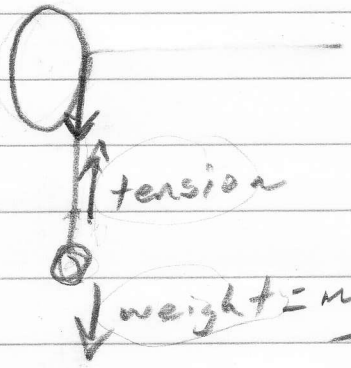
Answers to # 1-5 on p. 14, assuming that it takes 15s for the weight to fall.

1. $d = v_0 t + \frac{1}{2} a t^2$

$0.8\,m = \frac{1}{2}(a)(15\,s)^2$

$a = 0.00711\,m/s^2$

2.



$\Sigma F = ma = mg - \text{tension}$

$\text{tension} = mg - ma$

$\text{tension} = m(g - a)$

$\text{tension} = 0.05\,kg\,(9.8\,m/s^2 - 0.00711\,m/s^2)$

$\text{tension} = 0.490\,N$

3. $\tau = Fr = (0.490\,N)(0.05\,m) = 0.0245\,N \cdot m$

F ↑ String tension

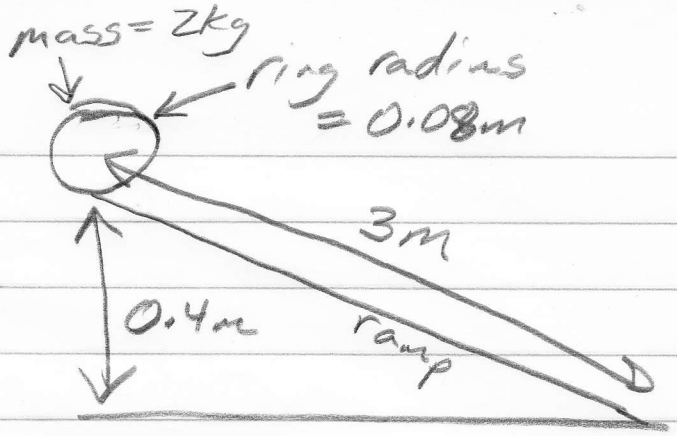
4. $\alpha = \frac{a}{r} = \frac{0.0071\ m/s^2}{0.05\ m/rad} = 0.142\ rad/s^2$ (from #1)

5. $\tau = I\alpha$ (from #3)

$0.0245\ N \cdot m = I(0.142\ rad/s^2)$

$I = 0.173\ kgm^2$

#7.



A ramp has a vertical drop of 0.4m and a length of 3m. Starting from rest, a ring rolls down the ramp. The trip down the ramp takes 3 seconds. What is the disc's moment of inertia?

$PE_1 + KE_1 = PE_2 + KE_{2\,Translational} + KE_{2\,Rotational}$

(PE_1: mgh; KE_1: zero; PE_2: zero; $KE_{2\,Translational}$: $\frac{1}{2}mv^2$; $KE_{2\,Rotational}$: $\frac{1}{2}I\omega^2$)

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 \qquad \omega = \frac{v}{r}$$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}\frac{Iv^2}{r^2}$$

If we find v, we can solve for I

(v @ bottom of ramp.)

$$v_{Ave} = \left(\frac{v_{Final} + v_0}{2}\right) \xrightarrow{v_0 = \text{zero}} v_{Ave} = \frac{v_{Final}}{2}$$

$$v_{Final} = (v_{ave})2$$

#7 cont'd

$$V_{Ave} = \bar{V} = \frac{d}{t} = \frac{3m}{3s} = 1 m/s$$

$$V_{Final} = 2(1 m/s) = 2 m/s$$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}\frac{Iv^2}{r^2}$$

$$2kg(9.8 m/s^2)(0.4m) = \frac{2kg(2m/s)^2}{2} + \frac{I(2m/s)^2}{2(0.08m)^2}$$

$$7.84j = 4j + \frac{313I}{s^2}$$

$$3.84j = \frac{313I}{s^2}$$

$$I = 0.0123 kg\,m^2$$