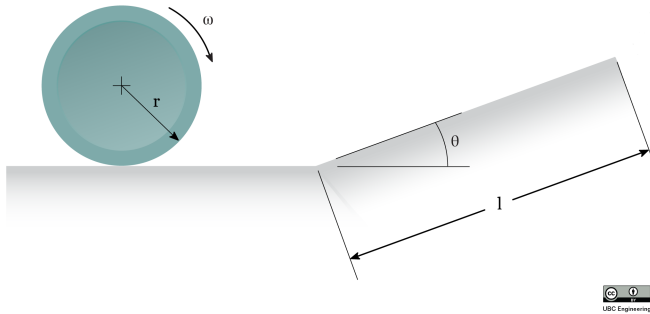


22-R-WE-TW-25



A metal cylinder of mass $m = 15$ kg and radius $r = 1$ m is rolling without slipping towards an incline of $\theta = 30^\circ$. If at the moment the cylinder starts rolling up the incline the angular velocity of the cylinder is $\vec{\omega} = -6\hat{k}$ rad/s, what is the maximum distance l the cylinder travels up the incline? (Use $g = 9.81$ m/s² and assume no energy is lost due to friction)

Solution:

$$T_1 = V_2$$

$$T_1 = \frac{1}{2}mv^2 + \frac{1}{2}I_G\omega^2$$

$$v_G = \omega r = (6)(1) = 6 \text{ [m/s]}$$

$$I_G = \frac{1}{2}mr^2 = \frac{1}{2}(15)(1)^2 = 7.5 \text{ [kg} \cdot \text{m}^2]$$

$$T_1 = \frac{1}{2}(15)(6)^2 + \frac{1}{2}(7.5)(6)^2 = 405 \text{ [J]}$$

$$T_1 = mgh \Rightarrow h = \frac{T_1}{mg} = \frac{405}{(15)(9.81)} = 2.75 \text{ [m]}$$

$$h = l \sin \theta \Rightarrow l = \frac{h}{\sin \theta} = \frac{2.75}{\sin 30} = 5.50 \text{ [m]}$$