18.

Problem 11.45E (HRW)

Calculate the rotational inertia of a wheel that has a kinetic energy of 24,400 J *when rotating at* 602 rev/min.

Solution:

The angular speed of the wheel in rad/s will be

$$\omega = 602 \times \frac{\text{rev}}{\text{min}} = \frac{602 \times 2\pi}{60} \frac{\text{rad}}{\text{s}} = 63.04 \text{ rad s}^{-1}.$$

The rotational kinetic energy is $\frac{1}{2}I\omega^2$, where I is the rotational inertia. As the kinetic energy of the wheel is 24,400 J, its rotational inertia will be

$$I = \frac{2 \times 24,400}{63.04^2} \text{ kg m}^2 = 12.3 \text{ kg m}^2.$$