42. a) $L(7) = ?$

$$\tau = \frac{dL}{dt} \qquad \tau\, dt = dL$$

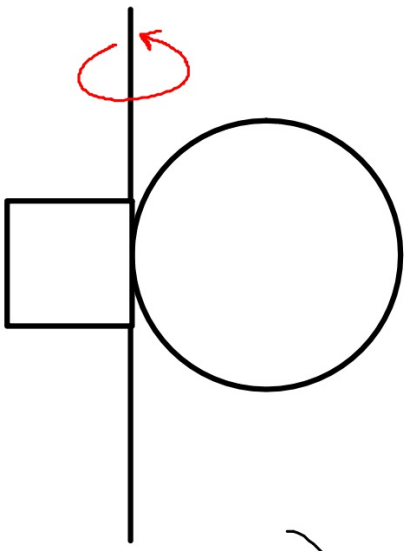
$$\text{area}\Big|_0^7 = \Delta L$$

$$= L_f - L_0$$

$$24\ \text{kgm}^2/\text{s} = L_7 - 0$$

b) $L(20) = ?$

41.



$I = ?$

$I = I_{hoop} + 2\left(I_{rods} + mh^2\right) + mr^2$

$$I = \left(\frac{1}{2}mR^2 + mR^2\right) + 2\left(\frac{1}{12}mR^2 + m\left(\frac{R}{2}\right)^2\right) + mR^2$$

$$= \frac{3}{2}mR^2 + \frac{2}{3}mR^2 + mR^2 = \frac{19}{6}mR^2$$

$$= \frac{19}{6}(2)(0.5)^2 = 1.6\ kg\,m^2 = I$$

b) $L = ?$ $\quad T = 2.5\,sec$

$L = I\omega$ $\quad \omega = \frac{2\pi\,rad}{2.5\,sec} =$

$L = (1.6)(2.5\,1/s)$

$L = 4\ kg\,m^2/s$

44. $\omega_f = ?$ $\sum \tau_{ext} = 0$ so...

$$l_0 + L_0 = l_f + L_f$$

$$m(r \times v) + I\omega = mr^2\omega_f + I\omega_f$$

$$(0.17)(.15)(2) + (5E\text{-}3)(-2.8) = (.17)(.15)^2\omega_f + (5E\text{-}3)\omega_f$$

$$0.037 = 0.008825\omega_f$$

$$4.19 \text{ rad/s} = \omega_f$$

48. $\frac{I_{\text{bug at rim}}}{I_{\text{DISK}}} = ?$

$\sum \tau_{ext} = 0$ so...

$L_o = L_f$

$I_{disk}\omega_o = (I_{disk} + I_{bug})\omega_f$

$I_D(6) = (I_D + I_B)5$

$6I_D = 5I_D + 5I_B$

$I_D = 5I_B$

$0.2 = \frac{I_B}{I_D}$

~~$M_{bug}R^2$~~

~~$\frac{1}{2}MR^2$~~

47. $\omega_{f_{W/E}} = ?$ $\quad \tau_{ext} = 0$ so....

$$L_o = L_f$$

$$0 = l_f + L_f$$

$$0 = mrv_{T/E} + I\omega_{W/E}$$

$$0 = mR^2\omega_{T/E} + 1.1mR^2\omega_{W/E}$$

$$0 = 0.3488 + \omega_{W/E} + 1.1\,\omega_{W/E}$$

$$-0.3488 = 2.1\,\omega_{W/E}$$

$$|\omega_{W/E}| = 0.166 \text{ rad/s}$$

$$I_W = mR^2 = 1.1mR^2$$

$$0.15 \text{ m/s} = v_{T/W}$$

$$0.15 = \omega r \qquad r = 0.43$$

$$\omega_{T/E} = \omega_{T/W} + \omega_{W/E}$$

$$\omega_{T/E} = \frac{0.15}{0.43} + \omega_{W/E}$$

37. $I = ?$

$$I = \sum_{i=1}^{3} m_i r_i^2$$

$$= md^2 + m(2d)^2 + m(3d)^2$$

$$I = 14md^2 = 14\,(0.023)(.12\text{m})^2$$

$$I = 4.6\times10^{-3}\ \text{kgm}^2$$

b) $L = ?$ $= I\omega$

for #2 $= (4md^2)(\omega) = 4(0.023)(.12)^2\left(0.85\frac{\text{rad}}{\text{s}}\right)$

$$I = 1.1\times10^{-3}\ \text{kgm}^2/\text{s}$$

c) $L_{total} = ?$ $L = I\omega$

$= (4.6E\text{-}3)(0.85)$

$L = 3.9 \times 10^{-3}\ Kgm^2/s$

39. $\Sigma\tau = ?$

$$\Sigma\tau = \frac{dL}{dt}$$

$$\overline{\Sigma\tau} = \frac{\Delta L}{\Delta t} = \frac{0.8 - 3}{1.5} = -1.47\ \text{Nm}$$

$$|\tau| = 1.47\ \text{Nm}$$

b) $\Delta\theta = ?$

$L_i = 3\ \text{rad/s}$ $\quad L = I\omega = (.14)(\omega_0)$ $\quad \omega_0 = 21.4\ \text{rad/s}$

$L_f = 0.8\ \text{rad/s}$ $\quad 0.8 = (.14)(\omega_f)$ $\quad \omega_f = 5.71$

$$\Delta\theta = \tfrac{1}{2}(\omega_0 + \omega_f)t = \tfrac{1}{2}(21.4 + 5.71)(1.5)$$

$$\Delta\theta = 20.3\ \text{rad}$$

c) $W = ?$ $W = \tau \cdot \Delta\theta$

$= (1.47\,Nm)(20.3)\cos 180^\circ$

$W = -29.9\,J$

$P = \frac{W}{\Delta t} =$ 29.9 W