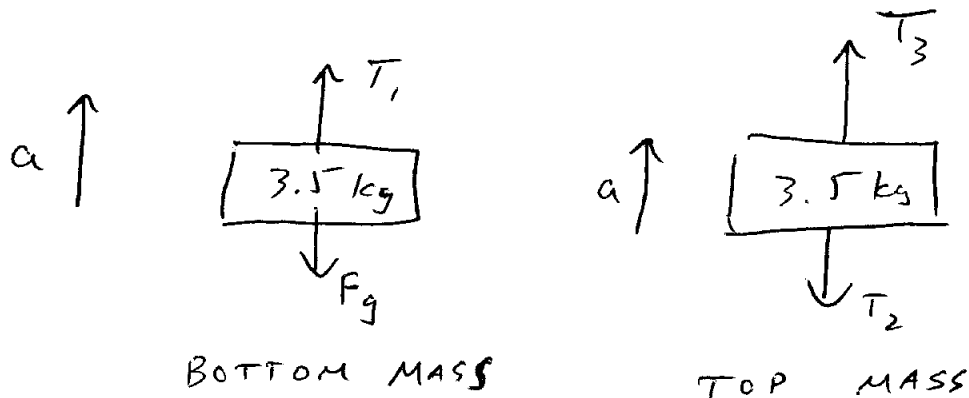


PROBLEM 4.21

FREE BODY DIAGRAM:



AND, SINCE THE ROPE CONNECTS THE MASSES,

$$T_1 = T_2$$

a) FIRST FIND T_1 : $T_1 - mg = ma$

$$\Rightarrow T_1 = mg + ma = m(g+a) = (3.5 \text{ kg})(9.8 \text{ m/s}^2 + 1.6 \text{ m/s}^2)$$

$$\boxed{T_1 = 39.9 \text{ N}}$$

NOW T_3 : $T_3 - mg - T_2 = ma$

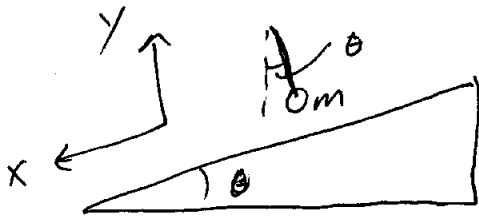
$$\Rightarrow T_3 = \underbrace{m(g+a)}_{=T_1} + \underbrace{T_2}_{=T_1} = 2T_1 = 79.8 \text{ N}$$

$$\boxed{T_3 = 79.8 \text{ N}}$$

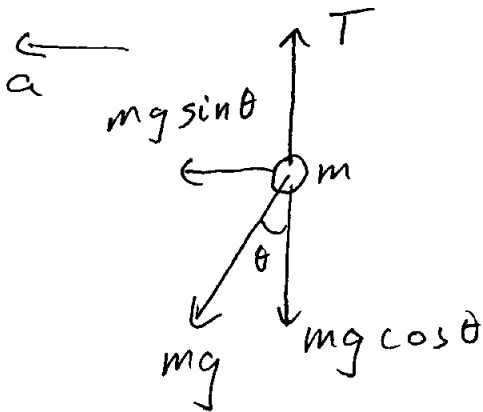
b) THE UPPER ROPE (T_3) HOLDS MORE WEIGHT THAN T_2 , SO IT WILL BREAK FIRST

$$\begin{aligned} T_3 - mg - mg &= 2ma \\ \Rightarrow a &= \frac{85 \text{ N} - 2(3.5 \text{ kg})(9.8 \text{ m/s}^2)}{2(3.5 \text{ kg})} = \boxed{2.34 \text{ m/s}^2} \end{aligned}$$

PROBLEM 4-73



FREE BODY DIAGRAM



X-COMPONENT: $mg \sin \theta = ma$

Y-COMPONENT: $T = mg \cos \theta$

① FIRST, FIND a : $v_f = v_0 + at$

$$\Rightarrow a = \frac{v_f - v_0}{t} = \frac{30 \text{ m/s} - 0 \text{ m/s}}{6 \text{ s}} = 5 \text{ m/s}^2$$

② FROM X-COMPONENT, FIND θ :

$$mg \sin \theta = ma \Rightarrow \sin \theta = \frac{a}{g} \Rightarrow \theta = \sin^{-1}\left(\frac{a}{g}\right) = \sin^{-1}\left(\frac{5 \text{ m/s}^2}{9.8 \text{ m/s}^2}\right)$$

$$\Rightarrow \boxed{\theta = 30.7^\circ}$$

③ FIND T FROM Y-COMPONENT

$$T = mg \cos \theta = (0.1 \text{ kg})(9.8 \text{ m/s}^2) \cos(30.7^\circ)$$

$$\boxed{T = 0.84 \text{ N}}$$