

Physics 10154 - Quiz 7B

^{150 gram}
A ~~1.50 kg~~ block is initially at rest on a horizontal surface with a coefficient of kinetic friction of 0.334. A 7.50-gram bullet is fired into the block and embeds itself into the block after the collision. After the collision, the bullet-block system slides 6.40 meters across the surface before coming to rest.

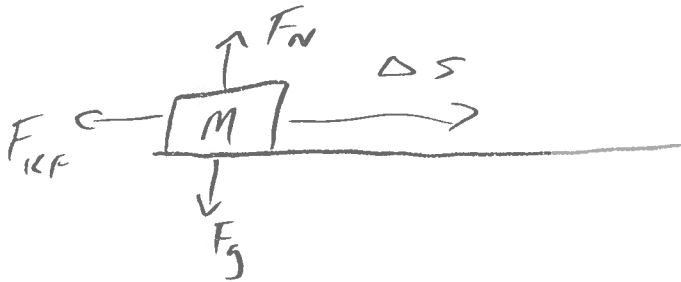
What was the speed of the bullet prior to the collision?

Collision

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$(0.00750) v_{1i} + 0 = (0.15750) v_f \quad \leftarrow \text{use } v_0 \text{ from part 2}$$

Work-Energy



$$\begin{aligned} \Sigma F_{\perp} &= F_N - mg = 0 \\ \Rightarrow F_N &= mg \end{aligned}$$

$$\Sigma W_F = W_{KF} + W_N + W_g = 0 - \frac{1}{2} m v_0^2$$

$$- \mu_k F_N \Delta s + 0 + 0 = - \frac{1}{2} m v_0^2$$

$$- \mu_k m g \Delta s = - \frac{1}{2} m v_0^2$$

$$v_0 = \sqrt{2 \mu_k g \Delta s} = 6.473 \text{ m/s}$$

$$\begin{aligned} v_{1i} &= \frac{0.15750}{0.00750} v_f = 21 (6.473) \\ &= \boxed{136 \text{ m/s}} \end{aligned}$$