

Simple Machines

- A simple machine is a device that makes work easier, faster and more convenient.
- Terms used in simple machines are:
 - Effort: force applied to the machine.
 - Load: body on which work is done.
 - Fulcrum: fixed point about which the machine can turn.
 - Input energy: energy supplied to the machine.
 - Output energy: useful work done by a machine.
 - Principle of machine: for an ideal machine the output is equal to its input.
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 - Velocity ratio = $\frac{VE}{VL} = \frac{dE}{dL} = \frac{dE}{dL}$
 - **Relation between mechanical advantage and velocity ratio**
 - $\eta = \frac{M.A.}{V.R.}$
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 - Efficiency = $\frac{\text{Output energy}}{\text{Input energy}}$

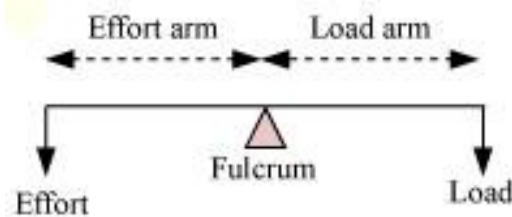
CARE OF MACHINE:

- Should be kept away from dust and moisture
- Proper lubrication should be used to avoid wear and tear
- Iron parts should be painted to avoid rusting.

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**

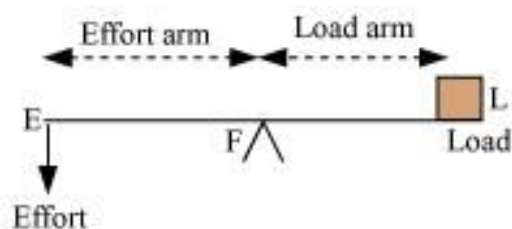


- $\text{Load} \times \text{Load arm} = \text{Effort} \times \text{Effort arm}$

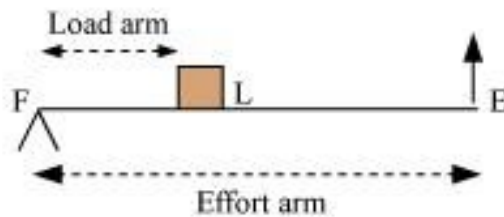
$$\frac{\text{load}}{\text{effort}} = \frac{\text{effort arm}}{\text{load arm}},$$

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

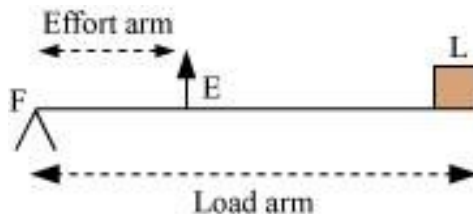
- **Types of lever:** Levers are of three types depending on the position of the fulcrum, load and effort.
 - **Lever of first order:** Fulcrum is situated between the load and the effort. E.g., see-saw, crowbar, beam balance



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



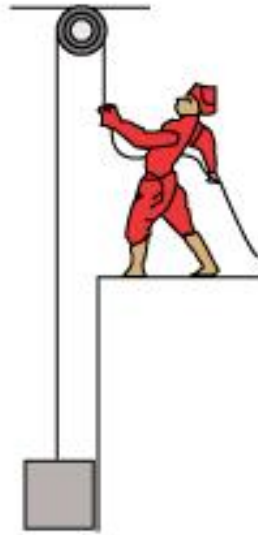
- - **Lever of third order:** Effort is situated between load and the fulcrum.
E.g, pair of tongs, fishing rod



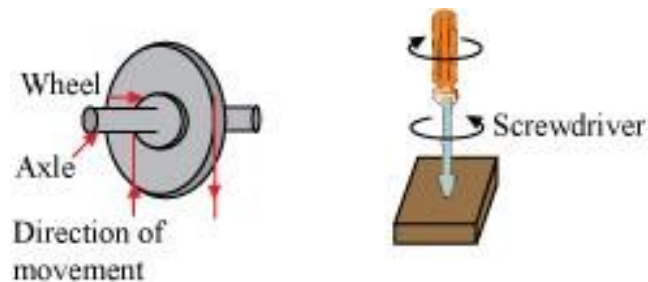
Order of Levers found in Human Body

- (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 axle arrangement.
- When a wheel is turned the axle also turns.
- E.g, steering wheel of a car, drill used by a carpenter.

- **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