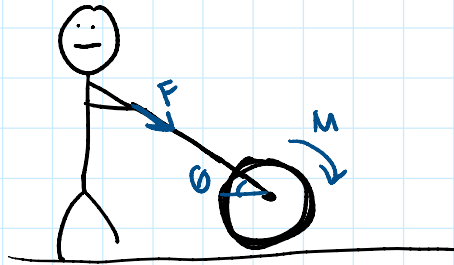


## 20-R-WE-DK-20 Beginner Power and Efficiency

Inspiration: None



A gardening company is testing a wheel barrow prototype for seniors. The wheel has a hub motor which can apply a moment  $M = 15 \text{ Nm}$ . If the wheel has a radius  $r = 0.3 \text{ m}$  and the wheel rolls without slipping, determine the power of the hub motor if it moves at a velocity  $v = 1.5 \text{ m/s}$  when a force of  $F = 15 \text{ N}$  is applied at an angle of  $\theta = 30 \text{ degrees}$ . Determine the efficiency of the motor if a total of  $250 \text{ W}$  is put into it.

$$P = \vec{F} \cdot \vec{v} + \vec{M} \cdot \vec{\omega}$$

$$v = \omega r \quad 1.5 = \omega(0.3) \quad \omega = 5$$

$$P = Fv \cos \theta + M\omega$$

$$= 15(1.5) \cos 30 + 15(5) = 94.49557169$$

$$\eta = \frac{P_{\text{out}}}{P_{\text{in}}} = \frac{94.49557169}{250} = 0.37794$$