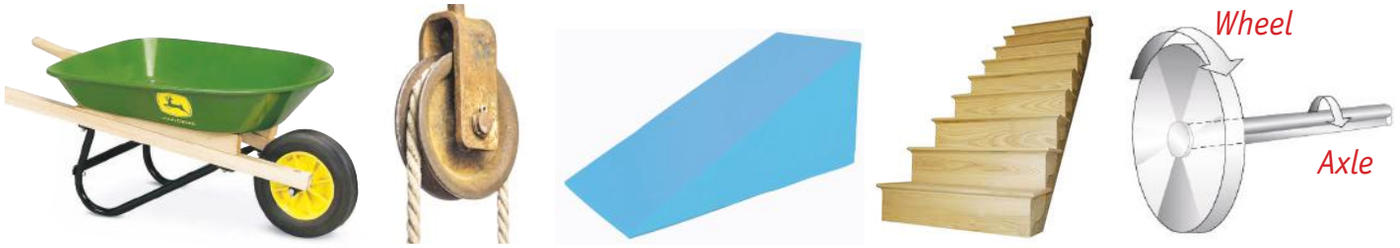
Simple Machines 11

A machine is a tool used to make work easier. It is a device that is used to change the amount, speed or direction of a force. All machines use force to do work.

Simple machines are simple mechanical devices that help people work faster, easier, and more efficiently. They also help accomplish tasks like moving large heavy objects such as pianos or rolling objects uphill. There are different types of simple machines: lever, pulley, wedge, inclined plane, wheel and axle, etc.



Simple Machines

LEVER

A lever is basically just a long stick that you push or pull against a fulcrum to move something. A lever helps you move something heavy, or make something go fast. A lever consists of a rigid rod fixed at a point called the fulcrum used for lifting or shifting a heavy load.

Lever

Fulcrum : It is the fixed point on which the rod moves. It is always stationary.

Load : It is the object that is to be lifted, moved or crushed.

Effort : It is the force which we have to apply on the rod to move or lift the load.

CLASSIFICATION OF LEVERS

Levers are classified according to the position of the fulcrum, the load and the effort.

First-class Lever

In the first-class lever, the fulcrum is between the load and the effort. A broom, see-saw, scissors, nail-cutter, etc, are some of the examples of first-class levers.

First-class lever

Second-class Lever

A second- class lever has the load between the fulcrum and the effort. Bottle opener, nut-cracker, wheel- barrow, etc, are some of the examples of second-class levers.

Second-class lever

Third-class Lever

In third-class lever, the effort is between the fulcrum and the load. A pair of tongs, stapler, forceps, etc., are some of the examples of third-class levers.

Third-class lever

Do You Know ?

The greater the distance between the effort and the fulcrum, the greater the load that can be moved.

INCLINED PLANE

An inclined plane is a slope which makes work easier. Walking up a slope is easier than climbing a ladder to the same height. When workers have to load or unload a truck they use a plank of wood as an inclined plane. In hospitals, inclined planes called ramps are provided next to staircases. This helps in pushing up wheelchairs carrying patients.

Inclined planes make the work of moving things easier. You would need less energy and force to move objects with an inclined plane.

Ramps

Slide

Wooden planks

PULLEY

A small wheel with a groove around its outer edge is called a pulley. The groove is used to hold a rope in position. Pulley makes our work easier by changing the direction of force. A pulley with a chain or rope is used for lifting objects. There are three types of pulleys- fixed pulley, movable pulley and combined pulley.

Flagpole

Well

Curtains with pulleys

Fixed pulley

Fixed pulley : This type of a pulley has a fixed axle. A fixed pulley makes work easier by changing the direction of the force. This type of a pulley is used to draw a bucket of water from a well.

Movable pulley : A movable pulley is a pulley that moves with the load. The movable pulley allows the effort to be less than the weight of the load. You have to use less effort to pull the load.

Movable pulley

Combined pulley

Combined pulley : A combined pulley is easier to use. A little effort is needed to lift the load, almost less than half the weight of the load.

WEDGE

A wedge is a simple machine that has a long triangular shape with one broad or blunt end, and another sharp end. It is made up of two inclined planes. The sharp end is used to cut or slice objects. A wedge may also be formed when two inclined planes are joined together. For example, axe, nail, fork, knife, etc. are wedges.

Knife

Nail

Axe

WHEEL AND AXLE

We know that pushing a load on wheels is easier than carrying it. But the wheel by itself is not a simple machine. It becomes one only when a rod or an axle is attached to it. A wheel with a rod attached to it is known as a wheel and axle arrangement. Such wheel and axle arrangements are used to lift loads. The wheel and axle is used in most big machines. It is used in steering wheels, bicycles, sewing machines, etc.

Screwdriver

SCREW

A screw is a kind of inclined plane which is wrapped around a rod. A screw looks like a nail with grooves in it. Screw has a winding edge called a thread. The head of the screw has a groove for holding the screw driver. It is used to hold things together tightly. Jar lids, light bulbs, jacks, wrenches, key rings, etc. are all screws. To insert a screw into wood, it has to be screwed in by turning it round and round with a screwdriver.

Screw

Know the Keywords :

Machine	:	A device that makes our work easier
Fulcrum	:	The fixed point on which the rod moves
Load	:	The weight to be lifted
Effort	:	The force applied
Inclined plane	:	A sloping surface

Point to Remember

- Simple machines do work either by changing the direction of force or by reducing the effort needed.
- A second- class lever has the load between the fulcrum and the effort.
- A pair of tongs, stapler, forceps, etc are some of the examples of third-class levers.
- An inclined plane is a simple machine used to move objects to a higher place.
- In a pulley, an effort can be applied in one direction and a load can be moved in the other direction.
- A wedge is simply two inclined planes sloping away from each other.
- A screw is used to hold things together. It is actually an inclined plane wrapped around a rod.

EXERCISE TIME

A. Multiple Choice Questions (MCQs).

Tick (✓) the correct word :

1. According to the positions of the fulcrum, the load and the effort, lever can be divided into :

   a. two groups ◯ b. three groups ◯ c. four groups ◯

2. An inclined plane is called a :

   a. wedge ◯ b. slope ◯ c. pulley ◯

3. The point where the lever is supported is :

   a. load ◯ b. fulcrum ◯ c. effort ◯

4. Which of these is an example of third-class lever?

   a. forceps ◯ b. nut-cracker ◯ c. nail-cutter ◯

B. Fill in the blanks :

1. See-saw and scissors are examples of _____ class levers. (first/second)
2. A _____ is a simple machine used to cut or slice objects. (screw/wedge)
3. In class _____lever, the load is located between fulcrum and effort. (second/third)
4. Screw has a winding edge called a _____. (thread/pulley)

C. Write 'T' for true and 'F' for false :

1. Simple machines increase our work. ( )
2. A screw has two inclined planes together. ( )
3. Third-class lever has effort in the middle. ( )
4. Wedge is shaped like a sharp tooth. ( )

D. Answer the following questions :

1. How is an inclined plane useful to us?
2. What is a pulley? How it makes our work easier?
3. What do you understand by wedge?
4. What is wheel and axle arrangement? Explain.
5. What is a screw? Mention its uses.

Creative Work

- Collect pictures of the simple machines found around you. Divide them into the six categories of simple machines.