



Simple Machines

Machines allow people to accomplish the same amount of work by applying a smaller amount of force over a longer distance.

The push or pull on an object when two or more objects interact is known as **force**.

Work is defined as force acting on an object in the direction of motion.

Machines are devices that people have invented to make work easier. Machines do one of the following:

- **Transfer** a force from one place to another
- **Change** the direction of a force
- **Increase** the magnitude of a force
- **Increase** the distance or speed of a force

Mechanical Advantage

Mechanical advantage is the amount of help you can get from a simple machine. The mechanical advantage of the lever depends on the lengths of the beam on either side of the fulcrum. It is the ratio of force produced by the machine (output) to the force applied to it (input). Mechanical advantage is a trade-off between force and distance. One of the big advantages of many simple machines is that they have high mechanical advantages. A crowbar (a Class I lever), for example, multiplies the force applied by a person (input force). The output force may be two or three times greater than the input force.

Some machines may have a low mechanical advantage (less than one). This is because the purpose of the machine is to change the direction or distance over which the force operates.

Six Simple Machines

Six simple machines may have no moving parts, or very few. Simple machines include:

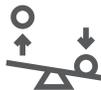


Wheel-and-axles: A wheel can turn freely when it is attached to an axle. This invention made hauling heavy objects much easier and transportation possible.

These other simple machines help people increase and/or redirect the force applied to an object.



Inclined plane: This is a flat surface that is raised at an angle with one side higher than the other. The greater the angle, the more effort is needed to lift a weight. For example, it takes more effort to push a full wheelbarrow up a short, steep ramp than if the ramp were longer and less steep.



Lever: The lever consists of a long beam and a pivot point, or fulcrum. A seesaw is an example of a lever.



Pulley: A pulley is a wheel with a grooved rim. Rope is passed around the pulley and attached to an object. By using a pulley, a person can lift a heavy weight by pulling down on the rope.



Wedge: A wedge is a triangular shaped tool that is a portable inclined plane. It can be used to separate two objects or portions of an object. Examples are a shovel and the blade on an axe used to split wood. A wedge changes the direction of the input force. For example, pushing a rubber doorstop under a door shifts the force downward, preventing the door from sliding on the floor.



Screw: A screw acts as a long inclined plane that is wrapped around a cylinder. It converts rotational motion (turning the screwdriver) into motion along a straight line. Types of screws include the base of a light bulb, a bolt and a faucet.

Many complex machines combine or modify these simple tools.





Simple Machines cont.

Levers

Levers are divided into three classes, depending upon the positions of the input lever arm, the fulcrum (pivot point) and the output arm (or load):

		
Class I lever	Class II lever	Class III lever
In this type of lever, the fulcrum is between the input arm and the output arm. An example is a crowbar.	In this lever, the output force is between the input force and the fulcrum. A wheelbarrow is an example of this type of lever.	In this type of lever, the input force is between the output force and the fulcrum. Your arm is an example of this type of lever!

What type of lever is a robotic arm?

