Chapter

17

Surface Chemistry

Single Correct Option Type Questions

Q.1 At STP the volume of nitrogen gas required to cover a sample of silica gel, assuming Langumir monolayer adsorption, is found to be 2.60 $cm^3\ g^{-1}$ of the gel. The area occupied by a nitrogen molecule is 0.16 nm^2. What is the surface area per gram of silica gel ?
[Given $N_A = 6 \times 10^{23}$]
(A) 5.568 $m^2\ g^{-1}$ (B) 3.48 $m^2 g^{-1}$ (C) 1.6 $m^2\ g^{-1}$ (D) None of these

Q.2 The gold numbers of protective colloids A, B, C and D are 0.16, 0.06, 0.01 and 0.1 respectively. The protective powers of A, B, C and D are in the order -
(A) A > B > C > D (B) C > B > D > A (C) D > C > A > B (D) D > C > B > A

Q.3 Select incorrect statement -
(A) Soap and detergent lower the interfacial surface tension between oil and water
(B) Basic principle of petization is reverse of coagulation
(C) Soap and detergent used as emulsifiers
(D) Lylophilic sols need stabilizing agent

Q.4 Coagulation occurs when
(A) Electrolytc addcd to Lyophobic colloidal solution.
(B) Two opposite charge colloids mixed.
(C) Electrophoresis takes place.
(D) All of these

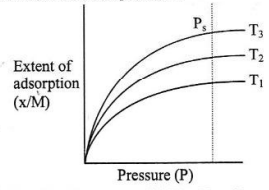
Q.5 One gram of activated carbon has a surface area of 1000 m^2. Considering complete coverage as well as monomolecular adsorption, how much ammonia at 1 atm and 273 K would be adsorbed on the surface of $\frac{44}{7}$ g carbon if radius of a ammonia molecules is 10^{-8} cm. [Given: $N_A = 6 \times 10^{23}$]
(A) 7.46 L (B) 0.33 L (C) 44.8 L (D) 23.5 L

Q.6 At 1 atm and 273 K the volume of nitrogen gas required to cover a sample of silica gel, assuming Langmuir monolayer adsorption, is found to be 1.30 $cm^3\ g^{-1}$ of the gel. The area occupied by a nitrogen molecule is 0.16 nm^2. What is the surface area per gram of silica gel ? [Given: $N_A = 6 \times 10^{23}$]
(A) 5.568 $m^2\ g^{-1}$ (B) 3.48 $m^2\ g^{-1}$ (C) 1.6 $m^2\ g^{-1}$ (D) None of these

Q.7 10% sites of catalyst bed have absorbed by H_2. On heating H_2 gas is evolved from sites and collected at 0.03 atm and 300 K in a small vessel of 2.46 cm^3.
No. of sites available is 5.4×10^{16} per cm^2 and surface area is 1000 cm^2. Find out the no. of surface sites occupied per molecule of H_2. (Given $N_A = 6 \times 10^{23}$)
(A) 1 (B) 2 (C) 3 (D) None of these

Q.8 A sample of 16g charcoal brought into contact with CH_4 gas contained in a vessel of 1 litre at 27°C. The pressure of gas was found to fall from760 to 608 torr. The density of charcoal sample is 1.6g/cm^3. What is the volume of the CH_4 gas adsorbed per gram of the adsorbent at 608 torr and 27°C ?
(A) 125 mL/g (B) 16.25 mL/g (C) 26 mL/g (D) None of these

Q.9 For the graph below, select correct order of temperature ?



(A) $T_1 > T_2 > T_3$ (B) $T_2 > T_3 > T_1$ (C) $T_3 > T_2 > T_1$ (D) $T_1 = T_2 = T_3$

Q.10 Although, nitrogen does not adsorb on a surface at room temperature, it adsorbs on the surface at 83 K. Which one of the following statement is correct ?
(A) At 83 K, there is formation of monolayer
(B) At 83 K, nitrogen is adsorbed as atoms
(C) At 83 K, nitrogen molecules are held by chemical bonds
(D) AT 83 K, there is formation of multimolecular layers

Q.11 Select the incorrect statement
(A) Soap is a type of associated colloids
(B) Adsorption process is involved in peptization process
(C) Diffusion process involved in dialysis of colloidal solutions
(D) Low value of critical temperature favours physical adsorption of gas at room temperature

Q.12 Which of the following statement is correct about colloids?
(A) Lyophobic sols has almost similar stability than lyophilic sols
(B) Greater extent of Tyndall effect is observed in lyophilic sols
(C) Lyophilic sols have large particle size that of lyophobic sols in general
(D) The charge on lyophobic sols is independent of pH

Q.13 When $AgNO_3$ is treated with KI, AgI precipitates out, which forms colloidal solution with:
(A) positive charge
(B) negative charge
(C) charge neutralization occurs, not change acquisition
(D) first positive, later negative

Q.14 Which of the following is correct ?
(A) Lyophilic sols are irreversible in nature
(B) Sulphur sol is an intrinsic colloid
(C) Soap remove grease by coagulation
(D) Curdling of milk is a coagulation process.

Statement Based Questions

Q.15 **Statement-1:** Micelles are formed by surfactant molecules above the critical micelle concentration (CMC).
Statement-2: The conductivity of a solution having surfactant molecules increase sharply at the CMC.
(A) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1.
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

Q.16 **Statement-1:** When SnO_2 is reacted with NaOH, then its sol particles are attracted towards cathode.
Statement-2: When SnO_2 is reacted with NaOH, then it gives SnO_3^{2-} which is adsorbed by SnO_2, so it is negatively charged sol.
(A) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 **is NOT** a correct explanation for Statement-1.
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

Multiple Correct Option Type Questions

Q.17 Select the incorrect statement(s) -
(A) Adsorption is a non-spontaneous process
(B) Surface energy decreases during the process of adsorption
(C) Adsorption takes place with decrease of entropy
(D) In general adsorption is exothermic process

Q.18 Amongst the following which is/are correct statement about the metal sulphide sols ?
(A) The sol particles are positively charged due to preferential adsorption of metal ions
(B) The sol particles are negatively charged due to preferential adsorption of sulphide ions
(C) The cations of added electrolytes are effective in causing the coagulation of the sol
(D) The sol is stabilized due to both the electric charge and hydration of the particles

Q.19 Which of the following statements is/are false for physisorption?
(A) High temperature is favourable for adsorption.
(B) It needs activation energy.
(C) It is reversible.
(D) Extent of adsorption increase with increase in pressure

Q.20 Select the correct statement :
(A) $Fe(OH)_3$sol can be used for coagulation of As_2S_3sol.
(B) Aqueous gold sol is negatively charged sol.
(C) Langmuir adsorption is a single layer phenomenon.
(D) Activity of an enzyme is pH dependent

Q.21 Which is/are correct statement?
(A) Flocculation value is a measure of protective power
(B) Brownian movement is related to the stability of colloids.
(C) When $AgNO_3$ is added to excess of KI then negative charge colloid results.
(D) Coagulation takes place due to electrophoresis.

Q.22 Select the correct statement(s):
(A) Benzene is dispersed phase in benzosols
(B) Lyophobic sols are irreversible and not so stable
(C) Lyophobic sold can be produce by double decomposition
(D) When a solution of sulphur in alcohol is added in excess of water a sol of alcohol is formed

Q.23 When negatively charged colloid like As_2S_3 sol is added to positively charged $Fe(OH)_3$ sol in stoichiometric amounts ?
(A) Both the sols are precipitated simultaneously
(B) This process is called mutual coagulation
(C) They becomes positively charged colloid
(D) They become negatively charged colloid

Q.24 Colloidal gold can be prepared by:
(A) Bredig's arc method (B) reduction of $AuCl_3$.(C) hydrolysis (D) peptization

Q.25 Select the correct statements(s) :
(A) A solution is prepared by addition of excess of $AgNO_3$ solution in KI solution. The charge likely to develop on colloidal particle is positive
(B) The effects of pressure on physical adsorption is high if temperature is low
(C) Ultra centrifugation process is used for preparation of lyophobic colloids
(D) Gold number is the index for extent of gold plating done

Q.26 The coagulation of sol particles may be brought in by -
(A) heating
(B) adding oppositively charged sol
(C) adding electrolyte
(D) persistent dialysis

Q.27 100 ml each of two sols of AgI, one obtained by adding $AgNO_3$ to slight excess of KI and another obtained by adding KI to slight excess of $AgNO_3$, are mixed together. Then
(A) The two sols will stabilize each other
(B) The sol particles will acquire more electric charge
(C) The sols will coagulate each other mutually
(D) A true solution will be obtained

Q.28 Adsorption is accompanied by :
(A) decrease in entropy of system
(B) decrease in enthalpy of system
(C) decrease in free energy of system
(D) no change in free energy of system

Q.29 Which of the following is correct ?
(A) All the adsorption processes are exothemic
(B) Rate of adsorption increase with time
(C) H_2O is absorbed in silicagel.
(D) Adsorption is specific and selective in nature.

Q.30 The volume methane, measured at STP, adsorbed on 2g of charcoal at 0 °C and several different pressures is given as follows

P (mm Hg)	100	200	300	400
Vol . of CH_4 adsorbed (ml)	19.50	29.0	36.4	42.0

What is the value of n if Freundlich' s is isotherm $\left(\frac{x}{m} \propto P^{\frac{1}{n}}\right)$ is followed : (given log 1.87 = 0.271).

(A) n = 1.75 (B) n = 0.57 (C) n = 1.70 (D) n = 0.59

Passage Based Questions

Passage # 1 (Ques. 31 – 33)

Coagulation is the process by which the dispersed phase of a colloid is made to aggregate and thereby separate from the continuous phase. The minimum concentration of an electrolyte in milli-moles per litre of the electrolyte solution which is required to cause the coagulation of colloidal sol is called coagulation value.

$$\text{Coagulation value} \propto \frac{1}{\text{coagulating power}}$$

The coagulation values of different electrolytes are different. This behaviour can be easily understood by Hardy-Schulze rule which states.

"The greater is the valency of the effective ion greater is its precipitating power."

Q.31 Which one has the highest coagulating power for Arsenic sulphide sol ?

(A) PO_4^{3-} (B) $[Fe(CN)_6]^{4-}$ (C) Sn^{4+} (D) Al^{3+}

Q.32 The ability of an ion to bring coagulation of given colloid depends upon -

(A) the sign of its charge (B) magnitude of its charge

(C) both magnitude and sign (D) none of these

Q.33 The coagulation of colloidal particles of the sol can be caused by -

(A) boiling (B) adding electrolyte

(C) adding oppositely charged sol (D) all of these

Passage # 2 (Ques. 34 – 36)

Coagulation is the process by which dispersed phase of a colloids is made to aggregate and separate from dispersed medium. Coagulation value is define as milimoles of electrolyte required to cause coagulation of one litre colloidal solution. Higher is coagulation power of electrolyte smaller will be the coagutation value of electrolyte.

Q.34 Which ion have highest coagulation value?

(A) K^{+} (B) Ca^{+2} (C) Al^{+3} (D) Sn^{+4}

Q.35 For the coagulation of 200 ml of As_2S_3 solution, 10 of 1 M NaCl solution is required. What is the coagulating value of NaCl?

(A) 200 (B) 100 (C) 50 (D) 25

Q.36 For the coagulation of As_2S_3, which have maximum coagulating power?

(A) NaCl (B) $CaCl_2$ (C) $AlCl_3$ (D) $K_4[Fe(CN)_6]$

Column Matching Type Questions

Q.37

Column I (Term)	Column II (Related property)
(A) Coagulation	(P) Associate colloids
(B) Dialysis	(Q) Protective colloids
(C) CMC	(R) Purification of colloids
(D) Gold number	(S) Electrolyte
	(T) Preparation of colloids

Q.38

Column I	Column II
(A) Chemisorption	(P) Not very specific and decreases with temperature
(B) Physisorption	(Q) Specific and increases with temperature
(C) Desorption of a solute on liquid surface	(R) Increases the surface tension of the liquid
(D) Adsorption of a solute on a liquid surface	(S) Decreases the surface tension of the liquid

Q.39

Column I	Column II
(A) Milk	(P) Aerosol
(B) Dust	(Q) Emulsion
(C) Cheese	(R) Gel
(D) Froth	(S) Foam

Q.40

Column I	Column II
(A) As_2S_3 sol	(P) Lyophobic colloid
(B) Sulphur sol	(Q) Macromolecular collloid
(C) Starch	(R) Multimolecular colloid
(D) Soap	(S) Associated colloid

Q.41

Column I	Column II
(A) Peptization	(P) Preparation of sols
(B) Ultra centrifugation	(Q) Purification of sols
(C) Electrodialysis	(R) Preparation of metal sols
(D) Bredig's are method	(S) Movement of ions across the membrane in presence of electric field

ANSWER KEY

Single Correct Option type Questions

1. (D)	**2.** (B)	**3.** (D)	**4.** (D)	**5.** (A)	**6.** (A)	**7.** (C)
8. (B)	**9.** (A)	**10.** (D)	**11.** (D)	**12.** (D)	**13.** (B)	**14.** (D)

Statement Based Questions

15. (C) **16.** (D)

Multiple Correct Option type Questions

17. (A)	**18.** (B,C)	**19.** (A,B)	**20.** (A,B,C,D)	**21.** (B,C,D)	**22.** (B,C)	**23.** (A,B)
24. (A,B)	**25.** (A,B)	**26.** (A,B,C,D)	**27.** (C)	**28.** (A,B,C)	**29.** (D)	**30.** (A)

Passage Based Questions

31. (C)	**32.** (C)	**33.** (D)	**34.** (A)	**35.** (C)	**36.** (C)

Column Matching Type Questions

37. [**A** → S; **B** → R; **C** → P; **D** → Q]

38. [**A** → Q; **B** → P; **C** → R; **D** → S]

39. [**A** → Q; **B** → P; **C** → R; **D** → S]

40. [**A** → P,R; **B** → P,R; **C** → Q; **D** → S]

41. [**A** → P; **B** → Q; **C** → Q,S; **D** → P,R]