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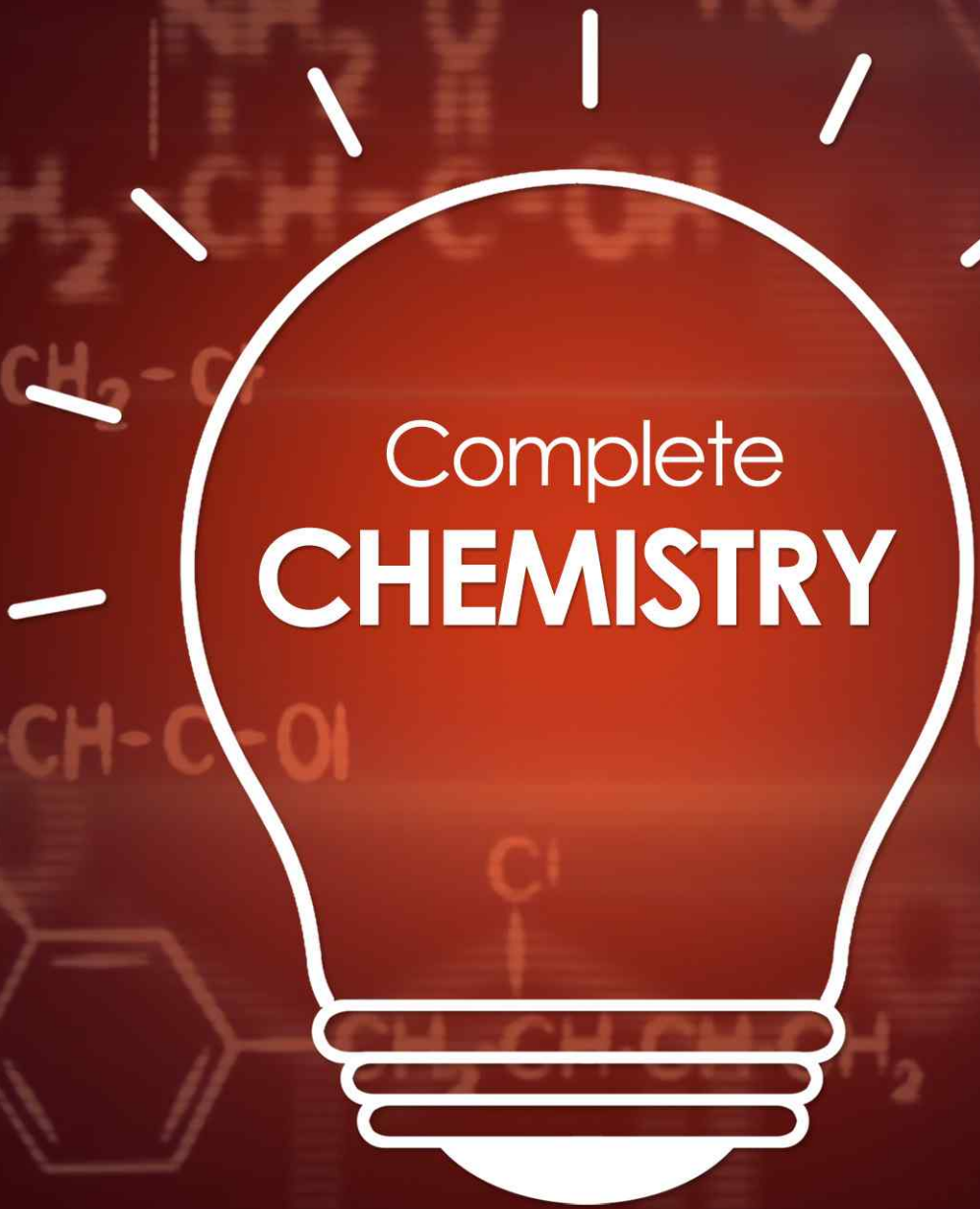


# Complete CHEMISTRY

## IIT-JEE · NEET · CBSE eBOOKS

CLASS 11&12th

CLASS 12th

# Surface Chemistry

## 01. Introduction

The phenomenon of attracting and retaining the molecules of a substance on the surface of a liquid or solid resulting into a higher concentration of molecules on the surface is called *adsorption*.

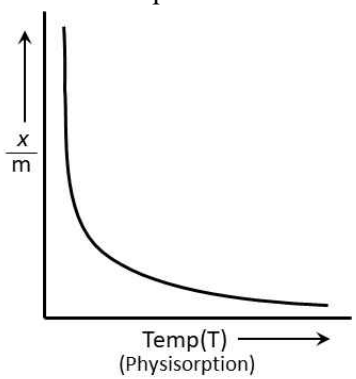
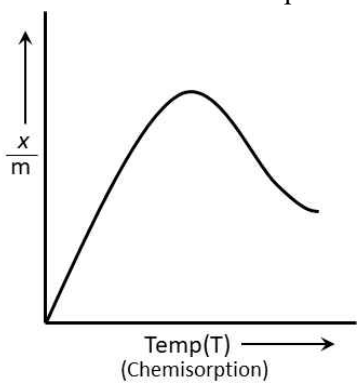
**Positive adsorption :** When the concentration of the adsorbate is more on the surface of the adsorbent than in the bulk, it is known as positive adsorption.

**Negative adsorption :** If the concentration of the adsorbate is less on the surface of the adsorbent than in the bulk, it is known as negative adsorption.

### Factor Affecting Adsorption

(i) Nature and surface area of the adsorbent
(ii) Nature of adsorbate
(iii) Temperature
(iv) Concentration/Pressure

## 02. Comparison of Physi-Sorption and Chemi-Sorption

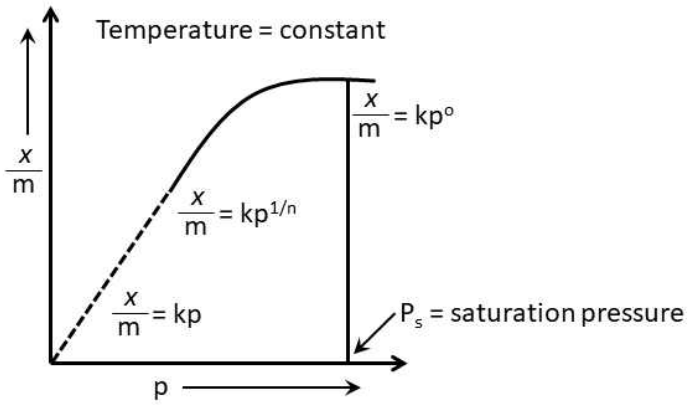
| | **Physical adsorption** | **Chemical adsorption** |
|---|---|---|
| (i) | It is caused by intermolecular Vander Waals' forces. | It is caused by chemical bond formation. |
| (ii) | It is reversible. | It is irreversible. |
| (iii) | It depends on the nature of gas. More easily liquefiable gases are adsorbed readily. | It depends on the nature of gas. Gases which form compounds with the adsorbent exhibit chemical-sorption |
| (iv) | Low temperature is favourable. It decreases with increase of temperature.   | High temperature is favourable. It increase with increase of temperature.   |

## 03. Adsorption Isotherms

A relation between x/m (amount adsorbed per unit weight of adsorbent) and the equilibrium concentration or pressure at a fixed temperature is called *adsorption isotherm*.

(i) **Freundlich Adsorption Isotherm :** it is represented as

$\frac{x}{m} = kC^{1/n}$ or $\frac{x}{m} = kP^{1/n}$, depending on whether the adsorbate is a solution or a gas.




(a) **At very low pressure :** At very low pressures, the graph is nearly straight line.

$\frac{x}{m} \propto P$ or $\frac{x}{m} = k.P$

(b) **At intermediate range of pressure :** At these pressures graph is curved

$\frac{x}{m} \propto P^{1/n}$ or $\frac{x}{m} = k.P^{1/n}$ (probable 'n' value is 0.1 – 0.5)

(c) **At very high pressure :** The graph becomes parallel to x-axis

$\frac{x}{m} \propto P^{0}$ or $\frac{x}{m} = k$

(ii) **Langmuir adsorption isotherm :** Langmuir considers the formation of only a monolayer of adsorbate on adsorbent.

(a) It takes place on the surface of solids till a unimolecular layer is formed.

(b) Adsorption is a result of condensation of adsorbate molecules on solid surface and their evaporation.

(c) At equilibrium, the rate of condensation becomes equal to the rate of evaporation.

$\frac{x}{m} = \frac{ap}{1+bp}$

## 04. Catalysis

The systematic study of the effect of different foreign substances on the rates of chemical reactions was made by Berzelins; in 1835. He named these foreign substances as catalyst. Which alter the rate of a chemical reaction and themselves remain chemically and quantitatively unchanged after the reaction, are known as catalysts and the phenomenon is known as catalysis.