Chapter 5 - Applications of Newton's Laws

Physics 206

Group 1 Problems:
Problem 1:

$$F_N = mg \cos \phi$$
$$F_\| = mg \sin \phi$$

Problem 2: $29.2 \text{ N} \leq F \leq 39.1 \text{ N}$

Problem 3:

$$N = 26 \text{ stones}$$
$$a = 0.65 \text{ m/s}^2$$

Problem 4:

$$\Delta x = 4.25 \text{ m}$$

Problem 5:

$$F_T = 1220 \text{ N}$$
$$F_T = 443 \text{ N}$$

Group 2 Problems:
Problem 6:

$$h = \frac{v_0^2 \sin \theta}{2g(\sin \theta + \mu_k \cos \theta)}$$
$$\mu_s = \tan \theta$$

Problem 7:

$$\frac{F_{push}}{F_{pull}} = 1.55$$

Problem 8:

(a) $F_h = mg \tan \beta$
$$F_v = \frac{mg}{\cos \beta}$$
(b) Ratio $= \cos^2 \beta$
(c) $a = g \sin \theta$

Problem 9:

$$t_1 = 0.530 \text{ s}$$
$$t_2 = 0.749 \text{ s}$$

Problem 10:

(a) $R = 6610 \text{ m}$
(b) $R = 3670 \text{ m}$

Group 3 Problems:
Problem 11a: Car A makes it farther

$$d_A = \frac{\mu_s gR}{2a}$$
$$d_B = \frac{\mu_s gR}{4a}$$
$$t_A = \frac{\sqrt{\mu_s gR}}{a}$$
$$t_B = \frac{\sqrt{\mu_s gR}}{\sqrt{2}a}$$

Problem 12:

(a) $3.60 \leq m_B \leq 11.4 \text{ kg}$
(b) $a = 0.482 \text{ m/s}^2$ up the ramp
(d) $a = 0.684 \text{ m/s}^2$ down the ramp
(c) $m_B = 10.1 \text{ kg}$
(e) $m_B = 4.90 \text{ kg}$

Problem 13:

$$T_{min} = 0.216 \text{ s}$$
$$T_{max} = 0.708 \text{ s}$$

Problem 14:

$$F = 23.5 \text{ N}$$
$$a = 1.57 \text{ m/s}^2$$

Problem 15:

(a) $m_C = 2.60 \text{ kg}$
(b) $a = 1.70 \text{ m/s}^2$
(c) $\Delta x = 1.60 \text{ m}$