(5)
~~(6)~~

HW ~~6~~ 5 p 310 MC 2
p 312 Problems 38, 49, 50, 56

(6)

p310 - Multiple Choice

2) Push child on swing, why not vertical circle?

✓a) Torque of force that Earth exerts on child pulls him back

(1)

✓b) swing doesn't have enough KE at bottom

✓c) swing doesn't have enough rotational momentum

(d) All are correct

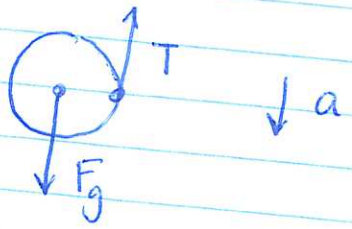
(6)
(5)

p 312 - Problems

38) wrap string around disk + use like yo-yo.

$r = .040\,m$
$m = .20\,kg$
$a = \frac{2}{3}g$

a) force diagram



b) $\Sigma F = ma$ (down)
$T - mg = -ma$
$ma = mg - T$

$\Sigma \tau = I\alpha$
$Tr = I\alpha$

$T = mg - ma$
$= mg - \frac{2}{3}mg$
$= \frac{1}{3}mg$

c) $I = ?$ $\quad I = \frac{1}{2}MR^2 = \frac{1}{2}(.20\,kg)(.040\,m)^2$

$= 1.6 \times 10^{-4}\ kg\,m^2$

(2)

d) $\alpha = ?$

$$\alpha = \frac{Tr}{I} = \frac{(mg - ma)(r)}{I}$$

$$= \frac{((.20\,kg)(9.81\,m/s^2) - (.20\,kg)(6.54\,m/s^2))(.040\,m)}{1.6 \times 10^{-4}\ kg\,m^2}$$

or $\alpha = \frac{a_T}{r} = \frac{2/3\,g}{r}$

$= 160\ rad/s^2$

(Textbook asked if answer was consistent

$\alpha = \frac{Tr}{I} = \frac{\frac{1}{3}mgr}{\frac{1}{2}mr^2} = \frac{2}{3}\frac{g}{r} = \frac{2}{3}\frac{a}{r}$ $\quad \alpha = \frac{2}{3}a\left(\frac{1}{r}\right)$ $\quad \alpha = \frac{a}{r}$

since ...

~~6~~ 5

49) gains K, has I, expression for ω_f=?

(1) $\Delta K = K_f - K_0 = \frac{1}{2} I \omega^2$ $\quad \omega = \sqrt{\frac{2K}{I}}$

50) automobile w/ flywheel power

$m = 1500\,kg$ car
$m_{wheel} = 300\,kg$
$I = 6.0\,kg\,m^2$
$\omega_{max} = 3600\,rad/s$

a) $K = \frac{1}{2} I \omega^2$

$= \frac{1}{2}(6.0\,kg\,m^2)(3600\,rad/s)^2$

$= 3.9 \times 10^7\,J$

b) How many a from zero to 15 m/s before E dissipate?

(1)

① $K = \frac{1}{2} m v^2 = \frac{1}{2}(1500\,kg)(15\,m/s)^2$

$= 1.7 \times 10^5\,J$

② $\# = \frac{K_R}{K_{need}} = \frac{3.9 \times 10^7\,J}{1.7 \times 10^5\,J} = 230$

5

5(6) Advanced locamotive propulsion system
gas turbine, high speed flywheel

$K_{stored} = 4.8 \times 10^8 \text{ J}$

$\omega_{max} = 15000 \text{ rpm}$

$V_T = 1000 \text{ m/s}$

$r = ?$

$I = ?$

① $\frac{15000 \text{ rev}}{\text{min}} \left(\frac{2\pi \text{ rad}}{1 \text{ rev}}\right)\left(\frac{1 \text{ min}}{60 \text{ s}}\right)$

$\omega_{max} = 1570 \text{ rad/s}$

② $K = \frac{1}{2} I \omega^2$

b) $I = \frac{2K}{\omega^2} = \frac{2(4.8 \times 10^8 \text{ J})}{(1570 \text{ rad/s})}$

(1)

$I = 390 \text{ kgm}^2$

③ $V_T = \omega r \quad r = \frac{V_T}{\omega} = \frac{1000 \text{ m/s}}{1570 \text{ rad/s}} = .64 \text{ m}$

a)