Processes :- A path along which change of state takes place.

(a) **Isochoric process:** Volume is constant

$$\Delta V = 0$$

(b) **Isobaric Process:** Pressure is constant.

$$\Delta P = 0$$

(c) **Isothermal process:** Temperature is constant

$$\Delta T = 0$$

(d) **Adiabatic Process:** Heat transfer not allowed.

(e) **cyclic process:** Initial and final state of the system are identical.

Reversible and Irreversible processes :- If both the system and Surrounding return to their original state after a series of changes, the process is called reversible. It occurs in infinitesimally small step.

Those process which take finite time to complete and are called irreversible process.

Heat and work :-

Heat: It is the energy transfer due to the temperature difference between system and surroundings. It appears at the boundary of the system only when the system undergo any change in state. It is represend by 'q'

q = +ve, if heat is absorbed by the system,

q = -ve, if heat is released by the system.

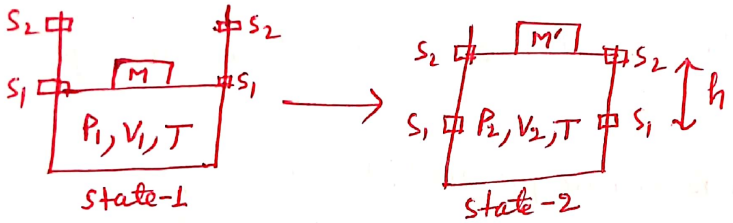
Work: It is the energy transfer between the system and surrounds due to macroscopic unbalanced force acting on the system. It represented by 'W'.

$W = +ve$, if work is done on the system.

$W = -ve$, if work is done by the system.

Expression of work :-

Work of expansion:



Consider a cylinder containg an ideal gas with a piston. In state-1 the variables are P_1, V_1 and T and state-2 contain the variable P_2, V_2 and T. The area of cross-section is A.

Now the mass M is replaced by m' so that the piston stops at S_2.

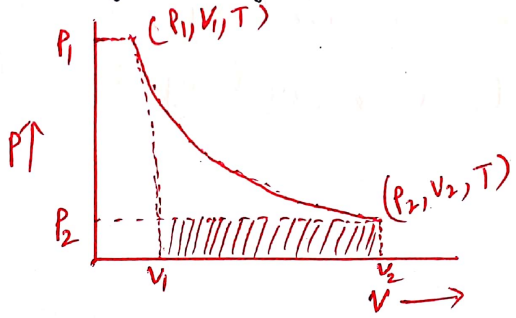
$$\text{Work}(W) = -\text{force} \times \text{displacement}.$$

$$W = -F \times h$$

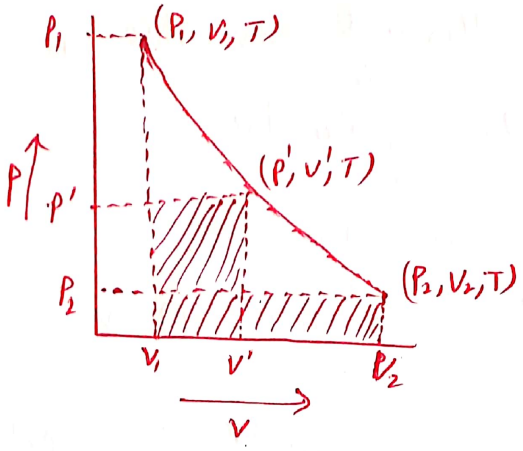
$$W = -\frac{F}{A} \times hA$$

$$W = -P_{ext} \times \Delta V$$

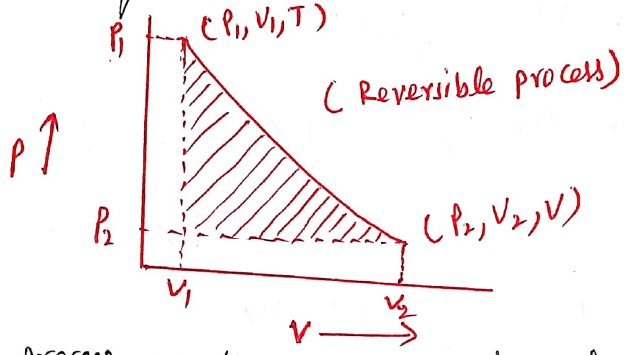
Now, if the expansion is carried out in a single step, then the work done is given by the shaded area in figure (a).



If it occurs in two steps, then

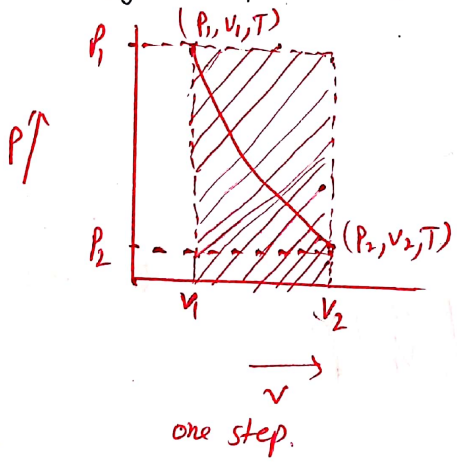


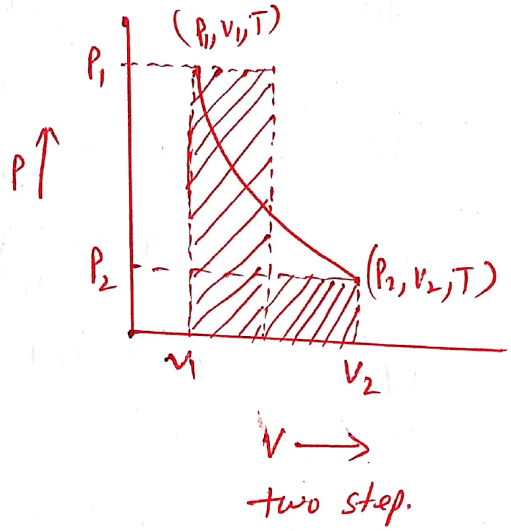
Similarly for infinitesimally number of small steps.



For reversible process work of expansion is maximum,

Work of compression $\frac{0}{0}$





For a reversible process work of compression is minimum,