What Is Work?

WHAT DO YOU THINK ABOUT WHEN YOU SEE OR HEAR THE WORD *WORK*?

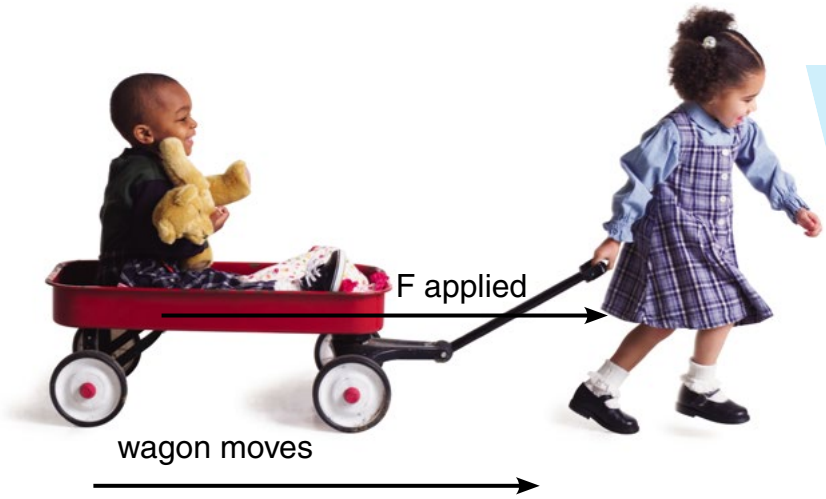
We use the word *work* in many different ways.

- Sometimes we say we are doing work when we are doing an activity that requires physical or mental effort. “Chopping wood is hard work.”
- Work might be used to describe your job or place of employment. “I am on my way to work.”
- Work can be used to describe how something functions. “This computer does not work.”
- Something done or made can be called a work. “I really like that work of art.”
- Can you think of other ways we use the word *work*?

In science, work has a specific meaning that is different from the other ways we use this term.

DOING WORK

When a force is applied to an object, and the object moves in the direction of that force, **work** has been done on the object. Let's look at some examples:

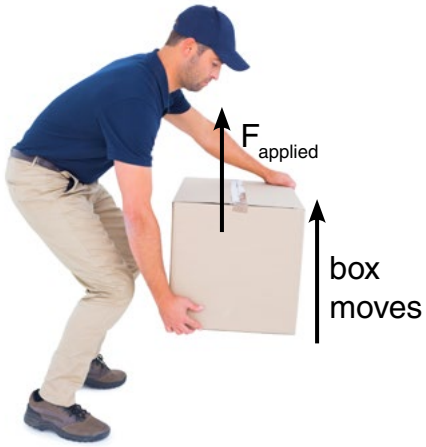


A girl pulls her brother in a wagon. Is work done on the wagon?

The girl is doing work on the wagon because she applies a force to the wagon, and the wagon moves in the direction of the force.

A woman pushes on a van, but the van does not move. Is work done on the van?

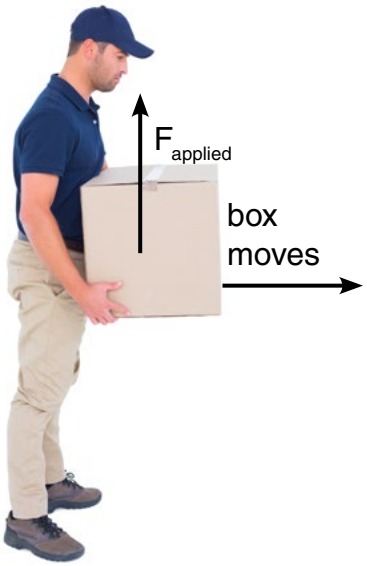
Work is not done on the van because the woman applies a force to the van, but the van does not move. Work is only done on an object when it moves in the direction of an applied force.



A delivery man picks up a package and carries it to the front door of a house. Is work done on the box?

This one is tricky! Work is only done when an object moves in the direction of an applied force.

Work is done on the box when the delivery man lifts it because he applies an upward force on the box, and the box moves upward. No work is done on the box while the man is carrying it. He applies an upward force to the box to hold the box in place, but the box is not moving upward. The man and the box are both moving forward. Since the motion of the box is not in the same direction as the force applied to the box, no work is done on the box.



CALCULATING WORK

The amount of work done on an object can be calculated by multiplying the force applied to the object times the distance the object moves *in the direction of the force*. The formula for work is Work = Force x distance.

$$W = Fd$$

Work is measured in a unit called a Joule (J). One Joule of work is done when one Netwon (N) of force is applied to an object and the object moves a distance of one meter (m).

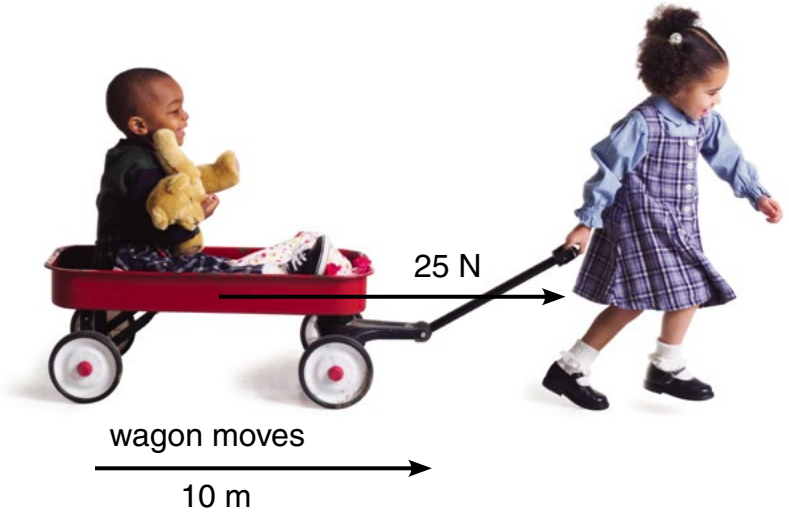
$$1\ J = 1\ N \bullet 1\ m$$

Because one Joule equals one Newton • one meter, remember to measure the distance in meters when calculating work.

Let's practice:

EXAMPLE 1

A girl takes her brother for a ride in a wagon. She applies 25 N of force to the wagon, and pulls the wagon a distance of 10 meters. How much work is done on the wagon?



W = Fd

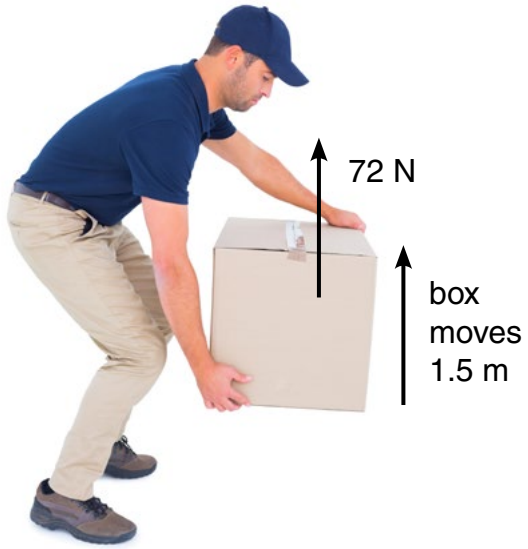
Force = 25 N distance = 10 m

W = 25 • 10

W = **250 J**

EXAMPLE 2

A delivery man uses 72 N of force to lift a box 1.5 m. How much work is done on the box?



W = Fd

Force = 72 N distance = 1.5 m

W = 72 • 1.5

W = **108 J**

WORK AND ENERGY

It takes energy to do work. In fact, in science, energy is defined as the ability to do work. Like work, energy can be measured in Joules. An object with 20 J of energy has the ability to do 20 J of work on another object. When work is done, energy is transferred from one object to another.

SUMMARY

- When a force is applied to an object and causes the object to move in the direction of the force, work is done on the object.
- When work is done on an object, energy is transferred to that object.
- Work can be calculated in Joules using the formula *W* = *Fd*.