\sqrt{2}\, v_e$

19. A body is projected with a velocity 3/4th the escape velocity from the surface of the earth. The maximum height reached by the body is (R is the radius of the earth)

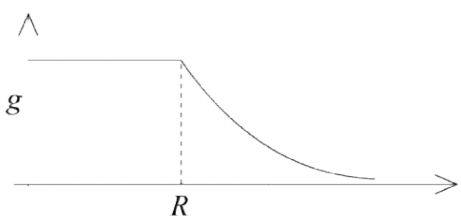
1. $7R/9$ 2. $9R/7$ 3. $R/2$ 4. $2R$

20. A body projected from the surface of the earth reaches a height that is equal to the radius of the earth. The velocity of projection is (G is universal gravitational constant, M is mass of the earth and R is radius of the earth)

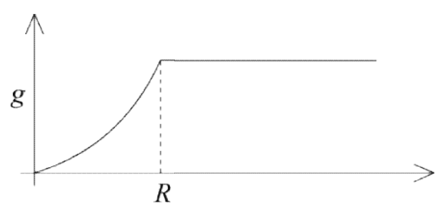
1. $\sqrt{\frac{GM}{R}}$ 2. $\sqrt{\frac{GM}{2R}}$ 3. $\sqrt{\frac{2GM}{R}}$ 4. $\sqrt{\frac{3GM}{2R}}$

21. The plot of variation of acceleration due to gravity (g) w.r.t the distance from the centre of the earth is given by (R is the radius of the earth)

1.



2.



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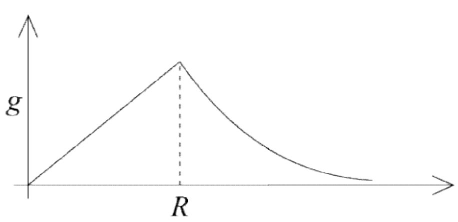
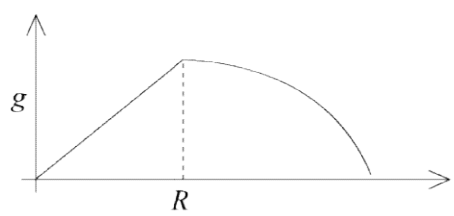


4.



22. For a satellite to attain escape velocity the percentage increase in its orbital velocity should be (assuming the orbit to be close to the surface of the earth)

1. 50% 2. 100 % 3. 41.4 % 4. 1.414 %

23. If R , ρ and G represent the radius, density and the universal gravitational constant respectively, then the gravitational potential energy of a body of mass m placed on the surface of the earth is

1. $-\frac{4}{3}\pi\rho R^2 Gm$ 2. $-\frac{4}{3}\pi\rho^2 RGm^2$ 3. $-\frac{4}{3}\frac{\pi\rho}{R^2 Gm}$ 4. $-\frac{4}{3}\frac{Gm}{\pi\rho R^2}$

24. A body is projected up from the surface of the earth with a velocity equal to √2 times the escape velocity. The velocity of the body at infinite distance is

1. v_e 2. $\sqrt{2}\, v_e$ 3. $2\, v_e$ 4. $v_e / 2$

25. A body is projected vertically up with a velocity equal to half the escape velocity. Height reached by the body is (radius of the earth is 6400 km)

1. 3200 km 2. 7200 km 3. 2133.3 km 4. 4122.3 km

Key

1. 4
2. 3
3. 1
4. 3
5. 2
6. 4
7. 2
8. 1
9. 3
10. 1
11. 2
12. 2
13. 1
14. 4
15. 4
16. 1
17. 2
18. 3
19. 2
20. 1
21. 3
22. 3
23. 1
24. 1
25. 3