AP Physics – Newton's Laws – 4

Is you who _____ Per___

I am a marvelous housekeeper. Every time I leave a man I keep his house. ~ Zsa Zsa Gabor

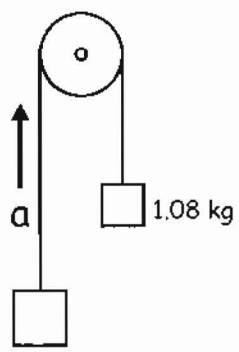
1. Okay, a small insect smashes into the windshield of your car while you are zooming down the interstate. (a) Which exerts the larger force; the bug on the car or the car on the bug? So how come? (b) Which experiences a larger acceleration; the bug or the car? How come?

a.) same force, OPPOSITE EQual Reaction (NO OUTSIDE FOR

b.) bug, because the mass is much less than the car.

2. A ultra low friction pulley deal is as shown. The two weights experience an acceleration of 0.450 m/s^2. Find the mass of the second weight.

m 9.8 → 1.08kg(9.8) = 10.584N



$F_{Net} = 10.584_N + (-m\,9.8)$

$F = ma$

$10.584_N - m(9.8) = (m + 1.08)\ .450^{m/s^2}$

$10.584 - 9.8m = .450m + .486$

$-10.584 \quad\quad -10.584$

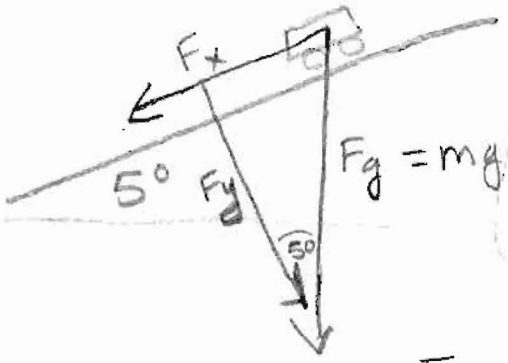
$-9.8m = .450m - 10.098$

$-.450m \quad -.450m$

$\frac{-10.25m}{-10.25} = \frac{-10.098}{-10.25}$

$m = .985\,kg$

3. A big dump truck is at rest on a section of road that is at an angle of 5.00° to the horizontal. The truck's mass is 15 500 kg. What force must the brakes exert to keep the truck from rolling down the sloped road?



$F_g = mg = 15500kg(9.8) = 151900N$

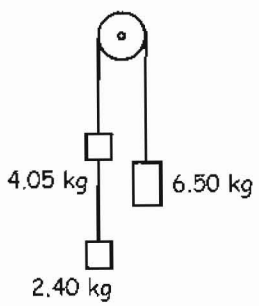
$F_x = \sin 5°(151900N)$

$= 13239N$

F_f must be the same as F_x so not to allow the truck to move!

$1.32 \times 10^4 N$

4. Three masses are connected by a light string that passes over a frictionless pulley as shown. (a) What is the acceleration of the system? (b) What are the tensions in the string?



$(m_1+m_2)g$ ← → $m_3 g$

$F_{Net} = m_3 g - (m_1+m_2)g$

$F_{Net} = g(m_3 - (m_1+m_2))$

$a = \frac{F}{m}$ $\quad a = \frac{g(m_3-(m_1+m_2))}{m_1+m_2+m_3} = \frac{9.8(6.50-(2.4+4.05))}{2.40+4.05+6.50}$

$= \frac{.49}{12.95kg} = .0378 m/s^2$

5. A soccer ball is kicked at an angle of 32.5° with a velocity of 21.5 m/s. (a) draw a FBD of the thing. Good, now find: (b) the time of flight for the soccer ball, (c) the distance the ball travels, and (d) the height of the soccer ball after 1.50 s.

a.) in the air

FBD

F_g

b.) $t = \frac{V_f - V_i}{a}$

$t = \frac{-11.55 - (11.55)}{-9.8\ m/s^2}$

$t = 2.36s$

21.5 m/s

$V_y = 11.55$ m/s

$V_x = 18.1$ m/s

c.) $d = vt$

$d = (18.1\ m/s)(2.36s)$

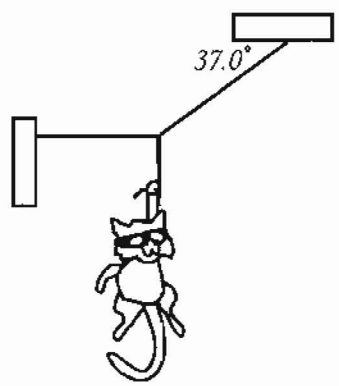
$= 42.67m$

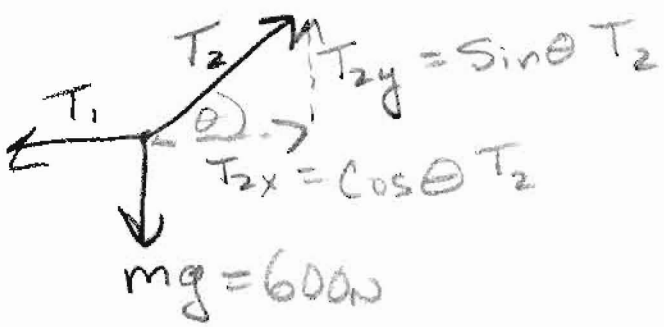
d) $x = v_i t + \frac{1}{2}at^2$

$x = (+11.55\ m/s)(1.50s) + \frac{1}{2}(-9.8)(1.50s)^2$

$6.23m$

6. Find the tension in each cable supporting the 600.0 N cat burglar.





Y

$F_{net} = 0 = -mg + (\sin 37^\circ) T_2$

$mg = \sin 37^\circ\ T_2$

$\frac{mg}{\sin 37} = T_2$

$\frac{600N}{\sin 37^\circ} = T_2 = 997N$

X

$F_{net} = 0 = T_1 + T_{2x}$

$0 = T_1 + \cos 37^\circ\ 997N$

$T_1 = 796N$