

Chapter 9 - Rotation of Rigid Bodies

Physics 206

Group 1 Problems:

Problem 1:

- (a) $d = 7.36 \text{ m}$
 (b) $a_{cp} = 327 \text{ m/s}^2$

Problem 2:

- (a) $I_A = \frac{1}{2}M(R_1^2 + R_2^2) + MR_1^2$
 (b) $I_B = \frac{1}{2}M(R_1^2 + R_2^2) + M(R_1^2 + R_2^2)$
 (c) $I_C = \frac{1}{2}M(R_1^2 + R_2^2) + MR_2^2$

Problem 3:

$$I = 15m\ell^2$$

Problem 4:

- (a) $t = 314 \text{ s}$
 (b) $\Delta\theta = 987 \text{ rad} = 157 \text{ rev}$
 (c) $a = 15.5 \text{ m/s}^2$

Problem 5:

$$\Delta\theta = -139 \text{ rad}$$

Group 2 Problems:

Problem 6:

- a) $t = 0.821 \text{ s}$
 b) $\alpha = 18.7 \text{ rad/s}^2$

Problem 7:

$$\omega = \sqrt{\frac{8g}{5R}}$$

Problem 8:

- a) $v = \sqrt{\frac{(m_2 - m_1)g\ell}{\frac{1}{3}M + m_1 + m_2}}$
 b) $v = \sqrt{\frac{(2m_2 + M)g\ell}{\frac{1}{3}M + m_2}}$

Problem 9:

$$h = 13.9 \text{ m}$$

Problem 10:

- Solid Sphere: Ratio = $\frac{\frac{2}{5}}{1 + \frac{2}{5}} = \frac{2}{7}$
 Hollow Sphere: Ratio = $\frac{\frac{2}{3}}{1 + \frac{2}{3}} = \frac{2}{5}$

Problem 11:

$$M = \frac{64}{36}(m_A + m_B)\frac{R_2^2}{R_1^2 + R_2^2}$$

$$M = 15.1 \text{ kg}$$

Group 3 Problems:

Problem 12:

$$\omega = \sqrt{\frac{2(mgH - W)}{mR^2 + I}}$$

Problem 13:

- a) $I = \frac{1}{2}(M_1R_1^2 + M_2R_2^2)$
 b) $v^2 = \frac{4mgH}{\frac{M_1R_1^2 + M_2R_2^2}{R_1^2} + 2m}$
 c) $v^2 = \frac{4mgH}{\frac{M_1R_1^2 + M_2R_2^2}{R_2^2} + 2m}$ faster

Problem 15:

- a) $I = \frac{\lambda_0\ell^3}{12} + \frac{\lambda_1\ell^5}{80}$
 b) $I = \frac{\lambda_1\ell^5}{80} + \frac{\lambda_1\ell^5}{48} + \frac{\lambda_0\ell^3}{12} + \frac{\lambda_0\ell^3}{4}$
 c) $I_{edge} - I_{CM} = \frac{\lambda_0\ell^3}{4} + \frac{\lambda_1\ell^5}{48}$