

I. Multiple Choice Questions (Type-I)

1. Which of the following process does not occur at the interface of phases?

- (i) crystallisation
- (ii) heterogeneous catalysis
- (iii) homogeneous catalysis
- (iv) corrosion

Solution:

Option (iii) is the answer.

2. At the equilibrium position in the process of adsorption _____.

- (i) $\Delta H > 0$
- (ii) $\Delta H = T\Delta S$
- (iii) $\Delta H > T\Delta S$
- (iv) $\Delta H < T\Delta S$

Solution:

Option (ii) is the answer.

3. Which of the following interface cannot be obtained?

- (i) liquid-liquid
- (ii) solid-liquid
- (iii) liquid-gas
- (iv) gas-gas

Solution:

Option (iv) is the answer.

4. The term 'sorption' stands for _____.

- (i) absorption
- (ii) adsorption
- (iii) both absorption and adsorption
- (iv) desorption

Solution:

Option (iii) is the answer.

5. Extent of physisorption of a gas increases with _____.

- (i) increase in temperature.
- (ii) the decrease in temperature.
- (iii) the decrease in surface area of the adsorbent.
- (iv) the decrease in strength of van der Waals forces.

Solution:

Option (ii) is the answer.

6. The extent of adsorption of adsorbate from the solution phase increases with _____.

- (i) increase in the amount of adsorbate in solution.
- (ii) the decrease in surface area of the adsorbent.
- (iii) increase in temperature of the solution.

(iv) the decrease in the amount of adsorbate in solution

Solution:

Option (i) is the answer.

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) $\Delta H < 0$

Solution:

Option (i) is the answer.

8. Which of the following is not a favourable condition for physical adsorption?

(i) high pressure

(ii) negative ΔH

(iii) the higher critical temperature of adsorbate

(iv) high temperature

Solution:

Option (iv) is the answer.

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 the adsorbent

(iv) the decrease in surface area of the adsorbent

Solution:

Option (ii) is the answer.

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.

Solution:

Option (i) is the answer.

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 the metal surface

Solution:

Option (ii) is the answer.

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

Gas	CO ₂	SO ₂	CH ₄	H ₂
Critical temo./K	304	630	190	33

- (i) CO₂
- (ii) SO₂
- (iii) CH₄
- (iv) H₂

Solution:

Option (iv) is the answer.

13. In which of the following reactions heterogenous catalysis is involved?

- (a) $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow [\text{NO}(\text{g})] 2\text{SO}_3(\text{g})$
- (b) $2\text{SO}_2(\text{g}) \rightarrow [\text{Pt}(\text{s})] 2\text{SO}_3(\text{g})$
- (c) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow [\text{Fe}(\text{s})] 2\text{NH}_3(\text{g})$
- (d) $\text{CH}_3\text{COOCH}_3(\text{l}) + \text{H}_2\text{O}(\text{l}) \rightarrow [\text{HCl}(\text{l})] \text{CH}_3\text{COOH}(\text{aq}) + \text{CH}_3\text{OH}(\text{aq})$

Solution:

Option (i) is the answer.

14. At high concentration of soap in water, soap behaves as _____.

- (i) molecular colloid
- (ii) associated colloid
- (iii) macromolecular colloid
- (iv) lyophilic colloid

Solution:

Option (ii) is the answer.

15. Which of the following will show the Tyndall effect?

- (i) An aqueous solution of soap below critical micelle concentration.
- (ii) An aqueous solution of soap above critical micelle concentration.
- (iii) An aqueous solution of sodium chloride.
- (iv) An aqueous solution of sugar.

Solution:

Option (ii) is the answer.

16. The method by which lyophobic sol can be protected.

- (i) By the addition of oppositely charged sol.
- (ii) By the addition of an electrolyte.
- (iii) By the addition of lyophilic sol.
- (iv) By boiling.

Solution:

Option (iii) is the answer.

17. Freshly prepared precipitate sometimes gets converted to colloidal solution by _____.

- (i) coagulation

(ii) electrolysis

(iii) diffusion

(iv) peptisation

Solution:

Option (iv) is the answer.

18. Which of the following electrolytes will have maximum coagulating value for

AgI/Ag⁺

sol?

(i) Na₂S

(ii) Na₃PO₄

(iii) Na₂SO₄

(iv) NaCl

Solution:

Option (ii) is the answer.

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

Solution:

Option (iv) is the answer.

20. The values of colligative properties of the colloidal solution are of small order in comparison to those shown by true solutions of same concentration because of colloidal particles _____.

(i) exhibit an enormous surface area.

(ii) remain suspended in the dispersion medium.

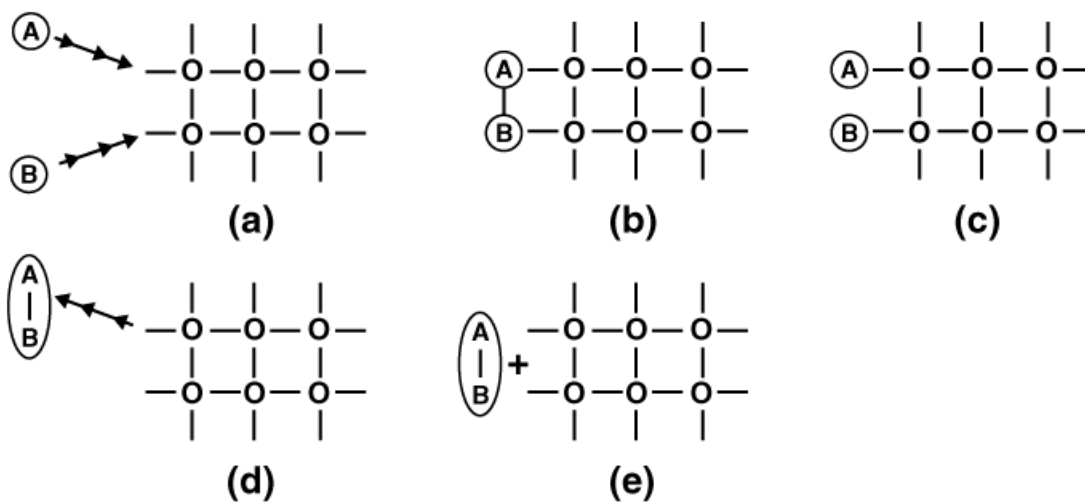
(iii) form lyophilic colloids.

(iv) are comparatively less in number

Solution:

Option (iv) is the answer.

21. Arrange the following diagrams in the correct sequence of steps involved in the mechanism of catalysis, in accordance with modern adsorption theory.



- (i) $a \rightarrow b \rightarrow c \rightarrow d \rightarrow e$
 (ii) $a \rightarrow c \rightarrow b \rightarrow d \rightarrow e$
 (iii) $a \rightarrow c \rightarrow b \rightarrow e \rightarrow d$
 (iv) $a \rightarrow b \rightarrow c \rightarrow e \rightarrow d$

Solution:

Option (ii) is the answer.

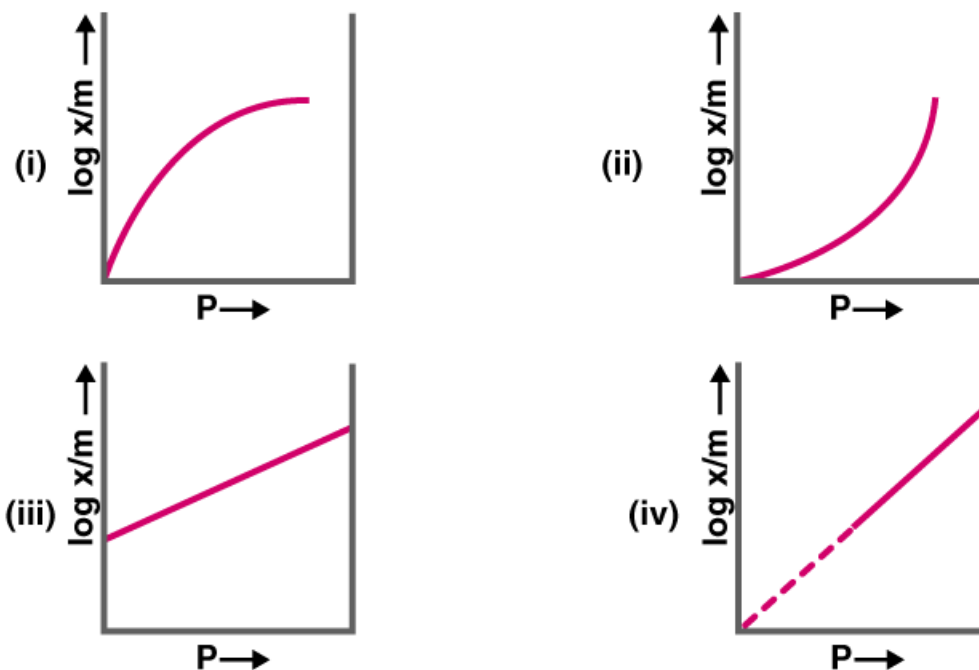
22. Which of the following process is responsible for the formation of the delta at a place where rivers meet the sea?

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

Solution:

Option (iii) is the answer.

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



Solution:

Option (iii) is the answer.

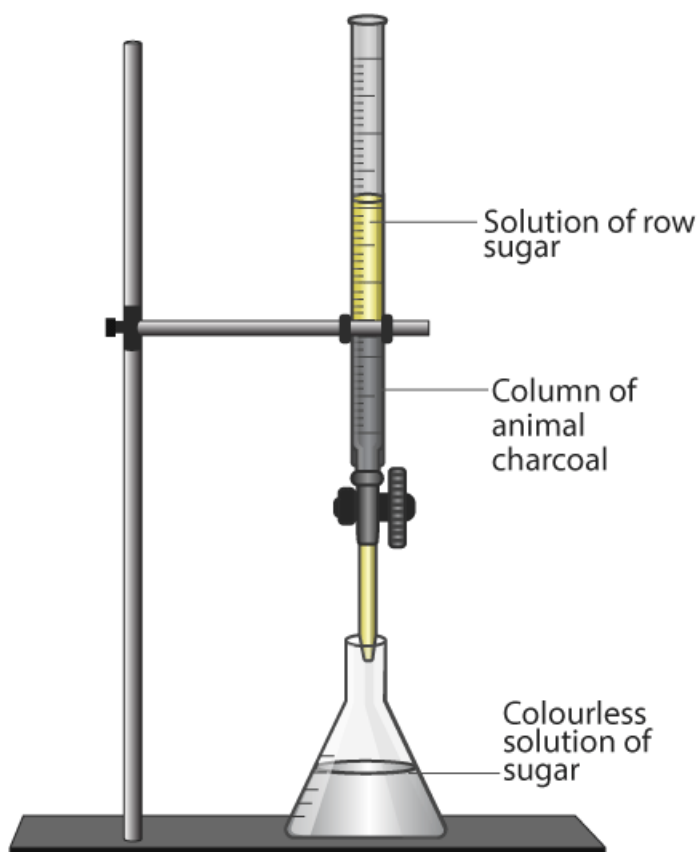
24. Which of the following process is not responsible for the presence of electric charge on the sol particles?

- (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.

Solution:

Option (iv) is the answer.

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



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

Solution:

Option (ii) is the answer.

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?

- (i) Micelle formation by soap in aqueous solution is possible at all temperatures.
- (ii) Micelle formation by soap in aqueous solution occurs above a particular concentration.
- (iii) On dilution of soap, solution micelles may revert to individual ions.
- (iv) Soap solution behaves like a normal strong electrolyte at all concentrations.

Solution:

Option (ii) and (iii) is the answer.

27. Which of the following statements are correct about solid catalyst?

- (i) Same reactants may give different product by using different catalysts.
- (ii) Catalyst does not change ΔH of reaction.
- (iii) Catalyst is required in large quantities to catalyse reactions.
- (iv) The catalytic activity of a solid catalyst does not depend upon the strength of chemisorption.

Solution:

Option (i) and (ii) is the answer.

28. Freundlich adsorption isotherm is given by the expression $x/m = kp^{1/n}$ which of the following conclusions can be drawn from this expression

- (i) When $1/n = 0$, the adsorption is independent of pressure.
- (ii) When $1/n = 0$, the adsorption is directly proportional to pressure.
- (iii) When $n = 0$, x/m vs p graph is a line parallel to x -axis.
- (iv) When $n = 0$, a plot of x/m vs p is a curve.

Solution:

Option (i) and (iii) are the answers.

29. H_2 gas is adsorbed on activated charcoal to a very little extent in comparison to easily liquefiable gases due to _____.

- (i) very strong van der Waal's interaction.
- (ii) very weak van der Waals forces.
- (iii) very low critical temperature.
- (iv) very high critical temperature.

Solution:

Option (ii) and (iii) are the answers.

30. Which of the following statements are correct?

- (i) Mixing two oppositely charged sols neutralises their charges and stabilises the colloid.
- (ii) 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.

Solution:

Option (ii) and (iv) are the answers.

31. An emulsion cannot be broken by _____ and _____.

- (i) heating
- (ii) adding more amount of dispersion medium
- (iii) freezing
- (iv) adding emulsifying agent

Solution:

Option (ii) and (iv) are the answers.

32. Which of the following substances will precipitate the negatively charged emulsions?

- (i) KCl
- (ii) glucose
- (iii) urea
- (iv) NaCl

Solution:

Option (i) and (iv) are the answers.

33. Which of the following colloids cannot be coagulated easily?

- (i) Lyophobic colloids.
- (ii) Irreversible colloids.
- (iii) Reversible colloids.
- (iv) Lyophilic colloids.

Solution:

Option (iii) and (iv) are the answers.

34. What happens when a lyophilic sol is added to a lyophobic sol?

- (i) Lyophobic sol is protected.
- (ii) Lyophilic sol is protected.
- (iii) Film of lyophilic sol is formed over lyophobic sol.
- (iv) Film of lyophobic sol is formed over lyophilic sol.

Solution:

Option (i) and (iii) are the answers.

35. Which phenomenon occurs when an electric field is applied to a colloidal solution and electrophoresis is prevented?

- (i) Reverse osmosis takes place.
- (ii) Electroosmosis takes place.
- (iii) Dispersion medium begins to move.
- (iv) Dispersion medium becomes stationary.

Solution:

Option (ii) and (iii) are the answers.

36. In a reaction, catalyst changes _____.

- (i) physically
- (ii) qualitatively
- (iii) chemically
- (iv) quantitatively

Solution:

Option (i) and (ii) are the answers.

37. Which of the following phenomenon occurs when a chalk stick is dipped in ink?

- (i) adsorption of coloured substance
- (ii) adsorption of solvent

(iii) absorption and adsorption both of solvent

(iv) absorption of solvent

Solution:

Option (i) and (iv) are the answers.

III. Short Answer Type

38. Why is it important to have a clean surface in surface studies?

Solution:

In the adsorption process, the surface of adsorbent adsorbs the desired gases. If the surface is already occupied by some other gases, it becomes saturated and thus cannot adsorb desired gases

39. Why is chemisorption referred to as activated adsorption?

Solution:

Chemisorption involves chemical bond formation which requires activation energy. That is why it is referred to as activated adsorption

40. What type of solutions are formed on dissolving different concentrations of soap in the water?

Solution:

Soap solution at low concentration behaves like normal electrolytic solution. But at high concentration soap solution behaves as associated colloid and form micelles.

41. What happens when gelatin is mixed with gold sol?

Solution:

When gelatin is mixed with gold sol, gelatin forms a protective layer on gold sol, thus preventing coagulation. So gold sol becomes stabilized by adding gelatin, which is a lyophilic sol.

42. How does it become possible to cause artificial rain by spraying silver iodide on the clouds?

Solution:

Clouds carry a charge as they are colloids. Silver iodide AgI being an electrolyte helps in coagulation process between colloidal particles of water in the cloud. Thus it forms bigger raindrops causing artificial rain. AgI is usually sprayed from an aeroplane or remote-controlled rockets.

43. Gelatin which is a peptide is added in icecreams. What can be its role?

Solution:

Gelatin acts as an emulsifying agent which is a hydrophilic colloid. They absorb the water content in the ice-cream and also a good source of protein. They also give a soft texture and shiny appearance to ice-cream.

44. What is collodion?

Solution;

Collodion is a 4% solution of nitrocellulose prepared in a mixture of alcohol and ether. it is the flammable and syrupy solution.

45. Why do we add alum to purify water?

Solution:

Alum is $KAl(SO_4)_2$ which is called potassium aluminium sulphate. when added react with alkaline bicarbonates and forms a gelatinous precipitate. When it is added to water they attract the colloidal particles and settles down at the bottom of the container.

46. What happens when the electric field is applied to a colloidal solution?

Solution:

When an electric field is applied to a colloidal solution, colloidal particles move towards different electrode depending on their respective charge.

47. What causes Brownian motion in colloidal dispersion?

Solution:

Brownian motion is due to the collision between the colloidal particles and with the dispersion medium. The movement results in the stabilisation of the colloidal solution.

48. A colloid is formed by adding $FeCl_3$ in excess of hot water. What will happen if excess sodium chloride is added to this colloid?

Solution:

$FeCl_3$ when added into hot water, it forms hydrated ferric oxide, which is a positively charged sol due to absorption of Fe^{3+} ions. On adding $NaCl$ the negatively charged chloride ions neutralize the positive charge of the solution and coagulation of the sol takes place.

49. How do emulsifying agents stabilise the emulsion?

Solution:

Emulsifying agents stabilize the emulsion by forming an interfacial film between suspended particle and dispersion medium. For example, agar is an emulsifying agent used in food.

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

Solution:

The colloidal solution has a larger surface area than a true solution. The surface area is directly proportional to the rate of assimilation in our body. So most of the medicines act more effective in colloidal form.

51. Why does leather get hardened after tanning?

Solution:

When leather is soaked in tannin, coagulation takes place due to the interaction of positively charged animal skin and negatively charged tannin. Thus leather gets hardened.

52. How does the precipitation of colloidal smoke take place in Cottrell precipitator?

Solution:

Cottrell precipitator is a filtration device that removes the fine particles like dust and smoke from a flowing gas. It neutralizes the charge on carbon particles.

53. How will you distinguish between the dispersed phase and dispersion medium in an emulsion?

Solution:

An emulsion is a dispersion of one liquid in another immiscible liquid. The dispersed phase is always present in fewer amounts than the dispersion medium.

54. Based on Hardy-Schulze rule explain why the coagulating power of phosphate is higher than chloride.

Solution:

According to Hardy-Schulze rule, the coagulation property of an electrolyte depends upon the valency of the coagulation ion. Higher the charge on flocculating ion smaller is the amount of electrolyte required for precipitation. Phosphate ion has -3 charge while chloride ion carries only -1 charge. So coagulating power of phosphate is higher than chloride.

55. Why does the bleeding stop by rubbing moist alum?

Solution:

Moist alum has highly charged Al^{3+} and SO_4^{2-} ions which neutralize the charged protein molecules present in the blood. This results in the coagulation of blood proteins and stops bleeding.

56. Why is $\text{Fe}(\text{OH})_3$ colloid positively charged, when prepared by adding FeCl_3 to hot water?

Solution:

When FeCl_3 is added to hot water, the hydrated ferric oxide is formed. This hydrated ferric oxide preferably adsorbs Fe^{3+} ions resulting in the positively-charged colloid.

57. Why do physisorption and chemisorption behave differently with rising in temperature?

Solution:

In physisorption, with an increase in temperature, this bond between adsorbent and adsorbate weaker and the amount of adsorbate decrease whereas in chemisorption an amount of activation energy required for the formation of a bond between adsorbent and adsorbate which is achieved by increasing the temperature.

58. What happens when dialysis is prolonged?

Solution:

If the dialysis continues for a long time, the traces of electrolyte present in blood also get completely removed and blood coagulation occurs.

59. Why does the white precipitate of silver halide become coloured in the presence of dye eosin?

Solution:

The surface of silver halide acts as a good adsorbent. It can adsorb the pigments of eosin dye, which is coloured. Thus silver halide appears coloured.

60. What is the role of activated charcoal in a gas mask used in coal mines?

Solution:

Activated charcoal acts as a good adsorbent as it is porous. In coal mines, the activated charcoal in a gas mask provides fresh air for inhaling.