Answer on Question #49237 – Physics – Mechanics | Kinematics | Dynamics

1. A stationary object is released from a point P at a distance 3R from the centre of the moon which has radius R and mass M. Which of the following gives the speed of the object on hitting the moon?

1. (2GM/3R)^1/2; 2. (4GM/3R)^1/2; 3. (GM/3R)^1/2; 4. (GM/R)^1/2.

Solution.

We must use the law of conservation and transformation of energy. The sum of the potential energy of an object and its kinetic energy remain constant:

$$-G\frac{mM}{3R}+\frac{m\cdot v_0^{\,2}}{2}=-G\frac{mM}{R}+\frac{m\cdot v_1^{\,2}}{2},$$

where m is the object mass, v_0 (v_1) is its initial (final) speed.

The object was stationary, so $v_0=0$.

Thus, we can find the speed of the object on hitting the moon.

$$-G\frac{M}{3R}=-G\frac{M}{R}+\frac{v_1^{\,2}}{2},\quad \frac{v_1^{\,2}}{2}=\frac{2GM}{3R},\quad v_1=2\sqrt{\frac{GM}{3R}}.$$

Answer: 2)