

CBSE Class 12 physics
Important Questions
Chapter 5
Surface Chemistry

3 Marks Questions

1. Explain modern theory of heterogeneous catalysis.

Ans. According to modern theory of catalysis, the mechanism of heterogeneous catalysis involves following steps –

- (i) Diffusion of reactants on the surface of catalyst.
- (ii) Adsorption of reactant molecules on the surface.
- (iii) Occurrence of reaction on the catalysts surface through formation of an intermediate.
- (iv) Desorption of products from surface.
- (v) Diffusion of products away from surface.

2. Differentiate between lyophobic and lyophilic sol?

Ans.

<u>Lyophobic sol</u>	<u>Lyophilic sol.</u>
1. It is relatively unstable due to Repulsion between dispersion medium and dispersed phase.	1. It is relatively more stable due to medium-attraction between dispersion medium and dispersed Phase.
2. It is irreversible.	2. It is reversible.
3. It cannot be easily peptised.	3. It can be easily peptised.
4. Small quantities of electrolyte cause precipitation.	4. Small quantities of electrolyte has no effect larger concentration causes precipitation.

3. Distinguish between the meaning of the terms adsorption and absorption.

Give one example of each.

Ans. *Adsorption* is a surface phenomenon of accumulation of molecules of a substance at the surface rather than in the bulk of a solid or liquid. The substance that gets adsorbed is called the 'adsorbate' and the substance on whose surface the adsorption takes place is called the 'adsorbent'. Here, the concentration of the adsorbate on the surface of the adsorbent increases. In adsorption, the substance gets concentrated at the surface only. It does not penetrate through the surface to the bulk of the solid or liquid. For example, when we dip a chalk stick into an ink solution, only its surface becomes coloured. If we break the chalk stick, it will be found to be white from inside.

On the other hand, the process of *absorption* is a bulk phenomenon. In absorption, the substance gets uniformly distributed throughout the bulk of the solid or liquid.

4. Why is adsorption always exothermic?

Ans. Adsorption is always exothermic. This statement can be explained in two ways.

(i) Adsorption leads to a decrease in the residual forces on the surface of the adsorbent. This causes a decrease in the surface energy of the adsorbent. Therefore, adsorption is always exothermic.

(ii) ΔH of adsorption is always negative. When a gas is adsorbed on a solid surface, its movement is restricted leading to a decrease in the entropy of the gas i.e., ΔS is negative. Now for a process to be spontaneous, ΔG should be negative.

Therefore, $\Delta G = \Delta H - T\Delta S$

Since ΔS is negative, ΔH has to be negative to make ΔG negative. Hence, adsorption is always exothermic.

5. How are colloids classified on the basis of

(i) Physical states of components

(ii) Nature of dispersion medium and

(iii) Interaction between dispersed phase and dispersion medium?

Ans. Colloids can be classified on various bases:

(i) On the basis of the physical state of the components (by components we mean the dispersed phase and dispersion medium). Depending on whether the components are solids, liquids, or gases, we can have eight types of colloids.

(ii) On the basis of the dispersion medium, sols can be divided as:

Dispersion medium	Name of sol
Water	Aquasol or hydrosol
Alcohol	Alcosol
Benzene	Benzosol
Gases	Aerosol

(iii) On the basis of the nature of the interaction between the dispersed phase and dispersion medium, the colloids can be classified as lyophilic (solvent attracting) and lyophobic (solvent repelling).

6. Explain what is observed

(i) When a beam of light is passed through a colloidal sol.

(ii) An electrolyte, 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 solution, then scattering of light is observed. This is known as the Tyndall effect. This scattering of light illuminates the path of the beam in the colloidal solution.

(ii) When NaCl is added to ferric oxide sol, it dissociates to give Na^+ and Cl^- ions. Particles of ferric oxide sol are positively charged. Thus, they get coagulated in the presence of negatively charged Cl^- ions.

(iii) The colloidal particles are charged and carry either a positive or negative charge. The

dispersion medium carries an equal and opposite charge. This makes the whole system neutral. Under the influence of an electric current, the colloidal particles move towards the oppositely charged electrode. When they come in contact with the electrode, they lose their charge and coagulate.

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

Ans. The cleansing action of soap is due to emulsification and micelle formation. Soaps are basically sodium and potassium salts of long chain fatty acids, $R - COO^-Na^+$. The end of the molecule to which the sodium is attached is polar in nature, while the alkyl-end is non-polar. Thus, a soap molecule contains a hydrophilic (polar) and a hydrophobic (non-polar) part.

When soap is added to water containing dirt, the soap molecules surround the dirt particles in such a manner that their hydrophobic parts get attached to the dirt molecule and the hydrophilic parts point away from the dirt molecule. This is known as micelle formation. Thus, we can say that the polar group dissolves in water while the non-polar group dissolves in the dirt particle. Now, as these micelles are negatively charged, they do not coalesce and a stable emulsion is formed.

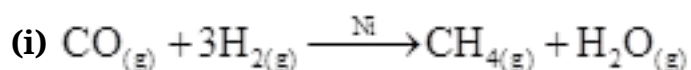
8. What do you mean by activity and selectivity of catalysts?

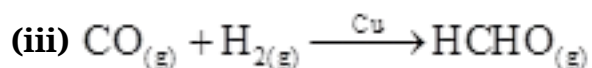
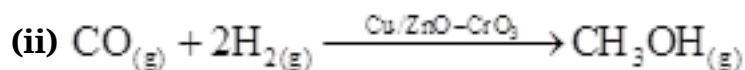
Ans. (a) Activity of a catalyst:

The activity of a catalyst is its ability to increase the rate of a particular reaction. Chemisorption is the main factor in deciding the activity of a catalyst. The adsorption of reactants on the catalyst surface should be neither too strong nor too weak. It should just be strong enough to make the catalyst active.

(b) Selectivity of the catalyst:

The ability of the catalyst to direct a reaction to yield a particular product is referred to as the selectivity of the catalyst. For example, by using different catalysts, we can get different products for the reaction between H_2 and CO.





9. Explain the terms with suitable examples: (i) Alcosol (ii) Aerosol (iii) Hydrosol

Ans. (i) Alcosol:

A colloidal solution having alcohol as the dispersion medium and a solid substance as the dispersed phase is called an alcosol.

For example: colloidal sol of cellulose nitrate in ethyl alcohol is an alcosol.

(ii) Aerosol:

A colloidal solution having a gas as the dispersion medium and a solid as the dispersed phase is called an aerosol.

For example: fog

(iii) Hydrosol

A colloidal solution having water as the dispersion medium and a solid as the dispersed phase is called a hydrosol. For example: starch sol or gold sol.