

P.232

1-5, 7, 8

1. There must be no unbalanced external forces acting on the system.

2.  $m_s = 55 \text{ kg}$   
 $m_B = 4.6 \text{ kg}$   
 $\vec{v}_i = 2.0 \text{ m/s [E]}$   
 $v_{sB} = 1.9 \text{ m/s [E]}$   
 $v_{sw}' = 1.9 \text{ m/s [E]} + \vec{v}_{Bw}'$   
 $= 3.9 \text{ m/s [E]}$

$$\vec{p}_i = (m_s + m_B) \vec{v}_i \quad \vec{p}_f = m_s \vec{v}_{sw}' + m_B \vec{v}_{Bw}'$$

$$(m_s + m_B) \vec{v}_i = m_s \vec{v}_{sw}' + m_B \vec{v}_{Bw}'$$

$$(m_s + m_B) v_i = m_s (1.9 + v_{Bw}') + m_B v_{Bw}'$$

$$(m_s + m_B) \vec{v}_i = 1.9 m_s + m_s \vec{v}_{Bw}' + m_B \vec{v}_{Bw}'$$

$$(m_s + m_B) v_i - 1.9 m_s = v_{Bw}' (m_s + m_B)$$

$$v_{Bw}' = \frac{(m_s + m_B) v_i - 1.9 m_s}{(m_s + m_B)} = \frac{(55 + 4.6)(2.0) - 1.9(55)}{(55 + 4.6)}$$

$$= 0.25 \text{ m/s [E]}$$

3.  $m_1 = 35.6 \text{ kg}$   
 $v_1' = 2.42 \text{ m/s}$   
 $v_2' = -3.25 \text{ m/s}$

$$p_i = 0$$

$$p_f = m_1 v_1' + m_2 v_2'$$

$$m_1 v_1' + m_2 v_2' = 0$$

$$m_2 = \frac{-m_1 v_1'}{v_2'}$$

$$= \frac{-35.6(2.42)}{-3.25}$$

$$m_2 = 26.5 \text{ kg}$$

$$4. \quad m_p = 80 \text{ kg}$$

$$m_B = 0.14 \text{ kg}$$

$$v_B' = 50 \text{ m/s}$$

$$p_i = 0$$

$$p_f = m_B v_B' + m_p v_p'$$

$$m_B v_B' + m_p v_p' = 0$$

$$v_p' = \frac{-m_B v_B'}{m_p} = \frac{0.14(50)}{80}$$

$$= -0.0875 \text{ m/s}$$

$$5. \quad m_1 = 4.5 \text{ kg}$$

$$m_2 = 6.2 \text{ kg}$$

$$v_1 = 0 \text{ m/s}$$

$$v_2 = 16 \text{ m/s [E]}$$

$$v_2' = 10 \text{ m/s [E]}$$

$$p_i = m_2 v_2$$

$$p_f = m_1 v_1' + m_2 v_2'$$

$$m_2 v_2 = m_1 v_1' + m_2 v_2'$$

$$v_1' = \frac{m_2 v_2 - m_2 v_2'}{m_1} = \frac{m_2 (v_2 - v_2')}{m_1}$$

$$= \frac{6.2(16-10)}{4.5} = 8.2\bar{6} \text{ m/s [E]}$$

$$7. \quad m_1 = 2.5 \text{ kg}$$

$$m_2 = 7.5 \text{ kg}$$

$$v_1 = 6 \text{ m/s}$$

$$v_2 = -15 \text{ m/s}$$

$$v_1' = v_2' = v'$$

$$p_i = m_1 v_1 + m_2 v_2$$

$$p_f = (m_1 + m_2) v'$$

$$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v'$$

$$v' = \frac{m_1 v_1 + m_2 v_2}{(m_1 + m_2)}$$

$$= \frac{2.5(6) + 7.5(-15)}{(2.5 + 7.5)}$$

$$v' = -9.75 \text{ m/s}$$

8. Throwing tools in to opposite direction of the airlock will cause her momentum to increase in the direction of the airlock in order to conserve momentum.