

59.

$$\tau = ? \quad P = 74.6 \times 10^3 \text{ W}$$

$$\omega = 1800 \text{ rev/min} = 188.5 \text{ rad/s}$$

$$P = \tau \omega$$

$$\tau = \frac{P}{\omega} = \frac{7.46 \times 10^4}{188.5} = 395.8$$

$$\tau = 396 \text{ Nm}$$

67.

$$\omega_f = ? \quad \omega_o = 0$$

$$U_{g_i} = K_f$$

$$mgh_i = \frac{1}{2} I_p \omega^2$$

$$(2m)g(4R) = \frac{1}{2} (I_{\text{stick}_P} + I_{\text{hoop}_P}) \omega^2$$

$$8mgR = \frac{1}{2} \left(\frac{1}{12} m(2R)^2 + mR^2 + \frac{1}{2} mR^2 + m(3R)^2 \right) \omega^2$$

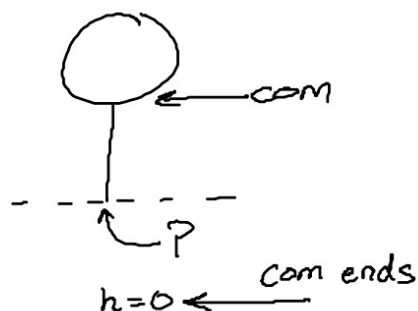
$$8mgR = \frac{1}{2} \left(\frac{1}{3} mR^2 + mR^2 + \frac{1}{2} mR^2 + 9mR^2 \right) \omega^2$$

$$8\cancel{m}g\cancel{R} = 5.417\cancel{m}R^2\omega^2$$

$$\omega = \sqrt{96.5}$$

$$8g = 5.417(0.15)\omega^2$$

$$\omega_f = 9.82 \text{ rad/s}$$



58.

$V = ?$



$$R = 0.12 \text{ m}$$

$$M = 0.4 \text{ kg}$$

$$m = 0.05 \text{ kg}$$

50cm

$V_f = ?$

$$V_f = \omega R \quad \omega = \frac{V}{R}$$

$$U_{g_i} = K_t + K_{rot}$$

$$mgh_i = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

$$(0.05)(9.8)(0.5) = \frac{1}{2}(0.05)v^2 + \frac{1}{2}\left(\frac{1}{2}(0.4)(0.12)^2\right)\left(\frac{v^2}{(0.12)^2}\right)$$

$$0.245 = 0.025v^2 + 0.1v^2$$

$$1.4 \text{ m/s} = v$$

61. $W = ?$ $P = ?$

$$m = 32 \text{ kg} \quad \omega_o = 280 \text{ rev/min} = 29.3 \text{ rad/s}$$

$$r = 1.2 \text{ m} \quad \omega_f = 0$$

$$t = 15 \text{ s}$$

$$U + K + W_{\text{net}} = U + K$$

$$0 + \frac{1}{2} I \omega^2 + W = 0$$

$$\frac{1}{2} (mr^2) \omega_i^2 + W = 0$$

$$\frac{1}{2} (32)(1.2)^2 (29.3)^2 + W = 0$$

$$W = -1.98 \times 10^4 \text{ J}$$

$$P = \frac{W}{\Delta t} = \frac{1.98 \times 10^4 \text{ J}}{15 \text{ s}}$$

$$P = 1320 \text{ W}$$

66. $V_f = ?$ (for block)
 $h_o = 0.82\text{m}$ $h_f = 0$

$$U_{g_o} = K_f$$

$$mgh_o = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 + \frac{1}{2}I\omega^2$$

$$mgh_o = \frac{1}{2}mv^2 + \frac{1}{2}I \frac{v^2}{r^2} + \frac{1}{2}\left(\frac{2}{3}MR^2\right) \frac{v^2}{R^2}$$

$$(0.6)(9.8)(0.82) = \frac{1}{2}(0.6)v^2 + \frac{1}{2}\frac{(3 \times 10^{-3})}{(0.05)^2}v^2 + \frac{1}{3}(4.5)v^2$$

$$4.8216 = 2.4v^2$$

$$1.42\text{m/s} = V_f$$