

Physics 10154 - Quiz 7C

A 150 gram block is at rest on the edge of a table, 85.0 cm above the ground. A 6.54-gram bullet is fired into the block and embeds itself into the block. The bullet-block system flies horizontally off the table, and after a short period in free-fall, lands 1.44 meters horizontally away from the table.

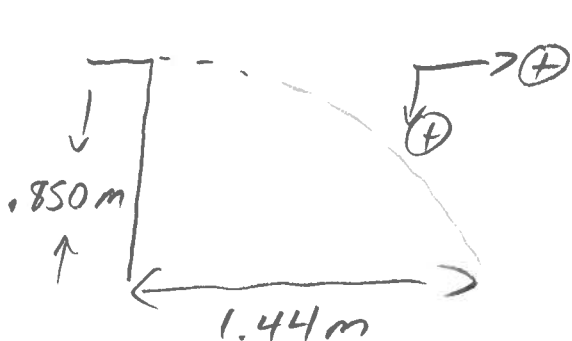
What was the initial speed of the bullet prior to the collision?

$$\text{Collision: } m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$(0.00654) v_{1i} + 0 = (0.15654) v_f$$

$$v_{1i} = 23.936 v_f \leftarrow v_{0x} \text{ from Part 2}$$

Free fall



$$\begin{array}{l} \underline{x} \\ \Delta x = 1.44 \\ v_{0x} = ? \\ v_x = ? \\ a_x = 0 \\ t = ? \end{array}$$

$$\begin{array}{l} \underline{y} \\ \Delta y = 0.850 \\ v_{0y} = 0 \\ v_y = ? \\ a_y = 9.8 \\ t = ? \end{array}$$

$$y: \Delta y = v_{0y} t + \frac{1}{2} a_y t^2$$

$$0.850 = 0 + \frac{1}{2} (9.8) t^2 \Rightarrow t = 0.4165 \text{ s}$$

$$x: \Delta x = v_{0x} t + \frac{1}{2} a_x t^2$$

$$1.44 = v_{0x} (0.4165) \Rightarrow v_{0x} = 3.4574 \text{ m/s}$$

$$v_{1i} = (23.936)(3.4574) = \boxed{82.8 \text{ m/s}}$$