

Physics 101-Rec
Quiz # 10

Instructor: Dr. Mekki

Name: _____

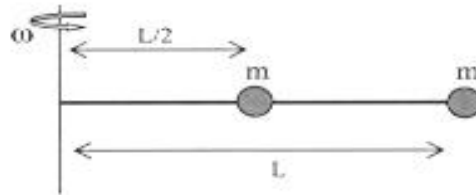
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The system shown in the figure is composed of a thin rod of length $L = 2.0$ m and mass $M = 1.5$ kg and two particles have equal masses of $m = 1.0$ kg each.

(a) What is the rotational inertia of the system?



$$I_{\text{Total}} = I_{\text{rod}} + I_{\text{mass}_1} + I_{\text{mass}_2}$$

$$I_{\text{rod}} = \frac{1}{12} M L^2 + M \left(\frac{L}{2} \right)^2 = \frac{1}{3} M L^2$$

$$I_{\text{mass}_1} = m r_1^2 = m \left(\frac{L}{2} \right)^2 = \frac{m L^2}{4}$$

$$I_{\text{mass}_2} = m r_2^2 = m (L)^2 = m L^2$$

$$I_{\text{Total}} = \frac{1}{3} M L^2 + \frac{m}{4} L^2 + m L^2 = \frac{1}{3} M L^2 + \frac{5}{4} m L^2$$

$$= \left(\frac{M}{3} + \frac{5m}{4} \right) L^2 = \left(\frac{1.5}{3} + \frac{5 \times 1}{4} \right) \times 4 = \boxed{7 \text{ Kg}\cdot\text{m}^2}$$

(b) If the system has an angular velocity of 5.0 rev/min, what is its kinetic energy?

$$\omega = 5 \frac{\text{rev}}{\text{min}} = 5 \times \frac{2\pi}{60} = 0.52 \text{ rad/s}$$

$$K = \frac{1}{2} I \omega^2 = \boxed{0.95 \text{ J}}$$