Machines → It is an Mechanical Arrangement Which Reduce our Effort and makes our work Easy. Called Machines → Simple Machine. → Sissors, Scissor, Knife, Screw driver, Pulley, Sugar-Tong

* How many types of performance or Nature of Work done by Simple Machines

(i) Force Multiplier → Effort < Load

(ii) Gain in speed → E > L → L < E

(iii) Change of direction of effort. → E=L

(iv) In Changing the point of Application of effort to a Convenient Point →

Some important term Related to Machine

(1) Load → A Resistive Force on Which a Machine work called Load. (L).

(2) Effort (E) → A machine User how much Force applied on Machine, called Effort (E).

(3) Mechanical Advantage (MA) → For a Machine the Ratio of Load (L) to Effort (E) is called M.A. ∴ $MA = \frac{L}{E}$ → $M.A = \frac{Load}{Effort}$

Note $MA = \frac{L}{E}$

→ Case → I → If Load > Effort → then $MA > 1$

In this Case Machine work as Force Multiplier

→ Case-II If Load = Effort → $L = E$

then $MA = 1$

then in this case machine acts as change the ~~dire~~ direction of ~~Effort~~ (E)

→ Case-III If Load < Effort → $L < E$

$\therefore E > L$

$\therefore MA < 1$

by Sonu sir

in this Case Machine acts as gain in speed or speed Multiplier. ex

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* Velocity Ratio (V.R) → Effort → E

displacement in effort = d_E

time = t

Velocity of Effort = $V_E = \frac{d_E}{t}$

For

And Load = L

Displacement of Load arm = d_L

Velocity of Load = $V_L = \frac{d_L}{t}$

* Velocity Ratio (V.R) define as ~~a~~ Ratio of Velocity of Effort (V_E) to Velocity of Load (V_L).

Since it is the ratio of two similar quantities, the mechanical advantage has no unit.

- For MA > 1, machine works as a force multiplier.
- For MA < 1, machine is used to gain speed.
- For MA = 1, machine is used to change the direction of applied force.

- **Velocity Ratio:** It is the ratio of the distance travelled by the effort to the distance travelled by the load in the same interval of time. It can also be defined as the ratio of the velocity of effort to the velocity of load.

$$\text{Velocity ratio (VR)} = \frac{\text{Distance travelled by effort}}{\text{Distance travelled by load}} = \frac{d_E}{d_L}$$

or
$$\boxed{\text{Velocity ratio} = \frac{\text{Velocity of effort}}{\text{Velocity of load}} = \frac{V_E}{V_L}}$$

Since it is the ratio of two similar quantities, velocity ratio has **no unit.**

- **Efficiency:** It is the ratio of useful work done by a machine (work output) to the total work done on the machine (work input). It is usually expressed as a percentage. It has no unit.

$$\text{Efficiency } (\eta) = \frac{\text{Work Output}}{\text{Work Input}}$$

or
$$\boxed{\eta\% = \frac{\text{Work Output}}{\text{Work Input}} \times 100}$$

The efficiency of an ideal machine is 100%. In practice, however, no machine is 100% efficient.

- **Relation between MA, VR and η:**

$$\text{MA} = \text{VR} \times \eta$$

Class - X | Sub. PHYSICS | MACHINE | ch-3

Q.N. 1. State Four ways in which machines are useful to us.

Q.N. 2. Name a machine For Each of the Following Use
(i) to multiply the Force
(ii) to change the Point of application of Force.
(iii) to change the direction of Force.
(iv) to obtain the gain in speed.

Q.N. 3. Define With Units (a) Mechanical Advantage (b) Velocity Ratio (c) Efficiency of machine.

Q.N. 4. How is the M.A. related to the Velocity Ratio (V.R) For (i) an ideal Machine (ii) a Practical Machine?

Q.N. (5) When does a machine acts as (a) Force multiplier (b) a speed multiplier.

Q.N. (6) State one Reason Why is Mechanical advantage Less than the Velocity ratio For an actual machine.

Q.N. (7) Name the term that will not change for a machine of a given design.

Q.N. (8) What is the Purpose of a Jack in lifting a car by it?

by Sonu sir

Q.N. (9). Calculate the ideal mechanical advantage of a machine having Load 60kgf and Effort is 4 kgf.

Q.N. (10) Write the Relation between Efficiency, MA. and Velocity Ratio.