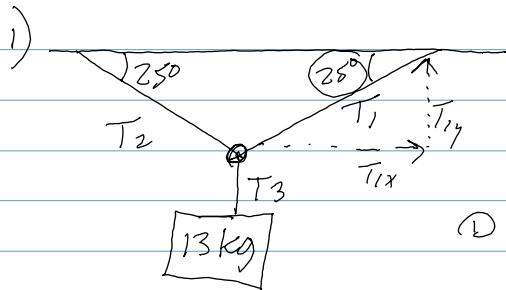
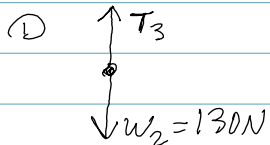


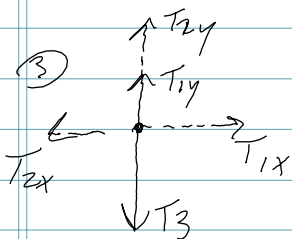
Unit 4 - Equilibrium Problems



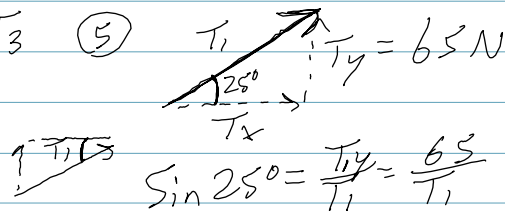
What is the tension in each string?



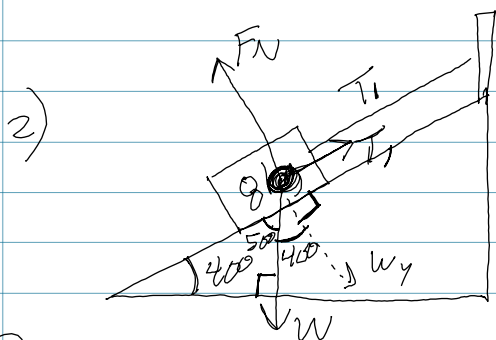
$$\begin{aligned} \textcircled{2} \quad \sum F_y = 0 &= T_3 + W_2 \\ 0 &= T_3 - 130 \\ \boxed{T_3 = 130 \text{ N}} \end{aligned}$$



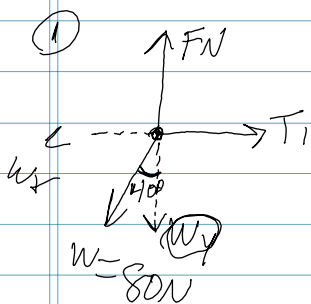
$$\begin{aligned} \textcircled{4} \quad \sum F_y = 0 &= T_{1y} + T_{2y} + T_3 \\ 0 &= 2T_y = 130 \\ T_y &= 65 \text{ N} \end{aligned}$$



$$\begin{aligned} \textcircled{5} \quad \sin 25^\circ &= \frac{T_y}{T_1} = \frac{65}{T_1} \\ T_1 &= \frac{65}{\sin 25^\circ} = \boxed{153.80 \text{ N}} \\ \boxed{T_2 = 153.80 \text{ N}} \end{aligned}$$



Draw a free body force diagram & label each force with its value.

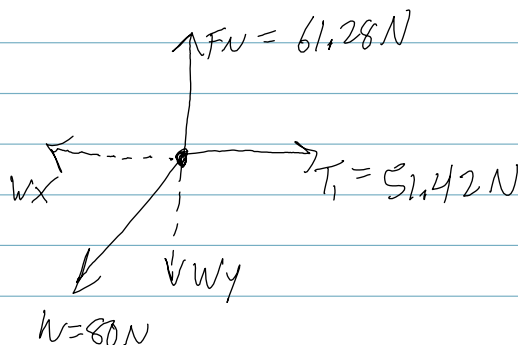


$$\begin{aligned} \textcircled{2} \quad \cos 40^\circ &= \frac{W_y}{W} = \frac{W_y}{80} \\ W_y &= 61.28 \text{ N} \end{aligned}$$

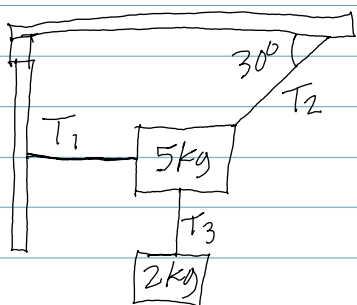
$$\begin{aligned} \textcircled{3} \quad \sum F_y = 0 &= F_N + W_y \\ 0 &= F_N - 61.28 \\ \boxed{F_N = 61.28 \text{ N}} \end{aligned}$$

$$\begin{aligned} \sin 40^\circ &= \frac{W_x}{W} = \frac{W_x}{80} \\ W_x &= 51.42 \text{ N} \end{aligned}$$

$$\begin{aligned} \textcircled{4} \quad \sum F_x = 0 &= W_x + T \\ 0 &= -51.42 + T \\ \boxed{T = 51.42 \text{ N}} \end{aligned}$$

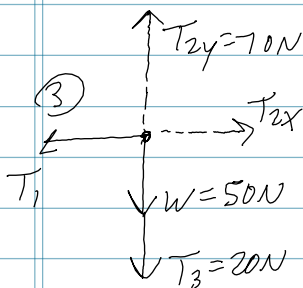


3) Find the tension in each string.

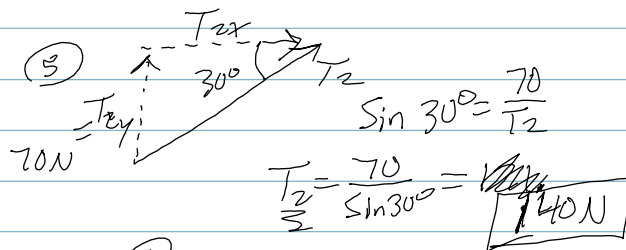


① $\uparrow T_3$
 $\downarrow W = 20\text{N}$

② $\sum F_y = 0 = T_3 + W$
 $0 = T_3 - 20$
 $T_3 = 20\text{N}$

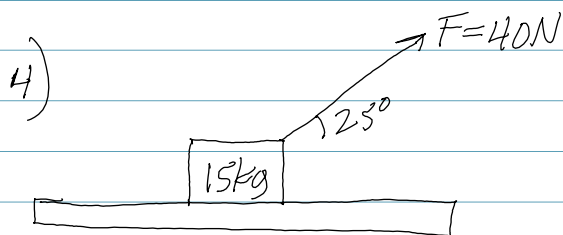


④ $\sum F_y = 0 = T_3 + W + T_{2y}$
 $0 = -20 - 50 + T_{2y}$
 $T_{2y} = 70\text{N}$

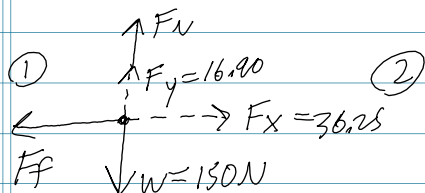


⑥ $\tan 30^\circ = \frac{70}{T_{2x}}$
 $T_{2x} = \frac{70}{\tan 30^\circ} = 121.24\text{N}$

⑦ $\sum F_x = 0 = T_1 + T_{2x}$
 $0 = T_1 + 121.24$
 $T_1 = -121.24\text{N}$



If the box is moving to the right at a constant speed, what is the normal force & frictional force acting on the box?



② $\sin 25^\circ = \frac{F_y}{40}$
 $F_y = 16.90\text{N}$

$\cos 25^\circ = \frac{F_x}{40}$
 $F_x = 36.25\text{N}$

③ $\sum F_x = 0 = F_x + F_f$
 $0 = 36.25 + F_f$
 $F_f = -36.25\text{N}$

④ $\sum F_y = 0 = F_N + F_y + W$
 $0 = F_N + 16.9 - 150$
 $F_N = 133.10\text{N}$