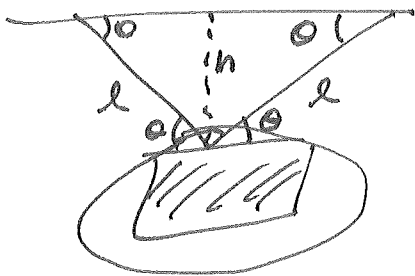


Physics 160

Extra Credit #12

Suspending A SPEAKER



$$m = 17 \text{ kg}$$

$$h = 1.6 \text{ m}, \quad l = 3.3 \text{ m}$$

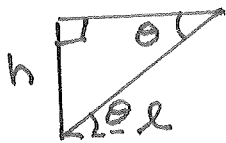
Forces: \vec{T}_1 at θ

\vec{T}_2 at θ

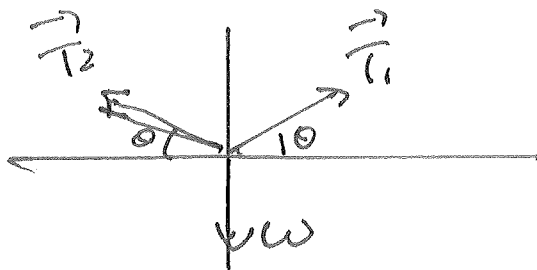
{ See Geometry at left }

Weight Down

$$w = (17 \text{ kg})(9.8 \text{ m/s}^2) = 166.6 \text{ N}$$



$$\sin \theta = \frac{h}{l} = \frac{1.6 \text{ m}}{3.3 \text{ m}} \Rightarrow \theta = \sin^{-1}(0.4848) = 29^\circ$$



EQUILIBRIUM $\sum F_x = 0, \sum F_y = 0$

$$\sum F_x = 0 \Rightarrow T_1 \cos \theta - T_2 \cos \theta = 0$$

$\Rightarrow T_{1x} + T_{2x} = 0$
 T_{1x} to Right
 T_{2x} to Left

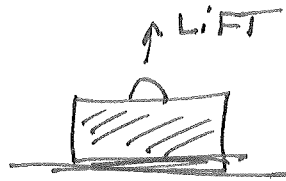
$$\Rightarrow \underline{T_1 = T_2 = T}$$

$$\sum F_y = 0 \Rightarrow T_{1y} + T_{2y} + w_y = 0 \Rightarrow T_1 \sin \theta + T_2 \sin \theta - w = 0$$

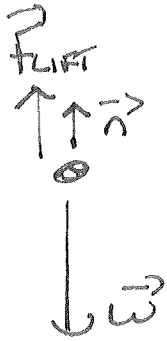
$$\Rightarrow T \sin 29^\circ + T \sin 29^\circ - 166.6 \text{ N} = 0 \Rightarrow T = \frac{166.6 \text{ N}}{2 \sin 29^\circ} = 171.8 \text{ N} = 172 \text{ N}$$

THE NORMAL FORCE:

WHEN LIFTING



FORCES ON SUITCASE: $\vec{F}_{\text{LIFT up}}$
 $\vec{N}_{\text{up}}, \vec{W}_{\text{down}}$



$$\sum F_y = 0 \text{ SINCE DOESN'T MOVE}$$

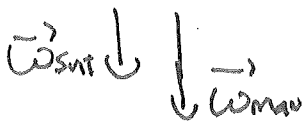
$$\Rightarrow F_{\text{LIFT}} + N - W = 0$$

$$\Rightarrow \underline{N = W - F_{\text{LIFT}}} \Rightarrow N < W$$

WHEN SITTING: Here we'll be careful \vec{W}_{MAN} vs. \vec{W}_{SUIT}

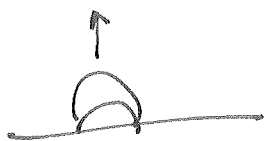


$$\sum F_y = 0 \Rightarrow N - W_{\text{SUIT}} - W_{\text{MAN}} = 0$$



$$\Rightarrow N = W_{\text{SUIT}} + W_{\text{MAN}} \Rightarrow N > W_{\text{SUIT}}$$

5.12



Rocket \rightarrow Total mass 118 kg
Forces: Thrust up \vec{T} , $T = 1960 \text{ N}$
AND weight DOWN, ~~for~~

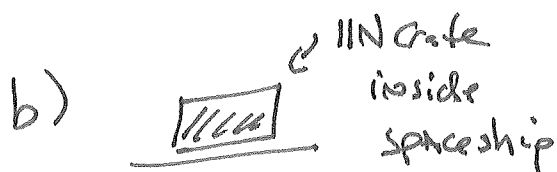
$$W = (118 \text{ kg})(9.8 \text{ m/s}^2) = 1156.4 \text{ N}$$



$$\Sigma F_y = ma_y$$

$$\Rightarrow T - W = ma_y \Rightarrow 1960 \text{ N} - 1156.4 \text{ N} = (118 \text{ kg})a_y$$

$$\Rightarrow a_y = \frac{803.6 \text{ N}}{118 \text{ kg}} = 6.81 \text{ m/s}^2$$



Forces on crate: \vec{n} UP,
 \vec{W}_c DOWN $W_c = 11 \text{ N}$

\vec{n} is force FROM spaceship $\Rightarrow n = ?$

$\Sigma F_y = ma_y$. Crate also accelerating $\Rightarrow a_y = 6.81 \text{ m/s}^2$

$$m = \frac{11 \text{ N}}{9.8 \text{ m/s}^2} = 1.122 \text{ kg}$$

$$\therefore n - W_c = ma_y \Rightarrow n - 11 \text{ N} = (1.122 \text{ kg})(6.81 \text{ m/s}^2) \Rightarrow n - 11 \text{ N} = 7.64 \text{ N}$$

$$\Rightarrow n = 18.6 \text{ N}$$