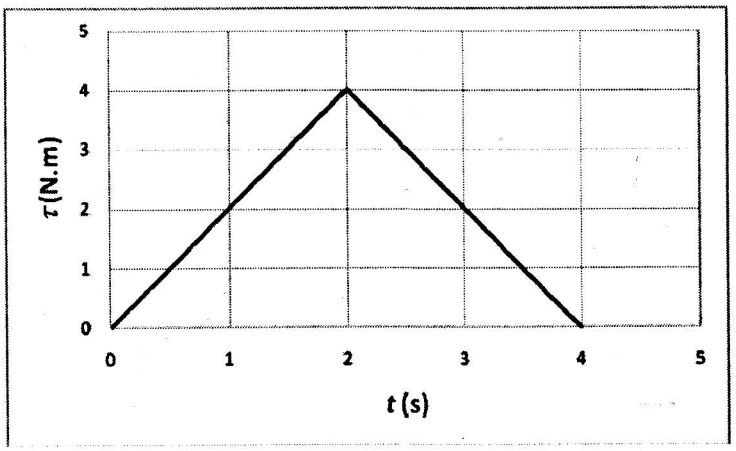
PHYS101
QUIZ#9 - CHAPTER 10
DATE: 25/11/12

Name: Key Id#: Sect#

A wheel rotating about a fixed axis has been subjected to the torque shown in the figure. The rotational inertia of the wheel is 2.0 kg m^2. Calculate the angular velocity of the wheel at t = 4.0 s if the angular velocity at t = 0 is 10 rad/s.



$$\tau = I\alpha = I\frac{d\omega}{dt}$$

$$\tau\,dt = I\,d\omega \Rightarrow \int \tau\,dt = \int I\,d\omega = I\int d\omega = I\,\Delta\omega$$

$$\Delta\omega = \frac{1}{I}\underbrace{\int \tau\,dt}_{\text{Area of } \tau \text{ vs. time graph}}$$

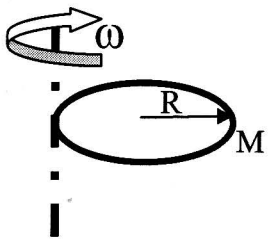
$$\Delta\omega = \frac{\text{Area}}{I} = \frac{8\ \text{rad/s}}{2} = 4\ \text{rad/s}$$

$$\omega_f - \omega_i = \omega_f - 10 = 4 \Rightarrow \boxed{\omega_f = 14\ \text{rad/s}}$$

PHYS101
QUIZ#9 - CHAPTER 10
DATE: 25/11/12

Name: Key Id#: Sect#

A 20.0-kg thin loop has a radius of 1.50 m and is rotating at 300 rev/min about an axis through the rim as shown in the figure. What is the average power required to bring it to a stop in 20.0 s? $I_{cm} = MR^2$.



$$P = \frac{W}{\Delta t} = \frac{|K_f - K_i|}{\Delta t}$$

$$= \frac{\left|\frac{1}{2} I \cancel{\omega_f^2}^{0} - \frac{1}{2} I \omega_i^2\right|}{\Delta t}$$

$$I = I_{cm} + m h^2 \quad \text{(parallel axis theorem)}$$

$$= mR^2 + mR^2 = 2mR^2$$

$\omega = 300$ rev/min

$= 31.4$ rad/s

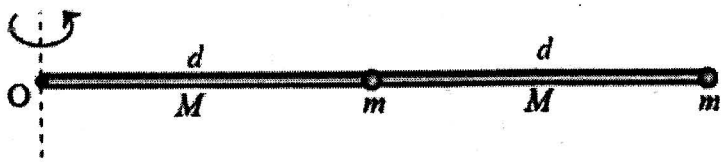
$$P = \frac{\frac{1}{2} I \omega_i^2}{\Delta t} = \frac{mR^2 \omega_i^2}{\Delta t}$$

$$= \frac{(20)(1.5)^2 (31.4)^2}{20} = \boxed{2221\ \text{W}}$$

PHYS101
QUIZ#9 - CHAPTER 10
DATE: 25/11/12

Name: Key Id#: Sect#

In the figure, two particles, each with mass m = 0.5 kg, are fastened to each other, and to a rotation axis at point O, by two thin rigid rods. Each rod has length d = 2.0 m and mass M = 2.0 kg. The system is rotating at constant angular velocity of 5.0 rad/s. Calculate the kinetic energy of the system.



$$I = I_1 + I_2 + I_3$$

$$= md^2 + m(2d)^2 + \frac{1}{3}(2M)(2d)^2$$

$$= 5md^2 + \frac{8}{3}Md^2 = 10 + 21.3 = 31.3 \text{ kg.m}^2$$

$$K = \frac{1}{2}I\omega^2 = \frac{1}{2}(31.3)(5)^2 = \boxed{391 \text{ J}}$$