Surface Chemistry

1. This phenomenon of attracting and retaining the molecules of a substance by a solid (or a liquid) on its surface resulting into a higher concentration of the molecules on the surface is known as **adsorption.**
2. The substance that is adsorbed is called **adsorbate** and the substance which adsorbs is called **adsorbent.**
3. Desorption is a process of removing an adsorbed substance from a surface on which it is adsorbed.
4. Absorption is different from adsorption. In absorption, the substance is uniformly distributed throughout the body of a solid or a liquid.
5. When the adsorbate is held on the surface by weak van der Waals forces, the process is called **physical adsorption** or **physical adsorption**. This type of adsorption can be reversed by heating or decreasing the pressure.
6. When the forces holding the adsorbate on the surface are of the magnitude of chemical bond forces, the process is called **chemical adsorption** or **chemisorption**. This type of adsorption is irreversible.
7. Adsorption is generally accompanied by evolution of heat, i.e., it is an exothermic process.
8. The extent of adsorption of a gas on a solid depends upon the **following factors:**
(a) Nature of the adsorbate,
(b) Nature of the adsorbent,
(c) Temperature, and
(d) Pressure.
9. A relation or a graph between the magnitude of adsorption x/m and the pressure P of the gas at a constant temperature is called **adsorption isotherm**.
10. Freundlich adsorption isotherm:

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

Plot of log x/m Vs log P will be a straight line with a slope of 1 In. It holds good at moderate temperature. At low pressure, n = 1.
11. Langmuir adsorption isotherm is based on following assumptions:
(i) Every adsorption site is equivalent in all respect.
(ii) The ability of a particle to bind at a particular site is independent of whether the nearby sites are occupied or not.
12. Langmuir derived the following relation.

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

where a and b are Langmuir parameters.
13. A substance that can influence the rate of a chemical reaction but itself remains unchanged chemically at the end is called a **catalyst.**
14. In a homogeneous catalysis, the catalyst is present in the same phase as the reactants.
15. In heterogeneous catalysis, the catalyst is present in a different phase than that of the reactants.
16. Enzymes also called **biological catalysts** are proteins which catalyse the reactions in living systems.

17. The colloidal solutions are intermediate between true solutions and suspensions. The diameter of colloidal particles varies from 1 to 1000 nm.
18. A colloidal system is a heterogeneous system which consists of disperse phase and dispersion medium.
19. The **disperse phase** constitutes the colloidal particles whereas the **dispersion medium** constitutes the medium in which the colloidal particles are dispersed.
20. There are eight types of colloidal systems based on the disperse phase and the dispersion medium.
21. Sols are the colloidal system in which the solid is disperse phase and the liquid is dispersion medium.
22. Hydrosols-Colloids in water.
Alcosols – Colloids in alcohol.
23. Lyophillic colloids (solvent loving) are those substances that directly pass into the colloidal state when brought in contact with the solvent, e.g., proteins, starch, rubber, etc.
These sols are quite stable because of the strong attractive forces between the particles and the, dispersion medium.
24. Lyophobic colloids (solvent hating) are those substances that do not form the colloidal sol readily when mixed with the dispersion medium. These sols are less stable than the lyophilic sols.
25. The colloids are also classified as multimolecular, macro-molecular and associated colloids.
26. Lyophobic sols can be prepared by the following methods:
(a) Chemical methods:
(i) Oxidation,
(ii) Reduction,
(iii) Hydrolysis ,
(iv) Double decomposition,
(b) Physical methods:
(i) Exchange of solvent:
(ii) Excessive cooling: A colloidal sol of ice in an organic solvent ($CHCl_3$ or ether) can be obtained by freezing a solution of water in the solvent.
(c) Dispersion methods:
(i) Mechanical dispersion:
(ii) Bredig's arc method:
(iii) Peptization method:
27. Lyophilic sols are readily prepared by warming the substance with a dispersion medium, e.g., starch, gelatin, gumarabic, etc., are easily brought into the colloidal state by warming with water.
28. The process of separating a soluble crystalloid from a colloid is called dialysis.
29. Characteristics of colloidal solution:
(a) The zig-zag and random motion of the colloidal particles is called **Brownian movement**.
(b) When a beam of light is passed through a colloidal solution, its path becomes visible.
This phenomenon is known as Tyndall effect.
It is due to the scattering of light by colloidal particles.
(c) This movement of colloidal particles under applied electric field is known as electrophoresis.
(d) Diffusion of colloidal particles takes place from a region of higher concentration to

lower concentration.

30. Emulsions: It is a colloidal system in which both the dispersed phase and the dispersion medium are liquids, e.g., milk consists of small drops of liquid fat dispersed in water.

31. Emulsification is the process of making an emulsion.

32. Types of Emulsions

(a) Oil-in-water type in which small droplets of an oil are dispersed in water, e.g., milk, cod- liver oil, etc.

(b) Water-in-oil type in which water droplets are dispersed in an oil medium, e.g., butter.