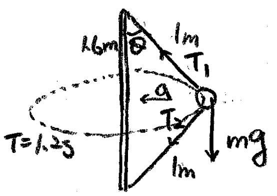
5-10



First, let us note that there are total 3 forces with which must conspire to produce the needed $\underset{\to}{F}_c$

The vertical force is totally zero

$$T_1 \cos\theta = T_2 \cos\theta + mg$$

where $\cos\theta = \frac{(1.6m/2)}{1m} = 0.8 \Rightarrow T_1 - T_2 = \frac{mg}{0.8} = 1.25\,mg \quad \cdots ①$

The horizontal force results in centripetal acceleration

$$T_1 \sin\theta + T_2 \sin\theta = \frac{mv^2}{r} = \frac{m\left(\frac{2\pi r}{T}\right)^2}{r} = \frac{4\pi^2 m r}{T^2}, \quad \sin\theta = 0.6$$

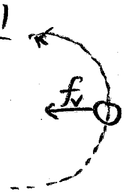
Thus, $T_1 + T_2 = \frac{4\pi^2 m r}{0.6T^2} \quad \cdots ②$

①+②, $2T_1 = m\left(1.25g + \frac{4\pi^2 r}{0.6T^2}\right)$ where $r = 1m \sin\theta = 0.6\,m$

$\Rightarrow T_1 = \frac{1}{2}(0.5kg)\left(1.25\cdot(9.8m/s^2) + \frac{4\pi^2(0.6m)}{0.6(1.2sec)^2}\right) = \underline{9.9N}$

Plug into ① $T_2 = T_1 - 1.25\,mg = 9.9N - 1.25(0.5kg)(9.8\,m/s^2) = \underline{3.8N}$

5-11



top view

We need $\underset{\to}{F}_c = -MR\omega^2$ to keep particle going on circle

if the viscous force f_v becomes less than $\underset{\to}{F}_c$

the particle will be separated out

$f_v < ma_c = m\,\omega^2 R \Rightarrow \omega > \sqrt{\frac{10^{-10}}{10^{-6}\times 0.5}} = 1.4\times10^{-2}$ rad/s

5-12

The Forces which Provide $\underset{\to}{F}_c$ <u>DO NO WORK</u> since THEY ARE always perpendicular to the direction of motion of the mass.