

Physics 101-Rec
Quiz # 9

Instructor: Dr. Mekki

Name: Key Id#: _____ Sect. #: _____

A 1.0kg block (A) moving at a speed of 5.0 m/s runs head on into a 1.5kg block (B) at rest in an elastic collision.

(a) What are the velocities of the blocks after the collision?

$$\text{Elastic collision} \Rightarrow \begin{cases} m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f} \\ \frac{1}{2} m_1 v_{1i}^2 + \frac{1}{2} m_2 v_{2i}^2 = \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2 \end{cases}$$

$$\Rightarrow v_{1f} = \frac{m_1 - m_2}{m_1 + m_2} v_{1i} + \frac{2m_2}{m_1 + m_2} v_{2i}$$

$$v_{2f} = \frac{2m_1}{m_1 + m_2} v_{1i} + \frac{m_2 - m_1}{m_1 + m_2} v_{2i}$$

in our case $v_{2i} = 0$ (target at rest)

$$\Rightarrow v_{1f} = \frac{-0.5}{2.5} \times 5.0 = \boxed{-1 \text{ m/s}}$$

$$v_{2f} = \frac{2}{2.5} \times 5.0 = \boxed{4 \text{ m/s}}$$

(b) What is the final kinetic energy (after the collision)?

$$K_f = \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2$$

$$= \frac{1}{2} \times (1.0) \times (-1)^2 + \frac{1}{2} \times (1.5) \times (4)^2 = \boxed{12.5 \text{ J}}$$