

Unit

5

# SURFACE CHEMISTRY

## I. Multiple Choice Questions (Type-I)

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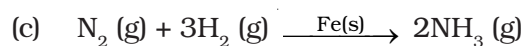
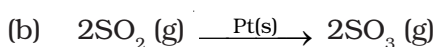
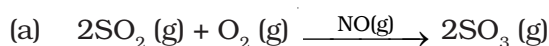
- Which of the following process does **not** occur at the interface of phases?
  - crystallisation
  - heterogenous catalysis
  - homogeneous catalysis
  - corrosion
- At the equilibrium position in the process of adsorption \_\_\_\_\_.
  - $\Delta H > 0$
  - $\Delta H = T\Delta S$
  - $\Delta H > T\Delta S$
  - $\Delta H < T\Delta S$
- Which of the following interface **cannot** be obtained?
  - liquid-liquid
  - solid-liquid
  - liquid-gas
  - gas-gas
- The term 'sorption' stands for \_\_\_\_\_.
  - absorption
  - adsorption
  - both absorption and adsorption
  - desorption

5. Extent of physisorption of a gas increases with \_\_\_\_\_.
- (i) increase in temperature.
  - (ii) decrease in temperature.
  - (iii) decrease in surface area of adsorbent.
  - (iv) decrease in strength of van der Waals forces.
6. Extent of adsorption of adsorbate from solution phase increases with \_\_\_\_\_.
- (i) increase in amount of adsorbate in solution.
  - (ii) decrease in surface area of adsorbent.
  - (iii) increase in temperature of solution.
  - (iv) decrease in amount of adsorbate in solution.
7. Which one of the following is **not** applicable to the phenomenon of adsorption?
- (i)  $\Delta H > 0$
  - (ii)  $\Delta G < 0$
  - (iii)  $\Delta S < 0$
  - (iv)  $\Delta H < 0$
8. Which of the following is **not** a favourable condition for physical adsorption?
- (i) high pressure
  - (ii) negative  $\Delta H$
  - (iii) higher critical temperature of adsorbate
  - (iv) high temperature
9. Physical adsorption of a gaseous species may change to chemical adsorption with \_\_\_\_\_.
- (i) decrease in temperature
  - (ii) increase in temperature
  - (iii) increase in surface area of adsorbent
  - (iv) decrease in surface area of adsorbent
10. In physisorption adsorbent does not show specificity for any particular gas because \_\_\_\_\_.
- (i) involved van der Waals forces are universal.
  - (ii) gases involved behave like ideal gases.
  - (iii) enthalpy of adsorption is low.
  - (iv) it is a reversible process.
11. Which of the following is an example of absorption?
- (i) Water on silica gel
  - (ii) Water on calcium chloride
  - (iii) Hydrogen on finely divided nickel
  - (iv) Oxygen on metal surface

12. On the basis of data given below predict which of the following gases shows least adsorption on a definite amount of charcoal?

<b>Gas</b>	CO <sub>2</sub>	SO <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub>
<b>Critical temp./K</b>	304	630	190	33

- (i) CO<sub>2</sub>  
(ii) SO<sub>2</sub>  
(iii) CH<sub>4</sub>  
(iv) H<sub>2</sub>
13. In which of the following reactions heterogenous catalysis is involved?



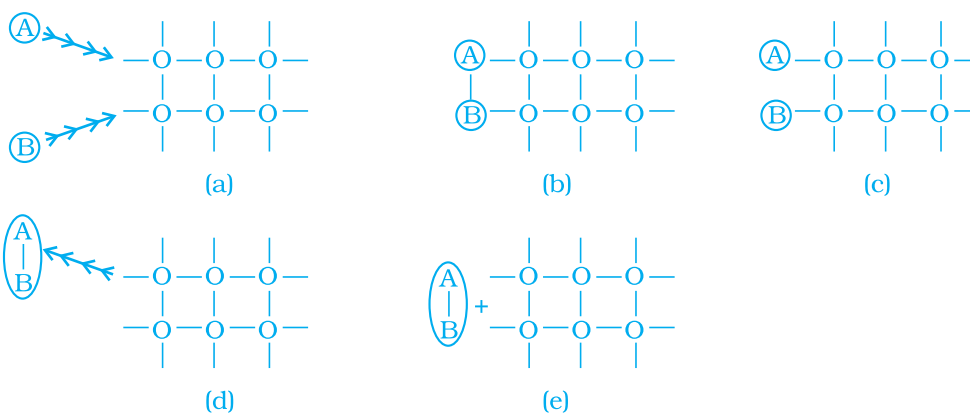
- (i) (b), (c)  
(ii) (b), (c), (d)  
(iii) (a), (b), (c)  
(iv) (d)
14. At high concentration of soap in water, soap behaves as \_\_\_\_\_.
- (i) molecular colloid  
(ii) associated colloid  
(iii) macromolecular colloid  
(iv) lyophilic colloid

15. Which of the following will show Tyndall effect?
- (i) Aqueous solution of soap below critical micelle concentration.  
(ii) Aqueous solution of soap above critical micelle concentration.  
(iii) Aqueous solution of sodium chloride.  
(iv) Aqueous solution of sugar.

16. Method by which lyophobic sol can be protected.
- (i) By addition of oppositely charged sol.  
(ii) By addition of an electrolyte.  
(iii) By addition of lyophilic sol.  
(iv) By boiling.

17. Freshly prepared precipitate sometimes gets converted to colloidal solution by \_\_\_\_\_.
- (i) coagulation  
(ii) electrolysis

- (iii) diffusion  
(iv) peptisation
- 18.** Which of the following electrolytes will have maximum coagulating value for AgI/Ag<sup>+</sup> sol?  
(i) Na<sub>2</sub>S  
(ii) Na<sub>3</sub>PO<sub>4</sub>  
(iii) Na<sub>2</sub>SO<sub>4</sub>  
(iv) NaCl
- 19.** A colloidal system having a solid substance as a dispersed phase and a liquid as a dispersion medium is classified as \_\_\_\_\_.  
(i) solid sol  
(ii) gel  
(iii) emulsion  
(iv) sol
- 20.** The values of colligative properties of colloidal solution are of small order in comparison to those shown by true solutions of same concentration because of colloidal particles \_\_\_\_\_.  
(i) exhibit enormous surface area.  
(ii) remain suspended in the dispersion medium.  
(iii) form lyophilic colloids.  
(iv) are comparatively less in number.
- 21.** Arrange the following diagrams in correct sequence of steps involved in the mechanism of catalysis, in accordance with modern adsorption theory.

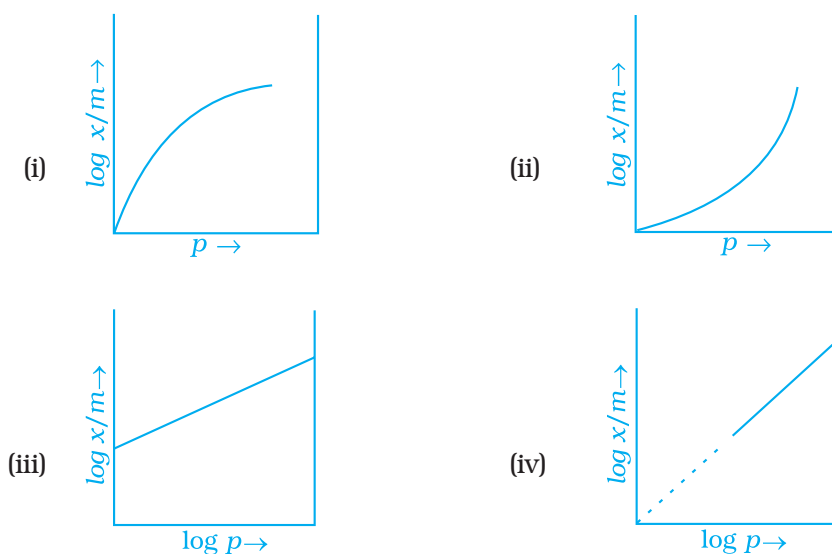


- (i) a → b → c → d → e  
(ii) a → c → b → d → e  
(iii) a → c → b → e → d  
(iv) a → b → c → e → d

22. Which of the following process is responsible for the formation of delta at a place where rivers meet the sea?

- (i) Emulsification
- (ii) Colloid formation
- (iii) Coagulation
- (iv) Peptisation

23. Which of the following curves is in accordance with Freundlich adsorption isotherm?



24. Which of the following process is **not** responsible for the presence of electric charge on the sol particles?

- (i) Electron capture by sol particles.
- (ii) Adsorption of ionic species from solution.
- (iii) Formation of Helmholtz electrical double layer.
- (iv) Absorption of ionic species from solution.

25. Which of the following phenomenon is applicable to the process shown in the Fig. 5.1?

- (i) Absorption
- (ii) Adsorption
- (iii) Coagulation
- (iv) Emulsification

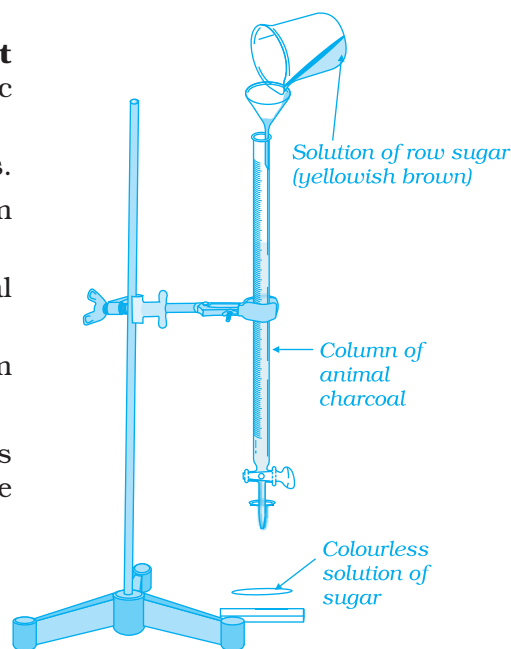


Fig. 5.1

## II. Multiple Choice Questions (Type-II)

**Note :** In the following questions two or more options may be correct.

- 26.** Which of the following options are correct?
- Micelle formation by soap in aqueous solution is possible at all temperatures.
  - Micelle formation by soap in aqueous solution occurs above a particular concentration.
  - On dilution of soap solution micelles may revert to individual ions.
  - Soap solution behaves as a normal strong electrolyte at all concentrations.
- 27.** Which of the following statements are correct about solid catalyst?
- Same reactants may give different product by using different catalysts.
  - Catalyst does not change  $\Delta H$  of reaction.
  - Catalyst is required in large quantities to catalyse reactions.
  - Catalytic activity of a solid catalyst does not depend upon the strength of chemisorption.
- 28.** Freundlich adsorption isotherm is given by the expression  $\frac{x}{m} = k p^{\frac{1}{n}}$  which of the following conclusions can be drawn from this expression.
- When  $\frac{1}{n} = 0$ , the adsorption is independent of pressure.
  - When  $\frac{1}{n} = 0$ , the adsorption is directly proportional to pressure.
  - When  $n = 0$ ,  $\frac{x}{m}$  vs  $p$  graph is a line parallel to  $x$ -axis.
  - When  $n = 0$ , plot of  $\frac{x}{m}$  vs  $p$  is a curve.
- 29.**  $H_2$  gas is adsorbed on activated charcoal to a very little extent in comparison to easily liquefiable gases due to \_\_\_\_\_.
- very strong van der Waal's interaction.
  - very weak van der Waals forces.
  - very low critical temperature.
  - very high critical temperature.
- 30.** Which of the following statements are correct?
- Mixing two oppositely charged sols neutralises their charges and stabilises the colloid.
  - Presence of equal and similar charges on colloidal particles provides stability to the colloids.

- (iii) Any amount of dispersed liquid can be added to emulsion without destabilising it.
- (iv) Brownian movement stabilises sols.
- 31.** An emulsion cannot be broken by \_\_\_\_\_ and \_\_\_\_\_.
- heating
  - adding more amount of dispersion medium
  - freezing
  - adding emulsifying agent
- 32.** Which of the following substances will precipitate the negatively charged emulsions?
- KCl
  - glucose
  - urea
  - NaCl
- 33.** Which of the following colloids **cannot** be coagulated easily?
- Lyophobic colloids.
  - Irreversible colloids.
  - Reversible colloids.
  - Lyophilic colloids.
- 34.** What happens when a lyophilic sol is added to a lyophobic sol?
- Lyophobic sol is protected.
  - Lyophilic sol is protected.
  - Film of lyophilic sol is formed over lyophobic sol.
  - Film of lyophobic sol is formed over lyophilic sol.
- 35.** Which phenomenon occurs when an electric field is applied to a colloidal solution and electrophoresis is prevented?
- Reverse osmosis takes place.
  - Electroosmosis takes place.
  - Dispersion medium begins to move.
  - Dispersion medium becomes stationary.
- 36.** In a reaction, catalyst changes \_\_\_\_\_.
- physically
  - qualitatively
  - chemically
  - quantitatively
- 37.** Which of the following phenomenon occurs when a chalk stick is dipped in ink?
- adsorption of coloured substance
  - adsorption of solvent
  - absorption and adsorption both of solvent
  - absorption of solvent

### III. Short Answer Type

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38. Why is it important to have clean surface in surface studies?
39. Why is chemisorption referred to as activated adsorption?
40. What type of solutions are formed on dissolving different concentrations of soap in water?
41. What happens when gelatin is mixed with gold sol?
42. How does it become possible to cause artificial rain by spraying silver iodide on the clouds?
43. Gelatin which is a peptide is added in icecreams. What can be its role?
44. What is collodion?
45. Why do we add alum to purify water?
46. What happens when electric field is applied to colloidal solution?
47. What causes brownian motion in colloidal dispersion?
48. A colloid is formed by adding  $\text{FeCl}_3$  in excess of hot water. What will happen if excess sodium chloride is added to this colloid?
49. How do emulsifying agents stabilise the emulsion?
50. Why are some medicines more effective in the colloidal form?
51. Why does leather get hardened after tanning?
52. How does the precipitation of colloidal smoke take place in Cottrell precipitator?
53. How will you distinguish between dispersed phase and dispersion medium in an emulsion?
54. On the basis of Hardy-Schulze rule explain why the coagulating power of phosphate is higher than chloride.
55. Why does bleeding stop by rubbing moist alum?
56. Why is  $\text{Fe}(\text{OH})_3$  colloid positively charged, when prepared by adding  $\text{FeCl}_3$  to hot water?
57. Why do physisorption and chemisorption behave differently with rise in temperature?
58. What happens when dialysis is prolonged?
59. Why does the white precipitate of silver halide become coloured in the presence of dye eosin.
60. What is the role of activated charcoal in gas mask used in coal mines?
61. How does a delta form at the meeting place of sea and river water?



- 62.** Give an example where physisorption changes to chemisorption with rise in temperature. Explain the reason for change.
- 63.** Why is desorption important for a substance to act as good catalyst?
- 64.** What is the role of diffusion in heterogenous catalysis?
- 65.** How does a solid catalyst enhance the rate of combination of gaseous molecules?
- 66.** Do the vital functions of the body such as digestion get affected during fever? Explain your answer.

## IV. Matching Type

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

- 67.** Method of formation of solution is given in Column I. Match it with the type of solution given in Column II.

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

- 68.** Match the statement given in Column I with the phenomenon given in Column II.

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

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

**Column I**

- (i) Protective colloid
- (ii) Liquid - liquid colloid
- (iii) Positively charged colloid
- (iv) Negatively charged colloid

**Column II**

- (a)  $\text{FeCl}_3 + \text{NaOH}$
- (b) Lyophilic colloids
- (c) Emulsion
- (d)  $\text{FeCl}_3 + \text{hot water}$

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

**Column I**

- (i) Solid in liquid
- (ii) Liquid in solid
- (iii) Liquid in liquid
- (iv) Gas in liquid

**Column II**

- (a) Foam
- (b) Sol
- (c) Gel
- (d) Emulsion

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

**Column I**

- (i) Dialysis
- (ii) Peptisation
- (iii) Emulsification
- (iv) Electrophoresis

**Column II**

- (a) Cleansing action of soap
- (b) Coagulation
- (c) Colloidal sol formation
- (d) Purification

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

**Column I**

- (i) Butter
- (ii) Pumice stone
- (iii) Milk
- (iv) Paints

**Column II**

- (a) dispersion of liquid in liquid
- (b) dispersion of solid in liquid
- (c) dispersion of gas in solid
- (d) dispersion of liquid in solid

## V. Assertion and Reason Type

**Note :** In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (i) Assertion and reason both are correct and the reason is correct explanation of assertion.
- (ii) Assertion and reason both are correct but reason does not explain assertion.

- (iii) Assertion is correct but reason is incorrect.
- (iv) Both assertion and reason are incorrect.
- (v) Assertion is incorrect but reason is correct.
- 73. Assertion** : An ordinary filter paper impregnated with collodion solution stops the flow of colloidal particles.
- Reason** : Pore size of the filter paper becomes more than the size of colloidal particle.
- 74. Assertion** : Colloidal solutions show colligative properties.
- Reason** : Colloidal particles are large in size.
- 75. Assertion** : Colloidal solutions do not show brownian motion.
- Reason** : Brownian motion is responsible for stability of sols.
- 76. Assertion** : Coagulation power of  $\text{Al}^{3+}$  is more than  $\text{Na}^+$ .
- Reason** : Greater the valency of the flocculating ion added, greater is its power to cause precipitation (Hardy Schulze rule).
- 77. Assertion** : Detergents with low CMC are more economical to use.
- Reason** : Cleansing action of detergents involves the formation of micelles. These are formed when the concentration of detergents becomes equal to CMC.

## VI. Long Answer Type

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- 78.** What is the role of adsorption in heterogenous catalysis?
- 79.** What are the applications of adsorption in chemical analysis?
- 80.** What is the role of adsorption in froth floatation process used especially for concentration of sulphide ores?
- 81.** What do you understand by shape selective catalysis? Why are zeolites good shape selective catalysts?