Bies & Plasma

20/8/20

Unit - 2nd

State of Matter & Properties of Matter

Matter :- Any substance which have some mass and which occupie some space is called matter.

State of Matter :- On the basis of structure & function, matter is exist in three states

(1) Solid (2) liquid (3) gas

Different in Properties of Solid, liquid & Gas

	Properties	Solid	Liquid	Gas
1.	Shape	fixed	no fixed	no fixed
2.	Volume	fixed	fixed	no fixed
3.	Rigidity / fluidity	are rigid cannot flow	can flow, not rigid	can flow, not rigid
4.	Intermolecular force	maximum	less than solids	very less
5.	Intermolecular space	Very less	more than Solids	maximum & less than gas

6.	Compressibility	negligible	compressible	highly compressible
7.	Rate of Diffusion	yes, but very slowly	yes, but slower than gases	yes, they diffuse very well
8.	Density & Mass	Maximum	less than solid	No Density & Mass.
9.	Surface Area.	Very less	less than gas	Maximum
10.	Flow property	No flow property	less than gas	high flow property
11.	Soundens	Maximum	less than solid	No Soundens.

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Gaseous Law

1) **Boyel's Law :-**

According to boyel's law at constent temp. pressure is inversely penpotional to the volume

$$P \propto \frac{1}{V}$$

$$PV = \text{constent}$$

$$\boxed{P_1 V_1 = P_2 V_2}$$

2. Charls Law

At constent pressure Volume is directly perpotional to temp.

$$V \propto T$$

$$\frac{V}{T} = \text{Constent}$$

$$\boxed{\frac{V_1}{T_1} = \frac{V_2}{T_2}}$$

3. Gaylussac law

At ~~cost~~ constent volume the pressure of any gas is directly perpotional to temp.

$$P \propto T$$

$$P/T = \text{Constent}$$

$$\boxed{\frac{P_1}{T_1} = \frac{P_2}{T_2}}$$

4) Avagadro law

At constant pressure & temp. if the volume of two different gases all ~~equ~~ equal then their ~~number of~~ number of moles will also be equal or same.

at constent P. & T

$$V \propto n$$

$$\frac{V}{n} = \text{constent}$$

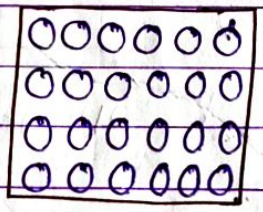
$$\boxed{\frac{V_1}{n_1} = \frac{V_2}{n_2}}$$

Types of Solid

It is of two types

1) Crystelline Solids :-

Those solid in which the crystal are of ~~the~~ same size & shape and the arrangment of crystal of in a fixed pattern or geometry



Fixed Pattern

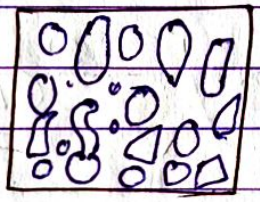
On the basis of shape & geometry crystelline solid are of seven types.

1. Cubic
2. Tetragonal
3. Orthorhombic
4. Hexagonal
5. Trigonal

6. Monoclinic
7. Triclinic

2. **Amorphous :-**

Those solid in which the shape & size are ~~ey~~ crystal are different and they are arranged in random pattern or non fixed geometry.



Random Pattern

Different b/e Amorphous & Crystelline Solid

Crystelline Solid	Amorphous Solid
– They have a definite shape & geometrical form.	They do not have a definite geometrical shape
– Anisotropic in nature	Isotropic in nature
– They have a definite heat of fusion.	They do not have a definite heat of fusion
– They ~~are~~ have definite melting point	They ~~have~~ do not definite melting point.
– Particle are arranged in an ~~ordered~~ repeating	Particle are arranged randomly and have no

pattern Ex. Quartz glass, Rubber Plastics	ordered pattern. Ex. Sodium chlorides, Quartz
They are rigid & incompressible	They too are usually rigid & cannot be compressed to any appreciable extent.
More ductile	Least ductile

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Polymorphism

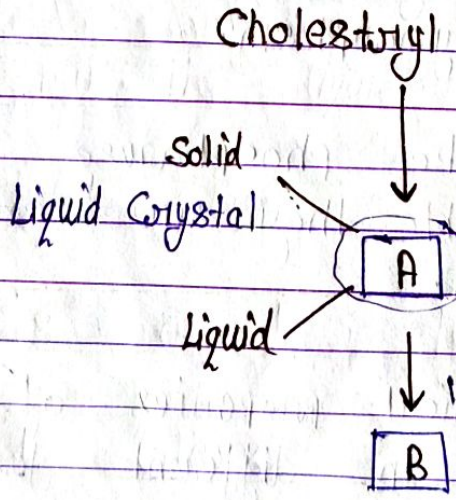
- When any substance exist in more than one form, shape or geometry & this phenomena is called polymorphism.
- Some substance like phosphorus and sulfur so polymorphism bic they are exist in more than one form.
- The physical & chemical properties of any substance is different - 2 in different form.
- Polymorphism can affect the machenical properties of drug & can there. for affect the manufacturing and physical natural of dosage form like tablet.

Liquid Crystal

- Liquid Crystal was discoven by Friedrich F. Reinitzen 1888.

- He show that cholestryl benzoate melt at 178°c into liquid but at 145°c it convent into a special state which is known as liquid Crystal.

- Liquid crystal is an intermediate state ble solid & liquid, they contain properties of both ~~the~~ solid & liquid.



- In liquid crystal shows the flow properties and density of liquids on the other hand they shows birefrigrance and stability properties of solid.

Types of Liquid Crystal

It is of three type

1) **Semetic :—**

In this type of liquid crystal the arrangment of particles are fixed and they are Unidirectional.

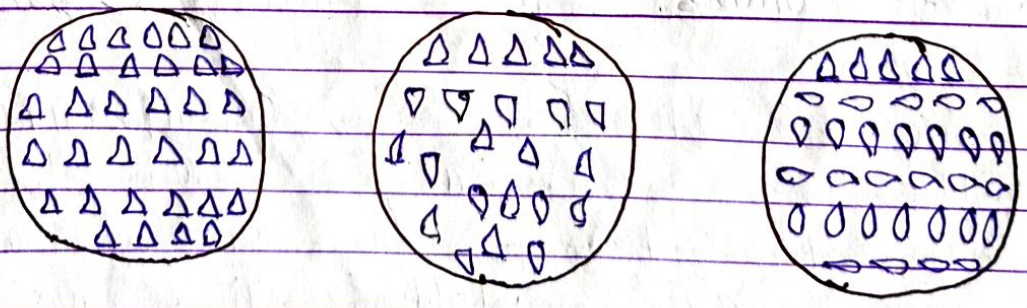
2) **Nemetic :—**

In this type of liquid crystal the arrangment of particles is not fixed & it is bidirectional.

3. **Cholestnic :—**

In this type of liquid crystal the arrangements of particles is fixed & it is maltidirectional.

In this type the direction of one layer is completely different from other layer.



Semetic (Soap like) Nemetic (Thread like) Cholesteric

Glassy State

- All though glass is consider to be non conducting transparent solid, it is acutally a type of solid matter.

- It can neigther considered as a typical solid nor a typical ~~liquid~~ liquid. The atoms and molecules in most solids are arreng in fixed, orderly manner. where as in glassy material these are highly disordered.

- Glassy material however have some salt range order in the case of polymers & they do not have a speffic melting point but the liquidfy on heating.

Type of Glass

- It is a four type.

Type 1 Glass

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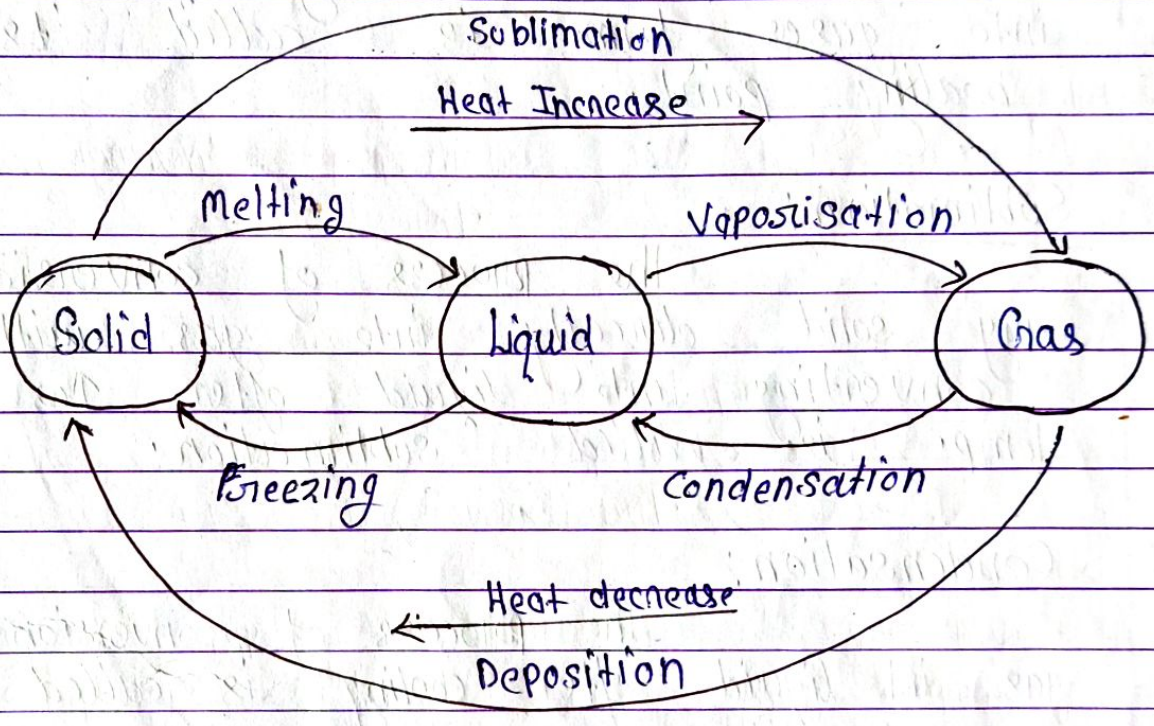
Phase Change / Change in State of Matter

The matter of present in solid, liquid & gas phase, one phase of matter can be inter-change into another phase of matter by changing temp., this is called phase change.



Melting – The process of conversion of any solid into liquid by rise / fes in temp. is called melting.

And the temp. at which any solid convent into liquid is called its melting point.

Alcohol 71.
Petrol boiling 31 - 32

The melting a different solids are different.

Vaporisation :-

The process of conversion of liquid into gas by ↑es in temp is called vaporisation.

And the temp. at which any liquid change into gases form is called its boiling point.

Sublimation :-

The process of conversion of any solid directly into gas without converting into liquid after ↑es in temp. is called sublimation.

Condensation :-

The process of conversion of gas into liquid after cooling is called condonsation.

Freezing :-

The process of convension of liquid into solid after cooling is called freezing.

Deposition :-

The process of convension of any gas directly into solid without

converting into liquid after ↑ ves in temp. is called Deposition.

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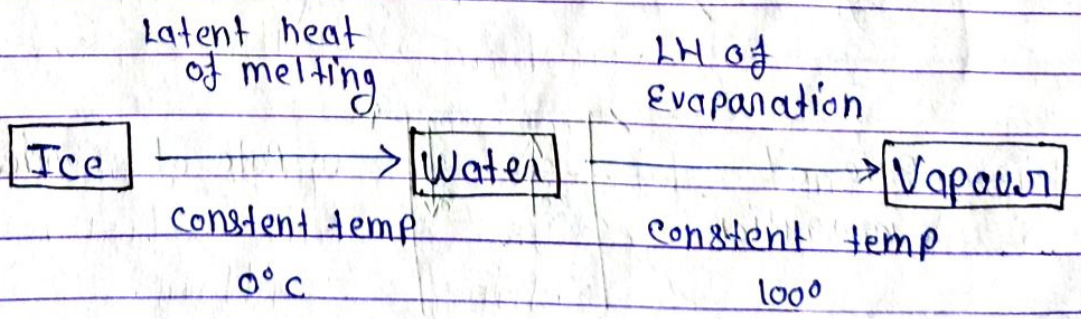
Latent Heat

- When be ~~↑es~~ supply the heat to water then its temp. is ↑es. up to 100°c but after 100°c when extra amount of heat is given then there is no ↑es in temp but the phase is change from liquid gas / vapour

- At constent temp. the amount of heat is given to any substance jon changes in phase of matter is called latent heat.

- Same like the amount of heat observe by ice to change into liquid at constent 0°c is called latent heat of melting.

- At constant 100°c the ~~about~~ amount of heat require to convert liquid into gas is called latent heat of ~~vapo~~ Evaporation.



Vapour Pressure

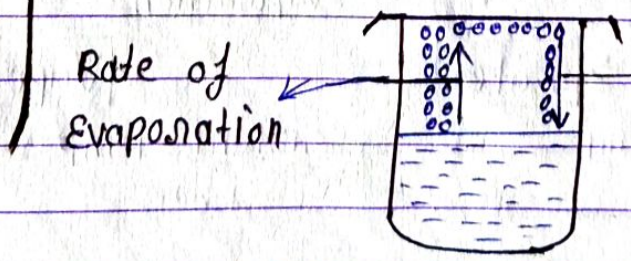
In a close cantainer when we heat any liquid then liquid give vaporized, and the pressure caiated by vapourses on the inner wall of cantainer is called vapour pressure of liquid

Or

At room temp. in a closed cantainer any liquid observe heat and start evaporation, intialy the rate of evaporation is slow.

- After some time vapourses get condence & fallen down in a form of liquid drops, intialy the rate of condensation is slow.

- At the point when the rate of evaporation is equal to the rate of condensation. at equillibrium, the pressure created by vapourses on the inner wall of cantainer is called vapour pressure of liquid.



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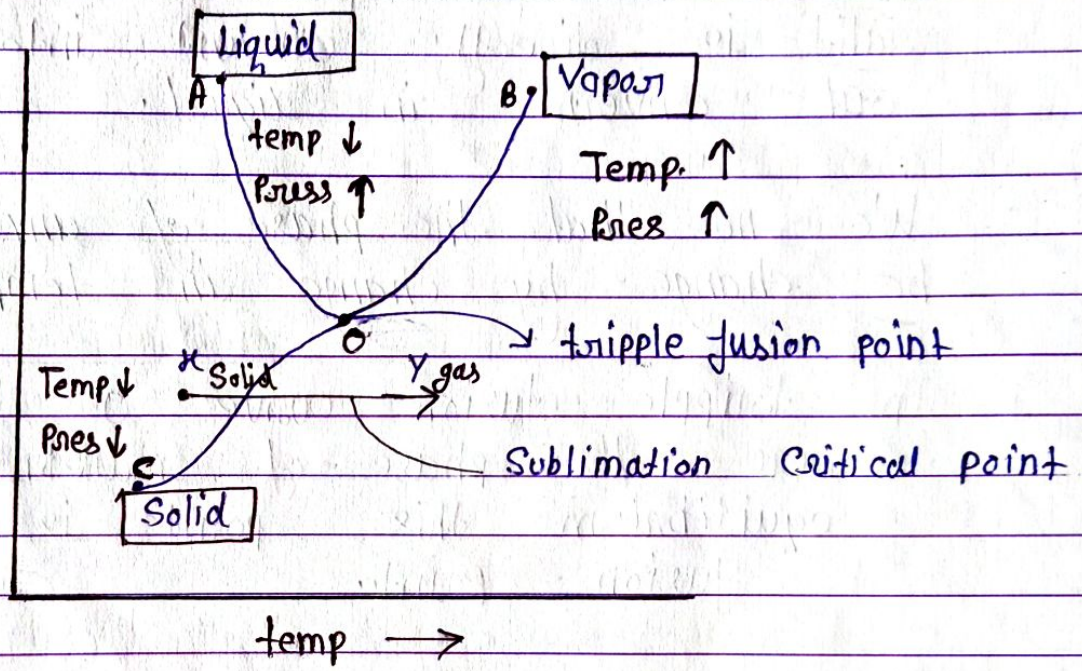
Sublimation Critical Point

Sublimation is a process in which any solid is directly convent into gas with out convent in liquid.

- We no that the phase of any matter can be change by change in temp & pressure.
- In tripple fusion curve O is the point where all phase of matter all in equilibrium this point is called tripple fusion point.
- Line OA represent that when be les the press. by les ~~the~~ temp. then substance exist in liquid form.
- Line OB represent that when temp. & press. is les then substance exist in vapon form.
- Line OC represent that when temp & press both les then substance exist in solid form.
- At reduce press. when be sudenly les the temp. then any solid convert into gas.

The temp at which this sublimation process takes place is called sublimation critical point.



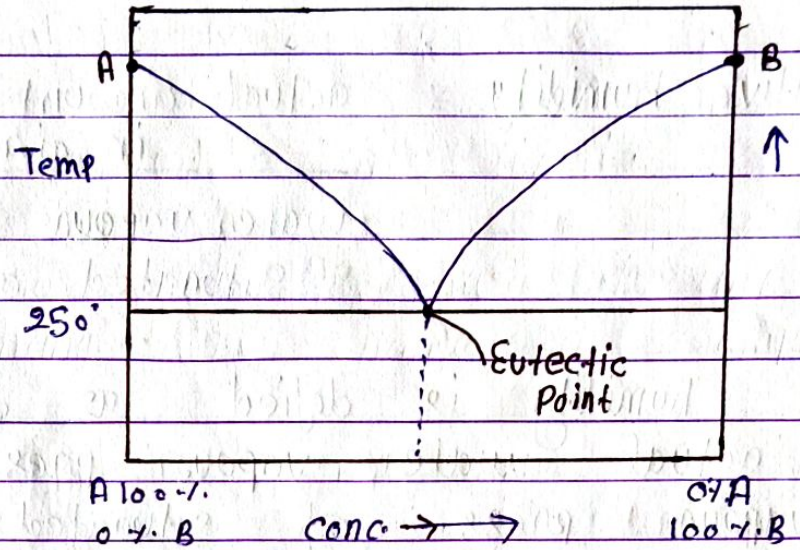
Eutectic Mixture

Certain mixture when mixed in a particular proportion tend to liquify due to reduction in there melting point.

Such substance which les the melting point of other substance, when mixted in such quantity that they reduce the melting point of each other & they liquified at room temp is called Eutectic Mixture.

Vapour में कर छुड़ाते हैं
Apparent

Example - Menthal, thymol, camphan, phenol, Salol



The % composition of both substance at which solid mixture get liquified is called Eutectic point.

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Relative Humidity - [RH]

~~Rel~~

Humidity is the total amount of ~~vapour~~ water vapour present in air.

Relative Humidity may be defined as the ratio of amount of the water vapour in the air at a specific temp. to the maximum amount of that air which hold the water at that temp.

OR -

dehydrating

The ratio of total amount of water vapour in air to the total amount of water vapour in saturated air.

$$\text{Relative humidity} = \frac{\text{actual amount of water vapour in air}}{\text{water vapour present in Saturated air.}}$$

Relative humidity is defied as the ratio of actual water vapour pressure to the vapour press. of saturated air.

$$RH = \frac{\text{Actual water Vapour Pressure}}{\text{Vapour pressure of saturated air}}$$

$$\% RH = \frac{\text{Actual water Vapour Pressure}}{\text{Vapour Pressure of saturated air}} \times 100$$

Aerosol

When any gaseous substance is could under High ~~reduce~~ press. & low temp. then convent into liquid form, when the press. is reduce the molecules expand & the liquid convent bact into gaseous state.

Aerosol are based on the principle of

reversible change of state on the application of release of pressure.

- In pharmaceutical aerosol a drug is dissolve in a propellent at high pressure.

Propellent is a substance which ↑es the pressure & convert gaseous drug into liquid

- The container is design in such a manner that on pressing a valve, some of the drug propellent mixture is release out due to the exes press. inside the container.

- Nitrogen & CO_2 gas is generaly used as propellen.

Note:

Metric dose inhaler (MDI)

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Physiochemical Properties of drug Molecules

Refractive Index :-

Refractive index is defined as the ratio of Vilocity of light in Vacuum (air) to the velocity of light in a substance (solid or liquid) at the same wave length.

$$\text{Reflective Index} = \frac{\text{Velocity of light in air}}{\text{velocity of light in water}}$$

$$\text{R-I} = \frac{\text{Velocity of light in air}}{\text{Velocity of light in Solid}}$$

The valve of Refractive index is depend upon the colour of light travelling through the medium, and it also depends upon the density of medium.

The white light of Sun contain seven different colour of different wave length.

Violet
Indigo
Blue
Green
Yellow

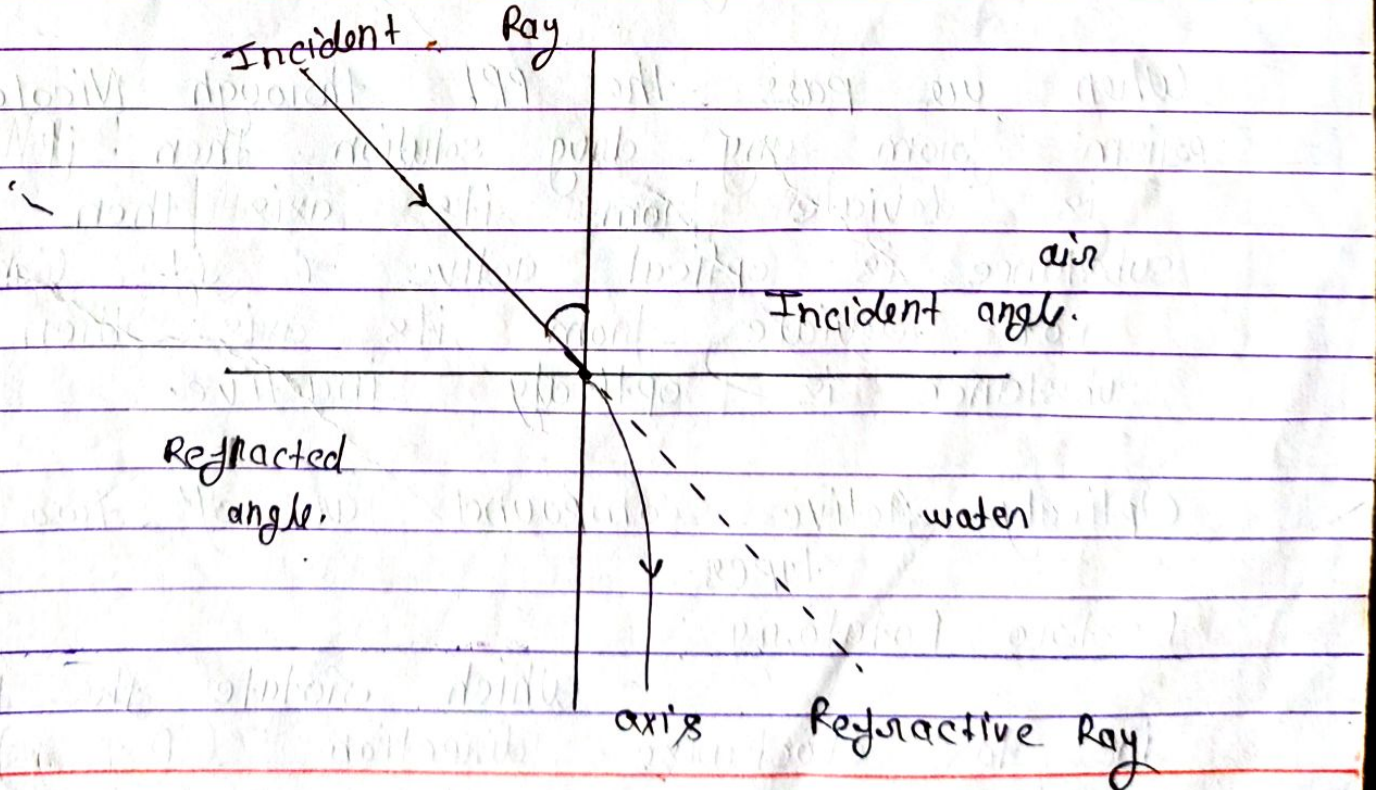
Orange
Red.

Snell Law

The Dutch (Netherland) Scientist willibard snell identified the exect relationship b/w the angal of ancident & the angle of reflection.

According to Snell Law a light travells from first medium to a second medium, the ratio of the sin of the angle of ancident to the sin of the angle of reflection each constant and it is called Reflective index.

$$R.I = \frac{\sin i}{\sin r}$$



Use of Refractive index

It is used to measure the conc. of a solute in an Aqous medium.

It can be used to determine the sugar contant in syrup.

It is used to calculate the focusing power of lenses & the dispersing power of prism.

Optical Activity

The capcity of any substance in solution form to rotate the plaien polarised light (PPL) from its axis is called optical activity.

When we pass the PPL through Nicole prism from any drug solution. Then if PPL is deviate from its axis then substance is optical active & if light is not deviate from its axis then substance is opticaly inactive.

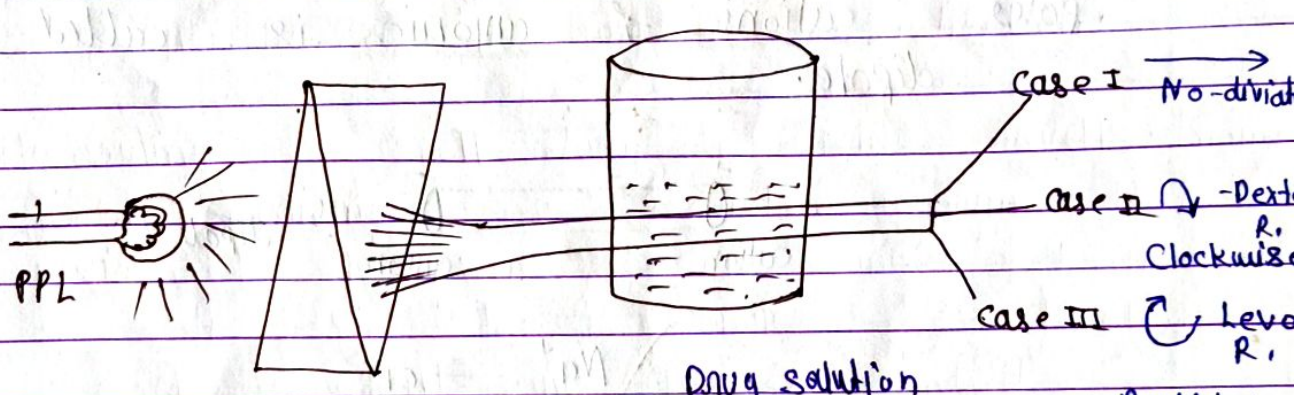
Opticaly Active compound are of two types.

Dextro Rotatory :-

Which rotate the PPL in to clockwise direction (D & +)

Levo Rotatory ⇒

Which rotate the PPL in to Anticlockwise direction it is known as (- and L)



(Plane Polar Nicole Prism Light)

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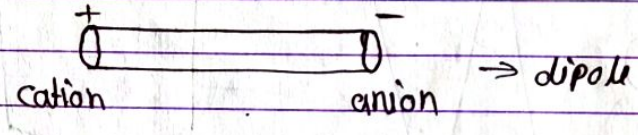
Dipole Moment

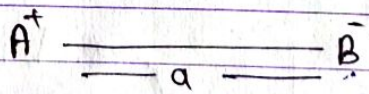
Those molecules which can be dissociated in to ions are called polon molecules. and polor substance which have two different poles cationic & anionic is called dipole.



$Na^+ — Cl^-$

$K^+ — Br^-$

In a dipole compound the multiplication of change and distance b/e both change is called dipole moment, it is represented by P

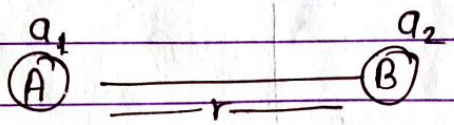


$$P = Q \times d$$

Dipole moment is a vector quantity and it is depened on direction of change atom.

Dielectric Constant

Dielectric constant is the ratio of the force between two charge and same distance apart in air to the same charges kept in other ~~same~~ medium



$$F \propto \frac{Q_1 Q_2}{r^2}$$

$F_{air} = 1$, $F_{water} = 1/81$, $F_{Glass} = 1/3$

$K_d = \frac{F_{air}}{F_{water}}$

$= \frac{1}{\frac{1}{81}} = K_{d/w} = 81$

$K_d = \frac{F_{air}}{F_{Glass}}$

$K_{d\,g/g} = \frac{1}{\frac{1}{3}} = 3$

Electric permitivity :-

Dielectric constant is similar has relative permitivity.

The ratio of permitivity in water an permitivity in air is called relative permitivity.

$$Kd_{a/w} = \frac{F_{air}}{F_{water}} = \frac{\frac{1}{4\pi\varepsilon_0} \times \frac{Q_1 Q_2}{r^2}}{\frac{1}{4\pi\varepsilon} \times \frac{Q_1 Q_2}{r^2}}$$

$$= \frac{\frac{1}{\varepsilon_0}}{\frac{1}{\varepsilon}} \Rightarrow \boxed{\frac{\varepsilon}{\varepsilon_0}} = \text{Relative Permitivity}$$

where -

ε = Permitivity in water

ε_0 = Permitivity in ~~oil~~ air

$$\boxed{Kd = \frac{\varepsilon}{\varepsilon_0}}$$

Dielectric constant = Relative per.

Importance / Application of Dielectric constant.

Dielectric constant may affect the solubility of a drug substance in phanmaceutical if the value of dielectric constant

is high then substanc will dissociated in faster rate & the solubility of drug is ↑es.

- By the study of dielectric constant of different medium one solvent we can select the proper solvent.

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Dissociation Constant

- The breaking of any electrolyte into ions is called dissociation.

- Strong electrolyte dissociate completly (100%.) an weak electrolyte dissociate less than 100%.

$$HA \rightleftharpoons H^+ + A^-$$

weak base

Apply Law of mass action

$$K_a = \frac{[H^+]\,[A^-]}{[HA]}$$

For any weak electrolyte the ratio of molar concentration of substance in ionised form to the molar conc. of unionised form is known as dissociation constant.

It is denoted by $\frac{Ka}{K_b}$ -- $\frac{\text{Weak acid}}{\text{Weak base}}$

Henderson - Hessel baen Equation

Henderson & Hessel baen gives the relation ship ~~we~~ b/e pH value and dissociation costant Pka for weak acidic drugs

Pka & pH Reaction.

$$Ka = \frac{[H^+][A^-]}{[HA]}$$

apply log on both side $\log Ka = \log \frac{[H^+][A^-]}{[HA]}$

$$\log Ka = \log[H^+] + \log \frac{[A^-]}{[HA]}$$

$-\log H^+ = pH$

$\log H^+ = -pH$

$$-Pka = -pH + \log \frac{(Ionised)}{(unionised)}$$

$$pH = pka + \log \frac{ionised}{unionised}$$

For weak akids

$$pOH = pKa + \log \frac{(ionised)}{(unionised)}$$

For Weake base

Application of dissociated Constant

- It is used to determine the pKa Value of acid.
- It is used to predict (पता लगाना) solubility of any pH provided that the solubility and pKa are known.
- Used to facilitate selection of suitable salt forming compound.
- It is used to predict the solubility & pH properties of a salt.