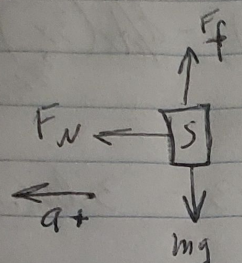
HW#8

1.



$\mu = 0.7 \quad r = 2.5\,m$

$\Sigma F_y = \mu F_N - mg = 0$

$\Sigma F_x = F_N = ma \Rightarrow a = \frac{v^2}{r}$

$\mu m \frac{v^2}{r} - mg = 0 \qquad \mu \frac{v^2}{r} - g = 0$

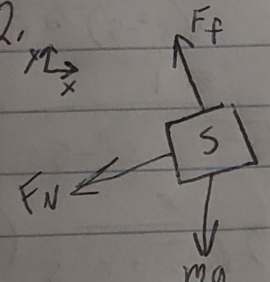
$\frac{\mu v^2}{r} = g \qquad \mu v^2 = rg \qquad v^2 = \frac{rg}{\mu}$

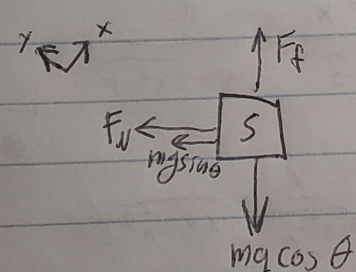
$v = \sqrt{\frac{rg}{\mu}}$ plug in $\sqrt{\frac{(2.5)(9.8)}{0.7}} = 5.92\,m/s$

$C = 2\pi r = 15.71\,m \qquad v = \frac{d}{t} \qquad t = \frac{d}{v}$

$t = \frac{15.71}{5.92} = 2.65\,rps = \boxed{159\,rpm}$

2.





$\theta = 20°$

$\Sigma F_y = \mu F_N - mg\cos\theta = 0$

$\Sigma F_x = F_N + mg\sin\theta = ma$

$F_N = \frac{mg\cos\theta}{\mu} \qquad \mu F_N = mg\cos\theta$

$\frac{mg\cos\theta}{\mu} + mg\sin\theta = m\frac{v^2}{r}$

$\frac{mg\cos\theta}{\mu} + \frac{\mu mg\sin\theta}{\mu}$

$\frac{mg\cos\theta + \mu mg\sin\theta}{\mu} = m\frac{v^2}{r}$

$\cancel{m}(g\cos\theta + \mu g\sin\theta) = \cancel{m}\left(\mu\frac{v^2}{r}\right) \qquad mg\cos\theta + \mu mg\sin\theta = \mu m\frac{v^2}{r}$

$\sqrt{\frac{r\,g\cos\theta + \mu g\sin\theta}{\mu}} = v$ plug in $\sqrt{\frac{(2.5)(9.8)(\cos 20) + (0.7)(9.8)(\sin 20)}{(0.7)}}$

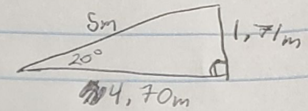
$\frac{15.71}{5.94} = \boxed{158.69\,rpm} \qquad \sqrt{\frac{22.32 + 2.35}{0.7}} = 5.94\,m/s$

HW#8

3. $t=\frac{d}{v}$ $4.49=\frac{7.86}{1.75}$ $\omega = 40\,rpm = 1.75\,m/s = 0.67\,rps$

$d=vt$

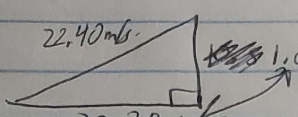
$x_f = v_i t + x_i$ $0 = v_i(4.49) - 4.70$



$\frac{4.70}{4.49} = 1.05\,m/s = V_{ix}$

$y_f = \frac{1}{2}at^2 + V_{iy}t + y_i$ $0 = \frac{1}{2}(9.8)(4.49^2) + V_{iy}(4.49) + 1.71$

$\frac{-4.9(4.49)^2 - 1.71}{4.49} = V_{iy} = 22.38\,m/s$

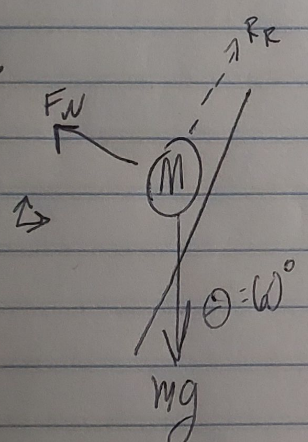


$\sqrt{501.97} = 22.40\,m/s$

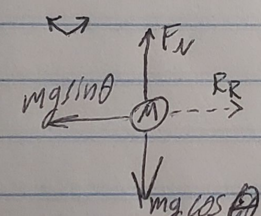
$\tan^{-1}\left(\frac{1.05}{22.38}\right) = \cancel{2.69°} \rightarrow 87.31°$

Stan's vomit was launched at 22.40m/s at 87.31° above horizontal

4.



$m = 0.05\,kg$



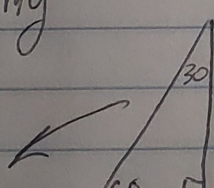
$\Sigma F_y = F_N - mg\cos\theta = 0$

$\Sigma F_x = mg\sin\theta = ma \rightarrow \frac{v^2}{r}$

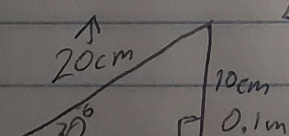
$g\sin\theta = \frac{v^2}{r}$

$\cancel{(0.05)}(9.8)(0.87)$ $rg\sin\theta = v^2$

$v = \sqrt{rg\sin\theta}$



0.2m



$0.92\,m/s = v = \sqrt{(0.1)(9.8)(0.87)}$

a. $\boxed{0.92\,m/s}$

$r = 0.1$

$\sqrt{\frac{r(mg\sin\theta - R_R)}{m}} = v$

b. Rolling resistance would act in the opposite direction as $mg\sin\theta$ and would change $\Sigma F_x = mg\sin\theta = m\frac{v^2}{r}$ to $\Sigma F_x = mg\sin\theta - R_R = m\frac{v^2}{r}$. It would need a force higher than what $mg\sin\theta$ can be so v won't change.

Question 1. The first question for which B is the correct answer is:

A. Question 1

~~B. Question 4~~

~~C. Question 3~~

~~D. Question 2~~

Question 2. The answer to Question 4 is:

~~A. D~~

~~B. A~~

C. B

~~D. C~~

Question 3. The answer to Question 1 is:

~~A. D~~

~~B. C~~

~~C. B~~

D. A

Question 4. The number of questions which have D as the correct answer is:

~~A. 3~~

B. 2

~~C. 1~~

~~D. 0~~

Question 5. The number of questions which have B as the correct answer is:

~~A. 0~~

~~B. 2~~

~~C. 3~~

D. 1