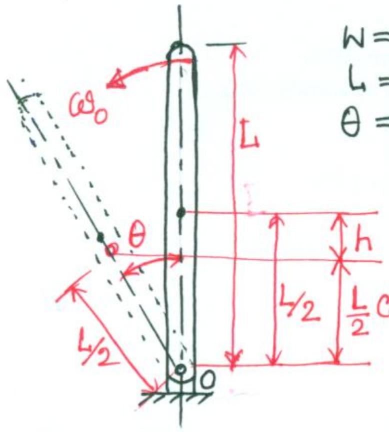
1430/P.420



$W = 16.1$ lb
$L = 4$ ft
$\theta = 120°$ from rest
$\bar{v} = ?$
KE = ?
ΔPE = ?

Note:

For a slender rod moment of inertia of mass about an axis through O & perpendicular to the plane of paper is – $I_0 = \frac{mL^2}{3}$

about centroidal axis, $\bar{I} = \frac{mL^2}{12}$

Example 164/PP. 233-234.

Sol^n

$$h = \frac{L}{2} - \frac{L}{2}\cos\theta = \frac{L}{2}(1-\cos\theta)$$

$$U_{net} = W \times h = W \times \frac{L}{2}(1-\cos\theta) = 16.1 \times \frac{4}{2}(1-\cos 120^0) = 48.3 \text{ lb-ft}$$

$$I_0 = \frac{mL^2}{3} = \frac{W}{g}\cdot\frac{L^2}{3} = \frac{16.1}{32.2} \times \frac{4^2}{3} = 2.67 \text{ slug-ft}^2$$

$$\Delta KE = \frac{1}{2} I_0 \omega^2 = \frac{1}{2} \times 2.67 \times \omega^2$$

According to principles of work and kinetic energy

$$U_{net} = \Delta KE$$

$$\Rightarrow 48.3 = \frac{1}{2} \times 2.67 \times \omega^2$$

$$\therefore \omega = 6.01 \text{ rad/s.}$$

$$\bar{v} = r\omega = \frac{4}{2} \times 6.01 = \boxed{12.02 \text{ fps}}$$

$$\Delta KE = \frac{1}{2} \times 2.67 \times 6.01^2 = \boxed{48.2 \text{ ft-lb}}$$

$$\Delta PE = -W \times h = -U_{net} = \boxed{-48.3 \text{ ft-lb}}$$

–ve means decrease in PE