

PhyzJob: Collisions in 2 Dimensions



In each case below, one moving object collides inelastically with another moving object. The masses and initial velocities of both objects are given. Find the final velocity of the compound object.

Example. Given: $m_1 = 1 \text{ kg}$, $m_2 = 3 \text{ kg}$, $\mathbf{v}_1 = (6 \text{ m/s}, 0 \text{ m/s})$, and $\mathbf{v}_2 = (0 \text{ m/s}, 4 \text{ m/s})$.

Find \mathbf{v}' .

$$x: m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

$$m_1 v_1 = (m_1 + m_2) v'$$

$$v' = m_1 v_1 / (m_1 + m_2)$$

$$v' = 1 \text{ kg} \cdot 6 \text{ m/s} / (1 \text{ kg} + 3 \text{ kg})$$

$$v' = 1.5 \text{ m/s}$$

$$y: m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

$$m_2 v_2 = (m_1 + m_2) v'$$

$$v' = m_2 v_2 / (m_1 + m_2)$$

$$v' = (3 \text{ kg} \cdot 4 \text{ m/s}) / (1 \text{ kg} + 3 \text{ kg})$$

$$v' = 3.0 \text{ m/s}$$

$$\mathbf{v}' = (1.5 \text{ m/s}, 3.0 \text{ m/s})$$

1. Given: $m_1 = 3 \text{ kg}$, $m_2 = 5 \text{ kg}$, $\mathbf{v}_1 = (4 \text{ m/s}, 0 \text{ m/s})$, and $\mathbf{v}_2 = (0 \text{ m/s}, 2 \text{ m/s})$.

Find: \mathbf{v}' .

2. Given: $m_1 = 3 \text{ kg}$, $m_2 = 5 \text{ kg}$, $\mathbf{v}_1 = (5 \text{ m/s}, 5 \text{ m/s})$, and $\mathbf{v}_2 = (-3 \text{ m/s}, 3 \text{ m/s})$.

Find: \mathbf{v}' .

3. Given: $m_A = 6 \text{ kg}$, $m_B = 9 \text{ kg}$, $\mathbf{v}_A = (12 \text{ m/s}, 0 \text{ m/s})$, and $\mathbf{v}' = (4.8 \text{ m/s}, 4.8 \text{ m/s})$.

Find: \mathbf{v}_B .