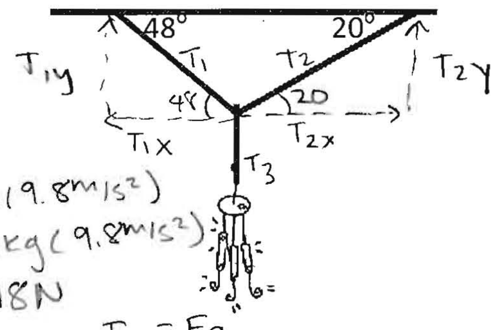
Name Key

Basic Forces and Statics Extra Practice:

1. A 10 kg wind chime is supported by three cables as shown in the figure below. Find the tension in each cable.



$F_g = m(9.8 m/s^2)$
$F_g = 10 kg(9.8 m/s^2)$
$= 98 N$

$T_3 = F_g$
$T_3 = 98 N$

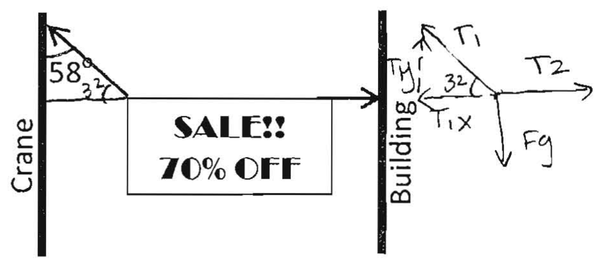
X

$F_{net} = T_{2x} - T_{1x}$
$0 = T_2 \cos 20 - T_1 \cos 48$
$T_2 \cos 20 = T_1 \cos 48$
$T_2 = T_1 \frac{\cos 48}{\cos 20}$
$T_2 = .712 T_1$
$T_1 = 70.72 N$

Y

$F_{net} = T_{2y} + T_{1y} - T_3$
$0 = T_2 \sin 20 + T_1 \sin 48 - 98 N$
$98 N = (.712 T_1) \sin 20 + T_1 \sin 48$
$98 N = .2435 T_1 + .7431 T_1$
$98 N = .98668 T_1$
$T_1 = 99.32 N$

2. A crane is attempting to remove a 60 kg sign from a building. If it is pulling on the sign as shown below, determine the tension in all of the ropes.



X

$F_{net} = T_2 - T_{1x}$
$0 = T_2 - T_1 \cos 32$
$0 = T_2 - (1109.6) \cos 32$
$T_2 = 940.996 N$

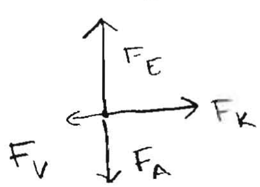
Y

$F_{net} = T_{1y} - F_g$
$0 = T_1 \sin 32 - 588 N$
$588 N = T_1 \sin 32$
$T_1 = 1109.6 N$

$F_g = m(9.8 m/s^2)$
$F_g = (60 kg)(9.8 m/s^2)$
$F_g = 588 N$

3. Ethan, Alex, Kaitlyn and Val are playing tug of war with a flag that has a mass of 4 kg. Ethan pulls to the North, Alex pulls to the South, Kaitlyn pulls to the East and Val pulls to the West. Determine the net force on the flag, the direction and its acceleration.

$F_{Ethan} = 75$ N
$F_{Alex} = 60.5$ N
$F_{Kaitlyn} = 40.2$ N
$F_{Val} = 5.7$ N.



X

$F_{net\,x} = F_K - F_V$
$F_{net\,x} = 40.2 N - 5.7 N$
$F_{net\,x} = 35.4 N$

Y

$F_{net\,y} = F_E - F_A$
$F_{net\,y} = 75 N - 60.5 N$
$F_{net\,y} = 14.5 N$

F_{net} — 14.5 N, 35.4 N

$F_{net} = 37.42 N$
$m a_{net} = 37.4$
$(4 kg) a_{net} = 37.42 N$
$a_{net} = 9.36 m/s^2$

4. An African elephant can reach heights of 13 feet is 6000 kg. What is its mass and weight on Earth? What is its mass and weight on the moon where the acceleration due to gravity is only 1.63 m/s/s?

Earth

$m = 6000 kg$

F_g = weight
$F_g = m(9.8 m/s^2)$
$F_g = (6000 kg)(9.8 m/s^2)$
$F_g = 58800 N$

Moon

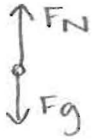
$m = 6000 kg$

$F_g = m(1.63 m/s^2)$
$F_g = (6000 kg)(1.63 m/s^2)$
$F_g = 9780 N$

Some Problems from physicsclassroom.com Calculator Pad – If you don't know how to do the problem click on this in the physicsclassroom website – go to the Newtons Law problem set and listen to the audio guide.

Problem 7

Sophia, whose mass is 52 kg, experienced a net force of 1800 N at the bottom of a roller coaster loop during her school's physics field trip to the local amusement park. Determine Sophia's acceleration at this location. Also determine the F_{normal} acting on her at this point in time.



$F_{net} = m a_{net}$

$1800\,N = (52\,kg)\,a_{net}$

$\boxed{a_{net} = 34.6\,m/s^2}$

$F_{net} = F_N - F_g$

$1800\,N = F_N - 509.6\,N$

$\boxed{F_N = 1290.4\,N}$

$F_g = m(9.8\,m/s^2)$

$F_g = (52\,kg)(9.8)$

$F_g = 509.6\,N$

Problem 10

Anna Litical and Noah Formula are experimenting with the effect of mass and net force upon the acceleration of a lab cart. They determine that a net force of **F** causes a cart with a mass of **M** to accelerate at 48 cm/s/s. What is the acceleration value of a cart with ...

$a = \frac{F}{m}$

$\frac{F}{m} = 48\,\frac{cm}{s^2}$

a. a mass of **M** when acted upon by a net force of **2F**?
b. a mass of **2M** when acted upon by a net force of **F**?
c. a mass of **2M** when acted upon by a net force of **2F**?
d. a mass of **4M** when acted upon by a net force of **2F**?
e. a mass of **2M** when acted upon by a net force of **4F**?

$\frac{2F}{m} \Rightarrow 2(48\,\frac{cm}{s^2}) = \boxed{96\,\frac{cm}{s^2}}$

b. $\frac{F}{2M} \Rightarrow \frac{1}{2}\left(\frac{F}{M}\right) \Rightarrow \frac{1}{2}(48\,\frac{cm}{s^2}) = \boxed{24\,cm/s^2}$

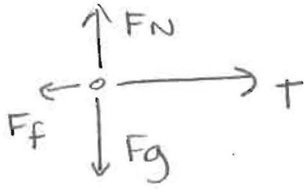
c. $\frac{2F}{2M} \Rightarrow \frac{2}{2}\left(\frac{F}{M}\right) \Rightarrow \frac{2}{2}(48\,\frac{cm}{s^2}) = \boxed{48\,\frac{cm}{s^2}}$

d. $\frac{2F}{4M} \Rightarrow \frac{1}{2}\left(\frac{F}{M}\right) \Rightarrow \frac{1}{2}(48\,\frac{cm}{s^2}) = \boxed{24\,\frac{cm}{s^2}}$

e. $\frac{4F}{2M} \Rightarrow \frac{4}{2}\left(\frac{F}{M}\right) \Rightarrow 2(48\,\frac{cm}{s^2})$ $\boxed{= 96\,\frac{cm}{s^2}}$

Problem 16

Mira and Tariq are lab partners for the Pulley and Bricks Lab. They have determined that the 2.15-kg brick is experiencing a forward tension force of 9.54 N and a friction force of 8.69 N as it is accelerated across the table top. Construct a free body diagram depicting the types of forces acting upon the brick. Then determine the net force and acceleration of the brick.



x Direction of acceleration

$F_{net} = T - F_f$

$m a_{net} = 9.54\,N - 8.69\,N$

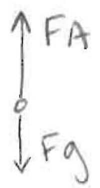
$(2.15\,kg)\,a_{net} = .85\,N$

$\boxed{F_{net} = .85\,N}$

$\boxed{a_{net} = .395\,m/s^2}$

Problem 29

While skydiving, Dee Selerate opens her parachute and her 53.4-kg body immediately accelerates upward for an instant at 8.66 m/s/s. Determine the upward force experienced by Dee during this instant.



$F_{net} = F_A - F_g$

$m a_{net} = F_A - F_g$

$(53.4\,kg)(8.66\,m/s^2) = F_A - 532.32\,N$

$F_A = 985.76\,N$

$F_g = m(9.8\,m/s^2)$

$F_g = (53.4)(9.8\,m/s^2)$

$F_g = 532.32\,N$