

Section II: Conservation of Momentum

1. A 16 kg canoe traveling at 12 m/s makes a head-on collision with a 4 kg raft moving in the opposite direction at 6 m/s. After the collision the raft moves **backwards** at 22.7 m/s. Determine the speed of the canoe after the collision.

i	f
$M_A = 16 \text{ kg}$ $V_{Ai} = 12 \text{ m/s}$ $M_B = 4 \text{ kg}$ $V_{Bi} = -6 \text{ m/s}$	$V_{Bf} = 22.7 \text{ m/s}$ $V_{Af} = ?$



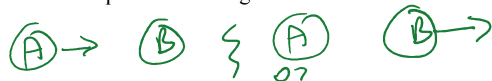
$$M_A V_{Ai} + M_B V_{Bi} = M_A V_{Af} + M_B V_{Bf}$$

$$(16 \text{ kg})(12 \text{ m/s}) + (4 \text{ kg})(-6 \text{ m/s}) = (16 \text{ kg}) V_{Af} + (4 \text{ kg})(22.7 \text{ m/s})$$

$$V_{Af} = 4.83 \text{ m/s}$$

2. A 2 kg ball traveling at 5 m/s collides with a 1 kg ball at rest. After the collision the 1 kg ball moves off with a speed of 7 m/s. Find the final speed of the 2 kg ball.

i	f
$M_A = 2 \text{ kg}$ $V_{Ai} = 5 \text{ m/s}$ $M_B = 1 \text{ kg}$ $V_{Bi} = 0 \text{ m/s}$	$V_{Bf} = 7 \text{ m/s}$ $V_{Af} = ?$



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

$$(2 \text{ kg})(5 \text{ m/s}) = (2 \text{ kg}) V_{Af} + (1 \text{ kg})(7 \text{ m/s})$$

$$V_{Af} = 1.50 \text{ m/s}$$

3. A 63 kg ice skater finishes her performance and crossed the finish line with a speed of 10.8 m/s. Suppose she accepts a huge 4.4 kg bouquet of flowers. Find her new speed.

i	f
$M_A = 63 \text{ kg}$ $V_{Ai} = 10.8 \text{ m/s}$ $M_B = 4.4 \text{ kg}$ $V_{Bi} = 0 \text{ m/s}$	$V_f = ?$



$$M_A V_{Ai} + M_B V_{Bi} = (M_A + M_B) V_f$$

$$(63 \text{ kg})(10.8 \text{ m/s}) = (63 \text{ kg} + 4.4 \text{ kg}) V_f$$

$$V_f = 10.1 \text{ m/s}$$

4. A 15,000 kg railroad car moving at 7 m/s collides and sticks to a 2nd car with a mass of 17,000 kg that is moving in the **same** direction at 1.5 m/s. What is the speed of the joined cars after the collision?

i	f
$M_A = 15000 \text{ kg}$ $V_{Ai} = 7 \text{ m/s}$ $M_B = 17000 \text{ kg}$ $V_{Bi} = 1.5 \text{ m/s}$	$V_f = ?$



$$M_A V_{Ai} + M_B V_{Bi} = (M_A + M_B) V_f$$

$$(15000 \text{ kg})(7 \text{ m/s}) + (17000 \text{ kg})(1.5 \text{ m/s}) = (15000 \text{ kg} + 17000 \text{ kg}) V_f$$

$$V_f = 4.08 \text{ m/s}$$