

5. A dry cleaner throws a <sup>A</sup>22 kg bag of laundry onto a stationary <sup>B</sup>9 kg car. The cart and laundry bag begin moving at 3 m/s. Determine the speed with which the bag was thrown.

$M_A = 22 \text{ kg}$   
 $M_B = 9 \text{ kg}$   
 $v_{Ai} = ?$   
 $v_{Bi} = 0$   
 $v_f = 3 \text{ m/s}$

$(A) \rightarrow (B) \quad | \quad (A+B) \rightarrow ?$

$$M_A v_{Ai} + M_B v_{Bi} = (M_A + M_B) v_f$$

$$(22 \text{ kg})(v_{Ai}) = (22 \text{ kg} + 9 \text{ kg})(3 \text{ m/s})$$

$$v_{Ai} = 4.23 \text{ m/s}$$

6. A tennis player places a <sup>A</sup>55 kg ball machine on a frictionless surface. The machine fires a <sup>B</sup>0.057 kg tennis ball with a velocity of 36 m/s. How fast does the machine roll backwards?

$M_A = 55 \text{ kg}$   
 $M_B = 0.057 \text{ kg}$   
 $v_{Ai} = 0$   
 $v_{Bi} = 0$   
 $v_{Bf} = 36 \text{ m/s}$   
 $v_{Af} = ?$

$(A) (B) \quad | \quad \leftarrow (A) (B) \rightarrow$

$$M_A v_{Ai} + M_B v_{Bi} = M_A v_{Af} + M_B v_{Bf}$$

$$-M_A v_{Af} = M_B v_{Bf}$$

$$-(55 \text{ kg})(v_{Af}) = (0.057 \text{ kg})(36 \text{ m/s})$$

$$v_{Af} = -0.037 \text{ m/s}$$

7. A <sup>A</sup>0.012 kg toy car moving at 0.2 m/s has a collision with a <sup>B</sup>0.02 kg toy car moving in the opposite direction at 0.3 m/s. After the collision, the 0.012 kg car moves backwards with a velocity of 0.37 m/s. Find the speed of the 0.02 kg car after the collision.

$M_A = 0.012 \text{ kg}$   
 $M_B = 0.02 \text{ kg}$   
 $v_{Ai} = 0.2 \text{ m/s}$   
 $v_{Bi} = -0.03 \text{ m/s}$   
 $v_{Af} = -0.37 \text{ m/s}$   
 $v_{Bf} = ?$

$(+ \rightarrow) (A) \rightarrow \leftarrow (B) \quad | \quad \leftarrow (A) (B) ?$

$$M_A v_{Ai} + M_B v_{Bi} = M_A v_{Af} + M_B v_{Bf}$$

$$(0.012 \text{ kg})(0.2 \text{ m/s}) + (0.02 \text{ kg})(-0.03 \text{ m/s}) = (0.012 \text{ kg})(-0.37 \text{ m/s}) + (0.02 \text{ kg})v_{Bf}$$

$$v_{Bf} = 0.042 \text{ m/s}$$

8. A <sup>A</sup>65 kg ice skater moving with a velocity 2.5 m/s is holding a <sup>B</sup>0.15 kg snowball. She throws the snowball forward with a velocity of 32 m/s relative to the ground. What is the speed of the ice skater after throwing the snowball?

$M_A = 65 \text{ kg}$   
 $M_B = 0.15 \text{ kg}$   
 $v_{Ai} = v_{Bi} = 2.5 \text{ m/s}$   
 $v_{Bf} = 32 \text{ m/s}$   
 $v_{Af} = ?$

$(A+B) \rightarrow \quad \{ \quad (A) ? (B) \rightarrow$

$$(M_A + M_B) v_{Ai} = M_A v_{Af} + M_B v_{Bf}$$

$$(65 \text{ kg} + 0.15 \text{ kg})(2.5 \text{ m/s}) = (65 \text{ kg})(v_{Af}) + (0.15 \text{ kg})(32 \text{ m/s})$$

$$v_{Af} = 2.43 \text{ m/s}$$