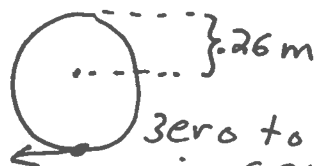
# 10 - dynamics

(1)




WANT $\alpha$

zero to $36\ \frac{m}{s}$ in 6.8 s.

Recall: $s = \theta r$ = arclength

$v = \omega r$ = tangential speed

~~$a = \alpha r$ = tangential acceleration~~

Also recall:

$a = \alpha r$

$a = \frac{36}{6.8}\frac{m}{s^2}$

$\alpha = \frac{a}{r} = \frac{36}{6.8}\frac{1}{.26} =$ **$20.4\ s^{-2} = \alpha$**

(2) Use $I = \sum m_j r_j^2 = MR^2$ ← GET UNITS HERE

since $r_j = R$ so that $I = R^2 \sum m_j$

Here $M = 2.2$ kg and $r = .57$ m

$I = (2.2)(.57)^2 =$ **$.715\ kg \cdot m^2 = I$**

(3) Want KE at $1.7\ \frac{rev}{sec}$

$\omega = 1.7\ \frac{rev}{sec}\ \frac{2\pi\ rad}{1\ rev} = 3.4\pi\ s^{-1}$

3) continued: $KE = \frac{1}{2}I\omega^2 = \frac{(.715)(3.4)^2\pi^2}{2}$

$=$ **$40.8\ J = KE$** I know the units are Joules b/c energy is Joules.

I could also get the units from

$[I] = [kg \cdot m^2]$ and $[\omega]^2 = s^{-2}$ ↳ since $[\omega] = s^{-1}$

$[\frac{1}{2}I\omega^2] = kg\ \frac{m^2}{s^2}$ ↳ **$KE = 40.8\ kg\ m^2/s^2$**

(4) $I = \sum m_j r_j^2 = \sum_1 mr^2 + \sum_2 mr^2 = I_1 + I_2$

$I = \frac{1}{2}MR^2$ for solid disk. $R = \frac{D}{2}$

$I = \frac{1}{2}(M_1 R_1^2 + M_2 R_2^2) = \frac{M}{2}\left(\frac{D_1^2}{4} + \frac{D_2^2}{4}\right)$

$= \frac{M}{8}(D_1^2 + D_2^2)$ where $D_1 = .46$ m

$D_2 = .9$ m

$M_1 = M_2 = M = 3.8$ kg

$\tau = F_\perp R = \frac{FD}{2} = \frac{(76)(.46)}{2} = \tau$

$= (76)(.23)$ newton-meters

$\tau = I\alpha \Rightarrow \alpha = \frac{\tau}{I} = \frac{(76)(.23)(8)(.46^2 + .9^2)^{-1}}{3.8}$

**$\alpha = 36.0\ s^{-2}$**