Question#19424

A 1 kg wooden block hanging from a 1 meter rope is struck by a 10g bullet moving horizontally is observed to rise 5cm. Assuming the bullet is lodged within the block, what must have been the speed of the bullet initially?

Solution:

Let:

$m_1 = 1\ kg$

$m_2 = 10\ g = 0.01\ kg$

$H = 5\ cm = 0.05\ m$

$v - ?$

The kinetic energy of a bullet was transformed to the sum of potential energy the block and the bullet.

$$Ek_{bullet} = Ep_{bullet} + Ep_{block}$$

$$\frac{1}{2}m_2v^2 = m_2gH + m_1gH,\ g = 9.8\ m/s^2$$

$$\boldsymbol{v = \sqrt{\frac{2gH(m_2+m_1)}{m_2}}}$$

$$\boldsymbol{v = \sqrt{\frac{2*9.8*0.05(0.01+1)}{0.01}} = 9.95\ m/s}$$

Answer: 9.95 m/s.