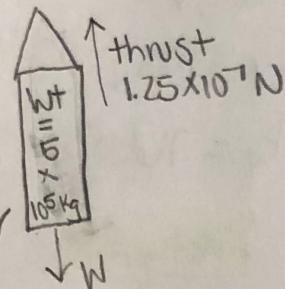


$$\textcircled{1} \quad \text{Weight} = 5 \times 10^5 \text{ kg}$$

$$\uparrow F = 1.25 \times 10^7 \text{ N}$$

$$\text{Air resistance} \downarrow F = 4.5 \times 10^6 \text{ N}$$

a.)



Julie Stauffer
id# 20633921

Score: 19/20,
great job

b.) Find Acceleration

$$F = ma$$

$$F = \text{Thrust} - \text{air resist.} - \text{wt}$$

$$ma = T - \text{air} - \text{wt}$$

$$a = \frac{(1.25 \times 10^7 \text{ N}) - (4.5 \times 10^6 \text{ N}) - (5 \times 10^5 \text{ kg})(9.81 \text{ m/s}^2)}{5 \times 10^5}$$

$$a = 6.2 \text{ m/s}^2$$

\textcircled{2}

$$\frac{P_1}{70 \text{ kg}} \xrightarrow{700 \text{ N}} \frac{P_2}{90 \text{ kg}}$$

P_2 puts equal + opposite F on P_1

\textcircled{3} decelerated at 200 m/s²

$$\text{mass} = 2,000 \text{ kg}$$

$$\text{air resist.} = 1000 \text{ N}$$

$$a = -200 \text{ m/s}^2 \quad \underline{\text{find force}}$$

$$F_x = ma$$

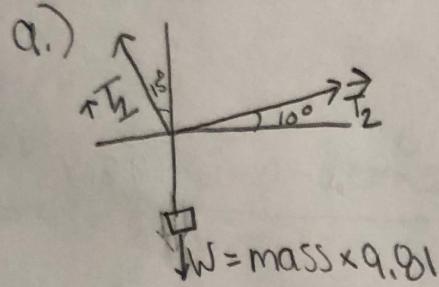
$$= (-200)(2,000)$$

$$F = -4,000 \times 10^5 \text{ N}$$

$$\textcircled{4} \quad \text{mass} = 76 \text{ kg}$$

$$T_1 \rightarrow \theta = 15^\circ, y$$

$$T_2 \rightarrow \theta = 10^\circ, x$$



b.) $F_{\text{net},x}$

$$F_x = ma_x$$

$$F_x = 76(0)_x$$

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

c.) $F_{\text{net},y}$

$$F_y = ma_y$$

$$F_y = 76(0)_y$$

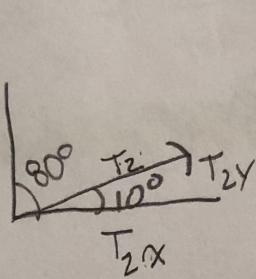
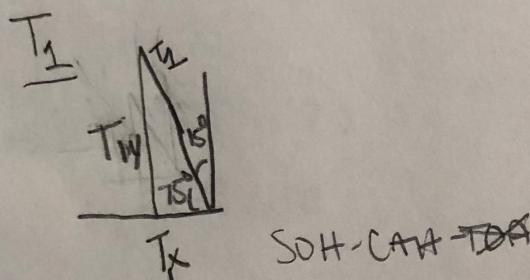
$$F_{\text{net},y} = 0$$

d.) $\vec{F}_{\text{net}} = 0$, find tension in $T_1 + T_2$

$$Wt = m \cdot a$$

$$76 \cdot 9.81$$

$$Wt = 745.56$$



$$\sin 75^\circ = \frac{\text{opp}}{\text{hyp}}$$

$$\cos 75^\circ = -T_{1x}$$

$$T_{1x} = -T_1 \cos 75^\circ$$

$$\sin 75^\circ = \frac{T_{1y}}{T_1}$$

$$\cos 10^\circ = \frac{\text{adj}}{\text{hyp}}$$

$$\cos 10^\circ = \frac{T_{2x}}{T_2}$$

$$T_{2x} = \cos 10^\circ (T_2)$$

$$\sin 10^\circ = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 10^\circ = \frac{T_{2y}}{T_2}$$

$$T_{2y} = T_2 \sin 10^\circ$$

$$T_2 \cos 10^\circ = T_1 \cos 75^\circ$$

$$T_1 = -\frac{T_2 \cos 10^\circ}{\cos 75^\circ}$$

$$\frac{193.753(\cos 10)}{\cos 75}$$

$$T_1 = 737.23 \text{ N}$$

$$T_1 (\sin 75^\circ) + T_2 (\sin 10^\circ) - 745.56 = 0$$

$$\left(\frac{-T_2 \cos 10^\circ}{\cos 75^\circ} \right) \sin 75^\circ + T_2 \sin 10^\circ - 745.56 = 0$$

$$T_2 (3.675) + T_2 (1.173) - 745.56 = 0$$

$$T_2 (3.675) + T_2 (1.173) = 745.56$$

$$\frac{T_2 (3.848)}{3.848} = \frac{745.56}{3.848} \quad T_2 = 193.753 \text{ N}$$

Chapter 5: Friction, drag, elasticity

①

120kg

Coefficients

Kinetic = 0.3

Static = 0.5

a.) max force = static
W · 0.5 = max

$$W = \text{mass} \cdot g$$

$$(120\text{kg})(9.81\text{m/s}^2)$$

$$W = 1177.2\text{N}$$

$$(1177.2)(0.5)$$

$$\text{max force} = 588.6\text{N}$$

$$\text{max} - F_K = a$$

$$588.6 - 353.16 = 120 \text{ m/s}^2$$

$$\frac{235.44}{120} = \frac{120a}{120}$$

$$\text{accel} = 1.962 \text{ m/s}^2$$

b.) force = 588.6N

$$W = 1177.2\text{N}$$

$$\text{Kinetic} = 0.3$$

$$F_K = 0.3(1177.2\text{N})$$

$$f_K = 353.16$$

② Kinetic = 0.1, $\theta = 25^\circ$

Find Accel

$$F_K = \mu_K N$$

$$\cos 25 = -\frac{W_y}{W}$$

$$F_K = \mu_K F_N$$

$$F_K = 0.1(W_y)$$

$$W_y = -W \cos 25^\circ$$

$$W \sin 25 - 0.1(W \cos 25) =$$

$$W(\sin 25 - 0.1(\cos 25)) = \text{max}$$

$$9.81(\sin 25 - 0.1(\cos 25)) = a_x$$

$$9.81(0.412 - 0.09)$$

$$9.81(0.332)$$

$$3.25 = \text{Accel.}$$

$$\text{m/s}^2$$

③ Speed = 40m/s $\rightarrow V$

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

$$\text{Area} = 0.75\text{m}^2 \rightarrow A$$

$$\text{density of air} = 1.225 \text{ kg/m}^{-3}$$

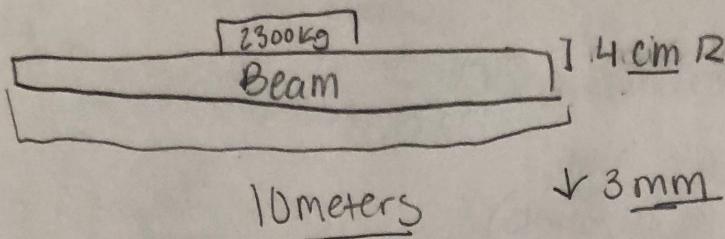
$$F_D = \frac{1}{2} (1.225 \text{ kg/m}^{-3}) (40\text{m/s})^2 (0.75) (0.75\text{m}^2)$$

$$C = 0.75$$

$$F_D = 551.25\text{N}$$

find magnitude of drag force

H.



$$\text{Young's modulus} = \frac{\text{stress}}{\text{strain}}$$

Young's modulus of wood?

meters
↓ × 1000
cm
↓ × 10
mm

beam is 10,000 mm long
after wt
9,997 mm long
radius = 40 mm

$$\pi 40^2 = 5024 \text{ mm}$$

$$F = 2300 \text{ kg} \cdot 9.81 \text{ m/s}^2$$

$$F = 22563 \text{ N}$$

$$A = 10,000 \text{ mm} \cdot 8 \text{ mm}$$

$$F^2 = \frac{E}{A} \cdot \theta = \frac{22563}{80,000}$$

$$\theta = .282038$$

$$E = \frac{\theta}{\delta/l} \quad E = \frac{.282}{3 \text{ mm} / 10,000 \text{ mm}}$$

E = 940 newtons per
square mm!

(-1) Units error? $Y = 15 \times 10^9 \text{ N/m}^2$, so $15 \times 10^3 \text{ N/mm}^2$

Chapter 6: uniform circular motion

① pitches @ 144 km/hr \rightarrow 144,000 m/hr \rightarrow 518,400,000 m/sec

ball rotates at radius of 0.5 meters \rightarrow 0.6365 rad/sec

find angular velocity of the ball

$$V = r\omega$$

$$r = 0.5 \text{ m}$$

$$V = 144 \text{ km/hr}$$

$$\frac{5.184 \times 10^8 \text{ m/s}}{0.5} = \frac{0.5 \text{ m} \cdot \omega}{0.5}$$

(-1) Not a reasonable order of magnitude, right?

$$\omega = 1.0368 \times 10^9 \text{ radians per sec.}$$

② ideal banking angle
turn of 9km radius

120 km/hr speed limit

120 km \rightarrow m/s

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

$$120 \times 1000 \\ = \frac{120,000}{3000} = 33.33 \text{ m/s}$$

$$V = 33.33 \text{ m/s}$$

$$\tan \theta = \frac{(33.33)^2}{900 \text{ m} (9.8 \text{ m/s})}$$

9 km \rightarrow m

$$9 \times 1000 \\ = 900$$

$$\tan \theta = 0.126$$

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

$$\theta = 7.101^\circ$$

③ a - path 2 would be taken. Reducing the amount of curve in the path taken, reduces the amount of friction of the tires

b.) path 1 = $\frac{\text{Radius}}{400 \text{ m}}$] coefficient
path 2 = 800 m] of friction = 1.0

$$V_f = r \times \omega$$

find tangential velocities

(-1) so were they calculated?

④ acceleration due to gravity

a.) $4.5 \times 10^{12} \text{ m apart}$

(+2) Bonus!

$$\text{mass of pluto} = 1.4 \times 10^{22} \text{ kg}$$

$$a_c = \frac{Gm}{r^2} \quad a_c = \frac{(6.67 \times 10^{-11})(1.4 \times 10^{22} \text{ kg})}{(4.5 \times 10^{12})^2}$$

$$a_c = 4.61136 \times 10^{-14} \text{ m/s}^2$$

Uranus has greater centripetal acceleration than Pluto

b.) Neptune due to Uranus
 $2.5 \times 10^{12} \text{ m apart}$
mass of Uranus = $8.62 \times 10^{25} \text{ kg}$

$$a_c = \frac{(6.67 \times 10^{-11})(8.62 \times 10^{25} \text{ kg})}{(2.5 \times 10^{12} \text{ m})^2}$$

$$a_c = 9.199 \times 10^{-10} \text{ m/s}^2$$