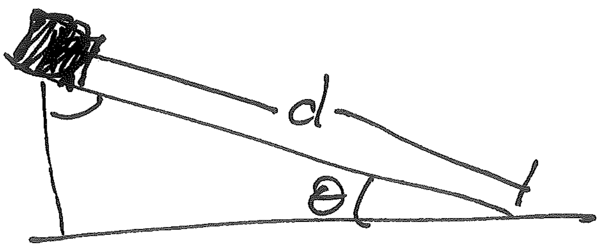
Review for Exam 2



(1)

$E_i = E_f$

gets speed in one step

a.) $W_g = F_g d \cos\theta$ between $\vec{F}_g$ & $\vec{d}$

$= F_g d \sin\theta$

$= mgh = (12\,kg)(9.8\,\frac{m}{s^2})(3m)$

$= \boxed{352.8\,J}$

b.) ∅ $\cos 90° = 0$

c.) $W_{net} = \Delta KE$

$352.8\,J = \frac{1}{2} m v^2$

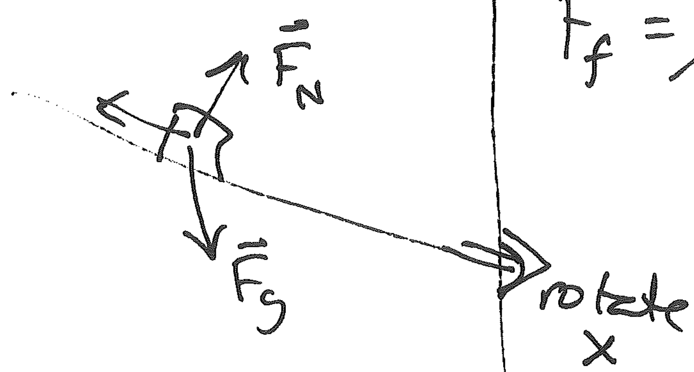
$v = \sqrt{\frac{2(352.8)}{12\,kg}} = \boxed{7.67\,m/s}$

(2) a.) & b.) are the same as Prob 1

a.) 352.8 J

b.) Ø

c.) $W_f = F_f \, d \cos 180°$



$F_f = \mu F_N$ from y-comps

$F_N - F_{gy} = 0$

$F_N = mg\cos\theta$

$W_f = \mu (mg\cos\theta)\, d \cos 180°$

$= -.2(12\,kg)(9.8\,\frac{m}{s^2})\cos 36.87° \, (5m)$ — 4m

$= \boxed{-94.1\ J}$

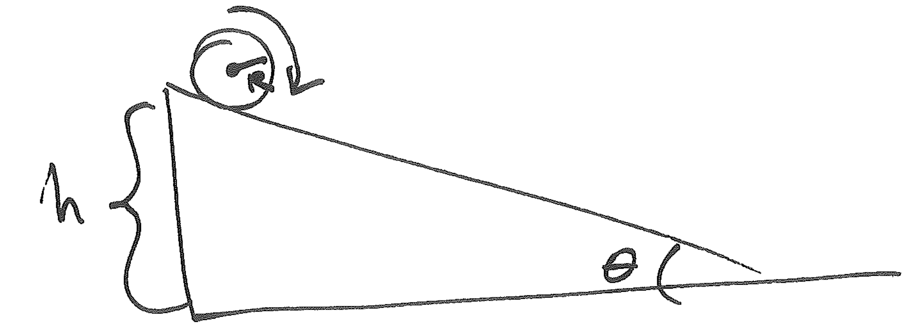
d.) $W_{net} = \Delta KE$

$(352.8 - 94.08)J = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2(258.72J)}{12\,kg}} = \boxed{6.57\ \frac{m}{s}}$

slower, as expected

3



$$E_i = E_f$$

$$KE_i + PE_i = KE_f + PE_f$$

($KE_i \to 0$, $PE_f \to 0$)

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

$$I_{sph} = \frac{2}{5}mr^2$$

$$\omega = \frac{v}{r}$$

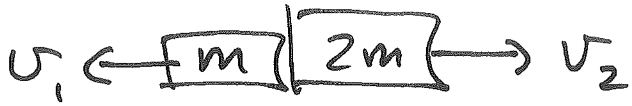
$$= \frac{1}{2}mv^2 + \frac{1}{2}\left(\frac{2}{5}mr^2\right)\left(\frac{v}{r}\right)^2$$

$$mgh = \left(\frac{1}{2}+\frac{1}{5}\right)mv^2 = \frac{7}{10}v^2$$

$$v = \sqrt{\frac{10}{7}gh} = \sqrt{\frac{10}{7}(9.8\,\tfrac{m}{s^2})(.70\,m)}$$

$$\boxed{v = 3.13\ m/s}$$

(4)



Cons $\vec{p}$: $0 = -mv_1 + 2mv_2$

$$mv_1 = 2mv_2$$

$$\boxed{v_1 = 2v_2}$$

Cons of E: $\frac{1}{2}kx^2 = \frac{1}{2}mv_1^2 + \frac{1}{2}(2m)v_2^2$ ($v_1 \to 2v_2$)

$$= 2mv_2^2 + mv_2^2$$

$$\frac{1}{2}kx^2 = 3mv_2^2$$

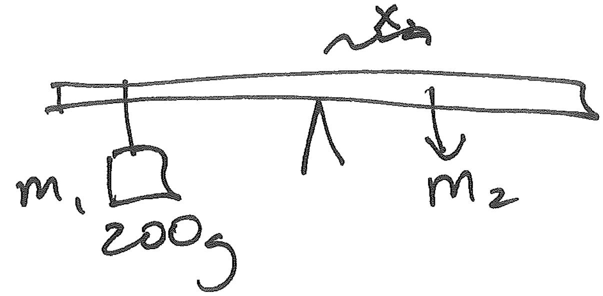
$$v_2 = \sqrt{\frac{kx^2}{6m}}$$

change k

$$v_2 = \sqrt{\frac{(2000\,\frac{N}{m})(.05\,m)^2}{6\,(.5\,kg)}} = \boxed{1.29\ m/s}$$

~~$= \sqrt{\frac{(200\,\frac{N}{m})(.05\,m)^2}{6\,(1.5\,kg)}} = .055\ m/s = 5.5\ cm/s$~~

5.



$$\sum \tau = I\alpha = 0 \leftarrow \text{at rest}$$

$$m_1 g x_1 - m_2 g x_2 = 0$$

$$m_1 x_1 = m_2 x_2$$

$$x_2 = \frac{m_1 x_1}{m_2} = \frac{200g\,(.4m)}{500}$$

$$x_2 = .16\ m$$

at **66cm mark**

(6.) $\omega_0 = 0 \quad \omega = 1500\,rpm$

a.) $1500 \frac{rev}{min} \times \frac{1\,min}{60\,s} \times \frac{2\pi}{1\,rev} = 157.1 \frac{rad}{s}$

b.) $\omega = \omega_0 + \alpha t$

$\alpha = \frac{\omega - \omega_0}{t} = \frac{157.1 \frac{rad}{s}}{.75\,s} = 209.4 \frac{rad}{s^2}$

c.) $\theta = \cancel{\theta_0}^{0} + \cancel{\omega_0 t}^{0} + \frac{1}{2}\alpha t^2$

$\theta = \frac{1}{2}(209.4 \frac{rad}{s^2})(.75\,s)^2 = 58.9\,rad$

$\times \frac{rev}{2\pi} = 9.38\,rev$

d.) $\Sigma\tau = I\alpha$

$= \frac{1}{2}mr^2\alpha$

$= \frac{1}{2}(.025\,kg)(.1\,m)^2(209.4 \frac{rad}{s^2})$

$= .0262\,mN$