Answer on Question 56092, Physics, Other

Question:

A $2.50g$ bullet, traveling at a speed of $385\,m/s$, strikes the wooden block of a ballistic pendulum. The block has a mass of $275g$.

A) Find the speed of the bullet/block combination immediately after the collision.

B) How high does the combination rise above its initial position?

Solution:

A) By the law of conservation of momentum we have:

$$m_{bullet}v_{bullet} = (m_{bullet} + m_{block})v_{bullet+block}.$$

From this formula we can find the speed of the bullet/block combination immediately after the collision:

$$v_{bullet+block} = \frac{m_{bullet}v_{bullet}}{m_{bullet} + m_{block}} = \frac{0.0025kg \cdot 385\frac{m}{s}}{0.0025kg + 0.275kg} = \frac{0.9625kg\frac{m}{s}}{0.2775kg} = 3.47\frac{m}{s}.$$

B) We can find the height on which the combination rise above its initial position from the law of conservation of energy:

$$PE_i + KE_i = PE_f + KE_f,$$

$$0 + KE_i = PE_f + 0,$$

$$\frac{1}{2}mv^2 = mgh,$$

$$h = \frac{v^2}{2g} = \frac{\left(3.47\frac{m}{s}\right)^2}{2 \cdot 9.8\frac{m}{s^2}} = 0.61m.$$

Answer:

A) $v_{bullet+block} = 3.47\frac{m}{s}$.

B) $h = 0.61m$.