Class 12 Surface Chemistry Important Questions with Answers

Short Answer Type Questions

Q1. Why is it important to have a clean surface in surface studies?

Answer:

It is essential to have a clean surface in surface studies as it facilitates the adsorption of desired species. If the air gases cover the surface, they will not be available for adsorption of desired gases. So, it is essential to have a clean surface in surface studies.

Q2. Why is chemisorption referred to as activated adsorption?

Answer:

Chemisorption is also called activated adsorption because the chemical bond between the reactants and the adsorbent is involved. This formation of chemical bonds requires high activation energy.

Q3. What type of solutions are formed by dissolving different concentrations of soap In water?

Answer:

Soap forms a standard electrolytic solution with water at lower concentrations. A colloidal solution is formed after a specific concentration called critical micelle concentration.

Q4. What happens when gelatin is mixed with gold sol?

Answer:

Gold sol is a solvent repelling sol, i.e., a lyophobic sol and unstable. The addition of gelatin stabilises the gold because gelatin forms a lyophilic sol and acts as a protective colloid.

Q5. Can it cause artificial rain by spraying silver iodide on the clouds? Comment.

Answer:

Yes, it is possible to cause artificial rain by spraying silver iodide on the clouds. Clouds are colloidal and carry charges. The spray of silver iodide, an electrolyte, results in coagulation leading to rain.

Q6. Gelatin, which is a peptide, is added in ice creams. What can be its role?

Answer:

Gelatin is an emulsifying agent in ice cream (an emulsion) and stabilises it. It is used to help the ice cream get a smooth texture by maintaining its consistency.

Q7. What is collodion?

Answer:

Collodion is a 4% solution of nitrocellulose in a mixture of alcohol and ether.

Q8. Why do we add alum to purify water?

Answer:

We add alum to purify water as alum coagulates the colloidal impurities present in water so that these impurities get settled down and removed by decantation or filtration. Thus, water gets purified by adding alum to water.

Q9. What happens when an electric field is applied to a colloidal solution?

Answer:

When an electric field is applied to a colloidal solution, the colloidal particles move towards the electrode. Positively charged particles move towards the cathode, while negatively charged particles move towards the anode.

Q10. What causes Brownian motion in colloidal solution?

Answer:

Brownian movement is caused due to the collision between the molecules of dispersion medium and chemical particles.

Q11. A colloid is formed by adding $FeCl_3$ in excess of hot water. What will happen if excess sodium chloride is added to this colloid?

Answer:

$FeCl_3$, when added into hot water, forms hydrated ferric oxide, which is a positively charged sol due to the absorption of Fe^{3+} ions. In NaCl, negatively charged chloride ions coagulate the positively charged hydrated ferric oxide. This results in the coagulation of sol.

Q12. How do emulsifying agents stabilise the emulsion?

Answer:

Emulsifiers, also known as emulsifying agents, stabilise an emulsion by reducing the interfacial tension or surface energy between two liquids forming the emulsion by forming a film between the medium and suspended particles.

Q13. Why are medicines more effective in a colloidal state?

Answer:

Medicines are more effective in colloidal because colloids have a larger surface area. Thus, they get easily assimilated, absorbed and digested.

Q14. Why does leather get hardened after tanning?

Answer:

Animal hairs are colloidal. When a hair, which has positively charged particles, is soaked in tannin, which contains negatively charged colloidal particles, mutual coagulation occurs, resulting in the hardening of leather.

Q15. How does the precipitation of colloidal smoke take place in the Cottrell precipitator?

Answer:

In the Cottrell precipitator, charged smoke particles pass through a chamber containing charges opposite the smoke particles. Smoke particles lose their charge on the plates and get precipitated.

Q16. How will you distinguish between the dispersed phase and dispersion medium in an emulsion?

Answer:

When a dispersion medium is added to an emulsion, it gets diluted to any extent. But on adding the dispersed phase, it forms a separate layer if added in excess. To distinguish between the dispersed

phase and dispersion medium, we increase the concentration of any dispersion medium or dispersed phase then notice the change.

Q17. Based on the Hardy-Schulze rule, explain why the coagulating power of phosphate is higher than chloride.

Answer:

According to Hardy-Schulze law, electrolyte coagulation properties depend on the valency of the coagulation ion. The higher the charge in flocculating ion, the smaller the amount of electrolyte required in the atmosphere. Phosphate ions have an -3 charge, while the chloride ion carries only a -1 charge. The coagulation capacity of phosphate is, therefore, higher than chloride.

Q18. Why does the bleeding stop by rubbing moist alum?

Answer:

Blood is a colloidal sol. When we rub the injured part with moist alum, blood coagulation occurs. Hence, the main reason is coagulation, which stops the bleeding

Q19. Why is $Fe(OH)_3$ colloid positively charged when prepared by adding $FeCl_3$ to hot water?

Answer:

When $FeCl_3$ is added to hot water, a hydrated ferric oxide is formed. This hydrated ferric oxide preferably adsorbs Fe^{3+} ions resulting in a positively-charged colloid.

Q20. Why do physisorption and chemisorption behave differently with a temperature rise?

Answer:

Physisorption involves weak van der Waals forces, which weaken with a temperature rise. Chemisorption involves the formation of chemical bonds involving activation energy and, like any other chemical reaction, is favoured by an increase in temperature.

Q21. What happens when dialysis Is prolonged?

Answer:

Due to excessive or prolonged dialysis, electrolyte traces that stabilise the colloids are removed entirely, making the colloids unstable. As a result, coagulation takes place.

Q22. Why does the white precipitate of silver halide become coloured in the presence of dye eosin?

Answer:

The white coloured precipitate of silver halide becomes coloured in the presence of dye eosin because dye eosin (coloured) gets adsorbed on the surface of silver halide precipitate.

Q23. What is the role of activated charcoal in gas masks used in coal dunes?

Answer:

Activated charcoal acts as an adsorbent that adsorbs other gases on its surface. Gas masks adsorb poisonous gases and hence prevent various occupational hazards.

Q24. A delta is formed at the seawater and river water meeting point. Why?

Answer:

River water is a colloidal clay solution, and seawater contains several electrolytes. When river water meets the seawater, the electrolytes present in the seawater coagulate the colloidal solution of clay, resulting in its deposition with the formation of the delta.

Q25. Give an example where physisorption changes to chemisorption with the temperature rise. Explain the reason for the change.

Answer:

The physisorption process, for example, that of H_2 on finely divided nickel, involves weak van der Waals forces. With the increase in temperature, hydrogen molecules dissociate into hydrogen atoms held on the surface by chemisorption.

Q26. Why is desorption important for a substance to act as a good catalyst?

Answer:

After the completion of the reaction between adsorbed reactants, the process of desorption is essential to remove products and further create space for the other reactant molecules to approach the surface and react. So, desorption is vital for a substance to act as a good catalyst.

Q27. What is the role of diffusion in heterogeneous catalysis?

Answer:

The gas molecules diffuse into the catalyst's surface and get absorbed. After the chemical change, the products diffuse away from the catalyst's surface, setting the surface free for other reactant molecules to adsorb on the surface and give the product.

Q28. How does a solid catalyst enhance the rate of the combination of gaseous molecules?

Answer:

Their concentration increases when the gaseous molecules get adsorbed on the solid catalyst. The more significant the concentration and closeness of the gaseous molecules, the higher the reaction rate will be.

Q29. Do the body's vital functions, such as digestion, get affected during fever? Explain your answer.

Answer:

The enzymes required for the digestion process are biological catalysts that are active only during the specific temperature range, and at elevated temperatures, the activity of enzymes is hampered. The optimum temperature for enzyme action is 298-310 K. Normally, during the fever, the body temperature is elevated. Hence, it is expected that it can hamper enzyme activity during fever, and therefore digestion can also get affected.

Matching Answer Type Questions

Note: Match the items of Column I and Column II in the following questions.

Q1. The method of formation of the solution is given in Column I. Match it with the type of solution given in Column II.

Column I	Column II
(i) Sulphur vapours passed through cold water	(a) Normal electrolyte solution
(ii) Soap mixed with water above critical micelle concentration	(b) Molecular colloids
(iii) White of egg whipped with water	(c) Associated colloid

(iv) Soap mixed with water below critical micelle concentration	(d) Macromolecular colloids

Answer:

(i) → (b)
(ii) → (c)
(iii) → (d)
(iv) → (a)

Q2. Match the statement given in Column I with the phenomenon given in Column II.

Column I	Column II
(i) Dispersion medium moves in an electric field	(a) Osmosis
(ii) Solvent molecules pass through semi-permeable membrane towards the solvent side	(b) Electrophoresis
(iii) Movement of charged colloidal particles under the influence of applied electric potential towards oppositely charged electrodes	(c) Electroosmosis
(iv) Solvent molecules pass through semi-permeable membranes towards solution side	(d) Reverse osmosis

Answer:

(i) → (c)
(ii) → (d)
(iii) → (b)
(iv) → (a)

Q3. Match the items given in Column I and Column II.

Column I	Column II
(i) Protective colloid	(a) $FeCl_3$ + NaOH

(ii) Liquid-liquid colloid	(b) Lyophilic colloids
(iii) Positively charged colloid	(c) Emulsion
(iv) Negatively charged colloid	(d) $FeCl_3$ + hot water

Answer:

(i) → (b)
(ii) → (c)
(iii) → (d)
(iv) → (a)

Q4. Match the types of colloidal systems given in Column I with the name given in Column II.

Column I	Column II
(i) Solid in liquid	(a) Foam
(ii) Liquid in solid	(b) Sol
(iii) Liquid in liquid	(c) Gel
(iv) Gas in liquid	(d) Emulsion

Answer:

(i) → (b)
(ii) → (c)
(iii) → (d)
(iv) → (a)

Q5. Match the items of Column I and Column II.

Column I	Column II
(i) Dialysis	(a) Cleansing action of soap

(ii) Peptisation	(b) Coagulation
(iii) Emulsification	(c) Colloidal sol formation
(iv) Electrophoresis	(d) Purification

Answer:

(i) → (d)
(ii) → (c)
(iii) → (a)
(iv) → (b)

Q6. Match the items of Column I and Column II.

Column I	Column II
(i) Butter	(a) dispersion of liquid in liquid
(ii) Pumice stone	(b) dispersion of solid in liquid
(iii) Milk	(c) dispersion of gas in solid
(iv) Paints	(d) dispersion of liquid in solid

Answer:

(i) → (d)
(ii) → (c)
(iii) → (a)
(iv) → (b)

Long Answer Type Questions

Q1. What is the role of adsorption in heterogeneous catalysis?

Answer:

Heterogeneous catalysis usually involves gaseous reactants and solid catalysts. Due to physisorption or chemisorption, the reactant molecules are adsorbed on the surface of the solid catalyst. This increases the reactant concentration on the catalyst surface and the reaction rate.

One of the reactant molecules fragments on the catalyst surface and produces active sites, which increase the reaction rate. The product molecules with no affinity for the adsorbent desorb and catalyst surface become accessible for adsorption of other catalyst molecules. This is under the adsorption theory.

Q2. What are the applications of adsorption in chemical analysis?

Answer:

There are numerous applications of adsorption in chemical analysis.

1. In preparing gas masks using activated charcoal to avoid poisonous gases like CO, CH_4 etc..
2. The Froth floatation method used for the concentration of sulphide ores is based on adsorption.
3. We can use silica gel to remove moisture and control humidity.
4. The ion exchange method used to soften water is based on adsorption.
5. Adsorption chromatography is used to purify and separate pigments, hormones etc.
6. Charcoal powder can remove coloured impurities from sugar.
7. Charcoal is used for making a high vacuum.
8. The cleaning action of soaps and detergents.
9. Formation of stable emulsions in cosmetics and syrups etc.
10. In heterogeneous catalysis.

Q3. What is the role of adsorption in the froth floatation process used, especially for the concentration of sulphide ores?

Answer:

In the froth flotation process, sulphide ore is shaken with pine oil and water; the ore particles are adsorbed on foam that floats, and the gangue particles settle down in the tank. Thus, we can understand the role of adsorption in the froth flotation process as follows.

(i) Adsorption of pine oil on sulphide ore particles.
(ii) Formation of emulsion takes place.
(iii) Froth is formed along with ore particles.
(iv) Mechanism of the functioning of shape-selective catalysis.
As sulphides are extracted using the froth flotation method, only sulphide ore particles will show this adsorbing tendency.

Q4. What do you understand by shape-selective catalysis? Why are zeolites good shape-selective catalysts?

Answer:

The catalytic reaction, which depends upon the pore structure of the catalyst and the size of the reactant and product molecules, is known as shape-selective catalysts.

Zeolites are good shape-selective catalysts because of their honeycomb-like structure.

(i) They are microporous aluminosilicates with Al-O-Si framework and general formula $M_{x/n}[(AlO_2)_x(SiO_2)_y]mH_2O$.
(ii) The reactions taking place in zeolites depend upon the size, shape of the reactant and product molecules and the pores and cavities of the zeolites.
(iii) Zeolites are widely used as catalysts in petrochemical industries to crack hydrocarbons and isomerisation. They are also used for removing the permanent hardness of the water.
(iv) Example: ZSM-5 is a catalyst used in the petroleum industry

$$Alcohols \overset{ZSM-5}{\rightarrow} Gasoline(petrol)$$