LINEAR IMPULSE and MOMENTUM (p. 140)

$$\text{momentum} = p = mv$$
$$\text{impulse} = \int F dt = \overline{F}t$$
$$\int F dt = mv_f - mv_i$$

1. $\overline{F} = m\overline{a} = 60.0\left(\dfrac{0-12.00}{1.100}\right) = 60(-10.909) = -655 \text{ N}$

3. $\text{Impulse} = Ft = mv_f - mv_i = 55.0(2.50) - 0 = 137.5 \text{ N.s}$

5. $mv_{fx} = mv_{ix} + \int F_x dt = 0 + 200$

$v_{fx} = 200 / 70.0 = 2.86 \text{ m/s}$

$mv_{fy} = mv_{iy} + \int F_y dt - Wt$

$= 0 + 1200 - 70(9.81)1.2 = 375.86$

$v_{fy} = 375.86 / 70.0 = 5.37 \text{ m/s}$

7. $v_{fy}^2 = v_{iy}^2 - 2g(y_f - y_i)$

$= 0 - 2(9.81)(-1.350 - 0) = 26.487$

$v_{fy} = \sqrt{26.476} = -5.1247 \text{ m/s}$

$a_{landing} = \dfrac{v_f - v_i}{t} = \dfrac{0-(-5.127)}{0.400} = 12.87 \text{ m/s}^2$

$F_{landing} = ma_{landing} = 60.0(12.87) = 772 \text{ N}$

9. $\overline{F}t = mv_f - mv_i$

$\overline{F} = \dfrac{-mv_i}{t} = \dfrac{-0.005(400)}{0.050} = -40.0 \text{ N}$

11. $v_f = v_i + \dfrac{\overline{F}t}{m} = 0 + 24.0(1)/4 = 6.00 \text{ m/s}$

ANGULAR IMPULSE and MOMENTUM (p. 145)

$$\text{angular momentum} = L = I\omega$$
$$\text{angular impulse} = \int M dt = \overline{M}t$$
$$\int M dt = I\omega_f - I\omega_i$$

1. $L = I\omega = 5.00(5.52)$
$= 27.6\ \text{kg.m}^2/\text{s}$

3. $L = I\omega = 5.65\left(2.25\frac{r}{s} \times \frac{2\pi\ \text{rad}}{1\,r}\right)$
$= 5.65(14.137) = 79.9\ \text{kg.m}^2/\text{s}$

5. $\overline{M}t = (\overline{F}d)t = 250(1.350)0.500$
$= 168.8\ \text{N.m.s}$

7. $\overline{M}t = (\overline{F}d)t = 68.0(0.320)5$
$= 108.8\ \text{N.m.s}$

9. $k = Kl = 0.326(1.235) = 0.4026\ \text{m}$
$I = mk^2 = 11.50(0.4026)^2 = 1.8641\ \text{kg.m}^2$
$L = I\omega = 1.8641(2.55) = 4.75\ \text{kg.m}^2/\text{s}$

CONSERVATION of MOMENTUM (p. 153)

$$p_f = p_i = mv = \text{constant}$$
$$L_f = L_i = I\omega = \text{constant}$$

1. (a)

$$L = I\omega = 2(20) = 40.0\ \text{kg.m}^2/\text{s}$$

(b)

$$I_{top}\omega_{top} = L_{start} = L_{top} = L_{land} = 40.0\ \text{kg.m}^2/s$$
$$I_{top} = L/30.0 = 1.333\ \text{kg.m}^2$$
$$I_{land} = L/26.6 = 1.504\ \text{kg.m}^2$$

3. (a)

$$L = I\omega$$
$$8.25 = 0.430\omega$$
$$\omega = 8.25/0.43 = 19.19\ \text{rad/s}$$

(b)

$$M = I\alpha = 0.43\left(\frac{19.19-0}{0.5}\right) = 16.50\ \text{N.m}$$

5.

$$\omega = L/I = 8.95/16.26 = 0.5504$$
$$\omega = \frac{\theta_f - \theta_i}{t}$$
$$t = \frac{\theta_f - 0}{\omega} = \frac{2p}{0.5504} = 11.42\ \text{s}$$

7.

$$I = L/\omega = 35.6/3.25 = 10.95\ \text{kg.m}^2$$