A wheel of mass of 30 kg and radius 1.5 m is rotating with an angular velocity of 280 rpm. Calculate the work that must be done to bring the wheel to rest in 15 seconds. What is the required average power?

$w = 280\ rpm = 280$ revolutions per minute

Angular velocity is measured in International System of Units (SI) in $\frac{rad}{second}$:

$$w = 280\ rpm = 280\ \frac{1}{minute} * \frac{2\pi}{60}\frac{rad}{second} * 60\ seconds = 2\pi * \frac{280}{60}\frac{rad}{second}$$

The energy conservation law:

$$\frac{Iw^2}{2} = A$$

I – moment of inertia of wheel

A - work that must be done to bring the wheel

For wheel

$$I = mr^2$$

m – mass of wheel

r – radius

Therefore:

$$A = \frac{mr^2w^2}{2} = \frac{30kg(1.5m)^2\left(280*\frac{2\pi}{60}\right)^2}{2} = 29017\ J$$

The average power equals:

$$P = \frac{A}{t} = \frac{29017J}{15s} = 1934\ W$$