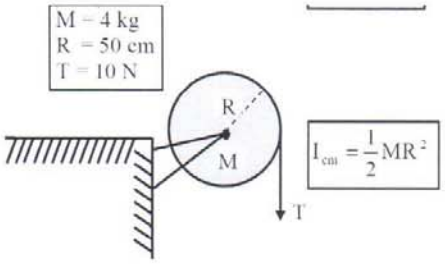
QUIZ#9- CHAPTER 10
DATE: 27/11/17

Name: Key Id#: Sect.#:

A uniform disk is mounted on a frictionless axle as shown in the figure. A light cord is wrapped around the rim of the disk and a constant force T is exerted on the cord.

(a) Calculate the angular acceleration of the disk.



$$TR = I_{cm}\alpha$$

$$\alpha = \frac{TR}{I_{cm}}$$

$$I_{cm} = \frac{1}{2}MR^2 = 0.5\,(4)(0.5)^2 = 0.5\ kg\cdot m^2$$

$$\alpha = \frac{10 \times 0.5}{0.5} = \boxed{10\ rad/s^2}$$

(b) The disk start from rest at t = 0. Calculate the angular velocity of the disk at t = 10 s.

$$\omega = \omega_0^{\,0} + \alpha t = 10 \times 10 = \boxed{100\ rad/s}$$

(c) Through how many revolution has the disk turned during the 10 sec time?

$$\Delta\theta = \omega_0^{\,0} t + \frac{1}{2}\alpha t^2 = 0.5\,(10)(10)^2$$

$$= 500\ rad$$

$$\Delta\theta = 500\ rad\left(\frac{1\ rev}{2\pi\ rad}\right) = \boxed{79.6\ rev}$$

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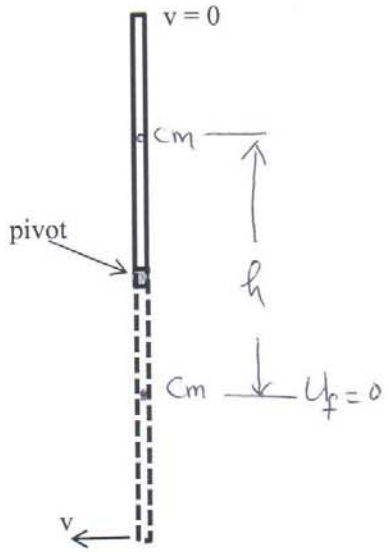
A thin rod of length 2.0 m and mass 1.0 kg is rotated at the lower end as shown in the figure. The rod starts from rest in the vertical position. Calculate the linear speed v of the tip of the rod in the position shown in the figure.
$I_{cm} = (1/12)\, mL^2$



$$\Delta K + \Delta U_g = 0$$

$$\Delta K = \frac{1}{2} I\omega^2 - 0$$

$$\Delta U_g = 0 - mgh$$

$$h = L$$

$$\Rightarrow \Delta U_g = -mgL$$

$$\frac{1}{2} I\omega^2 - mgL = 0 \Rightarrow \omega = \sqrt{\frac{2mgL}{I}}$$

$$I = I_{cm} + mh^2 \qquad h = \frac{L}{2}$$

$$= \frac{1}{12} mL^2 + m\frac{L^2}{4} = \frac{1}{3} mL^2$$

$$\omega = \sqrt{\frac{2mgL}{\frac{1}{3}mL^2}} \quad \sqrt{\frac{6g}{L}}$$

$$v_{tip} = \omega r = \omega L = \sqrt{6gL} = \boxed{10.8 \text{ m/s}}$$

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A t = 0, the motor of a wheel of radius R = 20 cm rotating at 30 rev/min, is turned off. It slows down uniformly and stops after 4.0 minutes.

(a) What is the angular acceleration of the wheel?

$$\omega_0 = 30 \frac{rev}{min} = 30 \times \frac{2\pi}{6} = \pi \text{ rad/s}$$

$$\omega = \omega_0 + \alpha t \qquad \alpha = -\frac{\omega_0}{t} = -\frac{\pi}{4\times 60} = \boxed{-0.013 \frac{rad}{s^2}}$$

(b) Through how may rotations has the wheel turned during this time?

$$\Delta\theta = \frac{1}{2}\alpha t^2 + \omega_0 t$$

$$= \frac{1}{2}(-0.013)(4\times 60)^2 + (\pi)(4\times 60)$$

$$= 379.6 \text{ rad}$$

$$\Delta\theta = \frac{379.6}{2\pi} = \boxed{60.4 \text{ rev}}$$

(c) What is the tangential acceleration of a point on the rim of the wheel?

$$a_t = \alpha R = 0.013 \times 0.2$$

$$= \boxed{2.6 \times 10^{-3} \text{ m/s}^2}$$