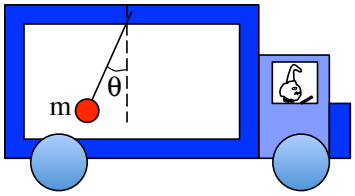
Problem 6.21



a.) This is one of those problems in which you can look at the picture, kind of get your brain scrambled, then just do the N.S.L. process and all turns out well. With the acceleration in the horizontal and the correct f.b.d.:

$$\sum F_y: \quad T\cos\theta - mg = \cancel{ma_y}^{\,0}$$

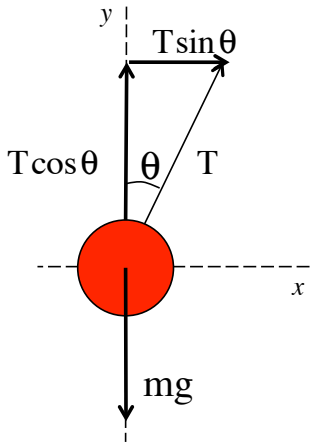
$$\Rightarrow \quad T = \frac{mg}{\cos\theta}$$

$$\sum F_x: \quad T\sin\theta = ma_x$$

$$\Rightarrow \quad \left(\frac{mg}{\cos\theta}\right)\sin\theta = ma_x$$

$$\Rightarrow \quad \tan\theta = \frac{a_x}{g}$$

$$\Rightarrow \quad \theta = \tan^{-1}\left[\frac{\left(3.00\ \text{m/s}^2\right)}{\left(9.80\ \text{m/s}^2\right)}\right] = 17.0^\circ$$



b.) For the tension in the string:

$$T\cos\theta = mg$$

$$\Rightarrow \quad T = \frac{mg}{\cos\theta}$$

$$\Rightarrow \quad T = \frac{\left(.500\ \text{kg}\right)\left(9.80\ \text{m/s}^2\right)}{\cos 17.0^\circ}$$

$$= 5.12\ \text{N}$$

OR

$$T\sin\theta = ma_x$$

$$\Rightarrow \quad T = \frac{ma_x}{\sin\theta}$$

$$= \frac{\left(.500\ \text{kg}\right)\left(3.00\ \text{m/s}^2\right)}{\sin 17.0^\circ}$$

$$= 5.13\ \text{N}$$

Close enough for government work! :)