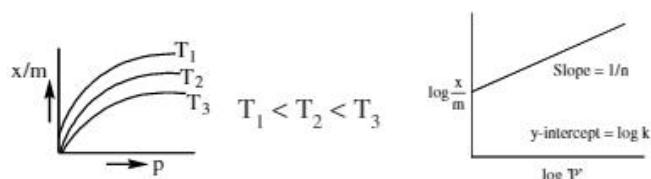


6. SURFACE CHEMISTRY

SYNOPSIS

I. ADSORPTION

1. The phenomenon by which the molecules of a substance are attracted and uniformly distributed into the bulk of another solid or liquid substance is called absorption. Whereas when the substance is distributed only on the surface of the adsorbent then it is called adsorption.
2. ΔH is negative and ΔS is negative for the adsorption process.
3. Adsorption is spontaneous and during adsorption ΔS becomes negative. Hence to make ΔG negative, ΔH must be negative according to the thermodynamic relation $\Delta G = \Delta H - T\Delta S$.
4. Easily liquifiable gases like HCl, CO₂, NH₃ and SO₂ with higher critical temperature can be more easily adsorbed than gases like H₂, N₂, O₂ etc which have lower critical temperature (T_c).
5. One gram of activated charcoal can adsorb 400 ml of SO₂, 20ml of CH₄ and 5ml of H₂ because T_c values are in the order : SO₂ > CH₄ > H₂
6. Freundlich adsorption Isotherm is given by : $\frac{x}{m} = K \cdot P^{\frac{1}{n}}$ (at low pressure only) ($n > 1$)
7. Freundlich adsorption Isotherm gives a graph as



8. The logarithmic expression of Freundlich adsorption isotherm is $\log \frac{x}{m} = \log K + \frac{1}{n} \log P$.
9. Langmuir adsorption isotherm $\frac{x}{m} = \frac{aP}{1+bP}$
where x is mass of gas adsorbed, m is mass of adsorbent, a is K_a and b is K_a/K_d .

II. COLLOIDS

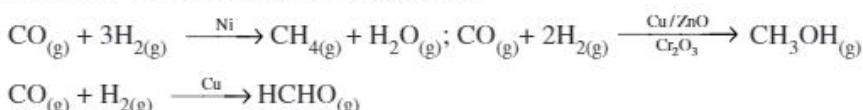
10. Gold sol is solid in liquid sol. It is an aquasol or hydrosol. It is lyophobic sol. It is a colloidal solution of gold particles (solid) in water. It is prepared by Bredig arc method. Gold sol is stabilised by the presence of an alkali.
11. Lyophobic sol can be protected from coagulation by an added electrolyte or by adding a lyophilic colloid to the lyophobic sol solution. This lyophilic sol added is called protective colloid.
12. Gold number is introduced by Zsigmondy. Gold number is inverse to the efficiency of protective action. Gelatin is the most efficient protective colloid and starch is least.
13. Scattering of light on colloidal particles is called as Tyndall effect.
14. Tyndall effect can be used to distinguish between a colloidal and true solution.
15. Hardy-Schulze laws : The ion with charge opposite to the charge of the colloidal particle is very effective. Greater the charge of the ion, greater is the ability for coagulation.
16. Positive colloids are coagulated by negative ions and decreasing order of effectiveness is : $[Fe(CN)_6]^{4-} > PO_4^{3-} > SO_4^{2-} > Cl^-$
17. Negative colloids are coagulated by positive ions. The decreasing order of effectiveness is : $Al^{3+} > Ba^{2+} > K^+$.
18. For soaps, the CMC is 10^{-4} to 10^{-3} mol L⁻¹. These colloids have both lyophobic and lyophilic parts. Micelles may contain as many as 100 molecules or more.

Example : Soaps (Sodium Stearate)

- Synthetic detergents :
- Sodium lauryl sulphonate - $\text{CH}_3[\text{CH}_2]_{11}\text{SO}_3\text{Na}^+$
 - Cetyl trimethyl ammonium bromide - $\text{CH}_3(\text{CH}_2)_{15}\text{N}^+(\text{CH}_3)_3\text{Br}^-$
 - p-Dodecyl benzene sulphonate - $\text{C}_{12}\text{H}_{25}-\text{C}_6\text{H}_4-\text{SO}_3\text{Na}^+$

III. CATALYSIS

- A substance which promotes the activity of the catalyst, to which it is added in small amounts is called a promoter or activator. The process is known as activation. Molybdenum (Mo) is promoter to the catalyst iron in the Haber's process.
- The presence of a foreign substance which retards the rate of a reaction is called a negative catalyst or inhibitor. The phenomenon is negative catalysis. For example, decomposition of H_2O_2 is retarded by the presence of glycerol, acetanilide, urea, sodium pyrophosphate etc.
- In a homogeneous catalysis, the catalyst and the reactants are in the same phase. It is not possible in solid state.
- In heterogeneous catalysis, the catalyst is in a different phase from that of the reactants.
- The action of a catalyst is explained by two different theories: Intermediate compound formation theory and the adsorption theory.
- A positive catalyst lowers the activation energy of the reaction by providing a new path way.
- When one of the intermediates formed in a reaction itself acts as a catalyst for the reaction, the catalysis is called autocatalysis. Mn^{2+} in the oxidation of oxalic acid by acidified KMnO_4 and As in the decomposition of arsene are examples.
- Examples for selectivity of catalyst are :



LECTURE SHEET

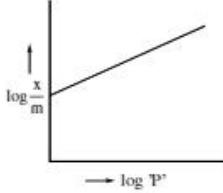
EXERCISE-I

(Adsorption)

LEVEL-I (MAIN)

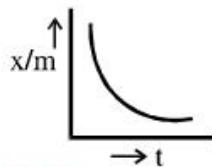
Straight Objective Type Questions

- Adsorption is the phenomenon in which a substance
 - accumulates on the surface of other substance
 - goes into the body of the other substance
 - remains close to the other substance
 - does not accumulate on the surface of the other substance
- Surface layer of a solid means
 - atoms present in the upper layer of the solid
 - atoms present upto a depth of 100 nm on the surface
 - atoms present in the bulk of the solid
 - atoms of the surface of a solid not preoccupied by other substances

3. Charcoal is activated in vacuum
 1) by cooling it from 623°C to 127°C 2) by cooling it to 23K
 3) by heating it from 573K to 1273K 4) by heating upto 300K
4. In adsorption of oxalic acid on activated charcoal, the activated charcoal is called
 1) adsorbent 2) adsorbate 3) adsorber 4) absorber
5. Valence forces cause
 1) chemisorption 2) Ionic bond
 3) sorption 4) adsorption involving multi layers
6. The bond between the adsorbate and adsorbent in chemisorption is
 1) ionic bond 2) covalent bond
 3) either ionic or covalent bond 4) Vander waal's forces
7. The nature of forces operating between the adsorbate and the adsorbent in the adsorption occurring at high temperature is
 1) vander waal's forces 2) chemical forces 3) gravitational forces 4) fermi forces
8. Which of the following statements is true in the case of physical adsorption of gases on solids
 1) it is exothermic process 2) it depends on the ease of liquification of the gas
 3) it decreases with increase in temperature 4) all the above
9. Which of the following is chemisorption
 1) adsorption of H₂ on Ni at high temperature 2) adsorption of H₂ on charcoal
 3) adsorption of moisture on silica gel 4) dehydration by using anhydrous CaCl₂
10. Adsorption is multilayered in case of
 1) chemisorption 2) desorption
 3) physical adsorption 4) both chemisorption and desorption
11. 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 40 – 400 KJ
12. The higher the critical temperature of the gas
 1) greater is its extent of adsorption 2) lower is its adsorption
 3) lesser is the case of liquification 4) more is its volatile nature
13. 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) $1/n$
 3) x/m
 4) P
- 
14. The plot of x/m versus temperature at constant pressure is called
 1) adsorption isotherm 2) adsorption isobar
 3) adsorption isochore 4) Freundlich isotherm

15. The type of adsorption depicted by the adsorption isobar is

- 1) physical
- 2) chemical
- 3) both (1) and (2)
- 4) none of these



16. Which is correct in case of van der Waals' adsorption?

- | | |
|-----------------------------------|------------------------------------|
| 1) High temperature, low pressure | 2) Low temperature, high pressure |
| 3) Low temperature, low pressure | 4) High temperature, high pressure |

LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. Adsorption of gases on solid surface is generally exothermic because

a) Enthalpy is positive	b) Entropy decreases	c) Entropy increases	d) free energy increases
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2. 1.30 Lit N₂ gas at 2atm and 300K in a container is exposed to 4g of solid surface. After complete adsorption the pressure of N₂ is reduced by 30% calculate the value of x/m

a) 0.22	b) 0.56	c) 0.32	d) 0.43
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3. 3.6gm of O₂ is adsorbed on 1.2gm of metal powder what volume of O₂ adsorbed per gram of the adsorbent at 1atm and 273K

a) 2.1	b) 0.19	c) 1	d) None
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4. A sample of 16gm of charcoal was brought into contact with CH₄ gas contained in a vessel of 1litre at 27°C and the pressure of gas was found to fall from 760 to 608 torr. The density of charcoal sample is 1.6gm/cm³. What is the volume of the CH₄ gas adsorbed per gram of the adsorbent at 608 torr and 27°C.

a) 125ml / gm	b) 26ml / gm	c) 16.25ml / gm	d) None
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5. In Freundlich adsorption isotherm equation $\log \frac{x}{m} = \log k + \frac{1}{n} \log p$ the value of n at moderate pressures is

a) any value from 0 to 1	b) Less than 1
c) Greater than 1	d) a positive or negative fractional number
6. Plot of $\log \frac{x}{m}$ against log p is a straight line inclined at an angle of 45°. When the pressure is 0.5atm and k value is 10, the amount of solute adsorbed per gram of adsorbent will be

a) 5gm	b) 10gm	c) 1gm	d) 15gm
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7. Which of the following is adsorbed to a maximum extent on a given amount of adsorbent?

a) H ₂	b) N ₂	c) O ₂	d) SO ₂
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8. Which statement is correct about physical adsorption?

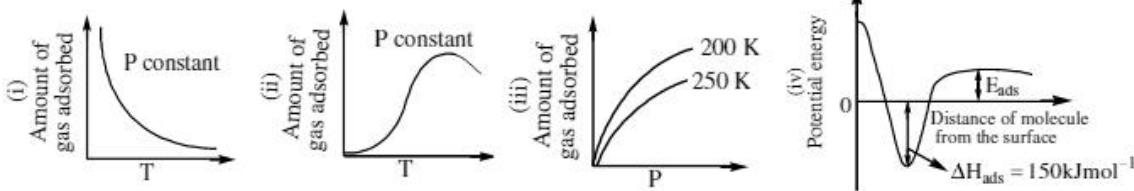
a) It is highly specific	b) It is unilayer adsorption
c) It depends on critical temp. of adsorbate	d) It is irreversible
9. When 0.1M CH₃COOH solution is shaken with activated charcoal and the charcoal is filtered out, the concentration of acid _____

a) Increases	b) Decreases	c) Remains unchanged	d) Can't say
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10. The phenomenon of simultaneous absorption and adsorption is called —
 a) Sorption b) Desorption c) Chemisorption d) Absorption
11. Chemical adsorption
 a) Increase with increase in temperature
 b) Decreases with increase in temperature
 c) First increases then decreases with increase in temperature
 d) First decreases then increases with increase in temperature
12. In Langmuir's model of adsorption of a gas on a solid surface,
 a) the rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered
 b) the adsorption at a single site on the surface may involve multiple molecules at the same time.
 c) the mass of gas striking a given area of surface is proportional to the pressure of the gas
 d) the mass of gas striking a given area of surface is independent of the pressure of the gas
13. 2.0 g of charcoal is placed in 100 mL of 0.5 M CH_3COOH to form an adsorbed mono-acidic layer of acetic acid molecules and thereby the molarity of CH_3COOH reduces to 0.49. The surface area of charcoal is $3 \times 10^2 \text{ m}^2 \text{ g}^{-1}$. The surface area of charcoal adsorbed by each molecule of acetic acid is
 a) $1.0 \times 10^{-18} \text{ cm}^2$ b) $1.0 \times 10^{-19} \text{ cm}^2$ c) $1.0 \times 10^{13} \text{ cm}^2$ d) $1.0 \times 10^{-14} \text{ cm}^2$

More than One correct answer Type Questions

14. Which of the following is not considered as absorption
 a) chalk piece dipped in ink b) sponge placed in water
 c) finely divided charcoal stirred with dilute acetic acid
 d) H_2 gas in contact with finely divided Pd
15. Chromatography is a technique based on
 a) adsorption and then dispersion of solute b) adsorbent's ability for preferential adsorption
 c) hydration of solute d) evaporation of solute
16. In the adsorption of acetic acid by charcoal which of the following statements are correct?
 a) Charcoal is called adsorbent b) Concentration of acetic acid decreases
 c) Concentration of acetic acid increases d) Acetic acid is adsorbate
17. Calculate the surface area of a catalyst that adsorbs 10^3 cm^3 of N_2 (reduced to STP) per gram in order to form the monolayer. The effective area occupied by N_2 molecule on the surface is $1.62 \times 10^{-15} \text{ cm}^2$
 a) $2520 \times 10^5 \text{ cm}^2$ b) 4350 m^2 c) 3720 m^2 d) $435 \times 10^5 \text{ cm}^2$
18. In the given graphs data I, II, III and IV represent general trends 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

19. Which one of the following are related to physical adsorption?
- It is reversible in nature
 - It involves the formation of unimolecular layer
 - It has low heat of adsorption
 - It takes place at low temperature
20. Which one of the following is/are correct about Freundlich's adsorption isotherm for gases and solution?
- $\frac{x}{m} = kc^{1/n}$
 - $\frac{x}{m} = \frac{1+bp}{a}$
 - $\log \frac{x}{m} = \log k + n \log p$
 - $\log \left(\frac{x}{m} \right) = \log k + \frac{1}{n} \log c$
21. Which statement(s) is/are correct?
- Physical adsorption is due to van der Waal's forces
 - Physical adsorption decreases at high temperature and low pressure
 - Physical adsorption is reversible
 - Adsorption energy for a chemical adsorption is generally lesser than that of physical adsorption
22. Which of the following statements are wrong?
- A solid with a rough surface is better adsorbent than the same solid with a smooth surface
 - Emulsifiers do not work on the principle of adsorption.
 - Silica and aluminium gels are used as adsorbents for removing moisture
 - In adsorption, concentration is same throughout the material
23. Select the correct statements among the following:
- At 83K, N₂ is physisorbed on the surface of iron.
 - At 772 K and above N₂ is chemisorbed on the iron surface
 - Activation energy is +ve in case of physisorption and zero in case of chemisorption
 - Activation energy is zero in case of physisorption and +ve in case of chemisorption

Linked Comprehension Type Questions

Passage :

In general, easily liquefiable gases like CO₂, NH₃, Cl₂ and SO₂ etc., are adsorbed to a greater extent than the elemental gases, eg., H₂, N₂, O₂, He, etc.

24. Which of the following gases will be most easily adsorbed by the charcoal in the gas mask
- H₂
 - O₂
 - N₂
 - SO₂
25. Gas mask contains
- Charcoal granules
 - powdered charcoal
 - calcium carbonate
 - Acetic acid
26. The correct order of the adsorption of gases studied will be
- NH₃ > SO₂ > CO₂ > HCl
 - CO₂ > SO₂ > NH₃ > HCl
 - SO₂ > NH₃ > HCl > CO₂
 - HCl > SO₂ > NH₃ > CO₂

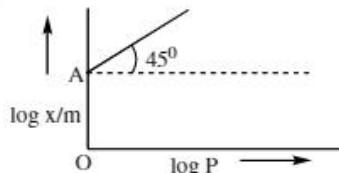
Matrix Matching Type Questions

- | 27. Column-I | Column-II |
|-------------------------|----------------------------------|
| A) Physical adsorption | p) Exothermic |
| B) Chemisorption | q) Endothermic |
| C) Desorption | r) Removal of material adsorbed |
| D) Activated adsorption | s) Specific in nature |
| | t) Multilayer formation possible |

Integer Type Questions

28. One gram of charcoal adsorbs 100 ml of 0.5M CH_3COOH & then molarity of acetic acid reduces to 0.49 M. The no. of milli moles of acetic acid adsorbed is _____

29. If $\theta = 45^\circ$ in the figure given below. Calculate the value of 'n' in Freundlich adsorption isotherm.



30. 50 ml of 1 M acetic acid is shaken with 0.5 g wood charcoal. The final conc. of the solution after adsorption is 0.5 M. What is the amount of acetic acid adsorbed per gram of carbon?

31. In an experiment, 500ml of 0.5M hydrated oxalic acid is shaken with 5g of activated charcoal and filtered. The conc. of filtrate is 0.4 M. If the extent of adsorption $\left(\frac{x}{m}\right)$ is 1.26×10^x then $x = ?$

EXERCISE-II

(Colloids)

LEVEL-I (MAIN)**Straight Objective Type Questions**

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 through membrane 2) particle size
3) chemical composition 4) solubility
4. Colloidal systems are
1) homogeneous 2) heterogeneous 3) suspensions 4) transparent
5. When dispersed phase is solid and dispersion medium is gas, the colloidal system is
1) smoke 2) clouds 3) emulsion 4) milk
6. When the dispersion medium is alcohol, the colloidal sol is known as
1) hydrosol 2) benzosol 3) alcosol 4) aquasol
7. 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
8. 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
9. 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

10. Which of the following may form associate colloids?
- 1) Gold
 - 2) Soap
 - 3) Starch
 - 4) Glucose
11. Which of the following is a lyophobic solution?
- 1) aqueous starch solution
 - 2) aqueous protein solution
 - 3) gold sol
 - 4) polymer solutions in some organic solvents
12. The simplest way to check whether a system is colloidal
- 1) Tyndall effect
 - 2) Brownian movement
 - 3) Electrodialysis
 - 4) Finding out particle size
13. The emulsifier for olive oil in water emulsion is
- 1) soap
 - 2) egg albumin
 - 3) mercuric iodide
 - 4) kerosene
14. Soap emulsifies
- 1) oil in water type
 - 2) water in oil type
 - 3) oil in oil type
 - 4) gel in oil
15. During the cleaning action of soap __ part of soap dissolves in the dirt and encapsulates to form micelle
- 1) both hydrophylic and hydrophobic
 - 2) hydrophylic
 - 3) hydrophobic
 - 4) Cation
16. Water in benzene is emulsified by
- 1) soap
 - 2) mercuric iodide
 - 3) egg albumin
 - 4) grease
17. The kind of colloid that does not exist
- 1) solid in gas
 - 2) gas in solid
 - 3) solid in solid
 - 4) gas in gas
18. Dispersed phase and the dispersion media in blood respectively are
- 1) Liquid, solid
 - 2) Liquid, liquid
 - 3) Solid, liquid
 - 4) Solid, solid
19. 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
20. The charge on As_2S_3 sol is due to the adsorption of :
- 1) H^+
 - 2) OH^-
 - 3) O_2^-
 - 4) S^{2-}
21. A colloidal system involves:
- 1) a state of dissolution
 - 2) a state of dispersion
 - 3) a state of suspension
 - 4) none of these
22. The Brownian movement is due to :
- 1) Temperature fluctuations within the liquid phase
 - 2) Attraction and repulsion between charges on the colloidal particles
 - 3) Impact of the molecules of the dispersion medium on the colloidal particles
 - 4) Scattering of light
23. Blood contains
- 1) +vely charged particles
 - 2) -vely charged particles
 - 3) Neutral particles
 - 4) -vely as well as +vely charged particles
24. Isoelectric point refers to the H^+ ion concentration at which the colloidal particles :
- 1) coagulate
 - 2) become electrically neutral
 - 3) can move to either electrode when subjected to an electric field
 - 4) reverse their electrical charge

25. Which of the following has least flocculating value of positive sol?
- Cl^-
 - SO_4^{2-}
 - PO_4^{3-}
 - $[\text{Fe}(\text{CN})_6]^{4-}$
26. Purple of cassius is :
- Au sol in water
 - Ag sol in water
 - Cu sol in water
 - None of these
27. Black diamonds are the dispersion of :
- Solid in solid
 - Solid in gas
 - Solid in liquid
 - Liquid in solid

Numerical Value Type Questions

28. The coagulation of 100 mL of colloidal solution of gold is completely prevented by addition of 0.25 g of a substance 'X' to it before addition of 1 mL of 10% NaCl solution. The gold number of 'X' is
29. The number of phases in a colloidal system is

LEVEL-II (ADVANCED)**Straight Objective Type Questions**

- The migration of positively charged colloidal particles, under an electrical field towards the cathode is called
 - Electrophoresis
 - Electro-Osmosis
 - sedimentation
 - Electrodialysis
- If a freshly formed ppt of SnO_2 is peptised by a small amount of NaOH, these colloidal particles may be represented as
 - $[\text{SnO}_2]\text{SnO}_3^{2-} : \text{Na}^+$
 - $[\text{SnO}_2]\text{Sn}^{4+} : \text{O}^{2-}$
 - $[\text{SnO}_2]\text{Na}^+ : \text{OH}^-$
 - $[\text{SnO}_2]\text{Sn}^{4+} : \text{OH}^-$
- Bredig arc method cannot be used to prepare colloidal solution of which of the following
 - Pt
 - Fe
 - Ag
 - Au
- The gold number of some colloids are given below.

Colloid	Gold number
A	0.01
B	2.5
C	20

The protective nature of these colloids follows the order

- $\text{C} > \text{B} > \text{A}$
- $\text{A} > \text{B} > \text{C}$
- $\text{A} = \text{B} = \text{C}$
- $\text{B} > \text{A} > \text{C}$

- Under the influence of an electric field the particles in a sol migrate towards cathode. The coagulation of the same sol is studied using NaCl , Na_2SO_4 and Na_3PO_4 solutions. Their coagulating values will be maximum for
 - Na_3PO_4
 - Na_2SO_4
 - NaCl
 - Same for all
- Which of the following is a lyophobic colloid
 - Jellies
 - Gelatin
 - Curd
 - Milk
- What type of molecules form micelles?
 - Non - polar molecules
 - electrolytes such as NaCl
 - Surfactant molecules
 - Salt of weak acid and weak base
- Micelles are formed only
 - below the CMC
 - above the CMC
 - above the 1M concentration
 - below 1M Concentration

9. Stability of emulsions increases by adding
 a) Electrolyte b) Acid c) Base d) Emulsifying agent
10. Which characteristic is the most important factor in giving rise to peculiar properties of colloids?
 a) Large size b) Small size
 c) High charge density d) High ratio of surface area to the volume
11. Which of the following mixture will lead to the formation of negatively charged colloid $[AgI]I^-$?
 a) 50 ml of 0.1 M $AgNO_3$ + 50 ml of 0.1 M KI b) 50 ml of 0.1 M $AgNO_3$ + 50 ml of 0.2 M KI
 c) 50 ml of 0.2 M $AgNO_3$ + 50 ml of 0.1 M KI d) 50 ml of 0.2 M $AgNO_3$ + 50 ml of 0.2 M KI
12. Which is correct?
 a) Brownian movement is more pronounced for small particles than the bigger ones.
 b) Sols of metal sulphides are lyophilic
 c) Hardy-Schulze law states that larger the size of the coagulation ion greater is its coagulation power.
 d) A lyophilic sol is most stable at isoelectric point

More than One correct answer Type Questions

13. Assosiated colloids
 a) raise the surface tension of water b) lower the surface tension of water
 c) rise the viscosity of water d) lower the viscosity of water
14. Artificial rain is caused by spray of
 a) electrified sand b) charged silver sols
 c) negatively charged sand or salt d) positively charged sand or salt
15. An emulsifier is an agent which
 a) accelerates the dispersion b) homogeneous an emulsion
 c) stabilises an emulsion d) Aids the flocculation of an emulsion
16. Select correct properties of emulsions
 a) emulsions exhibit Tyndall effect
 b) oil emulsions are more viscous than the aqueous emulsions
 c) electrical conductance of aqueous emulsion is higher than that of oil emulsion
 d) emulsion exhibits brownian movement
17. At CMC
 a) Osmotic pressure changes b) Surface tension slightly decreases
 c) The ΔH is highly negative d) association of particles takes place

Linked Comprehension Type Questions**Passage :**

The coagualtion value of different electrolytes are different. This behaviour can be easily understood by Hardy-Schulze rule which states. "The greater is the valency of the effective ion greater is its precipitating power"

18. Which one has the higest coagulation power ?
 a) K^+ b) Ca^{2+} c) Al^{3+} d) Sn^{4+}
19. As_2S_3 sol is negatively charged, capacity to precipitate it is highest in which ion ?
 a) K_2SO_4 b) Na_3PO_4 c) $AlCl_3$ d) $CaCl_2$

20. The coagulation of colloidal particles of the sol can be caused by :
- Heating
 - Adding electrolyte
 - Adding oppositely charged sol
 - All of these

Matrix Matching Type Questions

- | | |
|----------------------|---|
| 21. Column-I | Column-II |
| A) Solid sol | p) Dispersed phase is solid |
| B) Sol | q) Dispersion medium is solid |
| C) Emulsion | r) Dispersed phase is liquid |
| D) Gel | s) Dispersion medium is liquid |
| | t) Dispersed phase and dispersion medium are same |
| 22. Column-I | Column-II |
| A) Coagulation | p) Scattering of light |
| B) Peptization | q) Purification of colloidal solution |
| C) Tyndall effect | r) Addition of electrolyte |
| D) Dialysis | s) Precipitation of colloidal solution |
| 23. Column-I | Column-II |
| A) Tyndall effect | p) Purification of colloids |
| B) Brownian movement | q) Movement of colloidal particles towards oppositely charged electrode |
| C) Ultrafiltration | r) Scattering of light |
| D) Electrophoresis | s) Zig Zag motion |
| | t) Property of colloidal sol |

Integer Type Questions

- The coagulation of 100 ml of colloidal solution of gold is completely prevented by addition of 0.25 g of a substance 'x' to it before adding 1 ml of 10% NaCl solution. Calculate the gold number of 'x'. If gold number of x is a^2 then a is = ____?
- 0.05 moles of AlCl_3 is required to coagulate 500 ml of As_2S_3 sol. If its coagulation value is 10^x find x
- From the given following sol how many can coagulate the haemoglobin sol?
 Fe(OH)_3 , Ca(OH)_2 , Al(OH)_3 , Starch, Clay, As_2S_3 , CdS , basic dye.
- For the coagulation of 500 ml of arsenious sulphide sol, 2 ml of 1M NaCl is required. What is the flocculation value of NaCl?

EXERCISE-III

(Catalysis)

LEVEL-I (MAIN)***Straight Objective Type Questions***

- The rate of a chemical reaction is increased in presence of a catalyst. This is because
 - activation energy of the reaction is less in the new path
 - heat of reaction is decreased
 - threshold energy is increased
 - activation energy of the new path is more

2. An inhibitor is essentially
 1) a negative catalyst 2) an auto catalyst
 3) a homogeneous catalyst 4) a heterogeneous catalyst
3. Which of the following kind of catalysis can be explained by the adsorption theory?
 1) Homogeneous catalysis 2) Acid-base catalysis
 3) Heterogeneous catalysis 4) Auto catalysis
4. Which of the following processes does not involve a catalyst?
 1) Haber's process 2) Thermite process 3) Ostwald's process 4) Contact process
5. The catalyst used in the dehydration of ethylalcohol to ethene is
 1) Al_2O_3 2) Sb_2O_3 3) As_2O_3 4) Cu
6. In heterogteneous catalytic reactions involving solid catalyst and gaseous reactants, the catalysts, most generally used are
 1) metals 2) metal oxides only
 3) transition metals only 4) transition metals and transition metal oxides
7. The process which is catalysed by one of the products is called
 1) Acid-base catalysis 2) Auto catalysis 3) Negative catalysis 4) Positive catalysis
8. Which of the following reactions is an example of heterogeneous catalysis
 1) $2\text{CO(g)} + \text{O}_2\text{(g)} \xrightarrow{\text{NO(g)}} 2\text{CO}_2\text{(g)}$ 2) $2\text{SO}_2\text{(g)} + \text{O}_2\text{(g)} \xrightarrow{\text{NO(g)}} 2\text{SO}_3\text{(g)}$
 3) $2\text{CO(g)} + \text{O}_2\text{(g)} \xrightarrow{\text{Pt(s)}} 2\text{CO}_2\text{(g)}$ 4) $\text{CH}_3\text{CHO(g)} \xrightarrow{\text{I}_2\text{(g)}} \text{CH}_4\text{(g)} + \text{CO(g)}$
9. The catalyst used to increase the dissociation of H_2O_2 is
 1) Acetanilide 2) Glycerol 3) H_3PO_4 4) Caustic soda
10. A catalyst increases the rate of a reaction with out changing
 1) Energy of activation 2) Heat of the reaction 3) Path of reaction 4) Mechanism of reaction
11. Catalytic action of an enzyme is
 1) Highly specific 2) Non specific
 3) Does not depend on nature of substrate 4) Common for many biochemical reactions
12. Which of the following catalyst is used for preparing toluene by reacting benzene with methyl chloride?
 1) Ni 2) Anhydrous AlCl_3 3) Pd 4) Pt
13. In which of these processes platinum is used as a catalyst?
 1) Oxidation of ammonia to form HNO_3 2) Hardening of oils
 3) Production of synthetic rubber 4) Synthesis of methanol
14. A biological catalyst is
 1) An amino acid 2) A carbohydrate 3) The nitrogen molecule 4) An enzyme
15. Which of the following is an example for auto catalysis
 1) $2\text{AsH}_{3\text{(g)}} \rightarrow 2\text{As}_{(\text{s})} + 3\text{H}_{2\text{(g)}}$ 2) $\text{N}_{2\text{(g)}} + 3\text{H}_{2\text{(g)}} \rightarrow 2\text{NH}_{3\text{(g)}}$
 3) $2\text{SO}_{2\text{(g)}} + \text{O}_{2\text{(g)}} \rightarrow 2\text{SO}_{3\text{(g)}}$ 4) $\text{C}_{12}\text{H}_{12}\text{O}_{11\text{(aq)}} + \text{H}_2\text{O}_{\text{(aq)}} \rightarrow \text{C}_6\text{H}_{12}\text{O}_{6\text{(aq)}} + \text{C}_6\text{H}_{12}\text{O}_{6\text{(aq)}}$
- 16.. ZSM-5 is used to convert:
 1) alcohol to petrol 2) benzene to toluene
 3) toluene to benzene 4) heptane to toluene

LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. In a chemical reaction the catalyst
 - a) increases the activation energy
 - b) does not effect the equilibrium constant of reaction
 - c) reduces enthalpy of the reaction
 - d) decreases rate constant of the reaction

2. $\text{CH}_3\text{COCl} + \text{H}_2 \xrightarrow{\text{Pd}} \text{CH}_3\text{CH}_2\text{OH}$
 $\text{CH}_3\text{COCl} + \text{H}_2 \xrightarrow[\text{quinoline}]{\text{Pd/BaSO}_4} \text{CH}_3\text{CHO}$ here quinoline acts as
 - a) +ve catalyst
 - b) Catalyst poison
 - c) Promoter
 - d) Medium

3. The incorrect statement among the following is/are
 - a) A catalyst does not initiate the reaction
 - b) The action of catalyst in many instances is selective
 - c) Catalyst may loose its catalytic activity at high temperature
 - d) The composition of catalyst changes at the end of reaction

4. The conversion of Maltose to Glucose is possible by the enzyme
 - a) Zymase
 - b) Lactase
 - c) Diastase
 - d) Maltase

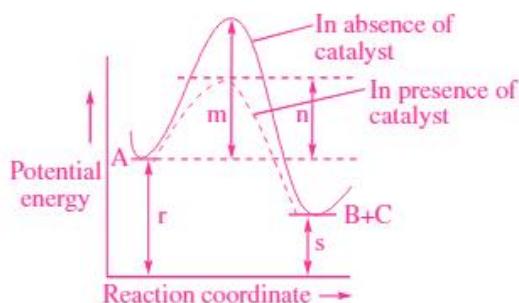
5. The catalyst used in the manufacture of H_2 by Bosch's process is
 - a) Cr_2O_3
 - b) $\text{Fe}_2\text{O}_3 + \text{Cr}_2\text{O}_3$
 - c) Fe_2O_3
 - d) Cu

6. The following are some statements about characteristics of catalyst
 - I) A catalyst generally function under the optimum conditions like pH, temperature
 - II) A catalyst has a selective action
 - III) Small amount of the catalyst is sufficient

The correct combination is

 - a) All are correct
 - b) Only I and II
 - c) Only II and III
 - d) Only II

7. For the reaction $\text{A} \rightarrow \text{B} \rightarrow \text{C}$; the energy profile diagram is given in the figure.

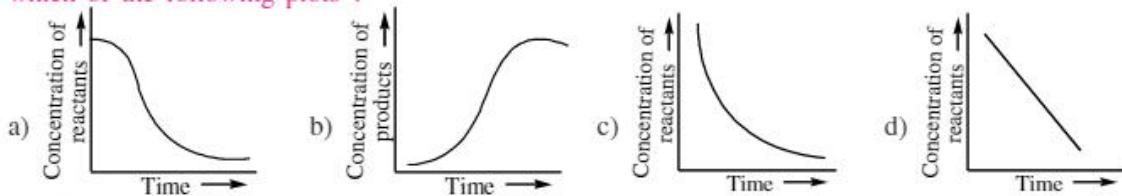


What is the decrease in energy of activation in presence of catalyst?

- a) m
- b) $m - n$
- c) $s - m$
- d) $m - r$

More than One correct answer Type Questions

8. In the reaction of autocatalysis, the variation of concentration with time is correctly represented by which of the following plots?



9. Zeolites are
- Water softeners
 - Catalysts
 - Complex nitrogen compounds
 - Inorganic sulphides
10. The activity and selectivity of zeolites as catalysts is based on
- Their pore size
 - size of their cavities on the surface
 - Muta rotation
 - None of the above
11. Which one of the following statements about zeolite is true?
- They are used as cation exchangers
 - They have structure which enables them to take up small molecules
 - Zeolites are aluminosilicates having three dimensional network
 - Some of the SiO_4^{4-} units are replaced by AlO_4^{5-} and AlO_6^{9-} ions in zeolites
12. Which statements are correct?
- Heterogeneous catalysis takes place through adsorption
 - Homogeneous catalysis occurs through intermediate formations
 - A catalyst can revert the sign of ΔG
 - A catalyst increases the energy of activation of a reaction

Linked Comprehension Type QuestionsPassage :

A catalyst alters the rate of a reaction by increasing the energy of activation. In Heterogeneous catalysis adsorption mechanism occurs and Homogeneous. Catalysis intermediate formation occurs. In auto catalysis one of the products acts as catalyst.

13. The ΔH of a reaction $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ is -20 KJ mol^{-1} . When a catalyst is used. What is ΔH for the reaction without catalyst (magnitude)
- $< 20 \text{ KJ}$
 - $> 20 \text{ KJ}$
 - 20 KJ
 - Depends on catalyst
14. $2\text{SO}_2 + \text{O}_2 \xrightarrow{\text{NO(g)}} 2\text{SO}_3$. This reaction is carried out through formation of _____ intermediate.
- N_2O
 - NO_2
 - N_2O_4
 - N_2O_3

Matrix Matching Type Questions**15. Column-I**

- Positive catalyst
- Negative catalyst
- Catalytic poison
- Promoter

Column-II

- H_2S to iron in 'Habers process'
- 'NO' to preparation of SO_3
- Glycerol to prevent decomposition of H_2O_2
- MnO_2 in the decomposition of KClO_3
- Mo to Fe in Haber's process

16. Column-I

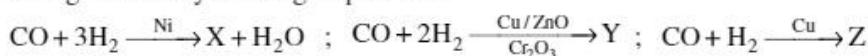
- A) Hydrogenation of oils
 B) Ostwald's process
 C) Contact's process
 D) Haber's process

Column-II

- p) Fe
 q) Ni
 r) V₂O₅
 s) Mo
 t) Pt

Integer Type Questions

17. Change of catalyst changed products



The magnitude of the algebraic sum of the oxidation state of carbon in X, Y and Z is

18. During oxidation of oxalic acid by acidified KMnO₄ how many unpaired electrons are present in the autocatalyst ?

KEY SHEET (LECTURE SHEET)

EXERCISE-I

LEVEL-I

- | | | | | | | | |
|------|-------|-------|-------|-------|-------|-------|-------|
| 1) 1 | 2) 2 | 3) 3 | 4) 1 | 5) 1 | 6) 3 | 7) 2 | 8) 4 |
| 9) 1 | 10) 3 | 11) 3 | 12) 1 | 13) 2 | 14) 2 | 15) 1 | 16) 3 |
-
- | | | | | | | | |
|--------|--------|----------------------------|--------|---------|--------|---------|---------|
| 1) b | 2) a | 3) a | 4) c | 5) c | 6) a | 7) d | 8) c |
| 9) b | 10) a | 11) c | 12) c | 13) d | 14) cd | 15) ab | 16) abd |
| 17) bd | 18) ac | 19) acd | 20) ad | 21) abc | 22) bd | 23) abd | 24) d |
| 25) b | 26) c | 27) A-pt; B-ps; C-qr; D-ps | 28) 1 | 29) 1 | 30) 3 | | |
| 31) 0 | | | | | | | |

EXERCISE-II

LEVEL-I

- | | | | | | | | |
|-------|-------|-------|--------|-------|-------|-------|-------|
| 1) 3 | 2) 4 | 3) 1 | 4) 2 | 5) 1 | 6) 3 | 7) 3 | 8) 2 |
| 9) 1 | 10) 2 | 11) 3 | 12) 1 | 13) 2 | 14) 1 | 15) 3 | 16) 2 |
| 17) 4 | 18) 3 | 19) 3 | 20) 4 | 21) 2 | 22) 3 | 23) 2 | 24) 2 |
| 25) 4 | 26) 1 | 27) 1 | 28) 25 | 29) 2 | | | |
-
- | | | | | | | | |
|---------|-------|-------|-------|------------------------------|-------------------------|---------------------------|----------|
| 1) a | 2) a | 3) b | 4) b | 5) c | 6) a | 7) c | 8) b |
| 9) a | 10) a | 11) b | 12) a | 13) bc | 14) abd | 15) c | 16) abcd |
| 17) abd | 18) d | 19) c | 20) d | 21) A-pqt; B-ps; C-rst; D-rq | 22) A-rs; B-r; C-p; D-q | 23) A-rt; B-st; C-p; D-qt | 24) 5 |
| 25) 2 | 26) 4 | 27) 4 | | | | | |

EXERCISE-III

LEVEL-I

- | | | | | | | | |
|------|-------|-------|-------|-------|-------|-------|-------|
| 1) 1 | 2) 1 | 3) 3 | 4) 2 | 5) 1 | 6) 4 | 7) 2 | 8) 3 |
| 9) 4 | 10) 2 | 11) 1 | 12) 2 | 13) 1 | 14) 4 | 15) 1 | 16) 1 |
-
- | | | | | | | | |
|-------|--------|---------|--------|-------|-------|-------------------------|--------------------------|
| 1) b | 2) b | 3) d | 4) d | 5) b | 6) a | 7) b | 8) ab |
| 9) ab | 10) ab | 11) abc | 12) ab | 13) c | 14) b | 15) A-qs; B-r; C-p; D-t | 16) A-q; B-t; C-rt; D-ps |
| | | | | | | 17) 6 | 18) 5 |

 PRACTICE SHEET 
 EXERCISE-I

(Adsorption)

LEVEL-I (MAIN)

Straight Objective Type Questions

1. $\frac{x}{m} = KC^{1/n}$ where C = Concentration of a solution, x = wt of adsorbed solute, m = Wt of adsorbent.
The equation represents
 - 1) Langmuir adsorption isotherm
 - 2) Freundlich adsorption isotherm
 - 3) Arrhenius equation
 - 4) Chemisorption isotherm
2. A graph drawn between ' $\log \frac{x}{m}$ ', and $\log P$ on 'Y' and 'X' axis respectively could be ____ regarding physical adsorption
 - 1) A hyperbola
 - 2) A parabola
 - 3) A straight line with positive slope
 - 4) A straight line with negative slope
3. Which of the following cannot act as an adsorbent?
 - 1) Silica gel
 - 2) Clay
 - 3) Oxygen gas
 - 4) Activated charcoal
4. Which can adsorb maximum amount of H_2 ?
 - 1) A platinum black
 - 2) Powdered palladium
 - 3) A platinum rod
 - 4) Nickel sphere
5. During activation of charcoal ___
 - 1) O_2 is adsorbed on charcoal
 - 2) Moisture is absorbed on charcoal
 - 3) Pre adsorbed material is desorbed
 - 4) Charcoal is covered with inert gas
6. The energy of molecules present on the surface of a substance is ___
 - 1) Equal to that of molecules in bulk
 - 2) Greater than that of interior molecules
 - 3) Less than that of interior molecules
 - 4) Dependent on nature of substance
7. The langmuir adsorption isotherm is given by
 - 1) $\frac{x}{m} = kP^{1/n}$
 - 2) $\frac{x}{m} = \frac{aP}{1+bP}$
 - 3) $\frac{x}{m} = \frac{bP}{a}$
 - 4) $\frac{x}{m} = kP^n$
8. At very high pressure the langmuir adsorption isotherm takes the form of
 - 1) $\frac{x}{m} = kP$
 - 2) $\frac{x}{m} = \frac{a}{b}$
 - 3) $\frac{x}{m} = \frac{1}{1+aP}$
 - 4) $\frac{x}{m} = P$
9. Based on Langmuir adsorption isotherm, the intercept in the graph ($\frac{m}{x}$ versus $\frac{1}{P}$) is equal to
 - 1) $\frac{1}{a}$
 - 2) $\frac{b}{a}$
 - 3) $\frac{a}{b}$
 - 4) $\frac{1}{\text{slope}}$
10. The following are some statements about adsorption of solutes from the solutions.
 - A) Increase in the surface area of the adsorbent increases the extent of adsorption.
 - B) Increase in temperature decreases the extent of adsorption.
 - C) The extent of adsorption (x/m) is related to the molar concentration of solution (c) and is given by $x/m = k.c^{1/n}$

The correct combination is

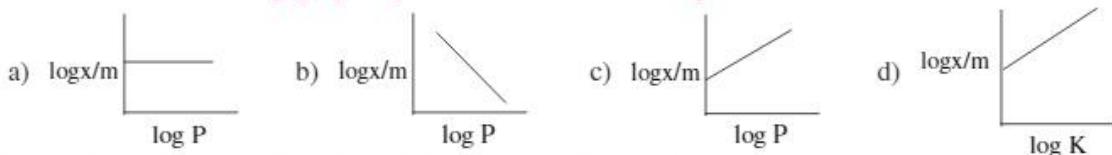
 - 1) only A and C
 - 2) only B and C
 - 3) only A and B
 - 4) all are correct

11. The following are some statements about physical adsorption
 A) Involves the weak Vanderwaals interaction between the adsorbate and adsorbent.
 B) Involves the chemical interactions between the adsorbent and adsorbate
 C) is irreversible in nature
 D) It depends upon both nature of adsorbent and adsorbate
 The correct combination is
 1) all are correct 2) only A and B 3) only A and C 4) only A
12. Which one of the following characteristics is not correct for physical adsorption?
 1) Adsorption increases with increases in temperature
 2) Adsorption is spontaneous
 3) Both enthalpy and entropy of adsorption are –ve
 4) Activation energy is slow
13. Amount of gas adsorbed per gram of adsorbent increases with pressure but after certain limit is reached, adsorption becomes constant. It is when
 1) multi layers are formed 2) desorption takes place
 3) temperature is increased 4) absorption also starts
14. Favourable conditions for physical adsorption are
 1) low T, high P 2) high T, high P 3) low T, low P 4) low T, low P
15. Which one of the following gases will be adsorbed most easily?
 1) N₂ 2) H₂ 3) O₂ 4) CO₂

LEVEL-II (ADVANCED)***Straight Objective Type Questions***

1. The volume of gases NH₃, CO₂ and H₂ adsorbed by one gram of charcoal at 300K are in order of
 a) H₂ > CO₂ > NH₃ b) NH₃ > H₂ > CO₂ c) CO₂ > NH₃ > H₂ d) NH₃ > CO₂ > H₂
2. Arsenous sulphide sol is prepared by passing H₂S through arsenous oxide solution the charge developed on the particles is due to adsorption of
 a) H⁺ b) S⁻² c) OH⁻ d) O⁻²
3. In Langmuir's model of adsorption of a gas on a solid surface
 a) The mass of gas striking a given area of surface is proportional to the pressure of the gas
 b) The mass of gas striking a given area of surface is independent of the pressure of the gas
 c) The rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered
 d) The adsorption at a single site on the surface may involve multiple molecules at the same time
4. According to adsorption theory of catalysts, the speed of the reaction increases because
 a) The concentration of the reactant molecules at the active centres of the catalyst becomes high due to adsorption
 b) In the process of adsorption, the activation energy of the molecules becomes large
 c) Adsorption produces heat which increases the speed of reaction
 d) Adsorption lowers the activation energy of the reaction

5. Which of the following graph represents Freundlich adsorption isotherm



6. The phenomenon of adsorption arises due to unbalanced

- a) valence force existing on the surface of solids
- b) chemical forces of atoms in the molecules
- c) coloumbic forces between electrons and nucleus
- d) electrostatic repulsions between the nuclei

7. Which of the following gases is adsorbed easily and more on activated charcoal

- | | |
|--------------------------------------|--|
| a) $\text{CO}_2 (T_c = 304\text{K})$ | b) $\text{SO}_2 (T_c = 430\text{K})$ |
| c) $\text{H}_2 (T_c = 23\text{K})$ | d) all gases undergo adsorption to the same extent |

8. According to Freundlich adsorption isotherm, at high pressure, value of x/m is

- a) directly proportional to pressure
- b) inversely proportional to pressure
- c) directly proportional to square of pressure
- d) independent of pressure

9. Adsorption isotherm of gases on solids gives the relation between

- a) volume of adsorbent and temperature
- b) amount of adsorbent per unit weight of adsorbate and pressure
- c) amount of adsorbate per unit weight of adsorbent and equilibrium pressure
- d) volume of adsorbate and pressure

10. Following are the events taking place to explain adsorption theory

I : Desorption

II : Diffusion of the reactants along the surface

III : adsorption of the reactants

IV : formation of the activated surface complex

These events are taking place in the following order

- a) I, II, III, IV
- b) II, III, IV, I
- c) III, IV, I, II
- d) IV, III, II, I

11. Which can adsorb larger volume of hydrogen gas?

- a) Colloidal solution of palladium
- b) Finely divided nickel
- c) Finely divided platinum
- d) Colloidal Fe(OH)_3

More than One correct answer Type Questions

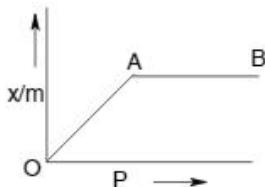
12. Which of the following are correct?

- a) silica gel adsorbs H_2O
- b) CaCl_2 (anhy) adsorbs H_2O
- c) Gas masks work on the principle of selective adsorption
- d) Zeolites are shape selective catalyst and water softners

13. Which of the following give linear plots?

- a) $\log \frac{x}{m}$ versus $\log C$
- b) $\log \frac{x}{m}$ versus $\frac{1}{P}$
- c) $\frac{m}{x}$ versus $\frac{1}{P}$
- d) $P/\left(\frac{x}{m}\right)$ versus P

14. In the following isotherm (Fig)



- a) $\frac{x}{m} \propto P^0$ When point B is reached
- b) Desorption may start along AB
- c) $x/m \propto P^{1/n}$ along OA
- d) $\frac{x}{m} \propto P$ when point B is reached

15. Which statements are correct?

- a) A gas with greater critical temperature gets more adsorbed
- b) The type of adsorption can be determined from the adsorption isobars
- c) Chemisorption is reversible in nature
- d) Variation of extent of adsorption with temperature tells about the type of adsorption

16. Which of the following statements are 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.

Linked Comprehension Type Questions

Passage-I :

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.

17. Which of the following gas molecules have maximum value of enthalpy of physisorption?

- a) C_2H_6
- b) Ne
- c) H_2
- d) H_2O

18. Which of the following gases is adsorbed most by activated charcoal?

- a) CO_2
- b) N_2
- c) Ar
- d) C_2H_6

19. Which of the following characteristics is not correct for physical adsorption?

- a) Adsorption is spontaneous
- b) ΔH and ΔS are negative
- c) It is reversible in nature
- d) Degree of adsorption increases with temperature

Passage-II :

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:

$$\frac{x}{m} = \frac{aP}{1+bP}$$

20. For adsorption of a gas on a solid, the plot of $\log\left(\frac{x}{m}\right)$ vs $\log P$ is linear with slope equal to (n being whole number)
- a) K b) $\log K$ c) n d) $\frac{1}{n}$
21. The equation of Langmuir adsorption isotherm under high pressure is:
- a) $\frac{x}{m} = \frac{a}{b}$ b) $\frac{x}{m} = aP$ c) $\frac{x}{m} = \frac{1}{aP}$ d) $\frac{x}{m} = \frac{b}{a}$

Matrix Matching Type Questions22. **Column-I**

- A) Chemisorption
B) Physisorption
C) Desorption of a solute from liquid
D) Adsorption of a solute on a liquid

Column-II

- p) Not very specific and decreases with temp.
q) Specific and increases with temp.
r) Increases the surface tension of the liquid surface
s) Adsorption is due to stronger interaction or bond formation

23. **Column-I**

- A) Physisorption
B) Chemisorption
C) Activated adsorption
D) Desorption

Column-II

- p) Multimolecular
q) High heat of activation
r) High temperature required
s) Low pressure required

Integer Type Questions

24. At STP the volume of nitrogen gas required to cover a sample of silica gel, assuming Langmuir monolayer adsorption, is found to be $1.33\text{cm}^3\text{g}^{-1}$ of the gel. The area occupied by a nitrogen molecule is 0.14nm^2 . What is the surface area per gram of silica gel (in m^2)?
25. 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.

EXERCISE-II

(Colloids)

LEVEL-I (MAIN)

Straight Objective Type Questions

1. Particles of which of the following do not pass through ultra filter paper
1) colloids only 2) true solutions
3) suspensions only 4) colloids and suspension
2. The Tyndall effect in colloidal solutions is due to
1) scattering of light 2) reflection of light
3) absorption of light 4) charge of particles

3. Which of the following is a homogeneous system?
 1) suspension 2) colloid solution 3) true solution 4) starch solution
4. 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
5. The dispersed phase, dispersion media, and the nature of colloidal solution of gold sol respectively are
 1) Solid, solid, lyophobic 2) Liquid, liquid, lyophobic
 3) Solid, liquid, lyophobic 4) Solid, liquid, lyophilic
6. Gold numbers of protective colloids A,B, C and D are 0.50, 0.01, 0.10, and 0.005 respectively. The correct order of their protective power is
 1) C < B < D < A 2) A < C < B < D 3) A < B < C < D 4) D < A < C < B
7. Which of the following is a non electrolytic colloidal sol?
 1) Starch 2) AgCl sol 3) Arsenic sulphide sol 4) Sb_2S_3 sol
8. In Faraday-Tyndall effect the colloidally suspended particles
 1) trace out the path of strong beam of light 2) coagulate
 3) show electrophoresis 4) show brownian movement
9. Which one of the following constitutes irreversible colloidal system with water as dispersion medium?
 1) Clay 2) Platinum 3) $\text{Fe}(\text{OH})_3$ 4) All of three
10. Insecticide sprays are example of
 1) Liquid in gas 2) Gas in liquid 3) Gas in solid 4) Solid in liquid
11. Bredig's arc method is used for the preparation of colloidal solution of
 1) Organic compounds 2) metals like silver, gold etc
 3) two liquids 4) inorganic compounds
12. There is no scum formation when hard water is being used. The washing powder can be
 1) $\text{C}_{17}\text{H}_{35}\text{COONa}$ 2) $\text{R}-\text{C}_6\text{H}_4-\text{SO}_3\text{Na}$ 3) both 4) none
13. Non-ionogenic surfactants are
 1) $\text{R}-\text{C}_6\text{H}_4-\text{SO}_3\text{Na}$ 2) $\text{C}_{17}\text{H}_{35}\text{COONa}$
 3) $\text{C}_n\text{H}_{2n+1}(\text{OCH}_2\text{CH}_2)\text{OH}$ 4) All
14. Micelles are
 1) Ideal solution 2) Associated colloids 3) Adsorbed surfaces 4) Absorbent solutes
15. A sol is prepared by addition of excess of AgNO_3 solution in KI solution. The charge likely to develop on colloidal particles is
 1) Negative 2) Positive 3) No charge 4) Both charges
16. The gold number of four protective colloids A, B, C and D are 0.03, 0.003, 10 and 30 respectively. Protective power of these colloids will be in the order:
 1) B > A > C > D 2) A > B > C > D 3) C > B > D > A 4) D > A > C > B
17. Cottrell precipitator works on the principle of
 1) distribution law 2) addition of electrolyte
 3) neutralisation of charge on colloids 4) Le Chatelier's principle

18. What is the emulsifier in milk?

- 1) Albumin 2) Soap 3) Gelatin 4) Caesin

Numerical Value Type Questions

19. For the coagulation of 50ml of ferric hydroxide sol 10ml of 0.5M KCl is required. What is the coagulation value of KCl

LEVEL-II (ADVANCED)

Straight Objective Type Questions

1. Which one of the following has maximum value of floccuation power
 a) Pb^{2+} b) Pb^{4+} c) Sr^{2+} d) Na^+
2. Which of the following electrolytes will be most effective ion in the coagulation of gold sol
 a) NaNO_3 b) $\text{K}_4[\text{Fe}(\text{CN})_6]$ c) Na_3PO_4 d) MgCl_2
3. The coagulating power of an electrolyte for Arsenous sulphide sol decreases in the order
 a) $\text{Na}^+ > \text{Al}^{3+} > \text{Ba}^{2+}$ b) $\text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{Cl}^-$ c) $\text{Cl}^- > \text{SO}_4^{2-} > \text{PO}_4^{3-}$ d) $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$
4. The coagulation of 200 ml of a positive colloid took place when 0.73g HCl was added to it without changing the volume much. The flocculation value of HCl for the colloid is
 a) 0.365 b) 36.5 c) 100 d) 200
5. Blue colour of the sky is due to
 a) Absorption of light by dust particle b) Scattering of light by dust particle
 c) Reflection of light by dust particle d) Presence of clouds
6. The volume of a colloidal particle V_c as compared to the volume of a solute particle in a true solution V_s could be
 a) $\frac{V_c}{V_s} = 10^3$ b) $\frac{V_c}{V_s} = 10^{-3}$ c) $\frac{V_c}{V_s} = 10^{23}$ d) $\frac{V_c}{V_s} = 1$
7. The apparatus used to coagulate carbon particles from smoke is called
 a) Cottrell smoker b) Cottrell absorber c) Cottrell precipitator d) None
8. When freshly precipitated Fe(OH)_3 is boiled with water in the presence of few drops of dil HCl, a hydrated ferric oxide sol is obtained. This method is termed
 a) Dialysis b) Peptization c) ultrafiltration d) Electro dispersion
9. Which of the following forms micelles in solutions of higher concentrations
 a) Sodium carbonate b) Sodium bicarbonate
 c) Potassium acetate d) Sodium stearate
10. A substance which forms micelles in solutions contains
 a) carboxylic group
 b) alkyl group
 c) water insoluble long hydrocarbon groups and water soluble polar groups
 d) water soluble hydrocarbon group and water insoluble polar group
11. A lyophilic sol is at its isoelectric point then it is:
 a) negatively charged b) positively charged c) not charged d) none of these

12. During micelle formation:
- $\Delta H = +ve; \Delta S = +ve$
 - $\Delta H = -ve, \Delta S = +ve$
 - $\Delta H = -ve, \Delta S = +ve$
 - $\Delta H = +ve, \Delta S = -ve$
13. Gel on standing excludes small amounts of liquid. This phenomenon is known as
- syneresis
 - efflorescence
 - adsorption
 - thixotropy
14. A micelle formed during the cleansing action by soap is
- a discrete particle of soap
 - an aggregated particles of soap and dirt
 - a discrete particle of dust
 - an aggregated particle of dust and water

More than One correct answer Type Questions

15. Anionic surfactants are
- $C_{15}H_{31}COONa$
 - $R-\text{C}_6\text{H}_4-\text{SO}_3\text{Na}$
 - $C_{18}H_{37}NH_3Cl$
 - All
16. Cationic surfactants are
- $C_{17}H_{33}COONa$
 - $R-\text{C}_6\text{H}_4-\text{SO}_3\text{Na}$
 - $C_{16}H_{33}-\text{C}_6\text{H}_4-\text{N}^+-\text{Cl}^-$
 - $C_{16}H_{33}\text{N}(\text{CH}_3)_3\text{Cl}$
17. Which of the following is represented by sols
- Adsorption
 - Tyndal effect
 - Flocculation
 - Paramagnetism
18. Select the properties which are for lyophilic colloidal sols
- Viscosity same as that of the medium
 - Extensive hydration takes place
 - Particles migrate either towards cathode or anode in an electric field
 - Particles cannot be detected even under ultramicroscopes
19. Colloidal gold can be prepared by
- reduction of AuCl_3
 - Bredig's arc method
 - hydrolysis
 - Peptization
20. Coagulation or de-emulsification can be done by which of the methods given below.
- by addition of a substance which would destroy the emulsifier
 - by addition of an electrolyte which would destroy the charge
 - by heating, freezing and centrifuging
 - by electro phoresis
21. Bleeding of blood is stopped due to
- the coagulation of blood by applying FeCl_3 and blood vessel is sealed
 - the coagulation of blood by applying Alum and blood vessel is sealed
 - blood combines with the FeCl_3
 - blood combines with Alum
22. At CMC, the surfactant molecules undergo:
- Ionization
 - aggregation
 - micelle formation
 - reduction in the surface tension of water
23. Which among the following are lyophilic in nature?
- Starch
 - Gum
 - Gelatin
 - Gold

*Linked Comprehension Type Questions**Passage :*

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.

24. The size of the colloidal particles lies in the range
 a) 10nm – 1000nm b) 10m μ – 1000m μ c) 1nm – 1000nm d) 10^{-5} cm – 10^{-7} cm
25. The colloidal solution of a solid as the dispersed phase and a gas as the dispersion medium is called
 a) Sol b) Solid foam c) Aerosol d) Gel

Matrix Matching Type Questions

- | | |
|--|--|
| 26. Column-I <ul style="list-style-type: none"> A) Brownian motion B) Tyndall effect C) Particle Size 10^{-9} – 10^{-8} m D) Completely transparent | Column-II <ul style="list-style-type: none"> p) Colloidal solution q) True solution r) Suspension s) Emulsion t) Scattering of light |
| 27. Column-I <ul style="list-style-type: none"> A) Bredig's arc method B) Electro dialysis C) Ultra filtration D) Peptization | Column-II <ul style="list-style-type: none"> p) Movement of ions towards oppositely charged electrodes q) Preparation of metal sols r) Purification of sols s) Preparation of colloidal solution t) The precipitate adsorbs one of the ions of the electrolyte on its surface. |
| 28. Column-I <ul style="list-style-type: none"> A) Mist B) Rain Cloud C) Jellies D) Whipped cream | Column-II <ul style="list-style-type: none"> p) Gel q) Foam r) Aerosol s) Solid or liquid dispersed in air |

Integer Type Questions

29. The no of moles of lead nitrate needed to coagulate 2 moles of colloidal $[AgI]$ I^- is ____
30. In an experiment addition of 10ml of 0.05 M $BaCl_2$ to 20ml of As_2S_3 sol causes coagulation in 1 hr. If the coagulation value of Ba^{+2} ion is $x^2/3$ then $x = ?$
31. When 1.0×10^{-5} mg of a protective colloid is added to 20 ml of standard gold sol, the precipitation of gold sol was prevented by adding 5 ml of 10% solution of NaCl. If the gold number of protective colloid is 10^{-x} then x is
32. The particle size of suspension should be greater than $10^x A^0$, x is ____
33. 548 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:
34. In an experiment, addition of 5.0 ml, of 0.005 M $BaCl_2$ to 10.0 ml of arsenic sulphite sol just causes the complete coagulation in 100 min. The flocculating value of the effective ion is :

EXERCISE-III

(Catalysis)

LEVEL-I (MAIN)

Straight Objective Type Questions

1. Catalyst increases the rate by
 - 1) Decreasing E_a
 - 2) Increasing E_a
 - 3) Decreasing Pressure
 - 4) Increasing entropy
2. Which of the following catalyst is used during the hydrogenation of oil?
 - 1) Fe
 - 2) Ni
 - 3) Pt
 - 4) Mo
3. Which of the following is present at the time of cracking of hydrocarbons?
 - 1) Copper
 - 2) Zeolite
 - 3) Nickel
 - 4) Molybdenum
4. Which is not the correct statement for a catalyst?
 - 1) It does not alter E_a
 - 2) The surface of a catalyst adsorbs reactants
 - 3) Catalyst may form intermediates with reactants
 - 4) Action of enzyme catalyst is always specific
5. Match Column-A (Catalyst) with Column-B (process)

A	B
1) Fe	I) Cracking of hydrocarbon
2) Pt	II) Haber process
3) Zeolites	III) Automobile converter
1) 1-I; 2-II; 3-III	2) I-III; 2-II; 3-I
3) 1-II; 2-III; 3-I	3) 1-II; 2-III; 3-I
4) 1-III; 2-I; 3-II	4) 1-III; 2-I; 3-II
6. Catalyst used in polymerization of ethene is
 - 1) $TiCl_4$ and AlR_3
 - 2) Fe, Co
 - 3) H_3PO_4
 - 4) Zeolites
7. Energy of activation of forward and backward reaction are equal in cases (numerical values) where
 - 1) $\Delta H = 0$
 - 2) No catalyst present
 - 3) $\Delta S = 0$
 - 4) Stoichiometry is the mechanism
8. What is the role of a catalyst in a catalyzed reaction?
 - 1) Lowers the activation energy
 - 2) Increases the activation energy
 - 3) Affects the free energy change
 - 4) Affects the enthalpy change
9. The role of a catalyst in a reversible reaction is to
 - 1) Increase the rate of forward reaction only
 - 2) Decrease the rate of backward reaction only
 - 3) Alter the equilibrium constant of the reaction
 - 4) Allow the equilibrium to be achieved quickly
10. Which of the following catalyzes the conversion of glucose into ethanol?
 - 1) Zymase
 - 2) Invertase
 - 3) Maltase
 - 4) Diastase
11. Which of the following affects the adsorption of gas on the surface of solid?
 - 1) Critical temperature
 - 2) Pressure of gas
 - 3) Temperature
 - 4) All of these
12. An inhibitor is essentially:
 - 1) an autocatalyst
 - 2) a negative catalyst
 - 3) a catalyst promoter
 - 4) a homogeneous catalyst

13. An example for homogeneous catalysis is:
- Contact process
 - Haber's process
 - Lead chamber process
 - Hydrogenation of oil
14. For chemisorption, which of the following is wrong?
- irreversible
 - it requires activation energy
 - it forms multi molecular layer on adsorbate
 - surface compounds are formed

Numerical Value Type Questions

15. In presence of catalyst, the activation energy is lowered by 3 k cal at 27°C. Hence, the rate of reaction will increase by:

LEVEL-II (ADVANCED)***Straight Objective Type Questions***

- Which of the following process does not occur at the interface of phases?
 - Crystallisation
 - Heterogeneous catalysis
 - Homogeneous catalysis
 - Corrosion
- Hydrolysis of protein in stomach and in intestine takes place due to action of enzyme:
 - pepsin in stomach, trypsin in intestine
 - trypsin in stomach, pepsin in intestine
 - both (a) and (b)
 - none of the above
- Which of the following is not a property of catalyst?
 - A catalyst remains unchanged chemically at the end of chemical reaction
 - A catalyst takes part in a chemical reaction
 - All kinds of catalysis undergo catalytic poisoning
 - A catalyst physically changes at the end of reaction
- The rate of a certain biochemical reaction catalysed by an enzyme in human body is 104 times faster than when it is carried out in the laboratory. The activation energy of this reaction:
 - is zero
 - is different in two cases
 - is the same in both the cases
 - none of the above
- Air can oxidize sodium sulphite in aqueous solution but cannot do so in the case of sodium arsenite. If however, air is passed through a solution containing both sodium sulphite and sodium arsenite then both are oxidized. This is an example of
 - positive catalysis
 - negative catalysis
 - induced catalysis
 - auto-catalysis
- In the reversible reaction, a catalyst is the substance which
 - Increases the rate of the forward reaction
 - Decreases the value of enthalpy change in the reaction
 - Reduces the time required for reaching the equilibrium state in the reaction
 - Decreases the rate of the reverse reaction
- The components of Zigler-Natta catalyst are
 - $\text{TiCl}_3 + \text{Al}(\text{C}_2\text{H}_5)_3$
 - $\text{TiCl}_4 + \text{Al}(\text{C}_2\text{H}_5)_3$
 - $\text{Ti}(\text{C}_2\text{H}_5)_3 + \text{AlCl}_3$
 - $\text{Ti}(\text{C}_2\text{H}_5)_4 + \text{AlCl}_3$
- The decomposition of H_2O_2 is slowed down by the addition of small amount of acetamide. Acetamide acts as :
 - promoter
 - stopper
 - inhibitor
 - poison

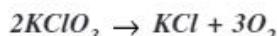
9. Catalyst can alter:
- The amount of product
 - heat of reaction
 - rate constant
 - equilibrium constant

More than One correct answer Type Questions

10. Which of the following statements are correct about solid catalyst?
- Same reactants may give different products by using different catalysts
 - Catalyst does not change ΔH of reaction.
 - Catalyst is required in large quantities to catalyse reaction
 - Catalytic activity of a solid catalyst does not depend upon the strength of chemisorption
11. In a reaction, catalyst changes _____
- physically
 - qualitatively
 - chemically
 - quantitatively
12. Which act(s) as negative catalyst?
- Lead tetraethyl as antiknock compound
 - Glycerol in decomposition of H_2O_2
 - Ethanol in oxidation of chloroform
 - None of the above
13. Which of the following statements is/are true?
- Iron is used as a catalyst in the hydrogenation of oils
 - V_2O_5 is used as a catalyst in the oxidation of SO_2 to SO_3
 - Haber's process requires iron as a catalyst
 - Thermite process does not involve any catalyst
14. Which of the following statements is/are true for heterogeneous catalysis?
- The energy of activation does not change
 - The catalyst combines with the reactant to form a compound
 - The reactant molecules are adsorbed on the surface of the catalyst
 - The catalyst lowers the energy of activation
15. Which of the following is/are not affected by the catalyst?
- Heat of reaction
 - Equilibrium constant
 - Amount of product
 - Rate constant of the reaction
16. Which of the following are correct about the catalyst?
- Physical adsorption is of multimolecular layer
 - Degree of chemical adsorption increases with increase in temperature
 - Adsorption increases the surface energy
 - Sometimes solvent is adsorbed in preference to solution
17. Select the correct statements about enzymes:
- Enzymes are biological catalysts found in organisms
 - All enzymes are proteins
 - Enzymes can catalyse any reaction
 - Enzymes activity is optimum at $27^\circ C$

*Linked Comprehension Type Questions**Passage :*

Catalysis are not consumed in the reaction, hence very small non-stoichiometric quantities are generally required. For example when potassium chlorate heated strongly decomposes slowly giving dioxygen, the decomposition occurs in the temperature range of 653-873K.



18. The oxidation of oxalic acid by acidified KMnO_4 becomes faster with the passage of time due to:
- a) Presence of H^+ ions
 - b) autocatalysis by Mn^{2+}
 - c) Presence of MnO_4^- ions
 - d) Presence of K^+ ions
19. In case of autocatalysis:
- a) product acts as catalyst
 - b) reactant acts as catalyst
 - c) solvent acts as catalyst
 - d) heat produced in the reaction catalysis

Matrix Matching Type Questions

- | | |
|---------------------|--|
| 20. Column-I | Column-II |
| A) Quinoline | p) Inhibitor for decomposition of H_2O_2 |
| B) Acetamide | q) Catalyst |
| C) Zeolite | r) Removes hardness of water |
| D) Nickel | s) Poison for Pd in Lindlar's catalyst |
-
- | | |
|---------------------------|--|
| 21. Column-I | Column-II |
| A) Nickel | p) Conversion of SO_2 into SO_3 |
| B) V_2O_5 | q) Conversion of starch into sugar |
| C) Diastase | r) Accumulation of molecules at the surface of a solid or liquid |
| D) Adsorption | s) Hydrogenation of vegetable oils |

KEY SHEET (PRACTICE SHEET)**EXERCISE-I**

LEVEL-I	1) 2	2) 3	3) 3	4) 2	5) 3	6) 2	7) 2	8) 2
	9) 2	10) 4	11) 4	12) 1	13) 1	14) 1	15) 4	
LEVEL-II	1) d	2) b	3) a	4) d	5) c	6) a	7) b	8) d
	9) c	10) b	11) a	12) acd	13) acd	14) abc	15) abd	16) abd
	17) d	18) a	19) d	20) d	21) a	22) A-qt; B-p; C-r; D-ps		
	23) A-p; B-qr; C-qr; D-s		24) 5	25) 6				

EXERCISE-II

LEVEL-I	1) 4	2) 1	3) 3	4) 1	5) 3	6) 2	7) 1	8) 1
	9) 4	10) 1	11) 2	12) 2	13) 3	14) 2	15) 2	16) 1
	17) 3	18) 4	19) 100					

LEVEL-II

- 1) b 2) d 3) d 4) c 5) b 6) a 7) c 8) b
 9) d 10) c 11) d 12) a 13) a 14) b 15) ab 16) cd
 17) abc 18) bd 19) ab 20) abcd 21) ab 22) bcd 23) abc 24) c
 25) c 26) A-pqrs; B-prst; C-ps; D-q 27) A-qs; B-pr; C-r; D-st
 28) A-rs; B-rs; C-p; D-q 29) 1 30) 5 31) 6 32) 3 33) 4
 34) 2

EXERCISE-III**LEVEL-I**

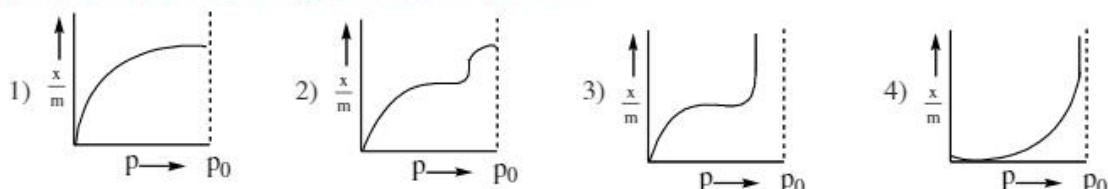
- 1) 1 2) 2 3) 2 4) 1 5) 3 6) 1 7) 1 8) 1
 9) 4 10) 1 11) 4 12) 2 13) 3 14) 3 15) 148

LEVEL-II

- 1) c 2) a 3) d 4) b 5) c 6) c 7) b 8) c
 9) c 10) ab 11) ab 12) abc 13) bcd 14) bcd 15) abc 16) abd
 17) abd 18) b 19) a 20) A-s; B-p; C-qr; D-q
 21) A-s; B-p; C-q; D-r

ADDITIONAL PRACTICE EXERCISE**LEVEL-I (MAIN)***Straight Objective Type Questions*

1. Which of the following adsorption isotherms represents the adsorption of a gas by a solid involving finite number of layers (p_0 = saturation pressure)?



2. The colligative property of a sol compared to the aqueous solution of glucose of same concentration will be

- 1) much smaller 2) much higher 3) the same 4) slightly lower
3. When FeCl_3 solution is added to NaOH a negatively charged sol is obtained. It is due to the
 1) Presence of basic group 2) Preferential adsorption of OH^- ions
 3) Self dissociation 4) Electron capture by sol particles
4. Graph between $\log \frac{x}{m}$ and $\log P$ is a straight line inclined at an angle $\theta = 45^\circ$. When pressure of 0.5 atm and $\log k = 0.699$, the amount of solute adsorbed per g of adsorbent will be
 1) 1 g/g adsorbent 2) 1.5 g/g adsorbent
 3) 2.5 g/g adsorbent 4) 0.25 g/g adsorbent

LEVEL-II

LECTURE SHEET (ADVANCED)

Straight Objective Type Questions

6. Which of the following is characteristic of an oil in water type of emulsion
 a) both oil and water are dispersed phases b) water is dispersed phase
 c) both oil and water are dispersion media d) oil is dispersed phase
7. Tyndall effect is not observed in
 a) True solution b) Suspension c) Emulsions d) Colloidal solution
8. Which one of the following constitutes irreversible colloidal system with water as dispersion medium?
 a) Clay b) Platinum c) Fe(OH)_3 d) All of three
9. Which of the following form micelles in aqueous solution above certain concentration
 a) Glucose b) Urea c) Dodecyl trimethyl ammonium chloride d) Pyridinium chloride
10. Which of the following is not an emulsion
 a) Butter b) Hair cream c) Milk d) Cloud
11. Oil soluble dye is mixed with water - in - oil emulsion then
 a) dispersion medium is coloured b) dispersed phase is coloured
 c) Both (a) and (b) d) None of these
12. Oil soluble dye is mixed with emulsion and emulsion remains colourless then it is
 a) O-in-W b) W-in-O c) O-in-O d) W-in-W
13. Which one is an example of micelle system
 a) Soap + Water b) Protein + Water c) Rubber + Benzene d) $\text{As}_2\text{O}_3 + \text{Fe(OH)}_3$
14. Soap removes grease by
 a) Adsorption b) Emulsification c) Coagulation d) None of these
15. **Column-I (Colloidal solution)**
- A) Liquid in gas
 - B) Solid in gas
 - C) Liquid in liquid
 - D) Solid in liquid
- Column-II (Example)**
- 1) Milk
 - 2) Paints
 - 3) Smoke
 - 4) Cloud
 - 5) Gold sol
- a) A-4; B-3; C-1; D-2 b) A-2; B-1; C-5; D-4
 c) A-4; B-3; C-2; D-5 d) A-1; B-4; C-3; D-2

More than One correct answer Type Questions

16. Which of the following are correct statements?
- a) Spontaneous adsorption of gases on solid surface is an exothermic process as entropy decreases during adsorption
 - b) Formation of micelles takes place when temperature is below Kraft Temperature (T_K) and concentration is above critical micelle concentration (CMC)
 - c) A colloid of Fe(OH)_3 is prepared by adding a little excess (required to completely precipitate Fe^{3+} ions as Fe(OH)_3) of NaOH in FeCl_3 solutions
 - d) According to Hardy-Schulze rules the coagulation (flocculating) value of Fe^{3+} ion will be more than Ba^{2+} or Na^+ .

17. Choose the correct statements.

- a) The movement of colloidal particles towards positive or negative electrode in an electric field is called electrophoresis
- b) The liquid-liquid colloidal dispersions are called emulsions
- c) The colloidal dispersions of liquids in solids media are called gels.
- d) The enthalpy of chemisorption is more negative than that of physisorption

18. Which one of the following is/are the surfactant/s?

- a) $\text{CH}_3 - (\text{CH}_2)_{15} - \underset{\substack{| \\ \text{CH}_3}}{\text{N}^+} - \text{CH}_3\text{Br}^-$
- b) $\text{CH}_3 - (\text{CH}_2)_{14} - \text{CH}_2 - \text{NH}_2$
- c) $\text{CH}_3 - (\text{CH}_2)_{16} - \text{CH}_2\text{OSO}_2^- \text{Na}^+$
- d) $\text{OHC} - (\text{CH}_2)_{14} - \text{CH}_2 - \text{COO}^- \text{Na}^+$

19. If a chemical reaction is catalyzed by a catalyst X, then which of the following statements is/are incorrect?

- a) X reduces enthalpy of the reaction
- b) X decreases rate constant of the reaction
- c) X increases activation energy of the reaction
- d) X does not affect equilibrium constant of the reaction

Linked Comprehension Type Questions

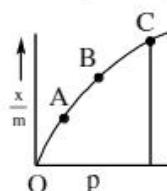
Passage :

The section contains one paragraph. Based upon the paragraph, 3 multiple choice questions have to be answered. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE is correct.

A graph between x/m and the pressure P of the gas at a constant temperature is called adsorption isotherm, where x is the number of moles of the adsorbate and m is the mass of the adsorbent.

Adsorption isotherms of different shapes have been experimentally observed. According to Freundlich adsorption isotherm, $x/m = kP^{1/n}$

Where k and n are constant parameters depending upon the nature of the solid and gas.

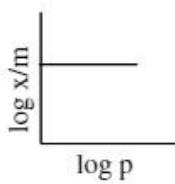


20. In the given isotherm select the incorrect statement

- a) $\frac{x}{m} \propto P$ along OA
- b) $\frac{x}{m} \propto P$ when point B is reached
- c) $\frac{x}{m}$ does not increase as rapidly with pressure along BC due to less surface area available for adsorption
- d) Nature of isotherm is different for two gases for some adsorbent

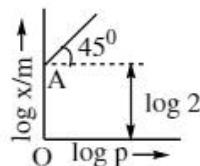
21. Adsorption isotherm of $\log\left(\frac{x}{m}\right)$ and $\log P$ was found of the type. This is true when

- a) $P = 0$
- b) $P = 1$
- c) $\frac{1}{n} = 1$
- d) $n = \infty$



22. Graph between $\log\left(\frac{x}{m}\right)$ and $\log P$ is a straight line at angle 45^0 with intercept OA as shown. Hence, $\left(\frac{x}{m}\right)$ at a pressure of 2 atm

- a) 2
- b) 4
- c) 8
- d) 1



Integer Type Questions

23. In an experiment, 200 ml of 0.5M oxalic acid is shaken with 10g of activated charcoal and filtered.

The concentration of the filtrate is reduced to 0.4M. The amount of adsorption $\left(\frac{x}{m}\right)$ is 0.06 p. Find the value of p.

24. How many following statements is false ?

- a) Increase of pressure of a gas causes the amount of adsorption to increase
- b) Increase of temperature may increase or decrease the amount of adsorption
- c) The adsorption may be monolayer or multilayer
- d) Particle size of the adsorbent does not affect the amount of adsorption

PRACTICE SHEET (ADVANCED)

Straight Objective Type Questions

1. The ability of an ion to bring about coagulation of a given colloid depends upon
 - a) Its size
 - b) The magnitude of its charge only
 - c) The sign of its charge
 - d) Both the magnitude and the sign of its charge
2. In the reaction $2SO_2 + O_2 \xrightarrow[AS_2O_3]{Pt} 2SO_3$, AS_2O_3 acts as a
 - a) autocatalyst
 - b) poison
 - c) promotor
 - d) positive catalyst
3. Amongst the following chemical reactions, the one representing homogeneous catalysis is

a) $N_2(g) + 3H_2(g) \xrightarrow{Fe} 2NH_3(g)$	b) $2SO_2(g) + O_2(g) \xrightarrow{2NO} 2SO_3(g) + 2NO(g)$
c) $CO(g) + 3H_2(g) \xrightarrow{Ni} CH_4(g) + H_2O$	d) $2SO_2(g) + O_2 \xrightarrow{V_2O_5} 2SO_3(g)$

4. According to the adsorption theory of catalysis, the speed of the reaction increases because
 - a) Adsorption lowers the activation energy of the reaction
 - b) The concentration of reactant molecules at the active centres of the catalyst becomes high due to strong adsorption
 - c) In the process of adsorption, the activation energy of the molecules becomes large
 - d) Adsorption produces heat which increases the speed of the reaction
5. Catalyst increases the rate of reaction by
 - a) decreasing threshold energy
 - b) decreasing activation energy
 - c) increasing activation energy
 - d) decreasing equilibrium constant
6. 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
7. The enzyme ptyalin used for the digestion of food is present in
 - a) saliva
 - b) blood
 - c) intestine
 - d) adrenal glands
8. In the redox reaction $2\text{MnO}_4^- + 5\text{C}_2\text{O}_4^{2-} + 16\text{H}^+ \rightleftharpoons 2\text{Mn}^{2+} + 10\text{CO}_2 + 8\text{H}_2\text{O}$. The ion acting as autocatalyst is
 - a) MnO_4^-
 - b) $\text{C}_2\text{O}_4^{2-}$
 - c) H^+
 - d) Mn^{2+}
9. The process which is catalysed by one of the products is called
 - a) acid-base catalysis
 - b) autocatalysis
 - c) negative catalysis
 - d) none of these
10. A catalyst remains unchanged at the end of the reaction regarding
 - a) mass
 - b) physical state
 - c) physical state and chemical composition
 - d) mass and chemical composition
11. Soap removes grease by
 - a) Adsorption
 - b) Emulsification
 - c) Coagulation
 - d) None of these
12. Concentration of uniform ‘micelle’ particles at CMC of a surfactant solution is 0.004M. Charge carried by each micelle is 4×10^{-17} coulombs. What is the molar concentration of the surfactant (soap) at CMC ?
 - a) 1M
 - b) 0.5 M
 - c) 0.2 M
 - d) 0.3 M
13. Which of the following give a positive micelle ?
 - a) $\text{CH}_3 - \text{CH}(\text{CH}_3)_2 - (\text{CH}_2)_5 - \text{N}(\text{CH}_3)_2 / \text{HCl}$
 - b) $\text{C}_{17}\text{H}_{35}\text{COOH}/\text{KOH}$
 - c) $\text{C}_{12}\text{H}_{25}\text{SO}_3\text{H} / \text{KOH}$
 - d) $\text{C}_{17}\text{H}_{33}\text{COONa}$
14. During micelle formation _____ in solution
 - a) VantHoff factor increases
 - b) VantHoff factor decreases
 - c) Colligative properties increases
 - d) Entropy decreases

15. Which of the following examples is/are oil-in-water-type emulsion?
 a) Ink b) Detergent c) Soap d) Milk
16. Emulsion can be destroyed by (more than one correct)
 a) The addition of emulsifier which tends to form another emulsion
 b) Electrophoresis with high potential
 c) Freezing
 d) All
17. Butter is an emulsion of type
 a) Water in oil b) Oil in water c) None d) adsorption
18. 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
19. Which of the following is homogeneous
 a) Milk b) Paint c) Shampoo d) All
20. Micelles are
 a) Emulsion-cum-gel b) Adsorbed catalyst c) Associated colloids d) Ideal solutions

More than One correct answer Type Questions

21. Which is/are correct statements about heterogeneous catalysis
 a) The reactants molecules form an intermediate compound with the catalyst
 b) The reactants get adsorbed side by side on the catalyst surface and react
 c) The products remain adhered to the catalyst
 d) The products formed immediately leave the surface of the catalyst
22. Which one of the following statements is/are correct in the case of heterogeneous catalysis?
 a) The catalyst lowers the energy of activation
 b) The catalyst actually forms a compound with the reactant
 c) The surface of the catalyst plays a very important role
 d) There is no change in the enegy of activation
23. Identify the incorrect statements regarding enzymes?
 a) Enzymes are specific biological catalyst that cannot be poisoned
 b) Enzymes are normally heterogeneous catalysts that are very specific in their action
 c) Enzymes are specific biological catalysts that can normally function at very high temperature ($T \sim 1000K$)
 d) Enzymes are specific biological catalysts that posses well-defined active sites
24. Regarding criteria of catalysis which one of the following statements is are true?
 a) The catalyst is unchanged chemically at the end of the reaction
 b) A small quantity of catalyst is often sufficient to bring
 c) In a reversible reaction the catalyst alters the equilibrium position
 d) The catalyst accelerates the reaction

Matrix Matching Type Questions**25. Column-I**

- A) Sb_2S_3 sol
 B) Gold sol
 C) Casein
 D) Gum arabic

Column-II

- p) Stabilized by electric charge on sol particles
 q) Highly sensitive to coagulation by electrolytes
 r) Intrinsic colloid
 s) Stabilized by electric charge and hydration of sol particles

26. Column-I

- A) Adsorption involving p van der waal's forces
 B) Adsorption involving chemical forces
 C) Positive adsorption of a solute on liquid surface of liquid
 D) Negative adsorption of a solute on surface of liquid

Column-II

- p) Specific and increases with temperature
 q) Non-specific and decreases with temp.
 r) Leads to decrease in surface tension
 s) Leads to increase in surface tension

KEY SHEET (ADDITIONAL PRACTICE EXERCISE)**LEVEL-I (MAIN)**

1) 2 2) 1 3) 2 4) 2 5) 2 6) 4 7) 3 8) 2 9) 3 10) 2

LEVEL-II**LECTURE SHEET (ADVANCED)**

1) c	2) b	3) b	4) b	5) d	6) d	7) a	8) d	9) c	10) d
11) a	12) a	13) a	14) b	15) a	16) abcd	17) abcd		18) acd	
19) abc	20) b	21) b	22) b	23) 3	24) 1				

PRACTICE SHEET (ADVANCED)

1) d	2) b	3) b	4) a	5) b	6) d	7) a	8) d	9) b	10) d
11) b	12) a	13) a	14) b	15) d	16) bc	17) a	18) a	19) a	20) a
21) bd	22) ac	23) abc	24) abd	25) A-pq; B-pq; C-rs ; D-rs					
26) A-q; B-q; C-r; D-s									

