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MACHINES

INTRODUCTION :- Screw - jack, cycle, pulley, etc

Resistance :- Control effort.

Effor :- (P) → (N)

** D = Distance moved by effort (m)

d = Distance moved by weight (m)

Input work :-

[Input work = P × D] N×m = Joule

Output work :-

[output work = W × distance] N×m = joule.
= W × d

M.A. :- (Force Ratio)

↑M.A = $\frac{\text{Weigh lifted (W)}\ (N)}{\text{effort (P)}\downarrow\ (N)}$ → No.

$$\boxed{M.A\uparrow = \frac{W}{P\downarrow}} > 1$$

$$\boxed{\uparrow M.A. \propto \frac{1}{P\downarrow}} > 1$$

V.R :- $\left\{\left[VR = \frac{D_P}{D_W}\right] = \frac{D}{d}\right\}$

Efficiency :- (η)

$$\eta = \frac{\text{output work}}{\text{Input work}}$$

$$\Rightarrow \eta = \frac{M.A.}{V.R} \times 100 \%$$

Ideal Machine :-

$$\eta = 100\ \%$$

$$\eta = \frac{O/P}{I/P}$$

$$1 = \frac{O/P}{I/P}$$

$$[I/P = O/P]$$

Real Machine :-

[outwork / output work = Input work − Work loss in friction]

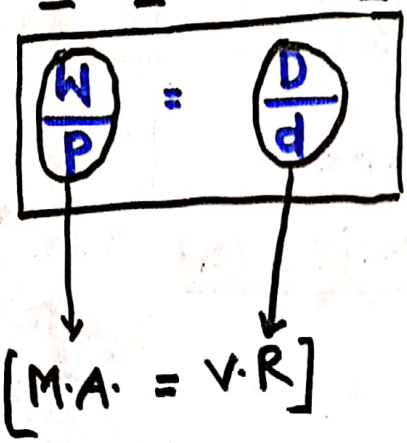
[effort loss in friction = Actual effort − Ideal effort]

* Relation b/w M.A. V.R. and η :-

(1) For ideal Machine :-

Output work = Input work

$W \times d = P \times D$



D = Distance moved by effort (P)

d = Distance moved by weight (W)

$* \left\{ \eta = \frac{MA}{VR} = 1 = 100\% \right\}$

(2) For Real Machine :-

output work = Input work − friction loss of effort.

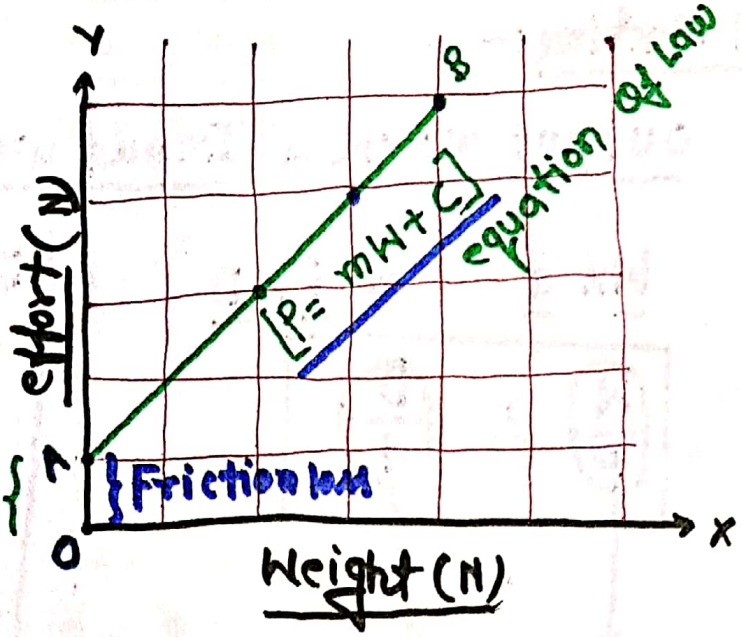
$\eta = \frac{O/P}{I/P} = \frac{W \times d}{P \times D}$ ① $\left\{ M.A. = \frac{W}{P} \right\}$

$\frac{W}{P} \times \left(\frac{d}{D}\right) = \eta$

$\left\{ \eta = \frac{\left(\frac{W}{P}\right) \rightarrow (M.A.)}{\left(\frac{D}{d}\right) \rightarrow (V.R.)} = \frac{(M.A.)}{(V.R.)} \right\}$ ② $\left\{ V.R. = \frac{D}{d} \right\}$

③ $\left\{ \eta = \frac{M.A.}{V.R.} \times 100\% \right\}$

Law of Machine :-



OA ⇒ C

P = effort (N)
m = slope of line AB
W = Weight (N)
C = Constant

mathematical form

$$[P = mW + C]$$

example :- A lifting Machine lifts the load of 7800 N with the effort of 150 N. What is the M.A. If the $\eta = 52\%$ then find V.R.

Conc. II

If 13500 N weight lifted with the effort of 250 N with this machine, then what will be the η of this machine.