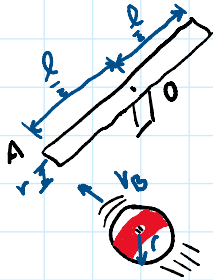


Beginner

Impact

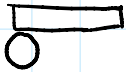
Video

Inspiration: 19-43 Hibbeler

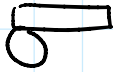


View is from an angle

State 1 Right before



State 2 Right after



A Rube Goldberg machine utilizes a pool ball and a slender 2 m long rod. If the pool ball has a mass $m_{\text{ball}} = 0.16\text{ kg}$ while the rod has mass $m_{\text{rod}} = 1\text{ kg}$, determine the angular velocity of the rod when the pool ball strikes it at $v = 3\text{ m/s}$. The pool ball has radius $r = 0.025\text{ m}$ and the coefficient of restitution is $e = 0.8$. The rod hits the pool ball at the same height as the ball's center of gravity.

$$I_{\text{rod}} = \frac{1}{12} m l^2 = \frac{1}{12} (1)(2)^2 = \frac{1}{3}$$

$$\text{Pinned at } O \therefore \omega_2 = \frac{v_{A2}}{\frac{l}{2}} = \frac{v_{A2}}{1}$$

$$\Sigma (H_0)_1 = \Sigma (H_0)_2$$

$$H_0 = H_G + r_{G/O} m v$$

$$0 + m_b v_b \frac{l}{2} + 0 = I_{\text{rod}} \omega_2 + m_b v_{b2} \frac{l}{2}$$

$$(0.16)(3)(1) = \frac{1}{3} \omega_2 + (0.16) v_{b2} (1)$$

$$e = \frac{v_{A2} - v_{B2}}{v_{B1} - v_{A1}}$$

$$0.8 = \frac{v_{A2} - v_{B2}}{3 - 0}$$

$$2.4 = v_{A2} - v_{B2}$$

$$0.44 = \frac{1}{3} v_{A2} + 0.16 v_{B2}$$

$$0.44 = \frac{1}{3} (2.4 + v_{B2}) + 0.16 v_{B2}$$

$$v_{B2} = -0.6446\text{ m/s}$$

$$v_{A2} = 1.751351$$

$$\omega_2 = 1.751351\text{ rad/s}$$