Surface Chemistry (Key Points)

The branch of chemistry which deals with the study of surface phenomena.

Adsorption: The phenomenon of attracting and retaining the molecules of a substance at the surface of the solid or a liquid resulting into higher concentration of the molecules on the surface than in the bulk.

Adsorbent: The substance where adsorption occurs.

Adsorbate: The substance that get adsorbed.

Absorption: The phenomenon in which the particles of gas and liquid get unity distributed throughout the body of the solid.

Desorption: The process of removal of an adsorbed substance from the surface on which it is adsorbed.

Sorption: When both absorption and adsorption occur together and are not distinguishable.

Mechanism of adsorption: arises due to unbalanced force of attraction on the surface of solid are responsible for attracting the adsorbate particles on the surface.

The extent of adsorption increases with increase in surface area.

Gibbs energy change during adsorption : During adsorption, there is always decrease in residual force i.e., there is decrease in surface energy, which appears as heat. Therefore adsorption is an exothermic process i.e. $\Delta H = -ve$.

Also movement of the particles is restricted in this process. Therefore $\Delta S = -ve$

According to Gibbs Helmholtz equation : $\Delta G = \Delta H - T\Delta S$, or $\Delta G = (-\Delta H) - T(-\Delta S)$

for adsorption to occur. ΔG must be negative which is possible only when $\Delta H > T\Delta S$

Types of Adsorption: physical and chemical adsorption

1. **Physical adsorption** : When the particles of adsorbate are held to the surface of adsorbent by weak Vander Waals forces,

Characteristics of physical adsorption: Lack of specificity, low enthalpy of adsorption, reversible in nature, no activation energy required, decrease with increase in temperature.

2. **Chemical adsorption:** When the molecules of adsorbate are held to the surface of adsorbent by strong chemical forces.

Characteristics of chemical adsorption: Highly specific in nature, high enthalpy of adsorption, Irreversible in nature, initially it increases with increase in temperature as it needs activation energy, very slow.

Adsorption Isotherm: The variation in the amount of gas adsorbed by the adsorbent with pressure at constant temperature can be expressed by means of a curve termed as adsorption isotherm.

(Its a plot/curve between extent of adsorption(x/m) and pressure P at constant T).

Freundlich adsorption Isotherm

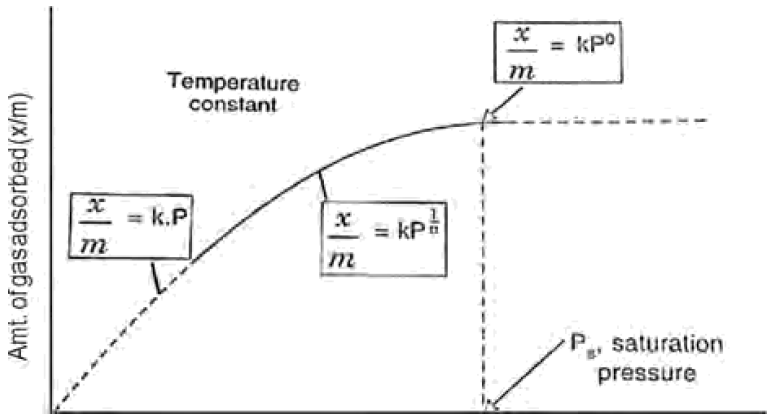
x/m = K.P"°(n>1) log x/m = logk+1/n logP

The factor 1/n can have values between 0 & 1.

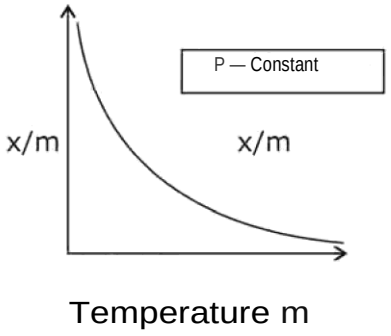
When 1/n=0, x/m = constant which shows that adsorption is independent of pressure.

When 1/n=1,x/m = kP, the adsorption varies directly with pressure.

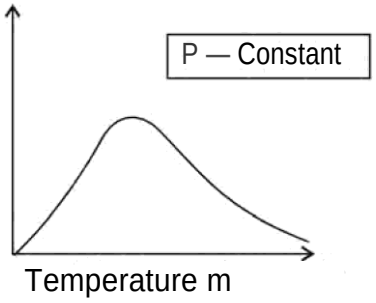
The variation in the amount of gas adsorbed by the adsorbent with temperature at a: Instant pressure can be expressed by means of a curve termed as adsorption isobar.



Adsorption isotherm in term of Fre undlich.



Physical adsorption



Chemical adsorption

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