Pg 250: 39, 40, 41, 42, 44

39 a.) $K_{trans} = \frac{1}{2} m v^2$

$K_{rot} = \frac{1}{2} I \omega^2$ $\quad v = r\omega \rightarrow \omega = \frac{v}{r}$ $\quad I = \frac{1}{2} m r^2$

b.) $K_{trans} = \frac{1}{2}(10.0 kg)(10 m/s)^2 = 500 J$

$K_{rot} = \frac{1}{2}(\frac{1}{2} m r^2)(\frac{v}{r})^2 = \frac{1}{2}(\frac{1}{2} \cdot 10.0 kg \cdot r^2)(\frac{10 m/s}{r})^2$

* the radius cancels out

$\rightarrow K_{rot} = 250 J$

c.) $K_{tot} = K_{rot} + K_{trans} = 500 J + 250 J = 750 J$

40. $W = \Delta$ Energy $= \Delta K_{rotational}$

$\rightarrow K_{rot_{final}} - K_{rot_{initial}} = W$

$\rightarrow \frac{1}{2} I \omega_f^2 - \frac{1}{2} I \omega_i^2 = W$

$\rightarrow \frac{1}{2} I \omega_f^2 - 0 = W$

$\rightarrow I = \frac{2W}{\omega_f^2} = \frac{2(3000 J)}{(200 rad/s)^2} = .150 kg \cdot m^2$

41.) * $I = \frac{1}{2} M R^2 = \frac{1}{2}(80.0 kg)(1.50 m)^2 = 90 kg \cdot m^2$

* need angular acceleration (α) $\rightarrow \alpha = \frac{\tau}{I} = \frac{Fd}{I} = \frac{(50.0 N \cdot 1.50 m)}{(90 kg \cdot m^2)} = .833 rad/s^2$

so we can find ω

$\Delta\theta$	
ω_0	0 rad/s
ω	?
α	.833 rad/s²
Δt	3.00 s

$\rightarrow \omega = \omega_0 + \alpha \Delta t = (.833 rad/s^2)(3.00 s) = 2.5 rad/s$

$\rightarrow K_{rot} = \frac{1}{2} I \omega^2 = \frac{1}{2}(90 kg \cdot m^2)(2.5 rad/s)^2 = 281 J$

41) $K_{rot} = \frac{1}{2} I \omega_f^2$ (only $K_{rotational}$ is present)

— need ω_F, so we need α as well

$$\alpha = \frac{\tau}{I} = \frac{F \cdot d}{\frac{1}{2}mr^2} = \frac{50.0N \cdot 1.50m}{\frac{1}{2}(80.0kg)(1.50m)^2} = .833 \, rad/s^2$$

$\omega_F = \omega_0 + \alpha \Delta t$

$\Delta\theta$	
ω_0	0
ω_F	?
α	.833 rad/s^2
Δt	3.00 s

$\omega_F = \alpha \Delta t$

$\omega_F = (.833 \, rad/s^2)(3.00s) = 2.5 \, rad/s$

$K_{rot} = \frac{1}{2}(\frac{1}{2}mr^2)(\omega_F^2) = \frac{1}{2}(\frac{1}{2}(80 \, kg)(1.5^2))(2.5 \, rad/s)^2$

$K_{rot} = 281 J$

42) $K_{rot} = \frac{1}{2} I \omega^2 \quad I = \frac{1}{2}Mr^2 = \frac{1}{2}(500kg)(2.00m)^2 = 1000 kg \cdot m^2$

$\omega = 5{,}000 \, rev/min \times \frac{2\pi}{1 \, rev} \times \frac{1 \, min}{60 \, s} = 523.6 \, rad/s$

$\rightarrow K_{rot} = \frac{1}{2}(1000 kg \cdot m^2)(523.6 \, rad/s)^2 = 137078480 J$