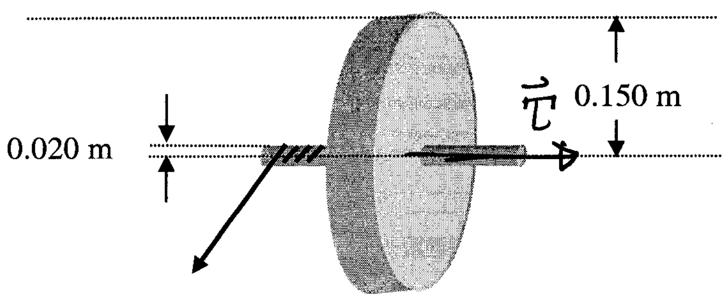
Name KEY
Section 8135/0531

SP211 Quiz
12 Nov 03

A wheel (**not necessarily** a solid cylinder) of radius 0.150 m is fixed to an axle of radius 0.020m supported by bearings (not shown) that exert negligible friction torque. A cord is wrapped around the axle, and a steady (constant) pull of 25.0 N produces and angular velocity of 16 rad/sec in 4.00 sec at constant angular acceleration.



a. What is the angular acceleration? (2 points)

$$\alpha = \frac{16 \text{ R/s}}{4} = 4 \text{ RAD/s}^2$$

b. What is the magnitude of the torque applied to the wheel? Draw the direction of the torque vector on the diagram. (2 points)

$$\vec{\tau} = \vec{R} \times \vec{F} \qquad |\tau| = (.02\text{m})(25\text{N}) = 0.5 \text{ N-m}$$

c. What is the moment of inertial of the system? (Yes, I know you don't have the mass, try another method) (2 points)

$$I = \frac{\tau}{\alpha} = \frac{.5 \text{ N}\cdot\text{m}}{4 \text{ RAD/s}^2} = .125 \text{ kg-m}^2$$

d. What is the initial and final kinetic energy? (2 points)

$$K_0 = 0 \text{ J}$$

$$K_f = \frac{1}{2} I \omega^2 = \frac{1}{2}(.125 \text{ kg-m}^2)(16 \tfrac{\text{RAD}}{\text{s}})^2 = 16 \text{ J}$$

e. How much work is done by the force during the 4 sec? (2 points)

16 J

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2 \qquad \omega = \omega_0 + \alpha t \qquad \omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$$

$$\vec{\tau} = I\vec{\alpha} \qquad \vec{L} = I\vec{\omega} \qquad K = \frac{1}{2}I\omega^2 \qquad W = \int \tau \, d\theta$$