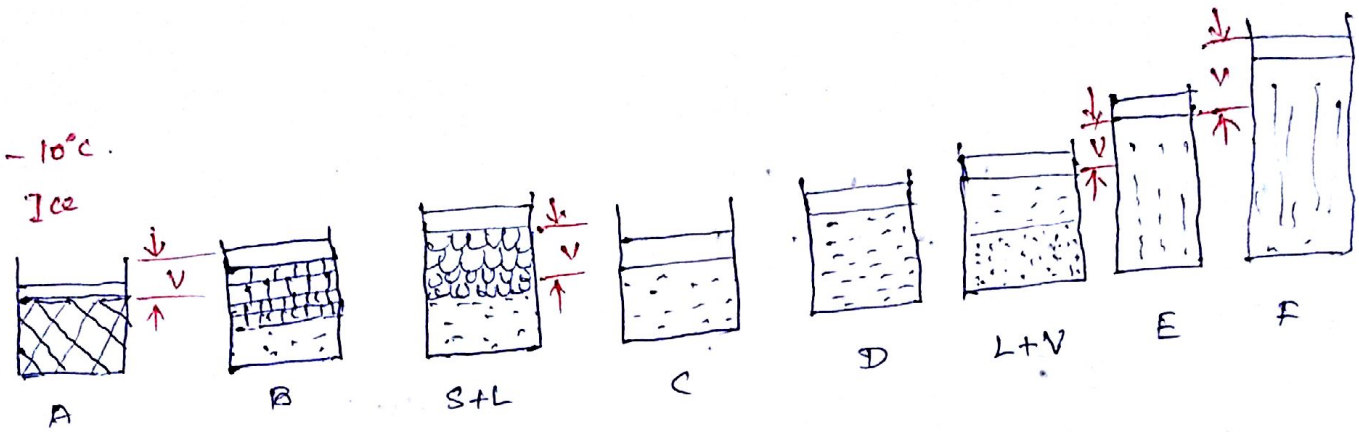
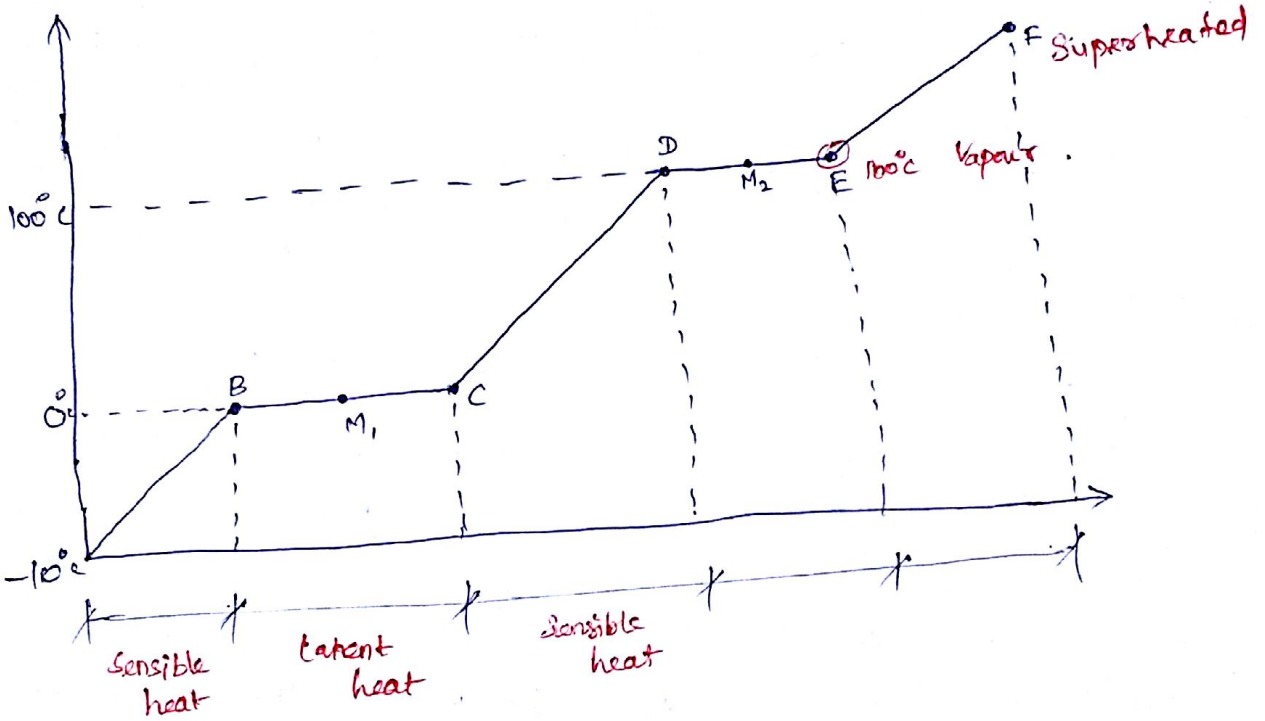
Phase change Phenomena of a Pure - Substance :-





→ A - B , Slight formation of liquid phase.

B - C . More amount of liquid phase.

S+L - C → volume is drop. because density of liquid higher than ice.

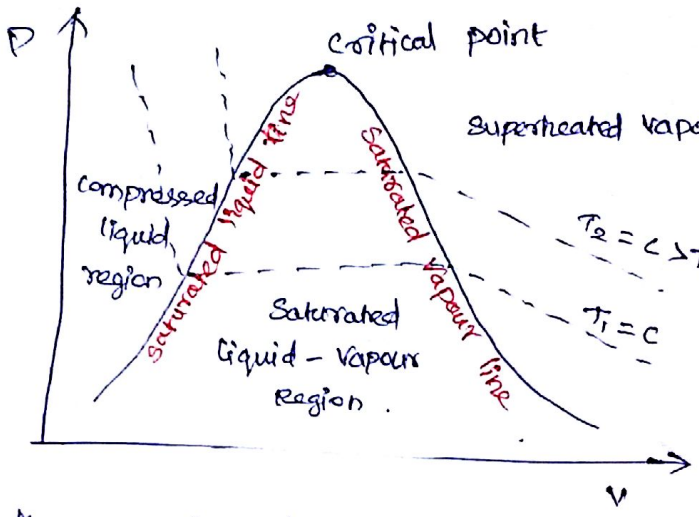
C - D → obtained 100°C - fully converted into liquid phase.

D - E → create Liquid + Vapour content.
enther liquid is converted into Vapour phase.

E - F → Vapour is converted into superheated Vapour, phase.

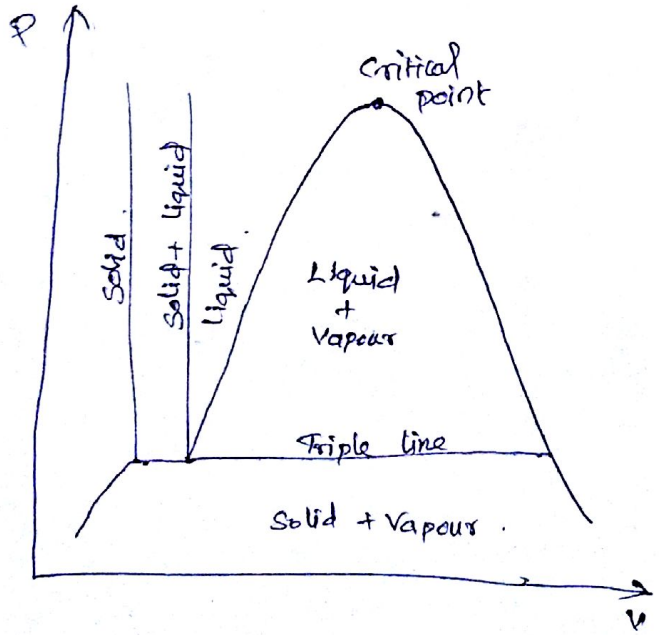
PV. Diagram :-

If we consider the pressure - cylinder device, but with some weights above the piston, if we remove the weights one by one to decrease the pressure and we allow a heat transfer to obtain an isothermal process, we will obtain one of the curve of the PV. digram.

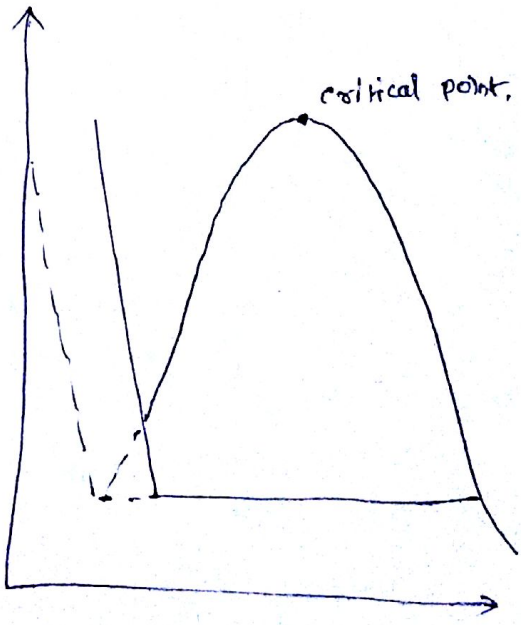


The P-V diagram can be extended to include the solid phase, the solid - liquid and the solid - vapour saturation regions.

As water, expand when they freeze, and the rest contracts during freezing process, we have 2 configurations for the PV diagram with solid phase.



Contracts during freezing



expands during freezing.

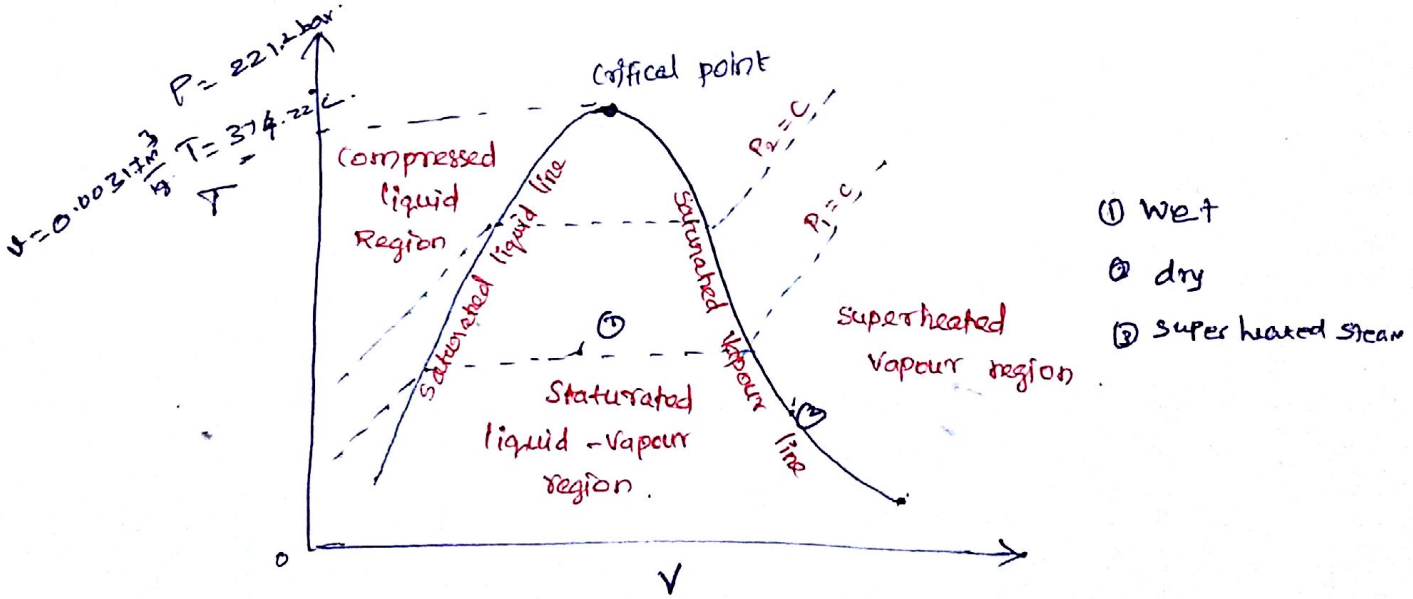
Property Diagram for phase change processes.

TV Diagram :-

If we increase the pressure of water in the piston-cylinder device, the process from compressed liquid to superheated vapour will follow a path that looks like the process for P=1, the only difference is that the width of the region will be shorter.

Then, at a certain pressure, the mixture region will be represented only by one point. This point is called the critical point. It is defined as the point at which the saturated liquid and saturated vapour states are identical.

At the critical point, the properties of a substance are called critical properties. [Critical temperature (T_{cr}), critical pressure (P_{cr}), Critical specific volume (v_{cr})]



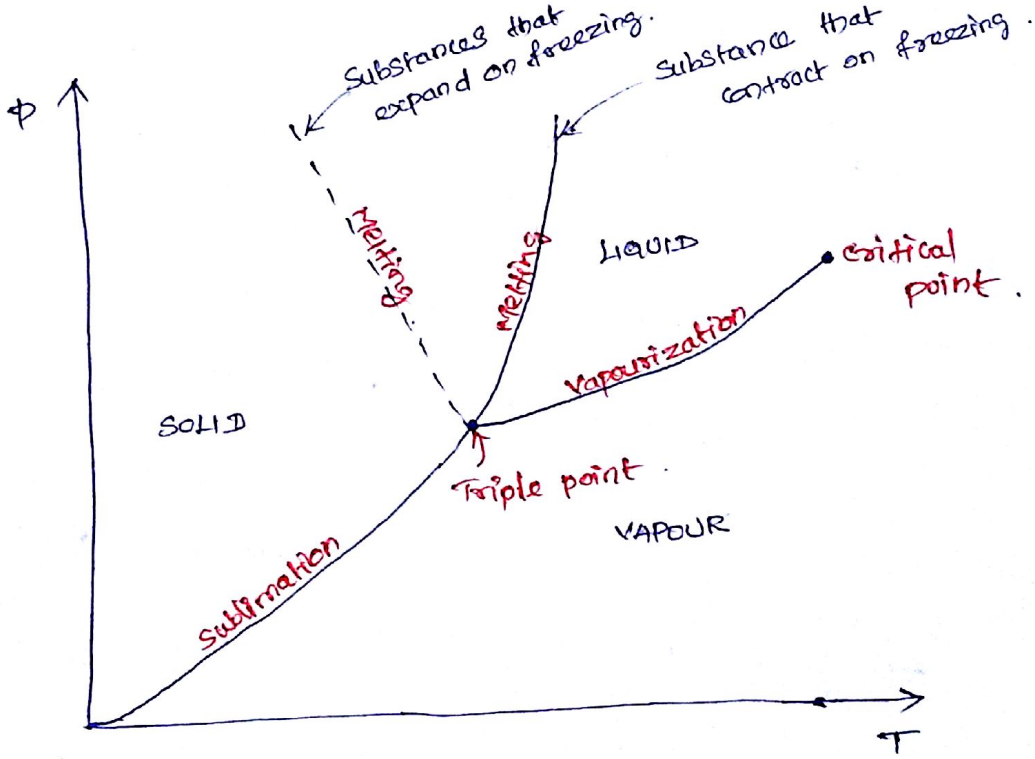
If we connect all the points representing saturated liquid we will obtain the Saturated liquid line.

If we connect all the point representing saturated vapour we will obtain the Saturated vapour line.

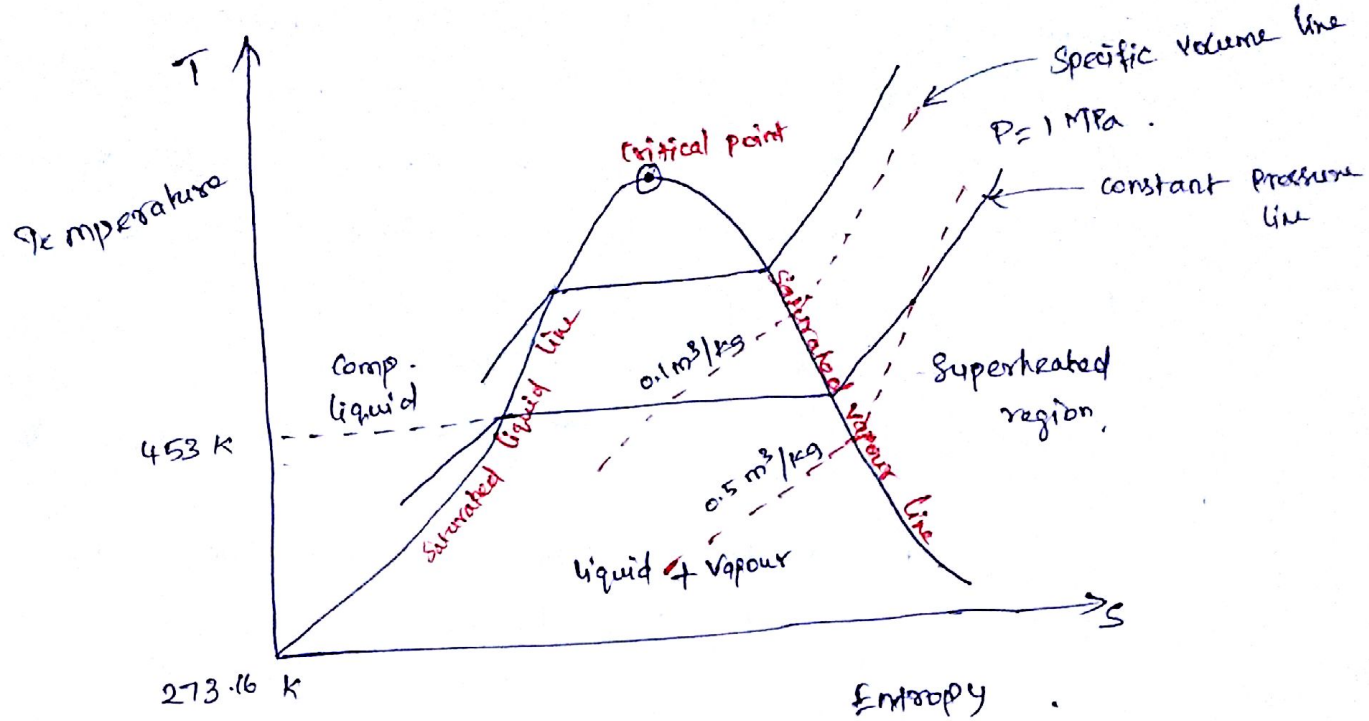
The intersection of the two lines is the Critical point.

P-T Diagram :

- All three phases are separated from each other by three lines.
- Sublimation line separates the solid and vapour region.
- Vapourization line separates the liquid and vapour region.
- Melting or fusion line separates the solid and liquid region.
- These three line meet at the triple point, where all three phases coexist in equilibrium.
- Vapourization line ends at the critical point because no distinction can be made between liquid and vapour phases above the critical point.
- Substances that expands and contract on freezing differ only in the melting line on the P-T diagram.



Temperature - Entropy diagram (T-s)



SLL almost start with . 273.16 K . (triple point temp . T_{tp})

$\Delta S_{tp} = 0$.

⇒ Constant pressure line is almost coincide with the Sat. liquid line

In L+V region (wed region) becomes parallel to constant temp

⇒ In superheated region,

Slope of isochoric (const volume) is higher than slope of const. pressure .

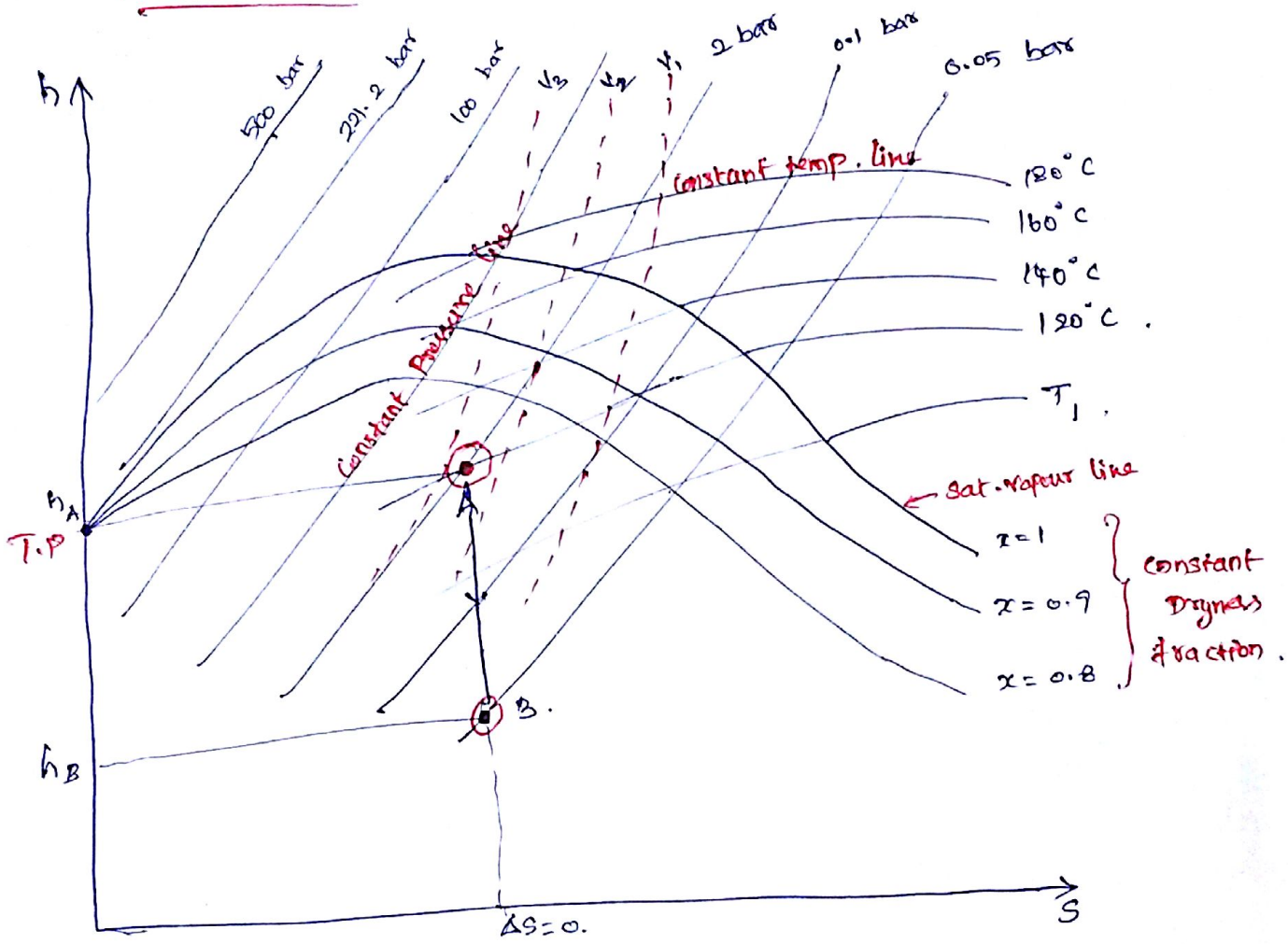
⇒ In wet region,

constant temp & const. pressure are parallel .

Enthalpy - Entropy Diagram (h-s)

(or)

Mollier chart.



It is used to find out the properties of steam in various condition.

condition for steam :-

- 2bar, 120°C
- 0.05 bar, 0.8 dryness fraction

} expansion (Isentropic)

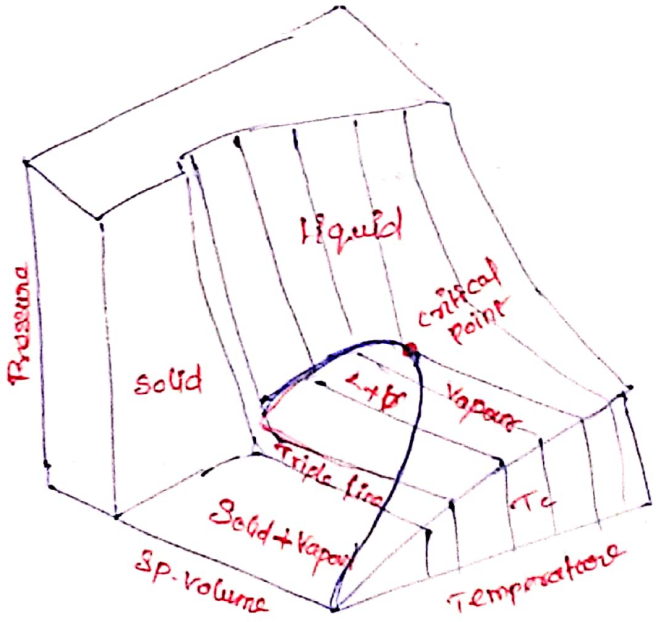
$W = h_A - h_B$.

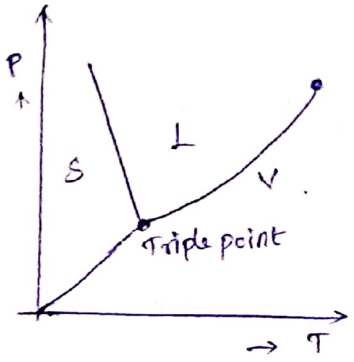
- It is also called as Mollier Chart.
- In h-s diagram, the dry steam line divides into two region.

  Below dry steam line - wet condition of steam.

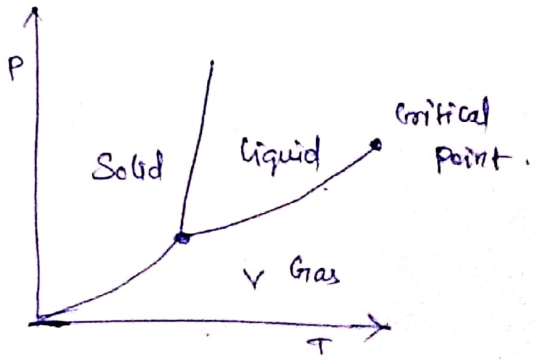
  Above dry steam line - superheated condition of steam.
- In this region, the constant temperature lines are shown. At the same time, the lines at constant pressure are straight in the wet steam region.
- An adiabatic process is represented by a vertical line on hs diagram Throttling process in which enthalpy remains constant.
- Constant pressure process, constant volume process, constant temperature process are also represented in the graph.

PVT Surface :-





a) water.



b) Vapour.