SURFACE CHEMISTRY

SOLVED SUBJECTIVE EXERCISE

Very Short Answer Type Questions (1 mark)

1. Why is ferric chloride preferred over potassium chloride in case of a cut leading to bleeding ?

Ans. Fe^{3+} ion has greater coagulating power than Na^+ ion as it has higher charge.

2. What cause Brownian movement is a collidal solution ?

Ans. This is due to the unequal bombardment of colloidal particles by the molecules of dispersion medium.

3. What is an emulsion ?

Ans. Emulsion is a colloidal solution in which both the dispersed phase and dispersion medium are liquids e.g. milk, cod liver oil, etc.

4. What is 'occlusion' ?

Ans. The adsorption of gases on the surface of metals is called occlusion.

5. Which will be adsorbed more readily on the surface of charcoal and why $-NH_3$ or CO_2 ?

Ans. NH_3 has higher critical temperature than CO_2, i.e., NH_3 is more liquefiable than CO_2. Hence, NH_3 has greater intermolecular forces of attraction and hence will be adsorbed more readily.

6. How is adsorption of a gas related to its critical temperature ?

Ans. Higher is the critical temperature of a gas, greater is the ease of liquefaction, i.e., greater are the van der Waals' forces of attraction and hence greater is the adsorption.

7. Why is a colloidal sol stable ?

Ans. All the particles in a colloidal sol carry the same charge and hence keep on repelling each other and cannot aggregate together to form bigger particles.

8. What is meant by the term 'peptization'?

Ans. The process of conversion of a freshly prepared precipitate into a colloidal solution by adding a suitable electrolyte is called peptization.

9. Why is it necessary to remove CO when ammonia is obtained by Haber's process ?

Ans. CO acts as catalytic poison and must be removed.

10. What is the role of desorption in the process of catalysis :

Ans. The reaction products formed on the catalyst surface get detached from the surface as a result of desorption, thereby making the surface available again for more reaction ion.

11. Vanishing cream and cold cream both are emulsions. Then what is the difference between the two?

Ans. Vanishing cream is an emulsion of oil-in-water whereas cold cream is emulsion of water-in-oil. The latter is used for dry skin as the base (dispersion medium) in this cream is oil.

12. Why is the ester hydrolysis slow in the beginning and becomes faster after some time ?

Ans. The ester hydrolysis takes place as follows:

$$\underset{\text{Ester}}{RCOOR'} + \underset{\text{Water}}{H_2O} \rightleftharpoons \underset{\text{Acid}}{RCOOH} + \underset{\text{Alcohol}}{R'OH}$$

The acid produced in the reaction acts as catalyst (autocatalyst) for the reaction. Hence, the reaction becomes faster after some time.

13. Why does leather get hardened after tanning ?

Ans. Animal hides are colloidal in nature and contain positively charged particles. Tannin contains negatively charged colloidal particles. When hide is soaked in tannin, their mutual coagulation takes place and leather becomes hard.

14. What happens when dialysis is prolonged ?

Ans. On prolonged dialysis, even the very small amount (trace amount) of the electrolyte which stabilizes the sol is completely removed. Hence, the sol becomes unstable and its coagulation takes place.

Short Answer Type Questions (2 mark)

15. What is the difference between physisorption and chemisorption ?

Ans.

S.No.	Physisorption	Chemisorption
1.	It arises because of van der Walls' forces.	It is caused by chemical bond formation.
2.	It is not specific in nature.	It is highly specific in nature.
3.	It is reversible in nature	It is irreversible.
4.	It depends on the nature of gas. More easily liquefiable gases are adsorbed readily.	It also depends on the nature of gas. Gases which can react with the adsorbent show chemisorptions.
5.	Enthalpy of adsorption is low (20-40 kJ mo^{-1}) in this case.	Enthalpy of adsorption is high (80-240 kJ mol^{-1}) in this case.
6.	Low temperature is favourable for adsorption. It decreases with increase of temperature.	High temperature is favourable for adsorption. It increases with the increase of temperature.
7.	No appreciable activation energy is needed.	High activation energy is sometimes needed.
8.	It results into multimolecular layers on adsorbent surface under high pressure	It results into unimolecular layer.

16. What role does adsorption play in heterogeneous catalysis ?

Ans. In heterogeneous catalysis, generally the reactants are gaseous whereas the catalyst is a solid. The reactant molecules are adsorbed on the surface of the solid catalyst by physical adsorption or chemical adsorption. As a result, the concentration of the reactant molecules on the surface increases and hence the rate of reaction increases. Alternatively, one of the reactant molecules undergoes fragmentation on the surface of the solid catalyst producing active species which react faster. The product molecules in either case have no affinity for the solid catalyst and are desorbed making the surface free for fresh adsorption. This theory is called adsorption theory.

17. Explain what is observed when

(i) An electrolyte, NaCl is added to hydrated ferric oxide sol.

(ii) Electric current is passed through a colloidal sol.

(iii) When a beam of light is passed through a colloidal solution.

Ans. (i) The positively charged colloidal particles of $Fe(OH)_3$ get coagulated by the oppositely charged Cl^- ions provided by NaCl.

(ii) On passing direct current, colloidal particles move towards the oppositely charged electrode where they lose their charge and get coagulated.

(iii) Scattering of light by the colloidal particles takes place and the path of light becomes visible (Tyndall effect).

18. Comment on the statement that "Colloid is not a substance but state of a substance".

Ans. The given statement is true. This is because the same substance may exist as a colloid under certain conditions and as a crystalloid under certain other conditions. For example, NaCl in water behaves as a crystalloid while in benzene, it behaves as a colloid (called associated colloid). It is the size of the particles which matters, i.e., the state in which the substance exists. If the size of the particles lies in the range 1 nm to 1000 nm, it is in the colloid state.

19. Explain the following observation :
(i) Cottrell's smoke precipitator is fitted at the mouth of the chimney used in factories.
(ii) Physical adsorption is multilayered, while chemisorption is monolayered.

Ans. (i) Cottrell's smoke precipitator, neutralises the charge on unburnt carbon particles, coming out of chimney and they get precipitated and settle down at the floor of the chamber.
(ii) As physical adsorption, involves only weak van der waal's force of interaction, so many layers of adsorbate get attached, while chemisorption involves chemical bond formation between adsorbate and adsorbents monolayer is formed.

20. What type of colloidal sols are formed in the following:
(i) Sulphur vapours are passed through cooled water.
(ii) White of an egg is mixed with water.
(ii) Soap solution.

Ans. (i) Multimolecular because sulphur molecules associate together to form colloidal sol.
(ii) Macromolecular because protein molecules present in the white of the egg are macromolecules soluble in water.
(iii) Associated because $RCOO^-$ ions associate together to form micelles.

21. Write two differences between multimolecular colloids and macromolecular colloids.

Ans. (i) Multimolecular colloids are formed by aggregation of small molecules (diameter < 1 nm) while macromolecular colloids are formed by macromolecules (polymers) and consist of single molecules.
(ii) Multimolecular colloids are generally lyophobic whereas macromolecular colloids are generally lyophilic.

22. Explain the following observations:
(i) Lyophilic colloid is more stable than lyophobic colloid.
(ii) Sky appears blue in colour.

Ans. (i) It is due to greater force of attraction between dispersed phase and dispersion medium in lyophilic colloid than lyophobic colloid.
(ii) Sky appears blue in colour due to scattering of light by colloidal particles. This is known as Tyndall effect.

23. What is electrodialysis ?

Ans. It is a process by which colloidal solutions containing ionic impurities are purified. The colloidal solution containing ionic impurities is placed in a bag of parchment paper in distilled water in electric field. The ions come out through parchment paper and the sol is purified.

24. Which one of the following electrolytes is most effective for the coagulation of $Fe(OH)_3$ sol and why?
NaCl, Na_2SO_4, Na_3PO_4

Ans. $Fe(OH)_3$ is a positively charged sol. According to Hardy-Schulze rule, greater the charge on the oppositely charged ion of the electrolyte added, more effective it is in bringing about the coagulation. Hence Na_2PO_4 (containing PO_4^{3-} ions) is most effective.

Short Answer Type Questions (3 mark)

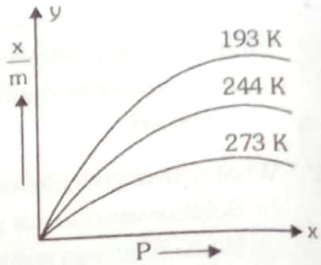
25. What is shape-selective catalysis ?

Ans. It is chemical reaction in which the rate depends on the pore size of the catalyst, and also on the shape and size of the reactant and produce molecules. A shape selective catalyst has a variety of active sites of different shape and size. Zeolite acts as a shape selective catalyst. In the crystal of a zeolite the pore size usually varies from 260 pm to 740 pm. If the reactant molecules are too large they can not fit into pores of zeolite and no reaction takes place. On the other hand, if the reactant molecules are too small, they would just slip through the pores in the catalyst without any interactions. ZSM-5 is used as shape selective catalyst to produce gasoline of high octane number from methanol.

$$xCH_3OH \xrightarrow[\text{Catalyst}]{\text{ZSM-5}} \underset{\text{Gasoline}}{(CH_2)_x} + xH_2$$

Where x varies form 5 to 10 . ZSM-5 stand for zeolite sieve of molecular porosity –5

26. Consider the adsorption isotherms given below and interpret the variation in the extent of adsorption (x/m) when
(i) (a) temperature increases at constant pressure
(b) pressure increases at constant temperature
(ii) Name the catalyst and the promoter used in Haber's process for manufacture of ammonia.



Ans. (i) (a) Extent of adsorption $\left(\frac{x}{m}\right)$ decreases with increase in temperature at constant pressure as adsorption is an exothermic process.

(b) Extent of adsorption increases with increase in pressure at constant temperature.

At low value of pressure $\frac{x}{m} \propto P$ or $\frac{x}{m} = KP$

At high pressure $\frac{x}{m} \propto P^{\circ}$ or $\frac{x}{m} = KP^{\circ}$ i.e., $\frac{x}{m} = K$

In the intermediate range of pressure

$\frac{x}{m} \propto P^{1/n}$ or $\frac{x}{m} = KP^{1/n}$ $(n > 1)$

(ii) Catalyst : Finely divided iron.
Promoter : Molybdenum.

27. (i) What are micelles : How do they differ from ordinary colloidal particles : Given two examples of micelles forming substances.

(ii) State Hardy-Schulze rule.

Ans. (i) There are some substances which at low concentration behaves as normal electrolyte but at higher concentrations exhibit colloidal behaviour due to formation of aggregated particles. The aggregated particles thus formed are called micelles.

The formation of micelles takes place only above a particular temperature called Kraft temp and above a particular concentration called critical micellisation concentration (CMC). On dilution these colloids revert back to individual ions.

Example are soaps and synthetic detergents.

(ii) ***Hardy-Schulze rule*** : The greater the valency of the action ion of the electrolyte, the greater will be its precipitating action.

$Al^{3+} > Mg^{2+} > Na^{+}$ for + ively charged sols

$PO_4^{3-} > SO_4^{2-} > Cl^{-}$ for – ively charged sols

28. Match the pairs (choose the correct answer from Section B for section A):

Section A	***Section B***
(a) Gold sol	(i) Hardy-Schulze rule
(b) Gold No.	(ii) Van der waal force
(c) Coagulation power	(iii) Electrochemical phenomenon
(d) Physical adsorption	(iv) Lyophilic collide
(e) Corrosion	(v) Lyophobic colloid
	(vi) Tyndall effect

Ans. (a) → (v), (b) → (iv), (c) → (i), (d) → (ii), (e) → (iii)

29. Give reasons for the following observations :

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

(b) Cottrell's smoke precipitator is fitted at the mouth of the chimeny used in factories.

(c) Colloidal gold is used for intermuscular injection.

Ans. (a) Ions (either +ve or –ve) of peptizing agent (electrolyte) are adsorbed on the particles of the precipitate. They repel and hit each other breaking the particles of the precipitate into colloidal size.

(b) It neutralizes the charge on the carbon particles which get precipitated and thus gases entering into chimney are free from carbon particles.

(c) This is done because gold particles have large surface area and easily assimilated into blood which is colloidal.

30. What modification can you suggest in the Hardy Schulze law?

Ans. According to Hardy Schulze law, the coagulating ion has charge opposite to that on the colloidal particles. Hence, the charge on colloidal particles is neutralized and coagulation occurs. The law can be modified to include the following :

When oppositely charged sols are mixed in proper proportions to neutralize the charges of each other, coagulation of both the sols occurs.

EXERCISE-1

PREVIOUS YEARS BOARD PROBLEMS

CBSE 2016

1. Write the reason for the stability of colloidal sols.
2. Define the following terms:
   (i) O/W Emulsion (ii) Zeta potential (iii) Multimolecular colloids

CBSE 2015

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

CBSE 2014

1. Why is adsorption always exothermic ?
2. What is the effect of temperature on chemisorption ?
3. What are the dispersed phase and dispersion medium in milk ?
4. What are emulsions ? What are their different types? Give one example of each type.

CBSE 2013

1. Define the following term giving an example: Adsorption.
2. Explain how the phenomenon of adsorption finds application in the following processes ?
   (i) Production of vacuum (ii) Heterogeneous catalysis
3. What is especially observed when a beam of light is passed through a colloidal solution ?
4. What are the characteristics of the following colloids ? Give one example of each.
   (i) Multi-molecular colloids (ii) Lyophobic sols
5. Define the following terms giving an example of each
   (i) Associated colloids (ii) Lyophilic sol
6. Define the following terms with and example in each case
   (i) Macro-molecular sol (ii) Peptization (iii) Emulsion

CBSE 2012

1. Write three distinctive features of chemisorption which are not found in physisorption.
2. What is meant by 'shape selective catalysis' ?
3. Define 'peptization'.
4. Define the following terms.
   (i) Tyndall effect
   (ii) Shape-selective catalysis
5. Explain the following terms giving a suitable example for each.
   (i) Aerosol (ii) Emulsion (iii) Micelle

CBSE 2011

1. Why is a finely divided substance more effective as an adsorbent ?
2. What are lyophobic colloids ? Give one example for them.
3. Classify colloids where the dispersion medium is water. State their characteristics and write and example of each of these classes.
4. Explain what is observed when
   (i) an electric current is passed through a sol ?
   (ii) a beam of light is passed through a sol?
   (iii)an electrolyte (say NaCl or KCl) is added to ferric hydroxide sol. (hydrated ferric oxide sol) ?
5. Explain the following terms
   (i) Electrophoresis (ii) Dialysis (iii)Tyndall effect

CBSE 2010

1. What is the basic difference between adsorption and absorption ?
2. Distinguish between physisorption and chemisorption.
3. Why is adsorption always exothermic ?
4. What is an adsorption isotherm ? Describe Freundlich adsorption isotherm.
5. Discuss the effect of pressure and temperature on the adsorption of gases on solids. Describe the application of adsorption in controlling humidity.
6. What is meant by coagulation of a colloidal solution ? Describe briefly any three methods by which cagulation of lyophobic sols can be carried out.
7. Define the following terms.
   (i) Peptization (ii) Reversible sols
8. Explain the following terms
   (i) Electrophoresis (ii) Coagulation (iii)Tyndall effect
9. Define the following terms
   (i) Tyndall effect (ii) Shap-selective catalysis

CBSE 2009

1. Why is adsorption always exothermic ?
2. What is the coagulation process ?

EXERCISE-1

SOLUTIONS OF PREVIOUS YEARS BOARD PROBLEMS

SURFACE CHEMISTRY

CBSE 2016

Sol.1 Like Charged particles cause repulsion/ Brownian motion/ solvation

Sol.2 (i) Oil as dispersed phase and water as dispersion medium

(ii) The potential difference between fixed layer and diffused / double layer of opposite charges.

(iii) Large number of atoms or smaller molecules of a substance aggregate together to form species having size in colloidal range.

CBSE 2015

Sol.1 $AlCl_3$, due to greater charge on Al^{3+}.

CBSE 2014

Sol.1 When a gas is adsorbed on the surface of the solid, its entropy decreases, i.e, As is negative. Now, $\Delta G = \Delta H - T\Delta S$ and for the process to be spontaneous. Free energy change, ΔG, must be negative. As $T\Delta S$ is negative, ΔG can be negative only if ΔH has sufficiently high negative value. Hence, adsorption is always exothermic.

Sol.2 Even though chemical adsorption is an exothermic process, it does not occurs slowly at lower temperture due to high kinetic energy barrier. Hence, like most chemical changes, the extent of chemisorption increases with increase in temprature up to certain limit and then after that it starts decreasing

Sol.3 Fat in water

Sol.4 The colloidal solution in which both the dispersed phase and dispersion medium are liquids is called an emulsion. There are two types of emulsions :

(a) Oil in water type :
Here, oil is the dispersed phase while water is the dispersion medium.
For example ; milk, varnishing cream, etc.

(b) Water in oil type :
Here, water is the dispersed phase while oil is the dispersion medium.
For example ; cold cream, butter, etc.

CBSE 2013

Sol.1 The process in which molecular species are accumulated at the surface rather than in the bulk of a solid or liquid phase is termed as adsorption. e.g, water vapours on silica gel. H_2, O_2, NH_3 on activated charcoal.

Sol.2 (i) Adsorption of remaining traces of air by charcoal from a vessel evacuated by a vacuum pump gives a very high vacuum.

(ii) Adsorption of reactants on the solid surface of the catalyst increases the rate of reaction, e.g. manufacture of ammonia using iron as a catalyst, manufacture of H_2SO_4 by contact process, hydrogenation of oils using finely divided nickel.

Sol.3 If a strong converging beam of light is passed through a colloidal solution placed in dark room, the path of beam gets illuminated and becomes visible due to scattering of light this phenomenon is known as Tyndall effect.

Sol.4 (i) In this type of colloids, colloidal particles are aggregates of atoms or small molecules with molecular size less than 1 mm. These are formed from large number of atoms or smaller molecules of a substance aggregate together to form species having size in the colloidal range. e.g. Sulphur sol. consists of particles containing a thousand or more of S_8 sulphur molecules, gold sol may contain particles of various sizes having many atoms.

(ii) The word 'lyophobic' means liquid–hating. substances like metals, their sulphides, etc. When simply mixed with the dispersion medium do not form the colloidal sol. Their colloidal Sols can be prepared only by special methods. Such Sols are called lyophobic Sols.

Sol.5 (i) There are some substance which at two concentrations behave as normal strong electrolytes, but at higher concentrations exhibit colloidal behavior due to the formation of aggregates. The aggregated particles thus formed are called micelles. These are also known as associated colloids.

(ii) The word 'lyophilic' means liquid–loving. Colloidal Sols directly formed by mixing substances like gum. gelatine, starch, rubber ete. With a saitable liquid are called lyophlic sols.

Ex. Starch sol.

Sol.6 (i) Macro molecular sol. ⟶ When certain substances having big sized molecules, called macromolecules, having large molecular masses are dissolved in a suitable liquid, they form a solution in which the molecules of the substance, i.e., the dispersed particles have size in the collidal range. E.g. polyethene, nylon, polystyrene, strach & protein.

(ii) Peptization ⟶ is a process of converting a fresh precipitate into colloidal particles by shaking it with the dispersion medium in the presence of small amount of a suitable electrolyte. The electrolyte added is called peptizing agent.

(iii) Emulsion ⟶ It's a type of colloidal system in which both dispersed phase and dispersion medium are liquids e.g. milk, hair cream.

CBSE 2012

Sol.1

	Physisorption		Chemisorption
(1)	It arises because of van der waal's forces	(1)	It is caused by chemical bond formation.
(2)	It is non-specific in nature.	(2)	It is highly specific in nature.
(3)	Low temperature is favourable for adsorption. It decreases with increase. of temperature.	(3)	High temperature is favourable for adsorption. It increase with the increase of temperature.

Sol.2 Coagulation : The phenomenon of precipitation of a colloidal solution by the addition of excess of an electrolyte is called **coagulation** or **flucculation.**

Sol.3 Peptization is a process of converting a fresh precipitate into colloidal solution by shaking it with the disprersion medium in presence of a small amount of a suitable electrolyte

Sol.4 (i) **Tyndall effect :** This phenomenon of scattering of light by colloidal particles as a result of which the path of beam becomes visible is called tyndall effect.

(ii) **Coagulation :** The phenomenon of precipitation of a colloidal solution by the addition of excess of an electrolyte is called **coagulation** or **flucculation.**

Sol.5 Aerosol – A colloidal solution having a gas as the dispersion medium and solid as dispersed phase is called as aerosol. Ex. Smok, Dust

Emulsion – The colloidal solution in which dispersed phase and dispersion medium is liquid.
(i) oil in water type
(ii) water in oil type
Miscelle – When hydrophobic and hydrophillic are associated at CMC and at kraft temperature.
The colloids are called miscelle or associated colloids.

CBSE 2011

Sol.1 Adsorption is a surface phenomenon. The extent of adsorption depends on the surface area. Both physisorption and chemisorption increase with an increase in the surface area. Hence a finely divided substance behave as a good adsorbent.

Sol.2 The word 'lyophobic' means liquid–hating. substances like metals, their sulphides, etc. When simply mixed with the dispersion medium do not form the colloidal sol. Their colloidal sols can be prepared only by special methods. Such Sols are called lyophobic Sols.

Sol.3 Classification of Colloids: Bases on the physical state of dispersed phase and dispersion medium: Depending upon whether the dispersed phase and the dispersion medium are solids, liquids or gases, eight types of colloidal systems are possible. A gas mixed with another gas forms a homogeneous mixture and not a colloidal system. The examples of the various types along with their typical names are :

Dispersed phase	Dispersion medium	Type of colloid	Examples
Solid	Solid	Solid sol	Some coloured glasses and gem stones
Solid	Liquid	Sol	Paints, Cell fluids
Solid	Gas	Aerosol	Smoke, Dust
Liquid	Solid	Gel	Cheese, butter, jellies
Liquid	Liquid	Emulsion	Milk, hair cream
Liquid	Gas	Aerosol	Fog. mist, cloud, insecticide sprays
Gas	Solid	Solid sol	Pumic stone, foam rubber
Gas	Liquid	Foam	Froth, whipped cream, soap lather

Sol.4 (i) When an electrolyte like KCl is added of $Fe(OH)_3$ sol, the positively charged colloidal particles of $Fe(OH)_3$ get coagulated by the oppositely charged Cl^- ions provided by KCl.

(ii) On passing the electric current, colloidal particles move towards the oppositely charged electrode where they lose their charge and get coagulated.

(iii) When a beam of strong light is passed through a colloidal solution scattering of light by colloidal particles takes place and the path of light becomes visible. This phenomenon is called **Tyndall effect.**

Sol.5 (i) The movement of colloidal particles under the influence of an applied electric field is known as electrophoresis. Positively charged particles move to the cathode, while negatively charged particles move towards the anode. As the particles reach oppositely charged electrodes, they become neutral and get coagulated.

(ii) The process of removing a dissolved substance from a colloidal solution by the means of diffusion through a membrane is known as dialysis. This process is based on the principle that ions and small molecules can pass through animal membrane unlike colloidal partiacles.

(iii) This phenomenon of scattering of light by colloidal particles as a result of which the path of beam becomes visible is called tyndall effect.

CBSE 2010

Sol.1

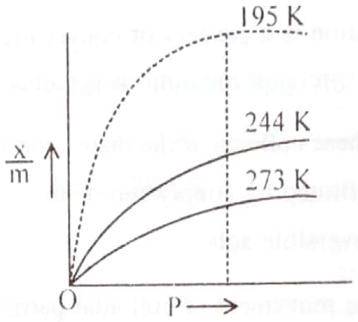
	Absorption		**Adrosption**
(i)	It is a bulk phenomenon, e.g. water vapour are absorbed by anhydrous calcium chloride	(i)	It is a surface phenomenon, e.g. water vapours are absorbed by silica gel on its surface
(ii)	The concertration of solute is uniform throughout the bulk of the solid, e.g. When cotton is dipped in blue ink, it gets blue throughout	(ii)	The concentration of substance [adsorbate] is only at the surface and it does not penetrate to the bulk. e.g. when a chalk stick is dipped in ink, it is blue on the surface and white in bulk.
(iii)	The concentration of solute is uniform throughout the bulk of the solid	(iii)	The concentration of the adsorbate increases only at the surface of the adsorbent.

Sol.2

	Physisorption		**Chemisorption**
(1)	It arises because of van der waal's forces	(1)	It is caused by chemical bond formation.
(2)	It is non-specific in nature.	(2)	It is highly specific in nature.
(3)	Low temperature is favourable for adsorption. It decreases with increases. of temperature.	(3)	High temperature is favourable for adsorption. It increase with the increase of temperature.

Sol.3 When a gas is adsorbed on the surface of the solid, its entropy decreases, i.e, As is negative. Now, $\Delta G = \Delta H - T\Delta S$ and for the process to be spontaneous. Free energy change, ΔG, must be negative. As $T\Delta S$ is negative, ΔG can be negative only if ΔH has sufficiently high negative value. Hence, adsorptionis always exothermic.

Sol.4 The variation in the amount of gas adsorbed by the adsorbent with pressure at constant temperature can be expressed by means of a curve termed as adsorption isotherm, as shown below.



› Freundlich gave the relationship between x/m and p at particular temperature.

$$\frac{x}{m} = K.P^{\frac{1}{n}} \qquad (n > 1)$$

where, m = mass of adsorbent,

x = mass of the gas adsorbed

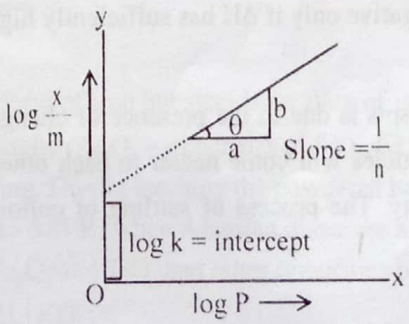
x/m = amount of gas adsorbed per unit mass of solid adsorbent

P = pressure

k and n = constant.

on taking logarithm of the above equation $\log\frac{x}{m} = \log k + \frac{1}{n}\log p$

› The validity of freundlich isotherm can be checked by plotting $\log\frac{x}{m}$ versus log p and observing trends as mentioned below.



Sol.5 → adsorption is a reversible process and is accompained by a decrease in pressure. Therefore, adsorption increases with an increase in pressure.

→ Adsorption is an exothermic process. Thus, in accordance with Le– Chatelliers principle, the magnitude of adsorption decreases with an increase in temperature.

→ Silica and aluminium geals are used as adsorbents for removing moisture and controlling humidity.

Sol.6 The phenomenon of precipitation of a colloidal solution by the addition of excess of an electrolyte is called **coagulation** or **flucculation.**

Sol.7 (i) **Peptization :** Peptization is a process of converting a fresh precipitate into colloidal solution by shaking it with the disprersion medium in presence of a small amount of a suitable electrolyte

(ii) **Reversible sols :** In these colloids, if the dispersion medium is separated from the dispersed phase, the sol. can be reconstituted by simply remixing with the dispersion medium. That is why, these sols are also called reversible sols.

Sol.8 (i) **Electrophoresis :** The movement of colloidal particles under the influence of an applied electric field is known as electrophoresis. Positively charged particles move to the cathode, while negatively charged particles move towards the anode. As the parficles reach oppositiely charged electro dos, they neutral and get coagulatied.

(ii) **Coagulation :** The phenomenon of precipitation of a colloidal solution by the addition of excess of an electrolyte is called **coagulation** or **flucculation.**

(iii) **Tyndall effect :** This phenomenon of scattering of light by colloidal particles as a result of which the path of beam becomes visible is called tyndall effect.

Sol.9 (i) **Tyndall effect :** This phenomenon of scattering of light by colloidal particles as a result of which the path of beam becomes visible is called tyndall effect.

(ii) **Coagulation :** The phenomenon of precipitation of a colloidal solution by the addition of excess of an electrolyte is called **coagulation** or **flucculation.**

CBSE 2009

Sol.1 When a gas is adsorbed on the surface of the solid, its entropy decreases, i.e, Δs is negative. Now, $\Delta G = \Delta H - T\Delta S$ and for the process to be spontaneous. Free energy change, ΔG, must be negative. As $T\Delta S$ is negative, ΔG can be negative only if ΔH has sufficiently high negative value. Hence, adsorptionis always exothermic.

Sol.2 The stability of the lyophobic so/s is due to the presence of change on colloidal particles. If, somehow, the charge is removed, the particles will come nearer to each other ot form aggregates and settle down down under the force of gravity. The process of settling of colloidal particles is called coagulation of the sol.