66. (a) Consider the three blocks as a system with mass of

\[ M = m_1 + m_2 + m_3 = 1.0 \text{ kg} + 2.0 \text{ kg} + 3.0 \text{ kg} = 6.0 \text{ kg}. \]

\[ a = \frac{\Sigma F}{M} = \frac{18.0 \text{ N}}{6.0 \text{ kg}} = 3.0 \text{ m/s}^2 \]

(b) For \( m_1 \): \( F_{net} = T_1 = m_1 a = (1.0 \text{ kg})(3.0 \text{ m/s}^2) = 3.0 \text{ N} \).

For \( m_2 \): \( F_{net} = T_2 - T_1 = m_2 a = (2.0 \text{ kg})(3.0 \text{ m/s}^2) = 6.0 \text{ N} \). so \( T_2 = 6.0 \text{ N} + T_1 = 9.0 \text{ N} \).

67. The free-body diagrams of the three objects.

For \( m_1 \): \( T_1 - m_1 g = m_1 a \), (1)

For \( m_2 \): \( T_2 - T_1 = m_2 a \), (2)

For \( m_3 \): \( m_3 g - T_2 = m_2 a \), (3)

(1) + (2) + (3) gives \( (m_2 - m_1)g = (m_1 + m_2 + m_3) a \),

so \( a = \frac{(m_2 - m_1)g}{m_1 + m_2 + m_3} \)

(a) \( a = \frac{(0.50 \text{ kg} - 0.25 \text{ kg})(9.80 \text{ m/s}^2)}{0.25 \text{ kg} + 0.50 \text{ kg} + 0.25 \text{ kg}} = 2.5 \text{ m/s}^2 \) to right

(b) \( a = \frac{(0.15 \text{ kg} - 0.35 \text{ kg})(9.80 \text{ m/s}^2)}{0.35 \text{ kg} - 0.15 \text{ kg} - 0.50 \text{ kg}} = -2.0 \text{ m/s}^2 \). So it is \( 2.0 \text{ m/s}^2 \) to left.

68. (a) Since the two objects accelerate together, they have the same acceleration, \( a \). Also according to Newton's third law, the tension on \( m_1 \) (up) is the same as the tension on \( m_2 \) (up).

For \( m_1 \): \( \Sigma F = T - m_1 g = m_1 a \), (1)

For \( m_2 \): \( \Sigma F = m_2 g - T = m_2 a \), (2)

(1) + (2) gives \( (m_2 - m_1)g = (m_1 + m_2) a \),

so \( a = \frac{(m_2 - m_1)g}{m_1 + m_2} = \frac{(0.80 \text{ kg} - 0.55 \text{ kg})(9.80 \text{ m/s}^2)}{0.55 \text{ kg} - 0.80 \text{ kg}} = 1.8 \text{ m/s}^2 \).

(b) From (1), \( T = m_1 (a + g) = (0.55 \text{ kg})(1.8 \text{ m/s}^2 + 9.80 \text{ m/s}^2) = 6.4 \text{ N} \).

69. From the result of 4.68a, \( a = \frac{(m_2 - m_1)g}{m_1 + m_2} = \frac{(0.25 \text{ kg} - 0.20 \text{ kg})(9.80 \text{ m/s}^2)}{0.25 \text{ kg} - 0.20 \text{ kg}} = 1.1 \text{ m/s}^2 \), up.