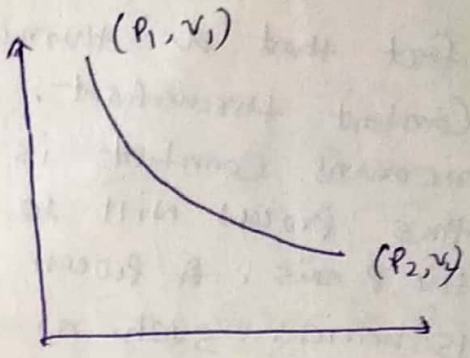
③ Thermal equilibrium

All parts of the system are in same temperature with surroundings.

i.e, In thermal equilibrium to constancy of temp^{r}

● Thermodynamic Processes (If thermodynamic variables or co-ordinate change from one equilibrium state to another)

When the value of thermodynamic variables associated with a system change from one equilibrium state to another, the system is said to undergo a thermodynamic process.



To analyse a thermodynamic process, the variation one thermodynamic variable is plotted with respect to another and the plot is known as an indicator diagram. And a process means a line connecting a series of such points. In the adjacent diagram, the initial state of the system is represented by the point (P, V_1), the system undergoes an expansion, and the final state of the system is defind by the point (P_2, V_2).

A thermodynamics process can be made to retrace it's original path to reach back the initial state. If retracing is possible, the process is said to be reversible; if not, it is said to be irreversible.

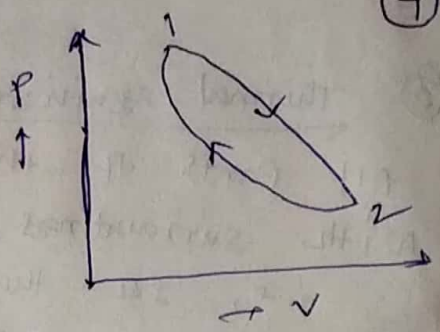
● quasistatic process :-

A process is called quasistatic if all the parameters of the system (P, V, etc. T) vary physically indefinitely slowly so that the system is found all the time in an equilibrium state.

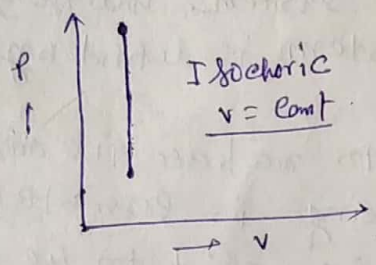
Physically, an indefinitely slow or quasistatic variation of any parameter A with time t is such that the rate of change dA/dt is considerably smaller than its mean rate of variation in relaxation. If the relaxation time is τ and the corresponding variation of the parameter is ΔA, then for a quasistatic process to occur,

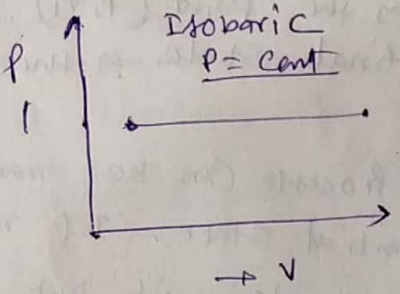
$$\frac{dA}{dt} \ll \frac{\Delta A}{\Delta \tau}$$

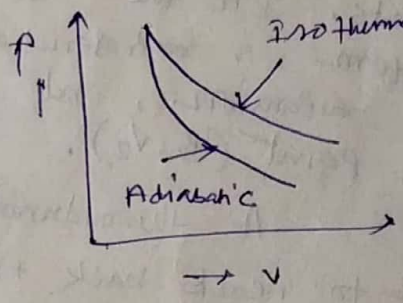
Many a time, the series of Process undergone by a system may revert it back to it's initial state. such a series is said to Continue a cyclic process. A cyclic Process is represented by a closed path on the indicator diagram.



Many Processes are characterised by the fact that a thermodynamic Co-ordinate of a system remains Constant throughout. A Process in which the volume of a system remains Constant is called isochoric. on the indicator diagram this Process will be represented by a straight line Parallel to the P-axis. A Process in which Pressure remains Constant is called isobaric. such a Process will be represented by a line Parallel to the V-axis. Similarly, a Process in which no thermal interaction takes places between a system and it's surroundings is said to be adiabatic, whereas a Process taking place at Constant temperature is called isothermal.







⇒ ● **state function** –

When a system changes from one state to another then if the change in independent of the the path in which the transformation is carried out then it is called state function. Example – Workdone / temp^{re} or Internal energy (U).

● **Path function** :

When a system change from one state to another then if some Parameters depends on the Path of the transformation such function are called Path function.

example → Heat, Work.