

Simple Machine Reading

What Is a Machine?

A machine is any device that makes work easier by changing a force. Work is done whenever a force moves an object over a distance. The amount of work done is represented by the equation:

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

When you use a machine, you apply force to the machine. This force is called the input force. The machine, in turn, applies force to an object. This force is called the output force. The output force may or may not be the same as the input force. The force you apply to the machine is applied over a given distance, called the input distance. The force applied by the machine to the object is also applied over a distance, called the output distance. The output distance may or may not be the same as the input distance.

How Machines Make Work Easier?

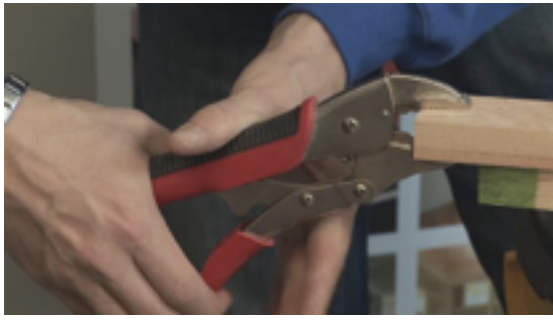
Contrary to popular belief, machines do not increase the amount of work that is done. They just change how the work is done. Machines make work easier by increasing the amount of force that is applied, increasing the distance over which the force is applied, or changing the direction in which the force is applied.

Increasing Force

Examples of machines that increase force are steering wheels and pliers (See Figure below). Read below to find out how both of these machines work. In each case, the machine applies more force than the user applies to the machine, but the machine applies the force over a shorter distance.



When you turn a steering wheel, it causes the smaller steering column in the center of the wheel to turn. The steering column turns a shorter distance but with greater force. The force applied by the steering column is great enough to turn the wheels of the car



When you press together the two handles of the pliers, it causes the other ends of the handles to squeeze an object such as the board in this photo. The squeezing ends move a shorter distance but with greater force, so the pliers squeeze the object harder than you could with your fingers alone.

Increasing Distance

Examples of machines that increase the distance over which force is applied are leaf rakes and hammers (See Figure below). Read below to find out how these two machines work. In each case, the machine increases the distance over which the force is applied, but it reduces the strength of the force.

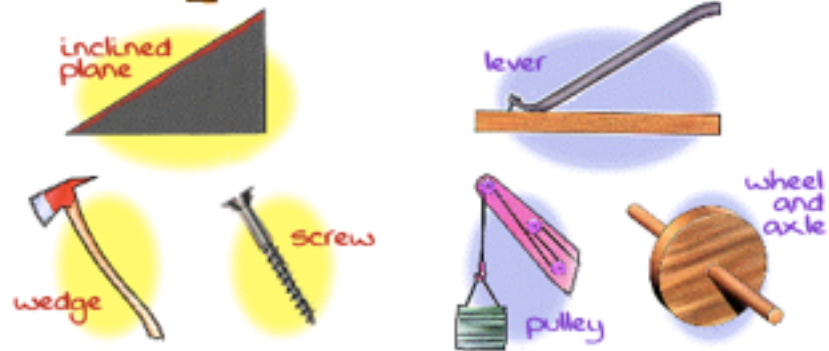


When this person applies force to the handle end of the rake, he moves it over a short distance. The other end of the rake moves over a greater distance but with less force. By covering a greater distance, the rake can do more work than the man can do with his hands alone.

Simple and Compound Machines

There are six types of simple machines that are the basis of all other machines. They are the inclined plane, lever, wedge, screw, pulley, and wheel and axle. The six types are pictured in the Figure below . You've probably used some of these simple machines yourself. Most machines are combinations of two or more simple machines. These machines are called compound machines. An example of a compound machine is a wheelbarrow (see bottom of Figures below). It consists of two simple machines: a lever and a wheel and axle. Many compound machines are much more complex and consist of many simple machines. Examples include washing machines and cars.

Simple Machines

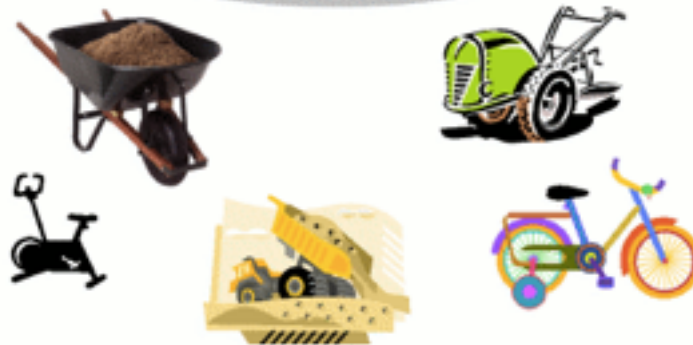


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Compound Machines

A compound machine is made up of two or more simple machines.

Simple + Simple = Compound



Answer the following questions:

1. In your own words, describe the concept of an *ideal machine*.

2. Circle the machines in the following list that are among the six simple machines identified during the Renaissance:

lever

hammer

screw

level

wedge

measuring tape

pulley

screwdriver

inclined plane

ladder

wheel and axle

chain

3. Give three examples of *compound machines*.