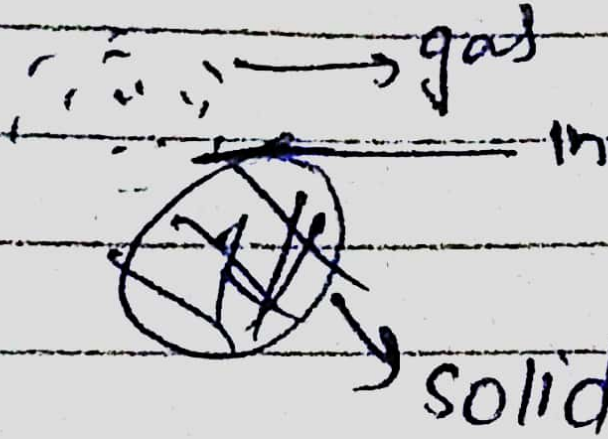
SURFACE CHEMISTRY

JUEVES _____ VIERNES _____ SÁBADO _____

Interface / interphase :-

→ boundry b/w two immicible phases.



It involves different states of matter.

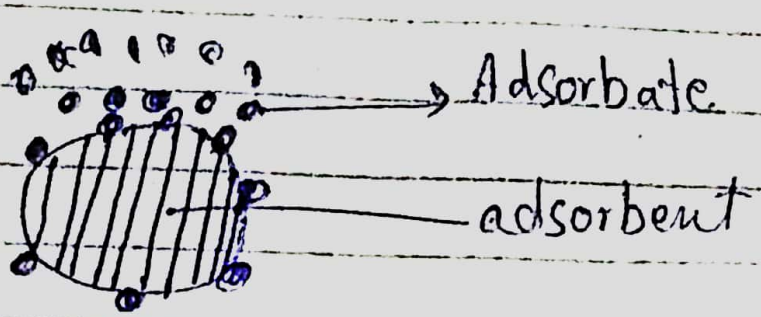
Types

1) Solid-gas interface
2) Solid - liquid interface
3) liquid - gas interface.

Define:-

Branch of phy. Chemistry which deals with the phenomena occuring on interfaces.

Adsorption



Def:-

Attachment of one substance on the surface of other substance."

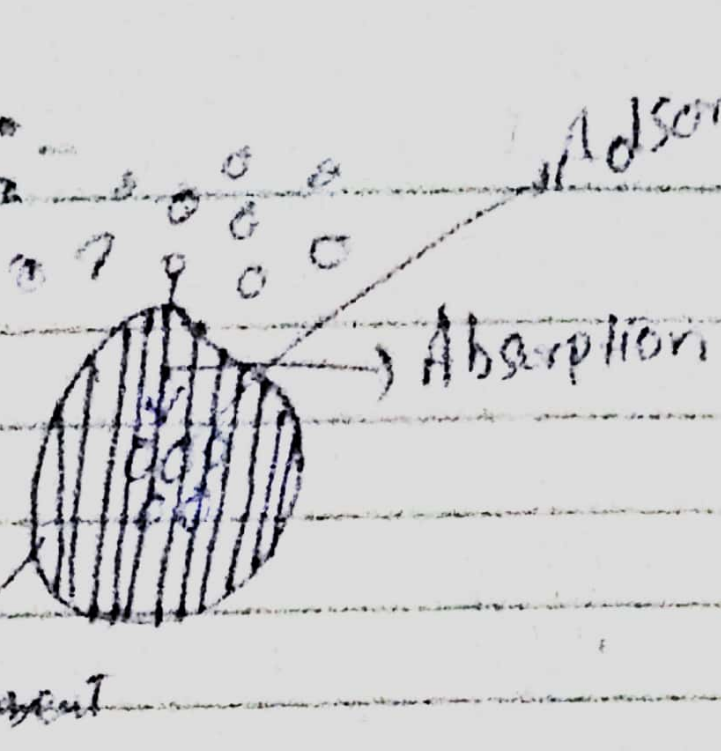
Adsorbate:-

substance which get adsorb on the surface of another Substance.

Adsorbent:-

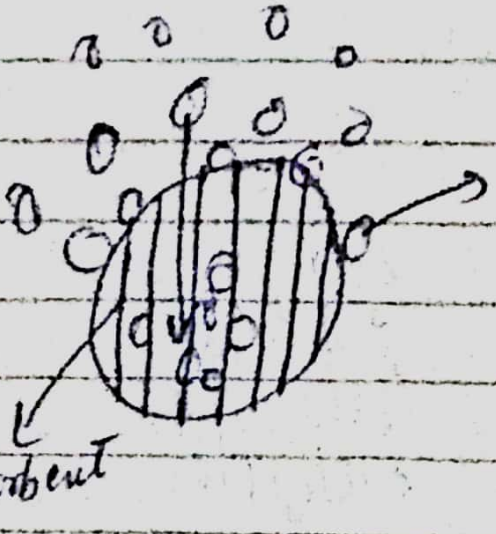
Substance on the surface of which other substance adsorb.

Absorption:



Defi: penetration of one substance into another substance.

Sorption :-



Defi:- When adsorption and absorption take place simultaneously then the occuring phenomena called Sorption.
eg Dying of Cotton fibre.

PHYSICAL ADSORPTION

"Due to presence of Van der Waals attractive forces"

Eg

H_2O on Surface of charcoal.

CHEMICAL ADSORPTION

Due to chemical Bond, gas or liq adsorb on solid surface.

Ex

H_2

Ni

→ When the adsorbate adsorb on the surface of adsorbent through the Vicander Walls forces then adsorption is called phy-adsorption or physisorption.	→ When adsorbate adsorb on the surface of adsorbent through chemical bond called chemical adsorption or Chamisorption.
eg Adsorption of dyes on the surface of Charcol	eg Adsorption of H_2 gas on Ni/Pt.
Speed	
Fast process	Slow process
Strength	
weak	Strong.

Specificity:	
Not specific	specific
Process	
reversible Attain or deattach	Reversible or Irriversible. ons
Enthalpy:-	
Heat of adsorption (ΔH_{ads})	greater heat of adsorp (ΔH_{ads}).

FACTORS:

(1) SURFACE AREA:

Adsorption ∝ Surface Area

(2) Nature of Gas:

- Greater critical temp, greater the adsorption.

(3) Heat of Adsorption:

Heat evolved when 1 g mole of gas absorbed on solid surface.

- Physical Adsorption → (5 Kcal/mol)
- Chemisorption → (20-100) Kcal mol⁻¹

(4) Reversible Process: (In closed vessel)

- Chemisorption is irreversible
- Phy adsorption is reversible.

(5) Temp: Low temp fav. Physical Adsorption
High temp fav Chemisorption

(6) Pressure: adsorption ∝ Pressure
↳ Multilayer at high pressure.

ADSORPTION ISOTHERM

The relationship b/w equilibrium pressure & weight of gas absorbed on surface of solid is called absorption isotherm keeping the temp constant.

FREUNDLICH ADSORPTION

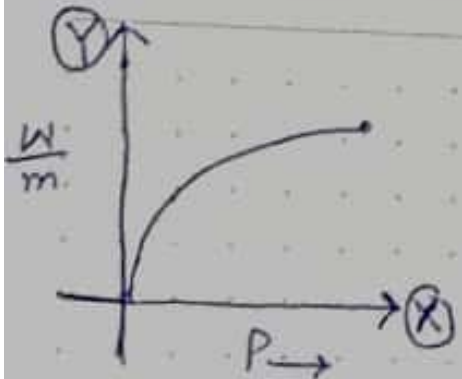
$$\frac{W}{m} = k P^{1/n}$$

W → mass of gas adsorbed

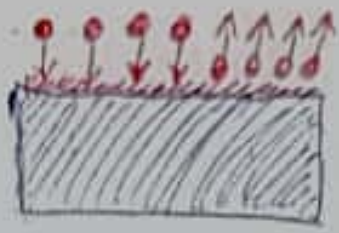
m → mass of adsorbent at P.

K → cons. depends upon nature of gas.

n → Cons. depends upon nature of gas, P&T



LANGMUIR ADSORPTION ISOTHERM



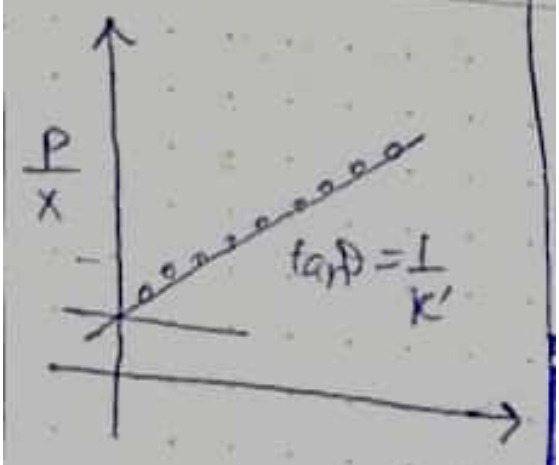
Rate of absorption becomes equal to rate of desorption i.e (Dynamic Eq)

ASSUMPTIONS

- Unimolecular layers.
- no interaction of gas molecules with each other.
- Layer of one molecule thickness.

$$\frac{P}{x} = \frac{1}{K''} + \left(\frac{P}{K'}\right) \times P$$

$$y = c + mx$$



Catalysis:-

Catalyst:-

Substance which speed up rate of reaction and remains unreacted at the end of reaction.

Process of increasing rate of reaction by addition of catalyst called catalysis.

→ Positive Catalyst:-

Catalyst which increases rate of reaction. e.g presence of Ni/Pt in hydrogenation process.

→ Negative Catalyst:-

Catalyst which decreases the rate of reaction e.g in case of decomposition of phosphoric acid acts as Negativ catalyst:-

Types of catalysis :-

two types.

1) Homogeneous Catalysis

2) Heterogeneous Catalysis

Homogeneous Catalysis :-

process in which both reactant and

Catalyst are in same phase.

e.g

Gaseous form

$$2SO_{2(g)} + O_{2(g)} \xrightleftharpoons{NO_{(g)}} 2SO_{3(g)}$$

Liquid form :-

$$C_{12}H_{22}O_{11(l)} + H_2O_{(l)} \xrightarrow{H_2SO_4(l)} C_6H_{12}O_6 + C_6H_{12}O_6$$

Solid form :-

$$2KClO_{3(s)} \xrightarrow{MnO_2(s)} 2KCl + 3O_2$$

Hetrogeneous Catalysis:-

process in which reactant and catalyst are in different phases.

e.g

Hydrogenation process

$$CH_2=CH_2 + H_2 \xrightarrow{Ni_{(s)}/Pt_{(s)}} CH_3-CH_3$$

(g) (g)

e.g

Formation of Amonia

Criteria for Catalyst

1) Amount and chemical Composition of Catalyst should not change during chemical Rex.

2) Catalyst is used in small quantity.

3) Catalyst is preferably used in powder form.

4) Catalyst is specific for any chemical Rex.

5) Catalyst can initiate only thermodynamically ~~Dfg~~ feasible chemical Rex.

6 - Catalyst can not change position of equilibrium.

7 - Catalyst only decrease activation Energy of ch- Rex.

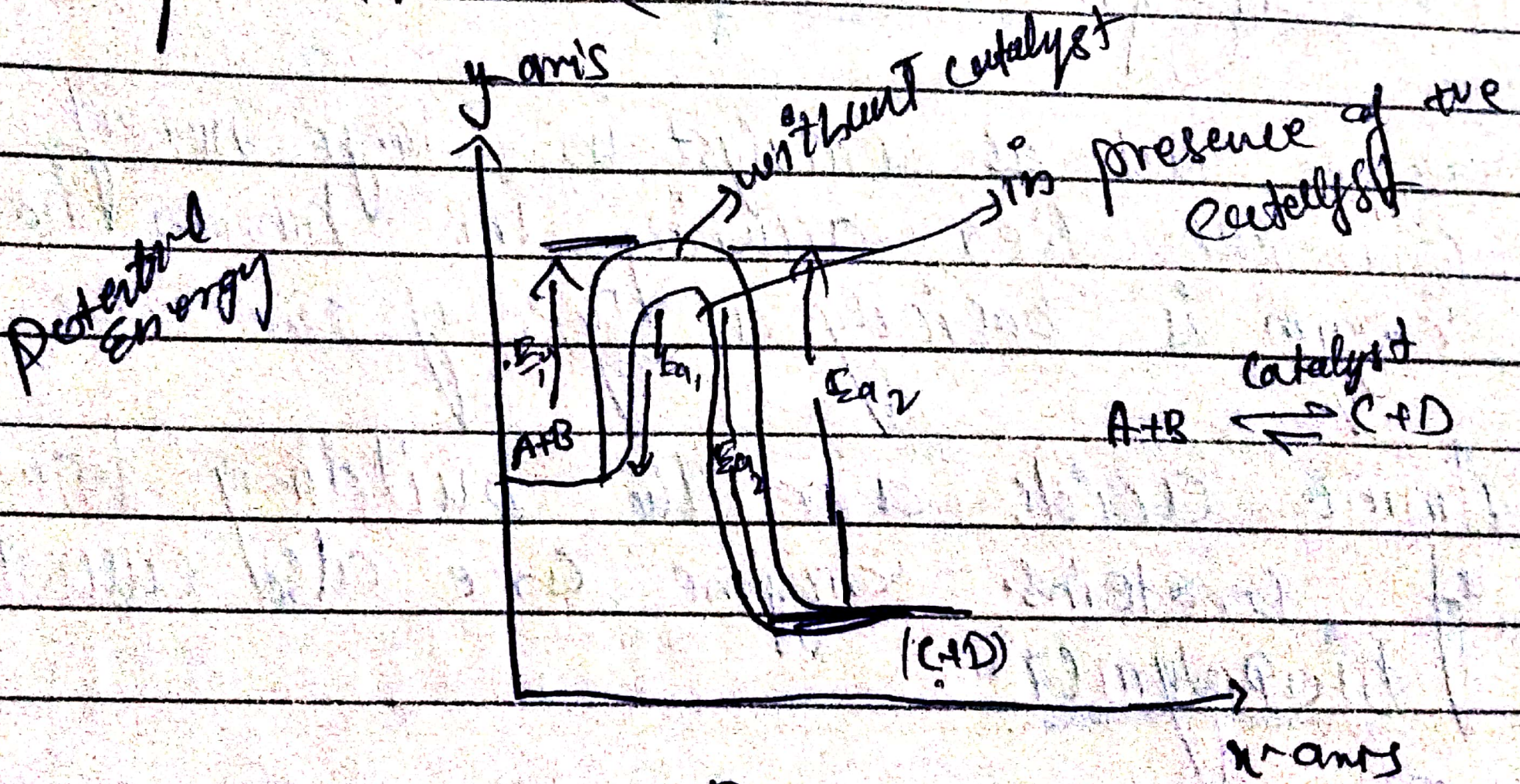
8 - Catalyst may be effected by experimental parameters like Temperature and ph etc.

a) Collision theory
b) Activated complex theory
formation

These two theories tells us rate of Chemical Rex depends upon collisions of reactant molecules and activation Energy i.e By increasing collision of reactant molecules, rate of Chemical Rex. can be increased upto some extent.

Or rate of reaction is also controlled by activation Energy. And rate of Rex. can be increased by addition of catalysts as by lowering the activation energy.

eg $A + B \rightleftharpoons C + D$



Rx. Coordinates

Enzyme Catalysis:-

Enzyme act as Catalyst in large no. of Chemical Rex occuring in human body Enzym is basicaly a type of proteins.

Amino acids are the building blocks of proteins. Enzyme are also called biopolymer.

⇒ There may be 600 - 100000

Amino acids in an Enzyme.

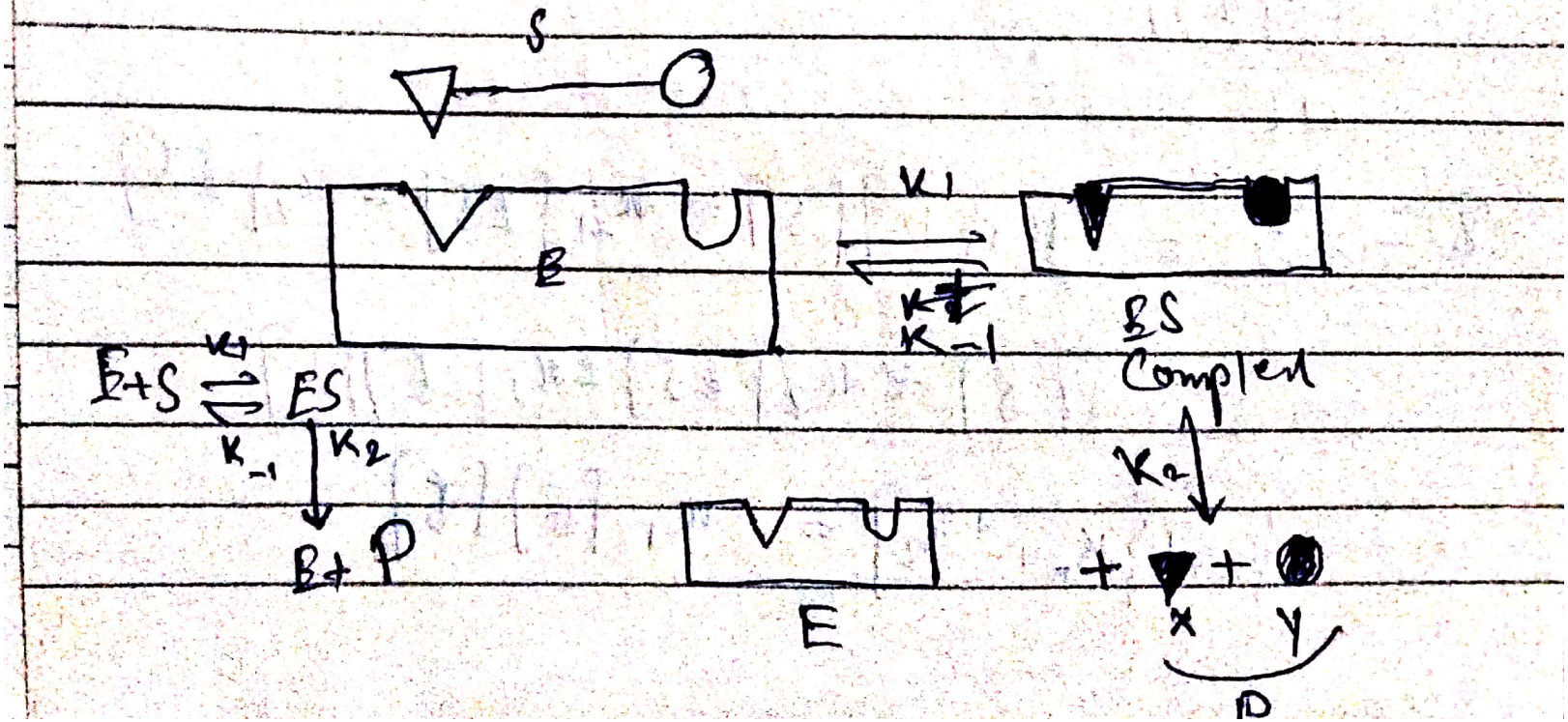
Enzyme act as Catalyst at certain condition i.e at specific T, PH etc.

↳ Temperature and ph at which any enzyme perform its function, known as optimum temperature and PH for that enzyme.

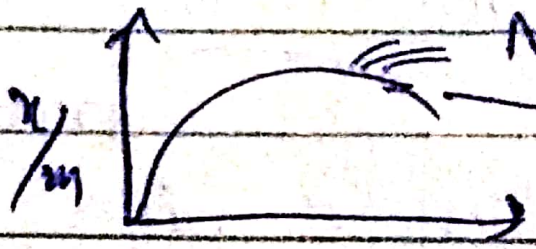
Mechanism of enzyme Catalysis

Michaelis Menton Mechanism.

According to Michaelis menton, substrate attach with enzyme according to key and lock model. Firstly, substrate attach with Enzyme through reversible process and substrate converted into product through irreversible process.



Frendlich Isotherms

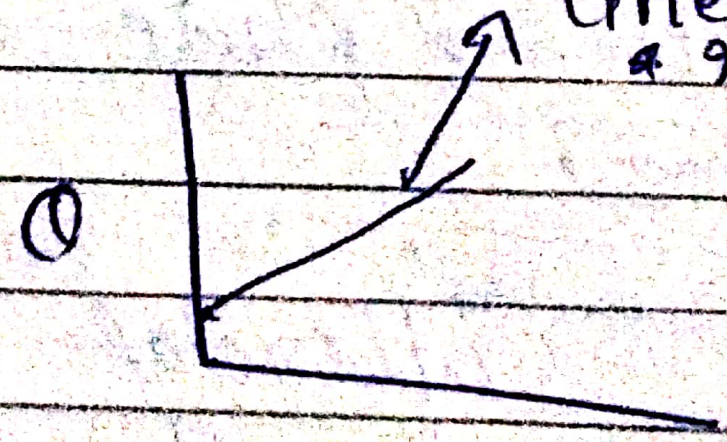


Multi layers
Curv

* 9ts For gase and liquid adsoption.

Difference

Langmuir



* 9ts For gases

MIERCOLES

APPLICATION OF Adsorption

(1) Decolourization:
Animal charcoal.

(2) Chromatographic analysis:

- Principle of selective adsorption.
- Alumina commonly used.
- Gas chromatography.

(3) Heterogenous Catalysis:
H_2 on Ni surface.

(4) Froth Floatation Process:
oil + detergent + water