4. EVALUATE Confirm your answer by making sure kinetic energy is also conserved using these values.

Conservation of kinetic energy

$$\tfrac{1}{2}m_1{v_{1,i}}^2 + \tfrac{1}{2}m_2{v_{2,i}}^2 = \tfrac{1}{2}m_1{v_{1,f}}^2 + \tfrac{1}{2}m_2{v_{2,f}}^2$$

$$KE_i = \tfrac{1}{2}(0.015\text{ kg})(0.225\text{ m/s})^2 + \tfrac{1}{2}(0.030\text{ kg})(-0.180\text{ m/s})^2 = 8.7 \times 10^{-4}\text{ kg}\cdot\text{m}^2/\text{s}^2 = 8.7 \times 10^{-4}\text{ J}$$

$$KE_f = \tfrac{1}{2}(0.015\text{ kg})(0.315\text{ m/s})^2 + \tfrac{1}{2}(0.030\text{ kg})(0.090\text{ m/s})^2 = 8.7 \times 10^{-4}\text{ kg}\cdot\text{m}^2/\text{s}^2 = 8.7 \times 10^{-4}\text{ J}$$

Kinetic energy is conserved.

PRACTICE G

Elastic Collisions

1. A 0.015 kg marble sliding to the right at 22.5 cm/s on a frictionless surface makes an elastic head-on collision with a 0.015 kg marble moving to the left at 18.0 cm/s. After the collision, the first marble moves to the left at 18.0 cm/s.

a. Find the velocity of the second marble after the collision.

b. Verify your answer by calculating the total kinetic energy before and after the collision.

2. A 16.0 kg canoe moving to the left at 12.5 m/s makes an elastic head-on collision with a 14.0 kg raft moving to the right at 16.0 m/s. After the collision, the raft moves to the left at 14.4 m/s. Disregard any effects of the water.

a. Find the velocity of the canoe after the collision.

b. Verify your answer by calculating the total kinetic energy before and after the collision.

3. A 4.0 kg bowling ball sliding to the right at 8.0 m/s has an elastic head-on collision with another 4.0 kg bowling ball initially at rest. The first ball stops after the collision.

a. Find the velocity of the second ball after the collision.

b. Verify your answer by calculating the total kinetic energy before and after the collision.

4. A 25.0 kg bumper car moving to the right at 5.00 m/s overtakes and collides elastically with a 35.0 kg bumper car moving to the right. After the collision, the 25.0 kg bumper car slows to 1.50 m/s to the right, and the 35.0 kg car moves at 4.50 m/s to the right.

a. Find the velocity of the 35 kg bumper car before the collision.

b. Verify your answer by calculating the total kinetic energy before and after the collision.