Chapter 8 End of chapter Problems

#73 $r = 45\text{cm} = 0.45\text{m}$ $\qquad v = r\omega;\ \omega = \frac{v}{r}$

$v = 23\text{m/s}$

$$\omega = \frac{23}{0.45} = 51\frac{\text{rad}}{\text{s}}$$

#75

a) $$1880\frac{\text{rev}}{\text{min}} \times \frac{2\pi^R}{\text{rev}} \times \frac{1\text{min}}{60\text{sec}} = 197\text{rad/sec}$$

b) $t = 2.50\text{sec}$ $\qquad \omega = \frac{\theta}{t};\ \theta = \omega t = \left(197\frac{\text{rad}}{\text{sec}}\right)(2.50\text{sec})$

$\theta = ?$

$\theta = 492\text{ rad}$

#77 $r = 9.00\text{ cm} = 9.00 \times 10^{-2}\text{m}$

$\omega = 2.50\text{ rad/sec}$

v at $r = 7.00\text{cm}\ (7.00 \times 10^{-2}\text{m})$

$$v = r\omega = (7.00 \times 10^{-2})(2.50) = 0.175\text{ m/s}$$

#79 $a_c = \omega^2 r$ $\qquad \frac{1g}{9.80\text{m/s}^2}$

$$\omega = 542\frac{\text{rev}}{\text{min}} \times \frac{2\pi^R}{\text{rev}} \times \frac{1\text{min}}{60\text{sec}} = 56.76\text{ rad/sec}$$

$$d = 2r;\ r = \frac{d}{2} = \frac{0.43}{2} = 0.215\text{m}$$

$$a_c = (56.76)^2(0.215) = 692.7\text{ m/s}^2$$

$$a_c = (692.7)\frac{1g}{9.80} = 70.7 = 71g$$

#81. $\tau = 8.0$ N-m $\tau = Fr\sin\theta$

$r = 0.35$m

at least force occurs when $\theta = 90°$

$\tau = Fr$; $F = \frac{\tau}{r} = \frac{8.0}{0.35} = 23$ N

#83 $m_1 = 0.45$kg $r = 0.23$m

$m_2 = 0.45$kg

$I = mr^2$ for each mass

$I = (0.45)(0.23)^2 + (0.45)(0.23)^2 = 0.048$ kg-m^2

#85 $v_f = 3.0$m/s

a) $\omega = \frac{v_f}{r} = \frac{3.0}{.0040} = 7.5\times10^2$ r/s

radius $= \frac{0.0080}{2} = 0.0040$m

b) $\tau = Fr\sin\theta$ and $\tau = \alpha I \rightarrow Fr\sin\theta = \alpha I$

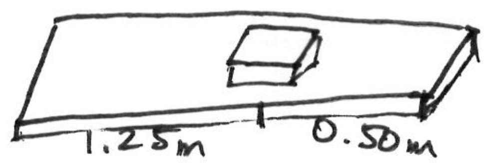
$$F = \frac{\alpha I}{r_{rod}\sin\theta} = \frac{\left(\frac{\Delta\omega}{\Delta t}\right)\left(\frac{1}{2}mr_{disc}^2\right)}{r_{rod}\sin\theta} = \frac{\Delta\omega\, m r_{disc}^2}{2\Delta t\, r_{rod}\sin\theta}$$

$$F = \frac{(\omega_f - \omega_o)\, m r_{disc}^2}{2\Delta t\, r_{rod}\sin\theta}$$

$$F = \frac{(7.5\times10^2 - 0)(.0125)\left(\frac{.035}{2}\right)^2}{2(0.50)(.0040)\sin 90.0} = 0.72\text{ N}$$

87. $m_1 = 4.25\ kg$ (Board)

$m_2 = 6.00\ kg$ (Box)



At equilibrium $\sum F = 0$ & $\sum \tau = 0$

$$F_{left} + F_{right} + F_{w\,board} + F_{w\,box} = 0$$

$$F_{left} r_{left} + F_{right} r_{right} + F_{w\,board} r_{board} + F_{w\,box} r_{box} = 0$$

set Location Left as 0.

$$F_{left}(0) + F_{right}(1.75) + (4.25)(-9.8)\left(\frac{1.75}{2}\right) + (6.00)(-9.80)(1.25) = 0$$

$F_{right} = 63N$

Substitute back into the $\sum F$ equation

$$F_{left} = -F_{right} - F_{board} - F_{box}$$

$$F_{left} = -63 - (4.25)(-9.80) - (6.00)(-9.80) = 37N$$

#89 (a) $\alpha = \frac{\tau}{I} = \frac{Fr\sin\theta}{\frac{1}{3}ml^2} = \frac{mg(\frac{1}{2}l)\sin 90.0°}{\frac{1}{3}ml^2}$

$\tau = Fr\sin\theta$

$I = \frac{1}{3}ml^2$

$$\alpha = \frac{3g}{2l}$$

(b) The acceleration is not constant. The angle between the door and the weight is changing and therefore so is the torque. This causes the acceleration to change.

91. sphere basketball

$d = 24.1\ cm$; $r = 12.05\ cm = .1205\ m$

$mass = 0.60\ kg$

$I = 5.8 \times 10^{-3}\ kg\text{-}m^2$

$v_0 = 2.5\ m/s$

a) $\omega_0 = \frac{v_0}{r} = \frac{2.5}{.1205} = 21\ rad/sec$

b) $s = 12\ m$; $s = r\theta$, $\theta = \frac{s}{r} = \frac{12\ m}{.1205} \cdot \frac{1\ rev}{2\pi R} = 16\ rev$

c) change 16 rev to radians

$\theta = \frac{12\ m}{.1205} = 1.0 \times 10^{2}\ rad$