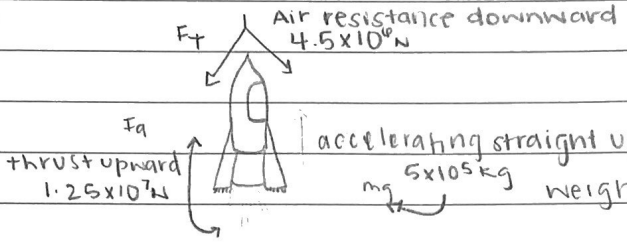
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

SUBJECT: PHYSICS MIDTERM #2

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

1. a) Draw a free body diagram, including the weight of the rocket, the thrust, and air resistance.



b) what is the rockets acceleration?

$F = ma$ $\quad F_r - (F_a - mg) = ma$

$1.25 \times 10^7 - (4.5 \times 10^6 + 4.9 \times 10^6) = 5 \times 10^5 a$

$a = 3.1 \times 10^6 / 5 \times 10^5 = 6.2 m/s$ ←

2. a) According to Newton's 3rd Law; if the first player exerts a force of 700N on the second player, what is the force the second player exerts on the first player?

$P_1 = 700N$ $\quad$ 700 → ← −700N

$P_2 = -700N$ on

3. what is the additional force is required to give the rocket deceleration?

$F = ma$ $\quad$ air resistance = 1000N

$a = -200 m/s^2$

$m = 2000 kg$

$F - 1000N = 2000(-200)$

$= -4000,000 + 1000$

$= -3,99,000NN$ or $-3.99 \times 10^5 N$ ←

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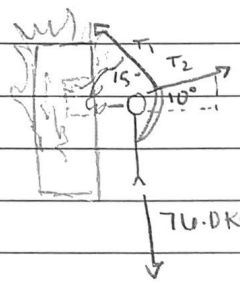
SUBJECT:

4.

a) Draw a free body diagram including the two tension vectors and the womens weight.



b) Write down an expression $F_{net,x}$.

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

c) Write down an expression for $F_{net,y}$.

$F_{net,y} = T_{2y} - T_{1y}$

d) Assuming $\vec{F}_{net} = 0$, calculate the tension in the two ropes.

$F_{net} = 0$

x $T_2 \cos 10 - T_1 \sin 15 = 0$

x $T_2 = \dfrac{T_1 \sin 15}{\cos 10}$

y $T_2 \sin 10 - T_1 \cos 15 - 744.8N = 0$

$T_1 = \dfrac{744.8N - (T_1 \sin 15 / \cos 10)(\sin 10)}{\cos 15}$

$.955T_1 + .045T_1 = 744.8N$

$1.01T_1 = 744.8N$

$T_1 \rightarrow T_1 = 736.92$

$T_2 = 736.92N \sin 15 / \cos 10$

$T_2 \rightarrow = 193.6$

$T_1 = \dfrac{744.8N - T_2 \sin 10}{\cos 15}$

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SUBJECT:

CHAPTER 5: FRICTION, DRAG, AND ELASTICITY

1 a) what maximum force can you exert horizontally on the crate without moving?

$W = 120(9.80)$

$W = 1,180\,N$ $\qquad f_s \leq 0.5(1,180N)$

$\Sigma F_y = 0$ $\longrightarrow$ $f_s \leq 590N$

$F_N + W = 0$

$F_n - 1,180 = 0$

$F_n = 1,180$

b) If you continue to exert this force once the crate starts to slip, what will the magnitude of its acceleration then be?

$f_k = \mu_k n$ $\qquad F_x = ma$

$f_k = 0.3(1,180)$ $\qquad \frac{590 - 354}{120} = \frac{120(a)}{120}$

$f_k = 354N$

$\longrightarrow$ $a = 1.97 m/s^2$

2. If the coefficient of kinetic friction

$F = ma$

$f_k = 0.1(n\cos 25)$

$mg(\sin 25) - (0.1)(\cos 25)(mg) = ma$

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

$\longrightarrow$ $= 3.24 m/s^2$

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SUBJECT:

3. DRAG FORCE. If this area is $0.75m^2$, the density of air is $1.225kgm^{-3}$ and C=0.75, what is the magnitude of the drag force in Newtons?

*. 40 m/s

$F_D = 1/2\ C\rho A v^2$

$= (0.5)(.75)(1.225 kg/m^3)(0.75m^2)(40m/s)^2$

$= 551.25 kgm/s^2$

$\rightarrow = 551 N.$

4 If the Length of the beam decreases by 3mm, what is the Young's modulus of the wood?

$m = 2300kg$

$A = \pi(r)^2$

$F/A = Y\{\Delta L / L_0\}$

$g = 9.8m$

$Y = \frac{(2300)(9.8m/s^2)(10)}{\pi(.04)^2(.003)}$

$\rightarrow = 1.49 \times 10\ N/m^2$

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SUBJECT:

CHAPTER 6: Uniform Circular Motion and Gravitation

1. What is the angular velocity of the ball as he throws it, in radians per second?

$v = 144\ km/hr$ $\quad \omega = v/R$

$r = 0.5m$

$\omega = 40/0.5 \rightarrow = 80\ rad/sec$

2 What is the ideal banking angle for a gentle turn of 0.9km radius on a highway with a 120km per hour speed limit, assuming everyone travels at the limit?

$\tan\theta = v^2/rg$ $\quad \tan\theta = (33.3)^2/900(9.8)$

$v = 120km \rightarrow = 33.3$ $\quad \theta = \tan^{-1}\left(\frac{(33.3)^2}{900(9.8)}\right) \rightarrow = 7.17°$

$r = 900m$

$g = 9.8m/s$

3 a) Which path may be taken at a higher speed, if both paths correspond to the same force of friction and centripital force?

$F_c = \frac{mv^2}{r}$ $\quad f = mN = \mu mg \rightarrow$

$v^2 = mgr$ $\quad v = \sqrt{mgr}$

1 $\rightarrow$ $v = \sqrt{(1)(9.8)(400)}$

$\rightarrow = 62\ m/s$

2 D $\rightarrow$ $= \sqrt{(1)(9.8)(800)}$

$\rightarrow = 88\ m/s$

SUBJECT:

b) Suppose path 1 has a radius of curvature of 400m, and path 2 has a radius of curvature of 800m. the coefficient of friction is 1.0. If the force of friction balances the centripital force, what are the tangential velocities of each race car?

$f = MN$

$M = 0.3$ $\quad f = 0.3(120kg)(9.81 m/s^2)$

$\therefore f = 353N$

$\therefore a = F_{net}/m$

$$\frac{588N - 353N}{120kg}$$

$a = 1.96 m/s^2$

4. BONUS POINTS:

a) calculate the acceleration due to gravity at Neptune due to Pluto when they are $4.5 \times 10^{12} m$ apart, & they are now. The mass of pluto is $1.44 \times 10^{22} kg$

$a_c = 6.637 \times 10^4 (1.4 \times 10^{22}) / (4.50 \times 10^{12})^2$

$\longrightarrow \quad a_c = 4.61 \times 10^{-14} m/s^2$

$\frac{20.000}{1}$

b) Now calculate the acceleration due to gravity at Neptune due to Uranus, presently about $2.5 \times 10^{12} m$ apart, & compare it with that due to Pluto. The mass of Uranus is $8.62 \times 10^{25} kg$.

$a_c = 6.637 \times 10^4 (8.62 \times 10^{25}) / (2.50 \times 10^{12})^2$

$\longrightarrow \quad a_c = 9.2 \times 10^{-10} m/s^2$