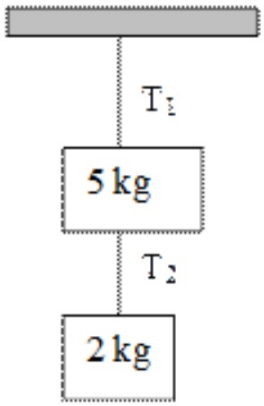
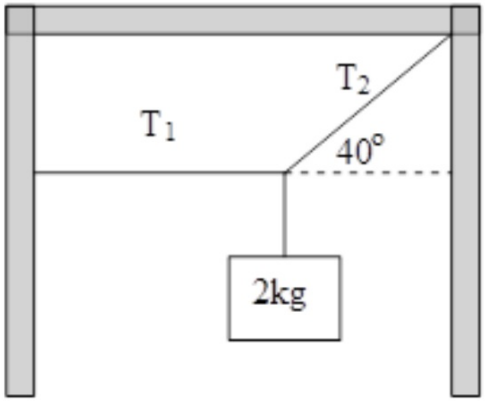
1. Find T_1 and T_2.



For m=2 kg:
$\sum F = T_2 - F_g = 0$ N
therefore $T_2 = F_g = mg$
so $T_2 = (2)(9.8) = 19.6$ N

For m=5 kg:
$\sum F = T_1 - T_2 - F_g = 0$ N
therefore $T_1 = T_2 + mg$
so $T_1 = 19.6 + (5)(9.8) = 68.6$ N

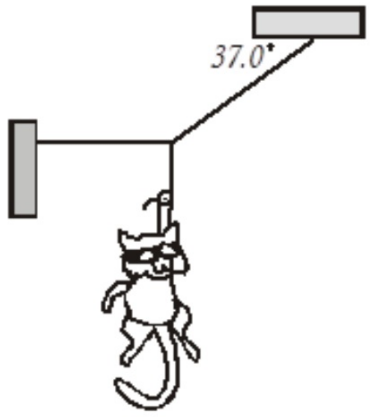
2. Find T_1 and T_2.



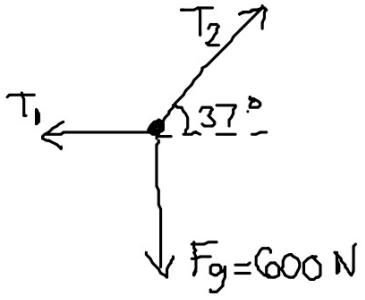
$\sum F_x = (T_2)_x - T_1 = 0$ N
therefore $(T_2)_x = T_1$
so $(T_2)\cos(40) = T_1$

$\sum F_y = (T_2)_y - F_g = 0$ N
therefore $(T_2)_y = F_g = mg$
so $(T_2)\sin(40) = (2)(9.8) = 19.6$ N
$T_2 = (19.6 \text{ N})/(\sin(40)) = 30.49$ N
$T_1 = (30.49 \text{ N})\cos(40) = 23.36$ N

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



FBD



ΣF Eqn:

$\Sigma F_x = T_2 \cos 37 - T_1 = 0\ N$

$\therefore T_2 \cos 37 = T_1$ (2)

$(T_2)_y - F_g$

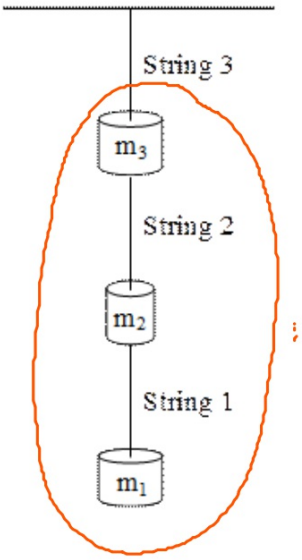
$\Sigma F_y = T_2 \sin 37 - F_g = 0\ N$

$\therefore T_2 \sin 37 = F_g$ (1)

* Solve for T_2 using Eqn 1
* Solve for T_1 using Eqn 2

$T_1 = 797\ N$ $T_2 = 997\ N$

4. Three masses hang on three strings as shown. Find the tension in the three strings. **Express your answer in terms of m_1, m_2, m_3, and *g* only.**

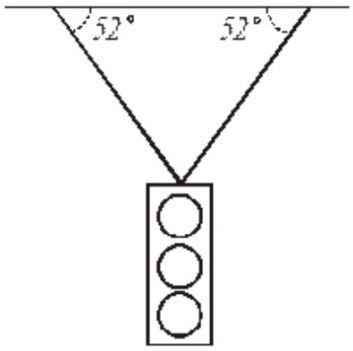


For m_1:
$\sum F = T_1 - F_g = 0$ N
therefore $T_1 = F_g = m_1 g$

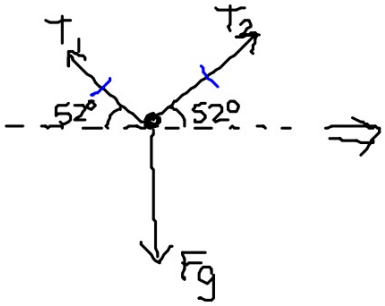
For m_2:
$\sum F = T_2 - T_1 - F_g = 0$ N
therefore $T_2 = T_1 + F_g = m_1 g + m_2 g$

For m_3:
$\sum F = T_3 - T_2 - T_1 - F_g = 0$ N
therefore $T_3 = T_2 + T_1 + F_g = m_1 g + m_2 g + m_3 g$

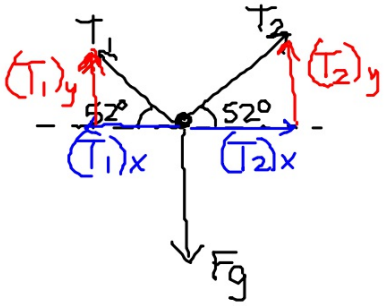
5. A 46.5 kg traffic light hangs from two cables which are at the angles shown. Calculate the tensions in the two cables.



FBD



Working Diagram



Equations

$\sum F_x = (T_2)_x - (T_1)_x = 0\ N$

$\therefore (T_1)_x = (T_2)_x$

$T_1 \cos 52 = T_2 \cos 52$

$\therefore T_1 = T_2$

$\sum F_y = (T_1)_y + (T_2)_y - F_g = 0$

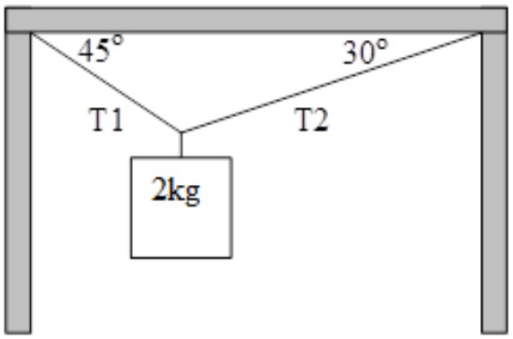
$T_1 \sin 52 + T_2 \sin 52 = F_g$

$\frac{2T \sin 52}{2 \sin 52} = \frac{mg}{2 \sin 52}$

$T = \frac{mg}{2 \sin 52}$

$T = T_1 = T_2 = 289\ N$

6. Find T_1 and T_2.



$\sum F_x = (T_2)_x - (T_1)_x = 0N$

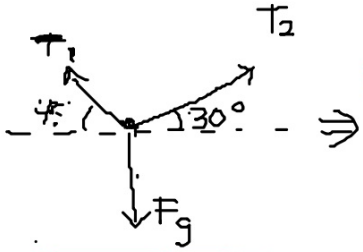
$\therefore (T_1)_x = (T_2)_x$

$T_1 \cos(45) = T_2 \cos(30)$ (1)

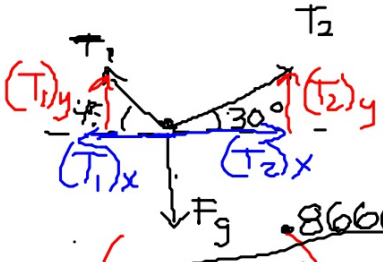
$\sum F_y = (T_1)_y + (T_2)_y - F_g = 0N$

(2) $\therefore T_1 \sin(45) + T_2 \sin(30) = F_g$

FBD:



Working Diagram



* Solve for T_1 in Eqn (1) then substitute into Eqn (2)

$T_1 = \frac{T_2 \cos(30)}{\cos(45)}$

$\frac{T_2 \cos(30)}{\cos(45)} \sin 45 + T_2 \sin 30 = mg$

.8660 .500 19.6

$.866 T_2 + .5 T_2 = 19.6$

$T_2 = 14.3N$

$\therefore T_1 = 17.6N$

Challenge: Two 2.0 kg masses are connected by a string and hung over two pulleys. A 2.5 kg mass is then hung between the pulleys, which causes the rope to sag. Find the angle.