Q.1 Suppose a smooth tunnel is dug along a straight line joining two points on the surface of the earth and a particle is dropped from rest at its one end. Assume that mass of earth is uniformly distributed over its volume. Then

(A) The particle will emerge from the other end with velocity $\sqrt{\frac{GM_e}{2R_e}}$ where, M_e and R_e are earth's mass and radius respectively

(B) The particle will come to rest at the centre of the tunnel because at this position, the particle is closest to the earth's centre.

(C) Potential energy of the particle will always be equal to zero at centreof the tunnel if it is along a diameter.

(D) Acceleration of the particle will be proportional to its distance from the mid-point of the tunnel.

Q.2 A tunnel is dug along the diameter of Earth. There is a particle of mass m at the centre of tunnel. The maximum velocity given to the particle, so that it just reaches the surface of earth is: (R is radius of Earth and M is the mass of the earth)

(A)$\sqrt{\frac{GM}{R}}$ **(B)**$\sqrt{\frac{GM}{2R}}$ **(C)** $\sqrt{\frac{2GM}{R}}$ **(D)**Zero

Q.3 A tunnel is dug along a diameter of the earth. If M_e and R_e are the mass and radius of the earth respectively, then the force on a particle of mass m placed in the tunnel at a distance r from the centre is: [Assume , walls of the tunnel are frictionless]

(A)$\frac{GM_e m}{R_e^3} r$ **(B)**$\frac{GM_e m}{R_e^2}$ **(C)** $\frac{GM_e m R_e^2}{r^5}$ **(D)**$\frac{2GM_e m}{R_e^3} r$

Q.4 If a tunnel is cut at any orientation through earth, then find the time taken by a ball released from one end to reach the other end. (Neglect earth rotation and take radius of earth as $R = 64 \times 10^5$ m and $\mathbf{g = 10\ m/sec^2}$)

(A)84.6 minutes **(B)**41.9 minutes

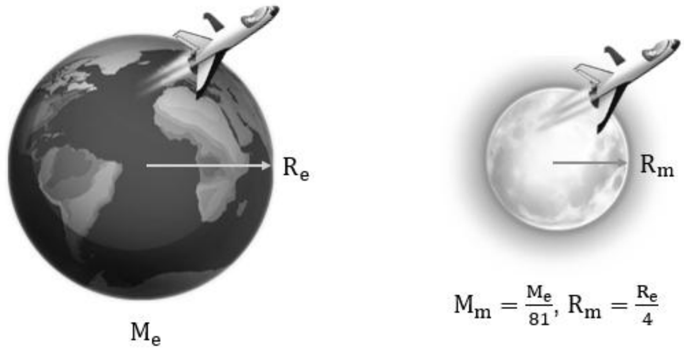
(C) 8 minutes **(D)**depend on orientation

Q.5 The kinetic energy required to project a body of mass m from earth's surface (radiusR) to just escape from earth's atmosphere

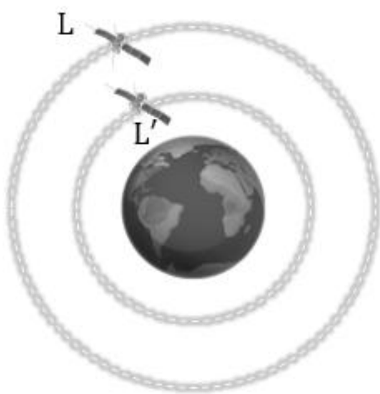
(A)$\frac{mgR}{2}$ **(B)**2mgR **(C)** mgR **(D)**$\frac{mgR}{4}$

Q.6 The escape velocity of a body from earth is about 11.2 km/s. Assuming the mass and radius of the earth to be about 81 and 4 times the mass and radius of the moon. The escape velocity in km/s from the surface of the moon will be

(A) 0.54 **(B)** 2.48 **(C)** 11 **(D)** 49.5

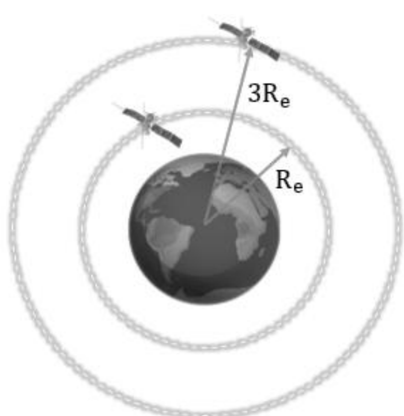


Q.7 An angular moment of a satellite revolving round the earth in a circular orbit at a height R above the surface is L. Here R is radius of the earth. The magnitude of angular momentum of another satellite of the same mass revolving very close to the surface of the earth is



(A) $\frac{L}{2}$ **(B)** $\frac{L}{\sqrt{2}}$ **(C)** $\sqrt{2}L$ **(D)** $2L$

Q.8 Energy of a satellite in circular orbit is E_0. The energy required to move the satellite to a circular orbit of 3 times the radius of the initial orbit is

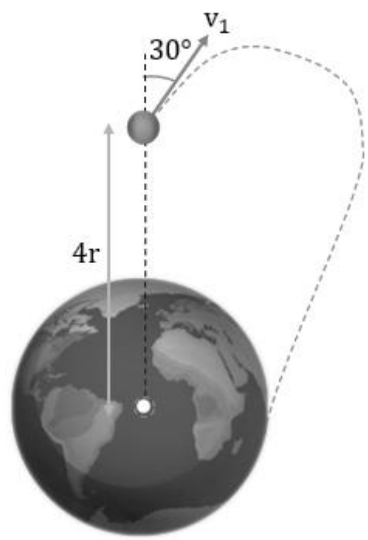


(A) $\frac{2}{3}E_0$ **(B)** $2E_0$ **(C)** $\frac{E_0}{3}$ **(D)** $\frac{3}{2}E_0$

Q.9 A geostationary satellite is orbiting the earth at a height of 5R above that surface of the earth, R being the radius of the earth. The time period of another satellite in hours at a height of 2R from the surface of the earth is

(A)$6\sqrt{2}$ hours **(B)**$\frac{6}{\sqrt{2}}$ hours **(C)** 5 hours **(D)**10 hours

Q.10 A body is projected from pointA, that is at a distance 4R from the centre of the earth with speedv_1,in a direction making angle 30° with the extension of line joining centre of the earth and pointA. Find the speed v_1 (inm/s) of the body if the body passes earth by grazing its surface. [Neglect air resistance and rotation of earth, and use $\frac{GM}{R} = 6.4 \times 10^7\ m^2/s^2$ for calculation.]



(A)$800\sqrt{2}$ **(B)**$\frac{8000}{\sqrt{2}}$ **(C)** 800 **(D)**None of these

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(D)	(A)	(A)	(B)	(C)	(B)	(B)	(A)	(A)	(B)