

LINEAR IMPULSE and MOMENTUM (p. 140)

$$\text{momentum} = p = mv$$

$$\text{impulse} = \int F dt = \bar{F}t$$

$$\int F dt = mv_f - mv_i$$

1. $\bar{F} = m\bar{a} = 60.0 \left(\frac{0 - 12.00}{1.100} \right) = 60(-10.909) = -655 \text{ N}$
3. Impulse = $Ft = mv_f - mv_i = 55.0(2.50) - 0 = 137.5 \text{ N}\cdot\text{s}$
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. $v_{fy}^2 = v_{iy}^2 - 2g(y_f - y_i)$
 $= 0 - 2(9.81)(-1.350 - 0) = 26.487$
 $v_{fy} = \sqrt{26.476} = -5.1247 \text{ m/s}$
 $a_{\text{landing}} = \frac{v_f - v_i}{t} = \frac{0 - (-5.127)}{0.400} = 12.87 \text{ m/s}^2$
 $F_{\text{landing}} = ma_{\text{landing}} = 60.0(12.87) = 772 \text{ N}$
9. $\bar{F}t = mv_f - mv_i$
 $\bar{F} = \frac{-mv_i}{t} = \frac{-0.005(400)}{0.050} = -40.0 \text{ N}$
11. $v_f = v_i + \frac{\bar{F}t}{m} = 0 + 24.0(1) / 4 = 6.00 \text{ m/s}$

ANGULAR IMPULSE and MOMENTUM (p. 145)

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

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

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

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

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

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

CONSERVATION of MOMENTUM (p. 153)

$$p_f = p_i = mv = \text{constant}$$

$$L_f = L_i = I\omega = \text{constant}$$

1. (a)

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

(b)

$$I_{top}\omega_{top} = L_{start} = L_{top} = L_{land} = 40.0 \text{ kg}\cdot\text{m}^2/\text{s}$$

$$I_{top} = L / 30.0 = 1.333 \text{ kg}\cdot\text{m}^2$$

$$I_{land} = L / 26.6 = 1.504 \text{ kg}\cdot\text{m}^2$$

3. (a)

$$L = I\omega$$

$$8.25 = 0.430\omega$$

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

(b)

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

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.

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