Answer on Question #43697 – Physics - Mechanics | Kinematics | Dynamics

a mass of 10 g moving with a speed of 100 cm/s strikes a pendulum bob of mass 10 g. the two masses stick together. The maximum height reached by the system now is?

Solution:
$V_1 = 1\dfrac{m}{s}$ − initial speed of the object;
$m_1 = 0.01 \text{ kg}$ − mass of the object;
$V_2 = 0$ − initial speed of pendulum bob;
$m_2 = 0.01 \text{ kg}$ − mass of the pendulum bob;
V_3 − the speed of the joined masses after the collision;
H − maximum height reached by the system;

This is an inelastic collision, so momentum is conserved but some energy is lost to heat, etc. in the collision
Thus:
$$m_1 V_1 + m_2 V_2 = (m_1 + m_2)V_3$$
$$V_3 = \frac{m_1 V_1 + m_2 V_2}{(m_1 + m_2)} \quad (1)$$

Now the system (mass + pandulum bob) have a joint KE and they will swing upward until that KE is turned into GPE
$$GPE = KE$$
$$(m_1 + m_2)gH = \frac{(m_1 + m_2)V_3^2}{2} \quad (2)$$
$$(1) in\ (2):$$
$$H = \frac{\left(\frac{m_1 V_1 + m_2 V_2}{(m_1 + m_2)}\right)^2}{2g} = \frac{(m_1 V_1 + m_2 V_2)^2}{2g(m_1 + m_2)^2} = \frac{\left(0.1 \text{ kg} \cdot 1\frac{m}{s} + 0.1 \text{ kg} \cdot 0\right)^2}{2 \cdot 9.8\frac{N}{kg} \cdot (0.1 \text{ kg} + 0.1 \text{ kg})^2} = 1.28 \text{ cm}$$

Answer: maximum height reached by the system now is 1.28 cm.