Gravitation

Q.No.1:
What is the minimum energy required to launch a satellite of mass m from the surface of a planet of mass M and radius R in a circular orbit at an altitude of 2R?

JEE 2013

A. $\frac{5GmM}{6R}$

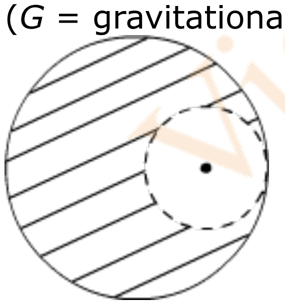
B. $\frac{2GmM}{3R}$

C. $\frac{GmM}{2R}$

D. $\frac{GmM}{3R}$

Q.No.2: From a solid sphere of mass M and radius R, a spherical portion of radius $\frac{R}{2}$ is removed, as shown in the figure. Taking gravitational potential $V = 0$ at $r = \infty$, the potential at the centre of the cavity thus formed is:
(G = gravitational constant)

JEE 2015



A. $\frac{-GM}{2R}$

B. $\frac{-GM}{R}$

C. $\frac{-2GM}{3R}$

D. $\frac{-2GM}{R}$

Q.No.3: A satellite is revolving in a circular orbit at a height '*h*' from the earth's surface (radius or earth *R*; *h* << *R*). The minimum increase in its orbital velocity required, so that the satellite could escape from the earth's gravitational field, is close to : (Neglect the effect of atmosphere) **JEE 2016**

A. $\sqrt{gR}$

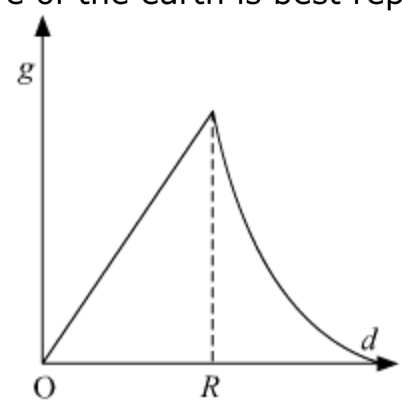
B. $\sqrt{gR/2}$

C. $\sqrt{gR}\left(\sqrt{2}-1\right)$

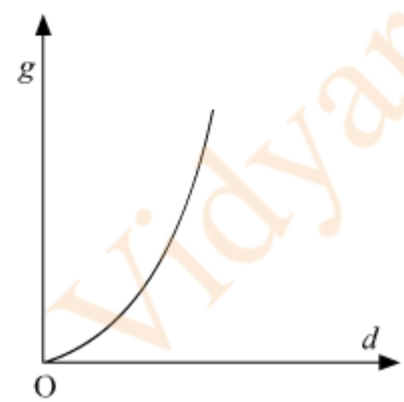
D. $\sqrt{2gR}$

Q.No.4: The variation of acceleration due to gravity g with distance d from centre of the earth is best represented by (R = Earth's radius) **JEE 2017**

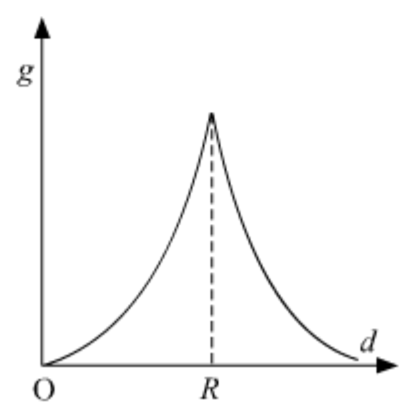
A.

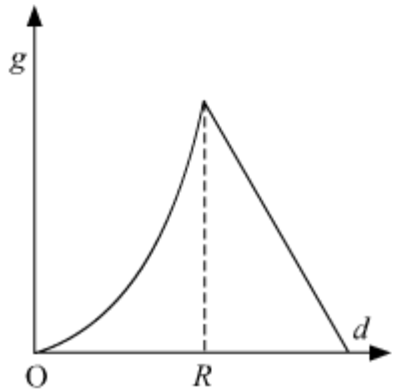


B.



C.



D. 

Q.No.5: A heavy ball of mass M is suspended from the ceiling of a car by a light string of mass m (m≪M). When the car is at rest, the speed of transverse waves in the string is 60 ms^{-1}. When the car has acceleration a, the wave-speed increases to 60.5 ms^{-1}. The value of a, in terms of gravitational acceleration g, is closest to: **JEE 2019**

A. $\frac{g}{30}$

B. $\frac{g}{5}$

C. $\frac{g}{10}$

D. $\frac{g}{20}$

Q.No.6: The energy required to take a satellite to a height '*h*' above Earth surface (radius of Earth = 6.4×10^3 km) is E_1 and kinetic energy required for the satellite to be in a circular orbit at this height is E_2. The value of *h* for which E_1 and E_2 are equal, is: **JEE 2019**

A. 1.6×10^3 km

B. 3.2×10^3 km

C. 6.4×10^3 km

D. 1.28×10^4 km

Q.No.7: A satellite is moving with a constant speed *v* in circular orbit around the earth. An object of mass *m* is ejected from the satellite such that it just escapes from the gravitational pull of the earth. If the mass of the satellite is negligible as compared to earth then what is the additional kinetic energy needed to be given to the mass *m*? **JEE 2019**

A. $2mv^2$

B. mv^2

C. $\frac{1}{2}mv^2$

D. $\frac{3}{2}mv^2$

Q.No.8: Water flows into a large tank with flat bottom at the rate of 10^{-4} m^3 s^{-1}. Water is also leaking out of a hole of area 1 cm^2 at its bottom. If the height of the water in the tank remains steady, then this height is: **JEE 2019**

A. 5.1 cm

B. 1.7 cm

C. 4 cm

D. 2.9 cm

Q.No.9: Two stars of masses 3×10^{31} kg each, and at distance 2×10^{11} m rotate in a plane about their common centre of mass O. A meteorite passes through O moving perpendicular to the star's rotation plane. In order to escape from the gravitational field of this double star, the minimum speed that meteorite should have at O is: (Take Gravitational constant G = 6.67×10^{-11} Nm^2 kg^{-2}) **JEE 2019**

A. 2.4×10^4 m/s

B. 1.4×10^5 m/s

C. 3.8×10^4 m/s

D. 2.8×10^5 m/s

Q.No.10: A satellite is revolving in a circular orbit at a height *h* from the earth surface, such that $h << R$ where *R* is the radius of the earth. Assuming that the effect of earth's atmosphere can be neglected the minimum increase in the speed required so that the satellite could escape from the gravitational field of earth is: **JEE 2019**

A. $\sqrt{2gR}$

B. $\sqrt{gR}$

C. $\sqrt{\frac{gR}{2}}$

D. $\sqrt{gR}\left(\sqrt{2}-1\right)$