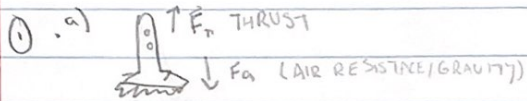


Score: 20/20, great work

JOSEPH EDERA  
20656837

## PHYSICS MIDTERM 2

### CHAPTER 4: DYNAMICS, FORCE AND NEWTON'S LAWS OF MOTION



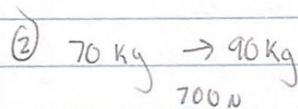
b)  $F_a = 4.5 \times 10^6 \text{ N}$

$\vec{w} = 5 \times 10^5 \text{ kg} (9.81)$   
 $\rightarrow 4.905 \times 10^6 \text{ N}$   
 $F_T = 1.25 \times 10^7 \text{ N}$

$1.25 \times 10^7 - (4.5 \times 10^6 + 4.905 \times 10^6) = 3.$

$\rightarrow 3.095 \times 10^6 \text{ N}$

$\frac{3.095 \times 10^6}{5 \times 10^5} = \boxed{6.19 \text{ m/s}^2}$



a)  $-200 \text{ N}$

(-1) Newton's 3rd law,  
same force opposite direction

3)  $-200 \text{ m/s}^2 = a$

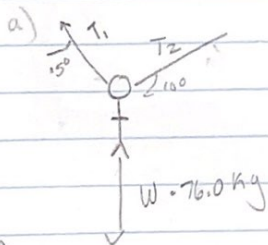
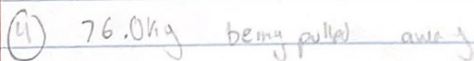
$2000 \text{ kg} = M$

$1000 \text{ N} = F_a$

$2,000 (100)$

$= 400,000 \text{ N} - 100$

$= 3.99 \times 10^5 \text{ N}$



b)  $F_{\text{net},x} = T_2 \cos 10^\circ - T_1 \sin 15^\circ$

$F_{\text{net},x} = 0$

$T_1 \cos 15^\circ = T_2 \sin 10^\circ$

c)  $F_{\text{net},y} = T_1 \sin 15^\circ + T_2 \sin 10^\circ - W$

$W = T_1 \sin 15^\circ + T_2 \sin 10^\circ$

d)  $T_2 \cos 10^\circ - T_1 \sin 15^\circ = 0$   
 $T_2 = T_1 \left( \frac{\sin 15^\circ}{\cos 10^\circ} \right)$

$T_1 \cos 15^\circ + T_2 \sin 10^\circ - mg = 0$

$T_1 = \frac{mg - T_2 \sin 10^\circ}{\cos 15^\circ}$

$\cos 15^\circ \cdot T_1 = \frac{mg - T_1 \left( \frac{\sin 15^\circ}{\cos 10^\circ} \right) \sin 10^\circ}{\cos 15^\circ}$



4) CONTINUED...

$$mg = T_1 \cos 15^\circ + T_2 \left( \frac{\sin 15^\circ}{\cos 10^\circ} \right) \sin 10^\circ$$

$$T_1 = \frac{mg}{\cos 15^\circ + \left( \frac{\sin 15^\circ}{\cos 10^\circ} \right) \sin 10^\circ}$$

$$T_1 = \frac{(76 \text{ kg}) (9.81 \frac{\text{m}}{\text{s}^2})}{\cos 15^\circ + \left( \frac{\sin 15^\circ}{\cos 10^\circ} \right) \sin 10^\circ}$$

$$T_1 = 736.33 \text{ N}$$

$$T_2 = 736.33 \text{ N} \left( \frac{\sin 15^\circ}{\cos 10^\circ} \right) = 143.51 \text{ N}$$

### CHAPTER 5: FRICTION, PRAG & ELASTICITY

① - 120 kg WOODEN CRATE LM

$$\mu_k = 0.5$$

$$g = 9.81 \frac{\text{m}}{\text{s}^2}$$

$$a) F = \mu N$$

$$F = 0.5 (120 \text{ kg}) (9.81 \frac{\text{m}}{\text{s}^2})$$

$$F = 588 \text{ N}$$

1

$$b) F = \mu N$$

$$f = (0.3) (120.0 \text{ kg}) (9.81 \frac{\text{m}}{\text{s}^2})$$

$$F = 353 \text{ N}$$

$$F_{\text{net}} = \mu N$$

$$a = \frac{F_{\text{net}}}{m}$$

$$a = \frac{588 \text{ N} - 353 \text{ N}}{120 \text{ kg}}$$

$$a = 1.96 \frac{\text{m}}{\text{s}^2}$$

② - 25°

$$- 0.1$$

$$a = g \sin \theta - g \cos \theta \mu$$

$$a = g (\sin \theta - \cos \theta \mu)$$

$$= 9.81 \frac{\text{m}}{\text{s}^2} (0.42 - 0.91 \cdot 0.1)$$

$$= 3.23 \frac{\text{m}}{\text{s}^2}$$

③ - 40 m/s

$$- 0.75 \text{ m}^2$$

$$= 1.225 \text{ kg} \cdot \text{m}^3$$

$$- C = 0.75$$

$$- N$$

$$F_D = \frac{1}{2} C \rho A v^2$$

$$F_D = \frac{1}{2} (0.75) (1.225 \text{ kg}) (0.75) (40)^2$$

$$F_D = 551 \text{ N}$$

④ - 2300 kg

$$- 10.0 \text{ m}$$

$$- \text{Radius of Ucm}$$

$$- 3 \text{ m}$$

$$F/A = g(0 + \frac{1}{2})$$

$$y = \frac{F \cdot L}{A \cdot \rho x} \rightarrow y = \frac{2,300 \text{ kg} (9.81 \frac{\text{m}}{\text{s}^2}) \cdot 10}{\pi (4)^2 \cdot 0.037} \rightarrow y = \frac{22,5430}{1.86}$$

$$y = 1.21 \times 10^5 \text{ N/m}^2$$

(-1) Almost, it's  $15 \times 10^9 \text{ N/m}^2$



## CHAPTER 6 - UNIFORM CIRCULAR MOTION & GRAVITATION

① - 144 km/hr  
- 0.5 meters

$$v = \frac{144 \text{ km}}{1 \text{ hr}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ rad}}{0.5 \text{ m}} \times \frac{1 \text{ hr}}{3600 \text{ s}} = 80 \text{ rad/sec}$$

② .0.4 km  
= 170 km/hr

$$\tan \theta = \frac{v^2}{r}$$

$$\theta = \tan^{-1} \left( \frac{v^2}{r} \right)$$

$$\theta = \tan^{-1} \left( \frac{(33.3 \frac{\text{m}}{\text{s}})^2}{(900 \text{ m})} \right)$$

$$\theta = \tan^{-1} (0.126)$$

$$\theta = 7.18^\circ$$

$$\frac{170 \text{ km}}{1 \text{ hr}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ hr}}{3600 \text{ s}} = 47.2 \frac{\text{m}}{\text{s}}$$

③ a) PATH 1

b) - 400m  
- 800m

PATH 1

$$v = \sqrt{(1.981)(400)}$$

$$v = 62.6 \frac{\text{m}}{\text{s}}$$

$$F_c = \frac{mv^2}{r} = m \frac{v^2}{r}$$

$$v = \sqrt{r \frac{F_c}{m}}$$

PATH 2

$$v = \sqrt{(1.981)(800)}$$

$$v = 88.6 \frac{\text{m}}{\text{s}}$$

④ BONUS

a)  $a_c = \frac{v^2}{r}$

$$= \frac{(6.637 \times 10^8) (1.4 \times 10^{12})}{(1.5 \times 10^{12})^2}$$

$$= 4.61 \times 10^{11} \frac{\text{m}}{\text{s}^2}$$

b)  $a_c = \frac{v^2}{r}$

$$= \frac{(6.675 \times 10^{-11}) (8.62 \times 10^{24})}{(2.50 \times 10^{12})^2}$$

$$= 9.2 \times 10^{-10} \frac{\text{m}}{\text{s}^2}$$

$$\frac{4.61 \times 10^{11}}{4.61 \times 10^{-10}}$$

$$= \frac{20,000}{1}$$

(+2) Bonus!