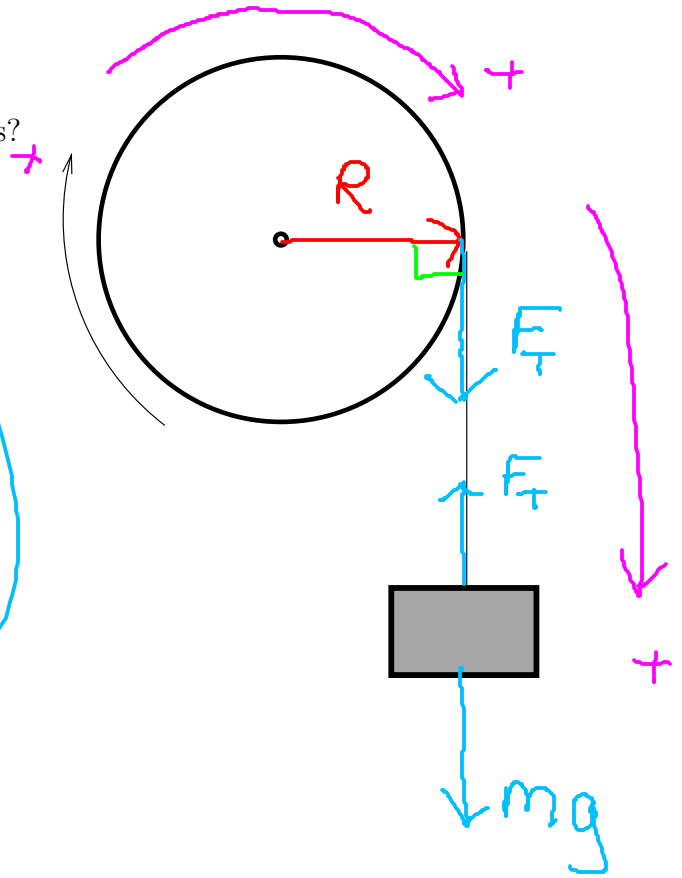
Quiz 6 – PH241 **Name**_____ ☐ **Pledged**

$\vec{F}_{net} = m\vec{a}$ $\vec{\tau}_{net} = I\vec{\alpha}$ $a = R\alpha$ $\tau = RF\sin\theta$
$I_{sphere} = \frac{2}{5}MR^2$ $g = 9.81 m/s^2$

A uniform sphere of mass 1.5 kg and radius 12 cm is free to rotate about its center. A string is wrapped around the sphere and allowed to rotate. There is a mass of 1.2 kg hanging off the string. **Show all work, draw force diagrams and torque diagrams, set up coordinate system, etc.**

(A) What is the tension in the string?

(B) What is the acceleration of the hanging mass?



Forces

① $ma = mg - F_T$

Torque ③ $\alpha = a/R$

② $I\alpha = RF_T$

$\frac{Ia}{R} = RF_T$

so $F_T = \frac{Ia}{R^2} = (2/5)Ma = \frac{2}{5}(1.5kg)(6.5 m/s^2) = 3.9N$

① $ma = mg - \frac{Ia}{R^2}$

$= 6.5 m/s^2$

$\left(m + \frac{I}{R^2}\right)a = mg$ so $a = \frac{mg}{m + \frac{2}{5}M} = \frac{(1.2kg)(9.8 m/s^2)}{(1.2kg + \frac{2}{5}(1.5kg))}$