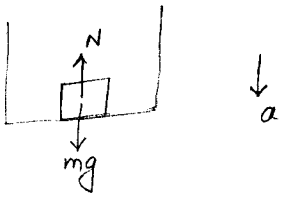
Solutions to MT02 PHYS-203A Spring 2016

Prob. 1



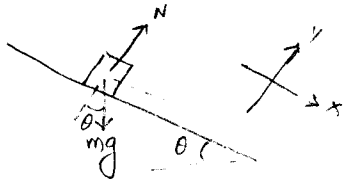
$$N - mg = -ma$$

$$N = mg - ma$$

$$= 95(9.8 - 1.0)$$

$$= 836\ N$$

Prob. 2



$$a = g\sin\theta = 9.8\sin 20 = 3.35\ m/s^2$$

$$v_i = -3.5\ \frac{m}{s}$$

$$\Delta x = 0$$

$$v_f =$$

$$\Delta t = ?$$

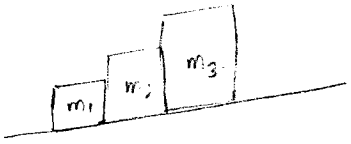
$$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

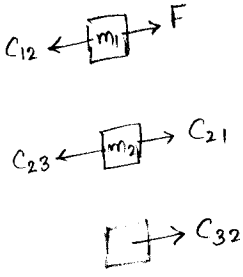
$$0 = -3.5\,\Delta t + \frac{1}{2} 3.35\,\Delta t^2$$

$$3.5\,\Delta t = \frac{3.35}{2}\,\Delta t^2$$

$$2.09\ s = \frac{3.5 \times 2}{3.35} = \Delta t$$

Prob. 3





$$F - C_{12} = m_1 a$$

$$C_{21} - C_{23} = m_2 a$$

$$C_{32} = m_3 a$$

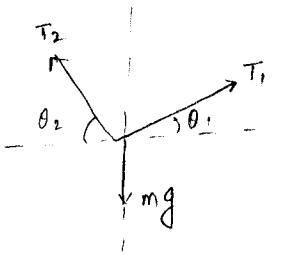
$$F = (m_1 + m_2 + m_3)\,a$$

$$\Rightarrow a = \frac{F}{(m_1 + m_2 + m_3)} = \frac{8.25}{(1.50 + 4.50 + 7.50)} = 0.611\ m/s^2$$

$$C_{12} = F - m_1 a = 8.25 - 1.50 \times 0.611$$

$$= 7.33\ N$$

Prob. 4



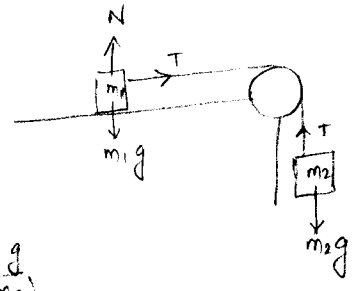
$$\vec{T_1} + \vec{T_2} + m\vec{g} = 0$$

$$T_1 \cos\theta_1 - T_2 \cos\theta_2 = 0$$

$$T_1 \sin\theta_1 + T_2 \sin\theta_2 = mg$$

$$\left.\begin{aligned} T_1\, 0.940 - T_2\, 0.643 &= 0 \\ T_1\, 0.342 + T_2\, 0.766 &= 118 \end{aligned}\right\} \Rightarrow \begin{aligned} T_1 &= 80.7\ N \\ T_2 &= 118\ N \end{aligned}$$

Prob. 5



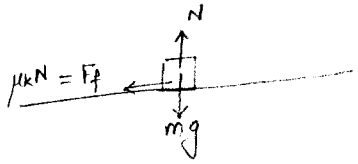
m_1: $T = m_1 a$

m_2: $m_2 g - T = m_2 a$

$$m_2 g = (m_1 + m_2)\, a \Rightarrow a = \frac{m_2 g}{(m_1 + m_2)}$$

$$T = \frac{m_1 m_2}{(m_1 + m_2)}\, g = \frac{45 \times 15}{(45+15)}\, 9.8 = 110.3\ N$$

Prob. 6



$$F_f = \mu_k N = \mu_k mg$$

$$-\mu_k \cancel{m} g = \cancel{m} a$$

$$a = -\mu_k g = -0.60 \times 9.8 = -5.88\ \frac{m}{s^2}$$

$V_i = +35.0\ \frac{m}{s}$

$V_f = 0$

$a = -5.88\ \frac{m}{s^2}$

$\Delta x = ?$

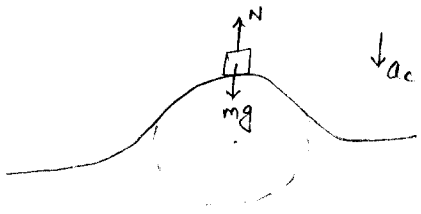
$\Delta t = ?$

$$\Delta x = \frac{V_f^2 - V_i^2}{2a} = \frac{0^2 - 35.0^2}{2 \times (-5.88)} = 104\ m$$

Prob. 7

$$a_c = \frac{v^2}{R} = \frac{30.0^2}{150} = 6.0 \frac{m}{s^2}$$

Prob. 8



$$mg - N = ma_c$$

car leaves the road when $N = 0$.

$$mg = ma_c$$

$$g = a_c$$

$$g = \frac{v^2}{R}$$

$$v = \sqrt{Rg} = \sqrt{150 \times 9.8} = 38.3 \frac{m}{s}$$