# Chapter 4 - Newton's Laws of Motion

## Physics 206

**Group 1 Problems:**
**Problem 1a:** The block and the floor. The rope and block A. The rope and block B. Block A and the earth (gravity). Block B and the earth (gravity).
**Problem 1b:**
**Problem 1c:**
**Problem 1d:**
**Problem 1e:**

**Problem 2:**

$$v_{Bert} = \frac{F}{m}t$$
$$v_{Al} = \frac{F}{M}t$$
$$M\vec{v}_A + m\vec{v}_B = 0$$

**Problem 3:**

$$F_c = \frac{M}{m+M}F$$

**Problem 4:**

$$F = m\frac{v^2 - v_0^2}{2\Delta x}$$
$$v = 0 \rightarrow F = 62.5 \text{ N}$$
$$v = 5 \rightarrow F = 46.9 \text{ N}$$

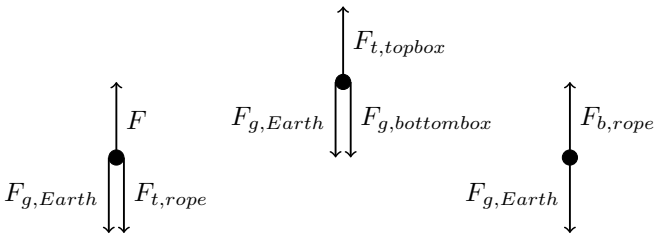
**Problem 5:**

(a) $F_N = m_M g$
(b) $F_N = m_M g$
(c) $F_N = m_M(g + a)$
(d) $F_N = m_M(g - a)$
(e) $F_N = m_M g$
(f) $F_N = m_M(g + a\cos(30))$

**Group 2 Problems:**
**Problem 6:**

a) $F_N = (m_A - m_B)g$
b) $F_N = 0$
c) $v = \sqrt{2gh\frac{m_B - m_A}{m_B + m_A}}$

**Problem 7:**




(b) $a = 3.53 \text{ m/s}^2$
(c) $F_t = 120 \text{ N}$
(d) $F_{mid} = 93.3 \text{ N}$

**Problem 8:**

a) $F = 59.1 \text{ N}$
b) $F = 372 \text{ N}$

**Problem 9:**

(a) $m_B = 7.50 \text{ kg}$
(b) $m_B \geq 7.50 \text{ kg}$
(c) $m_B \leq 7.50 \text{ kg}$

**Problem 10:**

$d = 6.30$ m so 3.15 above the anchor.

**Group 3 Problems:**
**Problem 11:**

(a) $\frac{m_1}{m_2} = \frac{\sin\beta}{\sin\alpha}$
(b) $a = 1.37 \text{ m/s}^2$ upwards for $m_1$

**Problem 12:**

$$y(t) = \frac{1}{6m}k_3 t^3$$
$$x(t) = \frac{1}{2m}k_1 t^2 + \frac{1}{120m^2}k_2 k_3 t^5$$

**Problem 13**

$$v(t) = g\ln(2 + 5.00 \times 10^{-4}e^t) - g\ln(2 + 5.00 \times 10^{-4})$$
$$v(20) = 114.7 \text{ m/s}$$

**Problem 14:**

(b) $|v| = gt_1 = 39.2$ m/s

(c) $t_2 - t_1 = 14.1$ s

(d) $\Delta y = -312$ m

(e) $t_{total} = 40.0$ s

(f) $v_{ave} = -12.5$ m/s