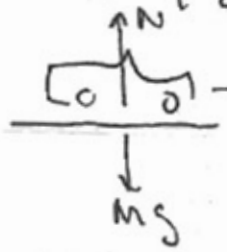
Physics Fall 2007 Exam 2 Solutions

① 

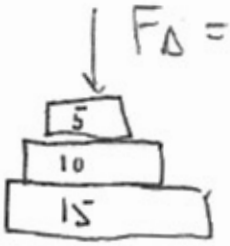
x: $F_x = ma_x = 2\times10^3 \times \frac{40}{10}\ N = 8\times10^3\ N$

y: $N - Mg = 0$

$\Rightarrow N = Mg = 2\times10^3 \times 9.8\ N = 1.96\times10^4\ N$

$F_{Total} = \sqrt{(0.8)^2 + (1.96)^2}\times10^4\ N$

$= \sqrt{0.64 + 3.84}\times10^4\ N = \boxed{2.1\times10^4\ N}$

② 

$-300 - 30\times9.8 = 30\,a_y$

$a_y = -10 - 9.8\ m/s^2 = -19.8\ m/s^2$

$F_{23,y} - 15g = 15a_y$

$F_{23y} = 15\times9.8 - 15\times19.8\ N$

$= -150\ N$

$\boxed{F_{32y} = +150N}$

③ 

$F_{Sc} - M_L g = M_L a_y$

$a_y = \frac{F_{Sc} - M_L g}{M_L}$

$= \frac{300 - 600}{600/9.8} = -\frac{300\times9.8}{600}$

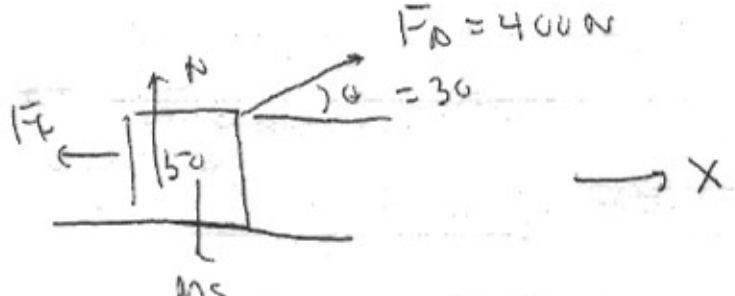
$a_y = -4.9\ m/s^2$

$T - M_{EL} g = M_{EL} a_y$

$T = M_{EL}(a_y + g) = 2\times10^3\,(-4.9 + 9.8)\ N = \boxed{9.8\times10^3\ N}$

Phy 2004 Fall 2007 Exam 2 Solutions

(4)



$F_D\cos\theta - F_F = ma_x$

$F_D\sin\theta + N - mg = 0$

$F_F = \mu_k N = \mu_k(mg - F_D\sin\theta)$

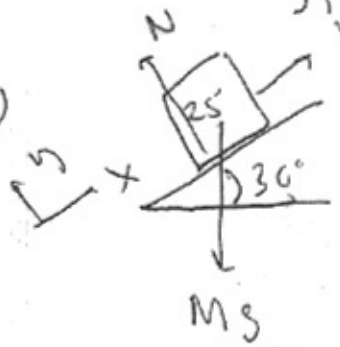
$F_D\cos\theta - \mu_k(mg - F_D\sin\theta) = ma_x > 0$

$\mu_k = \dfrac{F_D\cos\theta}{mg - F_D\sin\theta} = \dfrac{400\cos 30}{50\times 9.8 - 400\sin 30}$

$= \dfrac{346.4}{490 - 200} = \dfrac{346.4}{790} = 1.19$

$= \dfrac{173.2}{390} = 0.44$

(5)

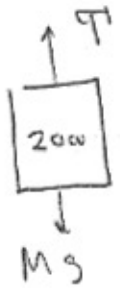


X: $F_F - mg\sin\theta = 0$

$F_F = mg\sin\theta = 25\times 9.8\times 0.5\ N$

$= 122.5\ N$

(6)



$W_T = \Delta\left(\frac{1}{2}mv^2 + mgy\right)$

$= \frac{1}{2}m(5)^2 + m\times 9.8\times 10$

$= 2\times 10^3\{12.5 + 98\}\ J$

$= 2.21\times 10^5\ J$

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(7) $F = ma = 2\times10^3 \times \frac{40}{10}\ N = 8\times10^3\ N$

$\text{Power} = FV = 8\times10^3 \times 4\times10^1\ W$

$= 32\times10^4\ W$

$\approx \boxed{429\ hp}$

(8) $W_{\text{friction}} = \Delta\left(\frac{1}{2}mv^2 + mgy\right)$

$= -\frac{1}{2}\times20\times(5)^2 - 20\times9.8\times10\sin30$

$= -250 - 980\ J$

$= \boxed{1230\ J}$