

## Answer on Question #41163, Physics, Mechanics | Kinematics | Dynamics

### Question:

two masses  $m_1=2\text{kg}$  and  $m_2=8\text{kg}$  infinite distance apart are initially at rest . under their mutual grav attaraction they start moving. When separation becomes 1m , velocity of  $m_2$  will be???

ans in terms of G?

### Answer:

The law of conservation of momentum:

$$m_1 \vec{v}_1 + m_2 \vec{v}_2 = 0$$

Therefore:

$$v_1 = \frac{m_2}{m_1} v_2$$

The law of conservation of energy:

$$T + U = \text{const}$$

where  $T = \frac{mv^2}{2}$  is kinetic energy,  $m$  - mass,  $v$  – speed,  $U = -\frac{Gm_1m_2}{r}$  is potential energy.

Therefore:

$$\begin{aligned} 0 &= \frac{m_1 v_1^2}{2} + \frac{m_2 v_2^2}{2} - G \frac{m_1 m_2}{r} \\ \frac{m_1 \left( \frac{m_2}{m_1} v_2 \right)^2}{2} + \frac{m_2 v_2^2}{2} &= G \frac{m_1 m_2}{r} \\ v_2^2 &= \frac{2Gm_1}{r \left( 1 + \frac{m_2}{m_1} \right)} \\ v_2 &= \sqrt{\frac{2Gm_1}{r \left( 1 + \frac{m_2}{m_1} \right)}} = 7.3 \cdot 10^{-6} \frac{m}{s} \end{aligned}$$

Answer:  $7.3 \cdot 10^{-6} \frac{m}{s}$