

**FAQ - Chapter 5 SURFACE CHEMISTRY**

**1 Mark Questions:-**

1. Bleeding caused by a nick from a razor during shaving can be stopped by rubbing with alum. Why?  
 Ans: Blood is a negatively charged colloidal solution. When alum is rubbed the positively charged  $\text{Al}^{3+}$  ions from alum neutralizes the charge on the particles and makes it coagulate to form a clot.

2. In which of the following does adsorption take place and why?

(i) Silica gets placed in the atmosphere saturated with water.

(ii) Anhydrous  $\text{CaCl}_2$  placed in the atmosphere saturated with water.

Ans: Water vapour gets adsorbed on the surface of silica since it is a good adsorbent.

3. Action of soap is due to emulsification and micelle formation. Comment.

Ans: Soap molecules adsorb on to the dirt surface and try to emulsify it by forming micelles. Soap micelles thus make the insoluble dirt (greasy materials) into colloidal form such that it gets washed away by water.

4. What is the use of ZSM-5?

Ans: It converts alcohols directly into gasoline (petrol) by dehydrating them to give a mixture of hydrocarbons.

5. Give one example for each (i) sol (ii) gel.

Ans: (i) paints (ii) Butter or any other correct options.

6. What is collodion?

Ans: It is a 4% solution of nitrocellulose in a mixture of alcohol and ether.

7. Can we form a colloid with two gaseous components? Comment.

Ans: No. a gas mixed with another gas forms a homogeneous mixture which does not come under a colloidal system.

8. What are the physical states of the dispersion medium and dispersed phase in froth?

Ans: In froth, the dispersed phase is a gas while dispersion medium is a liquid.

9. Write the equation for the preparation of colloidal sulphur?

Ans:  $\text{SO}_2 + 2\text{H}_2\text{S} \longrightarrow 3\text{S}(\text{sol}) + 2\text{H}_2\text{O}$

10. Why does physisorption decrease with increase of temperature?

Ans: Adsorption is an exothermic phenomenon. The increase in temperature will favour the reverse process i.e. desorption according to Le Chatelier's principle. Therefore physisorption decreases with increase in temperature.

11. What is CMC (Critical Micelle Concentration)

Ans:- It is a particular concentration above which the particles aggregate to form micelles or associated colloids.

12. Why are powdered substances more effective adsorbents as compared to their crystalline forms?

Ans:- Powdered form has more surface area than crystalline form.

13. Why is it necessary to remove CO when ammonia is obtained by Haber's process?

Ans:- In Haber's process iron is used as catalyst. If CO is present, it acts as catalytic poison.

14. What is electrophoresis due to?

Ans:- It is due to existence of positive or negative charge on colloidal particles.

15. Mention two ways by which lyophilic colloids can be coagulated. (C.B.S.E-2008)

Ans:- 1) By adding an electrolyte. 2) By adding a suitable solvent.

16. What is Kraft temperature? (C.B.S.E Foreign 2004)

Ans:- It is the temperature above which the formation of micelle takes place.

17. What is Brownian movement due to? (C.B.S.E -1999)

Ans:- It is due to unbalanced bombardment of the colloidal particles by the molecules of dispersion medium.

18. Name two industrial processes in which heterogeneous catalysts are employed. (C.B.S.E-2008)

Ans: (i). Manufacture of ammonia by Haber's process. (ii) manufacture of sulphuric acid by contact process.

19. What is an emulsion? (C.B.S.E Foreign 2009)

Ans:- Emulsion is a colloidal solution of two immiscible liquids of which one is the dispersion medium and the other is dispersed phase.

20. What is Zeta potential?

Ans:- The potential difference between the fixed layer and diffused layer of opposite charges around the colloidal particles.

## 2 Marks Questions

1. Explain why lyophilic sol are more stable than lyophobic sols?

Ans; Lyophilic colloids have great affinity for the dispersion medium i.e. dispersed phase particles are solvated to a greater extent in case of Lyophilic colloids. Hence Lyophilic sols are relatively more stable than lyophobic sols.

2. State two features of chemical adsorption which is not found with physical adsorption.

Ans: (i) Chemical adsorption has high enthalpy of heat.

(ii) It is highly specific.

3. Describe the following types of colloids giving one example for each?

(i) Multi molecular colloids    (ii) Macro molecular colloids    (C.B.S.E 2007)

Ans(i) Multi molecular colloids consist of aggregates of atoms or small molecules with diameter less than 1 nm. The colloidal particles are held by weak van der Waal's forces, e.g. sols of  $S_8$ .

(ii) Macromolecular colloids are those in which molecules of dispersed phase are of colloidal dimensions 1-1000nm. These have very high molecular mass, e.g. sols of proteins.

4. Explain the process of Ultra filtration.

Ans:- Ultra filtration is the process of separating the colloidal particles from the solvent and soluble solutes present in the colloidal solution by specially prepared filters which are permeable to all substances except the colloidal particles. These filter papers are prepared by impregnating ordinary filter paper with collodion solution and hardening by formaldehyde.

5. What is shape selective catalysis? (C.B.S.E -2003, Foreign-2004)

Ans:- A catalyst whose catalytic action depends upon its pore structure and molecular sizes of the reactants as well as the products is known as shape selective catalysis and the catalytic action is called shape selective catalysis. For example, Zeolites act as shape selective catalysts. Recently ZSM-5 has been used in producing gasoline from alcohol.

6.(a) Adsorption of a gas on the surface of solid is generally accompanied by a decrease in entropy. Still it is a spontaneous process. Explain.

(b) How does an increase in temperature affect both physical as well as chemical adsorption?

Ans: (a) During adsorption there is a decrease in energy. It is exothermic, i.e.  $\Delta H = -ve$ . During adsorption, freedom of molecules becomes restricted,  $\Delta S = -ve$ . But  $\Delta G$  becomes negative. Hence, the reaction is spontaneous.

(b) Extent of physical adsorption decreases with increase in temperature whereas the extent of chemical adsorption first increases and then decreases as the temperature increases.

7. What is an adsorption isotherm? Describe Freundlich adsorption isotherm.

Ans:-The graph drawn between the amount of gas adsorbed per unit mass of adsorbent  $x/m$  and pressure of the gas at a constant temperature is known as adsorption isotherm. After saturation pressure there is no more adsorption on the surface.

Freundlich adsorption isotherm can be expressed by

$$x/m = kp^{1/n} \quad (n > 1)$$

$$\log x/m = \log k + 1/n \log p$$

(Graphs for both expression can be drawn)

8. What is the difference between dialysis and osmosis?

Ans: The two processes appear to be the same since both involve the diffusion through semi permeable membrane. However in osmosis, only the solvent and not the solute particles can pass through the membrane, but in dialysis even small ions of electrolyte can pass through the membrane and colloidal particles which are comparatively big in size cannot pass.

9. Describe Bredig's Arc method for preparation of gold sol?

Ans:-An electric arc is struck between electrodes made of gold immersed in dispersion medium water. The intense heat produced vapourises the metal which then condenses to form particles of colloidal gold. (Label diagram to be drawn).

10. Name four different ways by which coagulation of lyophobic sols can be carried out?

Ans :- (i) By electrophoresis (ii) By boiling (iii) By mixing two oppositely charged sols (iv) by addition of electrolytes.

### 3 Marks Questions

1. What are emulsions? What are their different types? Give example of each type.

Ans: Emulsions are the colloidal solutions of two immiscible liquids in which dispersed phase as well as the dispersion medium are liquids. Since the two do not mix well, the emulsion is generally unstable and is stabilized by adding a suitable reagent called emulsifier, e.g. gum, soap, etc.

Types of emulsions: These are of two types:

(i) Oil in water emulsions in which oil acts as the dispersed phase while water acts as the dispersion medium. For example, milk is an emulsion of fats in water and here casein acts as an emulsifier.

(ii) Water in oil emulsions. In this case, water acts as the dispersed phase while the oil acts as the dispersion medium. For example, butter, cold cream.

2. Explain what is observed when (i) a beam of light is passed through a colloidal sol  
(ii) an electrolyte, say NaCl is added to hydrated ferric oxide sol (iii) electric current is passed through a colloidal sol?

Ans: (i) When a beam of light is passed through a colloidal sol placed in a dark room the beam of light is scattered by the colloidal particles and the path of the beam becomes visible. The phenomenon is called Tyndall effect.

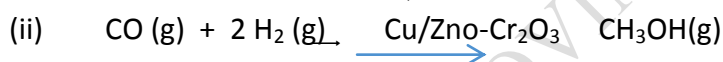
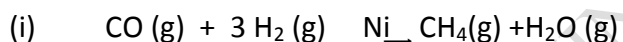
(ii) When NaCl is added to hydrated ferric oxide sol, the  $\text{Cl}^-$  ions of NaCl neutralizes the positive charge on ferric hydroxide sol particles, and coagulation of sol occurs.

(iii) When electric current is passed through a colloidal sol, the dispersed phase moves towards oppositely charged electrodes. On reaching the electrode, they lose their charge and get coagulated.

3. Write a short note on (i) Activity (ii) Selectivity and give examples?

Ans:- (i) Activity:- the activity of a catalyst depends upon the strength of chemisorptions to a large extent. The reactants must get adsorbed strongly on to the surface of catalyst to become active. Ex:-  
 $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \xrightarrow{\text{Pd}} 2\text{H}_2\text{O}(\text{l})$

(ii) Selectivity:- It is the ability of the catalyst to direct a reaction to yield a particular product. For example starting with  $\text{H}_2$  and  $\text{CO}_2$  and using different catalysts, we get different products.



4. Name & explain three methods of purification of colloids.

Ans:- Dialysis:- Separation of electrolytes and colloidal solution uses a semi-permeable membrane.

Electro-dialysis:- When dialysis is carried out with an electric field around the membrane, the purification process is enhanced.

Ultra-filtration:- Use of special filters, which are permeable to all substances except colloidal particles.

5. What is Hardy Schulze rule? Explain with examples?

"The greater the valence of the flocculating ion the greater is its power to cause coagulation". Ex:-  
 In the coagulation of a negative sol the flocculating power is in the order  $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$ . In the case of a positive sol the flocculating power is in the order  $[\text{Fe}(\text{CN})_6]^{4-} > \text{PO}_4^{3-} > \text{Cl}^-$

6. What is Tyndall effect, under what conditions it is observed?

Ans:- The scattering of light by colloidal particles is called Tyndall effect.

The required conditions to observe this effect are (i) The diameter of the dispersed particles is not much smaller than the wavelength of the light used, and

(iii) The refractive indices of the dispersed phase and the dispersion medium differ greatly in magnitude.

7. Explain mechanism of enzyme catalyzed reaction?



Thus the enzyme-catalysed reactions may be considered to proceed in two steps.

Step 1: Binding of enzyme to substrate to form an activated complex.



Step 2: Decomposition of the activated complex to form product.

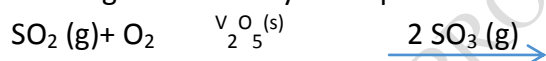


8. Differentiate between homogeneous and heterogeneous catalysis. Give one example of each.

Homogeneous catalysis:- In which the catalyst and reactants are in the same phase (i.e. liquid or gas).

Ex:- Oxidation of sulphur dioxide into sulphur trioxide with catalyst as NO(g). All are in the gaseous state.

Heterogeneous catalysis:- A process in which the reactants and catalyst are in different phases. Ex. 2



9. Write short notes on (a) multimolecular (b) macromolecular (c) associated colloids

Ans:- (a) It has many molecules aggregated together. Ex :-sulphur sol

(b) Consists of macromolecules in a suitable solvent Ex: dispersion of cellulose in a suitable solvent.

(c) Substances at low concentrations behave as electrolyte while at high concentrations they behave as colloids. Ex: Soap solution

10. Account for the following

(i) Delta is formed when river meets sea water

(ii) For water purification alum is added

(iii) Cottrell smoke precipitator is used to reduce pollution.

Ans:-(i) Electrolytes of sea water coagulate colloidal clay particles of river water.

(ii) Alum coagulates the suspended colloidal impurities.

(iii) In Cottrell smoke precipitator colloidal smoke particles lose their charge as they pass through it and coagulate.

