

## Surface Chemistry

### Adsorption Physisorption and Chemisorptions: Factors Affecting Adsorption of Gases on Solids

#### Level - I

#### Introduction - Adsorption

- 1. Adsorption is the phenomenon in which a substance**
  1. Accumulates on the surface of other substance.
  2. Goes into the body of the other substances
  3. Remains close to the other substances
  4. Oxidises or reduces the other substances.
- 2. Adsorption is always**
  1. Endothermic
  2. Exothermic
  3. Accompanies with increase in entropy
  4. Accompanies with increase of enthalpy
- 3. Which of the following is not considered as absorption?**
  - 1) Chalk piece dipped in ink
  - 2) Sponge placed in water
  - 3) Finely divided charcoal stirred in water dilute acetic acid
  - 4) All the above
- 4. Sorption is**

1) Bulk Phenomenon	2) Surface Phenomenon
3) Both	4) Dispersion

**5. Occlusion of gases by metals involves**

- |               |               |
|---------------|---------------|
| 1. Adsorption | 2. Absorption |
| 3. Sorption   | 4. Desorption |

**6. Which of the following substances act as adsorbent**

- |               |                 |
|---------------|-----------------|
| 1) Silica gel | 2) Metals       |
| 3) Colloids   | 4) All of these |

**7. The colouring matter removed by animal charcoal during purification of sugar acts as**

- |              |              |
|--------------|--------------|
| 1. Adsorbate | 2. Adsorbent |
| 3. Absorber  | 4. Catalyst  |

**8. Surface layer of solid means**

- 1) Atoms present in the upper layer of this solid.
- 2) Atoms present up to a depth of 100nm on the surface.
- 3) Atoms present in the bulk of the solid.
- 4) Atoms of surface of solid not preoccupied by other substances.

**9. In a chemical reaction the solid catalyst function as**

- |   |              |
|---|--------------|
| 1) Adsorbent                              | 2) Adsorbate |
| 3) Makes the reaction mixture homogeneous | 4) Micelle   |

**10. Separation of inert gases involves the process of**

- |               |                  |
|---------------|------------------|
| 1) Absorbent  | 2) Adsorption    |
| 3) Desorption | 4) Chemisorption |

**11. Activated charcoal is used in separating noble gases in Dewar's method. In this process activated charcoal acts as**

- |              |              |
|--------------|--------------|
| 1. Absorber  | 2. Adsorbent |
| 3. Adsorbate | 4. Catalyst  |

**12. The forces operating between the adsorbate and the adsorbent in physical adsorption are**

- |                         |                    |
|-------------------------|--------------------|
| 1. Van der Waals forces | 2. Chemical forces |
|-------------------------|--------------------|

3. Covalent forces  
4. All the three

**13. Physical adsorption is**

1. Reversible  
2. Decreases with increase in temperature  
3. Multi layer  
4. All of these

**14. Physical adsorption is useful in**

- 1) Producing colorless material  
2) Producing low pressure  
3) Producing high vacuum  
4) All of these

**15. Physical adsorption is appreciable at**

1. High temperature  
2. Low temperature  
3. At room temperature  
4.  $100^{\circ}\text{C}$

**16. Which statement is correct?**

- 1) Physical adsorption is multi-layer non directional and non-specific.  
2) Chemical adsorption is unilayer.  
3) Chemical adsorption is more stronger than physical adsorption.  
4) All the above.

**17. Which of the following is not a characteristic of chemisorption?**

- 1) It is irreversible  
2) It is specific  
3) It is multi layer phenomenon  
4) Heat of adsorption is about 400 KJ

**18. Heat evolved during chemisorption lies in the range of**

- 1) 4-20 kJ/mole  
2) 40-400 KJ/mole  
3) 20-40 KJ/mole  
4) 500-1000KJ/mole

**19. Which of the following is not a correct statement?**

1. Physical adsorption is reversible in the nature.

2. Physical adsorption involves Van der Waal's forces.
3. Rate of Physical adsorption increases with increase of pressure of the adsorbate.
4. High activation energy is involved in the physical adsorption.

**20. Valence forces cause**

- 1) Chemisorptions
- 2) Physical Adsorption
- 3) Sorption
- 4) Adsorption involving multi layer

**21. Which of the following is not a characteristic of chemisorptions?**

1. Adsorption is irreversible
2. Is of the order of 400 K.J
3. Adsorption is specific
4. Multilayered

**22. In a spontaneous adsorption process**

1. Is sufficiently negative
2. Is positive
3. Is zero
4. All the above

**23. The rate of chemisorptions**

1. Decrease with increase of pressure
2. Is independent of pressure
3. Is maximum at one atmospheric pressure
4. Increase with decrease of temperature

**24. Chemisorptions involves**

1. Multi layered
2. Unilayered
3. Zero layered
4. Bi layered

**25. Which is more selective?**

- 1) Physical adsorption
- 2) Sorption
- 3) Van der Waal's adsorption
- 4) Chemisorptions

### Factors Influence Adsorption

**26. The extent of adsorption of a gas on a solid depends on**

1. Nature of gas
2. Pressure of gas
3. Temperature
4. All the above

**27. Conditions favourable for high adsorption are**

1. Low pressure and high temperature
2. High pressure and low temperature
3. Large surface area
4. Both 2 and 3.

**28. The extent of adsorption from solution increases with**

1. Increasing the temperature
2. Increasing the surface area of the adsorbent
3. Decreasing the surface area of the adsorbent
4. Decreasing the concentration of the solute

**29. The extent of adsorption from solutions decreases with**

1. Decrease of temperature
2. Increase of surface area
3. Increase of temperature
4. Increasing the concentration of the solute

**30. Which one of the following is the correct statement?**

1. Chemisorption is reversible in nature.
2. Chemisorption is high at low temperature.
3. Chemisorption depends on the nature of gas.
4. Chemisorption does not depend upon the nature of the gas.

**31. Chemical adsorption**

1. Decreases with increase of temperature
2. Increase with increase of temperature
3. First increases and then decreases with increase of temperature
4. First decreases and then increases with increase of temperature

**32. Extent of adsorption during chemisorption depends upon**

1. Adsorbate
2. Adsorbent
3. Both adsorbate and adsorbent
4. Neither adsorbate nor adsorbent

**33. During the adsorption of acetic acid on porous charcoal from acetic acid aqueous solution, its concentration**

1. Increases
2. Decreases
3. Remains the same
4. First increases and then decreases

**34. The nature of forces operating between the adsorbate and the adsorbent in the adsorption occurring at high temperature is**

1. Van der Waals forces
2. Chemical forces
3. Gravitational forces
4. Fermi forces

**35. Chemisorption of gas on solid does not depend on**

- 1) Pressure of gas.
- 2) Temperature
- 3) Nature of Adsorbate
- 4) Nature of Adsorbent

### Adsorption- Isotherms

36. According to Freundlich adsorption isotherm, at high pressure, the value of  $\frac{x}{m}$

is

1. Directly proportional to pressure
2. Inversely proportional to pressure
3. Directly proportional to square of pressure
4. Independent of pressure

37. The mathematical equation relating  $x$ ,  $m$  and  $p$  that represents Freundlich isotherm.

1)  $\frac{x}{m} = \frac{k}{p}$

2)  $\frac{x}{m} = KP^{\frac{1}{n}}$

3)  $\frac{m}{x} = \frac{k}{p}$

4)  $\frac{x}{m} = \log p^n$

38. Freundlich adsorption isotherm in the logarithmic form is

1.  $\frac{1}{n} \log P = \log \left( \frac{x}{m} \right) + \log K$

2.  $\log K = \log P + \frac{1}{n} \log \left( \frac{x}{m} \right)$

3.  $\log \left( \frac{x}{m} \right) = \frac{1}{n} \log K + \log P$

4.  $\log \left( \frac{x}{m} \right) = \frac{1}{n} \log P + \log K$

39. The plot of  $\frac{x}{m}$  Vs temperature at constant pressure is called

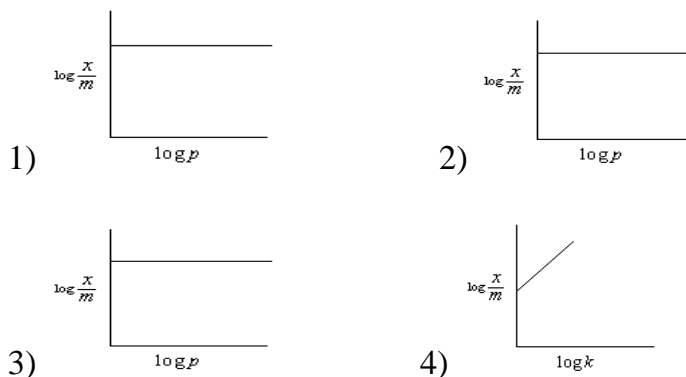
1. Adsorption Isotherm

2. Adsorption Isobar

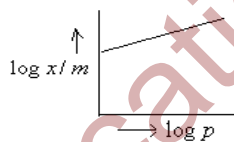
3. Adsorption Isochore

4. Freundlich Isotherm

40. Which one of the following represents Freundlich adsorption isotherm?



41. Freundlich adsorption isotherm is given by the expression  $\frac{X}{m} = KP^{1/n}$ . Then the



slope of the line in the following plot is

- 1)  $\sqrt{n}$     2)  $\frac{1}{n}$     3)  $X/m$     4)  $P$

42. The equation for Langmuir adsorption isotherm under high pressure is

- 1)  $\frac{x}{m} = \frac{a}{b}$     2)  $\frac{x}{m} = aP$
- 3)  $\frac{x}{m} = \frac{1}{aP}$     4)  $\frac{x}{m} = \frac{b}{a}$

43. In Langmuir's Adsorption of a gas on solid surface

- 1) The rate of desorption of adsorbed molecules from the surface does not depend on the surface covered
- 2) The adsorption at a single site on the surface may involve multiple molecules at the same time
- 3) The mass of gas striking a given area of surface is proportional to the pressure of the gas.



4) The mass of gas striking a given area of surface is independent of the pressure of the gas.

**44. Which of the following is less than zero during adsorption?**

- 1)  $\Delta G$                       2)  $\Delta S$                       3)  $\Delta H$                       4) All of these

**45. If 4g of nitrogen is allowed to adsorb at 300K and 0.8atm on 2g of solid surface. Calculate the amount of  $N_2$  Adsorbed per gram of solid**

- 1) 1                      2) 2                      3) 3                      4) 4

**46 Adsorption explains all the following except**

1. Origin of charge on colloids
2. Decolourization of sugar solution on charcoal
3. Efficiency of finely divided metals as catalyst
4. Action of enzymes

**47 A poisonous gas is adsorbed on activated charcoal. The activated charcoal is**

1. Absorber                      2. Adsorbate
3. Adsorbent                      4. Absorption

**48 Which of the following is not based on adsorption?**

1. Catalysis                      2. Chromatography
3. Photography                      4. Decolourisation of sugar

**49 When adsorption of Oxalic acid is carried out on activated charcoal, the activated charcoal is known as**

1. Adsorbate                      2. Adsorbent
3. Absorber                      4. Absorption

**50 In washing process the surface active detergents function as**

- 1) Adsorbate                      2) Desorber
- 3) Adsorbent                      4) Deactivator

**51. Which is used to remove colour from raw cane sugar juice?**

- 1) Alumina                      2) Silica gel

- 3) Activated charcoal                      4) Nickel powder

**52. When ammonia gas is enclosed in the presence of powdered charcoal in a closed vessel, the pressure of the gas decreases. It is due to**

1. Absorbate                                  2. Adsorption  
3. Decomposition                          4. Catalytic action of charcoal

**53. Chromatographic analysis finds a number of applications in analytical and Industrial fields, based on the principle of \_\_\_\_\_**

- 1) Chemical adsorption  
2) Physical adsorption  
3) Hydrogen bonding  
4) Sedimentation

**54. When water vapour is passed through silica gel, water vapour is**

1. Absorbate                                  2. Adsorbed  
3. Cooled                                      4. Decomposed

**55. Adsorption plays an important role in**

1. Heterogeneous catalysis              2. Homogeneous catalysis  
3. Positive catalysis                        4. Negative catalysis

**56. Assertion (A): Adsorption is a surface phenomenon.**

**Reason (R): Adsorption is an endothermic process.**

- 1) A and R are correct and R is the correct explanation of A.  
2) A and R are correct and R is not the correct explanation of A.  
3) A is true and R is false.  
4) A is false and R is true.

**57. Which one of the following statements is not applicable to chemisorptions?**

- 1) It is highly specific.  
2) It is practically independent of pressure.  
3) It is irreversible.

4) It is independent of temperature.

**58. Which of the following is chemisorptions?**

1. Adsorption of  $H_2$  on Ni at high temperature.
2. Adsorption of  $H_2$  on charcoal.
3. Adsorption of moisture on silica gel.
4. Hydration of anhydrous  $CaCl_2$ .

**59. Assertion (A): Chemical adsorption is unilayered where as physical adsorption is multilayered.**

**Reason (R): In chemical adsorption strong chemical bonds are forming between adsorbent and adsorbate where as it is not possible in physical adsorption.**

- 1) A and R are correct and R is the correct explanation of A.
- 2) A and R are correct and R is not the correct explanation of A.
- 3) A is true and R is false.
- 4) A is false and R is true.

**60. Assertion (A): Physical adsorption is reversible while chemical adsorption is irreversible**

**Reason(R): Physical adsorption is multilayered while chemical adsorption is unilayered one.**

**The correct answer is**

- 1) A and R are correct and R is the correct explanation of A.
- 2) A and R are correct and R is not the correct explanation of A.
- 3) A is true and R is false.
- 4) A is false and R is true.

**61. Which of the following can absorb large volume of hydrogen gas?**

1. Pd                      2. Ni                      3.  $Fe(OH)_3$                       4. Pt

**62 The temperature above which a gas cannot be liquefied even on application of high pressure is called as**

- 1) Boiling point
- 2) Freezing point
- 3) Critical temperature
- 4) Boyle's temperature

**63. The higher the critical temperature of the gas**

- 1) Greater is its adsorption.
- 2) Lower its adsorption.
- 3) Lesser is the case of liquification.
- 4) Lesser is its volatile nature.

**64. Which gas can be adsorbed more?**

- 1) Gas with high critical temperature
- 2) Gas which can be liquefied easily
- 3) Gas with low critical temperature
- 4) Both 1 and 2

**65 Which of the following gases is adsorbed easily and more on activated charcoal**

1.  $CH_4$
2.  $CO_2$
3.  $SO_2$
4.  $H_2$

**66 The gas which gets easily and extensively adsorbed at low temperature**

1.  $H_2$
2.  $CO_2$
3.  $N_2$
4.  $O_2$

**67 The least readily adsorbed gas among the following is**

1.  $NH_3$
2.  $SO_2$
3.  $HCl$
4.  $N_2$

**68 The correct order of extent of adsorption on 1 gm of an activated charcoal is**

1.  $H_2 > SO_2 > CH_4$
2.  $CH_4 > SO_2 > H_2$
3.  $SO_2 > CH_4 > H_2$
4.  $SO_2 > CH_4 < H_2$

**69 Activated charcoal is prepared by**

- 1) Heating charcoal at 573 K to 1273 K in vacuum or in the presence of inert gas.
- 2) Irradiating the charcoal with neutrons and make it radioactive.
- 3) Washing the charcoal with water .
- 4) All are correct.

**Key**

**Level-I**

- 1) 1    2) 2    3) 4    4) 3    5) 3    6) 4    7) 2    8) 2    9) 1    10) 2
- 11) 2    12) 1    13) 4    14) 4    15) 2    16) 4    17) 3    18) 2    19) 4    20) 1
- 21) 4    22) 1    23) 2    24) 2    25) 4    26) 4    27) 4    28) 2    29) 3    30) 3
- 31) 3    32) 3    33) 2    34) 2    35) 1    36) 1    37) 2    38) 4    39) 2    40) 3
- 41) 2    42) 1    43) 3    44) 4    45) 2    46) 4    47) 3    48) 3    49) 2    50) 3
- 51) 3    52) 2    53) 2    54) 2    55) 1    56) 3    57) 4    58) 1    59) 1    60) 1
- 61) 1    62) 3    63) 1    64) 4    65) 3    66) 2    67) 4    68) 3    69) 1

## Catalysis Homogenous and Heterogeneous Activity and Selectivity, Enzyme Catalysis

- 1. A catalyst is a substance which**
  1. Increases the energy of activation
  2. Decreases the energy of activation
  3. Does not change the energy of activation
  4. Energy of activation first increases and then decreases
- 2. When a catalyst is used in a reaction, then**
  1. Nature of products changes
  2. Product yield increases
  3. Product yield decreases
  4. Time required for reaction decreases
- 3. Which is not a characteristic of a catalyst?**
  1. It changes the equilibrium.
  2. It alters the reaction path.
  3. It increases the rate of reaction.
  4. It increases the average kinetic energy of the molecules.
- 4. According to adsorption theory of catalysis the speed of the reaction increases because**
  - 1) The concentration of reactant molecules at the active centre of the catalyst becomes high due to adsorption.
  - 2) In the process of adsorption the activation energy of the molecules becomes large.
  - 3) Adsorption produces heat which increases the speed of the reaction.
  - 4) Adsorption lowers the reaction temperature.
- 5. The efficiency of the catalyst depends upon**
  1. Molecular weight
  2. Physical state

3. Number of free valencies                      4. Amount used
- 6. The temperature at which the catalytic activity of the catalyst is maximum is called**
1. Critical temperature                              2. Room temperature  
3. Optimum temperature                          4. Absolute temperature
- 7. Which of the following catalyst is sensitive to temperature changes?**
1. Fe                              2. Pt                              3. Ni                              4. Enzyme
- 8. Which of the following statement is wrong among the following?**
1. Haber's process of  $NH_3$  requires iron as catalyst  
2. Friedel-Craft's reaction uses anhydrous  $AlCl_3$   
3. Hydrogenation of oils uses iron as catalyst  
4. Oxidation of  $SO_2$  to  $SO_3$  requires  $V_2O_5$
- 9. The formation of diethyl ether from ethanol is catalysed by**
1.  $H_2SO_4$ ,  $170^\circ C$                               2.  $Al_2O_3$ ,  $250^\circ C$   
3.  $H_2SO_4$ ,  $40^\circ C$                               4.  $Al_2O_3$ ,  $80^\circ C$
- 10. When sucrose is hydrolysed with invertase enzyme the products are**
1. Glucose                      2. Fructose                      3. Both                      4. Maltose
- 11. In a homogeneous catalysis the catalyst and the reactants are in the same**
1. Condition                      2. Phase                      3. Energy                      4. System
- 12. Which one of the following is not an example of homogeneous catalysis?**
1. Formation of  $SO_3$  in lead chamber process  
2. Formation of  $SO_3$  in contact process  
3. Hydrolysis of an ester in presence of an acid  
4. Hydrolysis of sugar in presence of sulphuric acid
- 13. Which of the following is not involved in a heterogeneous catalysis?**
- 1) Adsorption of reactants.

- 2) Diffusion of reactants along the surface
- 3) Reaction at the active site to form adsorbed product.
- 4) Decomposition of the catalyst

**14. Which statement is wrong for heterogeneous catalysis?**

1. Adsorption of reactants
2. Diffusion of products
3. Reaction at an active site to form product
4. Absorption of the product

**15. Catalyst used in the manufacture of  $\text{HNO}_3$  by Ostwald's process is**

1. Rh                      2. Pd                      3. Fe                      4. Pt

**16. If Pt is used as catalyst in the decomposition of,  $\text{H}_2\text{O}_2$  then it is an example of**

1. Homogeneous catalysis
2. Heterogeneous catalysis
3. Negative catalysis
4. Auto catalysis

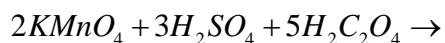
**17. Which is an example of auto catalyst?**

- 1) Hydrolysis of ethyl acetate
- 2) Decomposition of arsine
- 3) Oxidation of oxalic acid by acidified  $\text{KMnO}_4$
- 4) All

**18. In the titration between oxalic acid and acidified potassium permanganate, the manganous salt formed during the reaction catalyses the reaction. The manganous salt acts as**

- 1) A promoter    2) A positive catalyst    3) An auto catalyst    4) Catalytic poison

**19. In the reaction**



Product,  $\text{Mn}^{+2}$  acts as



1. Positive catalyst
2. Negative catalyst
3. Auto Catalyst
4. Induced catalyst

**20. In the hydrolysis of an ester, the reaction is catalysed by the acetic acid formed.**

**It is an example of**

1. Autocatalysis
2. Positive catalysis
3. Anticatalyst or catalysis
4. Positive catalyst

**21. When  $KClO_3$  is heated, it decomposes into  $KCl$  and  $O_2$ . If some  $MnO_2$  is added, the reaction goes much faster because**

1.  $MnO_2$  decomposes to give oxygen
2.  $MnO_2$  provides heat
3. Better contact is provided by  $MnO_2$
4.  $MnO_2$  acts as catalyst

**22. A finely divided state of the catalyst is more efficient because in this state**

1. More surface area is available.
2. More energy is stored in the catalyst.
3. Positive charge is acquired.
4. Negative charge is acquired.

**23. In a reversible reaction, a catalyst increases the rate of**

1. Forward reaction only
2. Backward reaction only
3. Forward and Backward reactions equally
4. Cannot participate in a reaction

**24. A catalyst works well in powdered state, because**

1. No of active centers decreases
2. No of active centers increases
3. Surface area decreases
4. It contains smooth surface

**25. Which of the following statements is not true?**

1. The action of the catalyst is specific
2. The catalyst does not alter the equilibrium
3. A small amount of the catalyst is sufficient to catalyse large amounts of reactants
4. The catalyst initiates the reaction

**26. The substance which reduces or even destroys the activity of a catalyst is called**

1. Auto catalyst
2. Catalytic poison
3. Negative catalysis
4. Enzyme catalysis

**27 Catalytic poison acts by**

1. Its reaction with product
2. Its reaction with reactant
3. Getting adsorbed on the active centers of the catalyst
4. Coagulating the catalyst

**28. Tetra ethyl lead increases the anti knocking property of petrol. Here it acts as**

1. Positive catalyst
2. Negative catalyst
3. Auto catalyst
4. Induced catalyst

**29. Which of the following exhibits specific activity in a catalytic reaction?**

- 1) Catalyst
- 2) Promoter
- 3) Catalyst poison
- 4) All the three

**30. In contact process of manufacture of in presence of  $H_2SO_4$  Pt as catalyst,  $As_2O_3$  acts as**

1. Negative catalyst
2. Inhibitor
3. Catalytic poison
4. Promoter

**31. The auto catalyst in the decomposition of Arsene to Arsenic and  $H_2$  is**

- 1)  $As_2O_3$
- 2)  $As$
- 3)  $H_2$
- 4)  $As$

- 32. In the Haber's process for the manufacture of, the following catalyst is used**
1. Platinised asbestos
  2. Iron with molybdenum as promoter
  3. Copper oxide
  4. Alumina
- 33. Protons accelerate the hydrolysis of esters. This is an example of**
1. A promoter
  2. A heterogeneous catalyst
  3. An acid-base catalyst
  4. An induced catalyst
- 34. In the decomposition of  $H_2O_2$  which of the following acts as negative catalyst**
- 1)  $MnO_2$     2) Glycerol    3)  $Al_2O_3$     4) Iron
- 35.  $CH_3CHO$  in vapour phase under goes decomposition in the presence of  $I_2$  vapour and gives.**
- 1) Acetic acid    2) Ethyl alcohol  
3) Only  $CH_4$     4)  $CH_4$  & CO
- 36. For a reaction occurring on the surface of a catalyst, the rate**
- 1) Decreases with surface area
  - 2) Does not change with surface area.
  - 3) Increases with surface area
  - 4) May increase or decrease depending on the nature of reaction
- 37. In the Ostwald process for the manufacture of  $HNO_3$ , the catalyst used is**
1. Fe                      2. Pt                      3.  $V_2O_5$                       4. Mo
- 38. Which of the following acts as negative catalyst?**
1. Lead tetra ethyl as antiknock compound
  2. Glycerol in the decomposition of  $H_2O_2$
  3. Ethanol in the oxidation of chloroform

4. All of the above

**39. In which of the following reactions a catalyst is required**

1.  $S + O_2 \rightarrow SO_2$
2.  $C + O_2 \rightarrow CO_2$
3.  $2SO_2 + O_2 \rightarrow 2SO_3$
4. All of the above

**40. In Lead-Chamber process the catalyst is**

1. NO only
2.  $NO_2$  Only
3. Mixture of NO &  $NO_2$
4.  $N_2O_5$

**41. In which of the following process, a catalyst is not used**

1. Haber process
2. Deacon's process
3. Solvay process
4. Lead chamber process

**42. In Haber's process of Ammonia synthesis, the substance that acts as catalytic poison**

- 1)  $Fe_2O_3$
- 2)  $As_2O_3$
- 3)  $CO_2$
- 4)  $H_2S$

**43. Organic catalysts differ from inorganic catalysts**

1. By acting at high temperature
2. By acting at low temperature
3. Being used up
4. Being protenious in nature

**44. Platinum is not used as a catalyst in the**

- 1) Oxidation of Hydrogen into water
- 2) Oxidation of  $SO_2$  by contact process
- 3) Oxidation of ammonia to Nitric Oxide
- 4) Synthesis of ammonia by Harbor's Process

**45. The catalytic enzyme that converts glucose and fructose into ethyl alcohol in the presence of**

- 1) Invertase
- 2) Diastase
- 3) Maltase
- 4) Zymase

**46. Assertion (A): +Ve catalyst increases the rate of reaction.**

**Reason (R): +Ve catalyst decreases the activation energy of the reactants.**

- 1) A and R are correct and R is the correct explanation of A.
- 2) A and R are correct and R is not the correct explanation of A.
- 3) A is true and R is false.
- 4) A is false and R is true.

**47. Assertion (A): Catalyst is more effective in the powdered state.**

**Reason (R): In the powdered state surface area is maximum.**

- 1) A and R are correct and R is the correct explanation of A.
- 2) A and R are correct and R is not the correct explanation of A.
- 3) A is true and R is false.
- 4) A is false and R is true.

**48. The catalyst iron employed in the Haber's process contains molybdenum.**

**Whose function is?**

1. To increase the rate of combination of gases.
2. To counter balance for the presence of impurities in the gases.
3. To act as a catalyst promoter and increase activity of catalyst.
4. To make up for the adverse temperature and pressure conditions.

### Types of catalysis

49. Which one of the following is not a homogeneous catalytic reaction?

- 1) Manufacture of  $H_2SO_4$  by lead chamber process
- 2) Acid catalysed hydrolysis of ester
- 3) Inversion of cane sugar in the presence of mineral acid
- 4) Manufacture of  $H_2SO_4$  by contact process

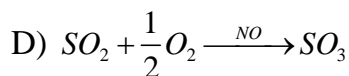
50. Catalysis in the oxidation of  $SO_2 \rightleftharpoons SO_3$  in lead chamber process

1. Acid-base catalysis
2. Homogeneous catalysis
3. Heterogeneous catalysis
4. Induced catalysis

51. Match the following.

#### List - I

- A) Ammonia preparation
- B) Hydrogenation
- C) Fermentation



#### List - II

1. Bio catalysed
2. Fe
3. Ni
- 4) Homogeneous

	A	B	C	D
1)	4	3	1	2
2)	3	2	1	4
3)	1	2	4	3
4)	2	3	1	4

52. Which of the following types of metals make the most efficient catalysts?

1. Transition metals
2. Alkali metals
3. Alkaline earth metals
4. Radioactive metals

53. The catalyst used in the hydrogenation of oils is

1.  $V_2O_5$
2. Fe
3. Co
4. Ni

**Key**

- 1) 2    2) 2    3) 1    4) 1    5) 3    6) 3    7) 4    8) 4    9) 2    10) 3
- 11) 3    12) 2    13) 4    14) 4    15) 4    16) 2    17) 4    18) 3    19) 3    20) 1
- 21) 4    22) 1    23) 3    24) 2    25) 4    26) 2    27) 3    28) 2    29) 4    30) 3
- 31) 2    32) 2    33) 3    34) 2    35) 4    36) 3    37) 2    38) 4    39) 3    40) 3
- 41) 3    42) 4    43) 2    44) 4    45) 4    46) 1    47) 1    48) 3    49) 4    50) 2
- 51) 4    52) 1    53) 4

**Colloidal State: Distinction between True Solutions, Colloids and Suspensions,  
Lyophilic, Lyophobic, Multi Molecular, and Macromolecular Colloids**

**1. Which of the following is a crystalloid?**

- 1) Gum                      2) Albumin                      3) Urea                      4) Glue

**2. Which of the following is not a colloid?**

- 1) Milk                      2) Blood  
3) Ice Cream                      4) Sugar Solution

**3. Crystalloid and colloid can be distinguished by**

- 1) Diffusion                      2) Particle Size  
3) Chemical Composition                      4) Solubility

**4. The particle size of the solute is less in**

- 1) Suspension                      2) Colloid  
3) True Solution                      4) Same in all states

**5. Colloidal systems are**

- 1) Homogeneous                      2) Heterogeneous  
3) Suspensions                      4) Transparent

**6. Example of a homogeneous system is**

- 1) Muddy Water                      2) Milk  
3) Concrete                      4) Sugar Solution

**7. Which of the following is a clear solution?**

- 1) Colloid                      2) True solution  
3) Suspension                      4) Suspensions of precipitate

**8. The number of phases in a colloidal system is**

- 1) 1                      2) 2                      3) 3                      4) 4

**9. A colloidal solution always has at least**

- 1) One phase                      2) More than two phases



- 3) A true solution                      4) Two phases

**10. Particles of which of the following do not pass through filter paper?**

- 1) Colloids                                  2) True Solutions  
3) Suspensions                              4) Colloids and Suspension

**11. The particles of which of the following do not diffuse at all?**

- 1) True solution                              2) Colloid  
3) Suspension                                4) Blood

**12. The Tyndall effect in colloidal solutions is due to**

- 1) Scattering of light                        2) Reflection of light  
3) Absorption of light                        4) Electrical charge of particles

**13. The Tyndall effect is not observed in**

- 1) Emulsions                                  2) Lyophobic sols  
3) Suspensions                                4) True solutions

**14. Which of the following is a homogeneous system?**

- 1) Suspension                                2) Colloid solution  
3) True solution                                4) Starch solution

**15. A colloidal system in which solid is dispersed in a liquid is called**

- 1) Precipitate                                  2) Sol    3) Emulsion                                  4) Gel

**16. When dispersed phase is solid and dispersion medium is gas, the colloidal system is**

- 1) Smoke                                        2) Clouds  
3) Emulsion                                      4) Milk

**17. The colloidal system in which the dispersed phase and dispersion medium are both liquids is known as**

- 1) A gel    2) An aerosol  
3) An emulsion                                4) A foam

**18. When the dispersion medium is alcohol, the colloidal sol is known as**

- 1) Hydrosol
- 2) Benzosol
- 3) Alcosol
- 4) Aquasol

**19. When dispersed phase is liquid and dispersion medium is a solid, the colloid is known as**

- 1) A solution
- 2) An emulsion
- 3) A gel
- 4) A foam

**20. A colloidal solution in which a solid is dispersed in a liquid is called**

- 1) Gel
- 2) Emulsion
- 3) Sol
- 4) Precipitate

**21. Milk is an example of**

- 1) Emulsion
- 2) Suspension
- 3) Gel
- 4) True solution

**22. The dispersed phase in milk is**

- 1) Water
- 2) Liquid fat
- 3) Protein
- 4) Water in oil

**23. Gel is a \_\_\_\_ sol**

- 1) Liquid in solid
- 2) Solid in liquid
- 3) Solid in solid
- 4) Solid in gas

**24. An aerosol is a colloidal system of**

- 1) A liquid dispersed in a solid
- 2) A liquid dispersed in a gas
- 3) A gas dispersed in a gas
- 4) A solid dispersed in liquid

**25. Blood is a colloidal solution of water containing**

- 1) Liquid fat as dispersed phase
- 2) Albuminoid as dispersed phase
- 3) Butter as dispersed phase

4) Proteins as dispersed phase

**26. When the dispersed phase has a greater affinity for the dispersion medium, the colloids are termed as**

- |                |              |
|----------------|--------------|
| 1) Lyophilic   | 2) Lyophobic |
| 3) Hydrophobic | 4) Emulsion. |

**27. Substances whose solutions can readily diffuse through animal membranes are called as**

- |                 |                     |
|-----------------|---------------------|
| 1) Colloids     | 2) Crystalloids     |
| 3) Electrolytes | 4) Non-electrolytes |

**28. In hydrosols water acts as**

- |                       |                      |
|-----------------------|----------------------|
| 1) Colloidal particle | 2) Dispersion medium |
| 3) Suspensions only   | 4) Dispersed phase   |

**29. Micelles contain**

- |                           |                               |
|---------------------------|-------------------------------|
| 1) Discrete particles     | 2) Discrete ions              |
| 3) Aggregate of particles | 4) Associated water molecules |

**30. Formula of sodium stearate is**

- |                          |                          |
|--------------------------|--------------------------|
| 1) $C_{12}H_{25}OSO_3Na$ | 2) $C_{12}H_{21}OSO_3Na$ |
| 3) $C_{17}H_{35}COONa$   | 4) $C_{17}H_{35}SO_3Na$  |

**31. When more sodium stearate is dissolved in water the nature of the solution is**

- |                  |                       |
|------------------|-----------------------|
| 1) True Solution | 2) Suspension         |
| 3) Emulsion      | 4) Colloidal Solution |

**32. Medicinal Cod liver oil is an example of**

- |             |                |
|-------------|----------------|
| 1) Emulsion | 2) Adsorbent   |
| 3) Aerosol  | 4) Gaseous Sol |

**33. Cold cream is an example of**

- |                          |                        |
|--------------------------|------------------------|
| 1) Oil in water emulsion | 2) Oil in oil emulsion |
| 3) Water in oil emulsion | 4) Emulsifier          |

**34. Vanishing cream is an example of**

- 1) O/W emulsion
- 2) Solid in a liquid sol.
- 3) W/O emulsion
- 4) Liquid in a solid sol.

**35. The emulsifier for olive oil in water emulsion is**

- 1) Soap
- 2) Egg albumin
- 3) Mercuric iodide
- 4) Kerosene

**36. Soap emulsifies**

- 1) Oil in water type
- 2) Water in oil type
- 3) Oil in oil type
- 4) Gel in oil

**37. Water in benzene is emulsified by**

- 1) Soap
- 2) Mercuric Iodide
- 3) Egg Albumin
- 4) Grease

**38. The viscosity of a lyophobic sol is\_\_its dispersion medium**

- 1) Equal to that of
- 2) Greater than that of
- 3) Less than that of
- 4) Exactly twice that of

**39. Which is an aerosol?**

- 1) Cloud
- 2) Blood
- 3) Milk
- 4) Gold sol

**40. Which is prepared by Bredig's method?**

- 1) Gold sol
- 2) Starch sol
- 3) Cod liver oil
- 4) Cold cream

**41. Tyndall effect is shown by**

- 1) Sugar solution
- 2) Common salt solution
- 3) Gold sol
- 4) Water

**42. Dispersion medium in blood is**

- 1) RBC
- 2) WBC
- 3) Hemoglobin
- 4) Water

**43. Which is a “W/O” type emulsion?**

- 1) Cold cream
- 2) Milk
- 3) Blood
- 4) Cloud

**44. Emulsifier in milk is**

- 1) Starch
- 2) Sucrose
- 3) Casein
- 4) Lactose

**45. The hydrophobic end of lauryl sulphate is**

- 1)  $C_{17}H_{35}$
- 2)  $C_{17}H_{33}$
- 3)  $C_{12}H_{25}$
- 4)  $-OSO_3^{---}$

**46. Vanishing cream is**

- 1) Lyphilic sol
- 2) Lyophobic sol
- 3) W/O emulsion
- 4) O/W emulsion

**47. Concentrated soap solution consists of**

- 1) Individual soap ions
- 2) Micelles
- 3) Dimers of soap ions
- 4) Flat type patterns of soap ions

**48. Which of the following may form associated colloids?**

- 1) Gold
- 2) Soap
- 3) Starch
- 4) Glucose

**49. Most common emulsifier for vegetable oil in water emulsion is**

- 1) Carbon powder
- 2)  $HgI_2$
- 3) Soap
- 4) Lyophobic colloid

**50. Emulsifying agents are generally**

- 1) +ve ions
- 2) -ve ions
- 3) Lyophobic colloids
- 4) Lyophilic colloids

**51. Which cannot act as an emulsifier?**

- 1) Soap
- 2) Egg albumin
- 3) Gelatin
- 4) Water

**52. Micelle is**

- |                                   |                           |
|-----------------------------------|---------------------------|
| 1) A single +ve ion               | 2) A single -ve ion       |
| 3) An aggregate of many soap ions | 4) An individual molecule |

**53. In the colloidal state, the particle size ranges from**

- |                            |                              |
|----------------------------|------------------------------|
| 1) 1 to 10 $\text{A}^0$    | 2) 2000 to 5000 $\text{A}^0$ |
| 3) 10 to 1000 $\text{A}^0$ | 4) 100 - 1000 nm.            |

**54. Particles in which of the following can be seen only with ultra microscope**

- |                   |                                  |
|-------------------|----------------------------------|
| 1) True solutions | 2) Colloids                      |
| 3) Suspensions    | 4) Both colloids and suspensions |

**55. The diffusion of particles in colloid is**

- 1) Rapid than in true solution
- 2) Slower than in suspension
- 3) Slower than in true solution
- 4) Equal as in true solution

**56. Weak tyndall effect can be observed with**

- |             |                |
|-------------|----------------|
| 1) Gold sol | 2) Sulphur sol |
| 3) Smoke    | 4) Starch sol  |

**57. Smoke, cloud and gold sol are respectively**

- 1) Aerosol, Hydrosol and Aquasol
- 2) Hydrosol, Hydrosol and Hydrosol
- 3) Aquasol, Aerosol and Hydrosol
- 4) Aerosol, Aerosol and Hydrosol

**58. Which of the following is not a colloidal solution?**

- |          |        |        |          |
|----------|--------|--------|----------|
| 1) Smoke | 2) Ink | 3) Air | 4) Blood |
|----------|--------|--------|----------|

**59. Curd is an example of**

- |             |         |            |        |
|-------------|---------|------------|--------|
| 1) Solution | 2) Foam | 3) Aerosol | 4) Gel |
|-------------|---------|------------|--------|

**60. Fog is a colloidal solution of**

- 1) Liquid particles dispersed in gas
- 2) Solid particles dispersed in liquid
- 3) Gaseous particles dispersed in solid
- 4) Solid particles dispersed in gas

**61. Which is a natural colloid?**

- 1) Cane sugar
- 2) Urea
- 3) NaCl
- 4) Blood

**62. Butter is a colloid. It is formed when**

- 1) Fat is dispersed in solid casein
- 2) Fat globules are dispersed in water
- 3) Water is dispersed in fat
- 4) Casein is suspended in water

**63. Which of the following colloid system contains solid as the dispersed phase?**

- 1) Smoke
- 2) Clouds
- 3) Lemonade Froth
- 4) Boot Polish

**64. Water loving colloids are called**

- 1) Hydrophilic
- 2) Hydrophobic
- 3) Lyophobic
- 4) Lyophilic.

**65. Which of the following is a hydrophilic solution?**

- 1) Barium Hydroxide Sol
- 2) Arsenic Sulphide Sol
- 3) Starch Sol
- 4) Silver Chloride Sol

**66. Colloidal solution of Arsenic Sulphide is an example of**

- 1) Lyophobic Sol
- 2) Hydrophilic Sol
- 3) Aerosol
- 4) Lyophilic Solution

**67. Which of the following is an example for hydrophobic sol?**

- 1) Starch Sol
- 2) Gum
- 3) Protein Sol
- 4) Arsenic Sulphide Sol

**Key**

- 1) 3    2) 4    3) 1    4) 3    5) 2    6) 4    7) 2    8) 2    9) 4    10) 4
- 11) 3    12) 1    13) 4    14) 3    15) 2    16) 1    17) 3    18) 3    19) 3    20) 3
- 21) 1    22) 2    23) 1    24) 2    25) 2    26) 1    27) 1    28) 2    29) 3    30) 3
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- 41) 3    42) 4    43) 1    44) 3    45) 3    46) 4    47) 2    48) 2    49) 3    50) 4
- 51) 4    52) 3    53) 3    54) 2    55) 3    56) 4    57) 4    58) 3    59) 4    60) 1
- 61) 4    62) 3    63) 1    64) 1    65) 3    66) 1    67) 4