Question:

The masses and radii of the earth and moon are M1, R1 and M2, R2 respectively. Their centres are at distance d apart. The minimum speed with which a particle of mass m should be projected from a point midway the two centres so as to escape to infinity is :-

Answer:

The law of conservation of energy:

$$T + U = const$$

where $T = \frac{mv^2}{2}$ is kinetic energy, m - mass, v – speed, $U = -\frac{GmM}{r}$ is potential energy, r is distance to the center of second body.

Therefore:

$$-\frac{GM_1 m}{\frac{d}{2}} - \frac{GM_2 m}{\frac{d}{2}} + \frac{mv^2}{2} = 0 + 0 + 0$$

$$v^2 = \frac{4G}{d}(M_1 + M_2)$$

$$v = \sqrt{\frac{4G}{d}(M_1 + M_2)}$$

Answer: $v = \sqrt{\frac{4G}{d}(M_1 + M_2)}$