Chapter 5

Surface Chemistry

Solutions (Set-1)

Very Short Answer Type Questions :

1. Define alcosol.

Sol. If the dispersed phase is solid and dispersion medium is alcohol (liquid), the system is known as alcosol.

2. Give the main difference between sol and gel.

Sol. Sol contains solids dispersed in liquid whereas gel contains liquid dispersed in solid.

3. What is CMC?

Sol. CMC stands for critical micelle concentration and it is the minimum concentration above which the formation of micelles takes place.

4. How peptization is different from coagulations?

Sol. Peptization is the process of converting a precipitate into colloidal solution whereas coagulation is the process of settling of colloidal particles. Thus peptization is reverse of coagulation.

5. What do you mean by Helmholtz electrical double layer?

Sol. The combination of the two layers of opposite charges around the colloidal particle is called Helmhottz electrical double layer.

6. Is haemoglobin positively or negatively charged sol?

Sol. Positively charged sol.

7. What is electroosmosis?

Sol. The movement of dispersion medium in an electric field, when the dispersed phase particles are prevented from moving, is called electro-osmosis.

8. What do you mean by flocculation value?

Sol. The minimum concentration of an electrolyte in millimoles per litre required to cause precipitation of a sol in two hours is called coagulating or flocculation value.

9. What is the role of emulsifier in forming emulsion?

Sol. Emulsifiers are added for the stabilisation of emulsion. Their role is to form an interfacial film between suspended particles and the medium.

10. What is the range of size of colloidal particles?

Sol. The size of the colloidal particles range from 1 to 1000 nm.

Short Answer Type Questions :

11. Does an adsorbent show any preference for a particular gas in chemisorption and in physisorption? Give reason for each case.

Sol. In the case of chemisorption an adsorbent prefers a gas with which it can form chemical bond easily. But in the case of physisorption no such preference is observed as it occurs due to weak van der Waals forces.

12. Why does Freundlich isotherm fail at high pressure?

Sol. According to Freundlich adsorption isotherm $\frac{x}{m} = kp^{\frac{1}{n}}$ but at high pressure $\frac{x}{m}$ is found to be independent of pressure because in this condition isotherms always seem to approach saturation.

13. Differentiate physisorption and chemisorption.

Sol. Refer to text

14. Discuss important features of solid catalysts.

Sol. There are two important features of solid catalysts.

(i) Activity $\rightarrow$ Activity is the ability of catalyst to accelerate chemical reaction.

$$H_2 + \frac{1}{2}O_2 \longrightarrow \text{No reaction}$$

$$H_2 + \frac{1}{2}O_2 \xrightarrow{Pt(s)} H_2O$$

(ii) Selectivity $\rightarrow$ Selectivity is the ability of a catalyst to direct a reaction to yield a particular product. The action of a catalyst is highly specific or selective in nature.

$$CO_2(g) + H_2(g) \xrightarrow{\text{Ni}} CH_4(g) + H_2O(g)$$

$$CO_2(g) + H_2(g) \xrightarrow[Cr_2O_3]{Cu/ZnO} CH_3OH(g)$$

$$CO_2(g) + H_2(g) \xrightarrow{Cu} HCHO(g)$$

15. Explain shape-selective catalysis by taking example of zeolites.

Sol. The reactions which depend upon the size and shape of reactant and product molecules as well as upon the pores and cavities of catalysts are called shape-selective catalysis. Zeolites are shape-selective catalysts. These have honeycomb-like structures. The reaction catalysed by zeolites proceeds in specific manner depending upon the size of the reactants and the products molecules compared to that of the pores of zeolites.

Zeolites are used in petrochemical industries for cracking of hydrocarbons and for isomerization. An important zeolite catalyst is ZSM-5 which converts alcohols directly into gasoline by dehydration.

16. Explain important characteristics of enzyme catalysis.

Sol. Important characteristics of enzyme catalysis are

(i) Highly specific in nature.

(ii) Highly active under optimum temperature.

(iii) In presence of co-enzymes activity gets increased.

(iv) Being colloidal in nature, efficiencies decreases in presence of electrolytes.

(v) Favourable range of pH is 5 to 7.

17. State Hardy Schulze rule. Give one example.

Sol. According to Hardy Schulze rule, the greater the valence of the flocculating ion added, the greater is its power to cause precipitation.

For example, flocculating power of PO_4^{3-} is greater than that of Cl^-.

18. What are emulsions? Write the use of emulsification.

Sol. The colloidal system in which both the dispersed phase and dispersion medium are liquid, is known as emulsion.

Emulsification is used to stabilize emulsions.

19. If in two beakers 'A' and 'B' each containing ferric hydroxide sol; Na_3PO_4 and KCl are added respectively what will you observe?

Sol. Ferric hydroxide sol is positively charged sol and hence, coagulated by adding negatively charged ions PO_4^{3-} and Cl^-.

According to Hardy-Schulze law coagulating action of PO_4^{3-} is greater than Cl^- so in beaker 'A' coagulation will take place first.

20. How do lyophilic colloids protect lyophobic colloids?

Sol. When a lyophilic sol is added to the lyophobic sol, the lyophilic particles form a layer around a lyophobic particles and thus lyophilic colloids protect lyophobic colloids from electrolyte and so from being coagulated.

21. Out of NaCl, K_2SO_4, $CaCO_3$ and Na_3PO_4 which one will be more effective for coagulation of $CrO_3 \cdot xH_2O$ and why?

Sol. Na_3PO_4 will be more effective because $CrO_3 \cdot xH_2O$ is a positively charged sol and according to Hardy. Schulze rule, greater the charge on the oppositely charged ion of the electrolyte added, more effective it is for coagulation.

22. How are photographic plates prepared?

Sol. Photographic plates are prepared by coating an emulsion of light-sensitive silver bromide in gelatin over glass plates or celluloid films.

23. What do you mean by coagulating ion? Mention its function.

Sol. The ion responsible for neutralisation of charge on the colloidal particles is called coagulating ion.

The function of coagulating ions is to coagulate colloid. Actually when excess of electrolyte is added the colloidal particles interact with ions of electrolyte *i.e.*, coagulating ions. These coagulating ions carry opposite charge to that present on colloidal particles and this causes neutralisation and is followed by coagulation.

24. Discuss hydrophobic and hydrophilic parts of stearate ion.

Sol. Stearate ion is a major component of soap. When sodium stearate $CH_3(CH_2)_{16}COO^-Na^+$ is dissolved in water, it dissociates to stearate ion, $CH_3(CH_2)_6COO^-$ and Na^+.

In stearate ions, the hydrocarbon part is water repelling and so it is hydrophobic whereas second part COO– is water loving and hence, it is hydrophilic. The hydrophobic part is also called as non-polar tail and the hydrophilic part is called as polar ionic head. These can be represented as

25. In case of chemisorption, why does adsorption first increase and then decrease?

Sol. In chemisorption, adsorption first increases due to the fact that heat supplied acts as an activation energy and as it is exothermic in nature decreases afterwards.

26. Why hard water consumes more soap?

Sol. When soap is dissolved in hard water, insoluble scum $(RCOO)_2Ca$ formed and thus micelle formation starts only when whole of Ca^{2+} or Mg^{2+} ions are precipitated out by soap. Hence, hard water consumes more soap.

27. Explain electrical disintegration method for the preparation of colloids.

Sol. Electrical disintergration method is also known as Bredig's Arc method. In this method, an arc is produced between rods of metals immersed in water (dispersion medium) by connecting the rods to high tension battery. High temperature of the arc vapourises some of the metals which condenses on cooling to form particles of colloidal size. KOH is added to stabilize the sol. Generally Ag, Au, Pt, Cu sols are prepared by this method.

28. Define the following.

(a) Enthalpy of adsorption

(b) Demulsification

(c) Cataphoresis

Sol. **(a) Enthalpy of adsorption :** The enthalpy change when one mole of an adsorbate is adsorbed at the surface of adsorbent is called enthalpy of adsorption.

(b) Demulsification : The separation of an emulsion into its components is called demulsification.

(c) Cataphoresis : Cataphoresis is the phenomenon of movement of colloidal particles under electric field towards cathode only.

29. Give reason for the following.

(a) Delta is formed when river meets the ocean

(b) Clear sky appears blue in clour

(c) Peptizing agent is added to convert precipitate into colloidal solution

Sol. (a) Delta is formed when river meets the ocean because river water is a colloidal solution of clay and ocean water contains a number of electrolytes. These electrolytes coagulate the colloidal solution of clay resulting in its deposition and as a result delta is formed.

(b) Clear sky appears blue in colour because dust particles present in atmosphere scatter blue light which reaches our eyes.

(c) When peptizing agent (electrolyte) is added to freshly prepared precipitate, the precipitate adsorbs one of the ions of the electrolyte on its surface. Thus, positive or negative charge develops on precipitates and these electrically charged particles then split from the precipitate as colloidal particles.

30. Medicines are more effective in colloidal state. Justify the statement.

Sol. The particles in colloidal state have larger surface area and hence show high tendency for adsorption. Due to this reason medicines are more effective in colloidal state. So given statement is correct.

Long Answer Type Questions :

31. How is validity of Freundlich isotherm established?

Sol. Freundlich adsorption isotherm is expressed as

$$\frac{x}{m} = KP^{\frac{1}{n}}$$

Taking logarithm, we have

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

This is an equation of straight line. Now validity of Freundlich isotherm can be established by plotting $\log\frac{x}{m}$ against log P. If it comes to be a straight line, the isotherm is valid, otherwise not.

32. What is adsorption? Explain its type with example.

Sol. Refer to text

33. Explain characteristics of chemisorption.

Sol. Refer to text

34. What do you mean by catalysts and catalysis? Explain homogeneous and heterogeneous catalysis.

Sol. Refer to text

35. Explain the modern adsorption theory.

Sol. Refer to text

36. Catalysts play important role in industry. Justify the statement with example.

Sol. It is correct to say that catalysts play important role in industry and it can be justified by taking examples of synthesis of ammonia and sulphuric acid.

For the manufacture of ammonia Haber's process is used and iron acts as catalyst.

In Contact process for the manufacture of sulphuric acid platinised asbestos or V_2O_5 is used as catalyst.

37. Explain properties of colloidal solution.

Sol. Refer to text.

38. What is Brownian movement? Why it happens and on what factors it depends?

Sol. The zig-zag motion of colloidal particles is called Brownian movement. It happens due to the unbalanced bombardment of the particles by the molecules of the dispersion medium.

Brownian movement depends on two factors.

(i) Size of particles : Smaller the size faster is the motion.

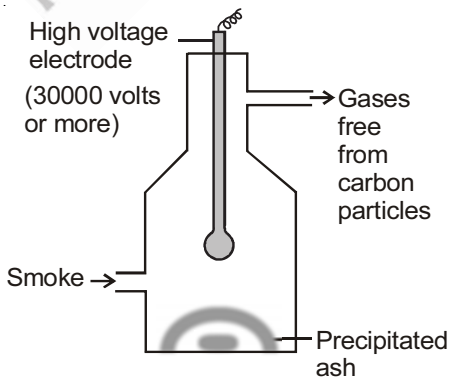
(ii) Viscosity of solution : Lesser the viscosity faster is the motion.

39. "Colloidal particles always carry electric charge". Justify the statement.

Sol. 'Colloidal particles always carry electric charge' is a correct statement. The existence of charge on colloidal particles is confirmed by phenomenon electrophoresis. The nature of charge is the same on all the particles in a given colloidal solution. The charge may be either positive or negative. The charge is due to electron capture by sol particles, due to preferential adsorption of ions from solution and/or due to formulation of electrical double layer.

40. Explain working of cottrell smoke precipitator.

Sol. Cottrell smoke precipitator consists of a chamber containing plates (high voltage electrode). Smoke is a colloidal solution hence, particles carry some charge. Before smoke comes out from chimney it is led through cottrell smoke precipitator. Here smoke particles come in contact with oppositively charged plates and lose their charge and finally get precipitated. Thus smoke particles like carbon, arsenic compounds, dust etc. settle down on the floor of the chamber.



Cottrell smoke precipitator

41. Discuss the nature of sol obtained by adding $FeCl_3$ to flask 'A' (containing excess of hot water) and to flask 'B' containing (NaOH sol).

Sol. Flask 'A' contains excess of hot water so on adding $FeCl_3$ adsorption of Fe^{3+} ions takes place. And thus a positively charged hydrated ferric oxide is formed.

$Fe_2O_3 \cdot xH_2O/Fe^{3+}$

Positively charged sol

Flask 'B' contains NaOH sol and when $FeCl_3$ is added a negatively charged sol is obtained due to adsorption of OH^- ions.

$Fe_2O_3 \cdot xH_2O/OH^-$

Negatively charged sol

42. On what factors colour of colloidal solution depends?

Sol. Colour of colloidal solutions depends upon the following factors :

(i) Wavelength of light scattered by dispersed particles

(ii) Size of the particles

(iii) Nature of the particles

(iv) The manner in which the observer receives the light.

43. Explain the following.

(a) Colloidal gold is used for intramuscular injection.

(b) A freshly formed precipitate of $Fe(OH)_3$ can be converted to a colloidal solution by shaking it with a small quantity of $FeCl_3$.

(c) Ferric hydroxide solution is more readily coagulated by Na_3PO_4 in comparison to KCl.

Sol. (a) Colloidal gold is used for intramuscular injection because in this state it has large surface area and so may be easily assimilated.

(b) When small quantity of $FeCl_3$ is added to freshly formed precipitate of $Fe(OH)_3$, it gets easily dispersed. Here $FeCl_3$ acts as peptizing agent which causes the development of positive charge on precipitate of $Fe(OH)_3$. The charged particles finally dissociates from precipitate and form colloid.

(c) Ferric hydroxide solution is readily coagulated by Na_3PO_4 in comparison to KCl because PO_4^{3-} has more valence than Cl^-.

44. What are colloids? Classify colloids on the basis of type of particles of the dispersed phase.

Sol. Refer to text

45. Explain the following

(a) Poisons

(b) Tanning

(c) Argyrol

(d) Peptization

Sol. **(a) Poisons :** The substances that decrease the activity of a catalyst are called poisons

(b) Tanning : Tanning is the process of hardening of leather. In this process animal hide, having positively charged particles, is soaked in tannin, having negatively charged particles. So mutual coagulation takes place and leather becomes hard.

(c) Argyrol : Argyrol is a silver sol it is used as on eye lotion.

(d) Peptization : The process of conversion of a freshly prepared precipitate into a colloidal solution by adding a suitable electrolyte is called peptization.

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Chapter 5

Surface Chemistry

Solutions (Set-2)

[Adsorption]

1. Which gas is adsorbed easily at solid surface?

   (1) SO_2 (2) H_2 (3) O_2 (4) N_2

Sol. Answer (1)

SO_2 gas has higher critical temperature due to which it can easily be liquefied and easily liquefiable gases can easily be adsorbed.

2. Which is an incorrect statement?

   (1) Heat of physical adsorption is 20–40 kJ mol^{-1}

   (2) Chemical adsorption is specific in nature

   (3) Physical adsorption is reversible

   (4) Physical adsorption takes place at very high temperature

Sol. Answer (4)

Physical adsorption is an endothermic process and low temperature favours the endothermic process. The variation of physical adsorption decreases with the increase in temperature.

3. Rate of adsorption of gas is greater when pressure increased

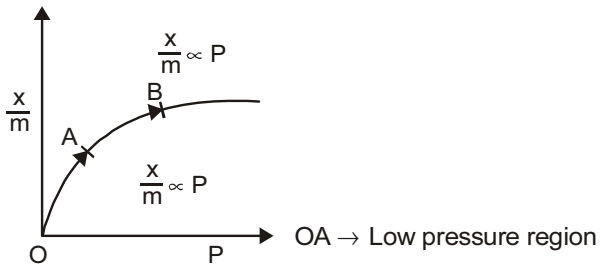
   (1) For low range of pressure

   (2) For high range of pressure

   (3) For moderate range of pressure

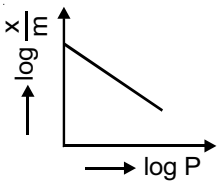
   (4) For every range of pressure

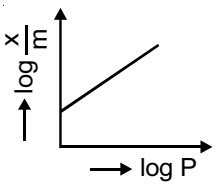
Sol. Answer (1)

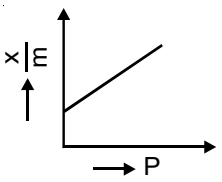


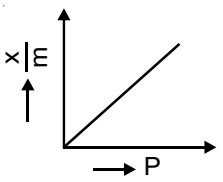
It is clear from the above graph that adsorption of gases is greater when pressure is increased in low range of pressure.

4. For Freundlich adsorption isotherm which is a correct graph?

(1) 

(2) 

(3) 

(4) 

Sol. Answer (2)

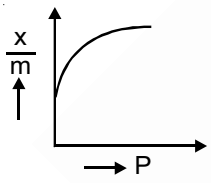
The equation of adsorption isotherm is $\frac{x}{m} = KP^{1/n}$

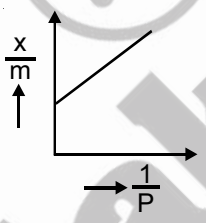
Taking log on both sides, we get,

$\log\left(\frac{x}{m}\right) = \log K + \frac{1}{n}\log P.$

$\therefore$ Graph between $\log\left(\frac{x}{m}\right)$ and log P will be straight line having $m = \frac{1}{n}$ and y intercept of log K.

5. For Langmuir adsorption isotherm, which is correct?

(1) 

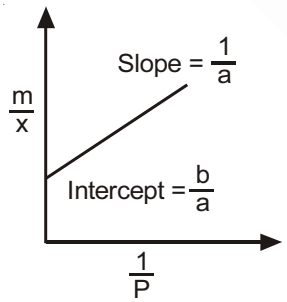
(2) 

(3) 

(4) None of these

Sol. Answer (4)

None of graph will be indicating Langmuir adsorption isotherms. Graph is



6. Which is not an application of adsorption?

(1) Purification of water by its exchange
(2) To create vacuum
(3) Chromatographic analysis
(4) Artificial rain

Sol. Answer (1)

In gas mask no adsorption takes place.

[Enzyme and Catalyst]

7. At a certain value of pH, amino acid does not migrate towards any of the electrode under the influence of electric field. This pH is called

(1) Neutralisation point (2) End point (3) Isoelectric point (4) All of these

Sol. Answer (3)

Under the influence of electric field, amino acid does not migrate towards any of the electrode and it contains the +ve and –ve ion end is called as isoelectric point.

8. Which catalyst is used in polymerisation of ethene?

(1) Pt (2) Ni (3) Zeolites (4) Ziegler–Natta catalyst

Sol. Answer (4)

The reaction is

$$\underset{\text{Ethene}}{n(CH_2 = CH_2)} \xrightarrow[+\ TiCl_4]{(C_2H_5)_3\ Al} \underset{\text{Polythene}}{-(CH_2 - CH_2)-_n}$$

The reaction involves Zieglar-Natta Catalyst which is basically a mixture of $(C_2H_5)_3Al + TiCl_4$.

9. Which is correctly matched?

(1) ZSM–5 – $H_x[(AlO_2)_x(SiO_2)_{96-x}].16H_2O$

(2) Gemelinite – $Na_2Ca(AlO)_2(SiO_2)_4.\ 6H_2O$

(3) Fauzasite (natural) – $Na_{56}[(Al_2O)_{56}(SiO_2)_{136}]\ .\ 250H_2O$

(4) All of these

Sol. Answer (4)

All the options are matching with the compounds given.

[Colloidal Solution]

10. Which is incorrectly matched?

(1) Anionic surfactant – $C_{17}H_{35}COONa$ (2) Cationic surfactant – $C_{16}H_{33}$–C$_6$H$_4$–$\overset{+}{N}H_3 - Cl^-$

(3) Erionite – $Na_2\ K_2CaMg(AlO_2)_2(SiO_2)_2.6H_2O$ (4) None of these

Sol. Answer (4)

The surfactant and erionite formula are correct.

11. Fixed parts of a colloidal solution of AgI are respectively $[AgI]I^-$ and $[AgI]Ag^+$ in presence of

(1) KI and $AgNO_3$ (2) $AgNO_3$ and KI (3) KI and KIO_3 (4) $AgNO_3$ and $Ba(NO_3)_2$

Sol. Answer (1)

$AgI + KI \rightarrow [AgI]\ I^- + K^+$

$AgI + AgNO_3 \rightarrow [AgI]\ Ag^+ + NO_3^-$

Fixed part is $[AgI]\ I^-$ and $[AgI]Ag^+$

12. 1 mol of $[AgI]Ag^+$ sol is coagulated by

(1) 100 ml 1 M K_2SO_4 (2) Fe^{+3} (3) 1 mol of Na^+ (4) None of these

Sol. Answer (4)

$SO_4^{2-} + 2[AgI]\ Ag^+ \rightarrow Ag_2SO_4 + 2\ AgI$

$2[AgI]\ Ag^+ \equiv K_2SO_4$; 1 mole $[AgI]Ag^+ \equiv \frac{1}{2}$ mol. K_2SO_4

13. Which method of preparation of sol involves chemical reaction?

(1) Hydrolysis (2) Mechanical dispersion

(3) Exchange of solvent (4) All of these

Sol. Answer (1)

Sols are prepared by hydrolysis. e.g. $FeCl_3 + H_2O \rightarrow$ Fe sol. $(OH)_3 + HCl$.

14. As_2S_3 colloidal solution obtained when As_2O_3 is saturated with H_2S. Which is the diffused part?

(1) As^{+3} (2) S^{-2} (3) H^+ (4) O^{-2}

Sol. Answer (2)

The reaction of As_2O_3 with H_2S forms As_2S_3, that is the colloidal obtained

$As_2O_3 + H_2S \rightarrow As_2S_3 + H_2O$

The diffused part is S^{2-}.

15. Gold number of starch is 25. How much of it is required to prevent coagulation of 100 ml of gold sol adding 1 ml of 10% NaCl solution?

(1) 25 mg (2) 250 mg (3) 2.5 mg (4) 0.250 mg

Sol. Answer (2)

It is clear from the very basic definition of gold number, that 250 mg is required to prevent coagulation of 100 ml of gold sol on adding 1 ml of 10% NaCl solution.

16. How many layers are formed in chemical adsorption?

(1) Zero (2) One

(3) Two (4) Very large in number

Sol. Answer (2)

Chemical adsorption is monolayered.

17. H_2 gas is adsorbed on a metal surface like platinum. This follow

(1) First order reaction (2) Second order reaction (3) Third order reaction (4) Zero order reaction

Sol. Answer (4)

Adsorption of H_2 on metal is zero order.

18. Which of the following occurs at low temperature?

(1) Physical adsorption (2) Chemical adsorption (3) Chemisorption (4) All of these

Sol. Answer (1)

At low temperature physisorption takes place.

19. A graph of adsorption isobar on chemisorption shows that adsorption

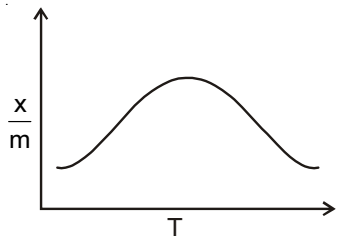
(1) First decreases with temperature and then increases

(2) First increases with temperature then decreases

(3) Increases with temperature

(4) Decreases with temperature

Sol. Answer (2)



20. Adsorption of gases on solid is accompanied by

(1) Increase in enthalpy (2) Increase in entropy

(3) Decrease in entropy (4) Increase in free energy

Sol. Answer (3)

$H_2 + \text{Solid} \rightleftharpoons \text{Adsorption} \qquad \Delta S = -ve$

21. In the Freundlich adsorption equation $\frac{x}{m} = kP^{1/n}$, the value of n is

(1) Always greater than one (2) Always smaller than one

(3) Always equal to one (4) Only fractional

Sol. Answer (1)

$n > 1$

22. Which of the following statements about physical adsorption is not correct?

(1) It is usually monolayer

(2) It is reversible in nature

(3) It involves van der Waal attraction between adsorbent and adsorbate

(4) It involves small value of heat of adsorption

Sol. Answer (1)

Physical adsorption is multilayered.

23. Which of the following statements regarding adsorption is not correct?

(1) Extent of adsorption of gases on charcoal increase with increase in pressure of the gas

(2) Extent of adsorption is independent of temperature

(3) Extent of adsorption by a given mass of adsorbent has an upper limit

(4) Extent of adsorption is dependent on the nature of adsorbate and adsorbent

Sol. Answer (2)

Extent of adsorption is dependent on temperature.

24. Volume of gases H_2, CH_4, CO_2 and NH_3 adsorbed by 1 g of charcoal at 288 K are in the order

(1) $CO_2 > NH_3 > H_2 > CH_4$ (2) $NH_3 > CO_2 > CH_4 > H_2$

(3) $CO_2 > CH_4 > NH_3 > H_2$ (4) $CH_4 > CO_2 > NH_3 > H_2$

Sol. Answer (2)

$NH_3 > CO_2 > CH_4 > H_2$

25. Which of the following is/are characteristics of chemisorption?

(1) It is irreversible in nature (2) It mainly forms unimolecular layer

(3) It is exothermic (4) All of these

Sol. Answer (4)

Chemisorption is irreversible.

26. Stability of solution not to sattle like suspension can be explained by

(1) Tyndall effect (2) Dialysis (3) Electrophoresis (4) Brownian motion

Sol. Answer (4)

Particle of solution are present in zig-zag motion.

27. Which of the following is/are correct statements?

(1) A colloidal solution is stable and particles do not settle down

(2) Milk is an example of water in oil type emulsion

(3) The formation of micelles takes place below CMC

(4) All of these

Sol. Answer (1)

Particles do not settle down.

28. A small quantity of $FeCl_3$ is added to freshly prepared $Fe(OH)_3$ precipitate, when a reddish brown positively charged solution is formed. This phenomenon is called

(1) Cataphoresis (2) Dialysis (3) Emulsification (4) Peptization

Sol. Answer (4)

Conversion of freshly prepared $Fe(OH)_3$ precipitate into colloidal.

29. Which of the following is macromolecular sol?

(1) Gold (2) Cellulose (3) Soap (4) Synthetic detergent

Sol. Answer (2)

Cellulose is macromolecular sol.

30. Milk is

(1) Fat dispersed in water (2) Water dispersed in fat

(3) Fat and water dispersed in an oil (4) A homogenous solution of fat and water

Sol. Answer (1)

Milk is example of fat dispersed in water.

31. Addition of soap in water

(1) Increases its surface tension till CMC

(2) Decreases its surface tension till CMC

(3) Increases at low concentration and decreases at high concentration

(4) Decreases at low concentration and increases at high concentration

Sol. Answer (2)

Soap reduce the surface tension.

32. On addition of 1 mL of solution of 10% NaCl to 10 mL of red gold sol in presence of 0.025 g of starch, the coagulation is just prevented. The gold number of starch is

(1) 0.025 (2) 0.25 (3) 2.5 (4) 25

Sol. Answer (4)

The amount of starch (in mg) that prevent the coagulation of 10 mL gold against 1 mL of 10% NaCl solution is gold number. So, gold number of starch is 25.

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