

WORK

The work done to an object, measured in joules or newton-metres. symbol "J" or "Nm"

The distance the object is pushed, measured in metres. symbol "m"

$$W = F \cdot d$$

The force applied to an object, measured in newtons. symbol "N"

Work at angles

The work done to an object, measured in joules. symbol "J"

The distance the object is pushed, measured in metres. symbol "m"

$$W = F \cdot d \cdot \text{Cos } \theta$$

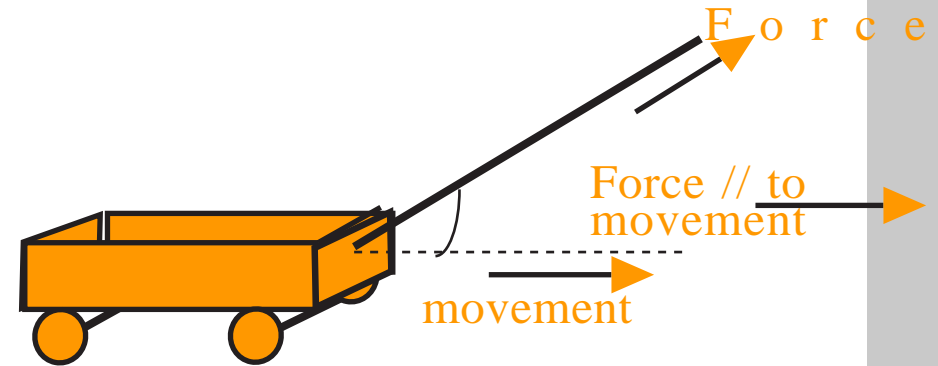
The force applied to an object, measured in newtons. symbol "N"

The angle between the direction of force and direction of movement, measured in degrees. symbol "°"

WORK

A wagon is pulled at a constant velocity with a 20 N force by a rope that make an angle of 35° with the horizon. What is the force of friction and how much work was done to move the wagon 100 m?

To find the amount of work done to move an object horizontally, we must use only the horizontal force which is the adjacent side of the angle, **NOT** the applied 20 N which is the hypotenuse. *Force and distance must be in the same plane.*



$$\cos \phi = \frac{F_{adj}}{F_{hyp}}$$

$$F_{adj} = \cos \phi \times F_{hyp}$$

$$F_{adj} = \cos 35^\circ \times 20N$$

$$F_{adj} = 16.4N$$

$$W = \Delta E = F_{horizontal} d_{horizontal}$$

$$W = 16.4N \times 100m$$

$$W = 1.64kJ$$

OR

$$W = F_{applied} d_{horizontal} \cos \phi$$

$$W = 20N \times 100m \cos 35^\circ$$

$$W = 1.64kJ$$