

Phys101 - Quiz # 8 (Ch.11) - Sec # 38

Name:

Key

ID #

1- The figure shows an overhead view of a thin rod of mass $M (= 2 \text{ kg})$ and length $L = 2 \text{ m}$ which can rotate horizontally about a vertical axis through the end A (use $I = I_{\text{com}} + Mh^2$). A particle of mass $m = 2 \text{ kg}$ traveling horizontally with a velocity $\mathbf{v}_i = (10 \text{ j}) \text{ m/s}$ strikes the rod (which was initially at rest) at point B . The particle rebounds with a velocity $\mathbf{v}_f = (-6 \text{ j})$. Find the angular speed (ω_f) of the rod just after collision. (I_{com} (for a

thin rod) = $\frac{1}{12}ML^2$

$$L_i = L_f$$

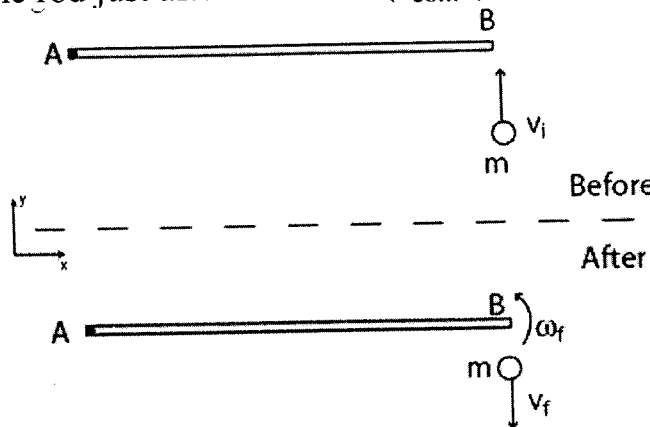
$$m r_{\perp} v_i = -m r_{\perp} v_f + I \omega_f$$

$$2(2)(10) = -2(2)(6) + \left(\frac{1}{12}ML^2 + M\left(\frac{L}{2}\right)^2\right) \omega_f$$

$$40 = -24 + \left(\frac{1}{12}(2)(2)^2 + 2(1)^2\right) \omega_f$$

$$40 + 24 = \left(\frac{2}{3} + 2\right) \omega_f$$

$$\Rightarrow \omega_f = \frac{64}{(8/3)} = \boxed{24 \frac{\text{rad}}{\text{s}}}$$



2- A 2-kg particle moves in the xy plane with a velocity of $\mathbf{v} = (4 \text{ i} - 3 \text{ j}) \text{ m/s}$. Determine the angular momentum of the particle about the origin when it is located at point $(2, 3) \text{ m}$.

$$\vec{L} = m(\vec{r} \times \vec{v})$$

$$= 2 \left[(2\hat{i} + 3\hat{j}) \times (4\hat{i} - 3\hat{j}) \right]$$

$$= 2 \left[-6\hat{k} - 12\hat{k} \right] = \boxed{(-36\hat{k}) \text{ kg} \frac{\text{m}^2}{\text{s}}}$$