Very Short Answer Questions

Very Short Answer Questions (PYQ)

Q.1. What type of forces are responsible for the occurrence of physisorption?

[CBSE (F) 2014]

Ans. van der Waals' forces.

Q.2. Which has a higher enthalpy of adsorption: physisorption or chemisorption?

[CBSE (AI) 2013]

Ans. Chemisorption.

Q.3. Out of $BaCl_2$ and KCl, which one is more effective in causing coagulation of a negatively charged colloidal sol? Give reason.

[*CBSE Delhi 2015*]

Ans. $BaCl_2$, Ba^{2+} ion has greater coagulating power than K^+ ion as Ba^{2+} ion has higher charge.

Q.4. Define desorption.

[*CBSE Delhi 2011*]

Ans. The process of removal of an adsorbed substance from a surface on which it is adsorbed is called desorption.

Q.5. What is the effect of temperature on chemisorption?

[*CBSE (AI) 2014*]

Ans. Chemisorption initially increases then decreases with rise in temperature. The initial increase is due to the fact that heat supplied acts as activation energy. The decrease afterwards is due to the exothermic nature of adsorption equilibrium.

Q.6. Give one example each of sol and gel.

[CBSE Delhi 2014]

Ans. Sol: Paints, cell fluids

Gel: Butter, cheese

Q.7. What is the type of charge on AgI colloidal sol formed when $AgNO_3$ solution is added to KI solution?

[*CBSE Bhubaneshwar 2015*]

Ans. Negatively charged sol, AgI/I^- is formed when $AgNO_3$ solution is added to KI solution.

Q.8. What is the 'coagulation' process?

[*CBSE (AI) 2009, 2010*]

Ans. The process of settling of colloidal particles is called coagulation.

Q.9. What is an emulsion?

[*CBSE (AI) 2009*]

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

Q.10. What are lyophobic colloids? Give one example for them.

[*CBSE (AI) 2011*]

Ans. Lyophobic sols are those sols in which the particles of the dispersed phase have little affinity for the particles of the dispersion medium, *e.g*., sols of metal and their sulphides and hydroxides.

Q.11. Give one example each of lyophobic sol and lyophilic sol.

[*CBSE Delhi 2014*]

Ans. Lyophobic sol — Gold sol, As_2S_3 sol

Lyophilic sol — Sol of starch, sol of gum

Q.12. Based on the type of dispersed phase, what type of colloid is micelles?

[*CBSE (F) 2014*]

Ans. Associated colloids

Q.13. Name the temperature above which the formation of micelles takes place. [CBSE (F) 2014]

Ans. Kraft temperature.

Q.14. Define 'peptization'.

[*CBSE Delhi 2011, (AI) 2012*]

Ans. The process of converting a precipitate into colloidal sol by shaking it with dispersion medium in the presence of small amount of electrolyte is called peptization.

Q.15. Write the dispersed phase and dispersion medium of butter.

[*CBSE Patna 2015*]

Ans. Dispersed phase : Liquid

Dispersion medium : Solid

Q.16.Give one example each of 'oil in water' and 'water in oil' emulsion.

[CBSE Delhi 2014]

Ans. Oil in water emulsion: milk, vanishing cream.

Water in oil emulsion: Butter, cold cream, cod liver oil.

Q.17. Write the main reason for the stability of colloidal sols.

[CBSE Delhi 2016]

Ans. All the particles of colloidal sol carry the same charge so they keep on repelling each other and do not aggregate together to form bigger particles.

Q.18. A delta is formed at the meeting point of sea water and river water. Why?

[CBSE Allahabad 2015]

Ans. 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 resulting in its deposition with the formation of delta.

Q.19. Write the dispersed phase and dispersion medium of smoke.

[CBSE Guwahati 2015]

Ans. Dispersed phase = Solid; Dispersion medium = Gas.

Q.20. Write one similarity between physisorption and chemisorption.

[CBSE Delhi 2017]

Ans. Both increase with increase in surface area.

Q.21. What type of colloid is formed when a liquid is dispersed in a solid? Give an example.

[CBSE (AI) 2017]

Ans. Gel, e.g., cheese, jellies

Q.22. What is the role of desorption in the process of catalysis?

[CBSE (F) 2017]

Ans. Desorption makes the surface available again for fresh adsorption of reactant molecules.

Q.23. What is the effect of temperature on chemisorption?

[CBSE (AI) 2014]

Ans. Chemisorption initially increases then decreases with rise in temperature. The initial increase is due to the fact that heat supplied acts as activation energy. The decrease afterwards is due to the exothermic nature of adsorption equilibrium.

Q.24. Give an example of shape-selective catalyst.

[CBSE (F) 2010]

Ans. ZSM–5

Q.25. Define the term 'Tyndall effect'.

[CBSE Delhi 2009]

Ans. The scattering of light by colloidal particles is known as Tyndall effect.

Very Short Answer Questions (OIQ)

Q.1. What is physical adsorption?

Ans. If the adsorbate is held on an adsorbent surface by weak van der Waals' forces, the adsorption is called physical adsorption.

Q.2. What is meant by chemical adsorption?

Ans. If the adsorbate is held on the surface of the adsorbent as a result of chemical reaction forming surface compounds, it is called chemical adsorption.

Q.3. What is sorption?

Ans. Sorption is the process in which adsorption and absorption take place simultaneously, e.g., dyeing of cotton fibres by azo dyes.

Q.4. What is 'occlusion'?

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

Q.5. 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 liquefication, i.e., greater are the van der Waals' forces of attraction and hence greater is the adsorption.

Q.6. Adsorption of a gas on the surface of solid is generally accompanied by a decrease in entropy still it is a spontaneous process. Why?

[HOTS]

Ans. According to the equation

$\Delta G = \Delta H - T\Delta S$

For a process to be spontaneous, ΔG should be negative. Even though ΔS is negative here, ΔG is negative because reaction is highly exothermic, i.e., ΔH is negative.

Q.7. Which will be adsorbed more readily on the surface of charcoal and why: NH_3 or CO_2?

[HOTS]

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.

Q.8. Give the expression of Freundlich isotherms.

Ans.

$$\frac{x}{m} = kp^{1/n} \quad \text{or} \quad \log \frac{x}{m} = \log k + \frac{1}{n}\log p$$

where m is the mass of the adsorbent and x is the mass of adsorbate, p is the pressure of the gas and n is an integer.

Q.9. Indicate a chemical reaction involving a homogeneous catalyst.

Ans.

$$2SO_2(g) + O_2(g) \xrightarrow{NO\,(g)} 2SO_3(g)$$

Q.10. How does a catalyst work?

Ans. Catalysts provide an alternate path involving lower activation energy for the reactants.

Q.11. Why is desorption important for a substance to act as good catalyst?

[NCERT Exemplar]

Ans. After the completion of reaction between adsorbed reactants, the process of desorption is important to remove products and further create space for the other reactant molecules to approach the surface and react.

Q.12. What is the role of diffusion in heterogenous catalysis?

[NCERT Exemplar]

Ans. The gaseous molecules diffuse on to the surface of the solid catalyst and get adsorbed. After the required chemical changes, the products diffuse away from the surface of the catalyst leaving the surface free for more reactant molecules to get adsorbed and undergo reaction.

Q.13. Define colloidal solution.

Ans. A colloidal solution is a state in which the particle size lies between 1 nm and 1000 nm. It appears to be homogeneous but actually it is heterogeneous.

Q.14. In what way is a sol different from a gel?

Ans. Colloidal system in which solid is dispersed in liquid is called sol and that in which liquid is dispersed in solid is called gel.

Q.15. 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.

Q.16. What is collodion?

[NCERT Exemplar]

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

Q.17. What is the principle of dialysis?

Ans. Dialysis is based on the principle that ions can pass through semipermeable membrane whereas colloidal particles cannot pass through it.

Q.18. What happens when dialysis is prolonged?

[NCERT Exemplar]

Ans. Due to excessive dialysis, traces of electrolyte which stabilises the colloids is removed completely, making the colloid unstable. As a result, coagulation takes place.

Q.19. What happens when an electric field is applied to a colloidal dispersion?

[NCERT Exemplar]

Ans. The colloidal particles move towards the oppositely charged electrode and get neutralised and coagulated there.

Q.20. 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.

Q.21. Define ultrafiltration.

Ans. In this process, colloidal solutions are purified by carrying out filtration through special types of graded filters called ultra-filters. Filter paper allows the passage of electrolyte but does not allow the passage of colloidal particles.

Q.22. Why do colloidal solutions exhibit Tyndall effect?

Ans. Colloidal solutions exhibit Tyndall effect because the size of the colloidal particles (1 nm–1000 nm) is such that they can scatter light.

Q.23. What causes Brownian movement in a colloidal solution?

[NCERT Exemplar]

Ans. Unbalanced bombardment of the particles of dispersed phase by molecules of dispersion medium causes Brownian motion. This stabilizes the sol.

Q.24. Give one example of positively charged sol and one example of negatively charged sol.

Ans. $Fe(OH)_3$ is a positively charged sol whereas As_2S_3 is a negatively charged colloid.

Q.25. What is the main cause of charge on a colloidal solution?

Ans. The charge on the colloidal particles is due to adsorption of common ions of the electrolyte on the surface of the colloidal particles, *e.g.*, Fe^{3+} from $FeCl_3$ on the surface of $Fe(OH)_3$ particles.

Q.26. What causes electrophoresis?

Ans. Electrophoresis is due to charge on colloidal particles, the charged particles move towards one of the electrodes in electric field.

Q.27. How can a lyophilic sol be coagulated?

Ans. This can be done (i) by adding an electrolyte, (ii) by adding a suitable solvent.

Q.28. Why is ferric chloride preferred over potassium chloride in case of a cut leading to bleeding?

[HOTS]

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

Q.29. What is common in aquasols and solid aerosols? How do they differ?

Ans. Aquasol and solid aerosol both have solid as the dispersed phase. They differ in dispersion medium. Aquasols have water as the dispersion medium while aerosols have gas as the dispersion medium.

Q.30. How will you distinguish between dispersed phase and dispersion medium in an emulsion?

[NCERT Exemplar]

Ans. On adding dispersion medium, emulsions can be diluted to any extent. The dispersed phase forms a separate layer if added in excess.

Q.31. Why are some medicines more effective in the colloidal form?

[NCERT Exemplar]

Ans. Medicines are more effective in the colloidal form because of large surface area and are easily assimilated in this form.

Q.32. It is possible to cause artificial rain by spraying silver iodide on the clouds. Comment.

[NCERT Exemplar] [HOTS]

Ans. Yes. Clouds are colloidal in nature and carry charge. Spray of silver iodide, an electrolyte, results in coagulation leading to rain.

Q.33. What happens when gelatin is added to gold sol?

[NCERT Exemplar]

Ans. Gold sol which is lyophobic starts behaving like a lyophilic colloid when gelatin is added to it.

Q.34. What is Kraft temperature?

Ans. Kraft temperature is the minimum temperature above which the formation of micelles takes place.

Q.35. Write two differences between sols and emulsions.

Ans. (i) Sols are dispersions of solids in liquids while emulsions are dispersions of liquids in liquids.

(ii) Sols are quite stable whereas emulsions are less stable.

Q.36. How do emulsifying agents stabilise the emulsion?

[NCERT Exemplar]

Ans. The emulsifying agent forms an interfacial layer between suspended particles and the dispersion medium thereby stabilising the emulsion.

Q.37. Which of the following is most effective electrolyte in the coagulation of AgI/Ag^+ sol?

K_2SO_4, $MgCl_2$, $K_4[Fe(CN)_6]$]

[*CBSE Sample Paper 2014*]

Ans. $K_4[Fe(CN)_6]$

Q.38. What is shape-selective catalysis?

[CBSE Sample Paper 2016]

Ans. The catalytic reaction which depends upon the pore structure of the catalyst and the size of the reactant and product molecules is called shape-selective catalysis. Zeolites are good shape-selective catalysts.

Short Answer Questions-I

Short Answer Questions-I (PYQ)

Q.1. Name the two groups into which phenomenon of catalysis can be divided. Give an example of each group with the chemical equation involved.

[CBSE Delhi 2012]

Ans. The two groups into which phenomenon of catalysis can be divided are:

(i) Homogeneous catalysis: When the reactants and the catalyst are in the same phase, the catalysis is said to be homogeneous catalysis. For example, SO_2 is oxidised to SO_3 in the presence of nitric oxide, NO as catalyst.

$$2\,SO_2\,(g) \;+\; O_2(g) \xrightarrow{NO\ (g)} 2\,SO_3\,(g)$$

(ii) Heterogeneous catalysis: When the reactants are in a different phase than the catalyst, the catalysis is said to be heterogeneous. For example, the combination of dinitrogen and dihydrogen to form ammonia in the presence of finely divided iron as a catalyst.

$$N_2(g) \;+\; 3H_2(g) \xrightarrow{Fe\ (s)} 2\,NH_3\,(g)$$

Q.2. Answer the following questions.

Q. What happens when a freshly precipitated $Fe(OH)_3$ is shaken with water containing a small quantity of $FeCl_3$?

Ans. It is converted into colloidal state.

$$Fe(OH)_3 \;+\; FeCl_3 \;\rightarrow\; [Fe(OH)_3\,Fe]^{3+} \;+\; 3\,Cl^-$$

Q. Why is a finely divided substance more effective as an adsorbent?

[CBSE (F) 2013]

Ans. Powdered substances have greater surface area as compared to their crystalline forms. Greater the surface area, greater is the adsorption.

Q.3. How are the following colloidal solutions prepared?

i. **Sulphur in water**
ii. **Gold in water**

[CBSE Delhi 2013]

Ans.

i. Sulphur sol is prepared by the oxidation of H_2S with SO_2.

$$SO_2 + 2H_2S \xrightarrow{\text{Oxidation}} 3\ S(\text{Sol}) + 2H_2O$$

ii. Gold sol is prepared by the reduction of $AuCl_3$ with formaldehyde.

$$2\,AuCl_3 + 3\,HCHO + 3H_2O \xrightarrow{\text{Reduction}} 2\,Au\,(\text{Sol}) + 3HCOOH + 6\,HCl$$

Q.4. Write the differences between physisorption and chemisorption with respect to the following:

i. **Specificity**
ii. **Temperature dependence**
iii. **Reversibility and**
iv. **Enthalpy change**

[*CBSE Delhi 2013*]

Ans.

	Physisorption	**Chemisorption**
(*i*) Specificity	It is not specific in nature.	It is highly specific in nature.
(*ii*)Temperature dependence	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.
(*iii*) Reversibility	It is reversible in nature.	It is irreversible.
(*iv*) Enthalpy change	Enthalpy of adsorption is low (20–40 kJ) in this case.	Enthalpy of adsorption is high (80-240 kJ mol) in this case.

Q.5. What is meant by coagulation of a colloidal solution? Describe briefly any three methods by which coagulation of lyophobic sols can be carried out.

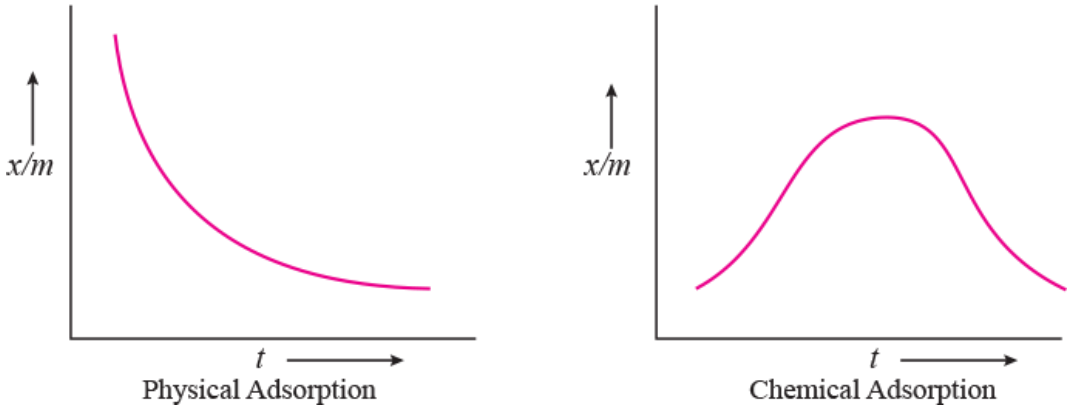
[*CBSE Delhi 2012*]

Ans. The process of settling of colloidal particles through induced aggregation by the addition of some suitable electrolyte is known as coagulation. Three methods by which coagulation of lyophobic sols can be carried out are:

i. **Electrophoresis:** During electrophoresis the colloidal particles move towards oppositely charged electrodes, get discharged and coagulated.
ii. **Boiling:** On boiling a sol, the adsorbed layer is disturbed due to increased collision with the molecules of dispersion medium. This reduces the charge on the particles which ultimately settle down in the form of a precipitate.
iii. **Addition of Electrolytes:** When excess of an electrolyte is added to a colloidal solution, the colloids interact with ions carrying charge opposite to that present on themselves. This causes neutralisation leading to their coagulation.

Short Answer Questions-I (OIQ)

Q.1. Physical and chemical adsorption respond differently with a rise in temperature. What is this difference and why is it so?



Ans. Adsorption isobar for physical adsorption shows that the extent of adsorption decreases with the increase in temperature. The adsorption isobar of chemical adsorption shows that the extent of adsorption first increases and then decreases with the increase in temperature. The initial unexpected increase in the extent of adsorption with temperature is due to the fact that the heat supplied acts as activation energy required for chemical adsorption which is much more than that of physical adsorption.

Q.2. Give an example where physisorption changes to chemisorption with rise in temperature. Explain the reason for change.

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

Q.3. Answer the following questions.

Q. How does BF_3 act as a catalyst in industrial process?

[*NCERT Exemplar*]

Ans. It is because BF_3 is an electron deficient compound and helps to generate electrophile.

Q. Give an example of shape-selective catalysis.

Ans. ZSM–5 (Zeolite Sieve with molecular porosity 5).

Q. 4. Do the vital functions of the body such as digestion get affected during fever? Explain your answer.

[*NCERT Exemplar*]

Ans. The optimum temperature range for the activity of enzymes is 298–310 K. On either side of this temperature range, enzymatic activity gets affected. Thus, during fever, when temperature rises above 310 K, the activity of enzymes may be affected.

Q.5. In which of the following does adsorption take place and why?

i. **Silica gel placed in the atmosphere saturated with water.**
ii. **Anhydrous $CaCl_2$ placed in the atmosphere saturated with water.**

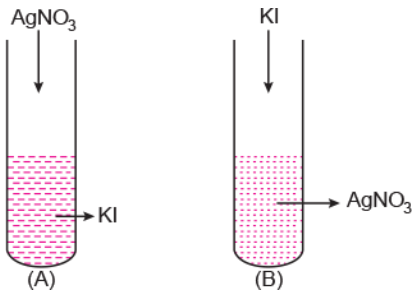
[*HOTS*]

Ans. i. In silica gel, adsorption takes place due to attraction and retention of water molecules on the surface.

ii. Anhydrous $CaCl_2$ undergoes absorption because it combines with water molecules to form hydrated calcium chloride, $CaCl_2.2H_2O$.

Q.6. A colloidal solution of AgI is prepared by two different methods as shown in figure below.

[HOTS]

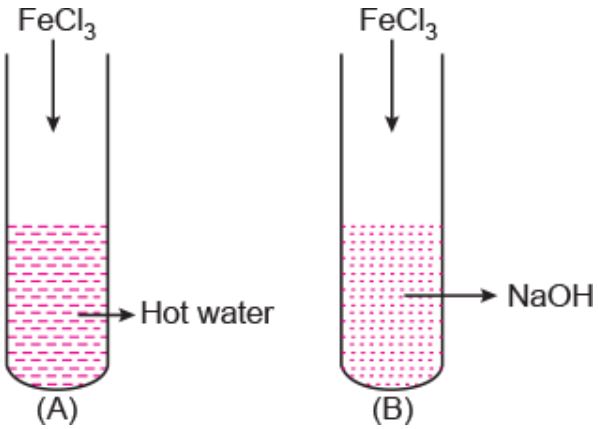


i. **What is the charge of AgI colloidal particles in the two test tubes (A) and (B)?**
ii. **Give reasons for the origin of charge.**

Ans.

i. Test tube (A) has negative charge whereas test tube (B) has positive charge on the colloidal particles.
ii. In test tube (A), I^- is adsorbed on precipitate AgI [or AgI/I^- is formed] and in test tube (B), Ag^+ is adsorbed on precipitate AgI [or AgI/Ag^+ is formed]

Q.7. A colloidal solution of ferric oxide is prepared by two different methods as shown below. [*HOTS*]



i. **What is the charge on colloidal particles in two test tubes (A) and (B)?**
ii. **Give reasons for the origin of charge.**

Ans. i. Colloidal particles of test tube (A) are positively charged whereas colloidal particles of test tube (B) are negatively charged.

ii. In test tube (A), Fe^{3+} is adsorbed on the precipitate $Fe_2O_3 \cdot xH_2O$ [or $Fe_2O_3 \cdot xH_2O/Fe^{3+}$ is formed].

In test tube (B), OH^- ion is adsorbed on the precipitate $Fe_2O_3 \cdot xH_2O$ [or $Fe_2O_3 \cdot xH_2O/OH^-$ is formed].

Q.8. Which one of the following electrolytes is the 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_3PO_4(containing PO_4^{3-} ions) is the most effective.

Q.9. Give reasons:

Q. Physisorption decrease with increase of temperature.

Ans. As physisorption is an exothermic process:

$$\underset{(\text{Adsorbent})}{\text{Solid}} + \underset{(\text{Adsorbate})}{\text{Gas}} \rightarrow \underset{(\text{Gas adsorbed on solid})}{\text{Gas / Solid}} + \text{Heat}$$

According to Le Chatelier's principle, if we increase the temperature, equilibrium will shift in the backward direction, i.e., gas is released from the adsorbed surface.

Q. Gelatin which is a peptide is added in ice-creams.

[*NCERT Exemplar*]

Ans. Ice-creams are emulsions which get stabilised by emulsifying agents like gelatin.

Short Answer Questions-II

Short Answer Questions-II (PYQ)

Q.1. Define adsorption with an example. Why is adsorption exothermic in nature? Write the types of adsorption based on the nature of forces between adsorbate and adsorbent. [CBSE Ajmer 2015]

Ans. The accumulation of the molecular species at the surface rather than in the bulk of a solid or liquid is known as adsorption. For example, water vapour are adsorbed by silica gel.

When a gas is adsorbed on the surface of a solid its entropy decreases, *i.e*., D*S* becomes –ve. Since adsorption is a spontaneous process, therefore, D*G* (= D*H* – *T*D*S*) must be negative. As – *T*D*S* is +ve, D*G*can be negative only if D*H* has sufficiently high –ve value. Hence, adsorption is exothermic in nature.

There are two types of adsorption based on the nature of forces between adsorbate and adsorbent.

- **i.** Physical adsorption, when accumulation of gas on the surface of a solid occurs due to weak van der Waal forces.
- **ii.** Chemical adsorption, when the gas molecules or atoms are held to the surface of solid by chemical bonds.

Q.2. Answer the following questions.

Q. Production of vacuum

Ans. Production of Vacuum: Adsorption can be successfully applied to create conditions of high vacuum. For this, a bulb of charcoal cooled in liquid air, is connected to vessel which has already been exhausted as far as possible by vacuum pump. The remaining traces of air inspite of low pressure are adsorbed by the charcoal almost completely

Q. Heterogeneous catalysis

Ans. Heterogeneous Catalysis: There are many gaseous reactions of industrial importance involving solid catalyst. Manufacture of ammonia using iron as a catalyst, manufacture of H_2SO_4 by contact process using V_2O_5catalyst and use of finely divided nickel in the hydrogenation of vegetable oils are the excellent examples. The gaseous reactants are adsorbed on the surface of the solid catalyst. As a result, the

concentration of the reactants increases on the surface of the catalyst and hence the rate of reaction increases.

Q. Froth Floatation process

[*CBSE Delhi 2011; (F) 2011*]

Ans. Froth Floatation Process: In froth floatation process, the powdered ore is mixed with water. It is then mixed with pine oil (a frother). The oil particles are adsorbed on the surface of ore particles. Now a stream of air is blown through the mixture from below when froth is formed at the water surface. The ore particles stick to the bubbles of the air rises to surface along with the foam while the gangue particles which are wetted by water settle at the bottom. The foam is separated out and is collected and in the course, the ore particles also settle down.

Q.3. Classify colloids where the dispersion medium is water. State their characteristics and write an example of each of these classes.

[*CBSE (AI) 2011; (F) 2012*]

Ans. These are of two types:

i. **HydrophilicStability:** More stable as the stability is due to charge and water envelope surrounding the sol particles. **Nature:** Reversible **Examples:** Starch, gum, etc.
ii. **HydrophobicStability:** Less stable as the stability is due to charge only. **Nature:** Irreversible **Examples:** Metal hydroxide like $Fe(OH)_3$ and metal sulphide like As_2S_3.

Q.4. Define the following terms:

Q. Homogeneous catalysis

Ans. In a catalysis process if the catalyst and the reactants are in the same phase (liquid or gas), the process is said to be homogeneous catalysis. For example, oxidation of SO_2 to SO_3 with O_2 in the presence of NO as a catalyst.

$$2\,SO_2\,(g) \;+\; O_2(g) \xrightarrow{NO\ (g)} 2\,SO_3\,(g)$$

Q. Coagulation

Ans. The process of settling of colloidal particles forming a precipitate is called coagulation.

Q. Macromolecular colloids

Ans. Macromolecules in a suitable solvent form solutions in which the size of the macromolecules may be in colloidal range. Such colloids are called macromolecular colloids. These colloids are quite stable and resemble true solutions in many respect, *e.g.*, starch dispersed in water.

Q.5. Answer the following questions.

Q. Differentiate between adsorption and absorption.

Ans.

S.No.	**Adsorption**	**Absorption**
(***i***)	It is a surface phenomenon. Adsorbate molecules are held at the surface of adsorbent.	Absorption occurs in the bulk of absorbing substance.
(***ii***)	The concentration of the adsorbate at the adsorbent surface is much more than that in the bulk.	Absorbed material is uniformly distributed throughout the bulk. Thus, concentration is same throughout.
(***iii***)	Initially, rate of adsorption is rapid. It decreases slowly till equilibrium is attained. **Example:** Water vapours on silica gel.	Absorption occurs with uniform rate. **Example:**Water vapours are absorbed by anhydrous $CaCl_2$.

Q. Out of $MgCl_2$ and $AlCl_3$, which one is more effective in causing coagulation of negatively charged sol and why?

Ans. $AlCl_3$ is more effective in causing coagulation of negatively charged sol as Al^{3+} ion has greater positive charge than Mg^{2+} ion.

Q.6. Define the following terms:'

Q. Brownian movement

[*CBSE Patna 2015*]

Ans. Brownian movement: The motion of the colloidal particles in a zig-zag path due to unbalanced bombardment by the particles of dispersion medium is called Brownian movement.

Q. Peptization

[*CBSE Patna 2015*]

Ans. Peptization: The process of converting a precipitate into colloidal sol by shaking it with dispersion medium in the presence of a small amount of suitable electrolyte is called peptization. During peptization, the precipitate absorbs one of the ions of the electrolyte on its surface. This causes development of positive or negative charge on precipitates, which ultimately break up into particles of colloidal dimension.

Q. Multimolecular colloids

[*CBSE Patna 2015*]

Ans. Multimolecular colloids: A large number of atoms or smaller molecules (diameter < 1 nm) of a substance on dissolution aggregate together to form species having size in the colloidal range. Such species are called multimolecular colloids. Examples: a sulphur sol consist of particles containing thousands of S_8 sulphur molecules, a platinum or gold sol may have particles of various sizes having many atoms.

Q.7. Differentiate among a homogeneous solution, a suspension and a colloidal solution, giving a suitable example of each.

[CBSE (F) 2012]

Ans.

S.No.	**Property**	**Homogeneous solution**	**Colloidal solution**	**Suspension**
(***i***)	Particle size	Less than 1nm	Between 1 nm to 1000 nm	More than 1000 nm
(***ii***)	Separation by l ordinary filtration l ultra filtration	 Not possible Not possible	 Not possible Possible	 Possible Possible
(***iii***)	Settling of particles	Do not settle	Settle only on coagulation	Settle under gravity
(***iv***)	Appearance	Transparent	Opaque	Translucent
(***v***)	Example	Glucose dissolved in water	Smoke, milk, gold sol	Sand in water

Q.8. Explain the cleansing action of soap. Why do soaps not work in hard water?

[*CBSE (AI) 2012*]

Ans. The cleansing action of soap such as sodium stearate is due to the fact that soap molecules form micelle around the oil droplet in such a way that hydrophobic part of the stearate ions is in the oil droplet and hydrophilic part projects out of the grease droplet like the bristles. Since the polar groups can interact with water, the oil droplet surrounded by stearate ions is now pulled in water and removed from the dirty surface. Thus, soap helps in emulsification and washing away of oils and fats.

Hard water contains calcium and magnesium salts. In hard water, soap gets precipitated as calcium and magnesium soap which being insoluble stick to the clothes as gummy mass. Therefore, soaps do not work in hard water.

Q.9. Define the following terms giving one suitable example for each:

Q. Electrophoresis

Ans. The movement of colloidal particles towards oppositely charged electrodes in an electric field is called electrophoresis.

Q. Micelles

Ans. There are some substances such as soap which at low concentration behave as normal electrolytes, but at higher concentration exhibit colloidal behaviour due to the formation of aggregates. The aggregated particles thus formed are known as micelles or associated colloids.

Q. Peptization

Ans. The process of converting a precipitate into colloidal solution by shaking it with dispersion medium in the presence of small amount of electrolyte is called peptization.

Q.10. What are emulsions? What are their different types? Give one example of each type.

[*CBSE (AI) 2014*]

Ans. Emulsions are the colloidal solutions in which both the dispersed phase and dispersion medium are liquids. Emulsion can be classified into two types. These are:

i. **Oil in water (O/W) type emulsion:** In this type of emulsions oil acts as disperse phase and water acts as dispersion medium e.g., milk, vanishing cream.
ii. **Water in oil (W/O) type emulsion:** In this type of emulsions water acts as disperse phase and oil acts as dispersion medium e.g., butter, cod liver oil, cold cream.

Q. 11. Answer the following questions.

Q. Write the dispersed phase and dispersion medium of milk.

Ans. Both the dispersed phase and dispersion medium of milk are liquid.

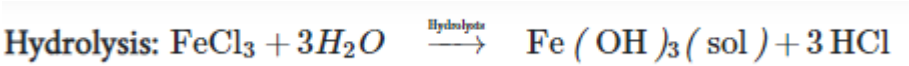
Q. Write one similarity between physisorption and chemisorption.

Ans. Both the physisorption and chemisorption increase with increase in surface area.

Q. Write the chemical method by which $Fe(OH)_3$ sol is prepared from $FeCl_3$.

[*CBSE (AI) 2017*]

Ans.



The $Fe(OH)_3$ molecules formed as result of hydrolysis of $FeCl_3$ aggregate leadig to the formation of sol.

Q.12. Write one difference in each of the following:

Q. Lyophobic sol and Lyophilic sol

Ans.

(*i*)	**Lyophobic Sol**	**Lyophilic Sol**
	Solvent hating Irreversible in nature	Solvent loving Reversible in nature (*Any one*)

Q. Solution and Colloid
Ans.

(*ii*)	**Solution**	**Colloid**
	Homogeneous mixture Does not show Tyndall effect	Heterogeneous mixture Shows Tyndall effect (*Any one*)

Q. Homogeneous catalysis and Heterogeneous catalysis

[CBSE Delhi 2017]

Ans. (iii)

Homogeneous catalysis	Heterogeneous catalysis
Reactants and catalyst are in same phase. $2\,SO_2\,(g) + O_2(g) \xrightarrow{NO(g)} 2\,SO_3\,(g)$ (*Any one*)	Reactants and catalyst are not in same phase. $N_2(g) + 3H_2(g) \xrightarrow{Fe(s)} 2\,NH_3\,(g)$ (*Any one*)

Q.13. Answer the following questions.

Q. Out of silica gel and anhydrous $CaCl_2$, which will adsorb the water vapours?

Ans. Silica gel

Q. Out of H_2SO_4 and H_3PO_4, which one is more effective in causing coagulation of positively charged sol? Give reason.

Ans.

$H_3\,PO_4$, as PO_4^{3-} ion has greater negative charge than SO_4^{2-}.

Q. Out of sulphur sol and proteins, which one forms macromolecular colloids?

[*CBSE South 2016*]

Ans. Proteins

Short Answer Questions-II (OIQ)

Q.1. How do size of particles of adsorbent, pressure of gas and prevailing temperature influence the extent of adsorption of a gas on a solid?

Ans. The influence is in the following ways:

i. Smaller the size of the particles of the adsorbent, greater is the surface area and greater is the adsorption.
ii. At constant temperature, adsorption first increases with increase of pressure and then attains equilibrium at a high pressure.
iii. In physical adsorption, it decreases with increase of temperature but in chemisorption, first it increases and then decreases.

Q.2. How does a solid catalyst enhance the rate of combination of gaseous molecules?

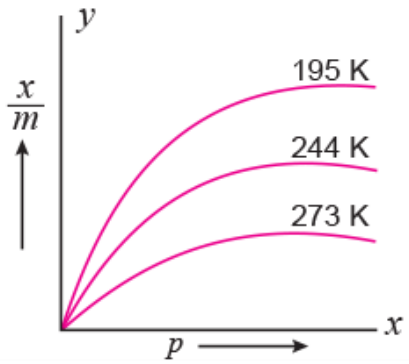
[*NCERT Exemplar*]

Ans. When gaseous molecules come in contact with the surface of a solid catalyst, adsorption of gaseous molecules takes place at the surface of the catalyst. It increases the concentration of reactants on the surface. Different molecules adsorbed side by side have better chance to react and form new molecules. This enhances the rate of reaction. Also, adsorption is an exothermic process. The heat released in the process of adsorption is utilised in enhancing the reaction rate.

Q.3. Consider the adsorption isotherms given alongside 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.**

[*HOTS*]



Ans.

i. (*a*) At constant pressure, extent of adsorption $\left(\frac{x}{m}\right)$ decreases with increase in temperature as adsorption is an exothermic process.
ii. (*b*) At constant temperature, first adsorption $\left(\frac{x}{m}\right)$ increases with increase in pressure up to a particular pressure and then it remains constant.

$$\text{At low pressure, } \frac{x}{m} = \text{kp}$$

$$\text{At intermediate range of pressure, } \frac{x}{m} = \text{kp}^{1/n} \quad (n > 1)$$

$$\text{At high pressure, } \frac{x}{m} = k \text{ (independent of pressure)}$$

(*ii*) Finely divided iron is used as a catalyst and molybdenum is used as promoter.

Q.4. Explain the following observations:

[*HOTS*]

Q. Sun looks red at the time of setting.

Ans. At the time of setting, the sun is at horizon. The light emitted by the sun has to travel a relatively longer distance through the atmosphere. As a result, blue part of light is scattered away by the particulate in the atmosphere causing red part to be visible.

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Q. Cottrell's smoke precipitator is fitted at the mouth of the chimney used in factories.

Ans. 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.]

Q. Physical adsorption is multilayered while chemical adsorption is monolayered.

[*HOTS*]

Ans. Physical adsorption involves van der Waals' forces, so any number of layers may be formed one over the other on the surface of the adsorbent. Chemical adsorption takes place as a result of the reaction between adsorbent and adsorbate. When the surface of adsorbent is covered with one layer, no further reaction can take place.

Q.5. What type of colloidal sols are formed in the following:

i. **Sulphur vapours are passed through cold water.**
ii. **White of an egg is mixed with water.**
iii. **Soap solution.**

Ans.

i. Multimolecular because sulphur molecules associate together to form multimolecular colloids.
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.

Q.6. Answer the foolowing questions.

Q. What are micelles? How do they differ from ordinary colloidal particles? Give two examples of micelle forming substances.

Ans. There are some substances which at low concentration behave as normal electrolyte but at higher concentrations exhibit colloidal behaviour due to formation of aggregated particles. The aggregated particles thus formed are called micelles. Surface active agents such as soaps and detergents are the example of micelle forming substances.

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

Q. State Hardy–Schulze rule.

Ans. Hardy and Schulze rules:

i. The ions carrying charge opposite to that of sol particles are effective in bringing about the coagulation of sol.
ii. Coagulating power of the electrolyte is directly proportional to the fourth power of the valency of the ions causing coagulation.

Q.7. SnO_2 forms a positively charged colloidal sol in acidic medium and a negatively charged sol in the basic medium. Why? Explain.

[*HOTS*]

Ans. SnO_2 is amphoteric in nature. It reacts with acids such as HCl, to form $SnCl_4$ in the solution. The common Sn^{4+} ions are adsorbed on the surface of SnO_2 particles to give a positively charged colloidal sol.

$$SnO_2 + 4HCl \rightarrow SnCl_4 + 2H_2O$$

$$SnO_2 + Sn^{4+} \rightarrow \underset{\text{Positively charged sol}}{(SnO_2) : Sn^{4+}}$$

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$$SnO_2 + 2NaOH \rightarrow \underset{\text{Sodium stannate}}{Na_2SnO_3} + H_2O$$

$$SnO_2 + SnO_3^{2-} \rightarrow \underset{\text{Negatively charged sol}}{(SnO_2) : SnO_3^{2-}}$$

Q.8. Answer the following questions.

Q. In reference to Freundlich adsorption isotherm write the expression for adsorption of gases on solids in the form of an equation.

Ans. Freundlich adsorption isotherm equation for adsorption of gases on solids:

$$\frac{x}{m} = \mathrm{kp}^{1/n} \qquad (n > 1)$$

$$\text{or} \quad \log \frac{x}{m} = \log k + \frac{1}{n} \log p$$

where *x* is the mass of the gas adsorbed on mass *m* of the adsorbent at pressure *p*, *k* and *n* are constants which depends on the nature of the gas and adsorbent at a particular temperature.

Q. Write an important characteristic of lyophilic sols.

Ans. Important characteristics of lyophilic sols:

(*a*) They are reversible in nature, *i.e*., once the dispersed phase is separated from dispersion medium the sol can be made again by simply remixing with dispersion medium.

(*b*) They are quite stable and are not easily coagulated.

Q. Based on type of particles of dispersed phase, give one example each of associated colloid and multimolecular colloid.

Ans.

Type of Colloid	**Example**
Associated colloid	Surface active agents such as soap (CMC is 10^{-4} to 10^{-3} mol L^{-1}) and synthetic detergents.
Multimolecular colloid	Sulphur sol, gold sol

Q.9. Give reasons for the following:

[*CBSE Sample Paper 2013*]

Q. Rough surface of catalyst is more effective than smooth surface.

Ans. Rough surface of a catalyst provides more surface area for adsorption.

Q. Smoke passed through charged plates before allowing it to come out of chimneys in factories.

Ans. Smoke is passed through charged plates so that unburnt charged carbon particles get settled between the charged plate leaving behind air free from pollutants.

Q. Ne gets easily absorbed over charcoal than He.

Ans. Ne has higher critical temperature, *i.e.*, stronger van der Waals forces therefore easily adsorbed.

Q. Explain what is observed when

[*CBSE Sample Paper 2015*]

Q. silver nitrate solution is added to potassium iodide solution.

Ans. If silver nitrate solution is added to potassium iodide solution, the precipitated silver iodide adsorbs iodide ions from the dispersion medium and negatively charged colloidal solution results.

$$\mathrm{AgI} + \underset{\substack{(\text{From dispersion}\\ \text{medium})}}{I^-} \rightarrow \underset{\substack{\text{Negatively charged}\\ \text{Sol}}}{\mathrm{AgI}\ /\ I^-}$$

Q. the size of the finest gold sol particles increases in the gold sol.

Ans. The colour of the colloidal solution depends on the wavelength of the light scattered by the colloidal particles which in turn depends on size and nature of the colloidal particle. Finest gold sol is red in colour, as the size of the particle increases, it appears purple, then blue and finally golden.

Q. two oppositely charged sols are mixed in almost equal proportions.

Ans. Two oppositely charged sols when mixed in almost equal proportions, neutralise their charges and get partially or completely precipitated. Such type of coagulation is called mutual coagulation.

Q.11. Answer the following questions:

[*CBSE Sample Paper 2016*]

Q. What happens when a freshly precipitated $Fe(OH)_3$ is shaken with a little amount of dilute solution of $FeCl_3$?

Ans. It is converted into colloidal state by preferential adsorption of Fe^{3+} ions.

$$Fe(OH)_3 + FeCl_3 \rightarrow [Fe(OH)_3]\ Fe^{3+} + 3Cl^-$$

Reddish brown coloured colloid

Q. Why are lyophilic colloidal sols more stable than lyophobic colloidal sols?

Ans. This is because the stability of lyophobic sol is only due to the presence of charge on the colloidal particles. On the other hand, the stability of lyophilic sol is due to charge on the colloidal particles as well as solvation of colloidal particles.

Q. What form Freundlich adsorption equation will take at high pressure?

Ans.

Freundlich Adsorption Isotherm, $\frac{x}{m} = kp^{1/n}$

At high pressure (beyond saturation pressure), $\frac{1}{n} = 0$ and $\frac{x}{m}$ = constant *i.e.*, the adsorption is independent of pressure. So,

$\frac{x}{m} = kp^0$ or $\frac{x}{m} = k$.

Q.12. Answer the following questions.

Q. Why does leather get hardened after tanning?

Ans. Animal hides are colloidal in nature. When a hide, which has positively charged particles, is soaked in tannin, which contains negatively charged colloidal particles, mutual coagulation takes place. This results in the hardening of leather.

Q. On the basis of Hardy-Schulze rule explain why the coagulating power of phosphate is higher than chloride.

Ans. Greater the valency of flocculating ion added, greater is its power to cause coagulation. Thus, for the coagulation of a positively charged sol PO_4^{3-} ion has higher coagulating power than Cl^- ion.

Q. Do the vital functions of the body such as digestion get affected during fever? Explain your answer.

[*CBSE Sample Paper 2017*]

Ans. The optimum temperature for enzymatic activity is 298-310K. On either side of this range enzyme activity decreases, that is why vital function of the body such as digestion get affected during fever.