Chapter-2
Surface Chemistry

All the phenomenon that occurs at surface of any substance is studied under surface chemistry.

⟹ Absorption :- It is a bulk phenomenon. It occurs throught the substance

⟹ Adsorption :- It is a phenomenon in which the concentration of substance is higher at surface as compared to the bulk of other substance.
It is a surface phenomenon.

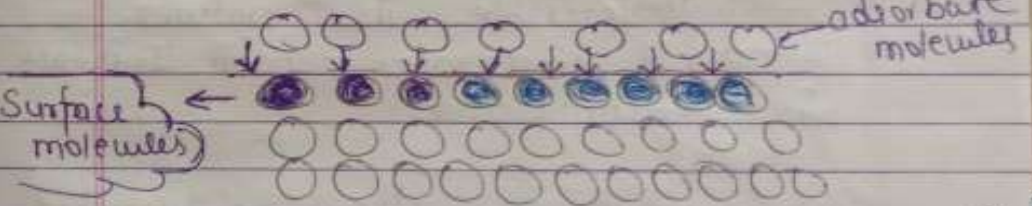
⟹ Sorption :- when absorption and adsorption both occurs simultaneously the process is called Sorption.

⟹ Adsorbent and Adsorbate
Adsorbent is substance on whose surface adsorption is taking place & Adsorbate is substance which gets adsorbed on adsorbent.

E.g:- Silica gel (adsorbent) adsorbs water (adsorbate) on its surface.

☆ Mechanism of adsorption

The main reason for adsorption are those unbalanced forces (called Residuel forces) acting on surface molecules. The molecules which are present at bulk of the solid Experience attraction forces from other molecules. But the surface molecules experience an inward attraction by bulk molecules. This attraction force is unbalanced.



Due to these unbalanced forces the surface molecules attract adsorbate molecules and hence adsorption occurs.

Note :- Adsorption is exothermic process as ΔH is -ve means heat is

released.
In adsorption Energy is always releases. Hence Adsorption is a Exothermic Process.

Types of adsorption

(i) PHYSISORPTION : When adsorbate molecules are bonded to adsorbent surface by physical forces, Vandell waal forces, the process is called Physisorption.
→ It is multilayer in nature.
→ Reversible in nature
→ It decreases with Increase in Temperature.

(ii) Chemisorption : When the adsorbate molecules are bonded through strong chemical bonds with adsorbent surface is called Chemisorption.
→ Chemisorption is monolayer in nature
→ It is irreversible in nature
→ It requires Activation Energy

to start.
→ It is highly specific in nature.

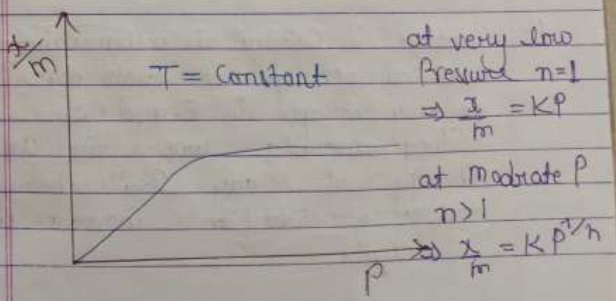
Adsorption Isotherm : The Curve plotted at Constant temperature is called Adsorption Isotherm.

Freundlic Adsorption Isotherm : According to Freundlic the amount of adsorption is directly proportional to $p^{1/n}$

$$\left(\frac{x}{m}\right) \propto p^{1/n}$$

$$\boxed{\frac{x}{m} = Kp^{1/n}}$$

where x is mass adsorbed per unit mass of m adsorbent and K, n are Constant at specific temperature for specific adsorbent and adsorbate.



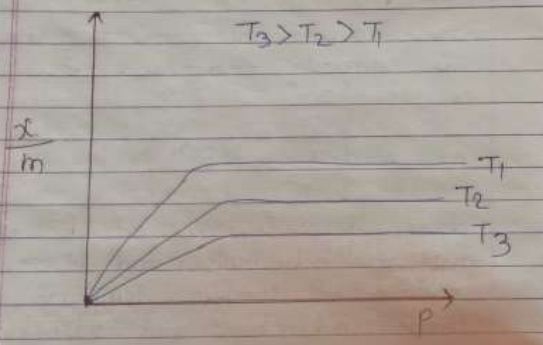
at very low Pressure $n=1$
$\Rightarrow \frac{x}{m} = Kp$

at moderate p
$n>1$
$\Rightarrow \frac{x}{m} = Kp^{1/n}$

At very high pressure the amount of adsorption will not depend on P.

We know that $\frac{x}{m} = kp^{\frac{1}{n}}$

$$\log \frac{x}{m} = \log k + \frac{1}{n} \log p$$



Catalyst : Catalyst is a chemical [illegible] which can change the rate [illegible] ng any change in the [illegible] They generally [illegible] Energy of [illegible] rate of [illegible]

Promoters :- These are the substances which increases the activity of Catalysts.

Eg:-

$$N_2(g) + 3H_2(g) \xrightarrow{Fe(s)\ Mo(s)} 2NH_3(g)$$

Here Mo (molebnum) is promoting the activity of Fe(s) hence Mo(s) is here Promoter.

Catalytic Inhibitor :- Substance that decrease the activity of catalyst.

Types of Catalysis

(i) Homogeneous Catalysis :- The rea^n in which a Catalyst has the same physical state as that of reactant & product is called Homogeneous Catalysis.

Eg:-

$$SO_2(g) + \frac{1}{2} O_2(g) \xrightarrow{NO(g)} SO_3(g)$$

(ii) Heterogeneous Catalysis :- Rea^n in which a Catalyst has different physical state as that of Reactant and Product

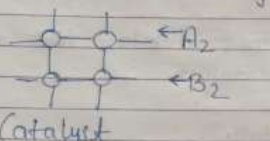
Eg:-

$$2SO_2(g) + O_2(g) \xrightarrow{V_2O_5(g)} 2SO_3(g)$$

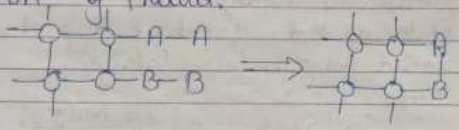
Adsorption theory of Catalysis

The Hetrogenous Catalysis occurs in few steps :-

Step (i) Diffusion of Reactant molecules towards the surface of catalyst.

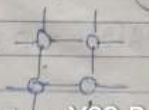


Step (ii) Adsorption of Reactant molecules on the surface of catalyst and formation of Product.



Step (iii) Desorption of product from the surface of catalyst.

Step (iv) Product will diffuse from surface of catalyst.

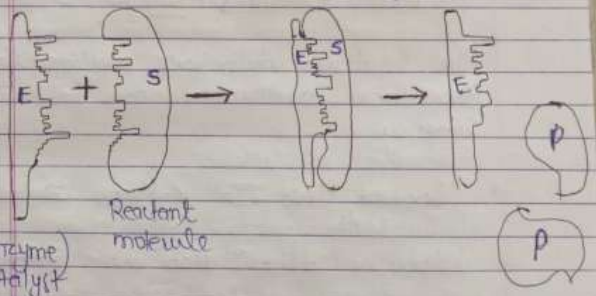


Enzyme Catalysis - Enzyme are Complex Organic Compounds Containing Nitrogen which are produced by living animals or plants.

In Enzyme catalysis one type of catalyst can ~~can~~ catalyse only one type of reaction.

Mechanism of Enzyme Catalysis

For an Enzyme to catalyse a Particular-



- Reaction, the cavity pattern present on the substrate should be similar to pattern on Enzyme (like lock and key). That's why Enzyme catalysis is

highly specific in nature.

Characteristics of Enzyme Catalysis

(i) Highly specific in nature
(ii) Highly efficient in nature.
(iii) Highly active under Optimum P_H
(iv) Highly active under Optimum Temperature.
(v) On increasing no. Enzyme molecules the Rate of catalysis increases

Colloidal Solutions (Sols)

The Solutions which have particle size b/w 1nm to 1000nm are fall in this Category.

→ Dispersed Phase: In colloids it acts as Solute.
→ Dispersion Medium: Acts as Solvent.

Classification of Colloids:

(1) On basis of Dispersed Phase and Dispersion medium.

(2) Based on size of particles of Dispersed phase (i) Multimolecular colloids
(ii) Macromolecular Colloids
(iii) Associated Colloids

(3) Based on Intraction b/w Dispersed phase and Dispersion medium:-
(i) Lyophilic colloids
They are Dispersion medium loving
There exist attraction b/w D.P & D.M

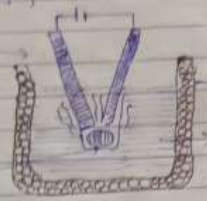
(ii) Lyophobic Colloids
In such colloids there exist a repulsion b/w DP & DM

Preparation on Colloids

(i) The process of converting a ppt in to a colloidal solution is called Peptization. The ppt is converted into Sol by shaking ppt with dispersion medium in the presence of a small amount of an electrolyte. The electrolyte used for this is called Peptizing agent.

(ii) Bredig's Arc Method

As soon as current is passed through electrodes, the intense heat generated by



electric spark vaporises the metal and the vapours when comes in contact with DM, vapours condense to form a Colloidal Soln

Properties of Colloids

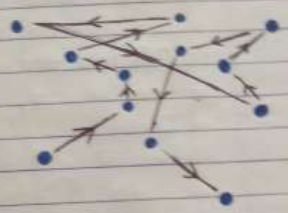
(i) Tyndall Effect :- When a light is passed through colloids, then path of light becomes visible and this phenomenon is called Tyndall effect.

Tyndall effect occurs due to [illegible] light by colloidal Parti-

(ii) Brownian Movement

The random zig-zag motion or movement of Colloidal particles are called Brownian Movement

It was first observed by Robert brown.



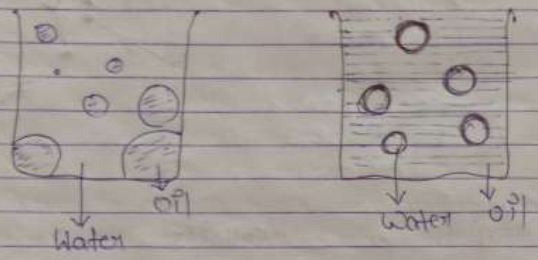
(iii) Charges on Colloids

A Colloidal Particle has charge on it due to its unique ability of "Preferential Adsorption of Ions" from the Solution.

On this way a Colloidal Solution can adsorb a specific type of ions and can be charged.

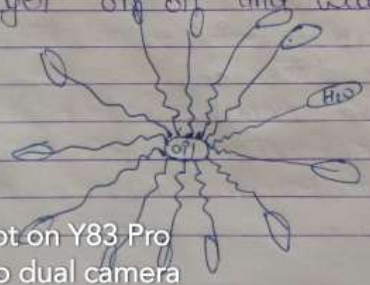
Emulsion: These are liquid-liquid immisicible colloidal system. They are of two types

(i) Oil in Water (ii) Water in Oil



- They are Prepared by using Emulsifying agent.

(Q) How does Emulsifying agent work?
Thes agents makes a protective layer on oil and water drop.



Emulsifying agent forms a protective layer around dispersed phase particle and dispersion medium particle.