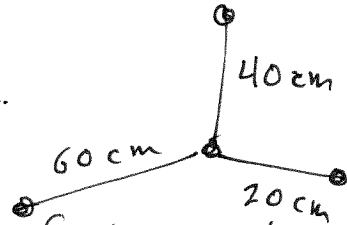


Chapter 10

Problem 54

$$m = 0.3 \text{ kg}$$

All points lie in the same plane.



a) What is the moment of inertia of the system?

$$\begin{aligned} I &= \sum m_i r_i^2 = m_1 r_1^2 + m_2 r_2^2 + m_3 r_3^2 \\ &= \cancel{(0.3 \text{ kg})} (0.2)^2 + (0.3 \text{ kg}) (0.4)^2 + (0.3 \text{ kg}) (0.6)^2 \\ &= m (r_1^2 + r_2^2 + r_3^2) \\ &= 0.3 \text{ kg} [(0.20 \text{ m})^2 + (0.40 \text{ m})^2 + (0.60 \text{ m})^2] \\ &= 0.3 \text{ kg} [0.04 + 0.16 + 0.36] \text{ m}^2 \end{aligned}$$

$$\boxed{I = 0.168 \text{ kg m}^2}$$

b) If $\omega = 5 \frac{\text{rev}}{\text{s}}$, what is its kinetic energy?

convert ω into rad/s

$$\omega = 5 \frac{\text{rev}}{\text{s}} \left(\frac{2\pi \text{ rad}}{1 \text{ rev}} \right) = 31.4 \text{ rad/s}$$

Rotational kinetic energy is

$$\begin{aligned} K &= \frac{1}{2} I \omega^2 = \frac{1}{2} (0.168 \text{ kg m}^2) (31.4 \frac{\text{rad}}{\text{s}})^2 \\ &= 82.8 \text{ kg } \frac{\text{m}^2}{\text{s}^2} \end{aligned}$$

$$\boxed{K = 82.8 \text{ J}}$$