12. simple machines

- A device that helps us lift heavy loads, change the speed of the motion or change the direction of a force is known as a **simple machine**.
- Simple machines are the tools that help people work faster and better.
- There are various simple machines: inclined plane, wedge, wheel and axle, pulley and lever.

- A machine made up of two or more simple machines are called **complex** or **compound machine**.
- Hand drill and bicycle are some common examples of complex machiens.
- Maintenance of machines is done by lubricating them properly and by painting the iron parts.

- **INCLINED PLANE:**
    - **It provides a sloping surface; heavy things can be easily be lifted or rolled down.**
    - **Applied force gets multiplied**
    - **Mechanical advantage of an inclined plane is the slope of the incline divided by the vertical rise.**

- **SCREW:**
    - **It has a winding edge called the groove.**
    - **Thread is an inclined plane wrapped round a rod.**

- **WEDGE:**
    - **It is a device that has two or more sloping surfaces that taper either to form a sharp edge or pointed edge.**

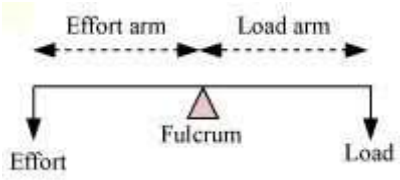
Knife

Axe

- **Types of Simple Machines:**
    - **Lever**

- **Inclined plane**
- **Pulley**
- **Wheel and axle**
- **Screw**
- **Wedge**

- **LEVER: It is a rod which moves freely about a fixed point called the fulcrum.**
- **Parts of a lever**

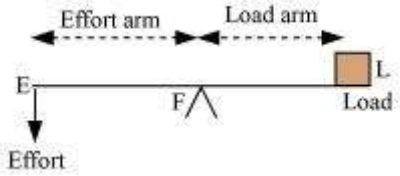


- Load × Load arm = Effort × Effort arm

$$\frac{\text{load}}{\text{effort}} = \frac{\text{effort arm}}{\text{load arm}},$$

$$\text{Mechanical advantage} = \frac{\text{effort arm}}{\text{load arm}}$$

- **Types of lever:** Levers are of three types depending on the position of the fulcrum, load and effort.
  - **Lever of first order:** Fulcrum is situated between the load and the effort. E.g., see-saw, crowbar, beam balance



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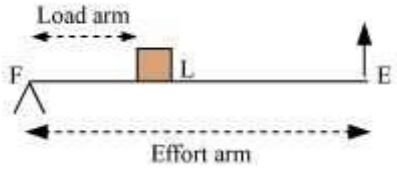
  - **Lever of second order:** Load is situated between the fulcrum and the effort. E.g., mango-cutter, wheel barrow, nut cracker



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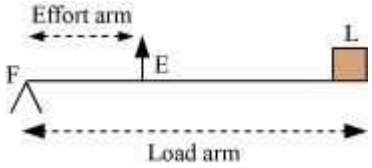
    - **Lever of third order:** Effort is situated between load and the fulcrum. E.g, pair of tongs, fishing rod

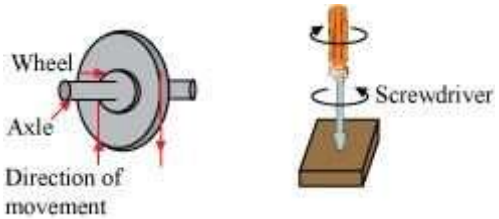


Order of Levers found in Human Body

(1) First order lever: Nodding of head
(2) Second order lever: Raising the weight of the body on toes
(3) Third order lever: Raising a load by forearm

- **PULLEY:**
    - **It consists of a circular disc made of metal or wood with a groove cut along its rim.**
    - **A rope passes around the groove; the groove prevents it from slipping off.**
    - **Pulley rotates about an axle fixed to a support called the block.**
    - **Load is attached to one end and the effort is applied to the other end.**
    - **Pulley allows us to apply force in a convenient direction.**

- **WHEEL AND AXLE:**



    - Wheel with a rod attached to it is known as a wheel and axel arrangement.
    - When a wheel is turned the axel also turns.
    - E.g, steering wheel of a car, drill used by a carpenter.