## Answer on Question #52424, Physics, Mechanics | Kinematics | Dynamics

A wheel of mass 0.80kg and radius 0.30m is rolling without slipping up a plane 15 degrees to the horizontal . at some instant it has an angular speed of 12rad/s, and it comes momentarily to rest after rolling a further 2.5 revolutions up the plane. 1 Use the conservation of energy to find the moment of inertia of the wheel.

**Solution:**

Conservation of energy gives:

$$PE_{gravity} = KE_{translational} + KE_{rotational}$$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

For rolling without slipping, $\omega = v/r$.

The height is

$$h = L\sin\theta = 2\pi rN\sin\theta = 2\pi * 0.30 * 2.5 * \sin 15° = 1.22\ \text{m}$$

Thus, for the moment of inertia of the wheel

$$\frac{1}{2}I\omega^2 = m\left(gh - \frac{1}{2}v^2\right)$$

$$I = \frac{2m}{\omega^2}\left(gh - \frac{1}{2}v^2\right) = \frac{2m}{\omega^2}\left(gh - \frac{1}{2}\omega^2 r^2\right)$$

$$I = \frac{2 * 0.80}{12^2}\left(9.8 * 1.22 - \frac{1}{2} * 12^2 * 0.3^2\right) = 0.061\ \text{kg}\cdot\text{m}^2$$

**Answer:** $0.061\ \text{kg}\cdot\text{m}^2$