Ch.10

10. (a) $\frac{1}{2}\alpha_w \cdot t^2 = w \cdot \quad \therefore \alpha_w = \frac{2w}{t^2} = \frac{40}{25} = 1.6\ rad/s^2$

(b) $\bar{\omega} = \alpha_w \cdot \frac{1}{2}t = \frac{8}{5} \times \frac{5}{2} = 4\ rad/s$

(c) $\bar{\omega} = 8\ rad \cdot s^{-1}$

(d). $\frac{1}{2}\alpha_w \cdot t_B^2 - \theta_{IB} = \frac{1}{2} \times \frac{8}{5} \times 10w - 20 = 60\ rad.$

28. $w_C = 100 rev/min = \frac{5}{3} rev/s = \frac{10}{3}\pi\ rad/s.$

Let $\omega_A = \frac{10}{3}\pi \times \frac{25}{10} = \frac{25}{3}\pi\ rad/s.$

$\therefore t = \frac{25}{6}\pi s. \approx 13.1 s.$

36.

$I_B - I_A = M(h_2^2 - h_1^2) = 0.1\ kg \cdot m^2 \quad \therefore M = \frac{0.1}{0.04} = 2.5kg$

51. (a) $a_{m2} = \frac{2h}{t^2} = \frac{2 \times 0.75}{25} = \frac{1.5}{25} = \frac{3}{50} = 0.06 m/s^2$

(b), (c) $m_2 g - T_2 = m_2 a_{m2} \quad \therefore 5 - T_2 = 0.5 \times 0.06. \quad \therefore T_2 = 4.97N$

$T_1 - m_1 g = m_1 a_{m1} \quad T_1 - 4.6 = 0.46 \times 0.06. \quad \therefore T_1 = 4.627 \approx 4.63N$

(d). $\alpha_w = \frac{a}{r} = \frac{0.06}{5 \times 10^{-2}} = 1.2\ rad \cdot s^{-2}$

(e). $\tau = I \cdot \alpha_w$

$I_{pulley} = \frac{-(T_2 - T_1) \cdot R}{\alpha_w} = \frac{1.28 \times 10^{-2}}{1.2} kg \cdot m^2.$

52. 取逆时针为正向:

$\tau_{net} = 6 \times 12 - 2 \times 5 - 4 \times 12 = 14\ N \cdot cm. = 0.14 N \cdot m.$

$\tau = I \alpha_w \quad$ 对于圆柱体 $I = \frac{1}{2}MR^2 = \frac{1}{2} \times 3 \times 0.12 \times 0.12$

$= 0.06 \times 0.36$

$= 2.16 \times 10^{-2} N \cdot m$

$\therefore \alpha_w = \frac{\tau}{I} = \frac{0.14}{2.16 \times 10^{-2}} = 6.48\ rad \cdot s^{-2}.$

方向 counterclockwise

56. $I = \int r^2 dm = 0.64m + 0.04m = 0.68m.$

$T = mg \quad I \cdot \alpha = 0.68 \alpha. \quad T = mg(L_1 - L_2)$

$\therefore$ 代入. $|x_1| = 1.73 m/s$

$|a_2| = 6.92 m/s^2$

62. $I = 0.1 \times \left((2 \times 10^{-2})^2 + (4 \times 10^{-2})^2 + (6 \times 10^{-2})^2\right).$

$= 0.1 \times 10^{-4} \times 56 = 5.6 \times 10^{-5} N \cdot m$

(a). $W_1 = \frac{1}{2} \times 5.6 \times 10^{-5} \times 400 = 1.12 \times 10^{-2} J$

(b) $W_2 = 3.36 \times 10^{-2} J$

(c) $W_3 = 5.60 \times 10^{-2} J.$

(d) $\tau_3 = 2.8 \times 10^{-5} N \cdot m$