Q 05 A body is moving in a low circular orbit about a planet of mass M and radius R. The radius of the orbit can be taken to be R itself. Then the ratio of the speed of this body in the orbit to the escape velocity from the planet is :

[Main 4 Sep. 2020 (II)]

(a) $\frac{1}{\sqrt{2}}$ (b) 2

(c) 1 (d) $\sqrt{2}$

(a) Orbital speed of the body when it revolves very close to the surface of planet

$$V_0 = \sqrt{\frac{GM}{R}} \quad ...(i)$$

Here, G = gravitational constant

Escape speed from the surface of planet

$$V_e = \sqrt{\frac{2GM}{R}} \quad ...(ii)$$

Dividing (i) by (ii), we have

$$\frac{V_0}{V_e} = \frac{\sqrt{\frac{GM}{R}}}{\sqrt{\frac{2GM}{R}}} = \frac{1}{\sqrt{2}}$$