Answer on Question #68526-Physics- Mechanics | Relativity

A disc of mass 20kg and radius 0.15m mounted on a horizontal cylindrical axle of radius 0.015m and negligible mass. No frictional losses exist in the rings. Calculate:

1) the moment of inertial of the disk.

2) the angular velocity acquired if the 20N force is applied for 12 seconds.

3) the kinetic energy of the disc at the end of the 12 seconds.

4) the time required to bring disc to rest if a braking force of 1N were applied tangentially to its rim.

Solution

1) The moment of inertial of the disk is

$$I = \frac{1}{2}MR^2 = \frac{1}{2}(20)(0.15)^2 = 0.225\ kgm^2.$$

2)

$$\beta = \frac{\tau}{I} = \frac{Fr}{I}$$

The angular velocity acquired if the 20N force is applied for 12 seconds is

$$\omega = \beta t = \frac{Fr}{I}t = \frac{(20)(0.015)(12)}{0.225} = 16\frac{rad}{s}.$$

3) The kinetic energy of the disc at the end of the 12 seconds is

$$K = \frac{1}{2}I\omega^2 = \frac{1}{2}(0.225)(16)^2 = 28.8\,J.$$

3) The time required to bring disc to rest if a braking force of 1N were applied tangentially to its rim is

$$\beta' = \frac{\tau'}{I} = \frac{F'R}{I}$$

$$t = \frac{\omega}{\beta} = \frac{\omega I}{F'R} = \frac{(16)(0.225)}{(1)(0.15)} = 24\ s.$$