Isobaric process:– During ~~an isothe~~ a thermodynamic process if the pressure of the system remains constant throughout the process, then it is called an isobaric process [Example: during an isobaric process the pressure on both sides of ~~a~~ movable piston remains same].

Isochoric process: If the volume of a system is kept constant throughout a thermodynamic process, it is called an isochoric process. [Example: the volume of a system with a rigid wall does not change.]

Isothermal process: A thermodynamic process in which the temperature of the system remains constant is known as isothermal process.

Adiabatic process: When ~~an~~ a thermodynamic process is carried out adiabatically i.e., during the process if the system is surrounded by an adiabatic wall, then it is called adiabatic thermodynamic process.

WORK

Let us now go into little more details of thermodynamic work. Consider a hydrostatic system (say gas) contained in a closed cylinder equipped with a frictionless movable piston. Let A be the area of cross-section of the piston and p the pressure exerted by the system at the piston face. If the external force on the piston changes infinitesimally, the piston will move slightly inwards by an amount of dx. Then the infinitesimal amount of work done is given by

$$dW = pA\,dx.$$

In thermodynamics infinitesimal work is represented by $đW$ instead of dW.

$đW \longrightarrow$ is read as dee-bar W.

We shall discuss the reason later.

But during compression, the volume of the system is decreasing, so

$$A\,dx = -dV,$$

$$\therefore \quad \boxed{đW = -p\,dV} \quad \text{———} \; (1)$$

In a finite quasi-static process in which the volume changes from V_i to V_f, the amount of work done by the system is

$$\boxed{W = -\int_{V_i}^{V_f} p\, dV} \quad \text{——— (2)}$$

Note: Here p is a thermodynamic co-ordinate. Thus, it can be expressed as a function of temperature and volume by means of an equation of state. The above integral can be evaluated only when the behaviour of T is ~~p~~ specified and then p can be expressed as a function of V only. If p is expressed as a function of V, the path of integration becomes defined. This implies that the evaluation of this integral depends on the specification of actual process.

Again, if we express the work as W_{if} while going from state i to state f through infinitesimal equilibrium states, then

$$W_{if} = -\int_{V_i}^{f} p\, dV \quad , \text{ work done by the system}$$

Now, if the system comes back from state f to i following exactly the same equilibrium states as earlier but in the reverse order, then it represents the work done ~~by~~ on the system.

Then,

$$W_{fi} = \int_{V_f}^{V_i} p\,dV$$

So, $\boxed{W_{if} = -W_{fi}}$ —

Representation of work in pV diagram :-

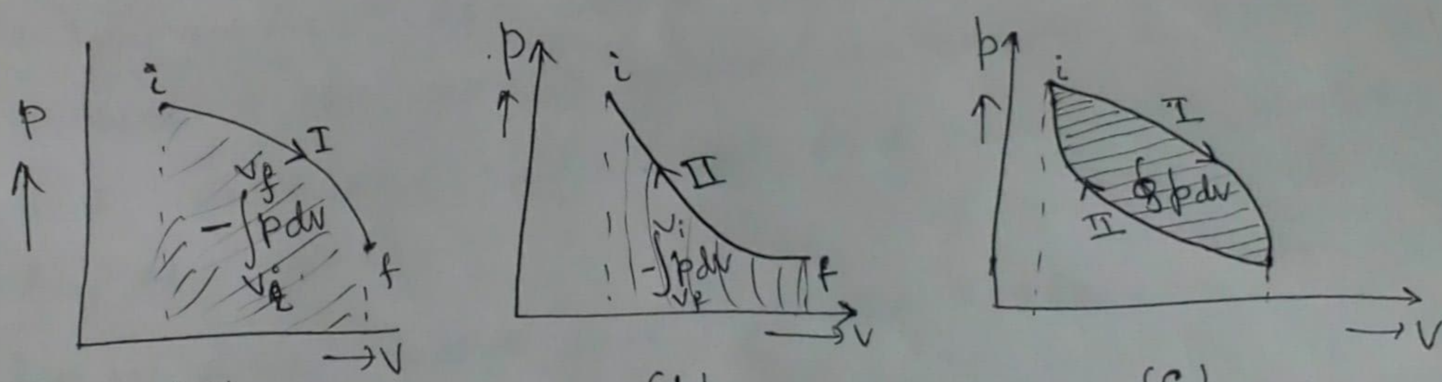

Figure: (a) (b) (c)

In Figure (a), curve I indicates the changes in pressure and volume ~~due~~ during the expansion of the system. The amount of work done (i.e., $\int_{V_i}^{V_f} p\,dV$) in going from state i to state f in this process is the shaded area under the curve.

Figure (b): curve II represents compression of the same system from state f to state i. The work done in this process $= -\int_{V_f}^{V_i} p\,dV$ and it is the area under the curve as shown.