Homework Problems

1. A large 10 kg sports ball is caught by a 70 kg student on the track team. If the ball was moving at 4.0 m/s and the student was stationary before catching the ball, how fast will the student be moving after catching the ball?

Answer: 0.5 m/s

2. An 0.010 kg bullet is fired down the barrel of a gun, which is pointed to the left. The bullet accelerates from rest to a velocity of 400 m/s. What velocity does the 1.5 kg gun acquire as a result of this impulse? (Note that neither the bullet nor the gun was moving before the “collision.”)

Answer: 2.7 m/s to the right

Use this space for summary and/or additional notes:
Although Blank momentum bar charts are not provided for the remaining problems, feel free to draw them if you would find them helpful.

3. A 730 kg Mini runs into a stationary 2500 kg sport utility vehicle. If the Mini was moving at $10. \frac{m}{s}$ initially, how fast will it be moving after making a completely inelastic collision with the SUV?

Answer: $2.3 \frac{m}{s}$

4. A 6.0 kg bowling ball moving at $3.5 \frac{m}{s}$ toward the back of the alley makes a collision, head-on, with a stationary 0.70 kg bowling pin. If the ball is moving $2.77 \frac{m}{s}$ toward the back of the alley after the collision, what will be the velocity (magnitude and direction) of the pin?

Answer: $6.25 \frac{m}{s}$ toward the back of the alley

5. A pair of 0.20 kg billiard balls make an elastic collision. Before the collision, the 4-ball was moving $0.50 \frac{m}{s}$ to the east, and the 8-ball was moving $1.0 \frac{m}{s}$ to the west. After the collision, the 4-ball is now moving at $1.0 \frac{m}{s}$ to the west. What is the velocity (magnitude and direction) of the 8-ball after the collision?

Answer: $0.50 \frac{m}{s}$ to the east

Use this space for summary and/or additional notes:
6. A pair of billiard balls, each with mass \( m \), make an elastic collision. Before the collision, the 4-ball was moving with a velocity of \( \vec{v}_{4,i} \), and the 8-ball was moving with a velocity of \( \vec{v}_{8,i} \). After the collision, the 4-ball is now moving with a velocity of \( \vec{v}_{4,f} \). What is the velocity of the 8-ball after the collision? (You may use your work from problem #5 above to guide your algebra.)

Answer: \[ \vec{v}_{8,f} = \vec{v}_{4,i} + \vec{v}_{8,i} - \vec{v}_{4,f} \]

7. A 75 kg astronaut on a spacewalk pushes to the south on a 1000 kg satellite. If the velocity of the satellite after the push is \( 0.75 \text{ m/s} \), what is the velocity of the astronaut?

Answer: \( 10 \text{ m/s} \) to the north