# Problem 2

A small off-road trailer can be approximated as a rectangular prism with a mass of 100kg supported by two wheels each approximated as thin circular discs with as mass of 25 kg and a diameter of 60 cm. Assuming the wheels roll without slipping, what is the power required to bring the trailer from rest to a speed of 80 kph over the course of 10 seconds?

$V_f = 80 \, kph = 22.22 \, m/s$
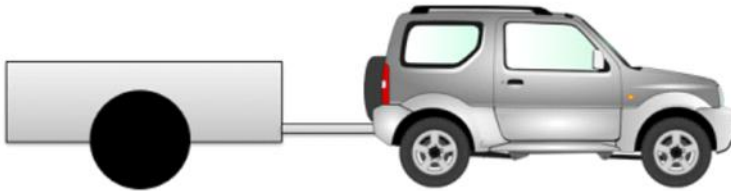
$I_{wheel} = \frac{1}{2}mr^2$

$= 1.125 \, kg\,m^2 \quad per \; wheel$

rolling without slipping $\quad V_f = 22.22 \, m/s \qquad V = r\omega \qquad r = .3m$

$$\omega_f = 74.07 \, rad/s$$

$$P = \frac{W}{t} = \frac{\Delta KE}{t} = \frac{\left(\frac{1}{2}mV_f^2 + \frac{1}{2}I\omega_f^2\right) - \left(\frac{1}{2}mV_i^2 + \frac{1}{2}I\omega_i^2\right)^0}{t}$$

$$P = \frac{\frac{1}{2}(150\,kg)(22.22 \, m/s)^2 + \frac{1}{2}(2)(1.125 \, kg\,m^2)(74.07 \, rad/s)^2}{10 \, s}$$

$$\boxed{P = 4320.2 \, W = 4.32 \, kW = 5.79 \, hp}$$