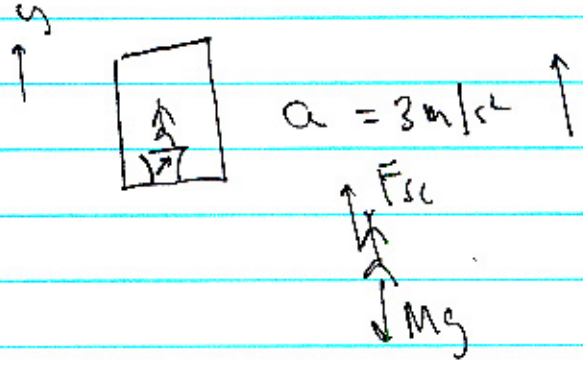
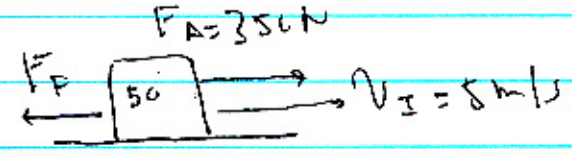
(1)



$F_{sc} - Mg = Ma_y \Rightarrow F_{sc} = M(g + a_y)$

$= 50(9.8 + 3)\,N = \boxed{640\,N}$

(2)



$F_f = \mu_k M g$

$F_A - F_f = Ma_x$

$350 - 0.5 \times 9.8 \times 50 = 50\,a_x$

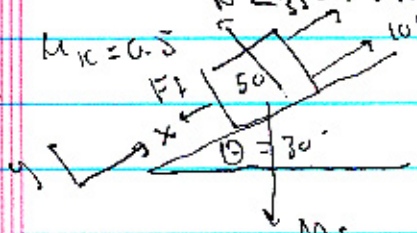
$a_x = \dfrac{350 - 0.5 \times 9.8 \times 50}{50}\ m/s^2$

$= 7 - 4.9\ m/s^2 = 2.1\ m/s^2$

$v_F = v_I + at = 5 + 2.1 \times 5\ m/s = 15.5\ m/s$

$\Delta x = \frac{1}{2}(v_I + v_F)t = 0.5 \times (5 + 15.5) \times 5\ m = \boxed{51.25\ m}$

(3)



$F_A - F_f - Mg\sin\theta = Ma_x$

$F_f = \mu_K Mg\cos\theta$

$F_A - \mu_K Mg\cos\theta - Mg\sin\theta = Ma_x$

$a_x = \dfrac{F_A}{M} - g(\mu_K \cos\theta + \sin\theta)$

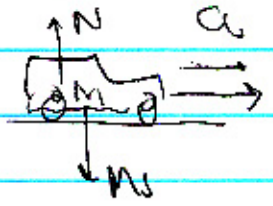
$a_x = \dfrac{350}{50} - 9.8(0.5 \times 0.866 + 0.5)\ m/s^2$

$= 7 - 9.14\ m/s^2 = -2.14\ m/s^2$

$0 = v_F = v_I + at \Rightarrow t = \dfrac{v_I}{-a} = \dfrac{10}{2.14}\ s = \boxed{4.67\ s}$

Phy2004 Exam 2 Solutions

(4)



$N = Mg \qquad F_f = Ma \qquad F_f \le \mu_s N$

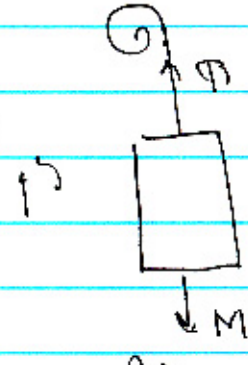
$F_f \le \mu_s Mg$

So

$\mu_s Mg \ge F_f = Ma$

i.e. $\mu_s Mg \ge Ma \Rightarrow \mu_s \ge \frac{a}{g} = \frac{3.0}{9.8} = \boxed{0.38}$

(5) 2000 lbs = M



$T - Mg = Ma_y$

$T = M(g + a_y) = 2\times10^3 (9.8 + 1)\,N$

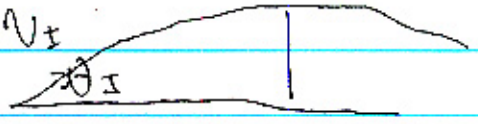
$T = 2.16 \times 10^4\,N$

After t = 5s $\quad v = at = 1 \times 5\ m/s = 5\ m/s$

Power $P = Tv = 2.16 \times 10^4 \times 5\ W$

$= \boxed{1.08 \times 10^5\ W}$

(6)



$\frac{1}{2}Mv_I^2 + Mgy_I = \frac{1}{2}Mv_F^2 + Mgy_F$

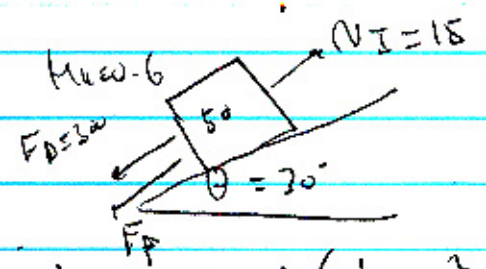
$\Rightarrow y_F - y_I = \frac{1}{2}v_I^2 - \frac{1}{2}v_F^2$

$v_F = v_{Ix} = v_I \cos\theta_I$

$\therefore y_F - y_I = \frac{v_I^2 \sin^2\theta_I}{2g} \Rightarrow v_I^2 = \frac{2g(y_F - y_I)}{\sin^2\theta_I}$

$v_I = \left\{\frac{2\times9.8\times10}{\sin^2 30^\circ}\right\}^{1/2} \left\{\frac{m}{s}\right\} = \left\{\frac{2\times9.8\times10}{(0.5)^2}\right\}^{1/2} \frac{m}{s} = \boxed{28\ m/s}$

(7)



$$W_{NC} = \Delta\left(\tfrac{1}{2}mv^2 + mgh\right)$$

$$-F_A \Delta x - F_f \Delta x = \Delta\left(\tfrac{1}{2}mv^2 + mgh\right)$$

$$F_f = \mu_K m g \cos\theta$$

$$-\left(F_A + \mu_K m g \cos\theta\right)\Delta x = \tfrac{1}{2}m v_F^2 - \tfrac{1}{2}m v_I^2 + mg\Delta x \sin\theta$$

$$\tfrac{1}{2}m v_I^2 = \left(F_A + \mu_K m g \cos\theta + mg\sin\theta\right)\Delta x$$

$$\Delta x = \frac{\tfrac{1}{2}v_I^2}{\frac{F_A}{m} + \mu_K g\cos\theta + g\sin\theta}$$

$$= \frac{0.5 \times 225}{\frac{300}{50} + 0.6 \times 9.8 \times 0.866 + 9.8 \times 0.5} \text{ m}$$

$$= \frac{112.5}{6 + 5.09 + 4.9} \text{ m}$$

$$= \boxed{7.04 \text{ m}}$$

8

$\text{lbs} = \frac{I}{\sim}$

$m = 0.1 \text{ lbs}$

$v_I = 40 \text{ m/s}$

$$\underset{\sim}{I} = \Delta p \qquad 0 = I_x = m(v_{Fx} - v_{Ix}) \Rightarrow v_{Fx} = v_{Ix}$$

$$10 = \frac{I}{m} = m(v_{Fy} - v_{Iy}) = m v_{Fy}$$

$$\Rightarrow v_{Fy} = 10/0.1 = 100 \text{ m/s}$$

$$v_F = \sqrt{v_{Fx}^2 + v_{Fy}^2} = \sqrt{1600 + 10^4} \text{ m/s} = \boxed{108 \text{ m/s}}$$