Chemistry Worksheets Class 12 on Chapter 5 Surface Chemistry with Answers - Set 1

Q1. Which of the following statements are correct?

a.) Mixing two oppositely charged sols neutralises their charges and stabilises the colloids.
b.) The presence of equal and similar charges on colloidal particles provides stability to the colloids.
c.) Any amount of dispersed liquid can be added to an emulsion without destabilising it.
d.) Brownian movement stabilises sols.

Correct Answer– (b.) The presence of equal and similar charges on colloidal particles provides stability to the colloids, (d.) Brownian movement stabilises sols.

Q2. Which of the following phenomenon occurs when a chalk stick is dipped in ink?

a.) adsorption of coloured substances.
b.) adsorption of solvent.
c.) absorption and adsorption both of solvent
d.) absorption of solvent.

Correct Answer– (a.) adsorption of coloured substances, (d.) absorption of solvent.

Q3. Which of the following is adsorbed by charcoal to the maximum extent?

a.) N_2
b.) CO_2
c.) Cl_3
d.) O_2

Correct Answer– (a.) N_2

Q4. Blue colour of the water in the sea is due to–

a.) refraction of blue light by impurities in seawater.
b.) scattering of light by water
c.) refraction of blue sky by water
d.) None of these

Correct Answer– (b.) scattering of light by water.

Q5. Emulsifying agent present in milk that makes it stable is–

a.) maltose
b.) casein
c.) lactose
d.) None of these

Correct Answer– (b.) casein

Q6. What is the basic difference between adsorption and absorption?

Answer. Adsorption compounds cling to the surface of the molecule, whereas absorption substances enter the bulk phase of a liquid or solid.

Q7. Out of $AlCl_3$ and NaCl, which is more effective in causing coagulation of a negative sol and why?

Answer. $AlCl_3$ is more effective in causing coagulation of a negative sol. This is because, according to Hardy and Schulze's rule, the higher the valency of the flocculating ion, the greater its ability to cause coagulation.

Q8. Define the term Tyndall effect.

Answer. The Tyndall effect is the phenomenon in which the particles in a colloid scatter the beams of light that are directed at them. This effect is exhibited by all colloidal solutions and some very fine suspensions. Therefore, it can be used to verify if a given solution is a colloid. The intensity of scattered light depends on the density of the colloidal particles as well as the frequency of the incident light.

When a beam of light passes through a colloid, the colloidal particles present in the solution do not allow the beam to completely pass through. The light collides with the colloidal particles and is scattered (it deviates from its normal trajectory, which is a straight line). This scattering makes the path of the light beam visible

Q9. What is the coagulation process?

Answer. It is the process of aggregating colloidal particles together to form larger particles that eventually settle as a precipitate.

- Coagulation is usually caused by the addition of electrolytes.
- The coagulating ion or Flocculating ion is the ion responsible for neutralising charge on colloidal particles.

Q10. How many types of Adsorption are there?

Answer. Depending upon the nature of forces which hold the molecules of the adsorbate on the surface of the adsorbent, the adsorption is classified into two types:

- Physical adsorption and
- Chemical adsorption

Q11. What is the difference between a colloidal solution and an emulsion? What is the role of emulsifiers in forming emulsions?

Answer. Colloidal solutions are solutions with dispersed phase particles with diameters ranging from 1 to 100 nm. These are intermediate of true solutions and suspensions. Even after a long period of time, colloidal particles do not settle down due to gravity. A colloid is a heterogeneous system, such as gold sol, sulphur sol, soap, and so on.
While Emulsions are a type of colloidal system in which the dispersed phase and dispersion medium are both liquids, such as milk.
The Emulsifier's Role- Emulsifying agents are used to stabilise emulsions. Between the suspended particles and the medium, the emulsifying agent forms an interfacial film. In oil-in-water emulsions, for example, the main emulsifying agents are gums, proteins, and natural and synthetic soaps.

Q12. What are the characteristics of a solid catalyst?

Answer. The characteristics of a solid catalyst are as follows-

- Activity
  - Activity of a catalyst is the capacity of the catalyst to increase the speed of the chemical reaction.
  - The adsorption should be strong reasonably but not very strong which makes the adsorbed molecules immobile and there is no place for other reactants to get adsorbed. For example- A combination of H_2 and O_2 in the presence of catalyst platinum to form water is an explosive reaction.
    But in the absence of the catalyst, the reactants do not react and can be stored for a very long period of time.
    $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$
- Selectivity
  - Selectivity is the ability of a catalyst to direct the reaction to form particular products excluding others.
  - For example- CO and H_2 form different products in the presence of different catalysts.

$$CO + 3H_2 \xrightarrow{Ni} CH_4 + H_2O$$

$$CO + 3H_2 \xrightarrow{Cu/ZnO+Cr_2O_7} CH_3OH$$

Q13. Give applications of Adsorption.

Answer. Applications of Adsorption are as follows-

- Air pollution masks:
  - These consist of silica gel or activated charcoal powder, when dust or smoke are paused through them, those particles get adsorbed on the surface of these materials.

- Separation of noble gases by Dewar's flask process:
    - A mixture of noble gases of Ne, Ar, Kr is passed through Dewar's flask in presence of heated coconut charcoal. Argon and Krypton gels adsorbed leaving Neon.
- Purification of water:
    - By the addition of alum stone to the water, impurities get adsorbed on the alum and water gets purified.
- Removal of moisture and humidity:
    - Moisture in the air is removed by placing silica gel on which water molecules get adsorbed.
- Adsorption chromatography:
    - It is used to separate pigments and hormones.
- Ion exchange method:
    - In this method of removing the hardness of water, calcium and magnesium ions get adsorbed on the surface of ion exchange resin
- In metallurgy:
    - In the froth floatation process of concentration of ore, the particle gets adsorbed on the froth.

Q14. Why are medicines more effective in a colloidal state?

Answer. A colloidal state has a larger surface area of sol particles and therefore, are more effectively adsorbed. Therefore, the medicines in the colloidal state are more easily assimilated or adsorbed and are more effective.

Q15. Differentiate between the following-
(i) Homogeneous and Heterogeneous catalysis.
(ii) Lyophobic and lyophilic colloids

Answer.
(i) Catalysis in which the reactants and catalyst are in the same phase. ie., the same physical state is known as homogeneous catalysis.

Example: $2SO_2 + O_2 \xrightarrow{NO(gas)} 2SO_3$

Catalysis in which the reactants and catalyst are in the same phase. ie., the same physical state is known as Heterogeneous catalysis.

Example: $2SO_2 + O_2 \xrightarrow{Pt(s)} 2SO_3$

(ii)

S.No.	Lyophilic colloids	Lyophobic colloids
1	Disperse phase has a high affinity, solvent attracting	Disperse phase has no affinity, solvent repelling.

2	They are easy to prepare just by mixing, shaking or heating substance with the dispersion medium.	They cannot be prepared directly. They require special methods to prepare and an electrolyte for stabilisation
3	They are reversible sols and can be reconstituted back by adding back the dispersion medium.	They are irreversible sols and once precipitated, they cannot be reconstituted back just by adding the dispersion medium.
4	Highly stable and do not coagulate easily on adding electrolytes.	They are unstable and can easily be coagulated by electrolytes.

Q16. The coagulation of 100 mL of a colloidal solution of gold is completely prevented by the addition of 0.25 g of starch to it before adding 1 mL of 10% of NaCl solution. Calculate the gold number of starch.

Answer.
Amount of starch added to 100 mL of gold sol required to prevent coagulation of 1 mL of 10% NaCl solution

=0.25 g
Or =250 mg

Starch required to be added to 10 mL of gold sol to completely prevent coagulation by 1mL of 10% NaCl solution-

$$= \frac{250}{100} \times 10 = 25mg$$

Therefore, Gold number of starch = 25.

Q17. A peptizing agent is added to convert precipitate into a colloidal solution. Explain.

Answer. Peptizing is a process of converting a freshly prepared precipitate into colloidal form by the addition of an electrolyte called a peptizing agent. The suitable ions from the peptising agent (electrolyte) are adsorbed by the particles of the precipitate giving it a positive or negative charge. The charged particle repel one another and break up the precipitate into smaller particles of the size of the colloid. Therefore, it results into the formation of colloids. For example, on treating a precipitate of iron (III) oxide with a small amount of $FeCl_3$ solution gives a reddish-brown coloured colloidal solution.

Q18. Differentiate between physical adsorption and chemical adsorption.

Answer. The difference between physical and chemical adsorption are as follows-

Physical Adsorption	Chemical Adsorption
The forces between the adsorbate molecules and	The forces between the adsorbate molecules and

the adsorbent are weak Vander Waals force	the adsorbent are strong chemical forces similar to chemical bonds.
Low enthalpy of adsorption of the order 20 to 40kJ mol^{-1}.	High enthalpy of adsorption of the order 80to 240 kJ mol^{-1}.
Usually occurs at low temperature and decreases with an increase in temperature.	It occurs at high temperatures and increases with the increase of temperature.
It is reversible in nature.	It is irreversible.
The extent of adsorption depends upon the ease of liquefaction of the gas. More easily liquefiable gases are adsorbed readily.	There is no correlation between the extent of adsorption and the ease of liquefaction of gas. It also depends on the nature of the gas. Gases which can react with the adsorbent show chemisorption.
It is not specific in nature i.e., all gases are adsorbed on the surface of a solid to some extent.	It is highly specific in nature and occurs only when there is a bond formation between adsorbent and adsorbate molecules.
No appreciable activation energy is needed.	High activation energy is sometimes needed.
The state of adsorbate is the same as in the bulk.	The state of adsorbate molecules may be different from that in the bulk.
It forms multimolecular layers.	It forms a mono-molecular layer.
The rate of adsorption increases with an increase in the pressure of adsorbate.	The rate of adsorption usually decreases as the pressure increases.

Q19. Explain how the phenomenon of adsorption finds application in each of the following processes:

(i) Production of vacuum
(ii) Heterogeneous catalysis
(iii) Froth floatation process

Answer.
(i) Production of vacuum: The remaining traces of air from a vessel evacuated by a vacuum pump can be adsorbed by charcoal. This creates a complete vacuum inside the vessel.

(ii) Heterogeneous catalysis: This occurs when the catalyst and reactants in a reaction are in different physical states (solid, liquid, or gas). In the presence of Pt, for example, sulphur dioxide is oxidised to sulphur trioxide.

$$2SO_2 + O_2 \xrightarrow{Pt} 2SO_3$$

This is an example of heterogeneous catalysis.

(iii) Froth floatation method: Concentrating a low grade sulphide ore involves separating it from silica and other earthy impurities with pine oil and a frothing agent. The sulphide particles are wetted by oil and rise upwards, where they are collected separately. Because the impurities are not wetted by the oil, they remain suspended.

Q20. What are multimolecular and macromolecular colloids? Give one example of each type. How associated colloids are different from these two types of colloids?

Answer. Multimolecular colloids- These are formed when a large number of atoms or smaller molecules of a substance aggregate together to form a species having the size in the colloidal range e.g., gold sol, sulphur sol (S_8).
Macromolecular colloids- These are obtained on the dissolution of a macromolecule in a suitable solvent to convert it into a colloidal range. These are quite stable and resemble true solutions in many respect. e.g, cellulose, protein etc.

Associated colloids behave as strong electrolytes at lower concentrations but at higher concentrations behave as colloids due to the formation of aggregates, called micelles. Colloidal behaviour is exhibited by them only above a particular temperature, called kraft's temperature and a particular concentration called, Critical Micelle Concentration (CMC). e.g., soaps and synthetic detergents.