Regents Physics

Work and Power

APlusPhysics

Objectives

- Define work and Power.
- Calculate the work and the power.

What is Work?

- You do work on an object when you move it.
- When you do work on an object, you transfer energy from one object to another.
- Work is the process of moving an object by applying a force.

Examples of Work

- A girl struggles to push her stalled car, but can't make it move.

  → Since car isn't moving, no work is done.

- A child in a ghost costume carries a bag of Halloween candy across the yard.

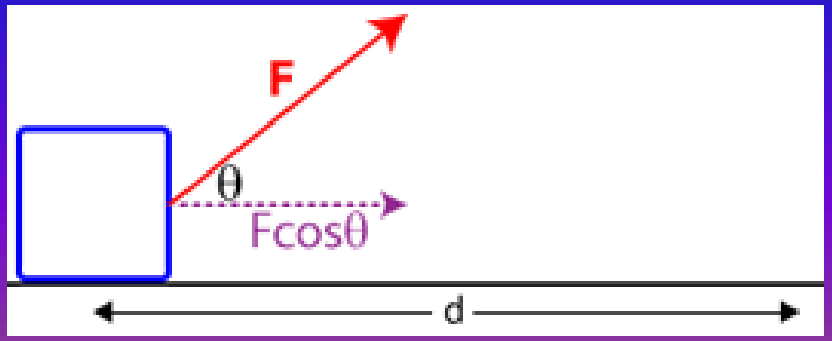
  → Forces of the child's arms on the bag don't cause the displacement, therefore no work is being done by the child.

Calculating Work

$$W = F\,d$$

- W is the work done in Joules (N·m)
- F is the force applied in Newtons
- d is the object's displacement in meters

- Only the force in the direction of the displacement counts.
- When force and displacement aren't in the same direction, we must take the component of force in the direction of the displacement.



$$W = F\cos\theta \cdot d$$

Sample Problem 1

An appliance salesman pushes a refrigerator 2.0 meters across the floor by applying a force of 200 N. Find the work done.

Sample Problem 2

You push a crate up a ramp with a force of 10 N. Despite your pushing, however, the crate slides down the ramp a distance of 4.0 m. How much work did you do?

What is Power?

- Power is the rate at which work is done.

$$P = \frac{W}{t}$$

- Units are Joules/second, or Watts (W)

- It is possible to do the same amount of work, but have different power outputs, if time is different.

Sample Problem 3

Rob and Peter move a sofa 3.0 meters across the floor by applying a combined force of 200 N horizontally.
If it takes them 6.0 seconds to move the sofa, what amount of power did they supply?

Kevin then pushes the same sofa 3.0 meters across the floor by applying a force of 200 N.
Kevin, however, takes 12 seconds to push the sofa.
What amount of power did Kevin supply?

Alternate Power Calculations

$$P = \frac{W}{t} = \qquad = Fv$$

Sample Problem 4

Motor A lifts a 5000 N steel crossbar upward at a constant 2.0 m/s.

Motor B lifts a 4000 N steel support upward at a constant 3.0 m/s.

Which motor is supplying more power?