Types of Simple Machines

The Lever

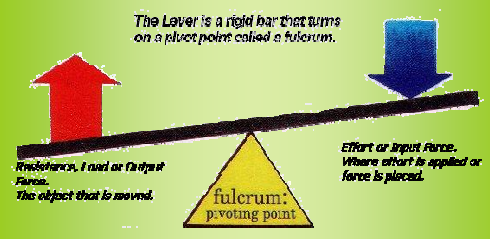
The Lever

a rigid bar that is free to turn about a fixed point called the fulcrum

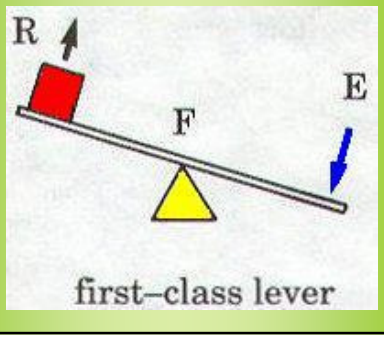
Every Lever has three (3) parts:

1. **Resistance Force, Input Force or Load,** What you are trying to move or lift.
2. **Effort Force or Output Force** - The work done on the Lever.
3. **Fulcrum** – A fixed pivot point.

The Lever



1st Class Lever

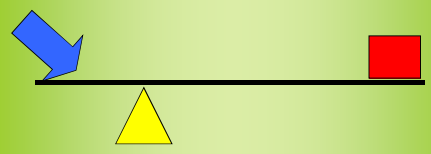


1st Class Lever

- The Fulcrum (fixed pivot point) is located between the Effort (Input) and the Resistance (Output) Forces.
- The effort and the resistance move in opposite directions.
- The effort force pushes down in order to lift the resistance or load.

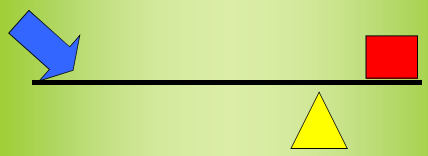
1st Class Lever

- When the fulcrum is closer to the effort than to the load:
  - there is a loss in force
  - There is a gain in speed and distance.



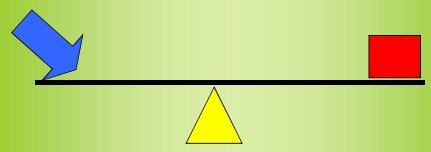
1st Class Lever

- When the fulcrum is closer to the load than to the effort:
  - there is a loss in speed and distance
  - There is a gain in force.



1st Class Lever

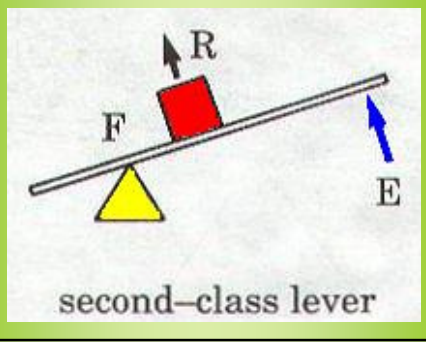
- When the fulcrum is midway between the effort and the load:
  - there is no change in force, speed or distance



1st Class Lever

- Examples:
  - Seesaw
  - Crowbar
  - Scissors

2nd Class Levers



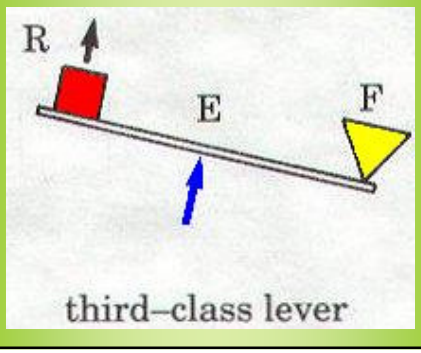
2nd Class Lever

- The load is between the effort and the fulcrum.
- The fulcrum is at one end of the lever.
- The fulcrum is usually closer to the load.
- Produce a gain in force.

2nd Class Levers

- Examples:
  - Wheelbarrow
  - Bottle opener
  - Nutcrackers

3rd Class Levers



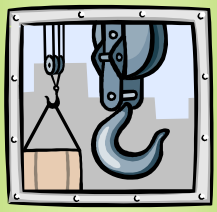
3rd Class Levers

- The effort is between the load and the fulcrum.
- There is usually a loss in force, but a gain in speed and distance.

3rd Class Levers

- Examples:
  - Broom
  - Shovel
  - Fishing rod

The Pulley



The Pulley

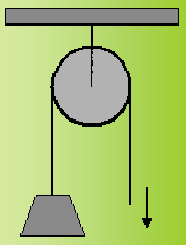
- A pulley changes the direction of the force:
  - Instead of lifting up, you can pull down using your body weigh against the load (what is being lifted)
- A pulley gains nothing in force, distance or speed

The Pulley
a wheel that turns around an axle

- A pulley is a grooved wheel that turns around an axle (fulcrum), and a rope or a chain is used in the grove to lift heavy objects.
- A pulley may be fixed, moveable, or used in combination.

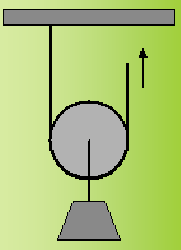
The Fixed Pulley

- Is attached to something that doesn't move such as the ceiling or wall)
- It acts as a first class lever with the fulcrum located at the axis
- Instead of a bar the pulley uses a rope or chain.



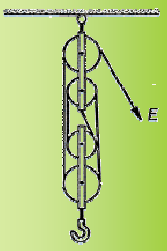
The Pulley

- A moveable pulley acts as second class lever
  - the load is between the fulcrum and the effort



The Pulley

- A compound pulley is a system of movable pulleys.
- Mechanical advantage can be increased by using more than one pulley.



The Inclined Plane

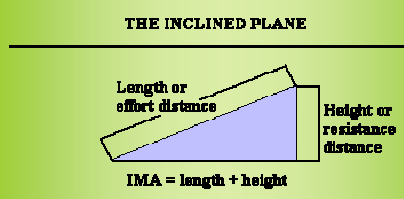
The Inclined Plane
a sloping surface that does not move

- An inclined plane provides for NOT Less work but less effort.
- The trade off is greater distance to travel.

The Inclined Plane

- Used to reduce the force needed to overcome the force of gravity when lifting or lowering a heavy object.

The Inclined Plane



The Screw

The Screw

an inclined plane wrapped around a central cylinder

- A Screw has two (2) parts:
  - The Body – Cylinder Post
  - The Thread – Inclined Plane wrapped around the cylinder.

The Screw

- Functions of the screw
  - To fasten things – the standard screw or nuts & bolts.
  - Drill bits are screws used to make holes.
  - A jackscrew is used to lift heavy objects; car jack.

The Screw

- When you turn a screw:
  - The input force is changed by the threads into an output force.
  - The output force pulls the screw into the materials.
  - Friction between the threads & the material holds the screw in place.

The Wedge

The Wedge

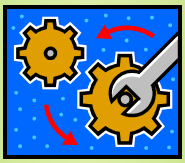
an inclined plane that tapers to a sharp edge

- The wedge used to increase force.
- The material remains in place while he wedge moves through it.
- A wedge changes the direction of the input force.

The Wedge

- Wedges can be forced between two things to hold them tightly together, like nails or a doorstop.
- Wedges can be used to split, cut or fasten.

The Wheel & Axle



The Wheel & Axle

a wheel connected to a rigid pole

- The Wheel & axle is a modified lever:
  - The center of the axle acts as a fulcrum – making the wheel a lever that rotates around in a circle.