

Work and Machines ▪ *Section Summary*

What Is Work?

Guide for Reading

- When is work done on an object?
- How do you determine the work done on an object?
- What is power?

In science, you do **work** on an object when you exert a force on the object that causes the object to move some distance. **Work is done on an object when the object moves in the same direction in which the force is exerted.** If the object does not move, no work is done no matter how much force is exerted.

In order to do work on an object, the force you exert must be at least partly in the same direction as the object's motion. When you carry an object at constant velocity, you exert an upward force to hold the object so that it doesn't fall to the ground. The motion of the object is in the horizontal direction. Since the force is vertical and the motion is horizontal you don't do any work on the object as you carry it.

The amount of work you do depends on both the amount of force you exert and the distance the object moves. **The amount of work done on an object can be determined by multiplying force times distance.**

$$\text{Work} = \text{Force} \times \text{Distance}$$

When force is measured in newtons and distance is measured in meters, the SI unit of work is the newton \times meter (N \cdot m). This unit is also called a joule. One **joule** (J) is the amount of work you do when you exert a force of 1 newton to move an object a distance of 1 meter.

Power is the rate at which work is done on an object. **Power equals the amount of work done on an object in a unit of time.** To do a set amount of work in a shorter period of time, you need to apply more power. Power is calculated by dividing the amount of work by the amount of time required to do the work.

$$\text{Power} = \frac{\text{Work}}{\text{Time}}$$

When work is measured in joules and time is measured in seconds, the SI unit used for power is the joules per second (J/s). This unit is also known as the watt (W).

$$1 \text{ W} = 1 \text{ J/s}$$