Name Key

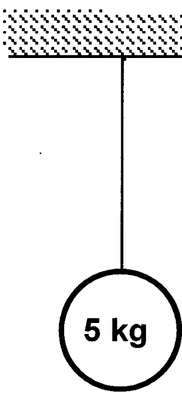
Date ________ Pd____

UNIT IV: Worksheet 3

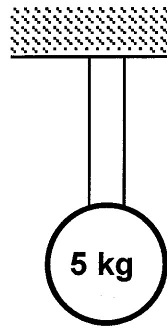
For each of the problems below, carefully draw a force diagram of the system before attempting to solve the problem.

1. Determine the tension in each cable in case A and case B.

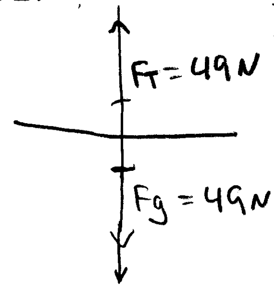
Case A

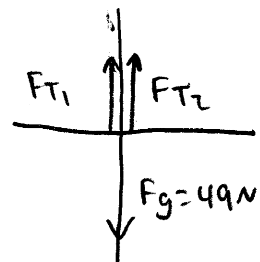


Case B



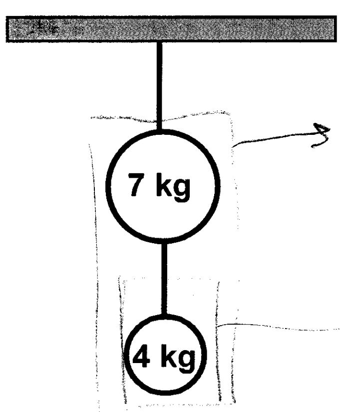
$w = mg$
$= 5kg \cdot 9.8 m/s^2$
$= 49N$

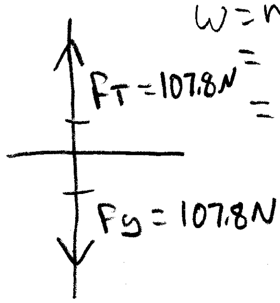




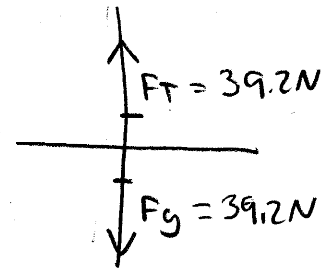
$\Sigma F_y = 0 = F_{T1} + F_{T2} + F_g$
$-F_g = F_{T1} + F_{T2}$
$-49N = (F_T)2$
$F_T = 24.5N$

2. Determine tension in each cable. (Hint: There is more than one way to define the system.)



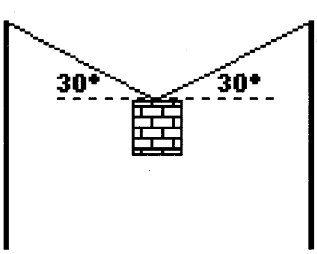


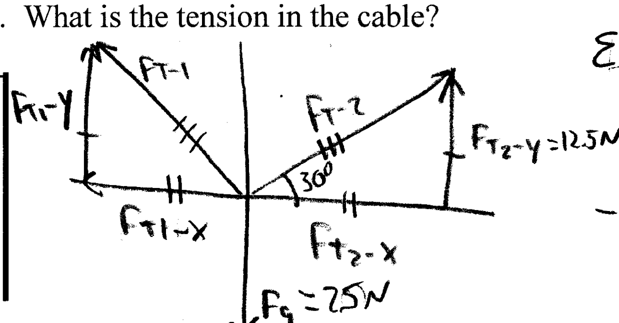
$w = mg$
$= (7kg + 4kg) 9.8 m/s^2$
$= 107.8 N$



$w = mg$
$= 4kg \cdot 9.8 m/s$
$= 39.2N$

3. The object hung from the cable has a weight of 25 N. Write the equation for the sum of the forces in the y-direction. What is the tension in the cable?



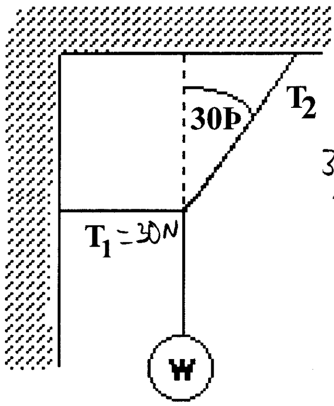


$\Sigma F_y = 0 = F_{T1-y} + F_{T2-y} + F_g$
$-F_g = 2(F_{T-y})$
$-(-25N) = 2(F_{T-y})$
$F_{T-y} = 12.5N$
so
$\sin 30 = \frac{12.5}{F_{T-2}}$
$F_{T-2} = 25N$

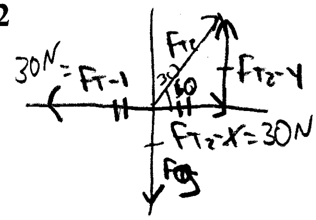
Repeat the problem above with a 5° angle. How does the tension compare?

$5° \longrightarrow \sin 5 = \frac{12.5}{F_{T\frac{1}{2}}}$
$F_{T2} = 143.42N$

4. The cable at left exerts a -30 N force.



a. Write the equation for the sum of the forces in the x-direction. What is the value of T_2?



$\Sigma F_x = 0 = F_{T-1} + F_{T_2-x}$

$\cos 60 = \frac{30N}{F_{T_2}}$

$F_{T_2} = 60\ N$

b. Write the equation for the sum of the forces in the y-direction. What is the force of gravity acting on the ball?

$\Sigma F_y = 0 = F_{T_2-y} + F_g$ So $-F_g = F_{T_2-y}$

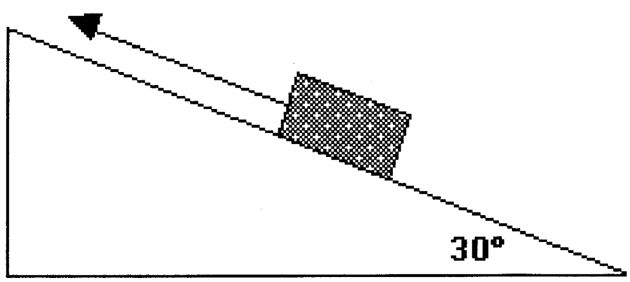
$\tan 60 = \frac{F_{T_2-y}}{30N}$

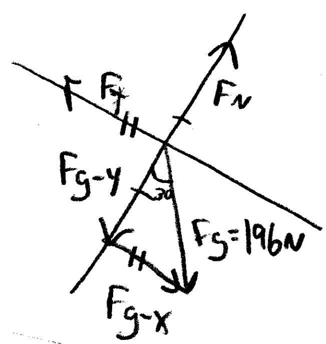
$F_{T_2-y} = 51.96N$

$F_g = -51.96N$

5. The box on the *frictionless* ramp is held at rest by the tension force. The mass of the box is 20 kg. What is the value of the tension force?

$W = mg$
$= 20kg\ 9.8m/s^2$
$= 196N$





$\Sigma F_x = 0 = F_T + F_{g-x}$

$\sin 30 = \frac{F_{g-x}}{196N}$

$F_{g-x} = 98N$

So

$-F_T = F_{g-x}$

$F_T = -98N$

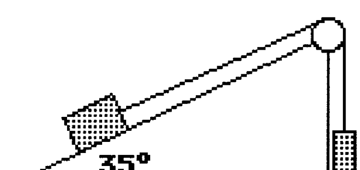
What is the value of the normal force?

$\Sigma F_y = 0 = F_N + F_{g-y}$ $\cos 30 = \frac{F_{g-y}}{196}$

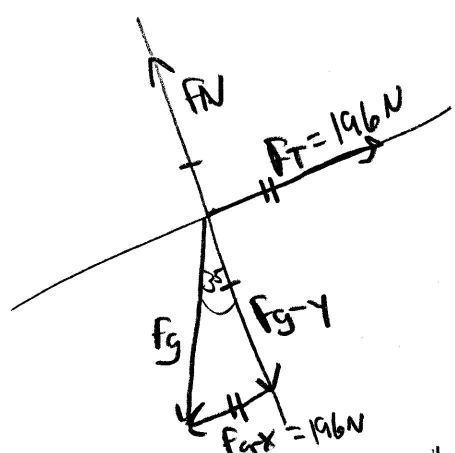
$F_{g-y} = 169.7N$

$F_N = 169.7N$

6. In the system below the pulley and ramp are *frictionless* and the block is in static equilibrium. What is the **mass** of the block on the ramp?



$W = mg$
$= 20kg\ 9.8m/s^2$
$= 196N$



$\sin 35 = \frac{F_{g-x}}{F_g}$

$\sin 35 = \frac{196}{F_g}$

$F_g = 341.7$

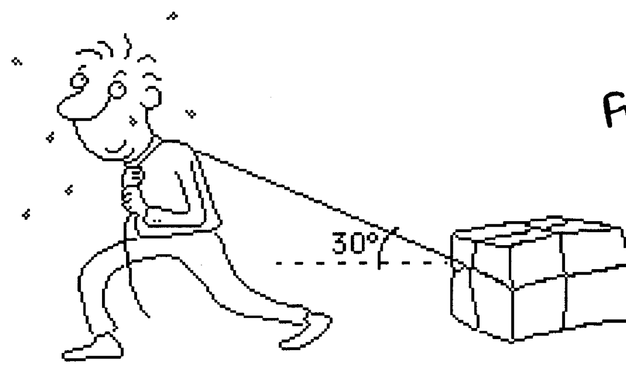
$W = mg$

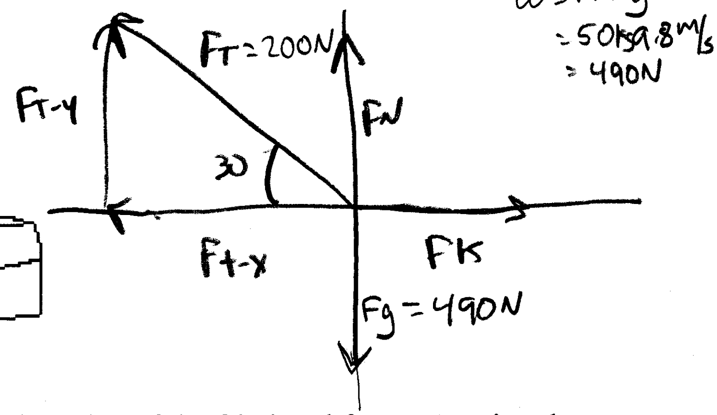
$341.7N = m\ 9.8$

$m = 34.87kg$

7. A man pulls a 50 kg box *at constant speed* across the floor. He applies a 200 N force at an angle of 30°.

$w = mg$
$= 50\,kg \cdot 9.8\,m/s$
$= 490\,N$





a. Sum the forces in the x-direction. What is the value of the frictional force opposing the motion?

$\Sigma F_x = F_{T-x} + F_K = 0$

$-173.2 + F_K = 0$

$\boxed{F_K = 173.2\,N}$

$\cos 30 = \frac{F_{t-x}}{200\,N}$

$F_{T-x} = 173.2\,N$

b. Sum the forces in the y-direction. What is the value of the normal force?

$\Sigma F_y = F_{T-y} + F_N + F_g = 0$

$= 100\,N + F_N + (-490\,N) = 0$

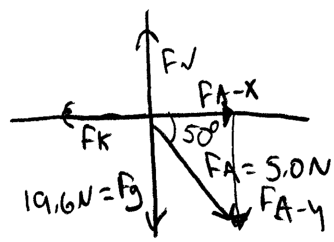
$\boxed{F_N = 390\,N}$

$\sin 30 = \frac{F_{T-y}}{200}$

$F_{T-y} = 100\,N$

8. A man pushes a 2.0 kg broom *at constant speed* across the floor. The broom handle makes a 50° angle with the floor. He pushes the broom with a 5.0 N force.

a. Sum the forces in the y-direction. What is the value of the normal force?



$W = 2\,kg \cdot 9.8\,m/s$
$= 19.6\,N$

$\Sigma F_y = F_N + F_{A-y} + F_g = 0$

$F_N + (-3.83\,N) + (-19.6\,N) =$

$\boxed{F_N = 23.43\,N}$

$\sin 50 = \frac{F_{A-y}}{5}$

$F_{A-y} = 3.83\,N$

b. Sum of the forces in the x-direction. What is the value of the frictional force opposing the motion?

$\cos 50 = \frac{F_{A-X}}{5}$

$\Sigma F_x = F_K + F_{A-x} = 0$

$F_K + 3.21\,N = 0$

$\boxed{F_K = -3.21\,N}$

$F_{A-X} = 3.21\,N$

c. If the frictional force were suddenly reduced to zero, what would happen to the broom?

It would change its state of motion due to its net force