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PHYSICS MIDTERM 2

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

① a)

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

$w = 5 \times 10^5$ kg (9.81)

$\hookrightarrow 4.905 \times 10^6$ N

$F_t = 1.25 \times 10^7$ N

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

$\hookrightarrow = 3.095 \times 10^6$ N

$\frac{30.95 \times 10^6}{5 \times 10^5} = \boxed{6.19\ m/s^2}$

② 70 kg → 90 kg

700 N

a) −200 N

③ $-200\ m/s = a$

2000 kg = M

1000 N = F_0

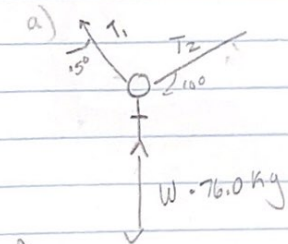
2,000 (200)

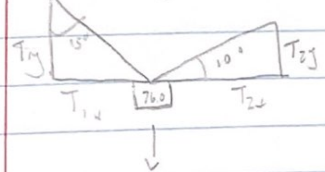
= 400,000 N −100

= 3.99×10^5 N

④ 76.0 kg being pulled away

a)





b) $F_{net,x} = T_{2x} - T_{1x}$

$F_{net,x} = 0$

$T_1 \cos\theta = T_2 \sin\theta$

c) $F_{net} = T_{1y} + T_{2y} - W$

$W = T_{1y} + T_{2y}$

REST

d) $T_2 \cos 10° - T_1 \sin 15° = 0$

$T_2 = T_1 \left(\frac{\sin 15°}{\cos 10°}\right)$

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

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

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

→

4) CONTINUED...

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

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

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

$\boxed{T_1 = 736.33\ N}$

$\boxed{T_2 = 736.33\ N \left(\frac{\sin 15}{\cos 10}\right) = 193.51\ N}$

CHAPTER 5: FRICTION, DRAG & ELASTICITY

1. - 120 Kg WOODEN CRATE IM
   - $\mu = 0.5$
   - $g = 9.81\ m/s$

a) $F = \mu N$

$F = 0.5(120\ kg)(9.81\ m/s^2)$

$\boxed{F = 588\ N}$

b) $F = \mu N$

$F = (0.3)(120.0\ kg)(9.81\ m/s^2)$

$F = 353\ N$

F_{net}

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

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

$\boxed{a = 1.96\ m/s^2}$

2. - 25°
   - 0.1

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

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

$= 9.81\ m/s^2\ (0.42 - 0.091\,\mu)$

$\boxed{= 3.23\ m/s^2}$

3. - 40 m/s
   - $0.75\ m^2$
   - $1.225\ kg \cdot m^{-3}$
   - $C = 0.75$
   - N?

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

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

$\boxed{F_D = 551\ N}$

4. - 2300 kg
   - 10.0 m
   - Radius of 4 cm
   - 3 mm

$F/A = Y(\Delta L/L)$

$Y = \frac{F \cdot L}{A \cdot \Delta x} \rightarrow Y = \frac{2{,}300\ kg\ (9.81) \cdot 10\ m/s}{\pi(4)^2 \cdot 0.037} \rightarrow Y = \frac{225630}{1.86}$

$\boxed{Y = 1.21 \times 10^{5}\ N/m^2}$

CHAPTER 6 - UNIFORM CIRCULAR MOTION & GRAVITATION

1 - 144 Km/hr
- 0.5 meters

$\frac{144\ km}{1\ K} \cdot \frac{1000\ m}{1\ Km} \cdot \frac{1\ rad}{0.5\ m} \cdot \frac{1\ hr}{3600\ s} = \boxed{80\ rad/sec}$

2 - 0.9 Km
- 120 Km/hr

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

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

$\theta = \tan^{-1}\left(\frac{33.3\ \frac{m}{s}^2}{(900\ m)(9.81\ \frac{m}{s})}\right)$

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

$\boxed{\theta = 7.18°}$

$\frac{120\ km}{1\ hr} \cdot \frac{1000\ m}{1\ km} \cdot \frac{1\ hr}{3600} = 33.3\ \frac{m}{s}$

3 a) PATH 2

b) - 400 m
- 800 m

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

$v = \sqrt{r\mu g}$

PATH 1

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

$v = 62.6\ m/s$

PATH 2

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

$= 88.6\ \frac{m}{s}^2$

4 BONUS

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

$= \frac{(6.637 \times 10^{-11})(1.4 \times 10^{22})}{(4.50 \times 10^{17})^2}$

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

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

$= \frac{(6.675 \times 10^{-11})(8.62 \times 10^{27})}{(2.50 \times 10^{12})^2}$

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

$\frac{9.2 \times 10^{-10}}{4.61 \times 10^{-14}}$

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