Chapter 5

Surface Chemistry

Solutions (Set-1)

SECTION - A

School/Board Exam. Type Questions

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.

$$CO_2(g) + H_2(g) \xrightarrow{\begin{matrix}Ni\\ Cu/ZnO\\ Cr_2O_3\\ Cu\end{matrix}} \begin{matrix}CH_4(g) + H_2O(g)\\ CH_3OH(g)\\ \\ HCHO(g)\end{matrix}$$

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.

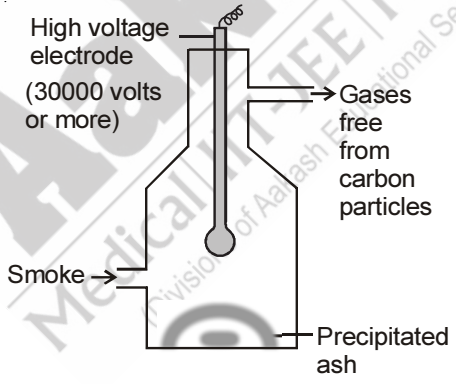
(ii) Viscosity of solution : Lesser the viscosity faster is the motion.

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.

SECTION - B

Model Test Paper

Very Short Answer Type Questions :

1. What is autocatalysis?

Sol. The phenomenon in which a chemical reaction is catalysed by product of the reaction is known as autocatalysis.

2. What is the use of ZSM-5?

Sol. ZSM-5 is used to convert alcohol to gasoline (petrol).

3. Why is gas in gas system not considered as colloid?

Sol. A gas in gas system is always homogeneous mixture so never form colloid.

4. Give an example of each W/O and O/W types of emulsions.

Sol. Suitable example such as for

W/O type emulsion $\rightarrow$ Butter, cream

O/W type emulsion $\rightarrow$ Milk, vanishing cream

5. What is Kraft temperature?

Sol. The minimum temperature above which the formation of micelles takes place is known as Kraft temperature.

6. Why do colloidal solutions exhibit tyndall effect?

Sol. Colloidal solutions exhibit tyndall effect because the size of colloidal particles lies in that range which can scatter light.

7. Define emulsification.

Sol. The process of making an emulsion is known as emulsification. In this process the mixture of two liquids is shaked vigorously and then emulsifier is added to stabilise the emulsion.

Short Answer Type Questions :

8. What is the effect of temperature on the activity of catalysts?

Sol. The activity of a catalyst is maximum at a particular temperature that is known as optimum temperature. On either side of the optimum temperature its activity decreases.

9. Why does a colloidal solution get coagulated by addition of an electrolyte?

Sol. A colloidal solution gets coagulated by addition of an electrolyte because charge of colloidal particles get neutralised by oppositely charged ions.

10. Define:

(a) CMC

(b) Argyrol

Sol. **(a) CMC :** CMC (Critical micelle concentration) is the minimum concentration above which formation of micelle takes place.

(b) Argyrol : Argyrol is a silver sol and used as an eye lotion.

11. What is coagulation? Explain coagulation value and coagulation power.

Sol. The process of settling down of colloidal particles is called coagulation.

Coagulation value of an electrolyte is its minimum concentration in millimoles per litre required to cause precipitation of a sol in two hours.

The reciprocal of coagulation value is called as coagulation power

12. How are photographic plates prepared?

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

13. Give two uses of emulsions.

Sol. Two uses of emulsions are

(i) In cleansing action of soaps

(ii) In preparation of photographic plates, emulsion of AgBr in gelatin is coated over glass plates.

14. How do the free valencies present on the surface of catalyst help in catalysis?

Sol. Free valencies present on the surface of solid catalyst combine temporarily with reacting molecules causing a strain on the surface of catalyst. And hence reactivity of reactants is increased.

15. Give three differences between physisorption and chemisorption.

Sol.

S. No.	Physisorption	Chemisorption
1.	It arises because of weak van der Waals forces.	It is caused by chemical bond formation.
2.	It involves a low enthalpy of adsorption.	It involves a high enthalpy of adsorption.
3.	It is not specific in nature.	It is highly specific in nature.
4.	It is reversible in nature.	It is irreversible.
5.	It forms multi molecular layer.	It forms monomolecular layer.

Short Answer Type Questions :

16. Give reason for

(a) $Fe(OH)_3$ coagulates on addition of K_2SO_4

(b) Physisorption decreases with increase in temperature

(c) A finely divided substance is more effective as an adsorbent

Sol. (a) $Fe(OH)_3$ coagulates on addition of K_2SO_4 because charge of colloidal particles get neutralised by SO_4^{2-}.

(b) Physisorption is exothermic process hence decreases with increase in temperature.

(c) As finely divided substance has larger surface area hence is more effective as an adsorbent.

17. How are associated colloids different from multimolecular and macromolecular colloids?

Sol. Multi molecular colloids are formed by aggregation of small molecules whereas macromolecular colloids are formed by molecule having the size of colloidal range.

A gold sol is example of multimolecular colloid. Starch, cellulose etc. are example of macromolecular colloids.

Associated colloids are different from these two types as these are formed by such electrolytes which above a particular concentration (CMC) associate together to form ionic micelles *e.g.*, soaps.

18. What do you mean by colloidal solution? How can a colloidal solution and a true solution of the same colour be distinguished from each other?

Sol. Colloidal solution is a heterogeneous system and consists of two phases-dispersed phase and dispersion medium. The size of the particles ranges from 1 nm to 1000 nm.

A colloidal solution and a true solution of the same colour can be distinguished from each other by passing beam of light through both solutions. a colloidal solution will show tyndall effect whereas true solution will not.

19. Define:

(a) Peptization

(b) Dialysis

(c) Electrophoresis

Sol. For definition see text.

20. Discuss characteristics of catalysis.

Sol. Refer to text.

Long Answer Type Questions :

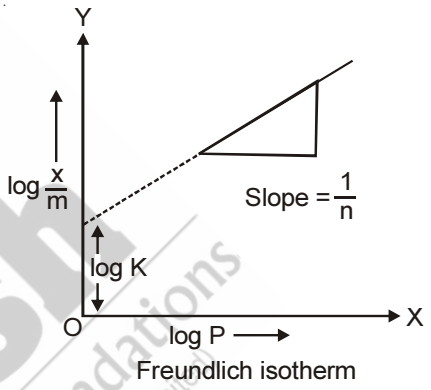
21. What do you mean by adsorption isotherm? Describe Freundlich adsorption isotherm.

Sol. The curve showing the variation in the amount of the gas by per gram of adsorbent $\left(\frac{x}{m}\right)$ with pressure at constant temperature is termed as an adsorption isotherm.

Freundlich adsorption isotherm can be expressed as

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

Where x is mass of the gas adsorbed on mass 'm' of the adsorbent at pressure P, k and n are constants which depend upon the nature of adsorbent and the gas at a particular temperature



Freundlich isotherm

By taking logarithm Freundlich adsorption isotherm is written as

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

The plot of $\log\frac{x}{m}$ versus log P comes to be a straight line which confirms the validity of Freundlich isotherm.

This isotherm explains the behaviour of adsorption approximately and the factor $\frac{1}{n}$ can have values between 0 and 1. Two extreme cases are:

Case I: When $\frac{1}{n} = 0$, $\frac{x}{m} = \text{constant}$, it means adsorption is independent of pressure.

Case II: When $\frac{1}{n} = 1$, $\frac{x}{m} = KP$ or $\frac{x}{m} \propto P$, it means adsorption varies directly as pressure.

Freundlich isotherm fails at high pressure as experimental isotherms always seems to approach saturation at high pressure.

22. Give reasons for the following :

(a) Cottrell precipitator is used in chimney

(b) Bleeding from a fresh cut can be stopped by applying alum

(c) Lyophilic sols are called reversible colloids

(d) Catalyst increases the reaction velocity

(e) Transition elements are good catalyst

Sol. (a) The solid particles present in smoke get settled before coming out from chimney with the help of cottrell precipitator.

(b) By applying alum on fresh cut bleeding stops due to coagulation of blood which forms a clot.

(c) Lyophilic sols are called reversible colloids because if the dispersion medium is separated from the dispersed phase, the lyophilic sol can be constituted by easily remaining with the dispersion medium.

(d) A catalyst reduces the time taken in the establishment of equilibrium and hence, increases the reaction rate.

(e) Transition elements have large number of unpaired electrons, so chemical adsorption occurs readily. Hence, these are good catalysis.

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Solutions (Set-2)

Objective Type Questions

(Adsorption, Catalysis)

1. Which one of the following is a property of physisorption?

   (1) Non-specific nature

   (2) High specificity

   (3) Irreversibility

   (4) Single layer adsorption

Sol. Answer (1)

Physisorption is non-specific, reversible, multilayered.

2. Which of the following is not a characteristic of chemisorption?

   (1) Irreversible nature

   (2) ΔH is of the order of 500 J

   (3) Specific in nature

   (4) Increases with increase of surface area

Sol. Answer (2)

ΔH of chemisorption is of the order of 80 – 240 kJ.

3. Freundlich adsorption isotherm gives a straight line on plotting

   (1) x/m versus P

   (2) log x/m versus P

   (3) log x/m versus log P

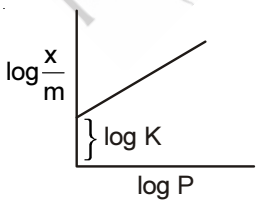
   (4) x/m versus 1/P

Sol. Answer (3)

$\frac{x}{m} \propto P^{1/n}$ or $\frac{x}{m} = kP^{1/n}$

take log on both side

$$\underbrace{\log\frac{x}{m}}_{y} = \underbrace{\frac{1}{n}}_{m}\underbrace{\log P}_{x} + \underbrace{\log k}_{c}$$



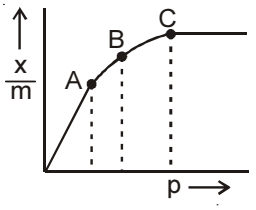
4. The process of froth floatation and chromatography are based on

   (1) Emulsification (2) Adsorption (3) Absorption (4) Both (2) & (3)

Sol. Answer (2)

Fact.

5. The graph plotted against adsorption versus pressure P at constant temperature, the Freundlich equation at points A, B, C respectively are (if n > 1)



(1) $\frac{x}{m} = kp, \frac{x}{m} = kp^{1/n}, \frac{x}{m} = kp^0$

(2) $\frac{x}{m} = kp, \frac{x}{m} = kp^n, \frac{x}{m} = kp^{1/n}$

(3) $\frac{x}{m} = kp^{1/n}, \frac{x}{m} = kp^n, \frac{x}{m} = kp^{1/n}$

(4) $\frac{x}{m} = kp^\infty, \frac{x}{m} = kp^{1/n}, \frac{x}{m} = kp^n$

Sol. Answer (1)

A, linear $\Rightarrow \frac{x}{m} = kp$ [n = 1]

B, curve $\Rightarrow \frac{x}{m} = kp^{1/n}$ [$n \neq 1$]

C $\Rightarrow \frac{x}{m}$ is independent of pressure.

$\Rightarrow \frac{x}{m} = kp^0 = k$ [$n \to \infty$]

6. The intercept on Y-axis in the graph of $\log \frac{x}{m}$ versus log P gives

(1) $\frac{1}{n}$ (n > 1) (2) k (3) log k (4) Temperature

Sol. Answer (3)

$\frac{x}{m} = kp^{1/n}$

$\underbrace{\log \frac{x}{m}}_{y} = \underbrace{\log k}_{c} + \frac{1}{n} \log \frac{P}{x}$

intercept

7. Which of the following is correct about the adsorption of N_2 over Iron?

(1) It is always physically adsorbed

(2) Extent of adsorption over iron decreases with the increase in temperature first and then increases

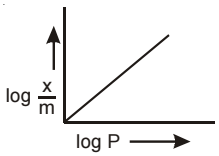
(3) It is always chemically adsorbed

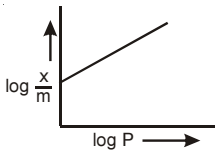
(4) N_2 is never adsorbed over iron

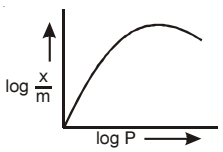
Sol. Answer (2)

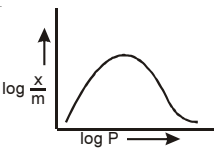
Adsorption of N_2 over iron is an example of chemisorption.

8. By plotting log x/m on y-axis and log P on x-axis, we should get

(1) 

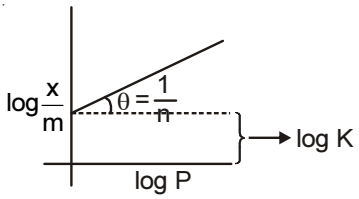
(2) 

(3) 

(4) 

Sol. Answer (2)

$$\underbrace{\log\frac{x}{m}}_{y} = \underbrace{\frac{1}{n}}_{m}\underbrace{\log P}_{x} + \underbrace{\log k}_{c}$$



9. In adsorption from solution phase, the Freundlich adsorption isotherm is modified as

(1) $\frac{x}{m} = k.T^{1/n}$ (2) $\frac{x}{m} = R.T^{1/n}$ (3) $\frac{x}{m} = nkP^{1/n}$ (4) $\frac{x}{m} = kC^{1/n}$

Sol. Answer (4)

Pressure is replaced by concentration term.

10. The example of homogeneous catalysis is

(1) Formation of NH_3 in Haber's process (2) Formation of NO in Ostwald's process

(3) Formation of SO_3 in Lead chamber process (4) Formation of SO_3 in Contact process

Sol. Answer (3)

Formation of SO_3 in lead chamber process in which catalyst and reactant and products are in same phase (gas phase).

(Colloids, Emulsions)

11. Size of colloidal particle ranges between

(1) 1 nm to 100 nm (2) 1 nm to 1000 nm (3) 10 nm to 1000 nm (4) 100 nm to 1000 nm

Sol. Answer (2)

Fact.

12. Which is not a colloidal solution?

(1) Smoke (2) Ink (3) Air (4) Blood

Sol. Answer (3)

Air is homogenous mixture so not colloid solution.

13. Lyophobic colloids are

(1) Reversible colloids (2) Irreversible colloids (3) Protective colloids (4) Gum, proteins

Sol. Answer (2)

Irrereversible colloids (facts).

14. Which of the following processes best describes the purification of muddy water by addition of alum?

(1) Absorption (2) Coagulation (3) Dialysis (4) Electrodialysis

Sol. Answer (2)

Alum coagulates the impurities present in muddy water, which settles down.

15. Colloidal solution commonly used in treatment of eye disease is

(1) Colloidal sulphur (2) Colloidal silver (3) Colloidal gold (4) Colloidal antimony

Sol. Answer (2)

Colloidal silver = argyrol. [fact.]

16. Micelles formation takes place

(1) At CMC and at kraft temperature (2) At CMC and at above kraft temperature

(3) At above CMC and at kraft temperature (4) Above CMC and above kraft temperature

Sol. Answer (4)

Fact.

17. Which of the following is positively charged colloidal particle?
(1) As_2S_3 (2) $Al_2O_3.xH_2O$ (3) Au (4) Pt

Sol. Answer (2)
$Al_2O_3.xH_2O$ [Generally, oxides are positively charged colloidal solution.]

18. Colloids can be purified by
(1) Tyndall effect
(2) Coagulation
(3) Peptization
(4) Ultrafiltration

Sol. Answer (4)
Fact.

19. Which of the following has minimum protecting power?
(1) Gelatin (Gold no. = 0.01)
(2) Dextrin (Gold no. = 15)
(3) Potato starch (Gold no. = 25)
(4) Albumin (Gold no. = 0.25)

Sol. Answer (3)

$$\text{Protecting power} \propto \frac{1}{\text{Gold number}}$$

20. Movement of colloidal particles under the influence of electric field is called
(1) Electrophoresis
(2) Dialysis
(3) Ionisation
(4) Electrodialysis

Sol. Answer (1)
Fact.

21. Emulsifier is an agent which
(1) Accelerates the dispersion
(2) Stabilises the emulsion
(3) Homogenizes the emulsion
(4) Dissociate emulsions

Sol. Answer (2)
Emulsifier stabilises the emulsion.

22. Gelatin is often used as an ingredient in the manufacture of ice-cream. The reason for this is
(1) To prevent the formation of a colloid
(2) To stabilize the colloid and prevent crystal growth
(3) To cause the mixture to solidify
(4) To improve the flavour

Sol. Answer (2)
Fact.

23. Milk can be preserved by adding a few drops of
(1) Formic acid solution
(2) Formaldehyde solution
(3) Acetic acid solution
(4) Acetaldehyde solution

Sol. Answer (2)

Fact.

24. When a river enters the sea, a delta is formed. Formation of delta is due to
(1) Peptization
(2) Coagulation
(3) Emulsification
(4) Dialysis

Sol. Answer (2)

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

25. Which statement is incorrect?
(1) Higher the gold number of lyophilic sol better is its protective action
(2) Lower the gold number of a lyophilic sol better is its protective action
(3) The Bredig's arc method is usually suitable for preparing sols of inert metals
(4) The osmotic pressure method gives the average molar mass of a polymer

Sol. Answer (1)

$$\text{protective action} \propto \frac{1}{\text{Gold number}}$$

26. The potential difference between the fixed charged layer and the diffused layer having opposite charge is called
(1) Zeta potential
(2) Streaming potential
(3) Dorn potential
(4) Colloidal potential

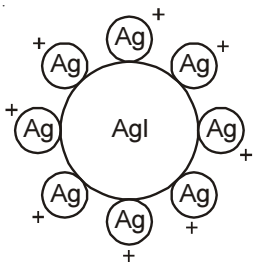
Sol. Answer (1)

Definition (Fact)

27. When dilute aqueous solution of $AgNO_3$ (excess) is added to KI solution, positively charged sol particles of AgI are formed due to adsorption of ion
(1) K^+
(2) Ag^+
(3) I^-
(4) NO_3^-

Sol. Answer (2)

Ag^+ ion is adsorbed on AgI.



28. In the preparation of AgI sol, $AgNO_3$ is added to excess of potassium iodide solution. The particles of the sol will acquire

(1) Negative charge (2) Positive charge (3) No charge (4) Unpredictable

Sol. Answer (1)

Concentration of I^- ion is much larger than Ag^+.

$\therefore$ I^- is adsorbed on AgI solution $\Rightarrow$ forming negative solution.

29. Which of the following method is not employed for the purification of colloids?

(1) Electrodialysis (2) Dialysis (3) Ultracentrifugation (4) Peptisation

Sol. Answer (4)

Peptisation : It is process of formation of colloidal solution.

30. During purification of colloidal sol by ultracentrifugation which of the following is observed?

(1) Colloidal particles are settled at the bottom of ultracentrifuge tube

(2) Impurities are settled at the bottom of the ultracentrifuge tube

(3) Impurities are removed through ultrafilters

(4) Its rate can be increased by applying pressure

Sol. Answer (1)

Due to centrifugal force, colloidal particles are settled at the bottom of ultracentrifuge rule.

31. A positive colloid will be formed when

(1) NH_4OH is added dropwise in dilute solution of $FeCl_3$

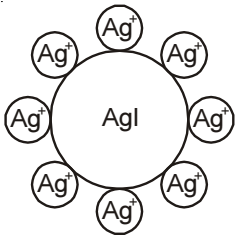
(2) H_2S is passed in dilute $AsCl_3$ solution

(3) Dilute $AgNO_3$ solution is added to saturated AgI solution

(4) Gelatin is dissolved in water

Sol. Answer (3)

Ag^+ ions are adsorbed on the surface of AgI molecule.



32. Which of the following is with highest and lowest flocculation value among Al^{+3}, Na^+, Mg^{+2}, Ba^{+2}?

(1) Al^{+3}, Na^+

(2) Na^+, Al^{+3}

(3) Ba^{+2}, Al^{+3}

(4) They have same flocculation value

Sol. Answer (2)

$$\text{Flocculation value} \propto \frac{1}{\text{Total charge an cation/anion}}$$

33. Most effective coagulant for a colloidal solution of arsenic sulphide in water is
    (1) 0.1 M sodium phosphate
    (2) 0.1 M zinc sulphate
    (3) 0.1 M zinc nitrate
    (4) 0.1 M aluminium chloride

Sol. Answer (4)

As_2S_3 is a negative colloid and to coagulate it, positive cation which highest charge is required.

34. Flocculation value is expressed in terms of
    (1) Millimoles of electrolyte per litre of solution
    (2) Moles of electrolyte per litre of solution
    (3) Gram of electrolyte per litre of solution
    (4) Millimoles of electrolyte per millilitre of solution

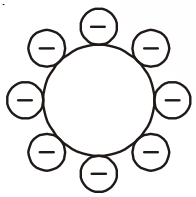
Sol. Answer (1)

Fact.

35. Colloidal particles in soap sol carry
    (1) Negative charge
    (2) Positive charge
    (3) No charge
    (4) Either positive or negative charge

Sol. Answer (1)

Fact.



36. Which of the following metallic sols cannot be prepared by Bredig's arc method?
    (1) Gold (2) Silver (3) Platinum (4) Sodium

Sol. Answer (4)

Solution of inert metal are prepared by Bredig's arc method.

37. When SO_2 gas is bubbled into H_2S gas
    (1) Lyophillic sol of sulphur is formed
    (2) Lyophobic sol of sulphur is formed
    (3) Suspension of water and sulphur is formed
    (4) A true solution of sulphur in water is formed

Sol. Answer (2)

$$SO_2 + 2H_2S \xrightarrow{\text{oxidation}} \underset{(sol)}{3S} + 2H_2O.$$

S is water repelent (non-polar) so form lyophobic solution.

38. The stabilization of the dispersed phase in a lyophobic sol is due to
(1) The viscosity of the medium
(2) The surface tension of the medium
(3) Affinity for the medium
(4) The formation of an electrical double layer between the two phases

Sol. Answer (4)

Fact.

39. When $FeCl_3$ solution is added to NaOH a negatively charged sol is obtained. It is due to the
(1) Presence of basic group
(2) Preferential adsorption of OH^- ions
(3) Self dissociation
(4) Electron capture by sol particles

Sol. Answer (2)

$FeCl_3 + NaOH \Rightarrow Fe_2O_3.xH_2O/OH^-$

[Concentration of OH^- ion is large and in case of cold NaOH solution, negatively charged solution is formed.]

40. Which can adsorb larger volume of hydrogen gas?
(1) Colloidal solution of palladium
(2) Finely divided nickel
(3) Finely divided platinum
(4) Colloidal $Fe(OH)_3$

Sol. Answer (1)

Colloidal solution of metal contain larger surface area for adsorption.

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