II Properties of pure Substance.

Introduction

> Matter exist in different states. eg Ice, water and steam are 3 states of same species water.

> Based on this we Classify the different States a) Solid (b) liquid (c) gas.

> The different States in which Substance can exist is called phase.

> A System which is uniform in Chemical compositon and physical State is called homogenous substance or phase.

Pure substance

Pure substane is one which is homogenous and has a fixed chemical compositon throughout its mass.

(Ex) Ice and water one in two phase System. A mixture of ice, water and steam is a pure substance or one component as the chemical compositon is same.

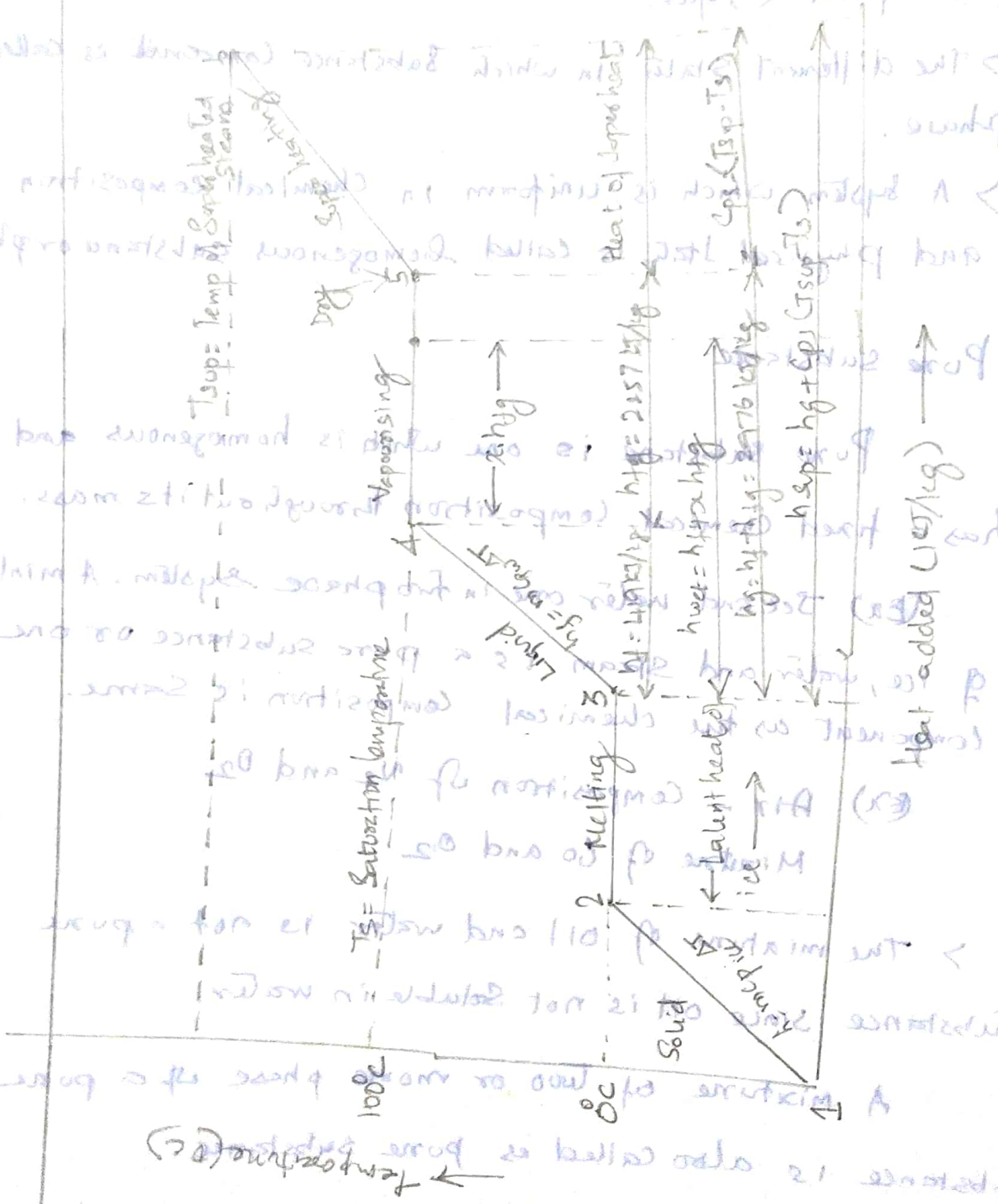
(Ex) Air – Compositon of N_2 and O_2

Mixture of Co and O_2

> The mixture of oil and water is not a pure Substance since oil is not Soluble in water.

A mixture of two or more phase of a pure Substance is also called as pure substance.

Phase change process of pure substance (water) or Steam formation.



Consider one kg of ice at $-20^{\circ}C$ in a closed vessel under a pressure of p (N/m^2). If we heat the water gradually when pressure remains constant, the following stages occurs

Solid Stage (1-2)

> In this Stage, Ice is ~~Converted in water at Constant temperature (0c). The~~ gradually heated as temperature increases

> Heat supplied ~~to latent heat of fusion~~ and when temparature reaches $0^{\circ}C$ (273K) ice begins to melt

> Temparature is freezing point of ice or melting point

Melting Stage (2-3)

> In this Stage Ice is Completely Converted into water at Constant temperature. ($0^{\circ}C$)

> Heat Supplied is Latent heat of fusion or latent heat of ice.

Liquid Stage (3-4)

> On further heating, the water reaches its boiling point 4.

> Saturation Temparature is at which water begins to boil. (Ts)

> Heat Supplied is Liquid enthalpy or Sensible heat of water. (h_f) — heat added from 0° to $100^{\circ}C$

$$h_f = m c_p (T_2 - T_1)$$

Boiling point of water is $100^{\circ}C$.

It is also called latent heat of water.

Evaporation Stage (4-5)

> On further Addition of heat beyond the point 4, water is gradually be converted to steam.

> The steam contains some water particles in suspension and is called wet steam.

> On further addition of heat wet steam is converted into dry steam. or Dry saturated steam.

> The Amount of heat added is latent heat of Vaporization or Enthalpy of Vaporization or enthalpy of steam. It is denoted by h_{fg}.

Super heating Stage (5-6)

On further heating the temperature rises again. The process is superheating and steam is known as the superheated steam.

> The heat supplied to the dry steam at saturation temperature is T_s and converted into superheated steam at temp (T_{sup}) is called heat of super heat. It is denoted h_{sup}.

$$h_{sup} = h_g + C_p(T_{sup} - T_s) \text{ KJ/kg}.$$

where C_p - Specific heat Capacity of water at Constant Pressure.