

Chapter Five Answers:

1. $P_b = P_a$

$$P_m + P_b = P_a + P_b$$

$$M_m V_m + M_b V_b = M_a V_a + M_b V_b$$

$$0 + 0 = M_a V_a + M_b V_b$$

$$-(70\text{kg})V_m = (5\text{kg})(+20)$$

$$-70 V_a = 100$$

$$-70 V_a / -70 = 100 / -70$$

$$\underline{V_a = -1.43 \text{ m/s}}$$

2. $P_b = P_a$

$$0 = M_a V_a + M_b V_b$$

$$-M_f V_f = M_s V_s$$

$$-(30)(-40) = 20(V_s)$$

$$1200 = 20V_s$$

$$1200 / 20$$

$$\underline{+60 = V_s}$$

3. $P_b = P_a$

$$3000 = MV$$

$$3000 = 250V$$

$$V = 12 \text{ m/s}$$

$$\underline{P_a = 2400 \text{ m/s}}$$

4. **A:** $I = F$ change in time

$$I = (50\text{N})(10\text{s})$$

$$\underline{I = 500\text{N}}$$

B: Change in momentum = 500 kg * m/s

C: Change in momentum = mass * change in velocity

$$\text{Change in momentum} = \text{mass} (V_a - V_b)$$

$$500 = 20 (V_a - 0)$$

$$25 = V_a - 0$$

$$\underline{V_a = 25 \text{ m/s}}$$

D: Change in momentum = $m(V_a - V_b)$

$$500 = 20(V_a - 15)$$

$$25 = V_a - 15$$

$$\underline{V_a = 40}$$

5. **A:** Change in momentum = mass * change in velocity

$$\text{Change in momentum} = \text{mass} (V_a - V_b)$$

$$\text{Change in momentum} = (0.20) (35-0)$$

$$\underline{\text{Change in momentum} = 7\text{kg} * \text{m/s}}$$

B: $I = \text{Change in momentum}$

$$\underline{I = 7 \text{ N}\cdot\text{s}}$$

C: $I = F * \text{Change in time}$

$$7 = F (0.002)$$

$$F = 7\text{N}\cdot\text{s} / 0.002 \text{ s}$$

$$\underline{F = 350 \text{ N}}$$

6. $I = \text{Change in momentum}$

$$F * \text{Change in time} = \text{mass} * \text{change in velocity}$$

$$F * \text{Change in time} = m(V_a - V_b)$$

$$F (0.015) = 0.25 (-50 - (+50))$$

$$F(0.015) = 0.25 (-100)$$

$$F(0.015) = -25$$

$$\underline{F = -1,667\text{N}}$$

7. $P_b = P_a$

$$M_1 V_1 + M_2 V_2 = M V_a + M_2 V_a$$

$$M_1 V_1 + M_2 V_2 = V_a (M_1 + M_2)$$

$$10(15 \text{ m/s}) + 0 = V_a (10+5)$$

$$150 = V_a (15)$$

$$\underline{V_a = 10\text{m/s}}$$

8. $M_1 V_1 + M_2 V_2 = M_1 V_1 + M_2 V_2$

$$(0.025) (400) + 0 = 1.5V_1 + 0.025(150)$$

$$10 = 1.5V_1 + 3.75$$

$$6.25 = 1.5V_1$$

$$\underline{V_1 = 4.167 \text{ m/s}}$$