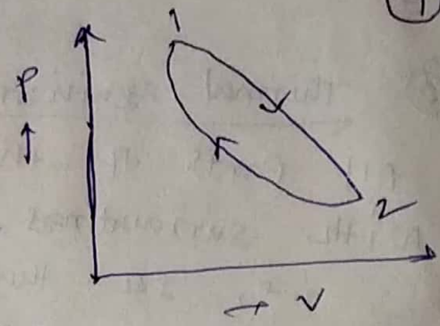
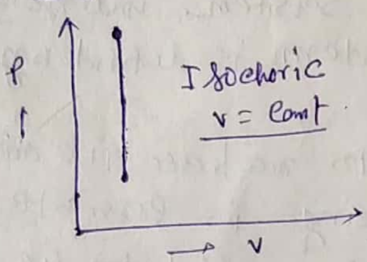
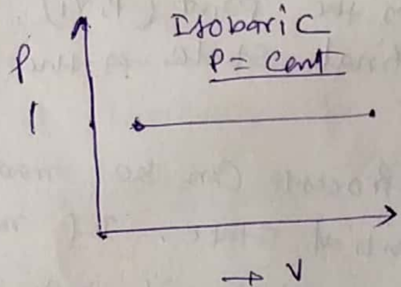


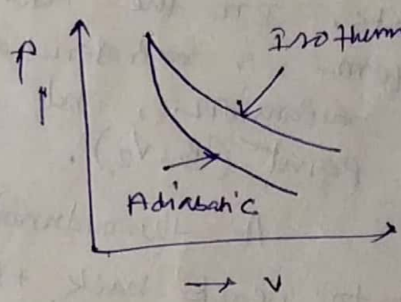
cyclic process.

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.





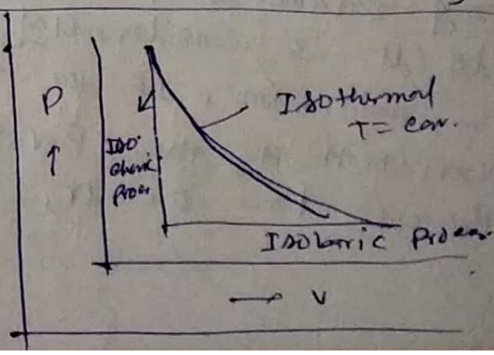


State function –

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$^{\underline{r}}$ 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.



Zeroth law of thermodynamics:

If two simple systems A and B are each in thermal equilibrium with a third system C, then the systems A, B and C are all in thermal equilibrium with one another. ~~Iff~~, ~~A, B~~ A, B & C three system, we may write,

If, $A = C$ & $B = C$, then

Mathematically, $\boxed{\text{then } A = B \text{ or } A = B = C}$

OR If two systems are separately in thermal equilibrium with a third system, they will also be in thermal equilibrium with one another.

Concept of temperature :-

The temperature of a system is a property that determines whether or not a system is in thermal equilibrium with other systems.

* If x, y, z are state function then prove that

$$\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial y \partial x}$$

$\Rightarrow$ Let $z = f(x, y)$

Diff. Partially,

$$dz = \left(\frac{\partial z}{\partial x}\right)_y dx + \left(\frac{\partial z}{\partial y}\right)_x dy$$

$$dZ = M\,dx + N\,dy$$

dz is a Perfect or exact differential if,

$$\boxed{\left(\frac{\partial M}{\partial y}\right)_x = \left(\frac{\partial N}{\partial x}\right)_y}$$

Now, $\left(\frac{\partial M}{\partial y}\right)_x = \frac{\partial}{\partial y}\left[\left(\frac{\partial z}{\partial x}\right)_y\right]_x = \frac{\partial^2 z}{\partial y \partial x}$

$\left(\frac{\partial N}{\partial x}\right)_y = \frac{\partial}{\partial x}\left[\left(\frac{\partial z}{\partial y}\right)_x\right]_y = \frac{\partial^2 z}{\partial x \partial y}$

$\therefore$ dz is exact differential.

* Consider an infinitesimal quantity $dF = (x^3 - y)\,dx + x\,dy$. Is this an exact differential?

$$dF = (x^3 - y)\,dx + x\,dy$$

$\Rightarrow$

$$= M\,dx + N\,dy$$

$$\left(\frac{\partial M}{\partial y}\right)_x = \frac{\partial}{\partial y}\left[(x^3 - y)\right]_x = -1$$

$$\left(\frac{\partial N}{\partial x}\right)_y = \frac{\partial}{\partial x}\left[x\right]_y = 1$$

$$\left(\frac{\partial M}{\partial y}\right)_x \neq \left(\frac{\partial N}{\partial x}\right)_y$$

$\therefore$ dF is not exact differential.