PH112 PHYSICS II

KEY Homework #1

CHJ Problems: Ch.11:7, 13, 19, 24, 32, 49

11-7 v = 127 mph = 56.8 m/s

circumference c = 2 π R = 1.00 mi = 1609 m

Therefore R = 256 m

$$\omega = \frac{v}{R} = \frac{56.8\ m/s}{256\ m} = 0.222\ rad/s$$

11-13 $a_t = R\alpha$; $a_c = R\omega^2 = R(\omega_o + \alpha t)^2 = R\alpha^2 t^2$

If we make $a_t = a_c$

We get $R\alpha = R\omega^2 = R\alpha^2 t^2$

Thereby we get $t = \sqrt{\frac{1}{\alpha}}$

11-19 The two disks rotate for the same length of time,at which time the sum of the angular displacements is 100 revolutions which is 628 rad.

a) $\theta_o = \omega_o t$; $\theta_f = \frac{1}{2}\alpha_f t^2$

$$\theta_o + \theta_f = \omega_o t + \frac{1}{2}\alpha_f t^2$$

$$= (0.209\ rad/s)t_f + \frac{1}{2}(0.105\ rad/s^2)t^2 = 628\ rad$$

$$t_f = 107s$$

b) $\theta_o = \omega_o t_f = 0.209\ rad/s)(107s) = 22.5\ rad = 3.59\ \ rev$

$$\theta_f = \frac{1}{2}\alpha_f t^2 = (0.5)(0.105\ rad/s)\ (107\ s) = 605\ rad = 96.4\ rev$$

11-24 $I = 0.206\ kg.m^2 = \frac{1}{12}ML^2 + 2m_s d^2$

$$d = \sqrt{\frac{\left(I - \frac{1}{12}ML^2\right)}{2m_s}}$$

$$d = \sqrt{\frac{\left(0.260 - \frac{1}{12}(0.600)(2.00)^2\right)}{2(0.500)}} = 0.245m$$

11-32 $K_t = \frac{1}{2}mv^2 = K_r = \frac{1}{2}I\omega^2$

$$\omega = \left(\sqrt{\frac{m}{I}}\right)v = \left(\sqrt{\frac{m}{\frac{1}{2}mR^2}}\right)v$$

$$\left(\sqrt{\frac{5}{2}}\right)\frac{v}{R} = (1.58)\frac{v}{R}$$

11-49 a) The three equations from the three free body diagram are

$$mg - T_1 = ma \quad (1)$$
$$T_2 - Mg\sin\theta = Ma \quad (2)$$
$$(T_2 - T_1)R = I\alpha = I\frac{r}{R} \quad (3)$$

$$mg - ma - Mg\sin\theta - Ma = I\frac{r}{R^2}$$
$$a = \frac{mg - Mg\sin\theta}{m + M + \frac{I}{R^2}}$$
$$a = \frac{(1.00)(9.80) - (1.500)(9.80)\sin(36.87)}{1.00 + 1.500 + \frac{5.00x10^{-3}}{(0.100)^2}}$$
$$a = 0.327m/s^2$$

$$T_1 = m(g - a) = 9.47N$$
$$T2 = M(g\sin\theta + a) = 9.31N$$

b) Equations 1 and 2 are the same and equation 3 is modified because of the friction.

$$mg - T_1 = ma \quad (1)$$
$$T_2 - Mg\sin\theta = Ma \quad (2)$$
$$(T_2 - T_1)R = I\alpha = I\frac{r}{R} \quad (3)$$