

5.SURFACE CHEMISTRY

Single Correct Answer Type

1. Aluminium hydroxide forms a positively charged sol. Which of the following ionic substance should be most effective in coagulating the sol?
 a) NaCl b) CaCl₂ c) Fe₂(SO₄)₃ d) K₃PO₄
2. The colloidal sol of As₂S₃ prefers to adsorb
 a) NO₃[⊖] b) K[⊕] c) S²⁻ d) H[⊕]
3. Which of the following is present at the time of cracking of hydrocarbons?
 a) Copper b) Zeolite c) Nickel d) Molybdenum
4. The stabilization of a dispersed phase in a lyophobic colloid is due to
 a) The adsorption of charged substances on dispersed phase
 b) The large electro-kinetic potential developed in the colloid
 c) The formation of an electrical layer between two phases
 d) The viscosity of the medium
5. Which of the following can act as a protective colloid?
 a) Gelatin
 b) Silica gel
 c) Oil-in-water emulsion
 d) All correct
6. Which one of the following is a natural colloid?
 a) Sodium chloride solution b) Cane sugar solution
 c) Urea solution d) Blood
7. Gold number of a lyophilic sol is such a property that
 a) The larger its value, the greater is the peptizing power
 b) The lower its value, the greater is the peptizing power
 c) The lower its value, the greater is the protecting power
 d) The larger its value, the greater is the protecting power
8. Which is/are correct statements about the role of a catalyst in a reaction?
 a) It is reactant in a rate-determining step and then a product of some subsequent step
 b) It provides an alternate mechanism with a lower energy of activation
 c) It increases the rate of chemical reaction but does not itself undergo a permanent change during the course of the reaction
 d) All of the above
9. The diameter of colloidal particle is of the order
 a) 10⁻³m b) 10⁻⁶m c) 10⁻¹⁵m d) 10⁻⁷m
10. Compared to common colloidal sols micelles have:
 a) Higher colligative properties b) Lower colligative properties
 c) Same colligative properties d) None is true
11. The colligative property of a colloidal sol compared to the solution of non-electrolyte of same concentration will be
 a) Same b) Higher c) Lower d) Higher or lower
12. Among the electrolytes Na₂SO₄, CaCl₂, Al₂(SO₄)₃ and NH₄Cl, the most effective coagulation agent for Sb₂S₃ sol is
 a) Na₂SO₄ b) CaCl₂ c) Al₂(SO₄)₃ d) NH₄Cl
13. Catalyst used in polymerization of ethene is:
 a) TiCl₄ and AlR₃ b) Fe, Co c) H₃PO₄ d) Zeolites
14. The process of removing dissolved impurities from a colloidal system by means of diffusion through suitable membrane under the influence of an electric field is called

- a) Electro-osmosis b) Electrodialysis c) Electrophoresis d) Peptization
15. Softening of hard water is done using sodium aluminium silicate (zeolite). This causes
- a) Adsorption of Ca^{2+} and Mg^{2+} ions of hard water replacing Na^{\oplus} ions
 b) Adsorption of Ca^{2+} and Mg^{2+} ions of hard water replacing Al^{3+} ions
 c) Both true
 d) None is true
16. Lyophilic sols are
- a) Irreversible sols b) They are prepared from inorganic compounds
 c) Coagulated by adding electrolytes d) Self-stabilising
17. Soaking of water by a sponge is an example of
- a) Simple adsorption b) Physical adsorption c) Chemisorption d) Absorption
18. Among the following, the surfactant that will form micelles in aqueous solution at the lowest molar concentration at ambient conditions, is
- a) $\text{CH}_3(\text{CH}_2)_{15}\text{N}^+(\text{CH}_3)_3\text{Br}^-$ b) $\text{CH}_3(\text{CH}_2)_{11}\text{OSO}_3^-\text{Na}^+$
 c) $\text{CH}_3(\text{CH}_2)_6\text{COO}^-\text{Na}^+$ d) $\text{CH}_3(\text{CH}_2)_{11}\text{N}^+(\text{CH}_3)_3\text{Br}^-$
19. Which is not the correct statement for a catalyst?
- a) It does not alter E_a
 b) The surface of a catalyst adsorbs reactants
 c) Catalyst may form intermediates with reactants
 d) Action of enzyme catalyst is always specific
20. Which one of the following statements is wrong about adsorption?
- a) It is a selective and specific process
 b) It is a reversible process
 c) An increase in the gaseous adsorbate causes an increase in a adsorption. However, at high pressure, the adsorption becomes constant
 d) It is an endothermic process
21. Micelles are
- a) Ideal solution b) Associated colloids c) Adsorbed surfaces d) Absorbent solutes
22. Non-ionic surfactants are
- a) $\text{R}-\text{C}_6\text{H}_4-\text{SO}_3\text{Na}$ b) $\text{C}_{17}\text{H}_{35}\text{COONa}$
 c) $\text{C}_n\text{H}_{2n+1}(\text{OCH}_2\text{CH}_2)_x\text{OH}$ d) All
23. Smoke has generally blue tinge. It is due to
- a) Scattering b) Coagulation c) Brownian motion d) Electro-osmosis
24. There is no scum formation when hard water is being used. The washing powder can be
- a) $\text{C}_{17}\text{H}_{35}\text{COONa}$ b) $\text{R}-\text{C}_6\text{H}_4-\text{SO}_3\text{Na}$ c) Both d) None
25. Colloidal solutions of gold prepared by different methods are of different colours because of
- a) Different diameters of colloidal gold particles
 b) Variable valency of gold
 c) Different concentrations of gold particles
 d) Impurities produced by different methods
26. There is desorption of physical adsorption when
- a) Temperature is increased b) Temperature is decreased
 c) Pressure is increased d) Concentration is increased
27. Tyndall effect is not observed in
- a) Suspension b) True solution c) Emulsions d) Colloidal solution
28. Adsorption is the phenomenon in which substance
- a) Accumulates on the surface of the other substance b) Goes into the body of the other substance
 c) Remains close to the other substance d) None is correct
29. If liquid is dispersed in solid medium, then this is called as:

- a) Sol b) Emulsion c) Liquid aerosol d) Gel
30. A freshly formed ppt of SnO_2 is peptized by a small amount of NaOH. These colloidal particles may be represented as
a) $[\text{SnO}_2]\text{SnO}_3^{2-}; 2\text{Na}^\oplus$ b) $[\text{SnO}_2]\text{Sn}^{4+}; \text{O}^{2-}$ c) $[\text{SnO}_2]\text{Na}^\oplus; \text{OH}^\ominus$ d) $[\text{SnO}_2]\text{Sn}^{4+}; \text{OH}^\ominus$
31. Of which of the following colloidal systems, fog is an example?
a) Liquid dispersed in gas b) Gas dispersed in gas
c) Solid dispersed in gas d) Solid dispersed in liquid
32. Which of the following statements is incorrect regarding physisorption?
a) It occurs because of van der Waals forces
b) Liquefiable gases are adsorbed more easily
c) Under high pressure it results surface
d) Enthalpy of adsorption ($\Delta H_{\text{adsorption}}$) is low and positive
33. The process of passing of a precipitate into colloidal solution on adding an electrolyte is called
a) Dialysis b) Peptization c) Electrophoresis d) Electro-osmosis
34. The rate of chemisorption :
a) Decreases with increase of pressure b) Increases with increase of pressure
c) Is independent of pressure d) Is independent of temperature
35. Sorption is the term used when
a) Adsorption takes place b) Absorption takes place
c) Both take place d) Desorption takes place
36. Smoke is a dispersion of
a) Gas in gas b) Gas is solid c) Solid in gas d) Liquid in gas
37. Which of the following is/are true statements
a) Water vapour is absorbed by anhydrous calcium chloride both adsorbed by silica gel
b) NH_3 is absorbed by water but adsorbed by charcoal
c) Sugar is decolourized by animal charcoal based on adsorption
d)
38. An emulsifier is an agent which
a) Accelerates the dispersion b) Homogenises an emulsion
c) Stabilizes an emulsion d) Aids the flocculation of an emulsion
39. The migration of positively charged colloidal particles, under an electrical field, towards the cathode is called
a) Cataphoresis b) Electro-osmosis c) Sedimentation d) Electrodialysis
40. Match column A (catalyst) with column B (process)
- | A | B |
|-------------------|----------------------------|
| 1. SiO_2 | I. Cracking of Hydrocarbon |
| 2. Pt | II. of benzene |
| 3. Zeolites | III. Automobile converter |
- a) 1 → I, 2 → II, 3 → III b) 1 → III, 2 → II, 3 → I c) 1 → II, 2 → III, 3 → I d) 1 → III, 2 → I, 3 → II
41. Energy of activation of forward and backward reaction are equal in cases (numerical values) where
a) $\Delta H = 0$ b) No catalyst present
c) $\Delta S = 0$ d) Stoichiometry is the mechanism
42. An oil-soluble dye is mixed with emulsion and the emulsion remains colourless. Then, it is
a) O-in-W b) W-in-O c) O-in-O d) W-in-W
43. Chromatography is a technique based on
a) Adsorption and then dispersion of solute b) Absorption of solute
c) Hydration of solute d) Evaporation of solute
44. Freundlich equation for adsorption of gases (in amount of X g) on a solid (in amount of mg) at constant temperature can be expressed as
a) $\log \frac{X}{m} = \log P + \frac{1}{n} \log K$ b) $\log \frac{X}{m} = \log K + \frac{1}{n} \log P$

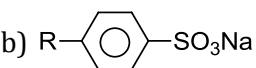
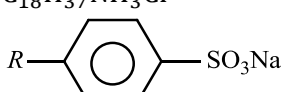
$$c) \frac{X}{m} \propto P^n$$

$$d) \frac{X}{m} = \log P + \frac{1}{n} \log K$$

45. Which one of the following statements is correct?
 a) Brownian movement is more pronounced for smaller particles than for bigger ones
 b) Sols of metal sulphides are lyophilic
 c) Hardy Schulze law states, the bigger the size of the ion the greater is its coagulating power
 d) One would expect charcoal to adsorb chlorine more strongly than hydrogen sulphide
46. Example of an intrinsic colloid is
 a) As_2S_3 sol b) S sol c) Egg albumin d) $Fe(OH)_3$ sol
47. Bleeding is stopped by the application of ferric chloride. This is because
 a) The blood starts flowing in opposite direction
 b) The blood reacts and forms a solid, which seals the blood vessel
 c) The blood is coagulated and thus the blood vessel is sealed
 d) The ferric chloride seals the blood vessel
48. Which of the following catalyst is used during the hydrogenation of oil?
 a) Fe b) Ni c) Pt d) Mo
49. Which of the following is not a characteristic of chemisorption?
 a) It is irreversible b) It is specific
 c) It is multi-layer phenomenon d) Heat of adsorption is about -400 kJ
50. In the adsorption of oxalic acid on activated charcoal, the activated charcoal is called
 a) Adsorbent b) Adsorbate c) Adsorber d) Absorber
51. Oil-soluble dye is mixed with water-in-oil emulsion, then
 a) Dispersion medium is coloured b) Dispersed phase is coloured
 c) Both coloured d) None is coloured
52. Amount of gas absorbed per gram of adsorbent increases with pressure, but after a certain limit is reached, adsorption becomes constant. It is where
 a) Multilayers are formed b) Desorption takes place
 c) Temperature is increased d) Adsorption also starts
53. Brownian motion is a/an
 a) Electrical property b) Mechanical property c) Optical property d) Colligative property
54. Arsenic (III) sulphide forms a sol with a negative charge. Which of the following ionic substances should be most effective in coagulating the sol?
 a) KCl b) $MgCl_2$ c) $Al_2(SO_4)_3$ d) Na_3PO_4

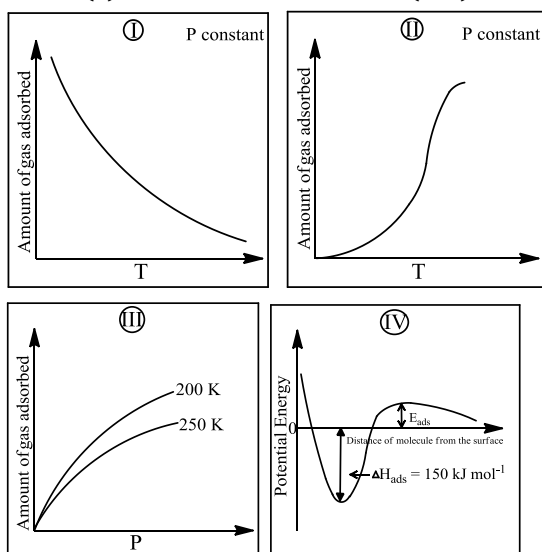
Multiple Correct Answers Type

55. Which of the following statements is/are correct?
 a) Anhydrous $AlCl_3$ is used as a catalyst in Friedel-Crafts reaction
 b) Iron is used as a catalyst in Haber's process of manufacturing NH_3
 c) The oxidation of SO_2 to SO_3 requires V_2O_5 as the catalyst
 d) The hydrogenation of oil requires nickel as the catalyst
56. Which of the following is/are not possible in case of auto-catalysis?
 a) Reactant catalysis b) Heat produced in the reaction catalysis
 c) Product catalysis d) Solvent catalysis
57. Which is/are not correct in case of catalyst?
 a) A catalyst is active only in solution
 b) The addition of catalyst changes the equilibrium constant
 c) A catalyst speeds up forward reaction and slows the backward reaction
 d) The composition of equilibrium mixture is not changes by a catalyst
58. On adding $AgNO_3$ solution into KI solution, a negative charged colloidal sol is obtained when they are in

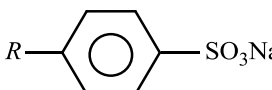
- a) 100 mL of 0.1 M AgNO₃ + 100 mL of 0.1 M KI b) 100 mL of 0.1 M AgNO₃ + 100 mL of 0.2 M KI
 c) 100 mL of 0.2 M AgNO₃ + 100 mL of 0.1 M KI d) 100 mL of 0.15 M AgNO₃ + 100 mL of 0.25 M KI
59. Choose the correct reason(s) for the stability of the **lyophobic** colloidal particles.
- Preferential adsorption of ions on their surface from the solution
 - Preferential adsorption of solvent on their surface from the solution
 - Attraction between different particles having opposite charges on their surface
 - Potential difference between the fixed layer and the diffused layer of opposite charges around the colloidal particles
60. Which statement(s) is/are true in case of catalyst?
- The catalyst is unchanged chemically at the end of a reaction
 - The catalyst accelerates the reaction
 - In a reversible reaction, the catalyst alters the equilibrium position
 - A small amount of catalyst is often sufficient to bring about a large change in reaction
61. Which of the following statements is/are correct in the case of heterogeneous catalyst?
- The catalyst lowers the energy of activation
 - The catalyst actually forms a compound with the reactant
 - The surface of the catalyst plays a very important role
 - There is no change in the energy of activation
62. The correct statement(s) pertaining to the adsorption of a gas on a solid surface is (are)
- Adsorption is always exothermic
 - Physisorption may transform into chemisorption at high temperature
 - Physisorption increases with increasing temperature but chemisorption decreases with increasing temperature
 - Chemisorption is more exothermic than physisorption, however it is very slow due to higher energy of activation.
63. A catalyst :
- Remains unchanged chemically at the end of a reaction
 - Usually does not initiate a reaction
 - Does not alter the equilibrium in a reversible reaction
 - Is used for altering the velocity of the reaction
64. Which of the following is/are negatively charged sol?
- Gold sol
 - Prussian blue dye
 - Hemoglobin
 - Starch
65. Which of the following statements is/are true?
- Iron is used as a catalyst in the hydrogenation of oils
 - V₂O₅ is used as a catalyst in the oxidation of SO₂ to SO₃
 - Haber's process requires iron as a catalyst
 - Thermite process does not involve any catalyst
66. Which is/are not natural colloid(s)?
- NaCl
 - Blood
 - RCOONa
 - Sugar
67. Anionic surfactants are
- C₁₅H₃₁COONa
 - 
 - C₁₈H₃₇NH₃Cl
 - All
68. Cationic surfactant(s) is/are :
- The substances whose cation possesses surface activity
 - C_nH_{2n+1}(OCH₂CH₂)_xOH
 - C₁₈H₃₇NH₃Cl
 - 
69. Which of the following electrolytes will not be most effective in the coagulation of gold sol?
- NaNO₃
 - K₄[Fe(CN)₆]
 - Na₃PO₄
 - MgCl₂

70. Which of the following is/are the characteristic of a catalyst?
- It changes equilibrium point
 - It alter the rate of reaction
 - It initiates the reaction
 - It increases the average KE of molecules
71. 1 mol of $[Ag] Ag^{\oplus}$ sol is coagulated by
- 1 mol of KI
 - 500 mL of 1 M K_2SO_4
 - 300 mL of 1 M Na_3PO_4 solution
 - 1 mol of AgI
72. Which of the following statements is/are correct?
- Physical adsorption is multilayer, non-directional and non-specific
 - In some cases, solvent may be adsorbed in preference to the solute on the surface of the adsorbent
 - Chemical adsorption increases with increase in temperature
 - Due to adsorption, surface energy increases
73. Protons accelerate the hydrolysis of esters. This is an example of :
- A promoter
 - A heterogeneous catalyst
 - An acid base catalyst
 - An autocatalyst
74. Which of the following statements is/are correct?
- Enzymes are catalysts found in organisms
 - Enzymes are proteins
 - Enzymes can catalyse any reaction
 - Enzymes activity is maximum at about 300K
75. Which of the following statements is/are correct?
- Increase of pressure increases the amount of adsorption
 - Increase of temperature may decrease the amount of adsorption
 - The adsorption may be monolayered or multilayered
 - Particle size of the adsorbent will not affect the amount of adsorption
76. Which one of the following is/are correct statement for physisorption?
- It is a reversible process
 - It requires less heat of adsorption
 - It requires activation energy
 - It takes place at low temperature
77. Which one of the followings is/are an example of homogeneous catalysis?
- Formation of SO_3 in the chamber process
 - Formation of SO_3 in the contact process
 - Hydrolysis of an ester in the presence of acid
 - Decomposition of $KClO_3$ in the presence of MnO_2
78. Which of the following is/are colloid(s)?
- Muddy water
 - Milk
 - Blood
 - Chlorophyll
79. Which of the following is/are elastic gel?
- Gelatin
 - Silicic acid
 - Agar agar
 - Starch
80. The aerosol is/are the colloidal system(s) of :
- Solid dispersed in gas
 - Liquid dispersed in gas
 - Gas dispersed in solid
 - Gas dispersed in liquid
81. Difference in between crystalloid and colloid is of :
- Particle size
 - To exhibit Tyndall effect
 - Diffusion through a membrane
 - None of the above

82. Which of the following is/are lyophobic colloids?
 a) Gold sol b) As_2S_3 sol c) $Fe(OH)_3$ sol d) Starch sol
83. Which of the following statements is/are correct about physical adsorption?
 a) It is a selective and specific process
 b) It is a reversible process
 c) An increase in the gaseous adsorbate causes increase in adsorption. However, at higher pressure the adsorption become constant
 d) It is an endothermic process
84. Which of the following belong(s) to the family of enzymes?
 a) Lipase b) Pepsin c) Ptylin d) Cellulose
85. Which of the following are macromolecular colloids?
 a) Starch b) Soap c) Detergent d) Cellulose
86. Isoelectric point is the pH at which colloidal particles
 a) Coagulate b) Become electrically neutral
 c) Can move toward either electrodes d) None of the above
87. A catalyst :
 a) Alters the velocity of reaction
 b) Changes the energy of activation of the given process
 c) Does not alter the state of equilibrium
 d) Decreases entropy of system
88. 1 mol of $[AgI] Ag^+$ sol is coagulated by
 a) 1 mol of KI b) 500 mL of 1 M K_2SO_4
 c) 1 L of 1 M KI d) None of these
89. Tyndall effect is applicable when
 a) The diameter of the dispersed particle is not much smaller than the wavelength of the light used
 b) The diameter of the dispersed particles is much smaller than the wavelength of the light used
 c) The refractive indices of the dispersed phase and the dispersion medium must be same
 d) The refractive indices of the dispersed phase and the dispersion medium must differ greatly in magnitude
90. The given graphs/data I, II, III and IV represent general trends observed for different physisorption and chemisorption processes under mild conditions of temperature and pressure. Which of the following choice(s) about I, II, III and IV is (are) correct?



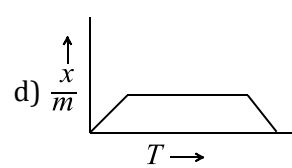
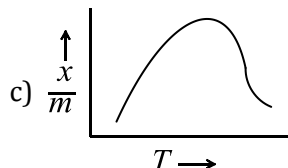
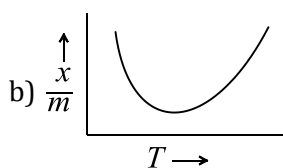
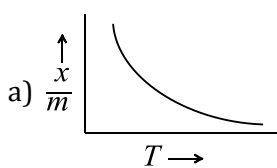
- a) I is physisorption and II is chemisorption
 b) I is physisorption and III is chemisorption
 c) IV is chemisorption and II is chemisorption
 d) IV is chemisorption and III is chemisorption

91. Which act(s) as negative catalyst?
 a) Lead tetraethyl as antiknock compound
 b) Glycerol in decomposition of H_2O_2
 c) Ethanol in oxidation of chloroform
 d) None of the above
92. Which of the following is/are not correctly matched?
 a) Emulsion-curd b) Foam-mist c) Aerosol-smoke d) Solid sol-cake
93. Which is/are true statements(s)?
 a) Water is absorbed by anhydrous $CaCl_2$
 b) Water is adsorbed by silica gel
 c) NH_3 is absorbed by water but adsorbed by charcoal
 d) Decolourisation of sugar by animal charcoal is based on adsorption
94. Which of the following is/are aerosols?
 a) Smoke b) Milk c) Butter d) Fog
95. Catalyst increases the rate by
 a) Decreasing E_a b) Increasing E_a c) Decreasing pressure d) Increasing entropy
96. The rate of a reaction increases with the addition of a catalyst. Which of the following statements does/do not explain this?
 a) The average kinetic energy of the molecules decreases
 b) The number of collision increases
 c) The activation energy increases
 d) The activation energy decreases
97. Multimolecular colloids are present in?
 a) Sol of sulphur b) Sol of protein c) Sol of gold d) Soap solution
98. Which is/are not lyophobic in nature?
 a) Gelatin b) Sulphur c) Starch d) Protein
99. Anionic surfactant(s) is/are :
 a) The substances whose anion possesses surface activity
 b) $C_{15}H_{31}COONa$ and $R-\text{C}_6\text{H}_4-\text{SO}_3\text{Na}$

 c) Anions are associated to form micelle
 d) $C_{18}H_{37}NH_3Cl$
100. Which of the following increase(s) the activation of a solid adsorbent?
 a) Polishing the surface of the solid adsorbent
 b) Subdividing the solid adsorbent
 c) Blowing superheated steam through the porous adsorbent
 d) Adsorption at very low pressure
101. The coagulation of sol particles may be brought in by :
 a) Heating
 b) Adding oppositely charged sol
 c) Adding electrolyte
 d) Persistent dialysis
102. Which of the following statements is/are not correct?
 a) A catalyst always increases the speed of a reaction
 b) A catalyst does not take part in the reaction
 c) A catalyst may affect the nature of the products formed
 d) A catalyst is always an external substance added to the reaction mixture
103. The size of the colloid particles is :
 a) > suspension particles
 b) < suspension particles

c) > true solution particles

d) None of the above

104. Which is not the adsorption isobar for chemisorption?



105. Which of the following is/are correctly matched?

a) Butter-gel

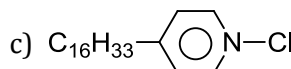
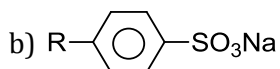
b) Milk-emulsion

c) Fog-aerosol

d) Dust-solid sol

106. Cationic surfactants are

a) $C_{17}H_{35}COONa$



d) $C_{16}H_{33}N(CH_3)_3Cl$

107. Which of the following is/are application(s) of adsorption?

a) De-ionization of water

b) Gas masks

c) Hygroscopic nature of $CaCl_2$

d) Heterogeneous catalysis

108. Efficiency of the catalyst does not depend on its?

a) Molecular weight

b) Number of free valencies

c) Physical state

d) Amount used

109. Which is/are not the example(s) of a heterogeneous catalysis?

a) Formation of SO_3 in the chamber process

b) Formation of SO_3 in the contact process

c) Hydrolysis of an ester in the presence of H^+ ions

d) Combination of H_2 and Cl_2 in the presence of moisture

110. Which of the following statements is/are wrong?

a) Zeolites are hydrated aluminosilicates which can be used as shape-selective catalysts

b) Enzymes show maximum activity when pH is either very low or very high

c) Enzymes show maximum activity at room temperature ($20 - 25^\circ C$)

d) Chemically, all enzymes are globular proteins

111. Which are correct statements for a catalyst?

a) It does not alter E_a

b) The surface of a catalyst adsorbs reactants

c) Catalyst may form intermediates with the reactants

d) Action of enzyme catalyst is always specific

112. Which is/are correct in case of heterogeneous catalyst?

a) The catalyst decreases the energy of activation

b) The surface of catalyst plays an important role

c) The catalyst actually forms a compound with reactants

d) There is no change in the energy of activation

113. Which of the following statements is/are true for heterogeneous catalysis?

a) The energy of activation does not change

b) The catalyst combines with the reactant to form a compound

c) The reactant molecules are adsorbed on the surface of the catalyst

d) The catalyst lowers the energy of activation

114. Which of the following statements about catalysis is/are true?

a) They change the equilibrium constant

b) They decrease the activation energy

c) They shorten the time taken to reach equilibrium

d) They influence the forward and the reverse reactions to the same extent

115. Which is/are correct statement about the role of a catalyst in a reaction?

a) It is reactant in a rate-determining step and then a product of some subsequent step

- b) It provides an alternate mechanism with a lower energy of activation
 - c) It increases the rate of chemical reaction but does not itself undergo a permanent change during the course of the reaction
 - d) It increases quantity of the product
116. Which is/are true in case of catalyst?
- a) A catalyst usually does not initiate a reaction
 - b) It does not alter the position of equilibrium in a reversible reaction
 - c) A catalyst remains unchanged in quality and composition at the end of a reaction
 - d) Catalysts are sometimes very specific in respect of a reaction
117. The capacity of an ion to coagulate a colloidal solution depends on :
- a) Its shape
 - b) Amount of its charge
 - c) The sign of charge
 - d) None of these
118. When a catalyst is added to a system, the :
- a) Value of the equilibrium constant decreases
 - b) Equilibrium concentration are unaffected
 - c) Rate of reaction is increased
 - d) Activation energy of the reaction decreases
119. Mark the incorrect statements. A catalyst :
- a) Remains chemically unchanged at the end of a chemical reaction
 - b) Is used up in the course of a reaction
 - c) Is a reactant required in small quantity
 - d) Is not specific in its action

Assertion - Reasoning Type

This section contain(s) 0 questions numbered 120 to 119. Each question contains STATEMENT 1(Assertion) and STATEMENT 2(Reason). Each question has the 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

- a) Statement 1 is True, Statement 2 is True; Statement 2 **is** correct explanation for Statement 1
- b) Statement 1 is True, Statement 2 is True; Statement 2 **is not** correct explanation for Statement 1
- c) Statement 1 is True, Statement 2 is False
- d) Statement 1 is False, Statement 2 is True

120

Statement 1: For the coagulation of sols carrying positive charge, PO_4^{3-} ions are more efficient than SO_4^{2-} or Cl^- ions

Statement 2: This follows Hardy-Schulze rule

121

Statement 1: A catalyst lowers the threshold energy level for reaction.

Statement 2: Catalyst combines with reactant to form an exothermic intermediate and provide another pathway to reaction.

122

Statement 1: Aqueous gold colloidal solution is red in colour

Statement 2: The colour arises due to scattering of light by colloidal gold particles

123

Statement 1: In chemisorption, adsorption keeps on increasing with temperature

Statement 2: Heat keeps on providing more and more activation energy

124

Statement 1: The molecules on the surface have lesser energy.

Statement 2: During adsorption the surface of solid is in a state of relaxation.

125

Statement 1: Zeolites are water softner as well as catalyst.

Statement 2: The catalytic action of zeolites is based upon their shape selectivity.

126

Statement 1: The mass of nickel catalyst recovered after being used in the hydrogenation of an oil is less than the mass of nickel added to the reaction

Statement 2: Catalyst take part in the reaction but are recovered in the end

127

Statement 1: The micelle formed by sodium stearate in water has -COO^\ominus groups at the surface

Statement 2: Surface tension of water is reduced by addition of stearate

128

Statement 1: A colloidal solution of Fe(OH)_3 formed by peptization carries positive charge.

Statement 2: During formation of Fe(OH)_3 solution, electrons are lost by the particles.

129

Statement 1: The activity of a catalyst depends upon the strength of physisorption .

Statement 2: The reactant must adsorb very strongly for the catalyst to be active.

130

Statement 1: Colloidal solutions are stable but colloidal particles do not settle down.

Statement 2: Brownian movement counters the force of gravity actively on colloidal particles.

131

Statement 1: Creaming from milk is known as phase inversion.

Statement 2: An agitation of milk brings in a change of D.P. into D.M. and *vice – versa*.

132

Statement 1: The micelle formation by a surfactant takes place at certain concentration at definite temperature.

Statement 2: The temperature above which a surfactant forms micelle is called Kraft point.

133

Statement 1: Addition of $\text{AgNO}_3(aq)$ to $\text{KI}(aq)$ gives -ve sol whereas addition of $\text{KI}(aq)$ to AgNO_3 gives +ve sol of AgI .

Statement 2: The sol particles adsorb the common ions present in solution and acquire their charge.

134

Statement 1: A needle can float on clear water but sinks when some detergent is added to it.

Statement 2: Detergent reduced the surface tension of water.

135

Statement 1: Thermal decomposition of $\text{KClO}_3(s)$ in presence of $\text{MnO}_2(s)$ is an example of homogeneous catalysis.

Statement 2: A homogeneous catalysis involves phase $P = 1$.

136

Statement 1: Physical adsorption of molecules on the surface requires activation energy

Statement 2: Because the bonds of adsorbed molecules are broken

137

Statement 1: ZSM - 5 is used as a catalyst in petrochemical industries

Statement 2: Zeolites are three dimensional network silicates in which some silicon atoms are replaced by aluminium atoms

138

Statement 1: Catalysts are always transition metals

Statement 2: Transition metals have variable oxidation state

139

Statement 1: Small quantity of soap is used to prepare a stable emulsion

Statement 2: Soap lowers the interfacial tension between oil and water

140

Statement 1: Hard water consumes more soap.

Statement 2: The ion responsible for cleansing action is precipitated out by Ca^{2+} or Mg^{2+} ion.

141

Statement 1: Aqueous gold colloidal solution is red in colour.

Statement 2: The colour arises due to scattering of light by colloidal gold particles.

142

Statement 1: Activity of an enzyme is pH dependent

Statement 2: Change in pH affects the solubility of the enzyme in water

143

Statement 1: Now-a-days term catalyst means specifically a substance that accelerates the reaction.

Statement 2: The terms inhibitor is commonly used for substances which retards the rate of reaction.

144

Statement 1: The effectiveness of catalyst has found more applications in solid catalyst and gaseous reactant systems.

Statement 2: A large number of industrial preparations are based on this type of reactions.

145

Statement 1: The charge on lyophobic particles is responsible for their nature to exist as sol.

Statement 2: It is the formation of thin layer around sol particles which is responsible for stability of lyophilic sols.

146

Statement 1: Oxidation of Na_2SO_3 is not caused by air but in presence of Na_3AsO_3 both undergo oxidation simultaneously.

Statement 2: Neither Na_2SO_3 nor Na_3AsO_3 is oxidised by air.

147

Statement 1: Langmuir adsorption is a single-layer phenomenon

Statement 2: It is due to van der Waals forces

148

Statement 1: Fe^{3+} can be used for coagulation of As_2S_3 sol

Statement 2: Fe^{3+} reacts with As_2S_3 to give Fe_2S_3

149

Statement 1: The activity of catalyst more or less specific.

Statement 2: A catalyst for one reaction is not necessary to catalyse the other reaction.

150

Statement 1: Gelatin is often used as protective colloid.

Statement 2: Protection is a property of lyophilic colloids.

151

Statement 1: A yellow coloured As_2S_3 sol on mixing with red coloured $\text{Fe}(\text{OH})_3$ sol gives colourless solution.

Statement 2: The -ve charge of As_2S_3 sol particles is neutralised by +ve charge of $\text{Fe}(\text{OH})_3$ sol particles and thus, sols are destabilized and show mutual coagulation.

152

Statement 1: The separation of insoluble impurities from a colloidal solution required dialysis.

Statement 2: The ionic impurities present in colloidal solution are separated by electro dialysis.

153

Statement 1: The stability of lyophobic sols is lesser than lyophilic sols.

Statement 2: Lyophilic sols possess loving nature for liquid.

154

Statement 1: A catalyst speeds up a reaction but does not participate in its mechanism

Statement 2: A catalyst provides an alternative path of lower activation energy to the reactants

155

Statement 1: Alcohols are dehydrated to hydrocarbons in the presence of acidic zeolites

Statement 2: Zeolites are porous catalysts

156

Statement 1: $C_{12}H_{25}NH_3Cl$ and $C_{12}H_{25}COONa$ are colloidal electrolyte.

Statement 2: The substances which behave as electrolyte at lower concentration and above definite concentration forms sol are called colloidal electrolyte.

157

Statement 1: An emulsion becomes stable if soap is added to it.

Statement 2: Soap contains hydrophilic hydrophobic parts.

158

Statement 1: Lead tetraethyl acts as inhibitor for combustion of gasoline.

Statement 2: It retards the precombustion of gasoline

159

Statement 1: Fruit formation process shows increase in the rate with passage of time

Statement 2: Hydrolysis of ester is homogeneous autocatalytic reaction

160

Statement 1: The concentration of sulphide ores by froth floatation is based on emulsification.

Statement 2: Pine oil in water forms emulsion.

161

Statement 1: Physical adsorption is weaker than chemical adsorption.

Statement 2: Activated complex formed during adsorption possess lower energy level in chemisorption as it is more exothermic.

162

Statement 1: All enzymes are proteins, but all proteins are not enzymes

Statement 2: Enzymes are biocatalysts and possess a stable configuration having active sites

163

Statement 1: Micelles are formed by surfactants above CMC.

Statement 2: The conductivity of a solution having surfactant molecule decreases sharply at CMC.

164

Statement 1: The presence of a catalyst increases the speed of the forward and backward reactions to the same extent

Statement 2: Activation energy for both the forward and backward reactions is lowered to same extent

165

Statement 1: According to Freundlich $\frac{x}{m} = K.P^{1/n}$.

Statement 2: The isotherm shows variation of the amount of gas adsorbed by the adsorbent with temperature.

166

Statement 1: Enzymes are proteins and enzyme catalysed reactions are called biological catalysis.

Statement 2: The activity of enzyme as catalyst is increased in presence of vitamins.

167

Statement 1: A reaction cannot become fast by itself unless a catalyst is added

Statement 2: A catalyst always increases the speed of a reaction

168

Statement 1: According to Freundlich, $\frac{x}{m} = k \cdot p^{1/n}$

Statement 2: The isotherm shows variation of the amount of gas adsorbed by the adsorbent with temperature

169

Statement 1: Medicines are more effective in colloidal form than in tablet form.

Statement 2: The colloidal state possess larger surface area than coarse form.

170

Statement 1: The blue colour of sky is due to scattering of light by dirt or dust particles present in air.

Statement 2: Larger size of dispersed phase particles show more scattering as well as higher is the wavelength of light longer is scattering.

171

Statement 1: Lyophilic colloids are called reversible sols

Statement 2: Lyophilic sols are liquid loving

172

Statement 1: Hydrolysis of ethyl acetate in the presence of acid is a reaction of first order whereas in presence of alkali, it is reaction of second order

Statement 2: Acid only acts as a catalyst whereas alkali acts as one of the reactants

173

Statement 1: A colloidal state, a dispersion of a dispersed phase in a dispersion medium is a heterogeneous state.

Statement 2: The particle size of dispersed phase ranges between true solution and suspension state.

174

Statement 1: The digestion of fat in intestine involves emulsification.

Statement 2: Bile salts stabilize the emulsion so formed.

175

Statement 1: A catalyst increases the rate of a reaction.

Statement 2: In presence of a catalyst, the activation energy of the reaction increases.

176

Statement 1: Sol particles show Tyndall effect.

Statement 2: The scattering is directly proportional to size of sol particle.

177

Statement 1: A reaction cannot become fast by itself unless a catalyst is added

Statement 2: A catalyst always increases the speed of a reaction

Matrix-Match Type

This section contain(s) 0 question(s). Each question contains Statements given in 2 columns which have to be matched. Statements (A, B, C, D) in **columns I** have to be matched with Statements (p, q, r, s) in **columns II**.

178.

Column-I

(A) Nickel

(B) V_2O_5

(C) Diastase

(D) Adsorption

Column- II

(p) Conversion of SO_2 into SO_3

(q) Conversion of starch into sugar

(r) Accumulation of molecules at the surface of a solid or liquid

(s) Hydrogenation of vegetable oils

CODES :

A B C D

- a) r q p s
 b) s p q r
 c) q r s p
 d) p s r q

179.

Column-I	Column- II
(A) Gold number	(p) Solvent heating
(B) Lyophobic	(q) Coagulation
(C) Butter	(r) Protective colloids
(D) Hardy Schulze rule	(s) Solvent
(E) Micelles	(t) Associated colloids
	(u) An emulsion

CODES :

	A	B	C	D	E
a)	R	s	u	q	t
b)	s	t	q	r	t
c)	q	r	s	u	t
d)	s	u	q	t	t

180. This section contains questions each with two columns –I and II. Match the items given in column I with that in column II

Column-I	Column- II
(A) Dispersion of $\text{Al}(\text{OH})_3$ by small quantity of AlCl_3	(p) Macromolecular colloid
(B) Addition of large quantity of AlCl_3 in (a)	(q) Selective adsorption
(C) Solution of hemoglobin in water	(r) Flocculation
(D) Chromatographic separation of components of a solution	(s) Peptization

CODES :

	A	B	C	D
a)	r	p	q	s
b)	s	r	p	
c)	p	q	s	r

d) q s r p

181.

Column-I

Column- II

(A) Activated charcoal

(p) A device to adsorb poisonous gases

(B) $x/m = KP^{1/n}$

(q) One of the adsorbents

(C) For humidity control

(r) Silica gel

(D) Gas masks

(s) Freundlich adsorption isotherm

CODES :

	A	B	C	D
a)	s	r	p	q
b)	r	p	q	s
c)	p	q	s	p
d)	q	s	p	r

182.

Column-I

Column- II

(A) Fog

(p) Gel

(B) Milk

(q) Foam

(C) Cheese

(r) Emulsion

(D) Soap lather

(s) Aerosol

CODES :

	A	B	C	D
a)	r	p	q	s
b)	s	r	p	q
c)	p	q	s	r
d)	q	s	r	p

183. Match the following

Column-I

Column- II

(A) Smoke

(p) Aerosol of liquid

(B) Milk

(q) Aerosol of solid

(C) Butter

(r) Emulsion

(D) Fog

(s) Gel

CODES :

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	ii	iv	i
c)	i	ii	iii	iv
d)	ii	iii	iv	i

184.

Column-I

Column- II

(A) Coagulation

(p) Scattering

(B) Lyophilization

(q) Washing of precipitates

(C) Peptization

(r) Purification of colloids

(D) Tyndall effect

(s) Electrolyte

CODES :

	A	B	C	D
a)	s	r	q	p
b)	r	p	s	q
c)	s	q	r	s
d)	q	s	p	r

185. Match list-I with list-II and select the correct match.

Column-I

Column- II

(A) Rain cloud

(p) Sol

(B) Milk of magnesia

(q) Foam

(C) Whipped cream

(r) Micelles

(D) Soap in water

(s) Aerosol

CODES :

	A	B	C	D
a)	i	ii	iii	iv
b)	iv	i	ii	iii
c)	iv	ii	iii	i

d) iii i ii iv

186. Match the following :

Column-I

Column- II

(A) Dialysis

(p) Precipitate converts to colloidal solution

(B) Peptization

(q) Precipitation of colloidal solution

(C) Flocculation

(r) Protective power

(D) Gold number

(s) Purification of colloidal solution

CODES :

	A	B	C	D
a)	i	iii	ii	iv
b)	iv	i	ii	iii
c)	ii	iv	iii	i
d)	iii	ii	iv	i

187.

Column-I

Column- II

(A) Physisorption

(p) Multimolecular

(B) Chemisorption

(q) High heat of activation

(C) Activated adsorption

(r) High temperature required

(D) Desorption

(s) Low pressure required

(E) Electro-osmosis

(t) Determination of charge on colloidal particles

CODES :

	A	B	C	D	E
a)	P	q,r	q,r	s	t
b)	q,r	s	t	p	t
c)	t	p	q	t	t
d)	q	r	s	q,r	t

188.

Column-I

Column- II

(A) Placing silica gel in water vapour

(p) Enzymatic catalysis

(B) Placing anhydrous CaCl_2 in water vapour

(q) Occlusion

- (C) Placing finely divided nickel in a closed vessel containing H₂ gas (r) Adsorption
 (D) Shaking dilute KCl solution with blood charcoal (s) Adsorption
 (E) Conversion of proteins into amino acids (t) Negative adsorption

CODES :

	A	B	C	D	E
a)	S	q	p	r	t
b)	t	p	r	s	t
c)	r	s	q	t	t
d)	p	q	t	s	t

189.

Column-I

Column- II

- | | |
|---------------------------|---|
| (A) Purple of cassius | (p) Gel |
| (B) Cheese | (q) Gold sol |
| (C) Dialysis | (r) Robert Brown |
| (D) Brownian movement | (s) Hydrophilic |
| (E) Water-loving colloids | (t) Purification of colloidal solutions |

CODES :

	A	B	C	D	E
a)	p	q	r	u	t
b)	t	u	s	t	t
c)	q	p	t	r	t
d)	u	r	q	s	t

Linked Comprehension Type

This section contain(s) 18 paragraph(s) and based upon each paragraph, multiple choice questions have to be answered. Each question has atleast 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 190 to -190

Freundlich adsorption isotherm is obeyed by the adsorptions where the adsorbate forms a multimolecular layer on the surface of adsorbent. In such case, the degree of adsorption varies linearly with pressure but at high pressure, it becomes independent of pressure. It is given as

$$\frac{x}{m} = kp^{1/n}$$

Where, k and n constants

Langmuir adsorption isotherm is obeyed by the adsorption where the adsorbate forms only a unimolecular

adsorbed layer. The mathematical relation of Langmuir adsorption isotherm is

$$\frac{x}{m} = \frac{ap}{1 + bp}$$

190. When $\log\left(\frac{x}{m}\right)$ is plotted against $\log p$, we get a straight line with slope

- a) $\frac{1}{n}$ b) n c) x d) m

Paragraph for Question Nos. 191 to - 191

Emulsions are also the colloidal solutions in which disperse phase as well as dispersions medium are liquids. It may be oil in water or water in oil type. Bancroft proposed that the phase in which the emulsifier is more soluble becomes the outer phase of the emulsion. Emulsifiers can be used to stabilize the emulsion. Soaps, detergents, proteins and gum etc, are used as emulsifiers

191. Addition of lyophilic solution to the emulsion forms

- a) A protective film around the dispersed phase
b) A protective film around the dispersion medium
c) An aerosol
d) True solution

Paragraph for Question Nos. 192 to - 192

Colloidal solution is a heterogeneous solution which contains particle of intermediate size, i.e., (diameter between 1 and 1000 nm) colloidal is not a substance but it is a state of a substance which depends upon the molecular size. Colloidal solutions are intermediate between true solutions and suspensions

192. The size of the colloidal particles lies in the range

- a) 10 nm – 1000 nm b) 10 m μ – 1000 m μ c) 1 nm – 1000 nm d) 10⁻⁵cm – 10⁻⁷cm

Paragraph for Question Nos. 193 to - 193

A chemist studied the phenomenon of adsorption by putting blood charcoal in KCl solution. He observed difference in the behaviour with dilute KCl solution and with concentrated KCl solution. He also studied the adsorption of different gases on solid adsorbent and the effect of temperature on adsorption. He put forward a mathematical relationship relating x/m with equilibrium pressure

193. Which of the following is correct?

- a) Adsorption is always exothermic?
b) Adsorption is always endothermic
c) Physical adsorption is endothermic whereas chemisorptions is exothermic
d) Chemical adsorption is endothermic whereas physical adsorption is exothermic

Paragraph for Question Nos. 194 to - 195

Colloidal dispersion have been classified into different types depending upon the physical state of the dispersed phase and the dispersion medium. They are prepared in the industry or in the laboratory by a number of

methods and then purified. The protective action of lyophilic colloids was studied by zsigmondy and he introduced a term called gold number

194. Which of the following does not form a lyophilic colloid?

- a) Rubber dissolved in benzene
- b) White of the egg dissolved into water
- c) Common salt added into benzene
- d) Stannous chloride solution added to gold chloride solution

Paragraph for Question Nos. 195 to - 196

Adsorption is the tendency of accumulation of molecular species at the surface of solid or liquid. Depending upon the nature of bonds or forces of attraction between adsorbate and adsorbent, it is classified between physisorption and chemisorption

195. Which of the following statements are correct? (More than one correct)

- a) Adsorption always leads to a decrease in enthalpy and entropy of the system
- b) Adsorption arises due to unsaturation in the enthalpy of valence forces of atoms or molecules on the surface
- c) Adsorption increases with rise in temperature
- d) Adsorption decreases the surface energy

Paragraph for Question Nos. 196 to - 197

Substances which alter the velocity of a reaction by mere presence, without undergoing any change in mass and composition are termed catalysts and the phenomenon is known as catalysis

196. According to the adsorption theory of catalysis, the rate of reaction increases because

- a) Adsorption lowers the activation energy of the reaction
- b) Concentration of reactant molecules at the active centers of the catalyst becomes high due to adsorption
- c) Adsorption increases the activation energy of the reaction
- d) Adsorption decreases the activation energy of the reaction

Paragraph for Question Nos. 197 to - 198

Only the surface atoms in an adsorbent play an active role in adsorption. These atoms possess some residual forces such as van der Waals forces and chemical forces. In the process of adsorption, weak adsorbate is substituted by strong adsorbate. Activated charcoal used in the gas mask is already exposed to the atmospheric air, so gases and water vapours in air are adsorbed on its surface. When the mask is exposed to chlorine atmosphere, the gases are displaced by chlorine. In general, easily liquifiable gases such as CO_2 , NH_3 , Cl_2 and SO_2 are adsorbed to a greater extent than the elemental gases, e.g., H_2 , N_2 , O_2 , He, etc

197. Gas mask works on the principle of

- a) Chemical adsorption
- b) Physical adsorption
- c) Both physical adsorption and chemical adsorption
- d) None of these

Paragraph for Question Nos. 198 to - 199

Emulsions are also called the colloidal solutions in which the disperse phase as well as dispersion medium are liquids. It may be oil-in-water or water-in-oil type. Emulsifiers can be used to stabilize the emulsion. Soaps, detergents, proteins, and gums are used as emulsifiers

198. Which of the following examples is/are oil-in-water-type emulsion?

- a) Ink b) Detergent c) Soap d) Milk

Paragraph for Question Nos. 199 to - 200

There are certain substances which behave as normal, strong electrolyte at low concentration but at higher concentration they behave as colloidal solutions due to the formation of aggregated particles. Such colloids are called associated colloids and the aggregated particles are called micelles. The formation of micelles takes place above certain concentration called critical micellization concentration (CMC) and a characteristic temperature

199. Micelles are

- a) Emulsion-cum-gel b) Adsorbed catalyst c) Associated colloids d) Ideal solutions

Paragraph for Question Nos. 200 to - 200

The catalytic activity and colloidal nature of a substance are surface phenomenon. Both these properties depend upon the property of adsorption. Adsorption may be physisorption or chemisorption. Adsorption is spontaneous and always leads to decrease in entropy along with evolution of heat. Chemisorption is irreversible with temperature, unilayer, specific and directional. Adsorbate molecules adsorb on catalyst surface and thus, lowers the energy of activation of reaction to provide a new pathway for reaction. In colloidal state dispersed phase particles possess the adsorption characteristics at the interface.

200. Select the correct statements :

1. Adsorption is spontaneous at all the temperatures.
2. Gases having high critical temperature possess more tendency for adsorption.
3. An adsorbent possesses more tendency for adsorption if it is in colloidal state.
4. Chemical adsorption first decreases with increase in temperature and then increases.
5. Water molecules are adsorbed in $\text{CaCl}_2(s)$.

- a) 1,2,3,4,5 b) 2,3,4 c) 1,2,3,4 d) 2,3

Integer Answer Type

201. The gold number of gelatin is 0.01. Calculate the amount of gelatin to be added to 1000 mL of a colloidal sol of gold to prevent its coagulation, before adding 1 mL of 10% NaCl solution

- a) 2 b) 1 c) 4 d) 5

202. From the given following sol how many can coagulate silica acid sol?

$\text{Fe}(\text{OH})_3$, $\text{Ca}(\text{OH})_2$, $\text{Al}(\text{OH})_3$, Starch, Clay, As_2S_3 , CdS, Basic dye

- a) 4 b) 3 c) 2 d) 8

203. 526.3 mL of 0.5 M HCl is shaken with 0.5 g of activated charcoal and filtered. The concentration of the filtrate is reduced to 0.4 M. The amount of adsorption (x/m) is

- a) 3 b) 6 c) 8 d) 4
204. In an experiment, addition of 5.0 mL, of 0.006 M BaCl₂ to 10.0 mL of arsenic sulphite sol just causes the complete coagulation in 34 h. The flocculating value of the effective ion is :
- a) 2 b) 3 c) 4 d) 5
205. The coagulation of 100 mL of a colloidal sol of gold is completely prevented by addition of 0.03 g of Haemoglobin to it before adding 1 mL of 10% NaCl solution. Calculate the gold number of Haemoglobin
- a) 4 b) 8 c) 3 d) 9
206. 11.42 g O₂ gas is adsorbed on 2 g of metal powder. The volume of O₂ adsorbed in litre/g of metal powder at STP is
207. How many of the following represent surface phenomenon? Adsorption, Surface tension, Surface energy, Viscosity, Absorption, Dissolution of soap in water, Silica gel in presence of moisture
208. From the given following sol how many can coagulate the haemoglobin sol?
Fe(OH)₃, Ca(OH)₂, Al(OH)₃, starch, clay, As₂S₃, CdS, basic dye
- a) 1 b) 3 c) 4 d) 8
209. For the coagulation of 500 mL of arsenious sulphide sol, 2 mL of 1M NaCl is required. What is the flocculation value of NaCl?
- a) 3 b) 2 c) 5 d) 4
210. In an adsorption experiment, a graph between $\log(x/m)$ versus $\log P$ was found to be linear with a slope of 45°. The intercept on the y axis was found to be 0.301. Calculate the amount of the gas adsorbed per gram of charcoal under a pressure of 3.0 atm
- a) 4 b) 2 c) 6 d) 8

: ANSWER KEY :

1)	d	2)	c	3)	b	4)	c	5)	d	6)	d	7)	b	8)	a
5)	a	6)	d	7)	c	8)	e	9)	c	10)	d	11)	a	12)	c
9)	d	10)	b	11)	c	12)	c	13)	d	14)	c	15)	c	16)	b
13)	b	14)	b	15)	a	16)	d	17)	e	18)	b	19)	b	20)	a
17)	d	18)	a	19)	a	20)	d	21)	c	22)	a	23)	c	24)	d
21)	b	22)	c	23)	a	24)	b	25)	c	26)	d	27)	a	28)	c
25)	a	26)	a	27)	b	28)	a	29)	c	30)	d	31)	d	32)	c
29)	d	30)	a	31)	a	32)	d	33)	b	34)	c	35)	e	36)	c
33)	b	34)	b	35)	c	36)	c	37)	c	38)	a	39)	c	40)	a
37)	e	38)	b	39)	a	40)	c	41)	c	42)	c	43)	b	44)	d
41)	a	42)	a	43)	a	44)	b	45)	a	46)	c	47)	d	48)	e
45)	a	46)	c	47)	c	48)	b	49)	c	50)	c	51)	c	52)	b
49)	c	50)	a	51)	a	52)	a	53)	a	54)	c	55)	c	56)	c
53)	b	54)	c	1)	a, b, c, d	57)	c	58)	d	1)	b	2)	a		
	2)	a,b,d	3)	a, b, c	4)	b,d		3)	b	4)	d				
5)	a, d	6)	a, b, d	7)	a,b,c	8)		5)	b	6)	d	7)	a	8)	b
	a, b, d							9)	b	10)	a	11)	c	12)	c
9)	a, c, d	10)	a,d	11)	b, c, d	12)		1)	a	2)	a	3)	c	4)	a
	a, c, d							5)	d	6)	a,b,d	7)	b	8)	c
13)	a,b	14)	a, c	15)	a,b,c	16)		9)	d	10)	a	11)	b	1)	b
	b,c,d							2)	a	3)	d	4)	a		
17)	a,b	18)	a,b	19)	c, d	20)		5)	c	6)	4	7)	5	8)	c
	a, b, d							9)	d	10)	c				
21)	a,b,c	22)	a,b,d	23)	a,c,d	24)									
	a, b, c														
25)	a,c,d	26)	a, b	27)	a, b, c	28)									
	a,b,c														
29)	a,b,c	30)	a,b,c	31)	a,d	32)									
	a,b,c														
33)	a, b, c, d	34)	a,b,c	35)	a,d										
	36)	a, c													
37)	a, b, c	38)	a,b,d	39)	a, b, c, d										
	40)	a,d													
41)	a,c	42)	a, b, c	43)	a,c	44)									
	a, c, d														
45)	a, b, c	46)	b,c	47)	a, b, c, d										
	48)	a,b,d													
49)	b, c	50)	a,b,d	51)	a,b,c	52)									
	c,d														
53)	a,b,d	54)	a,c,d	55)	a, c, d	56)									
	a,b,c														
57)	b,c,d	58)	a, b, c	59)	b, c, d	60)									
	b, c, d														
61)	a,b,c	62)	b, d	63)	b, c	64)									
	b, c, d														
65)	b, c, d	1)	a	2)	c	3)	a								
	4)	e													

: HINTS AND SOLUTIONS :

- 1 **(d)**
Al(OH)₃ is positively charged sol. K₃PO₄ has greater negative charge. Hence, it is most effective in coagulation of Al(OH)₃ sol
- 6 **(d)**
Blood is a natural colloid
- 7 **(c)**
The reciprocal of gold number is directly proportional to the protecting power
- 12 **(c)**
Sb₂S₃ is an anionic sol, therefore cation of highest valency (Al³⁺ in the present case) would be most effective coagulating agent.
- 13 **(b)**
For polymerization of ethene, Fe and Co is used
- 14 **(b)**
Dialysis is a process of purifying a substance
- 15 **(a)**
Hardness of water is due to carbonate or sulphate of Ca²⁺ and Mg²⁺ ions. When sodium aluminium silicate is added Na[⊕] replaces Ca²⁺ and Mg²⁺ by adsorption, and hence water become soft
- 16 **(d)**
Lyophilic sols are self stabilizing because these sols are reversible and are highly hydrated in the solution.
- 17 **(d)**
Soaking of water by a sponge is adsorption because water also accumulates in bulk of sponge as well as on the surface of it
- 18 **(a)**
Sodium dodecyl sulphate (SDS)
CMC (mm)>-10
Hexadecyl trimethyl ammonium bromide (CTAB)
Note At a certain concentration surfactant molecules start to aggregate and form micelle, the concentration is called critical micellisation concentration (CMC).
- 19 **(a)**
Catalyst changes the activation energy (E_a)
- 20 **(d)**
Adsorption is an exothermic process
- 23 **(a)**
Due to scattering, smoke has blue tinge
- 26 **(a)**
On increasing the temperature, adsorption decreases
- 27 **(b)**
Tyndall effect is observed for colloidal solution
- 29 **(d)**
It is factual statement
- 31 **(a)**
In fog, liquid water is dispersed in gas
- 32 **(d)**
Enthalpy of adsorption regarding physisorption is not positive. Rather it is negative
- 33 **(b)**
Peptization is a process of passing of a precipitate into colloidal solution on the addition of electrolyte
- 35 **(c)**
In sorption and adsorption take place
- 44 **(b)**
 $\frac{X}{m} \propto P^{1/n}$ or $\frac{X}{m} = KP^{1/n}$
Taking log on both sides,
 $\log \frac{X}{m} = \log K + \frac{1}{n} \log P$
- 48 **(b)**
Ni is used for catalytic hydrogenation of oil
- 50 **(a)**
Adsorption is a substance on which adsorption takes place
- 54 **(c)**
As₂S₃ sol is a negatively charged colloid. Al³⁺ has greater charge, therefore, Al₂(SO₄)₃ is most effective in the coagulation of As₂S₃ sol
- 58 **(b,d)**
AgI is precipitated by reaction of equivalent amount of Ag⁺ and I⁻. I⁻ is adsorbed (if present in excess) on the surface of AgI forming negatively charged colloidal sol. Thus,
$$\text{Ag}^+ + \text{I}^- \rightarrow \text{AgI}$$
$$\text{AgI} + \text{I}^- \rightarrow [\text{AgI}]\text{I}^-$$

(a) 100 mL of 0.1 M AgNO₃ = 10 millimol Ag⁺
100 mL of 0.01 M KI = 10 millimol I⁻
AgI is only precipitated
(b) 20 millimol I⁻ > 10 millimol Ag⁺
Thus, AgI is precipitated and then [AgI]I⁻

colloidal sol is formed

(c) 20 millimole of Ag^+ > 10 millimole of I^-

AgI is precipitated and then $[\text{AgI}]\text{Ag}^+$ colloidal sol is formed

(d) 25 millimole I^- > 15 millimole of Ag^+

Thus, $[\text{AgI}]\text{I}^-$ colloidal sol is formed

69 **(a,b,c)**

Gold sol is negatively charged. Hence, most effective for coagulation will be Mg^{2+} ions

70 **(b,c,d)**

Catalyst does not change equilibrium

72 **(a,b)**

(c) is wrong because chemical adsorption first increases and then decreases with increase in temperature

(d) is wrong because as a result of adsorption, there is a decrease in surface energy

75 **(a,b,c)**

Particle size of an adsorbent affects the amount of adsorption

76 **(a,b,d)**

Physisorption does not require activation energy

79 **(a,c,d)**

Silicic acid is a non-elastic gel

83 **(a,b,c)**

Adsorption is a selective, specific and reversible process. It increases in the gaseous adsorbate. But it is an exothermic process

84 **(a,b,c)**

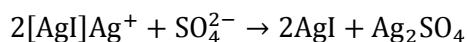
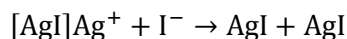
Cellulose is not an enzyme

85 **(a,d)**

Starch and cellulose are high molecular mass molecules

88 **(a,b,c)**

One mole of $[\text{AgI}]\text{Ag}^+$ is coagulated by 1 mol of I^-



2 mol 1 mol

1 mol 0.5 mol

500 mL of 1 M $\text{K}_2\text{SO}_4 = 0.5$ mol

Thus, (b) is true

1 L of 1 M $\text{KI} = 1$ mol I^-

Thus, (c) is also true

92 **(a,b,d)**

Smoke is an aerosol (solid carbon particles dispersed in air)

94 **(a,d)**

Milk is emulsion, butter is gel. Smoke and fog have gas (air) as the dispersion medium and hence are aerosol

95 **(a,c)**

Catalyst decreases the activation energy for the reaction hence reaction speeds up. It also decreases entropy (more negative), therefore, free energy less positive or more spontaneous

102 **(a,b,d)**

A catalyst is a substance that may increase or decrease the speed of reaction, also it may be added from outside and sometimes may produced during the reaction

104 **(a,b,d)**

In chemisorptions, adsorption first increases and then decreases

105 **(a,b,c)**

Dust is an aerosol and not a solid sol

108 **(a,c,d)**

Efficiency of catalyst depends upon the number of free valencies

110 **(a,b,c)**

1. is wrong because zeolites are not used as such but are first heated in vacuum so that the water of hydration is lost

2. is wrong, because enzyme have maximum activity at pH of 7.4

3. is wrong because enzyme has maximum activity at 37°C

- 111 **(b,c,d)**
According to adsorption theory, the surface of a catalyst adsorbs reactants. According to intermediate compound theory, a catalyst may form intermediate with the reactants. Action of enzyme catalyst is always specific
- 115 **(a,b,c)**
A catalyst is reactant in a rate-determining (r/d) step and then a product of some subsequent step. It also provides an alternate mechanism with a lower energy of activation. It alters rate of chemical reaction but can not change quantity of the product
- 120 **(a)**
According to Hardy-Schulze rule coagulating power of an electrolyte is directly proportional to the fourth power of the valency of the ions causing coagulation
- 121 **(c)**
Catalyst lowers energy of activation and threshold energy and provide another pathway to reaction.
- 122 **(a)**
The colours is due to scattering. It depends upon the size of particles. Finest gold sol has red colour. As the size of the particle increases, it becomes purple, then blue, and finally golden yellow
- 123 **(e)**
In chemisorptions, adsorption first increases and then decreases with change in temperature
- 124 **(d)**
The molecules on the surface, have higher energy than those inside.

The surface of a solid or liquid is in state of strain or tension on account of the unbalanced or residual forces.
- 125 **(d)**
Both are different facts but true.
- 128 **(c)**
During formation of $\text{Fe}(\text{OH})_3$ sol, Fe^{3+} ions are adsorbed on the particles.
- 129 **(d)**
The activity of a catalyst depends upon the strength of chemisorption to a large extent.

The reactant must absorb reasonably strongly for the catalyst to be active but must not adsorb so strongly that they are immobilized and other reactants are left with no space on catalyst surface for adsorption.
- 131 **(c)**
Milk is o/w emulsion, cream is w/o emulsion. To convert a o/w emulsion into w/o emulsion is known as phase inversion which can be achieved by mechanical agitation.
- 132 **(d)**
Both are different facts but true.
- 133 **(c)**

$$\text{AgNO}_3 + \text{KI}_{\text{Excess}} \rightarrow [\text{AgI}]^{1-}$$

$$\text{KI} + \text{AgNO}_3 \xrightarrow{\text{Excess}} [\text{AgI}]^{\text{Ag}^+}$$
- The preferential adsorption of common ion on AgI particles provides -ve and +ve charge.
- 134 **(c)**
Explanation is correct reason for statement.
- 135 **(b)**
Heterogeneous system has $P \geq 2$ $S + S$ has $P = 2$.
- 136 **(e)**
Activation energy is needed for chemical adsorption and not for physical adsorption. Breaking of bonds also takes place only in chemical adsorption
- 137 **(b)**
ZSM-5 converts alcohols directly into gasoline (petrol) by dehydrating them so that a mixture of hydrocarbons is formed
- 140 **(c)**

$$2\text{RCOONa} + \text{Ca}^{2+} \rightarrow \underset{\text{Insoluble}}{(\text{RCOO})_2\text{Ca}} + 2\text{Na}^+$$
- 141 **(a)**
The colour of colloidal solution depends upon the wavelength of light scattered by the dispersed particles which in turn depends upon size and nature of particles. Finest gold colloidal solution is red, as the size increase it become purple, blue and finally yellow.
- 142 **(c)**
With change in pH, the extent of protonation of

- the bases changes
- 143 **(d)**
Both are different facts but true.
- 144 **(c)**
Explanation is correct reason for statement.
- 145 **(d)**
Both are different facts but true.
- 146 **(a)**
It is called induced oxidation.
- 147 **(c)**
The single layer formed may be due to van der Waals adsorption or chemisorption
- 148 **(c)**
 Fe^{3+} neutralize the charge on the negatively charged As_2S_3 particles
- 149 **(d)**
Both are different facts but true.
- 150 **(d)**
Both are different facts but true.
- 151 **(c)**
Explanation is correct reason for statement.
- 152 **(b)**
Soluble impurities are removed by dialysis.
- 154 **(e)**
Catalyst may decrease the speed of reaction
- 155 **(c)**
Dehydration is not due to porous nature but due to the acidic group present in zeolites
- 156 **(c)**
Explanation is correct reason for statement.
- 157 **(a)**
Soap coats the drops of an emulsion and check them from coming together and emulsion stabilized.
- 158 **(c)**
Explanation is correct reason for statement.
- 160 **(c)**
Explanation is correct reason for statement.
- 161 **(c)**
Explanation is correct reason for statement.
- 163 **(d)**
Both are facts.
- 164 **(a)**
Catalyst does not change the equilibrium point
- 165 **(c)**
Freundlich adsorption isotherm gives an empirical relationship between the quantity of gas adsorbed by unit mass of solid adsorbent and pressure at a particular temperature.
- 166 **(d)**
Both are different facts but true.
- 167 **(e)**
Catalyst always does not increase the speed of reaction
- 168 **(c)**
Freundlich adsorption isotherm gives an empirical relationship between the quantity of gas adsorbed by unit mass of solid adsorbent and pressure at a particular temperature
- 169 **(c)**
Larger surface area provides more pronounced adsorption of medicine over tissues and thus effectiveness increases.
- 170 **(c)**
Explanation is correct reason for statement.
- 171 **(b)**
If the dispersion medium is separated from the dispersed phase, the lyophilic sol can be reconstituted by simply remixing with the dispersion medium. That is why these sols are also called reversible sols
- 173 **(c)**
Explanation is correct reason for statement.
- 175 **(c)**
A catalyst increases the rate of reaction because in the presence of catalyst the activation energy of the reaction and decreases.
- 176 **(c)**
Sol particles show Tyndall effect due to **scattering of light**. Also the scattering is directly proportional to size of sol particles.
- 177 **(d)**
There are reactions in which one of the products acts as catalyst (autocatalysis) and no catalyst is added

178 (b)
(d → r) Adsorption is the accumulation of any substance on the surface of liquid or metal. It is a surface phenomenon

179 (a)
(a → r) Gold number is the minimum number of milligrams of a lyophilic sol, needed to protect 10 mL of gold sol by addition of 1 mL of 10% NaCl

180 (b)
(a → s) Peptization is a process of conversion of a freshly precipitated substances into colloidal sol by shaking with suitable electrolyte
(b → r) Flocculation is minimum numbers of millimoles of the electrolyte required for complete coagulation of one liter of a colloidal sol
(c → p) Blood is a natural colloid

181 (d)
(d → p) Gas mask works on the participle of adsorption

184 (a)
(d → p) Scattering of dust particle by collision with light is Tyndall effect

185 (b)
Rain cloud is an example of aerosol. Milk of magnesia is a sol. Whipped cream is foam. Or soap in water is a form of associated colloids, *ie*, micelles

186 (b)
Dialysis is used to purification of colloidal solution
In peptization, freshly prepared precipitates converted in to colloidal solution.
Flocculation is precipitation of colloidal solution.
Gold number is a scale of protective power

187 (a)
(c → q, r) Activated adsorption requires high temperature

188 (c)
(b → s) In adsorption, molecules of substances are accumulated in bulk also

189 (c)
(c → t) Dialysis is the purification of colloids

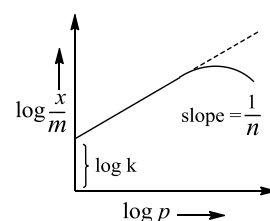
190 (a)
Freundlich adsorption isotherm is given as

$$\frac{x}{m} = kp^{1/n}$$

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

Thus, when $\log \left(\frac{x}{m}\right)$ is plotted against $\log p$, we

have a straight line with slope $\left(\frac{1}{n}\right)$ and intercept $\log k$



191 (a)
Addition of lyophilic solution to the emulsion forms a protective film around the dispersed phase

193 (a)
Adsorption is always exothermic

194 (d)
 $\text{SnCl}_2 + \text{AuCl}_3$ react to form gold sol which is a lyophobic sol

200 (b)
1. Adsorption decreases with increase in temperature but

$\Delta G = -ve$ at high temperature.

$\Delta H = -ve$ and $\Delta S = -ve$, thus $T\Delta S = -ve$

$\therefore \Delta G = \Delta H - T\Delta S = -ve - (-ve) =$
less negative

2. Gases having high critical temperature are easily liquefiable due to higher forces of attractions among molecules and thus, also show more adsorption.

3. Adsorption extent of an adsorbent is more if its surface area is more.

4. Chemisorption requires energy of activation.

5. H_2O is absorbed on CaCl_2 and nor adsorbed.

201 (b)
Gold number of gelatin = 0.01
or 0.01 mg gelatin required to be added to 10 mL of gold sol to completely prevent coagulation of 1 mL of 10% NaCl solution
Therefore gelatin added to 1000 mL of gold sol to prevent coagulation = $\frac{0.01 \times 1000}{10} = 1$ mg

202 (a)
Silicic acid is negatively charged sol. Hence the sol with positive charge can coagulate silicic acid, *i.e.*, $\text{Fe}(\text{OH})_3$, $\text{Ca}(\text{OH})_2$, $\text{Al}(\text{OH})_3$, basic dye

203 (d)
Mass of HCl acid adsorbed by 10 g charcoal = $526.3 \times 10^{-3} (0.5 - 0.4) \times 38 \approx 2$ (Mw of HCl = 38 g mol^{-1})

The amount of adsorption

$$\frac{x}{m} = \frac{2}{0.5} = 4$$

204 (a)

As₂S₃ sol is negatively charged owing to preferential adsorption of S²⁻ ions. Cation would be effective ion in coagulation

Flocculating value = millimole of the effective ion per litre of sol

$$= \frac{5 \times 0.006 \times 10^3}{5 + 10} = 2$$

205 (c)

Haemoglobin added to 100 mL of gold sol to prevent coagulation by 1 mL of 10% NaCl = 0.03 g = 30 mg Haemoglobin required to be added to 10 mL of gold sol to prevent coagulation by 1 mL of 10% NaCl sol = 3 mg

Therefore, gold number of haemoglobin = 3

208 (c)

Haemoglobin is positively charged sol. Hence the sol with negative charge can coagulate haemoglobin, i.e., starch, clay, As₂S₃, CdS

209 (d)

2 mL of 1 M NaCl contains NaCl = $\frac{2}{1000} = 2$ mmol

Thus 500 mL of As₂S₃ sol require NaCl for complete coagulation = 2 mmol

Hence 1 L, i.e., 1000 mL of the sol require NaCl for complete coagulation = 4 mmol

Therefore, flocculation value of NaCl = 4

210 (c)

$$\log \frac{x}{m} = \log K + \frac{1}{n} \log P$$

∴ Plot of $\log \frac{x}{m}$ versus $\log P$ is linear with slope = $\frac{1}{n}$ and intercept = $\log K$

Thus $\frac{1}{n} = \tan \theta = \tan 45^\circ = 1$ or $n = 1$

$\log K = 0.301$ or $K = \text{antilog } 0.301 = 2$

At $P = 3$ atm

$$\frac{x}{m} = KP^{1/n} = 2 \times (3)^1 = 6$$