Mechanical advantage, Velocity ratio and efficiency of machine

$$Mechanical\ Advantage = M.A. = \frac{Load}{Effort} = \frac{W}{P} \quad .....No\ Unit$$

$$Velocity\ Ratio = \frac{Distance\ Moved\ by\ Effort}{Distance\ Moved\ By\ load} = \frac{y}{x} \quad ..... No\ Unit$$

$$Efficiency = \frac{Output}{Input} = \frac{W \times x}{P \times y} \times 100 \ .....\% \quad Or \quad \eta = \frac{W}{P \times VR} \times 100 .....\%$$

Ideal load,ideal effort,effort lost in friction and load lost in friction

$$Ideal\ Load\ W_i = p \times VR$$
$$Load\ lost\ in\ friction = W_f = P \times V.R. - W$$
$$Ideal\ Effort\ P_i = \frac{w}{VR}$$
$$Effort\ lost\ in\ Friction = P_f = P - \frac{W}{VR}$$

Law of Machine

$$General\ Law\ of\ Machine \quad P = mW + C .....N$$

$$Max\ MA = \frac{1}{m} \qquad Max\ \eta = \frac{Max\ MA}{VR} \times 100$$

Slope of law of machine $m = \frac{P_2 - P_1}{W_2 - W_1}$

Y intercept $P_1 = mW_1 + C$

Condition for reversibility: If $\eta > 50\%$ .....*machine is reversible*

: If $\eta > 50\%$ .....*machine is nonreversible*

Different Machines

Screw Jack $VR = \frac{2\pi L}{P_t}$	Worm and worm $VR = \frac{RT}{nr}$
Westons diff pulley $VR = \frac{2D}{D-d}$	Simple wheel & axle $VR = \frac{D}{d}$
Diff. wheel & axle $VR = \frac{2D}{d_1 - d_2}$	
Single Pur. crab $VR = \frac{l}{r} \times \frac{N_1}{N_2}$	Double Pur crab $VR = \frac{l}{r} \times \frac{N_1}{N_2} \times \frac{N_3}{N_4}$
Geared Pulley Block $VR = \frac{N_1}{N_2} \times \frac{N_3}{N_4}$	