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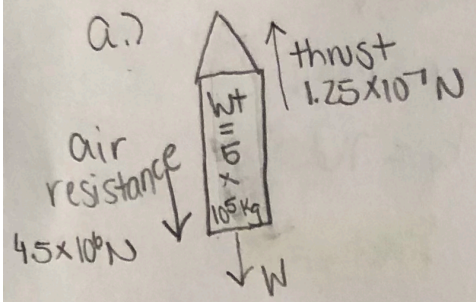
1. Weight $= 5 \times 10^5$ kg

$\uparrow F = 1.25 \times 10^7$ N

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

a.)



b.) Find Acceleration

$F = ma$

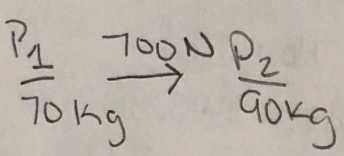
$F = T_{thrust} - \text{air resist.} - Wt$

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

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

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

2.



P_2 puts equal + opposite F on P_1

3. decelerated at $200\ \text{m/s}^2$

mass = 2,000 kg

Air resist. F = 1000 N

$a = -200$

find force

$F_x = ma$

$= (-200\ \text{m/s}^2)(2{,}000\ \text{kg})$

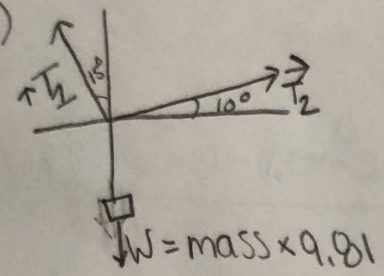
$F = -4.0 \times 10^5$ N

④ mass = 76 kg

$T_1 \rightarrow \theta = 15°, y$

$T_2 \rightarrow \theta = 10°, x$

a.)



b.) $F_{net,x}$

$F_x = ma_x$

$F_x = 76(0)_x$

$F_{net_x} = 0$

c.) $F_{net,y}$

$F_y = ma_y$

$F_y = 76(0)_y$

$F_{net_y} = 0$

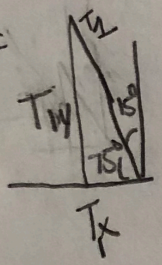
d.) $\vec{F}_{net} = 0$, find tension in $T_1 + T_2$

$Wt = m \cdot g$

$76 \cdot 9.81$

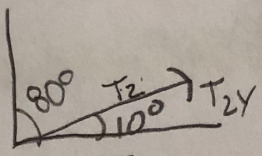
$Wt = 745.56$

T_1



SOH-CAH-~~TOA~~

T_2



$\sin 75° = \frac{opp}{hyp}$

$\sin 75° = \frac{T_{1y}}{T_1}$

$T_{1y} = \sin 75 (T_1)$

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

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

$\cos 10 = \frac{adj}{hyp}$

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

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

$\sin 10 = \frac{opp}{hyp}$

$\sin 10 = \frac{T_{2x}}{T_2}$

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

$T_2 \cos 10 = T_1 \cos 75$

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

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

$T_1 = 737.231 N$

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

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

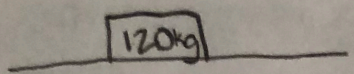
$T_2\ 3.675 + T_2(.173) - 745.56 = 0$

$T_2(3.675) + T_2(.173) = 745.56$

$T_2 \frac{(3.848)}{3.848} = \frac{745.56}{3.848}$

$T_2 = 193.753 N$

Chapter 5: Friction, drag, elasticity

① 

Coeffients
Kinetic = 0.3
Static = 0.5

a.) max force = static → 0.5

$W = mass \cdot 9.81$

$(120kg)(9.81 m/s)$

$W = 1177.2N$

$W \cdot 0.5 = max$

$(1177.2)(0.5)$

max force = 588.6N

b.) force = 588.6N

$W = 1177.2N$

Kinetic = 0.3

$F_k = 0.3(1177.2N)$

$f_k = 353.16$

$max - F_K = a$

$588.6 - 353.16 = 120\,a$

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

accel = $1.962\ m/s^2$

② Kinetic = 0.1, $\theta = 25°$

Find Accel

$F_K = \mu_K F_N$

$\sin 25 = \frac{W_X}{W}$

$F_K = \mu_K F_N$

$F_K = 0.1(W_Y)$

$F_K = 0.1(-W\cos 25°)$

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

$W_Y = -W\cos 25$

$W = mg$

$W\sin 25 - .1(W\cos 25) = ma_x$

$\frac{W}{g}(\sin 25 - .1(\cos 25) = a_x$

$9.81(\sin 25 - .1(\cos 25) = a_x$

$9.81(0.422 - 0.09)$

$9.81(0.332)$

3.25 = Accel. m/s^2

③ Speed = 40m/s → V

area = $0.75m^2$ → A

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

C = 0.75

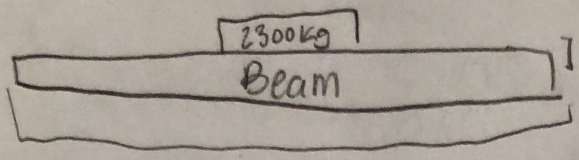
find magnitude of drag force

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

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

$F_D = 551.25N$

4.)



Youngs modulus = Stress / Strain

Youngs modulus of Wood?

meters ↓ ×1000 cm ↓ ×10 mm

beam is 10,000 mm long

after wt

9,997 mm long

radius = 40 mm

$\pi 40^2 = 5024 mm$

$F = 2300 kg \cdot 9.81 m/s$

$F = 22563 N$

$A = 10,000 mm \cdot 8 mm$ (L · W)

$\sigma = \frac{F}{A} \quad \sigma = \frac{22563}{80,000}$

$\sigma = .282038$

$E = \frac{\sigma}{d/l} \quad E = \frac{.282}{3mm/10,000mm}$

E = 940 newtons per square mm

Chapter 6: Uniform Circular Motion

1.) pitches @ 144km/hr → 144,000 m/hr → 518,400,000 m/sec

ball rotates at radius of 0.5 meters

find Angular velocity of the ball

$V = rw$

$r = 0.5m$

$V = 144km/hr$

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

$w = 1.0368 \times 10^9$ radians per sec

(2.) ideal banking Angle

↳turn of ,9km radius

120 km/hr speed limit

120km → m/s

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

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

$V = 33.33 m/s$

,9 km → m

,9 × 1000

= 900

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

$\tan\theta = 0.126$

$\theta = \tan^{-1}.126$

$\theta = 7.181^\circ$

(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 = 400m (Radius)
path 2 = 800 m
] coefficient of friction = 1.0

$V_t = r \times w$

find tangetial velocities

(4.) acceleration due to gravity

a.) 4.5×10^{12} m apart

mass of pluto = 1.4×10^{22} kg

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

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

Uranus has greater centripetal Accel than Pluto

b.) Neptune due to Uranus

2.5×10^{12} m apart

mass of Uranus = 8.62×10^{25} kg

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

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