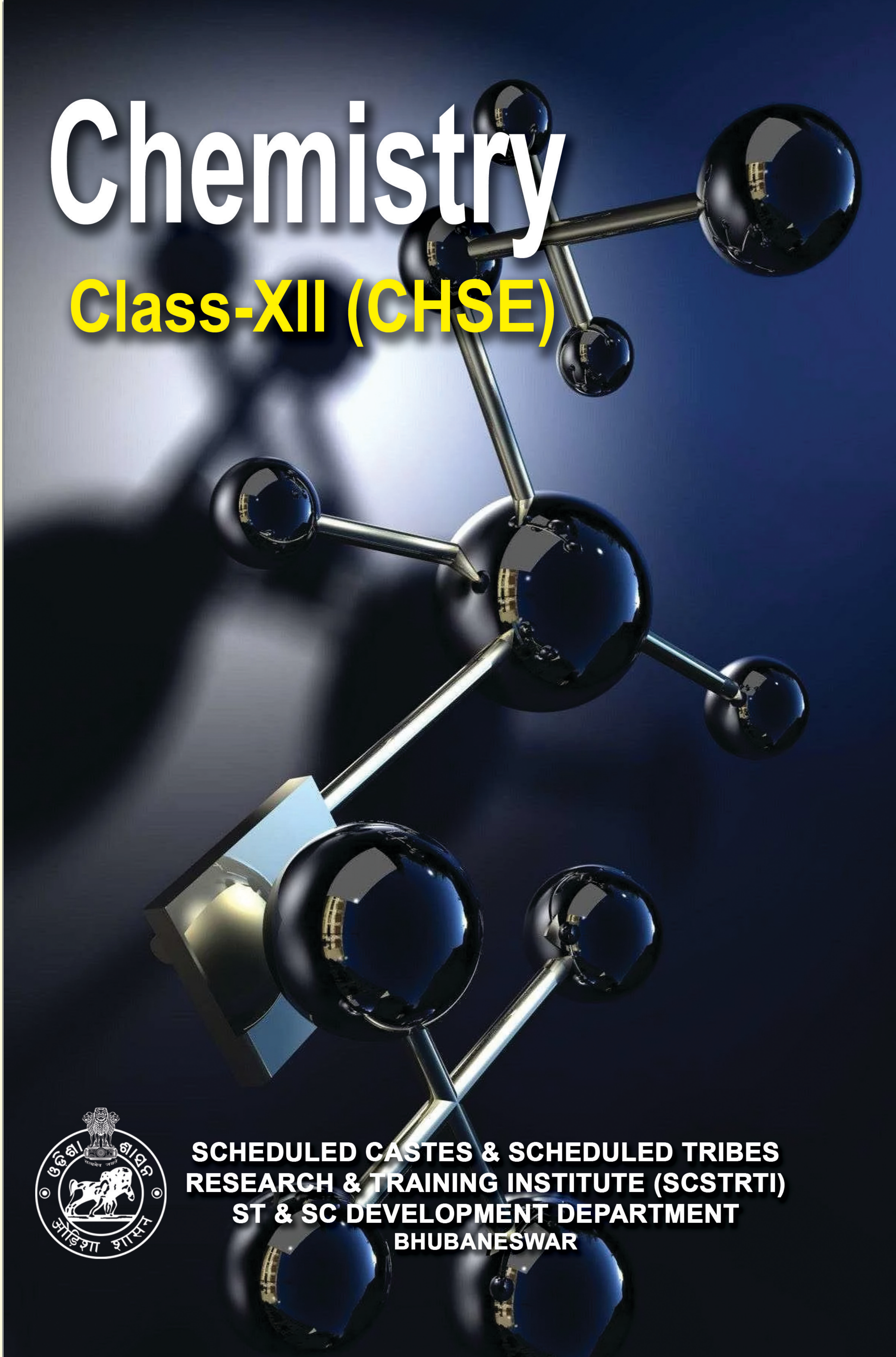
Workbook Cum Question Bank with Answers



Chemistry

Class-XII (CHSE)

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ओड़िशा शासन

SCHEDULED CASTES & SCHEDULED TRIBES
RESEARCH & TRAINING INSTITUTE (SCSTRTI)
ST & SC DEVELOPMENT DEPARTMENT
BHUBANESWAR

CHEMISTRY

WORKBOOK-CUM-QUESTION BANK WITH ANSWERS

CLASS - XII (CHSE)

Compiled by :

Dr. Uttam Kumar Biswal
Reader in Chemistry (Retd.)
B. J. B. (Autonomous) College,
Bhubaneswar

ST & SC DEVELOPMENT DEPARTMENT
GOVERNMENT OF ODISHA

Prepared by

**SCHEDULED CASTES SCHEDULED TRIBES
RESEARCH AND TRAINING INSTITUTE**
BHUBANESWAR-751003

2022

CHEMISTRY

for 2nd year Science

Course Structure

Unit	Title	Marks
I	Solid State	
II	Solutions	
III	Electrochemistry	23
IV	Chemical Kinetics	
V	Surface Chemistry	
VI	Isolation of Elements	
VII	p-Block Elements	
VIII	d- and f- Block Elements	19
IX	Coordination Compounds	
X	Haloalkanes and Haloarenes	
XI	Alcohols, Phenols and Ethers	
XII	Aldehydes, Ketones and Carboxylic Acids	
XIII	Organic Compounds containing Nitrogen	28
XIV	Biomolecules	
XV	Polymers	
XVI	Chemistry in Everyday Life	
	Total	**70**

Unit I: Solid State

Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea). Unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties. Band theory of metals, conductors, semiconductors and insulators and n & p type semiconductors.

Unit II: Solutions

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties - relative lowering of vapour pressure, Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, van't Hoff factor.

Unit III: Electrochemistry

Redox reactions, electrolytes and non-electrolyte conductor, conductance in electrolytic solutions, specific and molar conductivity, variation of conductivity with concentration, Kohlrausch's law, electrolysis and laws of electrolysis (elementary idea), dry cell electrolytic cells and Galvanic cells, lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, Relation between

Gibbs energy change and emf of a cell, fuel cells, corrosion.

Unit IV: Chemical Kinetics

Rate of a reaction (Average and instantaneous), factors affecting rate of reaction: concentration, temperature, catalyst, order and molecularity of a reaction, rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions), concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenius equation.

Unit V: Surface Chemistry

Adsorption - physisorption and chemisorption, factors affecting adsorption of gases on solids, catalysts, homogenous and heterogenous activity and selectivity; enzyme catalysts colloidal state distinction between true solutions,colloids and suspension; lyophilic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation, emulsion - types of emulsions.

Unit VI: General Principles and Processes of Isolation of Elements

Principles and methods of extraction - concentration, oxidation, reduction - electrolytic method and refining; occurrence and principles of extractionof aluminium, copper, zinc and iron.

Unit VII: p - Block Elements

Group15 Elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen preparation properties & uses; compounds of nitrogen, preparation and properties of ammonia and nitric acid, oxides of nitrogen (Structure only); Phosphorus - allotropic forms, compounds of phosphorus: preparation and properties of phosphine, halides PCl_3, PCl_5 and oxoacids (elementary idea only).

Group 16 Elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties, dioxygen: Preparation, Properties and uses, classification of oxides, Ozone, Sulphur allotropic forms; compounds of sulphur: Preparation properties and uses of sulphur - dioxide, sulphuric acid: industrial process of manufacture, properties and uses; oxoacids of sulphur (Structures

only).

Group 17 Elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens, Preparation properties and uses of chlorine and hydrochloric acid,interhalogen compounds, oxoacids of halogens (structure only).

Group 18 Elements: General introduction,electronic configuration, occurrence, trends in physical and chemical properties, uses.

Unit VIII: d and f Block Elements

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in proerties of the first row transition metals - metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation, preparation and properties of $K_2Cr_2O_7$ and $KMnO_4$.

Lanthanoids - Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences.

Actinoids - Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences.

Actinoids - Electronic configuration, oxidation states and comparison with lathanoids.

Unit IX: Coordination Compounds

Coordination compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's therory, VBT and CFT; structure and stereoisomerism, importance of coordination compounds (in qualitative analysis, extraction of metals and biological system).

Unit X: Haloalkanes and Haloarenes

Haloalkanes: Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions, optical rotation.

Haloarenes: Nature of C - X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only.

Uses and environmental effects of - dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT, BHC.

Unit XI: Alcohols, Phenols and Ethers

Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration, uses with special reference to methanol and ethanol.

Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophillic substitution reactions, uses of phenols. Eithers :Nomenclature, methods of preparation physical and chemical properties uses.

Unit XII : Aldehydes, Ketones and Carboxylic Acids

Aldehydes and Ketones : Nomenclature nature of carbonyl group methods of preparation, physical and chemical properties, mechanism of nucleophillic addition reactivity of alpha hydrogen in aldehydes uses. Carboxylic Acids : Nomenclature, acidic nature, methods of preparation, physical and chemical properties uses.

Unit XIII : Organic compunds containing Nitrogen

Amines : Nomenclature classification, structure, methods of preparation, physical and chemical proporties, uses identification of primary, secondary and teritary amines.

Cyanide and Isocyanides-will be mentioned at relevant places in context Diazonium salt - Preparation, chemical reactions and importance in synthetic organic chemistry.

Unit XIV : Biomolecules

Carbohydrates - Classification(aldoses and ketoses) Monosaccahrides(glucose and fructose), D-L configuration oligosaccharides(sucrose, lactose, maltose) polysaccharides(starch, cellulose, glycogem) importance.

Proteins-Elementary idea of l- amino acids, peptide bond, polypeptide, proteins, structure of proteinsprimary secondary, teritary structure and quaternary structure(qualitative idea only), denaturation of proteins, enzymes, hormones-Elementary idea excluding structure

Vitamins-Classification and functions Nucleic Acids : DNA and RNA

Unit XV: Polymers

Classification-Natural and synthetic methods of polymerization(addition and condensation)co polymerization, some important polymers, natural and synthetic like polythene, nylon, polyester, bakelite, rubber, Biodegradable and non-biodegradable polymers.

Unit XVI : Chemistry in Everyday life

Chemical in Medicines- Angesics, traqulizers antiseptics, disinfectants, antimicrobials, antifertility, drugs, antibiotics, antacids, antihistamines.

Chemical in food-Preservations, artificial sweetening agents, elementary idea of antioxidants

Clensing agents-Soap and detergents, cleansing action.

Question Pattern :

Group - A

1.	**MCQ Type**	**[1 x 7]**
2.	**Very short answer type questions**	**[1 x 7]**

Group - B

3.	**Short answer type questions. (7 out of 10)**	**[2 x 7]**
4.	**Short answer type questions. (7 out of 10)**	**[3 x 7]**

Group - C

5.	**Long answer type questions. (3 out of 5)**	**[7 x 3]**

Total Time - 3 Hours

Full Marks - 70

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CONTENTS

Type of Questions **Page**

Very Short Answer Type Questions

Very Sort Answer Type Questions

Multiple Choice Questions : Group – A(1)

UNIT - I

1. The number of atoms/molecules present in one body centred cubic unit cell is:
   (a) 1 (b) 2 (c) 4 (d) 6
2. Wax is an example of:
   (a) Ionic crystal (b) Covalent crystal
   (c) Molecular crystal (d) Metallic crystal
3. In a crystal, the atoms are located at the position of .... potential energy.
   (a) Zero (b) Infinite (c) Minimum (d) Maximum
4. In a solid lattice the cation has left a lattice site and is located at an interstitial position. The lattice defect is known as:
   (a) Interstitial defect (b) Valency defect
   (c) Frenkel defect (d) Schottky defect
5. Ionic solids with Schottky defects contain in their structure:
   (a) Equal number of cations and anion vacancies
   (b) Interstitial anions and anion vacancies
   (c) Cation vacancies only
   (d) Cation vacancies and interstitial cations
6. Which crystal has the largest lattice energy ?
   (a) KCl (b) MgO (c) LiBr (d) NaF
7. A substance Ax By crystallies in fcc lattice in which atom 'A' present each corner of the cube and atom B occupy the centre of each face of the cube. The formula of the compound is –
   (a) AB_3 (b) A_4B_3 (c) A_3B (d) AB_2
8. There are ________ primitive and ________ centered unit cells
   (a) 6, 7 (b) 7, 7 (c) 6, 6 (d) 7, 6
9. The Bravais lattice where $a = b = c,\ \alpha = \beta = \gamma = 90^0$ is _________.
   (a) cubic (b) Rhomboheded (c) Triclinic (d) none of these
10. In the orthorhombic crystal system the edge length and axial angles are ____ and ______ respectively.
    (a) $a \neq b \neq c,\ \alpha = \beta = \gamma = 90^0$ (b) $a = b \neq c, \alpha = \beta = \gamma = 90^0$
    (c) $a \neq b \neq c,\ \alpha \neq \beta \neq \gamma \neq 90^0$ (d) $a = b = c,\ \alpha = \beta = \gamma \neq 90^0$
11. A unit cell consists of a cube in which there are 'A' atoms at the corners and 'B' atoms at the face centred and 'A' atoms are missing from 2-corners in each unit cell. The formula of the compound ________.
    (a) AB_3 (b) A_2B (c) AB_4 (d) A_3B_4\
12. Octahedral voids are present / unit cell of ccp or fcc at
    (a) at the body cube (b) at the centre of each adge
    (c) both (a) and (b)
    (d) no. of octahedral void = no. of tetrahedral void.

13. In the ABAB - Pattern of packing (hcp) –
    (a) Tetrahedral voids of second layer is covered
    (b) fourth layer atom is aligned with 1st layer atom
    (c) Octahedral voids of 2nd layer are covered in 3rd layer.
    (d) both octahedral and tetrahedral voids are covered.

14. ABCABC .... type predicts _____ structure.
    (a) hcp (b) ccp (c) scp (d) none of these

15. The co-ordination number one dimensional close packing is
    (a) 2 (b) four (c) six (d) zero

16. What type of solid is p-nitrophenol ?
    (a) Ionic (b) covalent
    (c) molecular (d) H-bonded molecular solid

17. Which of the following solid is considered as liquid at all temperature ?
    (a) Quick lime (b) hornsilver (c) glass (d) gypsum

18. Solid 'A' is very hard electrical insulater in solid as well as molten state. It melts at very high temperature. What type of solid is it ?
    (a) Ionic (b) covalent (network)
    (c) Molecular (d) metallic

19. The number atoms per unit cell is _____, if cubic base unit cell having one atom on each corner and two atoms on each body diagonal.
    (a) 09 (b) 06 (c) 05 (d) 08

20. The number of voids in ccp per unit cell is
    (a) 08 (b) 04 (c) 12 (d) 06

21. Packing efficiency of ccp structure is ___________ .
    (a) 74% (b) 68% (c) 52.4% (d) 79%

22. The type of cubic lattices to which iron crystal belongs if the cell has an edge length of 268 pm and density of the crystal is 7.86 g/cm^3 (At wt of Fe = 56, $N_A = 6.02\times10^{23}\,\text{mol}^{-1}$) is _____
    (a) fcc (b) cubic
    (c) bcc (d) end central cubic

23. A compound forms hcp structure. The total number of voids per mole of it is ______.
    (a) 1.806×10^{24} (b) 1.806×10^{23} (c) 6.02×10^{23} (d) 1.2×10^{24}

24. Which of the following is not a consequence of Frenkel defect ?
    (a) The electrical conductivity of crystal is expected to increase.
    (b) The presence of holes decreases the stability of the crystal.
    (c) Due to vacant sites the density decreases.
    (d) The dielectric constant in expected to increase.

25. $K^+Cl^-(s)$ on treating in an atmosphere potassium vapour looks
    (a) violet (b) pink (c) yellow (d) white

26. Which of the following does not occur on heating ZnO ?
    (a) It turns yellow on heating & white when cold.
    (b) This is a case of metal excess defect.
    (c) Can function as n-type semiconductor.
    (d) The crystal becomes diamagnetic on heating.

27. Choose the incorrect satement` from the following :

(a) $\overline{e}$ in anion vacancy creates F-centre (F = Farbe)

(b) In defective ZnO, the Zn^{2+} ions occupy certain interstitial sites.

(c) Semiconductors are produced due to impurity defect.

(d) Conductivity ionic solid can be explained by $\overline{e}$ gas model.

28. 'K' crystalises in bcc lattice. Hence the co-ordination number of element in the crystal structure is :

(a) 0 (b) 4 (c) 6 (d) 8

29. Defective zinc oxide can be represented with formula –

(a) ZnO (b) $Zn_{1+x}O$ (c) ZnO_{1+x} (d) $Zn\ O_{1+y}$

30. Nickel oxide has formula $Ni_{0.98}\ O_{1.00}$ with Ni (II) and Ni(III). The percentage of Ni^{2+} is __________.

(a) 95.9 (b) 4.1 (c) 96.1 (d) None of these

31. A crystal has ionic radii ratio 0.155 to 0.225. So the co-ordination number will be ________.

(a) 3 (b) 4 (c) 6 (d) 8

32. In a face centred cubic lattice, a unit cell in shared equally by _______ no. of unit cells.

(a) 4 (b) 2 (c) 6 (d) 8

UNIT - II

33. Molality is expressed in :

(a) Grams/litre (b) Litres/moles (c) Moles/litre (d) Moles/kg.

34. The relative lowering in vapour pressure is proportional to the ratio between the number of:

(a) solute molecules to solvent molecules

(b) solute molecules to the total number of molecules in solution

(c) solvent molecules to the total number of molecules in solution

(d) solvent molecules to the total number of ions in solution

35. At 25°C, the highest osmotic pressure is expected by 0.1 M solution of :

(a) $CaCl_2$ (b) KCl (c) Glucose (d) Urea.

36. Which of the following salts will have the same value of van't Hoff factor (i) as that of $K_4[Fe(CN)_6]$:

(a) $Al_2(SO_4)_3$ (b) NaCl (c) $Al(NO_3)_3$ (d) Na_2SO_4

37. An elevation in b.p. of a solution of 10g of solute (molar mass = 100) in 100 g of water is ΔT_b. The ebullioscopic constant for water is :

(a) 10 (b) $10\,\Delta T_b$ (c) ΔT_b (d) $\Delta T_b/10$

38. Which concentration term is not affected by temperature ?

(a) Normality (b) Molality (c) Molarity (d) Formality.

39. A 5% solution of cane sugar (molar mass = 342) is isotonic with 1 % solution of a substance X. The molar mass of X is :

(a) 171.2 (b) 68.4 (c) 34.2 (d) 136.2.

40. Which has highest boiling point under 1 atm pressure ?

(a) 0.1 M NaCl (b) 0.1 M Sucrose (c) 0.1 M $BaCl_2$ (d) 0.1 M Glucose.

41. An aqueous solution freezes at -0.186^{0}C (K_f = 1.86, K_b = 0.512). What is the elevation in boiling point ?

(a) 0.186 (b) 0.512 (c) 0.86 (d) 0.0512.

42. For determination of the molar mass of colloids, polymers and proteins which colligative property is used ?

(a) Diffusion pressure
(b) Atmospheric pressure
(c) Osmotic pressure
(d) Turgor pressure.

43. Colligative properties of the solutions are those properties which depend on :

(a) shapes of the particles
(b) nature of the solvent
(c) nature of the particles only
(d) number of the particles only

44. 2.5 litres of 1M NaOH solution is mixed with a 3.0 litres of 0.5 M NaOH solution. The molarity of the resulting solution is :

(a) 0.80 M (b) 1.0 M (c) 0.73 M (d) 0.50 M.

45. The average osmotic pressure of benzoic acid is 7.8 bar at 37^{0}C. What is the concentration aqueous KCl solution that could be used in blood stream ?

(a) 0.16 mol L^{-1} (b) 0.32 mol L^{-1} (c) 0.60 mol L^{-1} (d) 0.45 mol L^{-1}

46. The van't Hoff factor for a solute that associates in solution is :

(a) zero (b) 1.0 (c) less than 1 (d) more than 1

47. An aqueous solution freezes at –0.186^{0}C $\begin{pmatrix} k_f = 1.86\,K\,kg \\ k_b = 0.512^0\,C \end{pmatrix}$

The boiling point of the solution will be _______ ^{0}C.

(a) 100.186 (b) 100.512 (c) 100.86 (d) 100.512

48. For an ideal solution of two volatile liquids (1 & 2), the total vapour P_{total} is represented as :

(a) $P_{total} = x_1p_1^0 + x_2p_2^0$
(b) $P_{total} = p_1^0 + \left(p_2^0 - p_1^0\right)x_2$
(c) The total vapour pressure over the solution varies linearly with mole fraction of one component
(d) All are correctly represented.

49. Choose the incorrect statement :

(a) The composition of the vapour phase i.e. above the solution obeys Dalton's law.
(b) At equilibrium, vapour phase will be always rich in the component which is more volatile
(c) When $x_2 = 0$ the the vapour pressure represents p_2^0.
(d) Higher the value of K_H at a given pressure lower in the solubility of the gas in liquid.

50. Increasing the temperature of an aqueous solution will cause

(a) molality to decrease
(b) molarity to decrease
(c) mole fraction to decrease
(d) wt % to increase

51. The boiling point of equimolal aq. solution will be minimum for

(a) Benzene diazonium chloride
(b) calcium nitrate
(c) silver chloride
(d) glucose

52. An X molal solution of a compound in benzene has made fraction of solute equal to 0.2. The value of X is nearly ________.

(a) 62.4 (b) 7.0 (c) 0.016 (d) 2.6

53. Molarity of liquid HCl if density is 1.17g/m is ________ .

(a) 36.5 (b) 18.25 (c) 32.05 (d) 42.10

54. The depression is freezing point, ΔT_f is directly propertional to

(a) mole fraction of solution (b) molarity of the solution
(c) molality of the solution (d) moles of the solvent

55. Normality of 0.3 M phosphorous acid (H_3PO_3) is ________

(a) 0.5 (b) 0.6 (c) 0.9 (d) 0.1

56. An azeotropic solution of two liquids has boiling point lower than either of two when it

(a) shows a negative deviation from Roult's law
(b) shows no deviation from Roult's law
(c) shows positive deviation from Roult's law
(d) is saturated

57. Benzoic acid undergoes dimerisation in benzene solution. The Vant's Half factor (i) is related to the degree of association (x) of the acid as

(a) i = (1-x) (b) $i = 1 + x$ (c) $i = \left(1 - \frac{x}{2}\right)$ (d) $1 = \left(1 + \frac{x}{2}\right)$

58. Which of the following 0.1 m aq. solution will have the lowest freezing point i.e. maximum ΔT_f ?

(a) Aluminium sulfate (b) glucose
(c) urea (d) potassium iodide

59. The volume of water to be added to 100 c.c of 0.5 N H_2SO_4 to get decinormal solution is __________ cc.

(a) 100 (b) 450 (c) 400 (d 500

60. 18 gram glucose, $C_6H_{12}O_6$ is dissolved in 1 kg of water is a saucepan. The boiling point of the solution is _________ K.

(a) 373.052 (b) 100.052 (c) 101 (d) 273

61. The boiling point of benzene is 353.23K. When 1.80 g of non-volatile solute was dissolved in 90 gram benzene, the boiling point is raised to 354.11 K. The molar mass of the solute is ______ (Kb for benzene 2.53 K kg mol^{-1}.

(a) 57.5 (b) 56.5 (c) 5.57 (d) 157.5

62. Which of the following is not the characteristic of ideal solution ?

(a) $\Delta_{mix}H=0$ (b) $\Delta_{mix}V=0$
(c) A–A and B–B interaction $\neq$ A–B interaction
(d) cohesive interaction is same as adhesive interaction.

63. Which of the following is not an ideal solution ?

(a) n-hexane, n-heptane (b) Bromoethane and chloroethane
(c) benzene and tolune (d) Acetone and chloroform

UNIT - III

64. The mass of a substance liberated at the electrode is directly proportional to its

(a) atomic mass
(b) equivalent mass
(c) molecular mass
(d) none of these

65. Standard electrode potentials are :

Fe^{+2}/Fe, $E^0 = -0.44$; Fe^{+3}/Fe^{+2}, $E^0 = 0.77$

Fe^{+2}, Fe^{+3} and Fe block are kept together, then

(a) Fe^{+3} increases
(b) Fe^{3+} decreases
(c) Fe^{+3} remains unchanged
(d) Fe^{+2} decreases

66. The unit of equivalent conductivity is

(a) $ohm^{-1}\ cm^2\ (equivalent)^{-1}$
(b) ohm cm^2 (g-equivalent)
(c) ohm cm^2
(d) $ohm^{-1}\ m^{-1}$

67. The standard reduction potentials for Fe^{2+}/Fe and Sn^{2+}/Sn electrodes are –0.44 V and –0.14 V respectively. The standard e.m.f of the cell with reaction.

$Fe^{2+} + Sn \rightarrow Fe + Sn^{2+}$ is :

(a) +0.30 V
(b) –0.30V
(c) +0.58 V
(d) –0.58V

68. Total charge on 1 mole of a monovalent metal ion is equal to:

(a) 9.65×10^4 coulombs
(b) 1.6×10^{-19} coulombs
(c) 6.2×10^{18} coulombs
(d) none of these

69. —— grams of chlorine can be prepared by the electrolysis of molten Sodium Chloride with 10 amperes current passed for 10 minutes.

(a) 2.2
(b) 4.4
(c) 3.8
(d) 5

70. The unit of cell constant is ——

(a) $ohm^{-1}\ cm^2$
(b) cm^{-1}
(c) $ohm^{-1}\ cm^{1-}$
(d) $ohm^{-1}\ cm^2$/gm equiv

71. 96500 coulomb will deposit — of metal.

(a) one electrochemical equivalent
(b) one gm
(c) one gm equivalent
(d) one gm molecular mass

72. Four alkali metals A, B, C, D are having respectively standard electrode potential as –3.05, –1.66, –0.8 and –0.40 V. Which one will be more reducing ?

(a) A
(b) B
(c) C
(d) D

73. Given $1/a = 0.5\ cm^{-1}$, R = 50 ohm, N = 1.0. The equivalent conductance of the electrolytic cell is

(a) 10 $ohm^{-1}\ cm^2\ gm\ eq^{-1}$
(b) 20 $ohm^{-1}\ cm^2\ gm\ eq^{-1}$
(c) 300 $ohm^{-1}\ cm^2\ gm\ eq^{-1}$
(d) 100 $ohm^{-1}\ cm^2\ gm\ eq^{-1}$

74. Which of the following expression is correct ?

(a) $\Delta G^0 = -nFE^0_{cell}$
(b) $\Delta G^0 = +nFE^0_{cell}$
(c) $\Delta G^0 = -2.303\,RTnFE^0_{cell}$
(d) $\Delta G^0 = -nF \log k_C$

75. The reduction potential values of 'M', 'N' and 'O' are + 2.46, – 1.13 and – 3.13V respectively. Which of the following order is correct regarding their reducing property ?

(a) O> N > M (b) O > M > N (c) M > N > O (d) M > O > N

76. Electrolytes conduct electricity due to movement of

(a) atoms (b) ions (c) electrons (d) molecules

77. Which of the following may not be present in all galvanic cell ?

(a) electrolyte (b) anode (c) cathode (d) salt bridge

78. The metal with greater oxidation potential is

(a) stronger oxidant (b) stronger reductant

(c) easily reduced (d) can't be predicted

79. Which of the following solutions can be stored in copper vessel ?

(a) $AgNO_3$ (b) $AuCl_3$ (c) $ZnCl_2$ (d) all of these

80. Out of Cu, Ag, Zn and Mg the metal which can displace all others from their aqueous salt solution is

(a) Cu (b) Zn (c) Ag (d) Mg

81. For a redox reaction to be spontaneous, the e.m.f. should be

(a) –ve (b) +ve

(c) zero (d) any one of these

82. Passage of 96500 coulomb of electricity liberates .... litre of O_2 at NTP during electrolysis :

(a) 5.6 (b) 6.5 (c) 22.2 (d) 11.2

83. Which of the following statements is wrong ?

(a) Na^+ has different molar cunductance at infinite dilution in NaCl and NaBr

(b) degree of dissociation (a) = $\frac{\Lambda_C}{\Lambda_\infty}$

(c) Kohlraush law is used to find Λ_∞ value for weak electrolytes

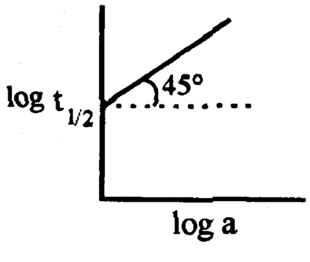
(d) $\mu_\infty(H_2SO_4) = 2\mu_\infty(H^+) + \mu_\infty(SO_4^{-2})$

UNIT - IV

84. Which of the following is correct for a first order reaction ?

(a) $t_{1/2}\ \alpha\ a$ (b) $t_{1/2}\ \alpha\ a$ (c) $t_{1/2}\ \alpha\ a^0$ (d) $t_{1/2}\ \alpha\ a^2$

85. Following is the graph between log $t_{1/2}$ and log a (a = initial concentration) for a given reaction at 27°C. Hence order of the reaction is



(a) 0 (b) 1 (c) 2 (d) 3

86. Consider the $2A + B \rightarrow$ Products

When concentration of B alone was doubled, the halflife did not change. When the cone. of A alone was doubled, the rate increased by two times. The unit of the rate constant for the reaction is

(a) mol lit^{-1} sec^{-1} (b) s^{-1} (c) L mol^{-1} s^{-1} (d) no unit

87. The rate of a first order reaction is 1.5×10^{-2} mol L^{-1} min^{-1} at 0.5 M concentration of the reactant the halflife of the reaction is

(a) 23.1 minutes (b) 8.73 minutes (c) 7.53 minutes (d) 0.383 minutes.

88. The rate constant for the reaction $2N_2O_5 \rightarrow 4\,NO_2 + O_2$ is $3.0 \times 10^{-5}\,S^{-1}$. If the rate is 2.4×10^{-6} mol lit s^{-1}, then the conc. of N_2O_5 in (mol lit^{-1}) is

(a) 1.4 (b) 1.2 (c) 0.04 (d) 0.8

89. In a first order reaction $A \rightarrow B$, if k is rate constant and initial concentration of the reactant A is 0.5 , then the halflife is

(a) $\frac{\log 2}{k}$ (b) $\frac{\log 2}{k\sqrt{0.5}}$ (c) $\frac{\ln 2}{k}$ (d) $\frac{0.693}{0.5k}$

90. Which one of the following statement for order of reaction is not correct ?

(a) Order can be determined experimentally

(b) Order of reaction is equal to the sum of the power of the concentration terms in differential rate law

(c) It is not affected with stoichiometric coefficient of reactants

(d) Order reaction can be more than three.

91. A chemical reaction proceeds following formula $k = P.Z.e^{-Ea/RT}$. Which of the following process will increase the rate of reaction ?

(a) Lowering of E_a (b) Lowering of P

(c) Lowering of Z (d) independent of all the above factor

92. The rate at which a substance reacts depends on its

(a) atomic mass (b) equivalent mass

(c) Molecular mass (d) active mass

93. According to collision theory

(a) all collisions are sufficiently violent

(b) all collisions are responsble for product formation

(c) all collisions are effective

(d) only a fraction of collisions are effective which have enough energy to form products.

94. For the reaction $A \longrightarrow B$, the rate of the reaction is quadrupled when the concentration of A is double, the rate of the reaction is $r = k\left[A\right]^n$, the value of 'n' is

(a) 1 (b) zero (c) 3 (d) 2

95. A zero order reaction is one

(a) in which the reactants do not react.

(b) in which one of the reactants is large excess

(c) Whose rate is uniform and not affected by time.

(d) whose rate inceases with time

96. In a first order reaction, the concentration of reactant decreases from 1.0 M to 0.25 M in 20 minutes. The value of specific rate is

(a) 69.32 (b) 6.932 (c) 0.6932 (d) 0.06932

97. Which plot can give us the value of activation energy ?

(a) k versus T (b) $\frac{1}{k}$ versus T (c) log k versus $\frac{1}{T}$ (d) C versus T.

98. Activation energy of a chemical reaction can be determined by

(a) changing the cncentration of reactants

(b) evaluating rate constant at standard temperature

(c) evaluating rate constants at two different temperatures

(d) evaluating velosities of reaction at two different temperatures.

99. $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$

What is the ratio of the rate of decomposition of N_2O_5 to the rate of formation of NO_2?

(a) 112 (b) 2:1 (c) 1:4 (d) 4:1

100. By increasing temperature by 10 K, the rate of reaction becomes double. How many times the rate of reaction will be if the temperature is increased from 303 K to 353 K ?

(a) 4 (b) 8 (c) 16 (d) 32

101. The elementary step of the reaction $2Na + Cl_2 \rightarrow 2NaCl$ is found to follow a third order Kinetics. The molecularity of the reaction is

(a) 1 (b) 2 (c) 3 (d) 4

102. 75% of a first order reaction was completed in 32 minutes; when was 50% of the reaction completed ?

(a) 4 minutes (b) 8 minutes (c) 24 minutes (d) 16 minutes

103. For the hypothetical reaction, $2A \rightarrow 3C$ the reaction rate is given by

(a) $r = \frac{-d[A]}{dt}$ (b) $r = -\frac{1}{2}\frac{d[A]}{dt}$ (c) $r = \frac{1}{3}\frac{d[A]}{dt}$ (d) $r = \frac{d[A]}{dt}$

104. Rate expression of a chemical change is $\frac{dx}{dt} = k[A]^2[B][C]^0$

The order of the reaction is

(a) 2 (b) 3 (c) 1 (d) 0

105. The rate law for the single step reaction $2A + B \rightarrow 2C$ is given by

(a) rate = k[A][B] (b) rate = $k[A]^2[B]$ (c) rate = k[A][B] (d) rate = $[A]^2[B]^0$

106. What will be amount of ${}^{128}_{53}I$ ($t_{1/2}$ = 25 minutes) left after 50 minutes ?

(a) one half (b) one fourth (c) one third (d) one eighth

107. Time required to decompose half the substance for nth order reaction is inversely proportional to

(a) $a^{1/2}$ (b) a^{n-2} (c) a^{n-1} (d) a^{n+1}

108. $T_{1/2}$ of C^{14} isotope is 5770 years. Time after which 80% of isotope left is

(a) 1861 years (b) 186 years (c) 2780 years (d) 278 years

109. Temperature dependant equation can be written as

(a) $\ln k = \ln A - \frac{E_a}{RT}$ (b) $\ln k = \ln A + \frac{E_a}{RT}$

(c) $\log k = \log A - \frac{RT}{E_a}$ (d) All of the above

110. Rate of reaction depends upon

(a) temperature (b) catalyst

(c) concentration (d) all of these

111. $t_{1/2}$ of first order reaction is

(a) directly proportional to initial concentration

(b) independent of initial concentration

(c) directly proportional to square of initial concentration

(d) inversely proportional to initial concentration.

112. Molecularity of a reaction is determined by

(a) stoichiometric representation of a reaction.

(b) reaction of atoms

(c) both (d) none

113. In a reaction, $A \longrightarrow B$, if concentration of A is doubled, the rate of reaction becomes 8 times. The order of reaction is :

(a) 1 (b) 2 (c) 3 (d) 1.5

114. Acidic hydrolysis of ester is an example of

(a) 1st order reaction (b) 2nd order reaction

(c) zero order reaction (d) pseudo 1st order reaction

115. The unit of rate constant for zero order reaction is

(a) sec^{-1} (b) mole $litr^{-1}$ sec^{-1}

(c) $mole^{-1}$ lit sec^{-1} (d) $mole^{-1}$ lit^{-1} sec^{-1}

116. A catalyst has no effect on

(a) rate of forward reaction (b) activation energy

(c) threshold energy (d) heat of reaction

Unit - V

117. Tyndall effect is observed in :

(a) Solution (b) Precipitate (c) Sol (d) Vapours

118. Which is the characteristic of a catalyst ?

(a) It changes equilibrium constant (b) It initiates a reaction

(c) It alters the rate of reaction

(d) It increases average KE of molecules

119. A liquid is found to scatter a beam of light but leaves no residue when passed through the filter paper. The liquid can be described as :

(a) A suspension (b) Oil

(c) Colloidal sol (d) True solution

120. Cloud is an example of :

(a) Solid dispersed in gas (b) Liquid dispersed in gas

(c) Liquid dispersed in solid (d) Solid dispersed in liquid

121. In physical adsorption, gas molecules are bound on the solid surface by :

(a) Chemical forces (b) Electrostatic forces

(c) Gravitational forces (d) van der Waals forces.

122. How many layers are involved in chemical adsorption ?

(a) One (b) Two (c) Many (d) Zero.

123. In the coagulation of colloidal sol of As_2S_3 which has minimum coagulating value ?

(a) NaCl (b) KCl (c) $BaCl_2$ (d) $AlCl_3$

124. In which of the following, electrophoresis is not observed.?

(a) Suspensions (b) Emulsions (c) Sugar solution (d) Gold sol.

125. Action of catalyst depends upon :

(a) mass (b) solubility (c) particle size (d) none of these.

126. At CMC, the surface molecules :

(a) Decompose (b) Become completely soluble

(c) Associate (d) Dissociate.

127. A biological catalyst is essentially :

(a) An enzyme (b) A carbohydrate

(c) An amino acid (d) A nitrogeneous base.

128. Which of the following is used for ending charge on colloidal solution ?

(a) Electrons (b) Electrolytes

(c) Positively charged ions (d) Compounds.

129. In colloidal particles, the range of diameter is :

(a) 1 to 100 nm (b) 1 to 1000 nm

(c) 1 to 100 cm (d) 1 to 100 m.

130. Foam is an example of colloidal system of:

(a) Gas in liquid (b) Liquid in gas, (c) Solid in liquid (d) Liquid in liquid.

131. In the following, the hydrophobic colloid is :

(a) Starch (b) Gelatin (c) Gum (d) Sulphur.

132. Milk can be preserved by adding a few drops of

(a) Formic acid solution (b) Formaldehyde solution

(c) Acetic acid solution (d) Acetaldehyde solution.

133. Which of the following is the example an associated colloid ?

(a) soap (b) cellulose (c) protein (d) carbon powder

134. Which of the following is not colloid?

(a) Chlorophyll (b) Smoke (c) Milk (d) Fog

135. Fog is a colloidal system of

(a) Liquid dispersed in gas (b) Gas dispersed in liquid

(c) Solid dispersed in liquid (d) Solid dispersed in gas

136. Brownian movement is due to

(a) Temperature fluctuation within the liquid phase

(b) Attraction and repulsion between the charges on colloidal particles

(c) Impact of the molecules of the dispersion medium on colloidal particles

(d) Convention current

137. Tyndal effect in the colloidal solution is due to
(a) Scattering of light (b) Reflection of light
(c) Absorption of light
(d) Presence of electrically charged particles

138. Which is an example of Emulsion ?
(a) Jelly (b) Boot polish (c) Froth (d) Milk

139. Which of the following is not a negatively charged sol ?
(a) gold sol (b) starch sol (c) cds sol (d) haemoglobin

140. Cow milk is an example of natural emulsion, it is stabilised by
(a) Fat (b) Water (c) Casein (d) Mg^{2+} ion

141. Gelatine is mostly used in making ice creams in order to
(a) Prevent making of a colloid
(b) Stabilize the colloid and prevent crystallization
(c) Stabilize the mixture (d) Enrich the arome.

142. On adding a few drops of dil. HCl to freshly precipitated Fe $(OH)_3$ a red coloured colloidal solution is obtained. The phenomenon is known as
(a) Peptization (b) Dialysin
(c) Protective action (d) Dissolution

143. Soap form colloidal solution in water and removes grease from clothes by
(a) Coagulation (b) Emulsification
(c) Adsorption (d) Absorption

144. Lyophilic sols are
(a) Irreversible sols (b) prepared from inorganic compounds
(c) coagulated by adding electrolyte (d) self- stabilizing

145. Among the electrolytes Na_2SO_4, $CaCl_2$, $Al_2(SO_4)_3$ and NH_4Cl the most effective coagulating agent for Sb_2S_3 sol is
(a) Na_2SO_4 (b) $CaCl_2$ (c) $Al_2(SO_4)_3$ (d) NH4Cl

146. Adsorption is multilayer in case of
(a) Physical adsorption (b) Chemical adsorption
(c) both physical and chemical adsorption (d) None

147. The term sorption stands for
(a) Adsorption (b) Absorption
(c) Both adsorption and absorption (d) Desorption

148. Adsorption is accompanied by
(a) Decrease in enthalpy and increase in entropy
(b) Increase in enthalpy and increase in entropy
(c) Decrease in enthalpy and decrease in entropy
(d) No change in enthalpy or entropy

149. Which of the following is not correctly matched ?
(a) Butter-Gel (b) Milk-emulsion (c) Fog-aerosol (d) Dust-solid sol

Unit - VI

150 Zone refining is used for the
(a) Concentration of an ore (b) Reduction of metal oxide
(c) Purification of metal (d) Purification of an ore

151. Which of the following processes is used for the concentration of Bauxite ?
(a) Froth floatation (b) Leaching
(c) Liquation (d) Magnetic separation

152. The earthy impurities associated with mineral used in metallurgy are called ?
(a) Slag (b) Flux (c) Gangue (d) Ore

153. In the electrorefining of copper, some gold is deposited as :
(a) Anode mud (b) Cathode mud (c) Cathode (d) Electrolyte

154. Most abundant metal on the surface of earth is :
(a) Iron (b) Aluminium (c) Calcium (d) Sodium

155. The lustre of a metal is due to
(a) its high density (b) its high polishing
(c) its chemical inertness (d) presence of free electrons

156. Which process is used for the purification of Al metal ?
(a) Hoop's process (b) Bayer's process
(c) Serpeak's process (d) Hall's process.

157. Which process represent the change,
$Ti + 2I_2 \rightarrow TiI_4 \rightarrow Ti + 2I_2$
(a) Cupellation (b) van Arkel (c) Poling (d) Zone refining

158. The following equation represents a method of purification of nickel by,

$$\underset{\text{Impure}}{Ni} + 2CO \xrightarrow{320K} Ni(CO)_4 \xrightarrow{420K} \underset{\text{Pure}}{Ni} + 4CO$$

(a) Cupellation (b) Mond's process
(c) van Arkel method (d) zone refining

159. Heating of pyrite ores in air to remove sulphur is known as :
(a) Calcination (b) Fluxing (c) Smelting (d) Roasting

160. Out of the following, which cannot be obtained by electrolysis of aqueous solution of the salt ?
(a) Ag (b) Mg (c) Cu (d) Cr

161. The slag obtained during the extraction of copper pyrites is composed mainly of:
(a) Cu_2S (b) $FeSiO_3$ (c) $CuSiO_3$ (d) SiO_2

162. Which of the following is a mineral of iron ?
(a) Malachite (b) Cassiterite (c) Pyrolusite (d) Magnetite

163. The ore having two different metal atoms is
(a) haematite (b) galena (c) magnetite (d) Copperpyrite

164. In which of the following minerals, aluminium is not present ?
(a) Cryolite (b) Mica (c) Feldspar (d) Fluospar

165. In the froth floatation process for benefaction of the ores, ore particles float because
(a) they are light (b) they bear electrical charge
(c) their surface is not easily wetted by water (d) they are insoluble

166. Which of the following metal can be extracted by smelting ?
(a) Al (b) Mg (c) Fe (d) None of these

167. The most important element in the earth's crust is
(a) Oxygen (b) Mg (c) Fe (d) Nitrogen

168. After levigation an ore is found to contain acidic impurities. Which of the following can be used as flux during smelting operation ?

(a) $CaCO_3$ (b) SiO_2
(c) HCl (d) both $CaCO_3$ and SiO_2

169. When lime stone is heated CO_2 is given off. The metallurgical operation is

(a) Smelting (b) Reduction
(c) Calcination (d) Roasting

170. Which of the following pairs of metals is purified by van Arkel method ?

(a) Ni and Fe (b) Ga and In (c) Zr and Ti (d) Ag- and Au

171. Identify an alloy containing a non-metal as a constituent in it.

(a) Invar (b) Steel (c) Bell metal (d) Bronze

172. During electrolytic refining of copper some metals present as impurity settle as “anode mud”. These are

(a) Sn and Ag (b) Pb and Zn (c) Ag and Au (d) Fe and Ni

173. Which of the following reaction is an example of calcination process ?

(a) $2Ag + 2HCl + (O) \rightarrow 2AgCl + H_2O$
(b) $2Zn + O_2 \rightarrow 2ZnO$
(c) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$
(d) $MgCO_3 \rightarrow MgO + CO_2$

174. During metallurgy roasting-calculation carried on — furnace

(a) reverberatory (b) electric
(c) blast (d) muffle

175. The metal refined by liquation is _________

(a) tin (b) silver (c) gold (d) zinc

176. The metal fails to be purified by zone refining is

(a) Ge (b) Si (c) B (d) K

177. Metals having standard reduction potential between +0.5 to –0.5 V are usually extracted by ————

(a) smelting (b) calcination
(c) Aluminothermy (d) hydrometallurgy

UNIT - VII

178. The dipole moment of NF_3 is less than NH_3 because:

(a) F is more reactive than H
(b) NH_3 forms associated molecules
(c) The resultant of the bond polarity is less
(d) The resultant of the individual polarities is opposed by the polarity of lone pair

179. The lightning in atmosphere cause the formation of:

(a) NO (b) O_3 (c) CO_2 (d) H_2O_2

180. Calcium carbide when heated with nitrogen forms:

(a) Ca_2N_2 (b) $Ca(CN)_2$ (c) $CaCN_2$ (d) $Ca(CNO)_2$

181. Which hydride is most stable ?

(a) AsH_3 (b) SbH_3 (c) PH_3 (d) NH_3

182. Which is a poison ?

(a) Hg_2Cl_2 (b) As_2O_3 (c) $NaHCO_3$ (d) NaCl

183. Ammonia on heating with carbon dioxide under pressure gives:

(a) NH_4HCO_3 (b) $(NH_4)_2CO_3$

(c) NH_2COONH_4 (d) $(NH_4)_2CO$

184. Basic oxide is:

(a) Bi_2O_3 (b) As_2O_3 (c) P_2O_3 (d) N_2O_3

185. NaOH can absorb:

(a) N_2O_5 (b) NO (c) N_2O (d) All of these

186. Which sulphide is insoluble in yellow ammonium sulphide ?

(a) SnS (b) As_2S_3 (c) Sb_2S_3 (d) Bi_2S_3

187. Calcium phosphide is used in smoke screens because it:

(a) Burns to form soot (b) Gives PH_3 which forms smoke

(c) Immediately catches fire in air (d) Is a gas which brings tears in eyes

188. Which of the following statements is not true

(a) NO_2 can be prepared by heating Pb $(NO_3)_2$

(b) NO_2 is red-brown gas

(c) NO_2 is paramagnetic (d) NO_2 readily dimerises to N_2O_4

189. Tailing of mercury is due to formation of

(a) mercuric oxide (b) mercurous oxide

(c) mercuric hydroxide (d) mercurous chloride

190. Which catalyst is used now-a-days in the contact process for the manufacturing of sulphuric acid ?

(a) Nil (b) V_2O_5 (c) Pt (d) Fe

191. About H_2SO_4 which is incorrect ?

(a) Reducing agent (b) Dehydrating agent

(c) Sulphonating agent (d) Highly viscous

192. When a lead storage battery is discharged

(a) SO_2 is dissolved (b) Lead sulphate is consumed

(c) Lead is formed (d) Sulphuric acid is consumed

193. Sulphuric acid has great affinity for water because

(a) it hydrolyses the acid (b) it decomposes the acid

(c) acid forms hydrates with water (d) acid decomposes water

194. Structure of SF_4 is

(a) octahedral (b) trigonal bipyramidal (See-saw-spahe)

(c) square planar (d) tetrahedral

195. Which of the following behaves as both oxidising and reducing agents ?

(a) H_2SO_4 (b) SO_2 (c) H_2S (d) HNO_3

196. Correct order of bond angle of H_2O, H_2S, H_2Se, H_2 Te is

(a) $H_2Te > H_2Sc > H_2S > H_2O$ (b) $H_2O > H_2S > H_2Se > H_2Te$

(c) $H_2S > H_2O > H_2Se > H_2Te$ (d) $H_2Se > H_2S > H_2Te > H_2O$

197. In which of the following all bonds are not equal ?

(a) SF_4 (b) SiF_4 (c) XeF_4 (d) BF_4^-

198. When potassium ferrocyanide crystals are heated with conc. H_2SO_4 the gas evolved as
(a) SO_2 (b) NH_3 (c) CO_2 (d) CO

199. What is wrong about H_2S ?
(a) It is a covalent compound (b) It is a gas with bad smell
(c) It is a weak base in water
(d) It is strong reducing agent than H_2O.

200. When natural rubber is heated with Sulphur, it is called
(a) vulcanisation (b) sulphonation (c) sulphurization (d) none of these

201. Tincture Iodine is
(a) Aqueous solution of Iodine (b) Solution of I_2 in aqueous KI
(c) Alcoholic solution of I_2 (d) Aqueous solution of KI

202. Which one is the strongest reducing agent ?
(a) HF (b) HCl (c) HBr (d) HI

203. The most powerful oxidising agent is
(a) Fluorine (b) Chlorine (c) Bromine (d) Iodine

204. Chlorine acts as a bleaching agent only in the presence of:
(a) dry air (b) sunlight (c) moisture (d) pure oxygen

205. Which of the following is a preparation of chlorine ?
(a) HCl acting on $KMnO_4$ (b) HCl acting on MnO_2
(c) Electrolysis of brine (d) All of these

206. Which one of the following reacts with chlorine to form phosgene ?
(a) SO_2 (b) CO_2 (c) NO (d) CO

207. Euchlorine is:
(a) a mixture of Cl_2 and ClO_2 (b) a chloride of europium
(c) a mixture of Cl_2 and ClO_7
(d) obtained by heating perchlorate and conc.HCl

208. Which of the following is a life saving mixture ?
(a) Mixture of Helium and Oxygen (b) Mixture of Neon and Oxygen
(c) Mixture of Neon and Nitrogen (d) Mixture of Argon and Oxygen

209. Which noble gas is most soluble in water ?
(a) He (b) Ar (c) Ne (d) Xe

210. The preparation of_____ compound by Bartlett confirms Xe can form compound.
(a) XeF_2 (b) XeO_3 (c) $O_2Pt\ F_6$ (d) $Xe\ Pt\ F_6$

211. Which type of hybridization is involved in the structure of XeF_2 ?
(a) sp^2d^2 (b) sp^2d^3 (c) sp^3d (d) sp^2

212. Which cannot be formed ?
(a) He^{2+} (b) He^+ (c) He (d) He_2

213. Which one of the following noble gases is the most abundant in atmosphere ?
(a) Kr (b) Ar (c) Ne (d) He

214. A rare gas that was dected in the sun before it was discovered on earth is
(a) helium (b) Neon (c) Krypton (d) Xenon

215. Which one of the following noble gases does not exist in atmosphere and is obtained on radioactive disintegration ?
(a) Rn (b) Kr (c) Ne (d) Ar

216. Helium is added to the oxygen supply used by deep-sea divers because:

(a) it is less soluble in blood than nitrogen at high pressures.

(b) it is lighter than nitrogen.

(c) it is readily miscible with oxygen. (d) it is less poisonous than nitrogen.

217. The coloured discharge tubes for advertisement mainly contain:

(a) Xenon (b) Helium (c) Neon (d) Argon

218. Shape of $XeOF_4$ is

(a) octahedral (b) square pyramidal (c) pyramidal (d) T-shaped

219. Bond angle in XeO_3 is

(a) 107° (b) 119° (c) 92° (d) 103°

220. Among the following, the species having square planar geometry for the central atom are :

(i) XeF_4 (ii) SF_4 (iii) $[NiCl_4]^{2-}$ (iv) $[PdCl_4]^{2-}$

(a) (i) and (iv) (b) (i) and (ii) (c) (ii) and (iii) (d) (iii) and (iv)

221. The reddish brown colour ags formed when nitric oxide is oxidised by air is

(a) N_2O_5 (b) N_2O_4 (c) NO_2 (d) N_2O_3

222. Among trihalides of nitrogen, which are is the least basic

(a) NF_3 (b) NCl_3 (c) NBr_3 (d) NI_3

223. Which of the following oxides is the most acidic /

(a) N_2O_5 (b) P_2O_5 (c) As_2O_5 (d) Sb_2O_5

224. The number of hydrogen atoms attached to 'P' in hypo phosphorus acid (Phosphinic acid) and its basicity are

(a) Zero, one (b) two, one (c) one, two (d) three, one

225. Which substance of the following has he highest proton affinity ?

(a) PH_3 (b) H_2O (c) H_2S (d) NH_3

226. The element which forms oxides in all oxidation states +I to +V is

(a) N (b) P (c) As (d) Sb

227. Which of teh following oxides of nitrogen is solid ?

(a) NO_2 (b) N_2O (c) N_2O_3 (d) N_2O_5

228. A gas dissolved in $FeSO_4$ solution giving brown ring. The gas is

(a) N_2O_3 (b) NO_2 (c) N_2O (d) NO

229. The bond angle of PPP in P_4 has

(a) 90^0 (b) 60^0 (c) 120^0 (d) 75^0

230. Lead reacts with cold dilute HNO_3, gives

(a) NH_4NO_3 (b) N_2O (c) NO (d) NO_2

231. Ortho phosphoric acid has the formula

(a) H_3PO_4 (b) HPO_3 (c) H_3PO_2 (d) H_3PO_3

232. The order of thermal stability of the following compounds:

H_2S, H_2Se, H_2Te, H_2O

(a) $H_2O > H_2S > H_2Se > H_2Te$ (b) $H_2S > H_2Se > H_2Te > H_2O$

(c) $H_2S < H_2Se < H_2Te < H_2O$ (d) $H_2O < H_2S < H_2Sw < H_2Te$

233. Sulphuric acid is a covalent molecule having hexavalent sulphur atom. Its structure is
(a) planar (b) Tetrahedral (c) octahedral (d) Trigonal

234. H_2SO_4 is a dibasic acid but the ionisation constants show
(a) $1/K_{a_2} > 1/K_{a_2}$ (b) $K_{a_1} < K_{a_2}$ (c) $K_{a_2} < K_{a_1}$ (d) $K_{a_1} = K_{a_2}$

235. The maximum covalency of sulphur is
(a) 2 (b) 4 (c) 8 (d) 6

236. Which of the following halides is most acidic in aqueous medion ?
(a) PCl_3 (b) $SbCl_3$ (c) $BiCl_3$ (d) CCl_4

237. Among the acids of phosphorous H_3PO_4, H_3PO_2, H_3PO_3 , the basicity is
(a) $H_3PO_2 > H_3PO_3 > H_3PO_4$ (b) $H_3PO_4 > H_3PO_3 > H_3PO_2$
(c) $H_3PO_3 > H_3PO_2 > H_3PO_4$ (d) $H_3PO_3 > H_3PO_4 > H_3PO_4$

238. Water is oxidised to oxygen by
(a) ClO_2 (b) $KMnO_4$ (c) H_2O_2 (d) Fluorine

239. Which of the following oxides of nitrogen is thermally most stable ?
(a) N_2O (b) N_2O_5 (c) NO (d) N_2O_3

240. The gases produced in the reaction $Pb(NO_3)_2 \xrightarrow{\Delta}$ and $(NH_4)NO_3 \xrightarrow{\Delta}$ are respectively.
(a) N_2O, NO (b) N_2O, NO_2 (c) NO, NO_2 (d) NO_2, N_2O

241. Ozone is a powerful oxidising agent due to
(a) paramengetic nature (b) diamagaetic nature
(c) presence of nascent oxygen (d) none of these

242. When conc H_2SO_4 is heated with copper turnings gives
(a) SO_3 (b) SO_2 (c) HSO_3^- (d) none of these

243. The bond angle of SO_2 is
(a) 119.5^0 (b) 109.5^0 (c) 125^0C (d) 90^0

244. In the test of SO_2 with acidified $K_2Cr_2O_7$ is green due to
(a) dichromate changes to cromate (b) formation of $Cr_2(SO_4)_3$
(c) formation of K_2SO_4 (d) none of these

245. The brown ring in nitrate test is the formation of
(a) penta aqua nitrosonium iron (I) sulfate (b) $[Fe(H_2O)_5\ SO_4]$ NO
(c) $FeSO_4$. NO (d) none of these

246. Dioxygen is gas but sulphur is solid. This is due to
(a) Oxygen forms $p\pi - p\pi$ multiple bond
(b) Sulphuri forms $p\pi - p\pi$ multiple bond
(c) Sulphur has weak vander waals force. (d) S-S bond is weaker.

247. The depletion of O_3 by CFC's because of
(a) F free radicals (b) Cl free radicals
(c) formation of F_2 molecule (d) none of these

248. The compounds of fluorine with oxygen is called
(a) fluorides of oxygen (b) oxides of fluorine
(c) oxofluro compounds (d) none of the above

249. Nitric oxide (NO) when released in air becomes
(a) Green (b) yellow (c) orange (d) brown

250. N_2 is less reactive because
(a) it is inert gas (b) it is gas at room temperature
(c) it has high bond dissociation energy (d) N–N bond in weak

251 Correct order of electron affinities of halogeous is
(a) $F > Cl > Br > I$ (b) $I > Br > Cl > F$
(c) $Cl > F > I > Br$ (d) $Cl > F > Br > I$

252. Iodine readily dissolves in potassium iodide solution giving
(a) I^- (b) KI^- (c) KI_2^- (d) KI_3

253. The acid used for etching glass is _
(a) H_2SO_4 (b) HF (c) HNO_3 (d) K_2CrO_4

254. When chlorine is passed through concentrated solution of KOH, the compound formed is
(a) $KClO_4$ (b) $KClO_3$ (c) $KClO_2$ (d) KClO

255. The correct order of thermal stability of hydrogen - halides (H–X) is
(a) $HI > HCl < KF > HBr$ (b) $HCl < HF > HBr < HI$
(c) $HF > HCl > HBr > HI$ (d) $HI > HBr > HCl > HF$

256. The strongest reducing agent among the following is
(a) F^- (b) Cl^- (c) Br^- (d) I^-

257. Iodine is formed when KI reacts with a solution of
(a) $CuSO_4$ (b) $(NH_4)_2SO_4$ (c) $ZnSO_4$ (d) $FeSO_4$

258. Th inert gases producing maximum number of compounds are
(a) He and Ne (b) Ar and Ne (c) Kr and Ne (d) Kr and Xe

259. Which following statement is incorrect
(a) He(g) is used for inflating aeroplane tyre
(b) The lowest boiling point of He is due to presence of weak vander Waals force.
(c) $XeOF_2$ is almost T-shaped (d) Xe can also compound with Cl_2

260. Most acidic oxide among the following is
(a) Cl_2O_5 (b) Cl_2O (c) Cl_2O_3 (d) Cl_2O_7

261. SO_2 acts as temporary bleaching agent but Cl_2 acts as permanent bleaching agent, because?
(a) Cl_2 bleaches due to reduction but SO_2 due to oxidation.
(b) Cl_2 bleaches due to oxidation but SO_2 due to reduction.
(c) Both of the anove (d) None of the above

262. The weakest acid among the following is
(a) HI (b) HBr (c) HCl (d) HF

263. The gas not adsorbed by coconut charcoal is
(a) He (b) Ne (c) Ar (d) Kr

264. In which of the following compounds all bonds are not identical ?
(a) SiF_4 (b) SF_4 (c) XeF_4 (d) BF_4^-

265. If the valence shell electronic configuration for an element is ns^2sp^5, this element will belong to the group of
(a) alkali metals (b) inert` metals (c) noble gases (d) halogens.

266. Oxidation of NH_3 by cupric oxide yields–
(a) N_2 (b) NO (c) $Cu(NO_3)_2$ (d) Cu_2O

UNIT - VIII

267. Essential constituent of an amalgam is:
(a) Fe (b) An alkali metal (c) Silver (d) Mercury

268. The chloride that turns black on addition of NH_4OH is:
(a) AgCl (b) $PbCl_2$ (c) Hg_2Cl_2 (d) Both (b) and (c)

269. Chemical name of corrosive sublimate is:
(a) Mercurous chloride (b) Zinc chloride
(c) Mercuric chloride (d) Aluminium chloride

270. In Nessler's reagent, the ion present is:
(a) Hg^+ (b) Hg^{2+} (c) HgI_2^{2-} (d) HgI_4^{2-}

271. Calomel is:
(a) Hg_2Cl_2 and Hg (b) $HgCl_2$ (c) Hg + $HgCl_2$ (d) Hg_2Cl_2

272. Cinnabar is an ore of:
(a) Lead (b) Zinc (c) Silver (d) Mercury

273. Calamine is:
(a) $ZnSO_4$ (b) $ZnCO_3$ (c) ZnO (d) $CaCO_3$

274. Sulphide ore of zinc is concentrated by:
(a) Froth Floatation process (b) Electromagnetic process
(c) Gravity process (d) Distillation

275. Zn cannot displace the following ions from their aqueous solutions:
(a) Ag^+ (b) Cu^{2+} (c) Fe^{2+} (d) Na^+

276. A metal gives two chlorides 'A' and 'B'. 'A' gives black precipitate with NH_4OH and 'B' gives white. With KI 'B' gives a red precipitate soluble in excess of KI. 'A' and 'B' are respectively:
(a) $HgCl_2$ and Hg_2Cl_2 (b) Hg_2Cl_2 and $HgCl_2$
(c) $HgCl_2$ and $ZnCl_2$ (d) $ZnCl_2$ and $HgCl_2$

277. An element which is highly toxic for plants and animals is ?
(a) Au (b) Mn (c) Hg (d) Ca

278. Zinc oxide is:
(a) A basic oxide (b) An acidic oxide
(c) A neutral oxide (d) An amphoteric oxide

279. Which is known as Philosopher's wool ?
(a) HgO (b) CdO (c) BaO (d) ZnO

280. Chemical name of vermilion is:
(a) Mercuric sulphide (b) Mercurous sulphide
(c) Zinc sulphide (d) Cadmium sulphide

281. The pair of metals which dissolves in NaOH(aq) is:
(a) Al, Cu (b) Zn, Cd (c) Pb, Sn (d) Zn, Al

282. Which one of the following ions is the most stable in aqueous solution ?
(a) Mn^{3+} (b) Cr^{3+} (c) V^{3+} (d) Ti^{3+}

283. The highest oxidation state is achieved by which of the following

(a) $(n-1)d^8ns^2$ (b) $(n-1)d^5ns^2$ (c) $(n-1)d^3ns^2$ (d) $(n-1)d^5ns^1$

284. KI and $CuSO_4$ solution when mixed give

(a) $CuI_2 + K_2SO_4$ (b) $Cu_2I_2 + K_2SO_4$

(c) $K_2SO_4 + Cu_2I_2 + I_2$ (d) $K_2SO_4 + CuI_2+I_2$

285. Passivity of iron is due to the formation of thin film of its:

(a) Oxide (b) Carbonate (c) Nitride (d) Hydroxide

286. Mn belongs to:

(a) s-block (b) p-block (c) d-block (d) *f*-block

287. $K_3[Co(NO_2)_6]$ is:

(a) Fischer's salt (b) Thenard's blue

(c) Rinman's green (d) Blue vitriol

288. The term 'fools gold' is used for a mineral which shines like gold. It is:

(a) Iron pyrite (FeS_2) (b) Cpper glance

(c) Cinnabar (d) Cadmium sulphide

289. Which match is incorrect ?

(a) Ammonia soda process—manufacture of potassium carbonate

(b) Bessemer's process—manufacture of steel

(c) Halls process – Aluminium

(d) Dow's process—manufacture of phenol

290. Wood's metal is an alloy of:

(a) Pb (b) Zn (c) Fe (d) Sn

291. Which of the following has the highest percentage of carbon ?

(a) Stainless steel (b) Pig iron (c) Solder (d) German silver

292. Other forms of iron can be produced from:

(a) Cast iron (b) Wrought iron (c) Pig iron (d) Steel

293. Which of the following does not show variable valency ?

(a) Sc (b) Cu (c) V (d) Hg

294. Mercury forms amalgams with all except:

(a) Al (b) Zn (c) Ni (d) Fe

295. Lithopone, a white pigment, consists of:

(a) Al_2O_3 and $CaCO_3$ (b) BaS and $PbSO_4$

(c) ZnS and $BaSO_4$ (d) PbS and MgO

296. Zinc white is a better white pigment than lead white because it:

(a) Has more covering power than lead white

(b) Is not blackened by the action of H_2S

(c) Is soluble in water

(d) Becomes yellow when heated

297. The pair of metals which fails to dissolve in NaOH(aq) is :

(a) Al, Be (b) Zn, Cd (c) Zn, Sn (d) Zn, Al

298. The formula of the zinc complex with ammonia is

(a) $[Zn(NH_3)_2]Cl$ (b) $(NH_4)_2ZnO_2$

(c) $[Zn(NH_3)_4]Cl_2$ (d) $[Zn(NH_3)_6Cl_2$

299. A transition element X has a configuration [Ar] $3d^4$ in its +3 oxidation state. Its atomic number is:

(a) 25 (b) 26 (c) 22 (d) 19

300. d-block elements form coloured ions because

(a) they absorb some energy for d-transition

(b) they absorb some energy for p-transition

(c) they absorb some energy for d-d transition

(d) they do not absorb any energy

301. The characteristics of transition metals to form the complex ion is

(a) having d-subshell unpaired electrons

(b) having paired d-subshell electrons

(c) providing appropriate empty d-orbitals

(d) having small charge / size ratio

302. Which of the following properties shows that iron is a transition element.

(a) it forms double salts (b) it forms stable complexes

(c) it decomposes steam at high temperature (d) it rusts on moist` air.

303. Which of the following elements involves gradual filling of 5-f level

(a) transition metal (b) Lanthanoids (c) coinage metals (d) Actinoids

304. The general electronic configuration of transition elements is

(a) ns^2nd^{1-10} (b) $(n-1)d^{1-10}\ ns^{0-2}$ (c) $(n-1)d^{1-10}\ ns^2$ (d) $ns^{0-2}\ (n-1)d^{10}$

305. Which of the ions will give colourless aqueous solution ?

(a) Cu^{2+} (b) Cu^+ (c) Ni^{2+} (d) Fe^{2+}

306. Which of the following belongs to the actinide series of elements ?

(a) Dy (b) U (c) Yb (d) Ta

307. Which of the following compounds will not give positive chromyl chlorids test.

(a) $HgCl_2$ (b) $ZnCl_2$ (c) $CuCl_2$ (d) $C_6H_5\overset{+}{N}H_3\,Cl^-$

308. Which metal in the first transition series exhibit + oxidation state most frequently.

(a) Zn (b) Sc (c) Cu (d) Cd

309. Which of the following oxides of Mn is amphoteric in nature MnO, MnO_2, Mn_2O_3, $Mn_{2\backslash}O_7$

(a) MnO (b) MnO_2 (c) Mn_2O_3 (d) Mn_2O_7

310 Which of the following form on alloy ?

(a) Zn + Pb (b) Fe + Hg (c) Fe + C (d) Pt + Hg

311. The highest magnetic moment is in the transition metal having

(a) $3d^2$ (b) $3d^7$ (c) $3d^5$ (d) d^9

312. A transition metal exist in its highest oxidation state. It is expected to behave as

(a) a chelating agent

(b) a central metal in a co-ordination compound

(c) an oxidising agent (d) a reducing agent

313. $K_4\left[Fe(CN)_6\right]$ is used for the detection of

(a) Cu^{2+} (b) Cu^{+} (c) Fe^{3+} (d) Ni^{2+}

314. The most common oxidation state of lanthanoids is

(a) +4 (b) +6 (c) +2 (d) +3

315. Which of the following metals is used in incandescent lamps ?

(a) cromium (b) Tungsten (c) Zirconium (d) molyvdemum

316. The disproportionate reaction combination of the following is

(i) $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$

(ii) $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

(iii) $2Cu^+ \rightarrow Cu^{2+} + Cu$

(iv) $2\ KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$

(a) (i) and (ii) (b) (ii) and (iii) (c) (i) and (iii) (d) (iii) and (iv)

317. Ni^{2+} gives coloured salts due to

(a) complete d-orbitals (b) incompletely filled d-orbitals

(c) presence of p-orbitals (d) presence of f-orbitals

UNIT - IX

318. $[Cr(NH_3)_6]^{3+}$ ion is :

(a) Paramagnetic (b) Diamagnetic (c) Square planar (d) None

319. Among $\left[Ni(CN)_4\right]^{2-}$ $\left[NiCl_4\right]^{2-}$ and $[Ni(CO)_4]$:

(a) $[Ni(CN)_4]^{2-}$ is square planar and $NiCl_4^{2-}$ and $Ni(CO)_4$ are tetrahedral

(b) $NiCl_4^{2-}$ is square planar and $NiCN_4^{2-}$ and $Ni(CO)_4$ are tetrahedral

(c) $Ni(CO)_4$ is square planar and $NiCN_4^{2-}$ and $\left[NiCl_4\right]^{2-}$ are tetrahedral

(d) None

320. EAN of Cr in $[Cr(NH_3)_6]Cl_3$ is:

(a) 32 (b) 33 (c) 34 (d) 35

321. Exchange of co-ordination group by a water molecule in complex molecule results in:

(a) lonisation isomerism (b) Hydration isomerism

(c) co-ordination isomerism (d) Geometrical isomerism

322. EDTA is a .... ligand:

(a) Monodentate (b) Hexadentate (c) Bidentate (d) Tridentate

323. The oxidation state of Ni in nickel carbonyl is:

(a) Zero (b) 1 (c) 2 (d) 3

324. The primary and secondary valency of cobalt in hexacyanido cobaltate (III) is

(a) 3, 6 (b) 6, 3 (c) 2, 6 (d) none of these

325. The correct formula of Zeise's ssalt is

(a) $PtCl_3, C_2H_6]^-K^+$ (b) $[PtCl_2, (C_2H_2)_2^-K^+$

(c) $K^+[PtCl_3 . C_2H_4]^-$ (d) $[PtCl_3, C_6H_6]^-K^+$

326. $[Co (NH_3)_3 Br] SO_4$ and $[Co (NH_3)_3 SO_4] Br$ are related as

(a) Linkage isomers (b) Ionisation isomers

(c) Co-ordination isomers (d) none of these

327. Which of the following complex or the complex ion will show geometrical isomerism ?

(a) $[Pt(NH_3)_2Cl_2]$ (b) $[Pt(NH_3)Cl_5]^-$

(c) $[Pt (NH_3)_5Cl]^{3+}$ (d) $[Co(NH_3)_6]Cl_2$

328. Fac - Mer isomerism is associated with which of the following general formula ?

(a) $M(AA)_2$ (b) $M(AA)_3$ (c) MABCD (d) MA_3B_3

329. What is the coordination number of metal in $[Co(en)_2Cl_2]^+$?

(a) 4 (b) 5 (c) 6 (d) 3

330. The oxidation state of Fe in brown ring complex $[Fe(H_2O)_5NO]SO_4$ is

(a) +1 (b) +2 (c) +3 (d) +4

331. All ligands are:

(a) Lewis acid (b) Lewis base (c) Neutral (d) None

332. The hybridisation of Fe in $K_4[Fe(CN)_6]$ complex is:

(a) d^2sp^2 (b) d^2sp^3 (c) dsp^2 (d) sp^3

333. The charge on cobalt in $[Co(CN)_6]^{3-}$ is :

(a) –6 (b) +3 (c) –3 (d) +6

334. Complex forming tendency increases with:

(a) Increase in size of cation (b) Decrease in size of cation

(c) Increase in size of anion (d) None

335. The number of unpair $\bar{e}$ (s) in hexafluoridocobaltate (III) ion is ______.

(a) 4 (b) 3 (c) 3 (d) 1

336. EAN of Fe in $K_4[Fe(CN)_6]$ is:

(a) 38 (b) 37 (c) 36 (d) 35

337. $[Cr(H_2O)_6]^{3+}$ ion has d-electrons equal to:

(a) 2 (b) 3 (c) 4 (d) 5

338. In SCN ligand if N is attached to central atom, the name of ligand is:

(a) Thiocyanato-N (b) Cyanato-N (c) Thiocyanato-S (d) Cyanato-S

339. Addition of KI to Hgl_2 forms complex $K_2[HgI_4]$ which in contact with $\overset{+}{\mathrm{N}}\mathrm{H}_4(\mathrm{Aq})$ gives

(a) Red colour (b) Blue colour

(c) Violet colour (d) Brown

340 . 'en' stands for ethylene diamine which is __________.

(a) Monodentate (b) Hexadentate (c) Bidentate (d) Tridentate

341. The complex $[Co(NH_3)_5Br]SO_4$ will give ____ moles of ions per mole of salt.

(a) 1 (b) 2 (c) 3 (d) 0

342. Complexes with bidentate ligands are called :

(a) Ligands (b) Chelates (c) Complexes (d) None

343. The oxidation number and co-ordination number of Ni in nickel carbonyl is :

(a) 0, 4 (b) 1, 0 (c) 2, 0 (d) 0, 6

344. The tendency of the transition metals to form complexes is not explained by :

(a) Small size of the metal ion (b) Large ionic or nuclear charge

(c) Low basicity of metal ions (d) Non-availability of d-orbitals

345. The number of ions formed on dissolving one mole of Mohr's salt is :

(a) 4 (b) 5 (c) 3 (d) 6

346. Nickel (II) tetracyanide complex has ...... geometry with _____ hybridisation.

(a) Linear, sp^2 (b) Tetrahedral, sp^3

(c) Square planar, dsp^2 (d) squareplaner, sp^3

347. In which of the following complexes the nickel metal is in highest oxidation state:

(a) $Ni(CO)_4$ (b) $K_2[NiF_6]$ (c) $[Ni(NH_3)_6](BF_4)_2$ (d) $K_4[Ni(CN)_6]$

348. The IUPAC name of $[CoCl(NO_2)(en_2)]Cl$ is:

(a) Chloronitrobis (ethylene diamine) cobaltic (in) chloride

(b) Chloronitrobis (ethylene diamine) cobalt (II) chloride

(c) Chlorobis (ethane-1, 2-diamine) nitro cobalt (III) chloride

(d) Bis (ethane-1,2-diamine) chloronitrocobalt (III) chloride

349. According to postulates of Werner's theory of co-ordination compounds :

(a) primary valency is ionisable (b) secondary valence is ionisable

(c) primany and secondary valencies are non- ionisable

(d) only primary valency is non-ionisable

350. Which of the following is not an outer orbital complex ?

(a) $\left[Co(CN)_6\right]^{4-}$ (b) $\left[CoF_6\right]^{3-}$

(c) $\left[Ni(NH_3)_6\right]^{2+}$ (d) $\left[Fe(H_2O)_6\right]^{3+}$

UNIT - X

351. The hydrogen atom in chloroform is:
(a) Acidic (b) Basic (c) Neutral (d) None

352. Solvent used in dry cleaning of clothes is:
(a) Alcohol (b) Acetone
(c) Carbon tetrachloride (d) Freon

353. In Wurtz reaction of alkyl halides with sodium, the reactivity order of these halides is:
(a) RI > RBr > RCl (b) RCl > RBr > Rl
(c) RBr >RI > RCl (d) None

354. Ethyl bromide and isopropyl chloride can be distinguished by:
(a) Alcoholic $AgNO_3$ (b) Comparing their colours
(c) Burning the compound on spatula (d) Aqueous KOH solution

355. Which alkyl halide is preferentially hydrolysed by S_{N^1} mechanism:
(a) CH_3Cl (b) CH_3CH_2Cl (c) $CH_3CH_2CH_2Cl$ (d) $(CH_3)_3C.Cl$

356. The alkyl group of Grignard reagent acts as:
(a) Free radical (b) Carbonium ion (c) Carbanion (d) None

357. Grignard reagent is prepared by the reaction between:
(a) Zinc and alkyl halide (b) Magnesium and alkyl halide
(c) Magnesium and alkane
(d) Magnesium and aromatic hydrocarbon

358. Which compound is used in cooling:
(a) $CHCl_3$ (b) CCl_4 (c) CF_4 (d) CCl_2F_2

359. Reaction of chloroform with alcoholic KOH in presence of a primary aromatic amine is called:
(a) Hydrolysis (b) Reduction
(c) Wurtz reaction (d) Carbylamine reaction

360. Grignard reagent shows addition on:
(a) $> C = O$ (b) $-C \equiv N$ (c) $> C = S$ (d) All

361. Non-sticking frying pans are coated with:
(a) Ethylene (b) Styrene
(c) Tetrafluoro ethylene (Teflon) (d) Chlorofluoro methane

362. Which reagent is useful in increasing the carbon chain of an alkyi halide:
(a) HCN (b) KCN (c) NH_4CN (d) AgCN

363. Which product is obtained when bleaching powder is distilled with acetone:
(a) CCl_4 (b) $CHCl_3$ (c) CH_2Cl_2 (d) CH_3Cl

364. The compound that will not give iodoform on treatment with alkaline iodine is:
(a) Acetone (b) Ethanol
(c) Diethyl ketone (d) Isopropyl alcohol

365. Ethyl alcohol gives ethyl chloride on treatment with:
(a) NaCl (b) $SOCl_2$ (c) Cl_2 (d) KCl

366. The reaction,

$RCl + NaI \xrightarrow{\text{Acetone}} R-I + NaCl$ is known as:

(a) Wurtz's reaction (b) Fittig reaction
(c) Frankland's reaction (d) Finkelstein's reaction

367. Carbon tetrachloride on treatment with Fe/H_2O gives:

(a) Chloromethane (b) Methane
(c) Chloroform (d) Methylene chloride

368. Vicinal and geminal dihalides can be distinguished by:

(a) KOH (aq.) (b) KOH (alc.) (c) Zn dust (d) None

369. Victor Grignard was awarded Nobel Prize for making useful compounds by joining organic compounds to:

(a) Fe (b) Mg (c) Proteins (d) Na

370. CO_2 on reaction with C_2H_5MgBr and H_2O gives:

(a) Ethane (b) Propionic acid (c) Acetic acid (d) None

371. Which one is liquid at room temperature:

(a) CH_3Cl (b) C_2H_5Cl (c) CH_3Br (d) C_2H_5Br

372. A compound A of formula $C_3H_6Cl_2$ on reaction with alkali can give B of formula C_3H_6O or C of formula C_3H_4. B on oxidation gave a compound of the formula $C_3H_6O_2$. C with dilute H_2SO_4 containing Hg^{2+} ion gave D of formula C_3H_6O, which with bromine and alkali gave the sodium salt of $C_2H_4O_2$. Then A is:

(a) $CH_3CH_2CHCl_2$ (b) $CH_3CCl_2CH_3$
(c) $CH_2ClCH_2CH_2Cl$ (d) $CH_3CHClCH_2Cl$

373. Anhydrous HCl gas, on passing through ethyl alcohol, in presence of anhy. $ZnCl_2$ gives:

(a) Ethane (b) Ethyl chloride (c) Ethene (d) CC_4

374. A mixture of two organic compounds was treated with sodium metal in ether solution Isobutane was obtained as a product. The two chlorine compounds are:

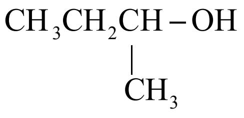
(a) Methyl chloride and propyi chloride (b) Methyl chloride and ethyl chloride
(c) Isopropyl chloride and methyl chloride
(d) Isopropyl chloride and ethyl chloride

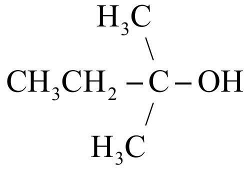
375. The reactivities of methyl chloride (A) propyl chloride (B) and chlorobenzene (C) are in the order :

(a) A > B > C (c) C > B > A (c) A < C > B (d) B > A > C

376. The order of reactivity of following alcohols with halogen acids is

(A) $CH_3\ CH_2\ CH_2-OH$

(B)

$CH_3CH_2\underset{\underset{CH_3}{|}}{CH}-OH$

(C)

$CH_3CH_2-\underset{H_3C}{\overset{H_3C}{C}}-OH$

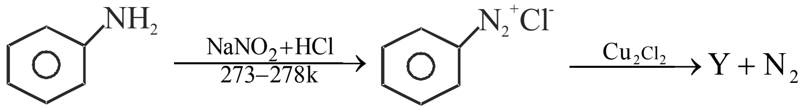
(a) A > B > C (b) C > B > A(c) B > A > C (d) A >C > B

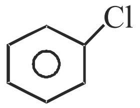
377. Which of the following alcohols will yield the corresponding alkyl chloride on reaction with concentrated HCl at room temperature ?

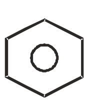
(a) $CH_3 - CH_2 - OH$ (b) $CH_3 - CH_2 - CH(CH_3) - OH$

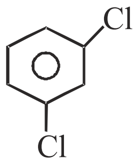
(c) $CH_3 - CH_2 - CH - (CH_3)_3 CH_2OH$ (d) $CH_3 - CH_2 - C(CH_3)_2 - OH$

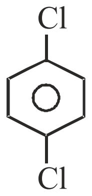
378. Identity the compound Y in the following reaction.



(a) 

(b) 

(c) 

(d) 

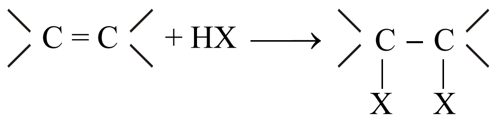
379. Toluene reacts with a halogen in presence of iron (III) chloride giving ortho and para halo compound. The reaction is

(a) Electrophilic elimination reaction (b) Electrophilic substitution reaction

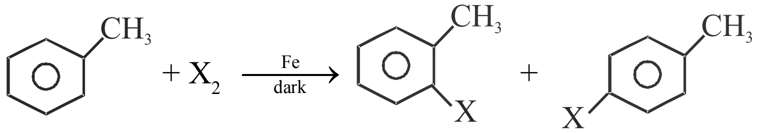
(c) free radical addition reaction (d) Nucleophilic substution reaction.

380. Which of the following is halogen exchange reaction ?

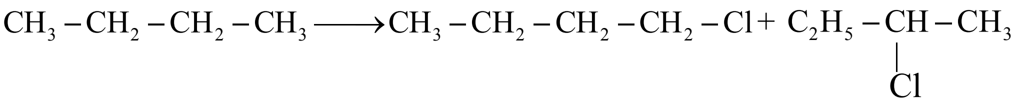
(a) $RX + NaI \longrightarrow R - I + NaX$

(b) 

(c) $R - OH + HX \xrightarrow{ZnCl} R - X + H_2O$

(d) 

381. Which reagent will you use for the following reaction ?



$$CH_3 - CH_2 - CH_2 - CH_3 \longrightarrow CH_3 - CH_2 - CH_2 - CH_2 - Cl + C_2H_5 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH_3$$

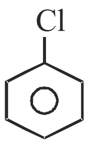
(a) Cl_2 / UV light (b) $NaCl + H_2SO_4$

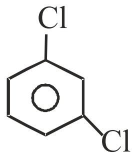
(c) Cl_2 gas in dark

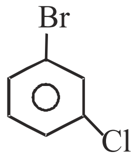
(d) Cl_2 gas in the presence of iron in dark

382. Arrange the following compounds in the increasing order of their densities.

(A) 

(B) 

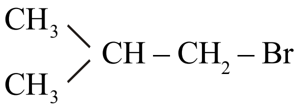
(C) 

(D) 

(a) A < B < C < D (b) D < C < B < A

(c) A < C < D < B (d) B < D < C < A

383. Arrange the following compounds in increasing order of their boiling points

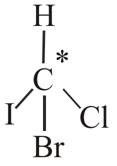
(A) 
$(CH_3)_2CH-CH_2-Br$

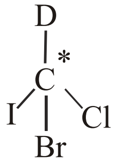
(B) $CH_3-CH_2-CH_2-CH_2-Br$

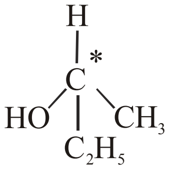
(C) $(CH_3)_3C-Br$

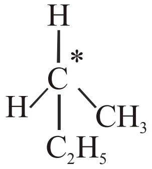
(a) B < A < C (b) C < A < B (c) A < B < C (d) C < B < A

384. In which of the following molecules carbon atom marked with asterisk is assymetric ?

(A) 

(B) 

(C) 

(D) 

(a) all of these (b) A, B, C only (c) A, B, D only (d) A and D only

385. Which of the following is an example of vic-dihalide

(a) Dichloromethane (b) 1, 2–dichloroethane

(c) ethylidene chloride (d) Alkyl chloride

386. The position of – Br in the compound in $CH_3-CH = CH\ C(Br)\ (CH_3)_2$ can _______.

(a) Allyl (b) Aryl (c) vinyl (d) Secondary

387. Chlorobenzene is formed by reaction of chlorine with benzene in the presence of $AlCl_3$ which of the following species attacks the benzene ring in this reaction ?

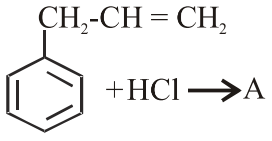
(a) Cl^- (b) Cl^+ (c) $AlCl_3$ (d) $[AlCl_4]^-$

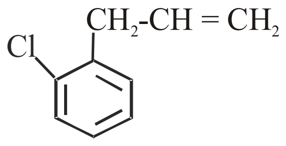
388. Whch of the following alkyl halide witll undergo SN^1 reaction most readily ?

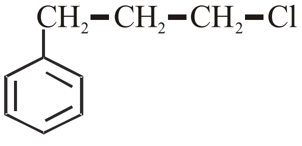
(a) $(CH_3)_3C-F$ (b) $(CH_3)_3C-Cl$

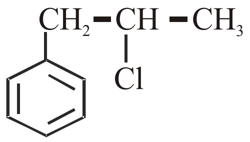
(c) $(CH_3)_3C-Br$ (d) $(CH_3)_3C-I$

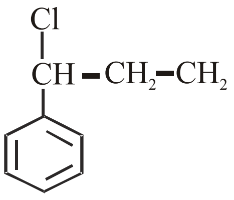
389. What is 'A' in the following reaction ?



(a) 

(b) 

(c) 

(d) 

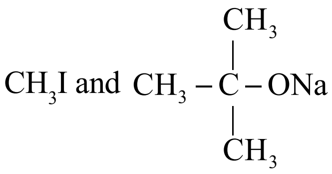
390. A primary alkyl halide would prefer to undergo _________.

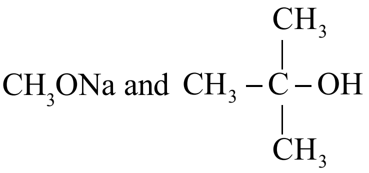
(a) S_N1 reaction (b) S_N2 reaction

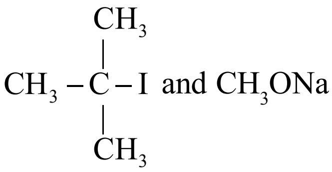
(c) α-Elimination (d) Racemisation

UNIT - XI

391. A suitable combination of reagents leading to the preparation of tert. butyl methyl ether in Williamson's synthesis is :

(a) 
$$CH_3I \text{ and } CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-ONa$$

(b) 
$$CH_3ONa \text{ and } CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-OH$$

(c) 
$$CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-I \text{ and } CH_3ONa$$

(d) None of the above

392. An alcohol on oxidation is found to give CH_3COOH and CH_3CH_2COOH finally. The alcohol is
(a) $CH_3CH_2CH_2OH$ (b) $(CH_3)_2C(OH)CH_2CH_3$
(c) $CH_3(CH_2)_2CH_2OH$ (d) $CH_3CH(OH)CH_2CH_2CH_3$

393. Primary, secondary and tertiary alcohols can be distinguished by employing :
(a) Oxidation (b) Victor Meyer's test
(c) Lucas test (d) All of these

394. Compound A reacts with PCl_5 to give B which on treatment with KCN followed by hydrolysis forms propanoic acid as the product. What is A ?
(a) Ethane (b) Propane
(c) Ethyl chloride (d) Ethyl alcohol

395. Ethanol is soluble in water due to :
(a) Ethyl group (b) Hydrogen bonding
(c) Its neutral, nature (d) Dissociation in water

396. Alcohols are isomeric with
(a) Acids (b) Ethers (c) Esters (d) Aldehydes

397. Reaction of t-butyl bromide with sodium methoxide produces:
(a) Isobutane (b) Isobutylene
(c) Sodium t-butoxide (d) t-butyl methyl ether

398. Dehydration of ethanol gives:
(a) Acetic acid (b) Ethane (c) Ethylene (d) Acetylene

399. Which alcohol is most acidic:
(a) Methanol (b) Ethanol
(c) Isopropyi alcohol (d) *t*-butyl alcohol

400. Methylated spirit is:
(a) Methanol containing some pyridine (b) Ethanol containing some methanol
(c) Pure methanol (d) 95% methanol

401. The end product (C) of the following sequence is:

$$CH_3Br \xrightarrow{KCN(adc.)} (A) \xrightarrow{H_2O^+} (B) \xrightarrow[Ether]{LiAlH_4} C$$

(a) CH_3CHO (b) CH_3CH_2OH (c) CH_3COCH_3 (d) CH_4

402. When isopropyl alcohol vapours are passed over heated copper it gives:

(a) Acetone (b) Ethyl alcohol

(c) Methyl alcohol (d) Acetaldehyde

403. 2 mole of ethanol are burnt. The amount of CO_2 obtained will be:

(a) 132 g (b) 44 g (c) 176 g (d) 88 g

404. The product formed in the following reaction

$C_6H_5 - O - CH_3 + HI \xrightarrow{\text{Heat}}$ are :

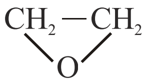
(a) C_6H_5OH and CH_3I (b) C_6H_5I and CH_3OH

(c) $C_6H_5CH_3$ and HOI (d) C_6H_6 and CH_3OI

405. In the reduction,

$R - CHO + H_2 \longrightarrow RCH_2OH$ the catalyst used is:

(a) Ni (b) Pd (c) Pt (d) Any of these

406. Reaction of  with RMgX followed with hydrolysis produces:

(a) RCHOHR (b) RCH_2CH_2OH (c) $RCHOHCH_3$ (d) RCH =CHOH

407. An isomer of ethanol is:

(a) methanol (b) diethyl ether (c) dimethyl ether (d) acetone

408. Which of the following is a primary alcohol?

(a) Butan-2-ol (b) Propan-2-ol

(c) Butan-1-ol (d) 4,5-dimethyl hexan-4-ol

409. The general molecular formula of homologous series of alkanols is :

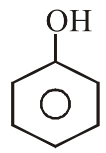
(a) $CnH_{2n+2}O$ (b) $CnH_{2n}O_2$ (c) $CnH_{2n}O$ (d) $C_nH_{2n-2}O$

410. Benzyl amine reacts with nitrous acid to form

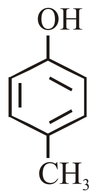
(a) azobenzene (b) benzene

(c) benzyl alcohol (d) phenol

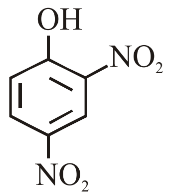
411. Strength of acidity is in the order :



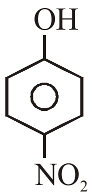
(I)



(II)



(III)



(IV)

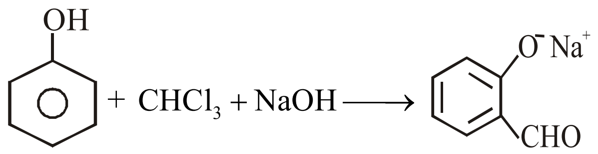
(a) II > I > III > IV (b) III > IV > I > II

(c) I > IV > III > III (d) IV > III > I > II

412. Phenol reacts with Br_2 in CS_2 to give :

(a) o-bromo phenol (b) m-bromo phenol

(c) o-and p-bromo phenol (d) 2, 4, 6-tri bromo phenol

413. 

The electrophile involved in the above reaction is

(a) dichloro methyl cation $\left(C^{\oplus}HCl_2\right)$ (b) dichloro carbene $(:CCl_2)$

(c) trichloromethyl anion $\left(C^{-}Cl_3\right)$ (d) formylcation $(C^{+}HO)$

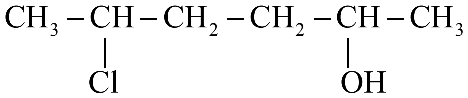
414. Phenol can be distinguished from ethanol by the following reagents except :

(a) sodium (b) NaOH+ I_2 (c) Neutral $FeCl_3$ (d) Br_2 / H_2O

415. When ethanol is heated with HI and red phosphorus it gives -

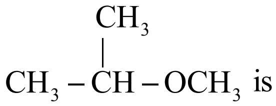
(a) Ethyl iodide (b) Ethane (c) Ethylene (d) Ether

416. The IUPAC name of the compound given below is


$CH_3-\underset{\displaystyle Cl}{CH}-CH_2-CH_2-\underset{\displaystyle OH}{CH}-CH_3$

(a) 2-chloro-5-hydroxy hexane (b) 2-hydroxy-5-chloro hexane

(c) 5-chloro hexan-2-ol (d) 2-chloro hexan-5-01

417. IUPAC name of  $CH_3-\overset{\displaystyle CH_3}{CH}-OCH_3$ is

(a) 1-methoxy - 1- methyl ethane (b) 2-methoxy - 2- methyl ethane

(c) 2-methoxy propane (d) isopropyl methyl ether

418. The process of converting alkyl halides to alcohols involves

(a) addition reaction (b) substitution reaction

(c) dehydro halogenation reaction (d) rearrangement reaction

419. Monochlorination of toluene in sunlight followed by hydrolysis with aq-NaOH gives

(a) 0-cresol (b) m-cresol

(c) 2, 1-dihydroxy toluene (d) Benzyl alcohol

420. Phenyl magnesium bromide reacts with methanol to give

(a) a mixture of anisole and Mg(OH) Br

(b) a mixture of benzene and Mg(OMe) Br

(c) a mixture of toluene and Mg(OH) Br

(d) a mixture of phenol and Mg(OH) Br

421. What is the order of reactivity of alcohols in the following reaction?

$ROH + HCl \xrightarrow{ZnCl_2} RCl + H_2O$

(a) $1^o > 2^0 > 3^0$ (b) $1° < 2° > 3°$ (c) $3° > 2° > 1°$ (d) $3° > 1° > 2°$

422. During dehydration of alcohols to alkenes by heating with cone. H_2SO_4, the initial step is

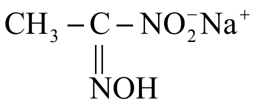
(a) formation of an ester (b) protonation of alcohol molecule

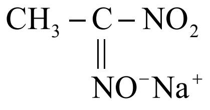
(c) formation of carbocation (d) elimination of water

423. CH_3CH_2OH can be converted to CH_3OH, step -I involves following Hofmann's bromamide reaction
(a) catalytic hydrogenation
(b) By treatment with LiAl H_4
(c) treatment with pyridinium chlorochromate
(d) treatment with acidified $K_2Cr_2O_7$

424. The most suitable reagent for the conversion of $RCH_2OH \longrightarrow RCHO$ is
(a) PCC (Pyridinium chloro chromate) (b) $KMnO_4$
(c) $K_2Cr_2O_7$ (d) CrO_3

425. The red coloured compound formed during Victor - Meyer's test for ethanol is

(a) 
$CH_3-\underset{\underset{NOH}{||}}{C}-NO_2^-Na^+$

(b) 
$CH_3-\underset{\underset{NO^-Na^+}{||}}{C}-NO_2$

(c) $CH_3CH=NOH$ (d) $CH_3CH_2NH\,OH$

426. Which of the following is most a acidic ?
(a) Benzyl alcohol (b) Cyclohexanol (c) Phenol (d) m-chlorophenol

427. Which one of the following is not expected to undergo iodoform reaction ?
(a) Propan-2-ol (b) Ethanol
(c) Diphenyl methanol (d) Butan-2-ol

428. Among following four compounds
(i) phenol (ii) p-methyl phenol
(iii) meta-nitro phenol (iv) p-nitro phenol
The acidity order in
(a) iv > iii > i > ii (b) iii > iv > i > ii (c) i > iv > iii > ii (d) ii > i > iii > iv

429. Phenol, when it first reacts with conc. H_2SO_4 and then with cone. HNO_3 gives
(a) nitrobenzene (b) 2, 4, 6 - trinitro benzene
(c) picric acid (d) p-nitrophenol

430. The major product obtained on interaction of phenol with NaOH and CO_2 is
[Kolbe - Schmitt reaction]
(a) Salicyaldehyde (b) Salicylic acid (c) phthalic acid (d) benzoic acid

431. In the following reaction $C_2H_5OC_2H_5 + 4H \xrightarrow{Red\,P+HI} 2X + H_2O', X'$ is
(a) ethane (b) ethylene (c) butane (d) propane

432. o-nitrophenol is less soluble in water than m- and p-nitrophenol because
(a) o-nitrophenol shows intramolecular H-bonding
(b) o-nitrophenol shows intermolecular H-bonding
(c) o-nitrophenol is more volatile than m-&p-isomers
(d) melting point of o-nitrophenol is less than those of m- and p-nitrophenol

433. Which of the following compounds can be used as antifreeze in automobile radiators ?
(a) Methyl alcohol (b) Ethane-1, 2-diol (c) Nitrophenol (d) Ethyl alcohol

434. Acid catalysed hydration of propene except ethane leads to the formation of
(a) primary alcohol (b) propan-2-ol
(c) mixture of primary and secondary alcohol propane
(d) mixture of secondary and tertiary alcohol propan-1-ol

UNIT - XII

435. Reagent used for the oxidation of allyl alcohol to acrolein is
(a) $KMnO_4$ (b) H_2O_2 (c) Active MnO_2 (d) OsO_4

436. Formic acid and acetic acid can be distinguished by
(a) Baeyer's reagent (b) $NaHCO_3$
(c) Tollen's reagent (d) Collin's reagent

437. Which of the following compounds does not have a carboxyl group ?
(a) Benzoic acid (b) Palmitic acid
(c) Picric acid (d) Oleic acid

438. The end –product in the sequence of reaction $R-X \xrightarrow{KCN} A \xrightarrow[\Delta]{dil.NaOH} B$ is
(a) an alkane (b) a carboxylic
(c) sodium alkanoate (d) saponification

439. Monocarboxylic acids show functional isomerism with
(a) esters (b) alcohols (c) ethers (d) aldehydes

440. Electrolysis of potassium salt of maleic acid to ethyne is known as
(a) Wurtz's reaction (b) Clemmensen's reduction
(c) Kolbe's reaction (d) Sabatier senderen's reactions

441. HVZ reaction is used to prepare
(a) aldehyde (b) ketones (c) primary amine (d) bromo acids

442. Acetamide is
(a) amphoteric (b) acidic (c) basic (d) neutral

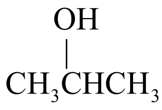
443. Ammonium formate on heating gives
(a) formamide (b) ammonium acetate
(c) formic acid (d) acetamide

444. The general formulae of aldehyde and ketone is
(a) $C_nH_{2n+2}O$ (b) $C_nH_{2n}O$ (c) $C_nH_{2n-2}O$ (d) $C_nH_{2n}O_2$

445. In Rosenmund reduction the catalyst used Pd-$BaSO_4$ to prepare
(a) RCHO (b) RCOR (c) RCH_2OH (d) none of these

446. A mixture of formaldehyde and benzaldehyde in presence of NaOH gives
(a) benzyl accohol and sodium formate (b) sodium benzoate and methyl alcohol
(c) sodium benzoate and sodium formate (d) benzyl alcohol and methyl alcohol.

447. The function of conc. H_2SO_4 in esterification process is
(a) catalyst (b) dehydrating agent
(c) hydrolysing agent (d) none of these

448. Which of the following do you consider to be suitable for obtaining acetone ?
(a) Heating $CH_3CH_2CH_2OH$ with acidic $Na_2Cr_2O_7$
(b) Passing  $CH_3\overset{\overset{OH}{|}}{C}HCH_3$ over heated copper
(c) Oxidation of $CH_3CH_2CH_3$ with concentrated HNO_3
(d) Heating $CH_3CH=CH_2$ with dilute H_2SO_4

449. Acetone reacts with HCN to form a cyanohydrin. It is an example of

(a) Electrophilic addition reaction (b) Electrophilic substitution reaction

(c) Nucleophilic addition reaction (d) Nucleophilic substitution reaction

450. Which of the following reagents will react readily with both aldehydes and ketones ?

(a) Grignard reagent (b) Fehling's reagent

(c) Tollen's reagent (d) Schiff's reagent

451. Acetone undergoes reduction with hydrazine is the presence of NaOH to form propane. This reaction is known as

(a) Clemmensen reduction (b) Wolf-Kishner reduction

(c) Rosenmund reduction (d) Reformatsky reduction

452. Which of the following is oxidised to the corresponding carbonyl compound ?

(a) propan-2-ol (b) o-nitrophenol

(c) phenol (d) 2-methyl -propan-2-ol.

453. The IUPAC name of $CH_3COCH\ (CH_3)_2$ is

(a) 3-methylbutan-2-one (b) Isopropyl methyl ketone

(c) 2-methyl-3-butanone (d) 4-methyl isopropyl ketone

454. Which of the following molecule yields acetone on ozonolysis ?

(a) 3-methyl-l-butene (b) Cyclopentane

(c) 2-methyl but-l-ene (d) 2-methyl but-2-ene.

455. In the following sequence of reactions

$CH_3-CH_2-OH \xrightarrow{P+I_2} A \xrightarrow[ether]{Mg} B \xrightarrow{HCHO} C \xrightarrow{H_2O} D$ the compound D is

(a) n-propyl alcohol (b) propanal

(b) butanal (d) n-butyl alcohol

456. Which of the following gives sodium propanoate on iodoform test ?

(a) Acetone (b) Acetaldehyde (c) butanone (d) acetophenone

457. Among the following compounds, which will react with acetone to give a product containing $\rangle C = N - $?

(a) $C_6H_5NH_2$ (b) $(CH_3)_3N$

(c) $C_6H_5NHC_6H_5$ (d) $C_6H_5NHNH_2$

458. Aldehydes and ketones can be reduced to alkanes by

(a) Clemmensen's reduction (b) Wolff-Kishner reduction

(c) Meerwein- Pondorf Verly reduction (d) Bouveault Blank reductions

459. Identify the final product (Z) in the following sequence of reactions

$Me_2CO + HCN \rightarrow X \xrightarrow{H_3O^+} Y \xrightarrow[\Delta]{H_2SO_4} Z$

(a) $(CH_3)_2\ C(OH)\ COOH$ (b) $CH_2 = C\ (CH_3)COOH$

(c) $HOCH_2\ CH\ (CH_3)COOH$ (d) $CH_3CH{=}CH{-}COOH$

460. Which of the following gives Cannizzarro's reaction ?

(a) Acetone (b) Acetic acid (c) formaldehyde (d) Acetal dehyde

461. Which one of the following will not react with ammoniacal $AgNO_3$ solution ?
(a) Acetylene (b) Acetone (c) Acetaldehyde (d) formic acid

462. Cannizzarro's reaction is not given by —
(a) formaldehyde (b) acetaldehyde
(c) trichloroacetal dehyde (d) benzal dehyde.

463. Aldehydes reacts with hydroxylamine to produce —
(a) oxime (b) alcohol
(c) hydrazone (d) Phenyl hydrazone

464. Which of the following on treatment with 50% aqueous NaOH undergoes disproportionation ?
(a) C_6H_5CHO (b) $CH_3–CH_2–CH_2CHO$
(c) $CH_3–COCH_3$ (d) $C_6H_6CH_2–CHO$

465. Propyne $\xrightarrow[H_2SO_4]{HgSO_4}$ A, the compound A is
(a) Propanal (b) Propane (c) Propene (d) propanone

466. The reagent used for the separation of acetal dehyde and acetophenone is
(a) $NaHSO_3$ (b) $C_6H_5NHNH_2$ (c) NH_2OH (d) $NaOH/I_2$

467. Acetic acid on heating in presence MnO gives
(a) CH_3COCH_3 (b) CO_2
(c) H_2O (d) mixture of all these

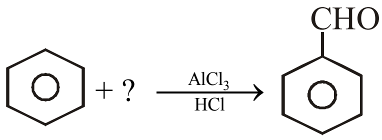
468. Among HCHO, CH_3CHO, and C_6H_5CHO which will under go aldol type condensation.
(a) HCHO (b) CH_3CHO (c) CH_3COCH_3 (d) (b) and C

469. Rosenmund's reduction fails to give ______
(a) Formaldehyde (b) acetone (c) acetaldehyde (d) (a) & (b)

470. Which of the following compounds will under go self aldol .condensation with cold dil. NaOH ?
(a) HCHO (b) CH_3COCH_3
(c) CH_3CHO (d) (a) and (b)

471. In the reaction $CH_2O + CH_3MgI \longrightarrow A \xrightarrow{H_2O} B + Mg(OH)I$. What are A and B?
(a) $CH_3OMgI + CH_3OH$
(b) $CH_3–CH_2– OMgI + C_2H_5O – C_2H_5$
(c) $CH_3–CH_2–OMgI + CH_3–CH_2–OH$ (d) $CH_3\text{-}CH_2I + CH_3CH_2–OH$

472 . Which of the following gives an aldehyde on dry distillation ?
(a) Calcium formate + Calcium acetate
(b) Calcium acetate + Calcium benzoate
(c) Calcium acetate (d) Calcium benzoate

473. 

Identify the reactiant -
(a) H_2O (b) HCHO (c) CO (d) CH_3CHO

474. Pentan-3-ol on reaction with aluminium tertiary butoxide in the presence of acetone gives
(a) 3- pentanal (b) 2-pentanal (c) pentan-3-one (d) 2-pentanone

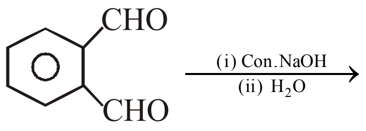
475. Silver mirror test is given by which one of the following compounds ?
(a) Acetaldehyde (b) Acetone
(c) formaldehyde, ethylmethyl ketone (d) boenzophenone

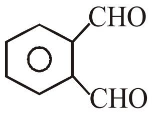
476. Trichloroacetaldehyde was subjected to Cannizzaro's reaction. The mixture of the products contains sodium trichloroacetate and another compound. The other compound is
(a) 2,2,2- trichloro ethanol (b) trichloro methanol
(c) 2,2,2- trichloro propanol (d) chloroform

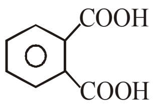
477. $CH_3COOH \xrightarrow{LiAlH_4} X \xrightarrow[300^0 C]{Cu} Y \xrightarrow[NaOH]{dilute} Z$

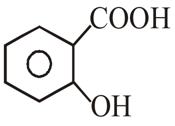
In the above reaction Z is
(a) butanol (b) aldol (c) ketol (d) acetal

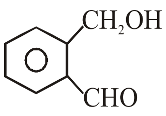
478. An organic compound of molecular formula C_3H_6O did not give a silver mirror with Tollen's reagent but gave an oxime with hydroxyl amine, it may be
(a) $CH_3-CO-CH_3$ (b) C_2H_5-CHO
(c) $CH_2=CH-CH_2-OH$ (d) $CH_3-O-CH=CH_2$

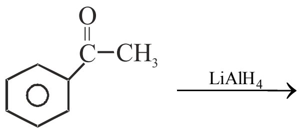
479. 

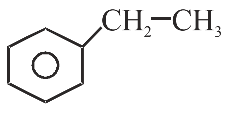
(a) 

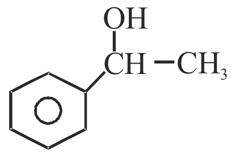
(b) 

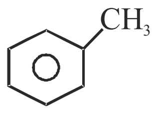
(c) 

(d) 

480. The product formed in the reaction  is

(a) 

(b) 

(c) 

(d) None of these

481. CH_3-CH_2-COOH

$\xrightarrow{Red P/Cl_2} \xrightarrow{Cl_2/P} (A) \xrightarrow[KOH]{alc.} (B)$ is
(a) CH_3CH_2-COCl (b) CH_3CH_2-CHO
(c) $CH \equiv C-COOH$ (d) $Cl-CH_2-CH_2-COOH$

482. When $CH_2=CH-COOH$ is reduced with $LiAlH_4$, the compound obtained will be.
(a) CH_3-CH_2-CHO (b) CH_3-CH_2-COOH
(c) $CH_2=CH-CH_2OH$ (d) CH_3-CH_2-COOH

483. The general formula $C_nH_{2n}O_2$ could be for open chain

(a) dialdehydes (b) diketones

(c) Alkenediol (d) diols

484. In $H{-}COO^-$ the two C–O bonds are found to be equal of length. What is the reason for this ?

(a) the anion is obtained by the removal of a proton from the acid molecule.

(b) the electronic orbitals of carbon atom are hybridised.

(c) the C=O bond is weaker than C—O bond.

(d) the anion $H{-}COO^-$ has two resonating structures.

485. The intermediate formed during the reaction of $R{-}CONH_2$ with Br_2 and KOH are :

(a) RCONHBr and RNCO (b) R–NHCOBr and RNCO

(c) RNHBr and RCONHBr (d) $R{-}CONH_2$

486. The-OH group of an alcohol or-COOH group of a carboxylic acid can be replaced by using :

(a) HOCl (b) Cl_2 (c) HCl (d) PCl_5

487. The correct order of increasing acid strength of the compounds.

(A) CH_3COOH (B) $CH_3O\ CH_2\text{-}COOH$

(C) CF_3COOH (D)  $\begin{matrix}M_e\\M_e\end{matrix}>CHCOOH$

(a) B < D < A < C (b) D < A < C < B

(c) D < A < B < C (d) A < D < C < B

488. Consider the acidity of the following carboxylic acids

(i) PhCOOH (ii) $o{-}NO_2\ C_6H_4{-}COOH$

(iii) p-nitro C_6H_4COOH (iv) m-nitro C_6H_4COOH

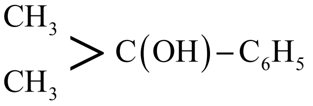
Which of the following order is correct.

(a) i > ii > iii > iv (b) ii > iv > iii > i (c) ii > iv > i > iii (d) ii > iii > iv > i

489. In a set of reaction acetic acid yields a product (c)

$CH_3COOH + PCl_5 \rightarrow A \xrightarrow[AlCl_3]{C_6H_6} B \xrightarrow[ether]{C_2H_5MgBr} (C)$ then the product C is

(a) $CH_3CH\ (OH)\ C_2H_5$ (b) $CH_3COC_6H_5$

(c) $CH_3CH\ (OH)\ C_6H_5$ (d)  $\begin{matrix}CH_3\\CH_3\end{matrix}>C(OH)-C_6H_5$

490. Which ofthe following compounds will form silver mirror with $[Ag(NH_3)_2]OH$?

(a) HCOOH (b) CH_3COOH (c) CH_3COCH_3 (d) CH_3OH

491. The end product 'Z' in the set of reactions is

$CH_3COOH \xrightarrow{NH_3} X \xrightarrow{\Delta} Y \xrightarrow{P_2O_5} Z$

(a) CH_4 (b) CH_3OH (c) CH_3CN (d) CH_3NC

492. Identify the correct order of boiling point of the following compounds.

(i) $CH_3CH_2CH_2CH_2{-}OH$ (ii) $CH_3{-}(CH_2)_2{-}CHO$

(iii) $CH_3CH_2CH_2{-}COOH$

(a) i > ii > iii (b) iii > i > ii (c) iii > ii >i (d) none of these

493. Ethylacetate reacts with sodium/alcohol gives

(a) ethanol (b) methanol (c) but-2-ol (d) butan-1-ol

494. Which reaction is suitable for the preparation of α-chloro acetic acid ?

(a) HVZ reaction (b) Nef reaction

(c) Stephen's reaction (d) Eerkin Condensation

495. Further oxidation of which compound is not possible ?

(a) $CH_3–COOH$ (b) $CH_3–COCH$

(c) CH_3CHO (d) $CH_3–CH_2–OH$

496. The acid which contains an aldehyde group is

(a) acetic acid (b) formic acid

(c) benzoic acid (d) Propionic acid.

497. The reagent which does not give acid chloride on treating with a carboxylic acid is

(a) PCl_5 (b) Cl_2 (c) $SOCl_2$ (d) PCl_3

UNIT - XIII

498. Primary amine is not given by

(a) reduction of amides (b) reduction of nitroalkanes

(c) reduction of alkyl cyanides (d) reduction of isonitriles

499. Primary and secondary amines are distinguished by

(a) Br_2 (b) NH_3

(c) $\left[Ag(NH_3)_2\right]^+$ (d) $CHCl_3/KOH$

500. Which amine gives on alcohol with nitrous acid ?

(a) $C_2H_5 – NH_2$ (b) $(C_2H_5)_2$ NH (c) $(C_2H_5)_3N$ (d) none of these

501. The reactive species during nitration of benzene is:

(a) NO_2^+ (b) NO_2^- (c) N_2O_4 (d) HNO_3

502. Chloropicrin is obtained by the reaction of

(a) steam on CCl_4 (b) nitric acid on chlorobenzene

(c) chlorine on picric acid (d) nitric acid on chloroform

503. Acetanalide on nitration followed by alkaline hydrolysis gives

(a) o-nitro acetanilide (b) p-nitro aniline

(c) m-nitro aniline (d) 2,4,6 trinitroaniline

504. Nitration is easy in case of

(a) toluene (b) nitrobenzene (c) chlorobenzene (d) sulpho benzene

505. Among the following weakest base is:

(a) $C_6H_6CH_2NH_2$ (b) $C_6H_6CH_2NHCH_3$

(c) $O_2N–CH_2NH_2$ (d) CH_3NHCHO

506. Reduction of nitroalkane in neutral medium is made with

(a) H_2/Ni (b) LiA/H_4 (c) Zn/NH_4Cl (d) $NaBH_4$

507. Reaction of acetamide with bromine water and KOH gives:

(a) CH_3COOH (b) $CH_3CH_2NH_2$

(c) CH_3COONH_4 (d) CH_3NH_2

508. Which of the following amines cannot be acytylated using acetyl chloride ?

(a) Methylamine (b) Dimethylamine (c) Trimethylamine (d) Ethylamine

509. The colour of the product obtained by reacting 2° nitroalkane with HNO_2 is:
(a) white (b) blue (c) red (d) yellow

510. Hinsberg's reagent is:
(a) benzene sulphonyl chloride (b) benzene sulphonic acid
(c) phenyl isocyanide (d) benzene sulphonamide

511. Glucose and fructose are :
(a) optical isomers (b) functional isomers
(c) chain isomers (d) position isomers

512. Which of the following has higher boiling point ?
(a) CH_3OH (b) $CH_3–CH_2OH$
(c) $CH_3CH_2NH_2$ (d) $CH_2=CH–NH_2$

513. Bromination aniline in aq medium gives _____
(a) 2-bromo aniline (b) 2, 4 dibromo benzene
(c) 2, 4, 6 tribromo benzenamine (d) none of these

514. Which of is not confirmed by dye test ?
(a) naphthol (b) naphthaline (c) phenol (d) aniline

515. For eliminating $–NH_2$ group from benzene ring the reagent(s) necessary _____
(a) $NaNO_2 + HCl$ (b) H_3PO_2 (c) a & b (d) ethylalcohol

516. Towards S_E reaction the most reactive is ______.
(a) nitrobenzene (b) aniline
(c) aniline hydrochloride (d) N-acetylaniline

517. Which of the following is most basic ?
(a) Benzylamine (b) Aniline (c) Acetanilide (d) p-nitroaniline

518. When ethyl amine is treated with CH_3MgBr, the product is :
(a) CH_3CH_3 (b) CH_4
(c) $CH_3CH_2CH_3$ (d) $CH_3CH_2CH_2CH_3$

519. When Aniline is heated with Conc.H_2SO_4 at 455-475K, it forms :
(a) Aniline hydrogen sulphate (b) m-Aminobenzene sulphonic acid
(c) Benzene sulphonic acid (d) Sulphonailic acid

520. Which of the following compound will give dye test?
(a) Aniline (b) Methyl amine
(c) Diphenyl amine (d) Ethyl amine

521. Which of the fallowings does not react with Hinsberg's reagent ?
(a) $C_2H_5NH_2$ (b) $(C_2H_5)_2$ NH (c) $(C_2H_5)_3N$ (d) CH_3NH_2

522. The reagent used for separation of acetaldehyde and acetophenone as
(a) $NaHSO_3$ (b) $C_6H_5NHNH_2$ (c) NH_2OH (d) I_2 + NaOH

523. Aniline is prepared in presence of Sn/Conc HCl from
(a) benzene (b) nitrobenzene (c) dinitrobenzene (d) none of these

524. Gabriel's synthesis is used mostly for the preparation of aliphatic _____.
(a) 1^0 amine (b) 1° alcohol (c) 3° amin (d) 3° alcohol

525. Which of the following is the strongest base in aqueous solution ?
(a) Trimethyl amine (b) Dimethyl amine (c) Methyl amine (d) Aniline

526. Libermann nitroso reaction is for detection of—
(a) Secondary amine (b) aniline
(c) CH_3NH_2 (d) 2-nitropropane

Unit - XV

527. Terylene is
(a) Polyamide (b) Polyster (c) Polystyrene (d) Polyacrylonitrile

528. Caprolactum polymerises to give
(a) Nylon-6 (b) Buna-S (c) Glypta (d) Teflon

529. Which of the following is a copolymer ?
(a) Buna-S (b) PAN (c) Polythene (d) PTFE

530. Rayon is a
(a) natural polymer (b) semi-synthetic polymer
(c) synthetic polymer (d) none of these

531. Which of the following is not a thermoplastic ?
(a) Polythene (b) Bakehte (c) Nylon 6,6 (d) Teflon

532. Which is not a condensation polymer ?
(a) nylon-6,6 (b) glyptal
(c) dacron (d) poly tetra fluoro ethene

533. Natural rubber is a polymer of
(a) butadiene (b) ethylene (c) isoprene (d) neoprene

534. Which of the following is a bio- degradable polymer ?
(a) cellulose (b) polythene (c) PVC (d) Nylon-6

535. Terylene is a condensation polymer of, ethylene glycol and
(a) benzoic acid (b) phthalic acid
(c) salicylic acid (d) terephthalic acid

536. Vulcanisation of rubber is carried out by adding
(a) sulphur (b) carbon (c) ozone (d) phosphorus

537. Which is not a biopolymer ?
(a) starch (b) protein (c) orlon (d) nucleic acid

538. Catalyst used in olefin polymerisation
(a) Zeigler -Natta catalyst (b) Wilkinson catalyst
(c) Raney nickel (d) Resin

539. Which of the following fibres are made of polyamides ?
(a) Dacron (b) Orlon (c) Nylon (d) Rayon

540. HDP is an example of_____ polymer.
(a) Linear chain (b) branched chain (c) crossed chain (d) coupling

541. Neoprene is a polymer of
(a) chloroprene (b) chloroquine (c) propylene (d) isoprene

542. Natural rubber is a polymer of
(a) cis-isoprene (b) neoprene (c) chloroprene (d) trans-isoprene

543. Which of the following is not an example of addition polymer ?
(a) Polystyrene (b) Polyethylene (c) Polypropylene (d) Terylene

544. Which one is a protein fibre ?
(a) Rayon (b) Polyester (c) Silk (d) Cotton

545. Orlon is a polymer of
(a) Styrene (b) Vinyl chloride
(c) Acrylonitrile (d) Butadine and adipic acid

546. Nylon - 66 is obtained from
(a) Hexamethylenediamine and adipic acid (b) Phenol and formaldehyde
(c) Propylene and adipic acid (d) Adipic acid and phthalic acid

547. Bakelite is obtained by
(a) Substitution Reaction (b) Condensation Reaction
(c) Addition Reaction (d) Elimination Reaction

548. Caprolactum can be obtained from:
(a) Benzaldehyde (b) Cyclohexane (c) Benzophenone (d) Adipicacid

549. A polymer of prop-2-ene nitrile is called:
(a) Saran (b) Orlon (c) Dacron (d) Tetron

550. Peptide bond is a key feature in:
(a) Polysaccharide (b) Proteins (c) Nucleotide (d) Vitamins

551. Synthetic human hair wigs are made from a Co-/ polymer of vinyl chloride and acrylonitrile and is called:
(a) PVC (b) Polyacrylonitrile (c) Cellulose (d) Dynel

552. The widely used PVC is a polymerised product of:
(a) $CH_2 = CH_2$ (b) $CH_2 = CCl_2$
(c) CH_2ClCH_2Cl (d) $CH_2 = CHCl$

553. Which of the following is a step growth polymer:
(a) Bakelite (b) Polyethylene (c) Teflon (d) PVC

554. Which of the following is incorrect about polymer ?
(a) thermosetting polymers are hard and brittle
(b) Chlorophyl has molecular formula $C_{55}H_{72}O_5 N_4Mg$
(c) Polymers have molecularmass in the order 10^3–10^7 u
(d) Teflon is also known as PMMA

555. The catalyst used in the manufacture of polythene by Zeigler method is:
(a) Titanium tetrachloride and triphenyl aluminium
(b) Titanium tetrachloride and triethyl aluminium
(c) Titanium dioxide (d) Titanium isoperoxide

556. Thermoplastics are:
(a) Linear polymers (b) Soften or melt on heating
(c) Molten polymer can be moulded in desired shape
(d) All

557. Which are true for elastomers:
(a) These are synthetic polymers possessing elasticity
(b) These possess very weak intermolecular forces of attractions between polymer chains
(c) Vulcanised rubber is an example of elastomer (d) All of these

558. Which of the following is not a biodegradable polymer ?

(a) PHBV (b) Nylone-2-nylon-6 (c) pectins (d) Teflon

Unit - XVI

559. Which of the following is antihistamine ?

(a) Ranitidine (b) Lansoprazole (c) Terfenadine (d) Luminal

560. Which of the following is a tranquilizer a drug to treat mental disease

(a) Naproxen (b) Tetracyclin

(c) chloropheniramine (d) Equanil

561. Which is used as pain killer ?

(a) Antibiotic (b) Analgesic (c) Antipyretic (d) Antioxidants

562. Structurally biodegradable detergents should contain

(a) normal alkyl chain (b) branched alkyl chain

(c) phenyl sidechain (d) cyclohexyl side chain

563. Which of the following is/are neurologically active drugs ?

(a) Antibiotic (b) Analgesic (c) Antipyretic (d) Antioxidants

564. The oxidant used as antiseptic is

(a) $KMnO_4$ (b) $KBrO_3$ (c) CrO_3 (d) KNO_3

565. Which of the following is a antihistamine drug?

(a) Ciprofloxacin (b) Chloroquine

(c) Chloromophenicol (d) Chloropheniramine maleate

566. A drug that is antipyretic as well as analgesic is

(a) Chloroquin (b) Penicillin (c) paracetamol

(d) Chloropromazine hydrochloride

567. Antiseptics and disinfectants generally contain.

(a) Acetamide group (b) Chlorophenolic group

(c) Ether function (d) Nitrogroup

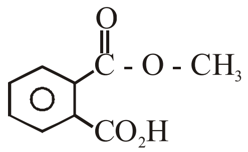
568. Morphine is

(a) Antiseptic (b) Antibiotics (c) Analgesic (d) Antimalaria

569. Novalgin is a common name of

(a) Analgesic (b) Antibiotic (c) Antipyretic (d) Antimalaria

570. The following compound is



(a) An anti-inflemmatory compound (b) Analgesic

(c) Hypnotic (d) Antiseptic

571. Which of the following is an anionic detergent ?

(a) $CH_3(CH_2)_{16}\ CH_2OSO_3Na$ (b) $CH_3(CH_2)_{16}\ N^+(CH_3)_3Cl^-$

(c) $C_6H_5SO_3Na$ (d) none of these

572. Medicine which is an antibiotic is

(a) ampicilin (b) aspirin (c) calmpose (d) chloroquine

573. A detergent is :

(a) drug (b) catalyst

(c) surface active agent (d) soap

574. Metal lauryl sulphate acts as:

(a) Soap (b) Disinfectant (c) Antiseptic (d) Detergent

575. Digestion of fat in intestine is aided by:

(a) Diffusion (b) Protection (c) Peptization (d) Emulsification

576. Hydrogenation of oils involves:

(a) Saturation of unsturated fatty acids . (b) Reaction with oxygen

(c) Conversion into fatty acids

(d) Driving of the impurities in oil by hydrogen gas

577. Which of the following is molecular disease ?

(a) Allergy (b) Cancer

(c) German measeles (d) Sickel-cell-anaemia

578. Salol can be used as:

(a) Antiseptic (b) Antipyretic (c) Analgesic (d) None of these

579. The drug which is effective in curing malaria, is:

(a) Quinine (b) Aspirin (c) Analgin (d) Equanil

580. A substance which can act both as antiseptic and disinfectant is:

(a) Aspirin (b) Chloroxylenol (c) Bithional (d) Phenol

581. The first viral disease detected in human being was:

(a) Cold (b) Influenza (c) Small pox (d) Yellow fever

582. Heroin is a derivative of:

(a) Cocaine (b) Morphine. (c) Caffeine (d) Nicotine

583. Phenacetin is used as:

(a) Antipyretic (b) Antiseptic (c) Antimalarial (d) Analgesic

584. Detergents are usually made from products obtained by cracking of petroleum like:

(a) Chloroalkanes (b) Sulphur compounds of benzene

(c) H_2S (d) Polyethylene derivatives

585. An antibiotic contains nitro group attached to aromatic nucleus. It is:

(a) Penicillin (b) Streptomycin

(c) Tetracycline (d) Chloramphenicol

586. Various phenol derivatives, tincture of iodine (2- 3% I in water/alcohol) and some dyes like methylene blue are:

(a) Antiseptics (b) Disinfectants (c) Analgesics (d) Antipyretics

(a) 0.155 (b) .225 (c) 0.414 (d) 0.732

Additional questions as per original syllabus :
A1 (MCQs)

Unit - I

587. For an octahedral arrangement the lowest radius ratio limit is ___________.
(a) 0.155 (b) .225 (c) 0.414 (d) 0.732

588. Which of the following compounds shows stoichiometric defect ?
(a) FeO (b) NiO (c) FeS (d) ZnS

589. Defects in non-stoichiometric solids are due to
(a) metal excess defect (b) anion vacancy
(c) extraction in interstitial sites (d) all of these

590. Conductivity of semiconductors is in the order :
(a) 10^{-20} to 10^{7} ohm^{-1} m^{-1} (b) $10^{4} - 10^{7}$ ohm^{-1} m^{-1}
(c) 10^{-20} to 10^{-10} ohm^{-1} m^{-1} (d) $10^{-6} - 10^{4}$ ohm^{-1} m^{-1}

591. Ferrimagnetic substances lose ferromagnetism on heating and become ______.
(a) paramagnetic (b) diamagnetic
(c) non-magnetic (d) antiferromagnetic

592. Which of the following is diamagnetic ?
(a) O_2 (b) N_2 (c) Cu^{2+} (d) Fe^{3+}

593. Which of the following does not characterise paramagnetism ?
(a) weakly attracted by magnetic field
(b) These are magnetised in magnetic field
(c) They lose their magnetism in the abesence of magnetic field.
(d) These have $\overline{e}(s)$ with opposite spin $(\downarrow\uparrow)$

594. On the basis of magnetic properties, substances are of _______ types.
(a) three (b) four (c) five (d) two

595. Ga As (Gallium arsenide) is ________ type of semiconductor.
(a) n- (b) h- (c) identical to SiB (d) n, p

596. Which of the following statement is in-correct one ?
(a) n-type semiconductor are conducting due to movement of $\overline{e}(s)$
(b) p-type conducts due to movement of holes
(c) n-p junctions are called diodes.
(d) Doping of 'P'(15)in silicon (14) form p-type semiconductor

597. The material used in solar cell contains :
(a) Cs (b) Si (c) Sn (d) Ca

598. In stoichiometric defects the ratio of positive and negative ions as indicated by chemical formula of the compound:
(a) decreases (b) increases (c) remains same (d) Variable

599. Which of the following is not the characteritic of crystalline solid ?
(a) These are anisotropic (b) They exhibit polymorphism
(c) On melting these become non-crystalline
(d) They don't have thermodynamic defects

600. Which of the following oxide is diamagnetic ?

(a) V_2O_3 (b) Fe_3O_4 (c) Cr O_2 (d) MnO_2

601. According to band theory, a metal can have

(a) Overlapping band

(b) large energy gape between filled and empty band

(c) Completely filled band

(d) Small energy gap between filled and empty band

Unit-II

602. Molecular mass of a solute determined by measurement of osmotic pressure is found to be abnormal is due to ___

(a) the solute is a non electrolyte

(b) solute is an electrolyte undergoing dissociation

(c) Solute undergoes association in the solution

(d) b and c

603. Molecular mass of acetic acid (in benzene) determined by colligative property method is observed to be _______ gm $mole^{-1}$.

(a) 60 (b) Less than 60 (c) > 60 (d) 59.9

604. van't Hoff factor(i) can be expressed as _____________

(a) normal molecular mass / abnormal moloecular mass

(b) Observed con-gative property/calculated colligative property

(c) Total number of moles particles after association (or) dissociation
Number of moles particles before association (a) dissociation

(d) any one of these.

605. In case of electrolyte as solute, the elevation in boiling point is __________.

(a) $\Delta T_b = iK_b$ (b) $\Delta T_b = i\,K_b m$ (c) $\Delta T_b = i\,K_b M$ (d) $\Delta T_b = K_b.M$

606. 1:1 electrolyte AB dissociates 50%. So its (i) value is __________ .

(a) 0.5 (b) 0.05 (c) 1.05 (d) 1.5

607. The observed molecular mass is found to be same as theoritical value, so the solute is _______.

(a) non-volatile (b) non-electrolyte

(c) the solution is dilute (d) having all of the character

608. 18 gram of glycose ($C_6H_{12}O_6$) is dissolved in 1 Kg of water. The boiling temperature of water at 1 atm pressures is __________ (K_b = 0.52 K Kg mol^{-1})

(a) 373 K (b) 373.052 K (c) 373.52 (d) none of these

609. The van't Hoff factor for a solute that associates in solution –

(a) Zero (b) 1.0 (c) less than 1 (d) more than 1

610. Which of the following is incorrect ?

(a) Molecular mass of NaCl by osmotic pressure method is 29.25

(b) Molecular mass of acetic acid in benzene by cryscopy is double of its theoretical value

(c) Osmotic pressure of 0.1 M glucose is half of that 0.1 M of NaCl (aq.)

(d) Molecular mass HCl is found to be 36.5 both in water and benzene

611. van't Hoff factor of 0.1M $Ba(NO_3)_2$ (aq.) is 2.74. The degree of dissociation is _________.

(a) 87% (b) 78% (c) 74% (d) 27.4%

Unit - III

612. The efficiency of fuel cell, η can be calculated by the relation –

(a) $\frac{\Delta G}{\Delta H} \times 100$ (b) $\frac{\Delta H}{\Delta G} \times 100$ (c) $\frac{\Delta H.\Delta G}{100}$ (d) $\Delta H / \Delta G^0$

613. The gas evolveed inside the Lechlanche cell is __________

(a) CO_2 (b) NH_3 (c) H_2 (d) H_2O (vap.)

614. In Lechlanche cell zinc cylinder acts as anode (–) and ——— acts cathode,

(a) NH_4^+ (b) $Mn\,O_2/C$ (c) carbon (d) Mn_2O_3

615. In H_2–O_2 fuel cell.

(a) H_2 is oxidised to water in alkaline medium

(b) O_2 is reduced to OH^-

(c) This cell does not cause pollution.

(d) Above features are true for fuel cell

616. In rusting of iron, the compound formed is _______

(a) $Fe\,(OH)_2$ (b) $Fe_2O_3.\ x\ H_2O$ (c) $FeO.2H_2O.\ 2H_2O$ (d) None of these

617. Choose the incorrect statement :

(a) Pure iron does not rust

(b) A miniature Galvanic cell is formed on the surface of metal.

(c) Pressure of CO_2 accelerates corrosion on the metallic surface (anode)

(d) Sacrificial metal should have high reduction potential value

618. At equilibrium point :

(a) The emf of the cell is zero ($E_{cell} = O$)

(b) $E_{cell} > 1$ (c) $E_{cell} = 1$ (d) $E_{cell} < 1$

619. Which of the following statements does not apply to hydrogen fuel cell :

(a) Anode and cathode are of porous carbon.

(b) Oxyygen and hydrogen are evolved during the redox reaction taking place in the cell

(c) Conc. NaOH / KOH (aq) is taken in between the porous carbon.

(d) It can work continuously as long as O_2 and H_2 are supplied at the electrode cathode and anode respectively.

Unit -IV

620. log k vs $\frac{1}{T}$ is a straightline plot with slope

(a) $-{}^{Ea}\!/_{2.303R}$ (b) $\frac{Ea}{2.303R}$ (c) ln A (d) $-\frac{2.303R}{E_a}$

621. The correct form of Arrhenius equation:

(a) $k = A\,e^{-Ea}/RT$ (b) $k = A\,e^{+\ Ea/RT}$ (c) $\frac{N}{\eta} = e^{-E_a/RT}$ (d) $\frac{n}{N} = e^{E_a/RT}$

Unit-VI

622. One of the metal in amalgam must be ———

(a) Zn (b) Hg (c) Cd (d) Au

623. The element present in stain less steel to the lowest percentage is _________.

(a) Cr (b) Ni (c) Mo (d) C

624. The metal commonly used as reductant is metallurgical operations is __________.

(a) Al (b) Cr (c) Na (d) Li

625. Copper is extracted from –

(a) Cuprite (b) copper glance (c) copper pyrite (d) malachite

626. Which of the following contains maximum % of copper ?

(a) anode sludge (b) copper matte (c) blister copper (d) smelted pyrite

627. Copper has high reduction potential $\left(E^0_{Cu^{2+}}\middle|Cu^{=+0.34V}\right)$. So during electrolytic refining the electrolyte may contain _______

(a) Zn^{2+} (b) Fe^{3+} (c) Ni^{2+} (d) all of these ions

628. Which of the following refining process copper obtained much in pure form ?

(a) By electrolytic mathod (b) poling method

(c) hydrometallurgical process (d) none of these

629. In the electro refining of copper _______ is used as cathode.

(a) Bar of impure copper (b) pure copper

(c) platinum (d) graphite

630. Which of the following alloys does not contain Cu ?

(a) German silver (b) Manganim

(c) Gun metal (d) Solder

631. Which of the following oxide formation is more favourable i.e. having more negative ΔG^0 value.

(a) MgO (b) ZnO (c) CO (d) FeO

632. In the above which metal behaves as better reducing agent ?

(a) Mg (b) Zn (c) C (d) Fe

633. In the Ellingham the diagram graphs are obtained on plotting ———

(a) ΔG^0 vs T (b) ΔH^0 vs T (c) ΔS^0 vs T (d) ΔG^0 vs P

634. Which of the following one contains more than one metal ?

(a) Limonite (b) Siderite (c) Haematite (d) Chalcopyrite

635. The most pure form of iron is ________.

(a) pig iron (b) cast iron (c) wrought iron (d) Steel

636. During manufacture of steel (Bassemer process) spiegeleisen is added which contains _________ alongwith iron.

(a) Mg (b) Mn (c) $P_2 O_5$ (d) SiO_2

637. The slag obtained during extraction of copper pyrite is the compound mainly of :

(a) Cu_2S (b) $Fe\,SiO_3$ (c) $CaCi\,O_3$ (d) $Si\,O_2$

638. In the electro refining of copper, some gold is obtained from

(a) anode mud (b) cathode mud (c) cathode (d) electrolyte

639. When compared the plots of ΔG^0 for formation of Al_2O_3, ΔG^0 for formation of Cr_2O_3 former one is found to be:

(a) Same (b) unpredicted (c) lower (d) higher

640. The common method for extraction of metals from the oxide ore is :

(a) reduction with carbon (b) reduction with hydrogen

(c) reduction with aluminium (d) electrolytic method

Unit - VIII

641. Lanthanoid mostly exhibit +3 O.S. while actinoids have wide range of O.S. (+3 to +7). This is due to

(a) only n(s) $\bar{e}$(s) take part in bond formation.

(b) (n–2)f $\bar{e}$ not easily participate

(c) In actinoids 5f, 6d and 7s energy levels are comparable.

(d) In lanthanoids 4f, 5d and 6s level are of almost same energy

642. The magnetic moment of $[Mn(CN)_6]^{4-}$ is ______ BM.

(a) 1.73 (b) 2.83 (c) 3.87 (d) 5.92

643. Chromium is a typical hard metal while Hg is liquid, because:

(a) Strength of metallic bonding

(b) Stronger inter atomic bonding due to $3d^5 4s^1$ configuration.

(c) Hg has filled d-orbitals ($5d^{10} 6s^2$)

(d) all of these

644. Ce^{4+} is used as _________ in volumetric analysis

(a) reducing agent (b) oxidising agent

(c) Complexing agent (d) none of these

645. The common oxidation state of Lanthanides is __________.

(a) III (b) II (c) IV (d) V

646. Chemistry of Lanthanoids is identical, because

(a) these have general electronic confuguration (n–2) f^{1-14} (n–1) $d^{0 or 1}$ ns^2

(b) 4f $\bar{e}$(s) are shielded by electrons present in the outershells

(c) f $\bar{e}$(s) are not available for bond formation

(d) of the above reasons

647. Lanthanoid contraction is due to increase in

(a) shielding by 4f$\bar{e}$(s) (b) atomic number

(c) effective nuclear charge (d) size of Δf orbital

648. When SO_2 (g) is passed through acidified $K_2Cr_2O_7$ solution

(a) the solution becomes blue (b) the solutions gets decolourised

(c) SO_2 is reduced to sulfar (d) green chromium sulfate is formed

649. Cerium (Z = 58) is an important member of lanthanoids. Which of the following statements about Ce is incorrect ?

(a) Ce(IV) is not known in solution (b) Ce (III) is more stable than Ce(IV)

(c) Ce(IV) in solution acts as oxidising agent

(d) common oxidation state of cerium is III and IV

650. 4f and 5f series of elements are called _______

(a) representative elements (b) normal elements

(c) special transition elements (d) Inner transition elements.

651. Which of the following is the correct sequency of increasing order of their ionic radii ?

(a) $Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$ (b) $Ce^{3+} < Yb^{3+} < Pm^{3+} < La^{3+}$

(c) $Yb^{3+} < Pm^{3+} < La^{3+} < Ce^{3+}$ (d) $Pm^{3+} < La^{3+} < Ce^{3+} < Yb^{3+}$

652. In the voluemetric analysis potassium permanganate is not acidified with dil. HCl but with dil H_2SO_4, because

(a) HCl is an acid as wall as a reducing agent consuming some volume of MnO_4^-.

(b) H_2SO_4 never reduces MnO_4^-

(c) H_2SO_4 is also an oxidising agent

(d) Correct result is obtained with dil HCl.

653. It is economical to use $KMnO_4$ in ____________ medium in volumetric analysis (permanganometry)

(a) acidic (b) alkaline (c) neutral (d) ammonical

654. Actinoid cations are coloured due to f - f transition but which of the following cation is coloureless.

(a) U^{3+} (b) Am^{3+} (c) Np^{3+} (d) Ac^{3+}

655. Which of the following is incorrect in respect of actinoids ?

(a) Actinoids form oxocation (e.g. UO_2^{+})

(b) these are radioactive

(c) Most of these elements are called transuranium elements

(d) These show oxidation states, II and III

656. Which of the following is the strongest base ?

(a) $La(OH)_3$ (b) $Yb(OH)_3$ (c) $Lu(OH)_3$ (d) $Ce(OH)_3$

657. Which of the following pairs has identical size ?

(a) Zn^{2+}, Hf^{4+} (b) Fe^{2+}, Ni^{2+} (c) Zr^{2+}, Ti^{4+} (d) Zr^{4+}, Hf^{4+}

Unit-IX

658. Which of the following does not show geometrical isomerism ?

(a) $\left[CrCl_2(Ox)_2\right]^{3+}$ (b) $\left[Fe(NH_3)_2(CN)_4\right]^-$

(c) $\left[Pt(NH_3)Cl_2\right]$ (d) $\left[Pt(NH_3)_3Cl\right]^+$

659. Which of the following is not correctly matched ?

(a) chlorophyll-Mg (b) haemoglobin - Fe

(c) Vitamin-12-Co (d) EDTA - Ni poisoning

660. During extraction of gold formation of _______ complex occurs.

(a) Cyanido (b) Chlorido (c) Pyridine (d) ammine

661. Choose the incorrect statement -

(a) Greater is the charge/radius ratio greater the stability.

(b) Nickel is purified on converting to carbonyl complex

(c) A π-bonded complex is formed when ligand is C_2H_4.

(d) Carbonyls are not organometallic compounds.

662. Which of the following is an optically active isomer ?

(a) trans. tetra ammine dichlorido Co(III) cation

(b) cis-$Co(en)_2Cl_2$ (c) $[Cu(NH_3)_4]^{2+}$ (d) Trans-Co $(en)_2$ Cl_2

Unit-X

663. Which of the following is optically active ?

(a) $CH_3–CH_2$ OH (b) CH_2OH CH(OH)–CH_2OH

(c) CH_3–CH(OH) C_2H_5 (d) C Cl_2 F_2

664. Lindane is also a name of________.

(a) BHC (b) Gammaxane (c) frecon (d) chlorobenzene

665. Choose incorrect statement in respect of freon.

(a) These are chloro fluoro derivatives of methane and ethane

(b) Freon prepared from CCl_4 with Sb F_3

(c) Freons are responsible for destruction of ozone layer (stratosphere)

(d) None of these

666. The IUPAC name of Westrosol is ________.

(a) 1, 1, 2 trichloro ethane (b) 1, 1, 2, 2 tetrachloroethane

(c) 1, 1 dichloro ethene (d) 1, 1, 2 trichloro ethane

667. Which of the following is not chosen as cleansing agent ?

(a) CCl_4 (b) Westrosol (c) detergent (d) chloroform

668. The compound used as refrigerant is _____________

(a) NH_4Cl (b) CCl_4 (c) CF_4 (d) CF_2Cl_2

669. Which of the following is non-polar ?

(a) CH_3 Cl (b) CH_2 Cl_2 (c) $CHCl_3$ (d) CCl_4

Unit-XIII

670. $C_6H_5NH_2 + NaNO_2 + 2HCl \xrightarrow{0–5^0 C} C_6H_5N_2Cl + NaCl + 2H_2O$. This reaction is called _________.

(a) Nitration (b) diazotisation

(c) diazonium salt formation (d) none of these

671. The conversion of aniline to benzene is called de-amination. This is carried out in treating benzene diazonium chloride with –

(a) H_3PO_2 (aq.) (b) ethanol

(c) oxidising agent (d) (a) or (b)

672. $C_6H_5 - NH_2 \xrightarrow[HCl, 0^0 C]{NaNO_2} A \xrightarrow{CuCN} B,$ The compound 'B' is ___________.

(a) Benzonitrile (b) Benzoic acid (c) Benzamide (d) BDC

673. Benzene diazonium chloride reacts with phenol to form :

(a) p-chlorophenol (b) chlorobenzene

(c) p-hydroxyazo benzene (d) DDT

674. Iodobenzene can be prepared by ———

(a) treating chlorobenzene with I_2 using $FeCl_3$ catalyst

(b) treating phenol with HI

(c) treating BDC (benzenediazonium chloride) with KI

(d) Chlorobenzene with SbI_3

675. Benzene diazonium chloride reacts with warm water to give____

(a) chloro benzene
(b) aniline
(c) phenol
(d) none of these

676. Diazonium salts are products of the reaction of nitrous acid with _________.

(a) primary aliphatic ammine
(b) primary aromatic amine
(c) cyclohexanamine
(d) Secondary aromatic amine

677. Which of the following reagents is used to prepare benzene diazonium chloride form aniline ?

(a) $NaNO_2$ (S) + dil HCl
(b) $LiAlH_4$
(c) NH_2NH_2 + KOH
(d) NaCl + HNO_2

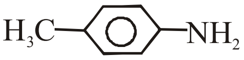
678. $C_6H_5N_2Cl \xrightarrow{HBF_4} A \xrightarrow[Cu/\Delta]{NaNO_2} B$. The compound 'B' is ____________ .

(a) fluoroborate
(b) nitrobenzene
(c) aniline
(d) chlorobenzene

679. Choose incorrect statement -

(a) BDC is prepared from aniline by diazotisation
(b) Aromatic diazonium salt is more stable than those of aliphatic primary amine
(c) $-NH_2$ group is aniline is protected on acetylation
(d) Benzamide is meta-directing in forming major product.

680. Which of the following reagents is used to distinguish between



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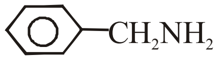


(a) dil HCl
(b) $C_6H_5SO_2Cl$(alkaline)
(c) ($NaNO_2$ + HCl) + β -naphthol
(d) Ag NO_3 (aq.)

UNIT - XIV

681. Which of the following is a keto sugar.

(a) Ribose (b) glycose (c) Erythrulose (d) erythrose

682. The carbohydrates which on hydrolysis give two to ten same or different monosaccharides are called _____________

(a) oligosaccharide (b) polysaccharide (c) aldose (d) ketrse

683. Which of the following a non-sugar ?

(a) monosaccharides
(b) oligoaccharides
(c) starch
(d) Ketosugars

684. Which of the following is not a reducing sugar ?

(a) sucrose (b) glucose (c) fructose (d) Lactose

685. Aminoacids supplied in the diet are called essential amino acids.
Choose such acid from the following. That is ________.

(a) Valine (b) Leucine (c) isoleucine (d) all of these

686. Choose the incorrect statement :

(a) Enzymes are globular proteins
(b) Proteins are amphoteric in nature
(c) Maltase, the enzyme required to convert maltose to glucose
(d) Enzymes end with suffic-ose.

687. Which of the following is not a fat-soluble vitamin.

(a) A (b) B (c) D (d) K

688. Which of the following bases is not present in RNA ?

(a) adenine(A) (b) guanine(G) (c) thyamine(T) (d) uracil(U)

689. Ascorbic acid is the name of

(a) a vitamin (b) an enzyme (c) an amino acid (d) a hormone

690. Which hormone contains iodine ?

(a) Thyroxine (b) Insulin (c) Adrenaline (d) Testosterone

691. Vitamin A is called ________

(a) Ascorbic acid (b) Retinol (c) Calciferol (d) Tocapherol

692. The helical structure of protein is stabilised by –

(a) H-bond (b) peptide bond (c) vander Waals force(d) None of these

693. Proteins are polymers of amino acids. Which of the following is not a protein.

(a) Wool (b) nails (c) hair (d) DNA

694. A mixture of amylase and amylopectin is called

(a) Starch (b) Cellulose (c) lactose (d) sucrose

695. Choose the incorrect statement.

(a) The monomer of nucleic acid is neucleotide

(b) Nucleotide is made up of phosphoric acid unit and nucleoside.

(c) Nucleoside consists of pentose sugar and a base derived from purine and pyrimidine

(d) Cytosine (c) base is derived from purine.

696. Which of the following is not properly matched ?

(a) Vit. A – Carotene derivative (b) Vit. B_1 – Beriberi

(c) Vit-B_{12}–anaemia (d) Vit.K– muscular weakness

697. Glucose in blood can be determined with–

(a) Tollen's reagent (b) Benedict's solution

(c) Alkaline iodine solution (d) Bromine water

698. An example of aminoacid containing benzene ring is ________.

(a) serine (b) lysine (c) tyrosine (d) alamine

699. Plant hormones are called _________.

(a) phytohormones (b) endocrine hormone

(c) exocrine hormones (d) cortisone

XVI

700. Which of the following is not a preservative ?

(a) Salt (b) sugarsyrup (c) sodiummeta bisulfite (d) milk

701. Which of the following is a powerful artificial sweetening agent ?

(a) Saccharin (b) Cyclamate (c) Sucralose (d) alitame

702. Antioxidants on adding to processed food prevent oxidation of fats and subsequent spoilage. Which of the following is not an antioxidant ?

(a) Butylated hydroxy toluene (BHT) (b) Butylated hydroxy anisole (BHA)

(c) Butylated Acetophenone (BAP) (d) Gallic acid

703. Sodium salt of ________ is not used as food preservative ?

(a) benzoic acid (b) sorbic acid

(c) propanoic acid (d) Gluconic acid

704. Which of the following vitamin acts as antioxidant

(a) B-complex (b) E (c) D (d) none of these

SELF ASSIGNMENT

Blacken the appropriate circle with blue pen : **Time - 15 mins.**

1. Quartz is type of solid.
(a) Amorphous ○ (b) covalent ○
(c) Molecular ○ (d) ionic ○

2. In NaCl structure, Cl^- ions occupy –
(a) corners of the Cube ○ (b) edge centre of the cube ○
(c) on the centre of the faces ○ (d) both (b) and (c) ○

3. Emf of a cell in terms of reduction potential of its left and right hand electrode is ——.
(a) $E = E_{left} - E_{right}$ ○ (b) $E = E_{left} + E_{right}$ ○
(c) $E = E_{right} - E_{left}$ ○ (d) $E = -\left(E_{right} + E_{left}\right)$ ○

4. What is the number of coulombs required for conversion of one mole of MnO_4^- to one mole of Mn^{2+} ?
(a) 1 F ○ (b) 3 F ○ (c) 5 F ○ (d) 7 F ○

5. The proces of getting fresh water from sea water in known as
(a) osmosis ○ (b) fitration ○
(c) reverse osmosis ○ (d) Sedimentation ○

6. Of the following 0.1 gram mole of aqueous solution, which will exhibit the largest depression in freezing point ?
(a) KCl ○ (b) $C_6H_{12}O_6$ ○ (c) $Al_2(SO_4)_3$ ○ (d) K_2SO_4 ○

7. What flows in internal & external circuit of a Galvanic cell respectively ?
(a) ions, electrons ○ (b) electrony only ○
(c) electrons, ions ○ (d) ions only ○

8. The standard emf of cell involving one electron charge is found to be 0.591 at 25^0C. The equilibrium constant of the reaction is ________.
(a) 1.0×10^1 ○ (b) 1.0×10^5 ○ (c) 1.0×10^{10} ○ (d) 1.0×10^{30} ○

9. The molal elevation constant of water is _____. If 0.1m aqueous solution of a nonvolatile, non-electrolyte substance boils at 100.052^0C
(a) 0.52 ^{0}C/molal ○ (b) 5.2 ^{0}C/molal ○
(c) 0.052 ^{0}C/molal ○ (d) None of these ○

10. What will be the pH of aqueous 0.1 M solution of sodium chloride in an electrolytic cell during electrolysis between graphite electrode ?
(a) pH = 01 ○ (b) pH > 7 ○ (c) pH < 7 ○ (d) pH = 7 ○

11. A negatively charged suspension of clay in water will need to coagulate with minimum of ______.
(a) Aluminium chloride ○ (b) potassium sulfate ○
(c) sodium hydroxide ○ (d) hydrochloride acid ○

12. Rate of physiosorption increases with —
(a) decrease in temperature (c) increase in temperature
(c) decreases in surface area (d) decrease in pressure

13. At high concentration of soap in water, soap behaves as
(a) molecular colloid (b) associated colloid
(c) macromolecular colloids (d) lyophilic colloid

14. Which of the following is not a colloid ?
(a) Chlorophyll ○ (b) smoke ○ (c) milk ○ (d) fog ○

15. Which of the following factor(s) affect the rate of chemical reaction ?
(a) The nature of the reactant ○ (b) The concentration of the reactant ○
(c) Temperature ○ (d) all of these ○

◆ ◆ ◆

Chemistry - A1

Answers

1.	b	2.	c	3.	c	4.	c	5.	a	6.	b
7.	a	8.	b	9.	a	10.	a	11.	c	12.	c
13.	a	14.	b	15.	a	16.	d	17.	c	18.	b
19.	a	20.	c	21.	a	22.	c	23.	a	24.	c
25.	b	26.	d	27.	d	28.	d	29.	b	30.	a
31.	a	32.	c	33.	d	34.	b	35.	a	36.	b
37.	c	38.	b	39.	b	40.	c	41.	d	42.	c
43.	d	44.	c	45.	b	46.	c	47.	d	48.	d
49.	c	50.	b	51.	d	52.	d	53.	c	54.	c
55.	b	56.	c	57.	c	58.	a	59.	c	60.	a
61.	a	62.	c	63.	d	64.	b	65.	b	66.	a
67.	b	68.	a	69.	a	70.	b	71.	c	72.	a
73.	a	74.	a	75.	a	76.	b	77.	d	78.	b
79.	c	80.	d	81.	b	82.	a	83.	a	84.	c
85.	a	86.	c	87.	a	88.	d	89.	c	90.	d
91.	a	92.	d	93.	d	94.	d	95.	c	96.	d
97.	c	98.	c	99.	b	100.	d	101.	c	102.	d
103.	b	104.	b	105.	b	106.	b	107.	c	108.	a
109.	a	110.	d	111.	b	112.	a	113.	c	114.	d
115.	b	116.	d	117.	c	118.	c	119.	c	120.	b
121.	d	122.	a	123.	d	124.	c	125.	c	126.	a
127.	a	128.	b	129.	b	130.	a	131.	d	132.	b
133.	a	134.	a	135.	a	136.	c	137.	a	138.	d
139.	d	140.	c	141.	b	142.	a	143.	b	144.	d
145.	c	146.	a	147.	c	148.	c	149.	d	150.	c
151.	b	152.	c	153.	a	154.	b	155.	d	156.	a
157.	b	158.	b	159.	d	160.	b	161.	b	162.	d
163.	d	164.	d	165.	c	166.	c	167.	a	168.	a
169.	c	170.	c	171.	b	172.	c	173.	d	174.	a
175.	a	176.	d	177.	a	178.	d	179.	a	180.	c
181.	d	182.	b	183.	c	184.	a	185.	a	186.	d
187.	b	188.	c	189.	b	190.	b	191.	a	192.	d
193.	c	194.	b	195.	b	196.	b	197.	a	198.	b

199. c	200. a	201. c	202. d	203. a	204. c
205. d	206. d	207. a	208. a	209. d	210. c
211. c	212. d	213. b	214. a	215. a	216. a
217. c	218. b	219. d	220. a	221. c	222. a
223. a	224. b	225. d	226. a	227. d	228. d
229. b	230. c	231. a	232. a	233. b	234. c
235. d	236. a	237. b	238. d	239. c	240. d
241. c	242. b	243. a	244. b	245. a	246. a
247. b	248. a	249. d	250. c	251. d	252. d
253. b	254. b	255. c	256. d	257. a	258. d
259. d	260. d	261. b	262. d	263. a	264. b
265. d	266. a	267. d	268. c	269. c	270. d
271. a	272. d	273. b	274. a	275. d	276. b
277. c	278. d	279. d	280. a	281. d	282. b
283. b	284. c	285. a	286. c	287. a	288. a
289. a	290. a	291. b	292. c	293. a	294. d
295. c	296. b	297. b	298. c	299. a	300. c
301. c	302. b	303. d	304. b	305. b	306. b
307. a	308. c	309. b	310. c	311. c	312. c
313. c	314. d	315. b	316. c	317. b	318. a
319. a	320. b	321. b	322. b	323. a	324. a
325. c	326. b	327. a	328. d	329. c	330. a
331. b	332. b	333. b	334. b	335. a	336. c
337. b	338. a	339. d	340. c	341. b	342. b
343. a	344. d	345. b	346. c	347. b	348. c
349. a	350. a	351. a	352. c	353. a	354. a
355. d	356. c	357. b	358. d	359. d	360. d
361. c	362. b	363. b	364. c	365. b	366. d
367. c	368. a	369. b	370. b	371. d	372. a
373. b	374. c	375. a	376. b	377. d	378. a
379. b	380. a	381. a	382. a	383. b	384. b

385. b	386. a	387. b	388. d	389. c	390. b
391. a	392. d	393. d	394. d	395. b	396. b
397. b	398. c	399. a	400. b	401. b	402. a
403. c	404. a	405. d	406. b	407. c	408. c
409. a	410. c	411. b	412. c	413. b	414. a
415. a	416. c	417. c	418. b	419. d	420. b
421. c	422. b	423. d	424. a	425. b	426. d
427. c	428. a	429. c	430. b	431. a	432. a
433. b	434. b	435. c	436. c	437. c	438. c
439. a	440. c	441. d	442. a	443. a	444. b
445. a	446. a	447. a	448. b	449. c	450. b
451. b	452. a	453. a	454. d	455. a	456. c
457. d	458. a	459. b	460. c	461. b	462. b
463. a	464. a	465. d	466. a	467. d	468. d
469. d	470. b	471. c	472. a	473. c	474. c
475. a	476. a	477. b	478. a	479. d	480. b
481. c	482. c	483. c	484. d	485. a	486. d
487. c	488. b	489. d	490. a	491. c	492. b
493. a	494. a	495. a	496. b	497. b	498. d
499. d	500. a	501. a	502. d	503. b	504. a
505. c	506. c	507. d	508. c	509. b	510. a
511. a	512. b	513. c	514. b	515. c	516. b
517. a	518. b	519. d	520. a	521. c	522. a
523. b	524. a	525. b	526. a	527. b	528. a
529. a	530. b	531. b	532. d	533. c	534. a
535. d	536. a	537. c	538. a	539. c	540. a
541. a	542. a	543. d	544. c	545. c	546. a
547. b	548. b	549. b	550. b	551. d	552. d
553. a	554. d	555. b	556. d	557. d	558. d
559. a	560. d	561. b	562. a	563. b	564. a
565. d	566. c	567. b	568. c	569. a	570. b
571. a	572. a	573. c	574. d	575. d	576. a
577. b	578. a	579. a	580. d	581. d	582. b
583. a	584. b	585. d	586. a		

Answers to the additional questions as per original syllabus

(A1 - MCQs)

587	c	588	d	589	d	590	d	591	a	592	b
593	d	594	c	595	a	596	d	597	b	598	c
599	d	600	a	601	a	602	d	603	c	604	d
605	b	606	d	607	d	608	b	609	c	610	d
611	a	612	a	613	b	614	b	615	d	616	b
617	d	618	a	619	b	620	a	621	a	622	b
623	d	624	a	625	c	626	c	627	d	628	a
629	b	630	d	631	a	632	a	633	a	634	d
635	c	636	b	637	b	638	a	639	d	640	a
641	c	642	a	643	d	644	b	645	a	646	d
647	c	648	d	649	a	650	d	651	a	652	a
653	a	654	d	655	d	656	a	657	d	658	d
659	d	660	a	661	d	662	b	663	c	664	b
665	d	666	a	667	d	668	d	669	d	670	b
671	d	672	a	673	c	674	c	675	c	676	b
677	a	678	b	679	d	680	c	681	c	682	a
683	c	684	a	685	d	686	d	687	b	688	c
689	a	690	a	691	b	692	a	693	d	694	a
695	d	696	d	697	b	698	c	699	a	700	d
701	d	702	c	703	d	704	b				

◆ ◆ ◆

Group - A(2)

Very Short Answer type questions.

Fill in the blanks :

Unit - I

1. In ZnS crystal, Zn^{2+} ions occupy———.
2. Na_2O crystal shows ——— structure.
3. Rock salt type structure has ——— coordination.
4. In most cubic close-packed lattices, ———% of space is filled.
5. Two types of voids are ——— and ———.
6. The point defect in a crystal that does not change the density of a solid is ———.
7. Graphite is ______ bonded type of solid.
8. In NaCl crystal, ——— ions occupy all the octahedral sites.
9. Co-ordination numbers of Cs^+ and Cl^- in CsCl crystal are in the ratio ———.
10. In NaCl crystal, Na^+ ion is surrounded by ——— Cl^- ions.
11. The number of nearest neighbours with which a given sphere is in contact is called —— ———.
12. Face-centred cubic unit cell has ——— atoms.
13. Glass is an example of——— solid.
14. Caesium chloride has ——— structure.
15. The co-ordination number of octahedral void is _______.
16. F-centres are formed in $Na^+ Cl^{-1}$ due to migration of_______ ion towards the surface.
17. An atom in hexagonal close packing (hcp) structure has ______ octahedral and ______ tetrahedral void.
18. Ionic solids never conduct electricity in _______ state due to imobility of______.
19. If 'r' is the radius, the edge length of face centred unit cell is _______.
20. In fcc lattice, a unit cell is shared equally by _______ number of unit cells.
21. In CsCl lattice each Cs^+ is surrouneded by _________ member of Cl^- ions.
22. In CaF_2, the $C.N_s$ of Ca^{2+} and F^- ions are ______ and _______ . respectively.
23. CsCl has bcc lattice. On heating at about 760 K it transforms into ______.
24. Empty space in bcc lattice is _________%.
25. In cubic arrangement of 'N' spheres, the number of tetrahedral and number of octahedral voids are respectively __________.
26. Number of unit cells in 168.5 gram of CsCl crystal is nearly (Mol. mass of CsCl = 168.5 g / mole) ______.
27. Number of unit cells in 1 mole of NaCl crystal is nearly ________.
28. Co-ordination number of ZnS crystal is ________ .
29. In a crystal arrangement 'X' atoms are placed at corners and 'Y' atoms at body centres. Then the formula of the compound is ________.

30. In a crystal arrangement, 'X' atoms are placed at corners and body centres. 'Y' atoms are placed at edge centres. The formula of the compound is _______.

31. The compound possessing both Schottky and Frenkel defect is _______.

32. Number of Na^+ occupy as 2nd nearest neighbour to the locations of Na^+ in the structure of NaCl is ______.

33. In hcp, ABAB ----------- type of arrangement takes place. So in bcc the arrangement is ______. While in ccp it is ________.

Unit - II

34. With the increase of temperature, the vapour pressure of a liquid ———.

35. With increase of altitude, the boiling point of water ———— .

36. Solutions having same osmotic pressure are called ———— .

37. On adding a solute, boiling point of solution ————.

38. For ideal solution $\Delta H_{mix} = 0$, but ΔS_{mix} is ______.

39. Density of 2.05 M solution of acetic acid in water is 1.02 g.ml. The molality of the solution is ______ .

40. Phenol dimerises in benzene having van't Hoff factor 0.54. The degree of association is _________.

41. The molal elevation constant of water 0.51 the boiling point 0.1m aqueous NaCl solution is __________.

42. Between sodium chloride and magnesium chloride _________ has lower vapour pressure.

43. Camphor is often used in determination of molecular mass because it hass bery high _________ value.

44. 20 gram of non-volatile solute is added to 500 gram solvent. Freezing point of solvent = 5.48^0C and that of solution = 0.75^0C. $K_f = 11.9$ molecular mass of the solute is __________ .

45. When an egg is placed in concentrated solution of sodium chloride, it shrinks due to _________.

46. The molarity of pure water is ________.

47. 5.85 g of NaCl is dissolved in 90 g of water. The mole fraction of the solute is ________.

48. For urea solution (1 M), the value of van't factor (*i*) is ________.

49. Alloys are _______ type of homogeneous solution.

50. The unit of cryoscopic constant is _________.

51. The depression in f. p. is directly proportional to _________.

52. The property of solution which depends on quantity of solute particles is called ________.

53. Higher is K_H value ________ is the solubility at a given temperature.

54. The value of ΔH_{mixing} is ________ for a liquid - liquid solution of benzene and toluene.

55. A–B interaction is greater than A–A and B–B interaction. The process of solution of, A in B is ______ solution with _____ deviation.

56. Nomality of 0.3 M phosphoric acid is ________ N.

57. Normality × equivalent is __________.

58. A 5% solution of cane sugar (molar mass = 342 g/mol) is isotonic with 1% of a substance X. Mol mass of X is ______.

59. If 'α' is the degree of dissociation of Na_2SO_4, the van't Hoff factor (i) will be _______.

60. Hydrostatic pressure set up due to osmosis is called _______.

61. Pressure required to prevent osmosis and the process is ________.

62. Benzoic acid present as _______ is non-polar solvent.

Unit - III

63. EMF of the cell when the cell reaction attains equilibrium is ________ . Where ΔG is also equal to _________.

64. pH value of aqueous solution of NaCl after electrolysis is ___________ .

65. For strong electrolytes degree of ionisation is ______________ .

66. On electrolysis of dilute sulphuric acid using Pt-electrode the product obtained at anode is ________.

67. The salt, that liberates hydrogen (g) at cathode and anode are ________ and ______ respectively.

68. Graphite is a conductor but ___________ another crystalline allotrope is insulator.

69. The most durable metal plating on iron to protect against corrosion is generally ____________.

70. If 0.5 amp. current is passed through acidified $AgNO_3$(Aq) for 100 minutes the mass of silver deposited on cathode is ____________.

71. Equivalent conductance of NaCl, HCl and CH_3 COONa at infinite dilution are 126.45, 126.16 and 91 ohm^{-1} cm^2 respectively. Λ^0 CH_3COOH would be ___________.

72. Between Al and Zn _____________ is a better reducing agent.

73. A piece of copper wire is immersed in a solution of $AgNO_3$(Aq). The colour of the solution turns ____________.

74. ______ amp. / sec is necessary to produce O_2(g) at 1 ml / sec.

75. The resistance of $^{N}\!/_{10}$ solution is found to be 2.5×10^3 ohms. The equivalent conductance of the solution kept in a cell with cell constant 1.25 cm^{-1} is ______ .

76. _____________ are responsible for electrolytic conduction.

77. _____________ are responsible for metallic conduction.

78. Temperature increases ___________ of metallic conduction.

79. Amount of substance liberated by the passage of one coulomb of electricity through an electrolyte is called _____________.

80. At ____________ electrode in a cell, oxidation takes place & at ____________ reduction takes place.

81. In electrochemical cell ________ energy is converted to ________ energy.

82. EMF of a standard hydrogen electrode is ___________.

83. In a Galvanic cell the difference of reduction potential of cathode and anode is called ___________.

84. Electrochemical equivalent of two metals are in the ratio of their ____________.

85. E.C.E × _________ = chemical equivalent.

86. The unit of molar conductance is ___________.

87. The unit of specific conductance is ___________.

88. Cell constant × __________ = specific conductance.

89. In Daniell cell copper vessel serves as ___________.

90. Resistance implied by one cm^3 of a substance is called ____________ and reciprocal of this is called ______________.

91. Charge on one mole of carbonate ion is _____________ .

92. Electrovalent compounds are regarded as ___________ in respect of conductance of electricity.

93. Electroplated silver spoon acts as ________ in a cell during formation.

94. Standard cell potential of Daniell cell is _______.

95. In an electrolytic cell one litre of 1M aqueous soluiton of MnO_4^- is reduced to 0.1 M MnO_4^{2-} on passage _________ quantity of electricity.

96. 48250 C of electricity was required to deposit all the copper present in 0.5 L of $CuSO_4$ solution using inert electrodes. Assuming no change in volume the molarity of the solution is _______ .

[2 F need to convert $Cu^{2+} \rightarrow Cu$]

Unit - IV

97. For a first order reaction, the $t_{0.5}$ is equal to ___________ .

98. Photochemical reaction between hydrogen and chlorine is __________ order reaction.

99. Arrhenius equation is given by __________ .

100. Unit of rate constant for first order reaction is ___________ .

101. Alkali hydrolysis of ester is a ___________ order reaction having molecularity _______ .

102. Molecularity cannot be greater than ___________ .

103. The 1st order reaction having molecularity greater than one is called ___________.

104. The unit of the rate constant for the second order reaction is _____________.

105. The specific rate of a first order reaction depends on ____________.

106. For an endothermic reaction where ΔH represents enthalpy of reaction is kJ/mol, the minimum value fo energy of activation (Ea) will be _____________.

107. The hydrolysis of ethyl acetate in acidic medium is __________ order reaction.

108. A graph is plotted between ln k and $\frac{1}{T}$ for a first order reaction. The slope of the plot expressed as ___________.

109. Ionic reactions are ______ in nature in respect of their kinetics.

110. $t_{1/2}$ for zero order reaction is proportional to _________ .

111. The value of order of reaction maximises to _____________.

112. If 'a' is the initial concentration of a substance according to zero order kinetic and rate constant is k. The time for the reaction to go completion is ________.

113. The rate for the single step reaction, $2A + B \rightarrow 2C$ is given as rate = ________ .

114. The rate law of the reaction, $2A + B \longrightarrow 2C$ is represented as, rate = $k[A]^2[B]$. If 'A' is taken large in excess, the order of the reaction is __________.

115. Rate expression of a chemical change is $\frac{dx}{dt} = k[A]^2[B][C]^0$, the order of the reaction is _______.

116. The difference of threshold energy (E_{th}) and average energy of reactants, (E_R) is _________.

117. The half life period of a reaction is 100 minutes. In 400 minutes the initial concentration of 2-gram will become _________.

118. Rate is proportional to the square of the concentration. So the order of the reaction is _______.

119. Unit of rate of reaction is ___________.

120. It $t_{0.5} \propto \frac{1}{a^2}$ (a = initial concentration), then the order of reaction is ___________.

121. The reaction, $2NO_2 \xrightarrow[\Delta]{Pt} 2N_2 + O_2$ is of _______ order.

122. Decomposition of H_2O_2 is __________ order reaction.

123. For a given reaction, $k = mol/\ell/sec$ the order of reaction is _________.

124. Order and molecularity of of hydrolysis of ester is __________ & _________ respectively ?

125. The slope of concentration of reactant vs time graph gives __________.

126. The number of species taking part is a single step of reaction is called ___________ of the reaction.

127. Molecularity cann't be greater than ___________.

128. If rate vs molar concentration of the reaction is linear passing through origin, it is ______ order reaction.

129. Temperature co-efficient of a reaction is ___________.

130. If the energy released by the activated complex in forming the products is more than the activation energy absorbed by the reactants the reaction is _________ in nature.

131. The catalyst used in the decomposition $KClO_3$ forming oxygen is __________.

132. The positive catalyst _________ the activation energy.

133. The reaction rate is found to depend upon two concentration terms. The order of reaction is ________.

134. Decomposition of ammonia on tungsten surface is a reaction of_______ order.

135. For the reaction $N_2 + 3H_2 \longrightarrow 2NH_3$, if $\frac{d(NH_3)}{dt} = 2\times10^{-4} \text{mol}\,L^{-1}\,S^{-1}$ the value of $-\frac{d[N_2]}{dt}$ is ____________ .

Unit - V

136. Ferric hydroxide sol has ―――――― charge.

137. The zig-zag motion of colloidal particles is called ――――― .

138. The scattering of light on the surface of colloidal particle is ――――― .

139. The colloidal system of liquid dispersed solid is called ――――― .

140. Milk is an example of――――― type emulsion.

141. In arsenic sulfide colloide the particles are __________ charged.

142. The conversion of precipitate to colloidal solution is called ___________.

143. The process of settling of colloidal solution is called __________.

144. Sky looks blue due to ____________.

145. The migration of positively charged colloidal particles under the influence electric field towards cathode is called ___________ .

146. A colloidal system where solid particles are dispersed in gas is called _________.

147. Colloidal solution is homogeneous like sugar solution. T/F.

148. The extent coagulation by different substance can be known from its ________ value.

149. Liquid-Liquid colloidal system is termed as __________.

150. Bodylotion is _________ type of emulsion.

151. A colloidal solution consists of two phases namely _________ & __________.

152. The term used where both absorption and adsorption take place is ___________.

153. Extent of physical adsorption increases with ___________ of temperature.

154. Reverse of adsorption is called ___________.

155. Absorption is a __________ phenomenon while adsorption is ____________.

156. S_8 is an example of _________ colloid.

157. (a) $NH_3(g)$ is ________ by water.
   (b) Silica gel _________ water vapour.

158. Lyophilic colloids are ________ stable than Lyophobic colloids.

159. Coconut charcoal is used to separate noble gases except _________(g).

160. Activated harcoal in a powerful adsorbent as it contains microscopic crystalline variety of ______ with large surface area.

161. The entropy value (ΔS) _________ during adsorption.

162. ΔH value in the process of adsorption is ___________.

163. Between NH_3 and N_2 _________ is a good adsorbate.

164. Absorption proceeds at uniform rate. T/F ____

165. The decomposition of H_2O_2 is retarded in the presence of __________.

166. Oxidation of chloroform to phosgene is retarded by __________.

167. Efficiency of catalyst can be increased by certain substance called __________.

168. In Haber's process catalytic activity of iron is enhanced by _________.

169. In the stomach the enzyme _______ converts protein to α-amino acid.

170. The enzyme activity is increased by certain substance called ________.

171. Enzyme amylase becomes more active in presence of __________.

172. At CMC the negatively charged —COO^- (head) remain _____ of the sphere.

173. The non-polar alkyl part (tail) of the soap is ________ while the polar ($-COO^-$) part is _______ in nature.

174. Pore size of the filter paper is __________ than the size of the colloidal particle.

175. Haemoglobin in Blood is an example of _______ colloid. (The anticoagulate heparin is –vely charged.)

176. An emulsion of oil and water can be stabilised by certain substances called __________.

177. The stabilsing power of Lyophilic sol is expressed in terms of __________.

178. The cleansing action of soap is linked with its tendency to act as _________ between oil & water.

179. Associated colloids are called __________.

180. $2SO_2(g) + O_2(g) \xrightarrow{NO(g)}$. Here $NO_{(g)}$ acts as _______ catalyst.

Unit - VI

181. Soluble metal oxide provide _________ ions in aqueous medium the solution is called _________.

182. Non-metallic oxide in aqueous solution gives _________ ion.

183. Sodium oxide is a basic oxide but zinc oxide is __________.

184. The most electronegative non-metal is __________.

185. Dolomite is an ore of __________ and __________.

186. The sulphide ore of Cu is known as ___________.

187. Calamine is an ore of ____________.

188. ZnS and PbS can be separated during froth flotation process using ___________ as depressant.

189. Wolfram from SnO_2 is separated by ___________.

190. NaOH acts as ___________ agent during concentration of bauxite.

191. Silver glance is leached by ____________.

192. Impurities + flux is called ____________.

193. Acidic impurity such as sand (SiO_2) is removed on treating with _______.

194. The acidic impurity, P_2O_5 is removed by __________ forming the fusible slag __________.

195. The gas liberated on roasting of zinc blende is ________.

196. Roasting is carried on in __________ furnace.

197. The process of heating the concentrated ore in absence of air at a temperature below its m.p is called __________.

198. The process of reduction during metallurgy is called ________.

199. Chalocopyrites contain metals, ____________ and ____________.

200. In the blast furnase ____________ reduces $Fe_2 O_3$ to Fe.

201. Blast furrace is charged with roasted ore along with _______ and ________.

202. The tapped out iron from the furnace is called ____________.

203. During electrolytic refining, the impure copper is choosen as __________in the cell.

204. Copper obtained by electrolytic refining __________% pure.

205. Calcination helps to remove _________ & _______.

206. During the refining Zr __________ is formed which on thermal decomposition gives pure metal.

207. The impurity in a mineral is called __________.

208. Froth floatation process is used for the metallurgy of__________ ore.

209. A non-metal which shines like a metal and conducts electricity is __________.

210. The art of extracting metals from their ores is called __________.

211. Th process of removal of gangue or matrix from are is called __________.

212. Coke used during smelting of iron acts as fuel as well as __________ agent.

213. Reduction of metal oxide by aluminium metals is called __________.

214. The most abundant metal in the earth-crust is __________.

215. In the electrorefining of copper, some gold is obtained in __________.

216. Zinc blende and iron pyrites` are sulfides. T/F __________.

217. Density of slag is always ________ than that of molten metal.

218. The metal purified by distillation is ___________.

Unit - VII

219. 'S' in H_2SO_4 undergoes ______ hybridization.

220. Among hydrides of group 15 ________ has the lowest boiling point.

221. Among halogens _____ has only one oxidation state.

222. Bromine gas turns starch-iodide paper ____ due to liberation _______.

223. The halogen that most readily reduced __________.

224. XeF_2 is AB_2L_3 type, so its shape is ________.

225. The gas used in inflating aeroplane tyres is _________.

226. Sea divers use a mixture He and O_2 for artificial respiration. On coming to the surface they feel painful sensation called ______.

227. The basicity of H_3PO_3 is _____ while H_3PO_4 is tribasic.

228. XeF_6 on partial hydrolysis produces ______.
(on hydrolysis o.s. does not change)

229. The basic stength of hydrides of group-15 decreases in the order ______.

230. The equivalent mass of H_3PO_4 in the reaction:

$$NaOH + H_3PO_4 \longrightarrow NaH_2PO_4 + H_2O \text{ is ________.}$$

231. When chlorine reacs with cold and dil solution of NaOH, it forms _________.

232. SO_2 reacts with Cl_2 in presence of sunlight produces ______.

233. Oxygen and Ozone are ______ of each other.

234. Among hhalogens _______ has the lowest bond dissociation enthalpy.

235. On thermal decomposition of ammonium dichromate or Bariumazide _____ gas is liberated.

236. With alkali metal NH_3 liberates _____ gas.

237. Ammonia gives brown precipitate with Nessler's reagent due to formation of _______.

238. In the aquaregia conc Nitric acid and conc. Hydrochloric acid present in the ratio ______.

239. The outer valence shell configuration of group 15 is ________.

240. The neutral oxide of nitrogen is _________.

241. Conc. HNO_3 oxidises 'P' to __________.

242. Shape of NH_3 is _________ while shape of $\overset{\oplus}{N}H_4$ is ______.

243. Anhydride of HNO_2 is __________.

244. In fuming sulfuric and the fumes are nothing but ________.

245. The O–O bond lengths is Ozone are identical. So Ozone exhibit in _______ form.

246. Sulfur molecule is reresented as _______.

247. Bleaching action of SO_2 due to ________.

248. O_3 reacts with KI solution to produce ________.

249. SO_2 reacts with H_2S where it reacts as ______ agent.

Unit - VIII

250. d- block elements are called transition elements where f- block elements are ______.

251. In the f-block of element ______ and ______ orbitals are in the process of filling.

252. The outer most shells configuration of f-block elements is _______.

253. The total number of elements can be accomodated in d-block in periodic table is ______.

254. _________ is the first and _______ is the last transition metal in periodic table with atomic number _____ and ________.

255. German silver is an alloy of ______ _____ and ______.

256. The % ____ metal is more in german silver.

257. The correct order of arrangement of m.p. of metals present in group is ________.

258. _____ group in periodic table contains maximum number of elements.

259. Cr^{3+} has _______ number of electrons in t_{2g} level.

260. The complementary colour of violet is ________.

261. Inner transition metal compounds are ____ type of compounds not following common rule of valency.

262. Mn_3O_4 is a mixed oxide of ______ and _____ .

263. Acidic oxides of Cr is ______ & anhydride of _______.

264. The magnetic moment of Mn^{2+} is _________ BM.

265. The ns electron of transition metal responsible for metallic bonding while (n–1)d orbital cause ______ bonding.

266. Among Ti, V, Cr and Mn _______ has / lower m.p.

267. The metals showing highest oxidation state of +8 are ______ with oxygen.

268. Co^{3+} present in vitamin ________.

269. The number of unpair $\bar{e}$s in $Mn^{2+}(Z = 25)$ is ________.

270. Brass is an alloy of —— and copper.

271. The transition metal/ion form maximum number of complexes is _______.

272. $TiCl_3$ used as _____ catalyst in the production of polyethene.

273. The number of water molecules in Mohr's salt is _______

274. In the first row (3d-block) of trasition metal ______ has positive $E^0_{M^{2+}|M}$ value.

275. Betweens p and d-block of elements ______ block elements are better reducing agent.

276. Between CuI_2 and Cu_2I_2 ______ is more stable.

277. The transition elements present in first triad is ________.

278. The decrease in ionic radius of Lanthanides from La^{3+} to Lu^{3+} is called ______.

279. Among the hydroxides of Lanthanoides _______ is more basic.

280. Between Actinoid contraction and Lanthanoid contraction is ______ greater.

Unit - IX

281. IUPAC name of $[Co(en)_3]_2(SO_4)_3$ is ———.

282. Carnallite is a ————— salt.

283. Oxidation state of Ni in $[Ni(CN)_4]^{2-}$ is —————.

284. Denticity of EDTA is —————.

285. IUPAC name of $[Fe(CO)_5]$ is ————.

286. $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are ——— isomers while $[Co(NH_3)_5NO_2]Cl_2$ and $[Co(NH_3)_5ONO]Cl_2$ are —— isomers.

287. Stable complex is formed if EAN is equal to the ———.

288. Chemical formulae of nitropentaminecobalt (III) chloride is ———.

289. According to Werner types of valencies present for metals in complexes are — and — ————.

290. The coordination number of cobalt in $[Co\,(en)_2Cl_2]$ is ———.

291. $C\bar{N}$ is called _______ ligand while $(CH_2)_2(NH_2)_2$ is called a chelating ligand.

292. Between $Ni(CO)_4$ and $[Fe(H_2O)_6]^{2+}$ ______ is more paramagnetic.

293. $[Mn(CN)_6]^{4-}$ is an _________ orbital complex.

294. Argentite (Ag_2S) dissolves in KCN forming a complex. The IUPAC name of it is _________.

295. The co-ordination number and O.N. of iron is potassium ferrocyanide are ______ and _______ respectively.

296. The IUPAC name of $K_2[Ni(CN)_4]$ is ________.

297. The number of moles of AgCl formed on adding excess $AgNO_3$ to hexaamineplatium (IV) chloride is __________.

298. The aqueous solution of chloro complex of diammine platinum (IV) is an electrolyte. T/F __________.

299. Between $[Mn(en)_2]^{2+}$ and $[Ni(en)_2]^{2+}$ _______ more stable.

300. The formula of tetraammine dichlorido chromium (III) chloride is _________.

301. Complexes where more than one kind of ligand / donor group is known as ________ complex.

Unit - X

302. Ethyliodide reacts with sodium ethoxide to produce ________________.

303. When alkyl halide is treated with alcoholic KOH, the compound formed is _______.

304. Between 1-chlorobutane and 2-chlorobutane ____________ is optically active.

305. RX + KOH $\rightarrow$ ROH + KX is example of __________ reaction.

306. The reagent required to convert CH_3I to CH_4 is ___________.

307. For a given alcohol the order of reactivity with halogen hydraacid is __________.

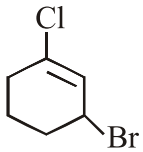
308. The non polar compound is __________ (CH_3Cl, CH_3Cl_2, CCl_4, $CHCl_3$)

309. $(CH_3)_3CCl$ is named as __________.

310. Methylene chloride is also named as ___________.

311. Ethylene chloride on action with alcoholic KOH gives ___________.

312. The compound used as refrigerant is ___________.

313. The IUPAC name of 

is _______.

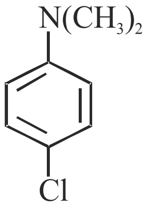
314. The structure of 2–(4–chlorophenyl) buta-1, 3-diene is __________.

315. Aniline $\xrightarrow[\text{HCl},5^0\text{C}]{\text{NaNO}_2}$ A $\xrightarrow{\text{HBF}_4}$ B. The product ‘B’ is ____________.

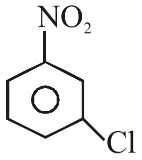
316. Between o-dichlorobenzene and p-dichlorobenzene __________ has higher m.p.

317. Chlorobenzene on treatment with sodium in dry ether gives diphenyl. The name of the reaction is ____________.

318.



(i)



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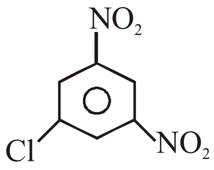

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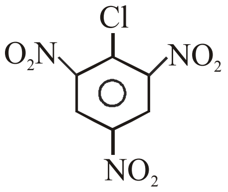


(iv)

The order of reaction towards S_N is __________.

319. $C_6H_5-CH_2-Cl+CH_3Cl \xrightarrow{\text{Na / ether}}$. Name of the reaction is __________.

320. $C_6H_5Cl+CH_3Cl \xrightarrow{\text{Na / dryether}} C_6H_5-CH_3$ and this is an example of ________ reaction.

321. Bromination of ethyl benzene in presence of sunlight preferentialy yield __________. (1-Bromo-1-phenyl ethane ethane).

322. Ethyl bromide with excess of ammonia gives ___________.

323. HBr adds to propene in presence of peroxide is called ____________ effect & the product formed is __________.

324. $CH_3-CH_2-OH+PCl_3 \longrightarrow CH_3-CH_2Cl+$ __________.

325. $CH_3-CH_2-OH+PCl_5 \longrightarrow CH_3-CH_2Cl+$ __________ + __________.

326. The reagent(s) used in Wurtz reaction is ______________.

327. HBr is added to propene to give _________ as per ___________ rule.

328. The metal used in the preparation of Grignard’s reagent is _________.

329. 3-Bromo-2,2-dimethylbutane heated with alc. KOH to give _________.

330. Preparation of chlorobenzene from $C_6H_5N_2Cl$ with Cu and HCl is called _________ reaction.

331. Silver acetate with bromine gives ______ and _____ the reaction is called ______ .

332. Hydrogen atom in chloroform is ________ in nature. (acidic / alkaline / neutral)

333. Solvent used in dry cleaning of clothes is _________.

334. The ease of alkyl halides undergoes Wurtz reaction is _________.

335. Ethyl bromide and isopropyl chloride can be distinguished by ________.

336. The alkyl bromide better hydrolysed by S_N-1 mechanism is ________.

337. Grigrard’s reagent is prepared by refluxing alkyl halide with _______ in _______ median.

338. Grignard’s reagents with acetone is an example of ________ reaction.

339. The reagent that on action with alkyl halide increases the C-atom in chain is _________.

340. The product formed when bleaching powder is distilled with acetone is ________.

341. Diethylketone responds iodoform test. T/F _______.

342. $RCl + NaI \xrightarrow{acetone} RI + NaCl$ is known as _______.

343. Vicinal and gem-dihalide can be distinguished by ______.

344. C_2H_5MgBr on carboxylation gives ________.

345. Isopropylbromide with sodium tertiary butoxide gives ___________.

346. Sodium tetriary butoxide with CH_3Br gives ________.

347. t-butyl bromide with sodium methoxide gives ____________ as major product.

348. $(CH_3)_3CCl$ on Wurtz reaction gives __________ (IUPAC name).

349. An optically active compound must have atleast one ___________C atom.

350. $R\,CN \xrightarrow{SnCl_2+HCl} RCHO$, It is an example of _______ reaction.

351. Alkyhalide with AgCN gives __________.

352. Alkyl isocyanide on reduction with $LiAlH_4$ gives ________, which is a _______ amine.

353. In S_N2 reaction the rate of reaction depends on concentration of substrate and _________.

354. The dipolemoments of chloromethanes follow in the order : __________.

355. Chlorobenzene on Friedel Crafts alkylalation gives _________ as major product.

Unit - XI

356. Alcohols and ethers are ____________ isomers.

357. The isomer of ethanol is __________.

358. Butan-1ol and Butan-2-ol are _______ isomers.

359. The number of structural isomers with formula C_4H_9OH is ___________.

360. Alkan-1-ol is classified as ________.

361. Ethyl alcohol heated with conc. H_2SO_4 to give ___________.

362. $CH_3–CH_2–CH_2OH \xrightarrow{PCl_5} A \xrightarrow{alc.KOH} B$.

363. ____________ alcohol reacts with Lucas reagent fastest at room temperature.

364. Primary and secondary alcohol on action of reduced Cu at 300°C give ________ respectively.

365. ___________ alcohol on heating with copper at 300°C gives alkene.

366. Dehydrogenation of butan-2-ol gives ___________, while dehydration gives _________.

367. ___________ gives methyl ethyl ketone on oxidation.

368. Propan-2-ol is obtained on reduction of ___________.

369. Maltase converts ______ to glucose.

370. __________ converts glucose to, ethylalcohol.

371. A low boiling alcohol failed to give the Lucas test, but give iodoform test. The alcohol is _________.

372. A compound 'X' having molecular formula, $C_4H_{10}O$ when oxidised produces an acid, $C_4H_8O_2$. The compound X is __________.

373. An organic compound ‘X’ ($C_3 H_8O$) on treatment with acidified $K_2 Cr_2 O_7$ gives ‘Y’ which responds iodoform test. The compound X is ________.

374. Between HCHO and CH_3CHO _______ does not respond to iodoform test.

375. The IUPAC name of carbinol is _________.

376. In CH_3CH_2OH, the bond that undegoes heterolytic cleavage most readily is __________.

377. 1-chlorobutane on reaction with alcoholic KOH gives __________.

378. Ethylalcohol is miscible in water because it forms __________.

379. Ethanol has higher boiling point than that of dimethyl ether. T/F

380. Secondary alcohol on oxidation gives ________.

381. Phenol on reduction with zinc dust gives _________.

382. Formylayion of Phenol is __________ reaction.

383. Phenol reacts with ________ to give o– and p– nitrophenols.

384. Phenol with CrO_2Cl_2 gives __________.

385. Phenol with nitrous acid (HONO) gives ________.

386. Phenol is acidic but fails to gives effervescene with ___________.

387. Phenol is named as __________ acid.

388. Phenol undergoes electrophilic substitution at ___________ positron.

389. The general formula of alkenol is _________.

390. Ethyl iodide with dry silver oxide gives __________.

391. _________ widely used as a solvent for preparation of Grignard’s reagent.

392. Phenetole with HI gives ___________ and ____________ .

393. Between phenol an cresol ___________ is more acidic.

394. $(CH_3)_3COCH_3$ on hydroiodination gives ____________ and ____________.

395. Anisole when treated with HI at 373 K, gives __________ and __________.

Unit - XII

396. Aqueous solution of formaldehyde is called _______ .

397. The formation of cyanohydrin from a ketone is an example of———.

398. Aldehydes are obtained by the catalytic dehydrogenation of———.

399. Aldehydes and Ketones are collectively known as ——— compound.

400. Acetaldehyde + conc. H_2SO_4 polymerises to ————

401. Rosenmond’s reduction ——— and ——— used as catalyst.

402. At room temp., formaldehyde is a ————.

403. ——— being an aldehyde, does not react with Fehling’s solution.

404. Formaldehyde with NH_3 forms —————

405. Test that distinguishes between pentan-2-one and pentan-3-one is ________.

406. Between acetal dehyde and acetone ______ is more reactive.

407. ——— distinguishes between acetaldehyde and acetone.

408. Reduction of Ag^+ ions, provided by Tollen's reagent to silver metal is known as ——— test.

409. Aldehydes restore the — colour of Schiff's reagent.

410. Calcium acetate when heated with calcium formate forms ————.

411. $2HCHO + NaOH \rightarrow HCOONa +$ ———.

This reaction is called _______.

412. When acetaldehyde reacts with hydroxylamine ——— is formed.

413. When calcium acetate is heated dry 400°C it forms ———.

414. Ammoniacal solution of silver nitrate is known as ————— .

415. The precipitate formed when aldehyde reacts with Fehling's solution is ————.

416. $CH_3COOH + PCl_3 \rightarrow 3\ CH_3COCl +$ ————.

417. ——— is the strongest of all aliphatic monocarboxylic acid.

418. Vinegar is ———— solution of acetic acid.

419. ———— is the only aliphatic carboxylic acid which acts as a reducing agent

420. When acetic acid is treated with P_2O_5 ——— results.

421. IUPAC name of $CH_3CH = CHCOOH$ is ———.

422. General formulae of aliphatic monocarboxylic acid is ————.

423. Acetyl chloride on being treated with ______ gives acetone.

424. Sodium acetate is subjected to electrolysis to produce —— at anode.

425. When sodium formate is heated upto 390°C, the product is ————.

426 . When sodium salt of formic acid reacts with sodalime ——— gas is evolved.

427. Dehydration of an amide with P_2O_5 gives ———.

428. _____ sigma and ___ Pi bonds are present in formaldehyde molecule.

429. Fehling's solution is a mixture of — and —.

430. When an acid is reduced with $LiAlH_4$ ——— is formed.

431. To produce an ester, an acid reacted upon ________ reagent.

432. Acetyl chloride on heating with ________ gives acetic anhydride.

433. Acid chlorides react with ________ to form as ester.

434. Acetamide reacts with bromine in presence of ______ to produce methylamine.

435. Acid chloride on reduction with $LiAlH_4$ gives __________.

436. Calcium salt of ______ acid fails to form ketone.

Unit - XIII

437. The general formule of alkanamine is ___________.

438. Tetra-alkyl ammonium salt is called is __________.

439. The structure of N-methyl benznenamine is ___________.

440. The IUPAC name of Triemthyl amine is ___________.

441. Benzamide with alkaline bromine gives ___________.

442. The reagent used in Hofmann bromamide reaction is ___________.

443. Chloramine with C_2H_5MgBr is ___________.

444. Isocyanate (RNCO) on hydrolysis gives ___________. .

445. Mono-carboxylic acid with hydrazoic acid acid is called ___________ reaction.

446. ___________ is formed by Schmidt reaction.

447. ___________ is prepared by Gabriel phthalimide reaction.

448. Between $ClNH_2$ and CH_3NH_2 ___________ is more basic.

449. Freshly prepared aniline is colourless but on exposure it becomes ________.

450. Reduction nitrile and isonitrile gives _________ and ______ amine respectively.

451. NItro methane on heating with Sn and HCl gives ___________.

452. 2-nitro propane $\xrightarrow{Sn/HCl} A \xrightarrow[\text{dil HCl}]{NaNO_2(s)} B$. Compound 'B' is ________.

453. The number of isomeric amines given by $C_3\,H_9N$ is ___________.

454. Lower amines are soluble in water due to formation of___________.

455. Primary amine with nitrous acid gives ___________.

456. A primary amine can be distinguished from 2^0 and 3^0 amines by ________ reaction.

457. The reagent that reacts with nitromethane to form methyl hydroxylamine is___________.

458. Chloroform with nitric acid gives ___________.

459. The reagent required for diazotisation is ___________.

460. Diazotisation can be carried out on cold at___________.

461. Between $C_6H_5CH_2\,NH_2$ and $(NO_2)\,CH_2NH_2$ _______ is a weaker base.

462. The gas liberated on treatment 1^0-amine with nitrous acid is ________.

463. Ethylamine with alkaline chloroform gives _________.

464. Hinsberg reagent is ___________.

465. Silver chloirde is soluble in methyl amine due to formation of___________.

466. The compound which on reaction with nitrous acid at low temperature produces an oily compound is ___________.

467. Tertiaryamine, $(CH_3)_3N$ with nitrous acid on heating gives ___________.

468. ___________ is used for dehairing hides.

469. Formation of benzene diazonium chloride from aniline is called ___________.

470. Benzene diazonium chloride with KI formes ___________.

471. Benzene diazonium chloride boiled with water to give ___________.

472. $C_6H_5NH_2 + H_2PO_2 + H_2O \longrightarrow$ __________.

473. Arene diazonium fluoroborate on heating gives __________.

474. Benzene diazonium chloride with ethanol gives benzene. This a process of________ where ethanol acts as ________ agent.

475. The gas liberated on heating acetamide with NaOH is ___________.

476. The amine used for dehairing hides is ___________.

477. Quarternary ammonium salt is used in the product of ___________.

**

Unit - XV

478. Amino acids are building block of _______.

479. Monomers of terylene is _______ and _______ .

480. Orlon is a polymer of _______ .

481. The polymer used for making non stick utensils is _______.

482. Teflon is a type of _______ .

483. _______ is natural elastomer.

484. Polymerisation of ethene is _______ .

485. Natural rubber is a polymer of _______ .

486 . Radio and TV bodies are made up of _______ .

487. The name saran is given to copolymers obtained by the copolymerisation of _______ with _______ .

488. Nylon-6,6 is Co-polymer of ________ & _______.

489. Polymerisation of two or more different monomers gives _______ .

490. Nylon - 6, 10 is a copolymer of _______ and _______ .

491. Glyptal or alkyl resin is a coplymer of _______ and _______ .

492. Terelyne is nothing but a group of ___________ .

493. PCTFE is obtained from __________ .

494. The monomer of Nylon-6 is __________.

495. Condensation of phenol with formaldehyde produces a compound called _______ .

496. The growth condensation polymer is called _______ .

497. Polythene is an example of _______ .

498. Bakelite is _____ plastic.

499. Buna - S rubber is also known as _______ .

500. Nylon, Decron, Glyptal are _______ .

501. Polythene, PVC are _______ .

502. Polymer made up of identical repeat units are known as _______ .

503. Carbohydrates and proteins are _______ polymer.

504. Neoprene is a polymer of _______ .

505. Hexamethylenediamine is used in the manufacture of _______ .

506. Formula of Melamine is _________ .

507. Electrical insulators are made up of _______ .

508. Bakelite is — polymer.

509. Neoprene is used as ______.

510. Automobile tyres or shoe sole are made up of______.

511. Buna-N rubber is a co-polymer of______ and ______.

512. The IUPAC name of monomer of orlon is _______.

Unit - XVI

513. Phenol is used as both antiseptic as well as _______.

514. _______ act as both an analgesic and antipyretic.

515. Nature of morphine is _______ .

516. A mixture of chloroxylenol and terpineol gives _______ properties of dettol.

517. Streptomycin is used to _______ .

518. Pencillin has a _______ spectrum.

519. Tetracycline and chloroamphenicols are _______ .

520. Medicines against harmful micro organisms are called _______ .

521. Ampicillin acts as _______ .

522. Chemicals which prevent the growth of micro organisims are called _______ .

523. Acetyl salicylic acid is known as _______ .

524. The oil from which soaps are prepared, belongs to a class of compound known as _______ .

525. Paracetamol is used as _______ .

526. Mercurochrome is an example of _______ .

527. Dettol is a mixture of _______ and _______ in a suitable solvent.

528. Oils and fats are _______ of higher carboxylic acids.

529. Aspirin and Analgin are (narcotic/non-narcotic) drug _______ .

530. Tincture iodine is _______ drugs.

531. Crocin or Phenacetin is _______ .

532. Novalgin is an — drug.

533. Terphenadine is a common ________.

534. Medicine used to prevent allergy is ________.

535. Boric acid used as mild _________.

536. To reduce the acid secretion in stomach wall the medicine generally prescribed is _____.

**

Unit-XIV (Additional Questions as per original syllabus):-

537. __________ catalyses biochemical reactions.

538. The metal prsent in Vit. B_{12} is ___________.

539. Sugar present in RNA is ___________.

540. Plant hormones are called ____________.

541. _________ is the chemical basis of heredity.

542. Enzymes are globular protein soluble in __________ and ___________.

543. The vitamin obtained from sunlight is __________.

544. The nucleic acid used in protein synthesis is ___________.

545. The disease corneas of eyes becomes opaque is ___________.

546. __________ is known as antisterility vitamin.

547. Sugar units are joined by __________ linkage, while aminoacids linked by _______ bond/linkage.

548. __________ is known as invert sugar.

549. Open chain structure of fructose contains ___________ chiral centres.

550. On hydrolysis of starch finally _______ is obtained.

551. Lactose on hydrolysis gives glucose and __________.

552. Keratin (hair) is an examaple of _________ protein.

553. Boiling of an egg is called ___________.

554. The enzyme used to convert urea to NH_3 is __________.

555. Insulin is responsible for metabolism of glucose, released by _________.

❖ ❖ ❖

Chemistry

Answers - Group - A(2)

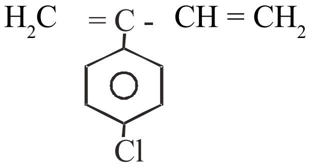
1. tetrahedral void
2. antifluorite
3. 6:6
4. 74%
5. octahedral voids, tetrahedral voids
6. frenkel defect
7. Covalently
8. $Na^{+\backslash}$
9. 8:8
10 six
11. co-ordination number
12. 4 (four)
13. amorphous
14. bcc
15. six
16. Cl^{-}
17. one, two
18. solid, ions
19. $2\sqrt{2}.r$
20. six
21. eight
22. 8, 4
23. fcc & NaCl structure
24. 32
25. 2N, N
26. 6.023×10^{23}
27. 1.5×10^{23} (4 molecules/Unit cube)
28. 4 : 4
29. XY
30. XY_3
31. AgBr
32. 12
33. ABAB..........., ABCAB...........
34. increases
35. decreases
36. isotonic solutions
37. elevates (increases)
38. not zero
39. 2.28 m
40. 0.92
41. 100.102 °C
42. $MgCl_2$
43. K_f
44. 76.4 g/mol
45. osmosis
46. 55.56 m
47. 0.02
48. one
49. solid-solid
50. K.Kg mol^{-1}
51. molality of solution
52. Colligative property
53. less
54. zero
55. Non-ideal, negative
56. 0.9 N
57. g/L (strength)
58. 68.49 g/mol
59. $1 + 2\alpha$
60. osmotic pressure
61. Reverse Osmosis
62. dimer
63. Zero, nFE
64. > 7
65. one
66. O_2 (g)
67. NaCl, NaH
68. diamond
69. Zinc
70. 3.3575 g
71. 90.71 $ohm^{-1}cm^{2}$/gm eqv.
72. Al
73. colourless
74. 17.23 amp/sec
75. 0.5 ohm^{-1} cm^{2} eqv^{-1}
76. ions
77. electrons
78. resistance
79. ECE (Z)
80. anode, cathode
81. Chemical, electrical
82. zero
83. Cell potential
84. Chemical equivalent $\left[{}^{W_1}\!/_{W_2} = \frac{Z_1}{Z_2} = {}^{E_1}\!/_{E_2} \right]$
85. $(E = 96500\times Z), E = Z.F$
86. ohm^{-1} cm^{2} mol^{-1}
87. ohm^{-1} cm^{-1}
88. Conductance
89. Cathode (+)
90. specific resistance, sp.conductance
91. $2\times1.6\times10^{-19}$ C/ion i.e. 2F / mole
92. electrode
93. cathode
94. 1.1 volts
95. 0.1 F

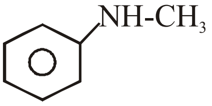
96. 0.5 M
97. 0.693 /K
98. zero
99. $k=Ae^{-Ea/RT}$
100. sec^{-1}
101. second, 2
102. three
103. pseudo-unimolecular
104. litre mol^{-1} sec^{-1}
105. temperature
106. $\Delta H = Ea$
107. first
108. –Ea/R
109. instantaneous
110. initial conc. (a)
111. three
112. a/k
113. $-\frac{1}{2}\frac{d[A]}{dt}=\frac{-d[B]}{dt}=+\frac{1}{2}\frac{d[C]}{dt}$
114. first
115. three
116. Ea(activation energy)
117. $2\times\left(\frac{1}{2}\right)^4=\frac{1}{8}$
118. two
119. mol l^{-1} sec^{-1}
120. three
121. zero
122. first
123. zero
124. one, two
125. $\frac{dc}{dt}$ (rate of reaction)
126. molecularity
127. three
128. first
129. 2 or 3
130. exothermic
131. MnO_2
132. lowers
133. second
134. zero
135. $-\frac{d[N_2]}{dt}=+\frac{1}{2}\frac{d[NH_3]}{dt}=1.0\times10^{-4}\ mol^{-1}\ sec^{-1}$
136. Positive
137. Brownian movement
138. Tyndal effect
139. gel
140. o/w
141. –vely
142. peptisation
143. coagulation
144. scattering light
145. aenosol (of solid)
146. electrophoresis / cataphoresis
147. F
148. Flocculation
149. emulsion
150. w/o
151. despersed phase & dispersion medium
152. sorption
153. decrease
154. desorption
155. bulk, surface
156. multimolecular
157. absorbed, adsorbs
158. more
159. Helium
160. graphite
161. decreases
162. negative
163. NH_3
164. T
165. glycerol/H_3PO_4
166. ethanol
167. promotor
168. Mo
169. Tripsin
170. Co-enzyme
171. Na^+
172. outward
173. hydrophobic, hydrophilic
174. bigger
175. positive
176. emulifier
177. gold number
178. emulsifier
179. micelle
180. homogeneous
181. OH^- alkaline
182. H^+
183. amphoteric
184. F
185. Ca, Mg
186. Copper pyrite/glance
187. Zn($ZnCO_3$)
188. NaCN
189. Magnetic separation
190. Leaching
191. NaCN
192. Slag

193. CaO (lime)
194. Ca, $Ca_3(PO_4)_2$
195. SO_2
196. reverberatory
197. roasting
198. smelting
199. Fe, Cu
200. CO
201. limestone and coke
202. pig iron
203. anode
204. 99.9%
205. moisture, volatile impurities
206. ZrI_4
207. gangue
208. sulfide
209. graphite
210. Metallurgy
211. concentration
212. reducing
213. aluminothermy
214. aluminium
215. anode mud
216. T
217. less
218. mercury
219. sp^3
220. PH_3
221. Fluorine
222. blue, iodine
223. fluorine
224. linear
225. Helium
226. bends
227. 2(dibasic)
228. $XeOF_2 + HF$
229. $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$
230. $\frac{98}{1}$
231. NaCl +NClO
232. SO_2Cl_2
233. allotrope
234. I – I
235. $N_2(g)$
236. $H_2(g)$
237. iodide of Millon's base, $H_2N-Hg-O-HgI$
238. 1 : 3
239. $ns^2\ np^3$ (n=2 to 7)
240. N_2O
241. H_3PO_4
242. pyramidal, tetrahedral
243. N_2O_3
244. SO_3
245. resonating
246. S_8
247. reduction
248. iodine
249. oxidising agent
250. inner transition elements
251. 4f & 5f
252. $n-2f^{(0-14)}\ (n-1)d^{0(or)1}ns^2$
253. forty
254. Sc, Cn (21–112)
255. Cu, Ni, Zn
256. Copper (60%)
257. increasing from top to bottom
258. 3rd group (32) elements
259. three
260. yellow
261. non-stoichiometric (interstitial)
262. Mn(II)O, Mn(III)O,
263. CrO_3 (H_2CrO_4)
264. $\sqrt{35} = 5.92$
265. covalent
266. Mn
267. Ru, Os (OsO_4),
268. B_{12}
269. five ($3d^5$)
270. Zn
271. Co(II) or Co(III)
272. Zeigler-Natta
273. six
274. $Cu^{2+}|Cu$
275. s
276. $Cu_2I_2\left[2Cu^{2+} + 4I^- \rightarrow Cu_2I_2 + I_2\right]$
277. Fe, Co, Ni
278. Lanthanide
279. $La(OH)_3$
280. Actinoid
281. Trisethylenediaminecobalt(III) sulfate
282. double
283. +2
284. six
285. pentacarbonyliron (0)
286. ionisation, linkage
287. atomic no. of nextnoble gas
288. $\left[Co(NH_3)_5NO_2\right]Cl_2$
289. primary, secondary
290. six
291. ambidentate
292. $\left[Fe(H_2O)_6\right]^{2+}$

293. inner
294. $K\left[Ag(CN)_2\right]$, Potassiumdicyanido argentate (I)
295. 6, 2
296. Potassium tetracyanido nickelate (II)
297. $\left[Pt(NH_3)_6\right]Cl_4 \xrightarrow{4AgNO_3} 4AgCl$
298. $\left[Pt(NH_3)_2Cl_4\right]^0$, F
299. $\left[Ni(en)_2\right]^{2+}$
300. $\left[Cr(NH_3)_4Cl_2\right]Cl$
301. heteroleptic

Unit–X

302. diethylether
303. alkene
304. 2-chlorobutane
305. S_N
306. Zn-Cu couple + ethanol
307. HI > HBr >HCl > HF
308. CCl_4
309. 2-chloro-2-methyl propane
310. dichloromethane
311. acetylene $CH \equiv CH$
312. freon
313. 3-bromo-1-chloro cyclohexene
314. 
$H_2C = C(C_6H_4Cl) - CH = CH_2$
315. fluorobenzene
316. p-dichlorobenzene
317. Fittig reaction
318. (iv) > (iii) > (ii) > (i)
319. Wurtz reaction
320. C_6H_5-CH_3 (Wurtz-Fittig reaction), 1-bromopropane
321. 1-Bromo-1-phenyl ethane
322. $CH_3 - CH_2 - NH_2$
323. Kharasch, 1-bromopropane
324. H_3PO_3
325. $POCl_3$ + HCl
326. Na–dryther
327. 2-Bromopropane, Markownikoff's
328. Mg
329. 2,3– dimethyl but -2- ene
330. Sandmeyer's
331. CH_3Br+CO_2, Hunsdiecker reaction.
332. acidic
333. CCl_4
334. RI > RBr > RCl
335. alc. $AgNO_3$
336. $(CH_3)_3C - Br$
337. Mg, dryether
338. AdN
339. KCN
340. Chloroform
341. F
342. Finkelstein
343. KOH(aq)
344. propanoic acid
345. propene
346. CH_3–O–$C(CH_3)_3$
347. 2-methyl propene
348. 2, 2, 3, 3-tetramethyl butane
349. chiral / asymmetric
350. Stephen's reaction
351. RNC
352. N-methyl (alkanamine, (2^0)
353. reagent (nucleophile)
354. $CH_3Cl > CH_2Cl_2 > CHCl_3 > CCl_4$
355. p -chlorotoluene
356. functional
357. methoxy methane
358. position
359. Seven
360. primary alcohol
361. ethene
362. propene
363. 3^0-alcohol
364. aldehyde and ketone
365. Tertiary
366. butanone, butene
367. Buton-2-ol
368. propanone

369. maltose
370. zymase
371. ethylalcohol
372. Butan-1-ol
373. $CH_3CH(OH)CH_3$
374. HCHO
375. methanol
376. –O–H
377. But-2-ene (2^0 carbocation > 1^0)
378. H-bonding
379. True (T)
380. ketone
381. benzene
382. Reimer-Tiemann
383. dil.HNO_3
384. p-benzoquinone
385. p-nitro phenol
386. $NaHCO_3$(Aq)
387. Carbolic
388. o–/p–
389. $C_nH_{2n}O$
390. diethyl ether
391. diethylether
392. phenol & C_2H_5I
393. phenol
394. $(CH_3)_3CI$, CH_3OH
395. C_6H_5OH, CH_3I
396. formalin (40% Aq)
397. Ad_N
398. 1^0-alcohol
399. carbonyl
400. paraldehyde, $(CH_3CHO)_3$
401. Pd-$BaSO_4$
402. gas
403. benzaldehyde
404. urotropine, $(CH_2)_6N_4$
405. iodoform test (I_2+KOH)
406. acetaldehyde
407. Tollen's reagent
408. silver minor
409. pink (p-rosalin hydrochloride decolarised by SO_2)
410. acetaldehyde
411. CH_3OH (Cannizzaro's reaction)
412. acetaldehyde-oxime
413. acetone
414. Tollen's reagent
415. Cuprous oxide (red)
416. H_3PO_4
417. Formic and (HCOOH)
418. 5-8% acetic acid by vol
419. HCOOH $\left(+O \rightarrow CO_2 + H_2O\right)$
420. acetic anhydride
421. But-2-enoic acid
422. $C_nH_{2n}O_2$
423. $(CH_3)_2Cd$
424. ethane
425. Sod. oxalate + H_2
426. Hydrogengas $\left(+Na_2CO_3\right)$
427. RCN (alkane nitrile)
428. three, one
429. $CuSO_4$ (aq)+ Rochelle salt
430. R CH_2OH (1^0-alcohol)
431. alcohol
432. Sod. acetate
433. an alcohol
434. KOH
435. primary alcohol
436. formic acid
437. RNH_2, $CnH_{2n+3}N$
438. quarternary ammoniumsalt
439. 
440. N, N–dimethyl methanamine
441. $C_6H_5NH_2$ (aniline)
442. Br_2 + KOH
443. $ClNH_2 + C_2H_5MgBr \longrightarrow C_2H_5NH_2 + Mg(Br)Cl$
444. $RNCO + H_2O \xrightarrow{OH^-} RNH_2 + CO_2$
(Curtius reaction)
445. $RCOOH + HN_3 \xrightarrow[\Delta]{H_2SO_4} RNH_2 + N_2 + CO_2$ (Schmidt reaction)
446. Primary amine
447. aliphatic 1^0-amine
448. CH_3NH_2(+ I effect)
449. blackish brown (atmospheric oxidation)
450. 1^0 and 2^0

451. methanamine 452. $CH_3–CH(OH)CH_3$

453. Four. $\left[CH_3-CH_2-CH_2NH_2, CH_3-CH(-NH_2)CH_3, CH_3-CH_2\,NH-CH_3, (CH_3)_3\,N\right]$

454. inter molecular H-bonding 455. 1^0-alcohol

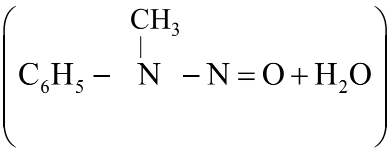
456. Crabylamine 457. $Zn+NH_4Cl$

458. $Cl_3CH+HONO_2 \longrightarrow Cl_3CH\text{-}NO_2$ (Chloropicrin)

459. $NaNO_2(s)$+di/HCl (at 5^0C) 460. $0\text{-}5^0C$

461. $NO_2\text{-}CH_2\text{-}NH_2$ (–I effect) 462. $N_2(g)$ 463. Carbylamine

464. $C_6H_5SO_2Cl$ 465. $\left[Ag(CH_3NH_2)_2\right]Cl$

466. 2^0 amine, $C_6H_5NH\text{-}CH_3+HONO \rightarrow$ 

$$\left(C_6H_5-\underset{}{\overset{CH_3}{\overset{|}{N}}}-N=O+H_2O\right)$$

(Yellow)

467. $(CH_3)_3\,N \xrightarrow{HNO_2} (CH_3)_3\,\overset{+}{N}HNO_2^- \xrightarrow{\Delta} (CH_3)_2\,N=NO+CH_3OH$

(nitrosoamine)

468. CH_3NH_2, $C_2H_5NH_2$ 469. diazotisation 470. C_6H_5I

471. phenol 472. $C_6H_5N_2Cl+H_3PO_2+H_2O \longrightarrow C_6H_6+H_3PO_3+HCl+N_2$

(Benzene)

473. $C_6H_5F+N_2+BF_3$ 474. deamination reducing

475. ammonia 476. CH_3NH_2 477. Surfactant (detergent)

478. Protein 479. ethylene glycol & Terephthalic acid

480. acrylonitrile 481. Teflon 482. addition polymer

483. natural rubber 484. polythene

485. isoprene (cis-1, 4-polyiosprene)

486. polystyrene or styron

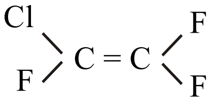
487. vinyl chloride ($CH_2=CHCl$) & vinyldene chloride, $CH_2=CCl_2$

488. $NH_2(CH_2)_6–NH_2$ and adipic acid 489. co-polymer

490. $H_2N(CH_2)_6-NH_2$ + Sebacoylchloride

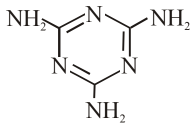
491. ethylene glycol & phthalic acid

492. (poly) ester (condensation type)

493.  (C_2F_3Cl) 494. caprolactum

495. bakelite 496. step growth polymerisation

497. thermoplastic polymer 498. thermosetting plastic

499. co-polymer of butadiene & styrene
500. co-polymer
501. homopolymer
502. homopolymer
503. natural polymers
504. 2-chlorobuta-1, 3-diene (Chloroprene)
505. Nylon 66
506. 

507. bakelite
508. Condensation
509. rubber
510. Buna-S
511. butadiene and acrylonitrile
512. propenenitrile
513. disinfectant
514. Aspirin
515. analgesic or hypnotic
516. antiseptic
517. cure diseases caused by gram +ve, –ve bacteria.
518. narrow
519. broad spectrum antibiotic
520. broad spectrum antibiotic
521. antibiotic
522. antiseptic
523. aspirin
524. ester
525. antipyretic
526. antiseptic
527. Terpenol and chloroxylenol
528. triglycerides
529. non-narcotic
530. antiseptic
531. antipyretic
532. analgesic
533. antihistamine
534. cetrizine
535. antiseptic
536. ranitidine

**

537. Enzyme
538. cobalt
539. ribose
540. Phytohormones (auxins)
541. DNA
542. alcohol, water
543. vit. D
544. RNA
545. Xerophthalamia
546. vit. E
547. glycosidic, peptide
548. sucrose
549. three
550. glucose
551. galactose
552. fibrous
553. denaturation
554. urease
555. pancreas

❖ ❖ ❖

Very Short Answer type Questions
(One mark each) :
Group - A(3)

Answer the following :

Unit - I

1. Arrange simple cubic, body centred cubic and face centred cubic lattice in increasing order of the fraction of the occupied space.
2. What is the C.N. of octahedral void ?
3. What is C.N. of tetrahedral void ?
4. What make alkali metal halides sometimes coloured which are otherwise colourless ?
5. What are the structures of NaCl and CsCl ?
6. In which defect the crystal loses its density ?
7. What is packing effeciency of simple cubic crystal ?
8. What is F– centre ?
9. ZnS shows Frenkel defect - explain.
10. What are the number of Cl^- ions present around Na^+ ?
11. What is co-ordination number ?
12. What type of forces operate in molecular solid ?
13. Write two characteristic properties of molecular solid.
14. Ionic solid behaves as an insulator - explain.
15. What is meant by point defect in crystal ?
16. Mention the type of interaction / bond present in following :

    ice, diethyl ether (s) NaCl, Silicon carbide
17. How many lattice point are there in one unit cell of each of the following lattice ?

    (i) Fcc (ii) bcc
18. What are the possible variation in orthorhombic crystal system ?
19. Identify the primitive unit cells in crystals.
20. Name the lattice where edges and angles are identical.
21. What types of solid are electrical conductors, malleable and ductile ?
22. What are Bravais lattices ?
23. Why is glass considered as a super cooled liquid ?
24. Name a covalent solid that conducts electricity.
25. Choose the amorphous solids from among the following ?

    Polytrethene, benzoic-acid, coke, copper, cellophane, potassium nitrate, teflon.
26. Amorphous solids are isotropic - explain.
27. What happens when crystalline solids are heated ?
28. Provide two examples molecular solids.

Unit - II

29. Mention the important use of reverse osmosis (RO)
30. Provide two examples of ideal solutions.
31. Is solution of chlroform and acetone an ideal solution ?
32. What is Charles - van'Hoff law ?
33. What happens to acetic acid in benzene and water (solvents) ?
34. Define molefraction ?
35. Identify the concentration terms independent of temperature.
36. What is the mole fraction of 1 molal aqueous solution ?
37. The vapour pressure is reduced to 80%. What is relative lowering of vapour pressure ?
38. How does the solubility of gas in liquid change with temperature ?
39. What happens to the b.p. if vapour pressure is reduced ?
40. At what % ethanol - water forms a minimum boiling azeotrope. Mention the b.p. of the azeotrope.
41. Arrange the aqueous solutions in order of increasing boiling point : 0.01 m urea, 0.01 m sodium chloride, 0.01 m sugar, 0.01m potassium sulfate.
42. How does osmotic pressure change with temperature and concentration ?
43. Name a compound which has the same i value with potassium ferrocyanide.
44. Write down the units of molarity, molality, normality, strength and mole fraction.
45. Camphor is prefered as solvent for measuring the molecular mass of naphthalene by-Rust method. Why ?
46. Distinguish between b.p. and normal boiling point of a liquid.
47. Why does sea water boil at higher temperature ?
48. 2 gram each of two solutes A and B (molecular mass of A > B) are dissolved separately for 50 gram each of water. Which will show higher boiling point ?
49. Provide an example of maximum boiling azeotrope.
50. How is colligative property $\left(\Delta T_b\right)$ related to molar mass of solute ?
51. Mention T/F
    (i) K_H is directly proportional to solubility of gas is a solvent.
    (ii) Osmosis takes place from hypotonic solution to hypertonic solution.

Unit - III

52. What is electrochemical equivalent ?
53. Can nickel spatula be used to stire a solution of $CuSO_4$?

$$[\text{ Given } E^0_{Ni^{2+}|Ni} = -0.25V;\ E^0_{Cu^{2+}|Cu} = +0.34V$$

54. What is relationship between Gibbs free energy change and cell potential ?
55. In the electrolysis a solution containing H^+ and Cu^{2+}ion, at cathode $H_2(g)$ is liberated. Is the statement correct ?
56. Notation of SHE.

57. Name the electrode whcih has oxidation and reduction potential identical.

58. Write down the unit of specific conductance / equivalent conductance / molar conductance.

59. Provide the direction of movement of $\bar{e}$ in galvanic cell.

60. What is unit of emf ?

61. What is an electrochemical cell ?

62. What is charge on the proton (H^+) ?

63. Provide two examples in each case of strong electrolytes and weak electrolytes.

64. Write down the cell notation of Daniell cell.

65. Find out the standard emf. of Daniell cell.

66. $Cu + 2Ag\ NO_3 \longrightarrow Cu(NO_3)_2 + 2Ag$. Represent the cell.

67. Identify the salt used in salt bridge.

68. Write down the equation relating $\wedge$ and concentration.

69. What will be the cell constant of a conductivity cell if specific conductance and conductance of a solution are of equal vaue ?

70. Writedown the coulombs of change required for the reduction of (i) 1 mole Al^{3+} to Al (ii) 0.1 mole Cu^{2+} to Cu (iii) 6.023×10^{22} MnO_4^- ions to Mn^{2+}.

71. How much electricity required to liberate 11.2 L of oxygen at NTP from water ?

72. Identify two metals that decolorises copper sulfate solution (Blue).

73. What is the relationship between standard reduction potential and equilibrium constant?

74. What is the standard potential of $Cu\text{-}AgNO_3$ cell ?

75. What do you mean by a weak electrolyte ?

76. Define degree of ionisation ?

77. What is electrode potential ?

78. What is an electrolyte ?

79. $\frac{W_1}{W_2} = \frac{E_1}{E_2} = \frac{Z_2}{Z_1}$. Is it a correct expression ?

80. What is cell constant ?

81. Suggest some metals that are extracted electrolytically.

82. If a current of 0.5 amp flows through a metallic wire for 2. hours then how many $\bar{e}(s)$ flow through the wire ?

83. What is the basis on which anode on cathode is identified in a chemical cell ?

Unit - IV/

84. For a reaction $A + H_2O \longrightarrow B$, rate = $k[A][H_2O]^0$. What is the molecularity and order of reaction.

85. What is an elementary reaction ?

86. When ln k is plotted against $1/T$, the slope was found to be -10.7×10^3 K. What is the activation energy?

87. What is the value of $\log\frac{k_2}{k_1}$, if the temperature of a reaction changes from T_1 to T_2?

88. How will rate of reactions change when [A], is doubled for

(i) zero order reaction

(ii) second order reaction ?

89. Calculate the order reaction having the rate expression,

rate = $k[A]^{1/2}[B]^{1/2}$

90. The complex reaction as a whole has no molecularity. T/F __________.

91. Provide one example of first order reaction, unimolecular reaction.

92. Give one example of zero order reaction.

93. What is an activated complex ?

94. The half life period of a first order reaction is 60 min. Calculate the time required for completion of 90% of the reaction.

95. 99% of the reaction.

96. 99.9% of the reaction.

97. A reaction is found to be zero order. Will its molecularity be zero ?

98. Can reaction have negative activation energy ?

99. What do you mean by rate determining step ?

100. Calculate the value of rate constant of a first order reaction having half life period 10 minutes.

101. Define activation energy.

102. Define Half life period of a reaction.

103. Define collision frequency.

104. What is a pseudo first order reaction ?

105. Write down the average rate expression for $2N_2O_5(g) \longrightarrow 4NO_2(g) + O_2(g)$.

106. The conversion of molecules $X \rightarrow Y$ follows second order kinetics. If concentration of X tripled how it will affect rate of formation of Y.

107. What is value of temperature co-efficient of a reaction ?

108. What is value of k at extremely high temperature $(=\infty)$? Is it feasible ?

109. The rate law for a reaction is, rate = $k[A][B]^{3/2}$. Is the reaction an elementary one ?

Unit - V

110. What is adsorption ?

111. Define molar heat of adsorption.

112. What is the binding force in physisorption ?

113. What is name of the process of removing an adsorbed substance from the surface of adsorbent ?

114. Why animal charcoal is used for purification of sugar ?

115. Why colloids can not be filtered by ordinary filter paper ?

116. Compare is the size of colloidal and crystalloid particles ?

117. Give an example of emulsion.

118. Why does colloidal solution coagulate on addition of electrolyte ?

119. What is the sign of heat of adsorption ?

120. Why alum is used for clearing muddy water ?

121. How does extent of adsorption change with temperature, pressure ?

122. What do you mean by positive and negative adsorption ?

123. Catalysts are adsorbents ______ is it so ?

124. What is flocculation value ?

125. Calculate the flocculation value of KCl if 5ml of 1M solution is added to 100 ml of arsenic sulfide sol so as to bring complete coagulation.

126. How can you know that milk is an o/w emulsion ?

127. Colloids are heterogeneous in nature, give reason.

128. What is a colloidal solution ?

129. Why does smoke from a fire often with a blue tinge ?

130. What will happen if equimolar solutions of positively and negatively charged solutions be mixed ?

131. What is collodion ?

132. What is dispersion medium in gel ?

133. For coagulation of 500 ml of arsenic sulfide (–ve sol), 2 ml of 1 M NaCl is required. What is the flocculation value of NaCl ________.

134. Name the enzyme to prepare ethanol from glucose.

135. Why i s it necessary to remove CO during synthesis of NH_3 by Haber's process.

Unit - VI

136. Name two metals isolated by electrometallurgy ?

137. Identify two minerals having more than one metal.

138. Which is the cheapest reducing agent used in Metallurgy ?

139. Write a method for refining of copper / Al.

140. Write down the composition of brass, bronze.

141. What is germen silver ?

142. Name any two alloys of steel.

143. Write the formulae of zincblende, greenvitriol.

144. What happens when calamine is calcined ?

145. What is flux ?

146. Provide two examples of acidic flux.

147. All minerals are ores. T/F

148. What is slagging ?

149. What is auto-reduction ?

150. Name the important ores of Fe/Al/Cu.

151. Explain the term ‘Levigation’.

152. Which type of metals are concentrated by liquation method ?

153. Magnetite is an ore magnesium. T/F

154. Manganin is an alloy of copper used in electrical apparatus. It contains lowest percentage of maganese. Rewrite with correction if any.

155. What do you mean by matte ?

156. What type of ore generally roasted ?

157. What is pyrometallurgy / electrometallurgy / hydrometallurgy ?

158. Why is copper matte put in silica lined convertor ?

159. How is ‘cast’ iron different from ‘pig’ iron ?

160. Arrange in order of increasing stability : MgO, ZnO, FeO, Cu_2O

Unit - VII

161. What happens of the bond angles of hydrides of group 15/16?

162. Compare the acidic nature of oxides of nitrogen family.

163. Arrange the hydrides of group-15 in order of increasing nature as reducing agent.

164. Arrange the noble gases in the increasing order of their abundance.

165. Write down two uses of XeF_2.

166. What are the products formed when nitrous acid undergoes disproportionation?

167. Which oxide of nitrogen used as rocket fuel?

168. What is carbogen? What is Its use?

169. Arrange the fallowing in-order of increasing acid strength $HClO_4$, $HClO_2$, $HClO_3$, HClO.

170. NO is paramagnetic in gaseous state but diamagnelic in liquid and solid stale.

171. H_3PO_2 in monobasic while H_3PO_3 in dibasic: Justify.

172. Show that Na_2O_2 is a peroxide,

173. Draw the structure of pyrosulfuric and pyrophosphoric acid.

174. What happens to following test tubes containing (i) cane sugar (ii) Sodium bromide (iii) Copper turnings (iv) sulfur powder (v) Potaslum chlonde, on heating with cone. H_2SO_4?

175. NF_3 and PF_3 are not hydrolysed. Give reason.

176. Which are the anhydrides of HNO_3 and H_3PO_4?

177. Balance the following.

$$Cu+HNO_3 \longrightarrow Ca\left(NO_3\right)_2 + H_2O + NO$$

178. What happens when NH_4Cl reacts with quick lime?

179. How can you get nitric acid from potassium nitrate?

180. Which catalyst in used in the manufacture of NH_3 by Haber’s process?

181. What happens when NH_4NO_3 is strongly heated?

182. What substance is used to dry NH_3?

183. Why is P_2O_5 not used to dry NH_3?

184. Name the catatyst used in Ostwalds process to manufacture HNO_3.

185. Write the reaction of the thermal decomposition of NaN_3 azide.

186. Name the types of salt formed on neutralization of H_3PO_4 by NaOH.

187. What happens when H_3PO_4 is heated?

188. How do you account for the reducing behaviour of H_3PO_2 on the basis of its structure.

189. Which of the following does not react with oxygen directly? Zn. Ti. Pt, Fe

190. Name the compound, formed when Al_2O_3 reacts with (i) acid (ii) alkali

191. Draw the resonance hybrid of ozone and mention the bond angle and bond length.

192. Is S_2 molecule paramagnetic in nature?

193. Write down the equation of SO_2 with Fe^{3+}.

194. Mention three areas in which H_2SO_4 plays an important role.

195. Identify two reagents to liberate chlorine from HCl.

196. Name the poisonous gases which can be prepared from chlorine.

197. How gases $Cl_2(g)$, $SO_2(g)$ getting dried?

198. Write an equation where SO_2 acts as oxidizing agent.

199. What is the basicity of sulfuretted hydrogen/ hydrosulfuric acid?

200. What happens when paper soaked in lead acetate solution is shown in $H_2S(g)$?

201. Name. two allotropic modifications of sulfur.

202. Write the electronic configuration of second element of group-16

203. Which oxide of group-16 is amphoteric in nature?

204. HP is less volatile than HCl. why?

205. Arrange the halogen hydrides in the order of bond length.

206. Which of halogen form H-bonding?

207. Which halogen shows only one O.N. in its compounds.

Unit - VIII

208. Write down the electronic configuration of Cr^{3+} and Cu^{2+}.

209. Which elements of transition series don't almost resemble the rest of the members in their characteristics ?

210. Why copper corrodes in moist air producing green layer on its surface ?

211. What are the colours of Fe^{2+} (Aq) and Fe^{3+} (aq.) ?

212. Name the trivalent lanthanoid of maximum size.

213. Which substance is prepared from Kipp's waste ?

214. Identify a property to justify the presence of Zn in d-block.

215. What are actinoids ?

216. Write two alloys of steel.

217. Which are the purest and impure form of iron ?

218. Name the furrance to get blister copper.

219. What is the gas present in blister copper ?

220. What is the molecular formula of feric chloride in anhydrous state ?

221. Why transition elements are hard ?

222. Which is the lightest transition metal ?

223. Write the formula of rouge ?

224. What is annealing ?

225. Name the three groups d-block where horizontal similarity dominates.

226. Identify the low cost catalyst during hydrogenation of oil (unsaturated) to fat (saturated).

227. What is the most common oxidation state of Lanthanoids ?

228. Write down the oxidation states exhibited by Mn(Z=25).

229. Name the elements with which metal / element can have highest (positive) O.S.

230. Predict which of the following ions are coloured & write their d-electrons.

Cu^{2+}, Zn^{2+}, Sc^{3+}, Ni^{2+}

231. Mercures ion is written as Hg_2^{2+} instead of Hg^+.

232. Why large number of oxidation states exhibited by actinoids than corresponding lanthanoids ?

233. Transition metal exists in its highest oxidation state better behaves as an oxidising agent. Give reason.

234. Why Fe^{3+} is most common ?

235. What is the maximum O.S. of actinoid ?

236. Why CuCl is colourless while $CuCl_2$ is blue. Is it so ?

237. Why the properties of 3rd transition series are very similar to 2nd transition series ?

238. $La(OH)_3$ is more basic than $Lu(OH)_3$?

239. Arrange MnO_4^-, $Cr_2O_7^{2-}$, VO_2^+ in order of increasing oxidising power.

Unit - IX

240. What does 'en' represent in Co-ordination chemistry. How many co-ordination sites does it have ?

241. Give the chemical formula of potassium hexacyanido ferrate (II).

242. What does EDTA stand for ? Write its structure.

243. Calculate the number of unpair electrons in the following complexes.

i) $\left[Cr(NH_3)_6\right]^{3+}$, ii) $\left[CoF_6\right]^{3-}$ iii) $\left[Fe(CN)_6\right]^{3-}$

244. Provide the IUPAC names of the above ions.

245. Why are tetrahedral comlexes high spin ?

246. What is the name of $\left[Co(NH_3)_5(NO_2)\right](NO_3)_2$.

247. Write the hybridisation and shape of $\left[\mathrm{Ni\,F_4}\right]^{2-}$

248. A $CuSO_4$ solution is mixed with $\left(NH_4\right)_2 SO_4$ in the ratio 1 : 4, does not give test test for Cu^{2+}. Explain.

249. On the basis of CFT, write the d^4 configuration $\Delta_0 < P$.

250. Which of the following is more stable ? & name it $\left[\mathrm{Co}\left(\mathrm{NH_3}\right)_6\right]$ and $\left[\mathrm{Co}\left(\mathrm{en}\right)_3\right]^{3+}$.

251. Write the shape and magnetic behaviour of $\left[\mathrm{Co}\left(\mathrm{NH_3}\right)_6\right]^{3+}$.

252. Between CO, CN^- which forms more stable complex ?

253. Show the magnetic behaviour of hexafluoridocobaltate (III)

254. $\left[\mathrm{Ni}\left(\mathrm{H_2O}\right)_2\left(\mathrm{OX}\right)_2\right]^{2+}$ is an outer orbital complex, is it so ?

255. $\left[\mathrm{Fe}\left(\mathrm{CN}\right)_6\right]^{4-}$ and $\left[\mathrm{Fe}\left(\mathrm{H_2O}\right)_6\right]^{2-}$ are of different colour is solution.

256. What are ambident ligands ?

257. What is denticity ?

258. What are different 'd'-orbitals ?

259. What is spectrochemical series ?

260. EDTA used as water softening agent. explain.

261. Gold is extracted from its ore on treating it KCN. Give reason.

262. Why sulfide ore is leached with NaCN ?

263. What is the shape of hexacyanido ferrate (II) ion ?

264. What is valency of Ru in $K_2\,[Ru(OH)_4Cl_2]$?

265. What is the C.N and O.N. central metal ion in $\left[\mathrm{Fe}\left(\mathrm{C_2O_4}\right)_3\right]^{3-}$.

Unit - X

266. Which will react faster in S_N-2 reaction in respect of KOH (aq).

(i) CH_3Br, CH_3I

(ii) $(CH_3)_3CCl$, CH_3Cl

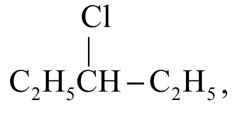
(iii) $CH_3{-}CH_2{-}CH_2Br$, $C_6H_5{-}CH_2Br$

(iv) $CH_2 = CH{-}CH_2Br$, $CH_3{-}CH_2{-}CH_2\ Br$

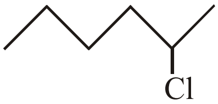
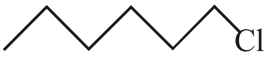
(v) $CH_2 = CH\ Br$, $CH_3{-}CH_2{-}Br$

(vi) Chlorobenzene and chlorocyclohexane

267. In the following pairs of halogen compounds, which compound undergoes faster S_N–1 reaction ?



(i) $\left(CH\right)_3 CCl$, $C_2H_5\underset{}{\overset{\overset{\displaystyle Cl}{|}}{C}}H - C_2H_5$,

(ii)  , 

(iii) C_6H_5Cl, $C_6H_5CH_2Cl$,

(iv) C_6H_5Cl, $(C_6H_5)_2CH-Br$

(v) $CH_3-CH_2-CH_2Cl$, $CH_2=CH-CH_2Cl$

268. Draw the structural isomers of the compound C_4H_9Br Name and classify as 1^0, 2^0 or 3^0.

269. Provide the structures of the following :
   - (i) 1-Bromo-4-sec. butyl-2-methyl benzene
   - (ii) 1, 4-dibromobut-2-ene

270. Complete the reactions with appropriate product (s).

   (i) $CH_3-CH_2OH+KI+H_3PO_4 \longrightarrow$

   (ii) $CH_3-CH(OH)-CH_3+Br_2+ \xrightarrow{\text{red(p)}}$

271. Name the product when $Cl_2(g)$ is passed under U.V. light inside
   - (i) n-butane and isobutane
   - (ii) $(CH_3)_2CH-CH_2-CH_3$

272. $B \xleftarrow{\text{Na/alcohol}} A \xleftarrow{\text{AgCN}} CH_3-CH_2Br \xrightarrow{\text{KCN}} A_1 \xrightarrow{\text{Na/alcohol}} B_1$

   Identify the compounds A, B and A_1, B_1.

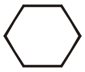
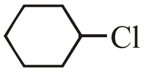
273. What are (i) Swart's reaction ?

   (ii) Finkelstein reaction ?

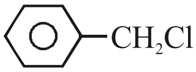
274. Arrange the following compounds in order of increasing boiling points.
   - (i) Bromomethane, bromoform, chloromethane, dibromomethane
   - (ii) 1-chloropropane, isopropyl chloride, 1-chlorobutane

275. Predict the isomers of bromobutane and arrange in order of increasing reactivity towards S_N-1 reaction.

276. In the following pairs of halogen compounds which would respond faster to react with KOH(aq).

   (i)  CH_2Cl and 

   (ii)  and 

   (iii) $(CH_3)_3CCl$ and 

277. Identify the reagent(s) for the following conversion.

   (i) $CH_3-CH=CH_2 \longrightarrow CH_3-CH_2-CH_2Br$

(ii) $CH_3-CH_2-CH_2Br \longrightarrow CH_3-CH_2-CH_2NC$

(iii) $CH_3-CH_2-Br \longrightarrow CH_3-CH_2-NO_2 \longrightarrow CH_3-CH_2-NH_2$

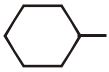
(iv) $C_6H_5-Cl \longrightarrow C_6H_5CN \longrightarrow C_6H_5CHO$

(v) $CH_3-CH_2Br \longrightarrow But-1-yne$

278. What type of isomerism is shown by 1,2 dibromo ethene ? Between these two which has higher m.p. and higher b.p.

279. Between 1-bromobutane and 2-bromobutane which one is optically active ?

280. Hydrocarbons molecular formula C_5H_{12} and C_5H_{10} give a single monochloro compound in bright sunlight. Name tthese.

281.  $-Br + Mg \xrightarrow{\text{dry ether}} A \xrightarrow{H_2O}$

282. Name the alkenes that would be formed by dehydrohalogenation of the following in presence of sodium ethoxide & ethanol.

(i) 1-Bromo-1- methyl cyclo hexane

(ii) 2-chloro-2-methyl butane

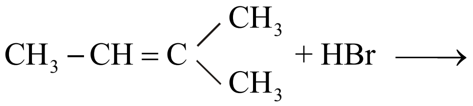
283. Write the structure of the major product of the following :

(i) $(CH_3)_3\,C-Br \;\frac{\text{alc.}}{\text{KOH}}$

(ii) $CH_3-CHBr-CH_3 \xrightarrow{KOH(aq)}$

(iii) $CH_3-CH_2-Br + KCN \xrightarrow{CH_3} CH_2OH(Aq)$

(iv) $C_6H_5O\,Na + C_2H_5Cl \longrightarrow$

(v) 

$CH_3-CH=C\begin{matrix} \diagup CH_3 \\ \diagdown CH_3 \end{matrix} + HBr \longrightarrow$

284. Name the product, if following alkyl halides undergoing Wurtz reaction :

(i) isobutyl bromide

(ii) isopropyl bromide

(iii) sec.butyl bromide

(iv) chlorocyclopropane

285. What is β . elimination ?

286. State Saytzeff rule.

Unit - XI

287. Name the isomers of the alcohols with moelcular formula $C_4H_{10}O$.

288. Identify the first member of the optically active monohydric alcohol.

289. Write the structures of major product expected from

(i) mono nitration and dinitration of 3-methyl phenol.

(ii) mononitration of phenyl ethanoate.

290. Give the structure of the products you would expect when butan-1-ol, 2-methylbutan-2-ol treated with

i) HCl-$ZnCl_2$ ii) $SOCl_2$ (Equation only)

291. Predict the major product of acid catalysed dehydration of

i) 1-methyl cyclohexanol ii) butan-1-ol

292. Draw the resonating structures of p-nitrophenoxide.

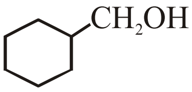
293. Arrange the following in order of their acids strength. propan-1-ol, 2, 4, 6–tritritrophenol, 3-nitrophenol, 3, 5-di nitrophenol, 4-methyl phenol.

294. Arrange the following sets of compounds in order of their increasing boiling point.

i) Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol

ii) n-butane, ethoxyethane, 3-methylbutan-1-ol, pentan-1-ol.

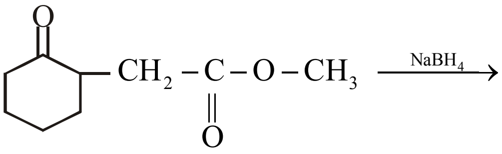
295. Write down the Grignard's reagent to prepare following 1^0-alcohol.

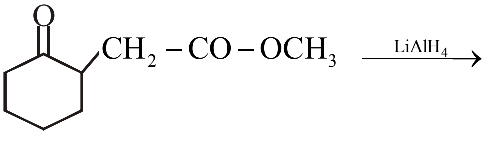
i) 

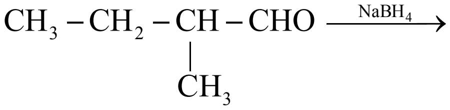
ii) iso-butyl alcohol iii) ethyl alcohol

296. Write the structures of the products of the following reactions :

i) $CH_3-CH=CH_2 \xrightarrow{H_3O^+}$

ii) 

iii) 

iv) 

$$\underset{\displaystyle CH_3}{CH_3-CH_2-\underset{|}{CH}-CHO} \xrightarrow{NaBH_4}$$

297. Provide the IUPAC name of the product formed on

i) Catalytic reduction of butanone

ii) Propanol on dehydration

iii) reaction of propane one with CH_3MgBr following by hydrolysis

298. Write the reactions of Willimson's synthesis of 2-ethoxy-3-methylpentane

299. How can you prepare 1-methoxy-4-nitrobenzene from :

(i) sodium-4-nitrophenoxide. (ii) 4-bromonitrobenzene)

300. Predict the products :

i) $CH_3–CH_2–CH_2–O–CH_3 + HBr \rightarrow$

ii) $C_6H_5-OC_2H_5 \xrightarrow[H_2SO_4]{HNO_3}$

iii) $C_6H_6-O-C_2H_5 \xrightarrow{HBr}$

iv) $(CH_3)C–O–C_2H_5 \xrightarrow{HI}$

v) $C_6H_5CH_2-O-C_6H_5 \xrightarrow{KI+H_3PO_4}$

301. Arrange the following in order of increasing acid strength :
o-nitrophenol, m-nitrophenol, p-nitrophenol

302. Find the order of reactivity of HX to cleave the C–O bond is ether.

303. Name the reagent (s) used in the following reactions :

i) 1^0 alcohol to corboxylic acid.

ii) 1^0 alcohol to aldehyde

iii) Bromination phenol to 2, 4, 6 tribromo phenol.

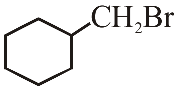
iv) benzylalcohol to benzoic acid. v) Ethylalcohol to diethylether

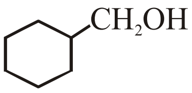
vi) Butan-2-one to butan-2-ol

vii) $CH_3-CH=CH-CHO$ to $CH_3-CH=CH-CH_2OH$

viii) $CH_3-CH=CH-CHO$ to $CH_3CH_2-CH_2-CH_2OH$

ix) $CH_3-CH=CH_2-CHO$ to $CH_3-CH_2-CH_2-CH_3$

(x) 

to 

304. Mention equation to show acidic nature of phenol.

305. Provide equation of the following reactions :

(i) Oxidation of propan-1-ol with alk. $KMnO_4$.

(ii) Bromine in CS_2 with phenol

(iii) Phenol with dil HNO_3

(iv) Treating phenol with alkaline chloroform and CCl_4 separately.

306. Arrange the cresols in order of Ka value.

307. Arrange the order of ease of esterification of alcohols with a given acid.308. Name the alcohol failing to give VictorMeyer's state.

Unit - XII

309. What happens when ethyl benzene is treated with chromyl chloride in CCl_4 medium ?

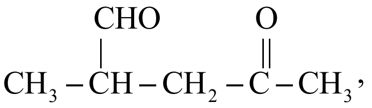
310. What type of reaction is carried out by carbonyl compounds ?

311. Write down the physical state of aldehyde & ketone.

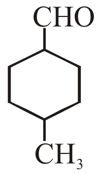
312. What is RDX ?

313. Benzophenone fails to react with $NaHSO_3$. F/T _____

314. Name the following :



$CH_3-\overset{\overset{\displaystyle CHO}{|}}{C}H-CH_2-\overset{\overset{\displaystyle O}{||}}{C}-CH_3$,



315. Give the functional isomers of propanone.

316. Write down the structural formula of 1-Bromo-2-methyl pentan-3-one.

317. What is Tollen's reagent / Fehling solutin / Brady's reagent.

318. Aldehyde reacts with hydroxyl amine gives :

(a) Oxime (b) hydrazone

(c) phenyl hydrozone (d) Ketal

319. Arrange the following compounds in inceasing order of their boiling points : ethylalcohol, dimethylether, acetaldehyde, CH_3-CH_3

320. Which aldehyde can undergo iodoform test ?

321. Why HCHO does not undergo aldol condensation ?

322. Name the aldehydes undergoing Cannizzaro's reaction.

323. Arrange HCHO, CH_3 CHO and CH_3 $COCH_3$ in order of inceasing reactivity towards HCN.

324. Write down the IUPAC name of first member of mono and dicarboxylic acid.

325. What happens ethanitrile undergoes acidic hydrolysis ?

326. Prepare acetamide from acetic acid ?

327. Name the Grignard's reagent from which benzoic acid is prepared.

328. How is benzoylchloride prepared ?

329. Arrange the following in order of inceasing acidic strength :

(i) HCOOH, $ClCH_2$ COOH, CH_3COOH

(ii) CH_3COOH, $(CH_3)_2CHCOOH$, $(CH_3)_3C$–OOH

(iii) $ClCH_2$ COOH, $Cl_2CHCOOH$, Cl_3C COOH

(iv) $ClCH_2$ COOH, CH_3CH_2 COOH, $ClCH_2CH_2COOH$, $(CH_3)_2CH$–COOH, CH_3COOH

330. Which bond is cleared in the formation of

(i) RCOCl (b) RCOONa (c) RCOOR (d) $RCONH_2$

331. Arrange the following in order of increasing b.p.

(i) C_3H_8 (b) C_2H_5OH (c) CH_3CHO (d) CH_3COOH

332. Between benzoicacid and acetic acid which one is more soluble in water.

333. Arrange the following increasing order of acidic strength i.e. liberating CO_2 from $NaHCO_3$ (aq.). HCOOH, benzoic acid, CH_3COOH, Cl_3C COOH.

334. Name the reagent what converts CH_3–CH=CH–COOH to CH_3–CH = CH – CH_2OH.

335. Write down the structural formula of

(i) pyrovic acid (b) succinic acid

336. Arrange in increasing order of acidic strength :

(i) isomers of nitrobenzoic acid

(ii) Toluic acids.

(iii) Haloacetic acids.

(iv) HCOOH CH_3COOH, C_2H_5COOH, C_3H_7COOH.

(v) Hydroxy benzoic acid.

337. What is oil of bitter almonds ?

Unit - XIII

338. What is Balz-Schiemann reaction ?

339. Identify the reagents to prepare nitrogenzene from benzenediazonium chloride.

340. Coupling takes place at p-position, if it's occupied substitution occurs at o-position?

341. Write the medium when coupling occurs with phenol and aniline respectively.

342. How can you prepare iodobenzene from benzene diazonium chloride (BDC) ?

343. Arrange the following :

(i) Increasing order of b.p:

C_2H_5OH, $(CH_3)_2NH$, $C_2H_5NH_2$

(ii) Inceasing order solubility in water :

$$C_6H_5NH_2, (C_2H_5)_2\ NH,\ C_2H_5NH_2$$

344. Prepare benzoic and from aniline.

345. Name the product formed on oxidation of aniline with chromic acid.

346. What is the product formed when benzamide is treated with $LiAlH_4$?

347. What are the products formed on (i) sulfonation and (ii) nitration of aniline ?

348. How can you obtain ethylamine from ethyl isocyanide.

349. How to distinguish CH_3CN (Cyanide) from CH_3NC isocyamide on reduction ?

350. Tertiary butylamine can't be heated with NH_3, is it true ?

351. Arrange the following in increasing order of S_E.

$$C_6H_5CH_3,\ C_6H_5-N(CH_3)_2,\ C_6H_5-\overset{\oplus}{N}(CH_3)_3$$

352. Name the reagents to prepare isocyanide from aniline.

353. Prepare aniline from benzoic acid.

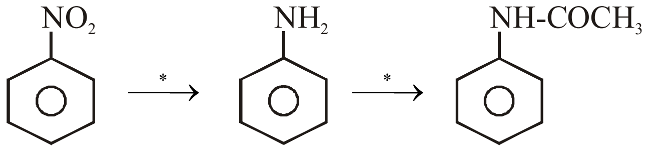
354. What is Gattermann's reaction ?

355. Why nitroalkanes are used as explosives ?

356. Arrange in order of their basic strength :

$C_2H_5NH_2$, $C_6H_5NH_2$, NH_3, C_6H_5 CH_2NH_2 $(C_2H_5)_2NH$

357. Identify the missing reagent(s):



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Unit - XV

358. What is macromolecule ?

359. Provide one example in each case of
   - i) Linear chain polymer.
   - ii) Brached chain polymer
   - iii) Crossed chian polymer.

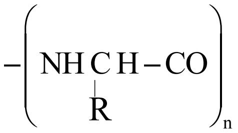
   (Classified on the basis of structure)

360. Arrange in order of inceasing inter molecular forces :
   - i) polythene, Nylon - 66, Buna-S
   - ii) Neoprene, polyvinyl chloride, Nylon-6

361. What is difference between Buna-N and Buna-S ?

362. Write two uses of Buna-N-rubber.

363. Mention the monomer of Nylon-2-nylon-6.

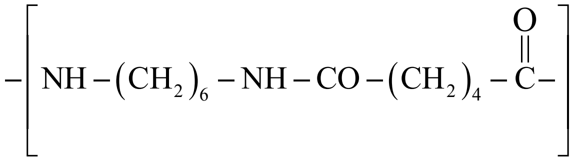
364. Is  a homopolymer ?

$$-\left(\mathrm{NH}\underset{\mathrm{R}}{\underset{|}{\mathrm{C}}}\mathrm{H}-\mathrm{CO}\right)_n$$

365. Name a common initiator during free radical polymerisation.

366. Classify the polymers in respect of intramolecular force of attraction.

367. Name the monomers in the following polymers –



$$-\left[\mathrm{NH}-(\mathrm{CH_2})_6-\mathrm{NH}-\mathrm{CO}-(\mathrm{CH_2})_4-\overset{\mathrm{O}}{\overset{\|}{\mathrm{C}}}-\right]$$

368. Provide one example in case of

   chain growth (addition), step growth (condensation) polymerisation.

369. What is PMMA ?

370. Name a substance which inhibits free radical polymeisation.

371. What is mode of free radical polymerisation in alkene ?

372. What are PAN, PTFE, PCTFE, PHBV ?

373. Why should one always use purest monmer in free radical polymerisation ?

374. Show that CCl_4 acts as chain transfer agent during polymerisation of styrene.

375. What do you mean by HDP and LDP ?

376. What is used in making non-breakable plastic crockery.

Unit - XVI

377. Write the name of (two) antibiotics, analgesic, antiseptic, antipyretic.

378. Name an antacid which prevents the formation of acid in the stomach.

379. What type of medicine chloromphenicol is?
380. Name a substance which can be used as antiseptic as well as disinfectant ?
381. What is tincture of iodine ? What for it is used ?
382. Give an example of cationic detergent and anionic detergent.
383. What do you mean by biodegradable detergent ?
384. What do you mean by antimicrobial drugs ?
385. Which class of drugs is used in sleeping pills ?
386. What for medicine is used ?
387. What is a soft soap ?
388. What class of drug is ranitidine ?
389. To which class of drug barbiturates belong ?
390. What is the important use of equanil in pharmacy ?
391. What is salvarsan ?
392. Why is bithional added to soaps ?
393. Label the hydrophlic and hydrophobic parts in the following :

$$CH_3-(CH_2)_{10}-CH_2-OS\bar{O}_3\overset{+}{N}a\text{ , }CH_3-(CH_2)_{15}^{-}\overset{+}{N}(CH_3)_3Br^{-}$$

394. Fillers are added to soap and detergents. Explain.

**

Unit- XIV (Additional Questions as per original syllabus):-

395. What are monosaccharides ?
396. Write two major functions of carbohydrates in plants.
397. Name the bases present in RNA and DNA.
398. Which elements are generally present in proteins ?
399. What are hydrolysis product of sucrose ?
400. Name two carbohydrates used as bio fuels ?
401. What causes the disease sickle cell anaemia ?
402. Which polysaccharide stored in the liver of animals ?
403. What are Zwitter ions ?
404. Identify the mono-and di saccharides of the following :
Ribose, 2-deoxyribose, maltose, galactose, fructose and Lactose.
405. What happens glucose is treated with (i) bromine water (ii) HI and HNO_3
406. What are essential and non-essential amino acids ?
407. What are vitamines ? Name the fat soluble vitamins ?
408. What are different types of RNA found in the cell ?
409. What do you mean by nucleoside and nucleotide ?
410. Name the disease caused on deficiency of vita. C and vit. B.
411. Identify two possible sequence of amino acids.
412. Name two sources of vit. A
413. Where does protein synthesis occur ?
414. Fructose is a Ketose but why does it act as a reducing sugar.
415. Name the vitamins synthesised in our body.

❖ ❖ ❖

Answers

Group - A(3)

Very Short Questions (1 mark each)

Unit - I

1. Simple cubic 52.4% < bcc (68%) < FCC (74%).
2. The coordination number of octahedral void is six.
3. The coordination number of tetrahedral void is four.
4. This is due to metal excess defect forming F–centres i.e, $\overline{e}$ being trapped in anion vacancy.
5. NaCl. fcc, CsCl - bcc.
6. Schottky defect / vacancy defect.
7. Packing efficiency of simple cubic crystal is 52.4%.
8. F = Farben Zenter meaning colour. This contains unpair $\overline{e}$, on exposure to white light the crystal provides / emits different colour. e.g. KCl looks violet (lilac).
9. $r_{Zn^{2+}} < r_{S^{2-}}$, due to smaller size of the cation it occupies the interstital space. Vacancy at cation site (Zn^{2+}) occurs.
10. Six Cl^{-1} octahedrally surround Na^+ and vice versa.
11. The number of nearest neighbours of a particle is called its co-ordination number. e.g. in one dimensional closed packed arrangement, the co-ordination number is two, square close packing in two dimensional the C.N is four, hexagonal closed packing in two dimension the C.N. is six, hcp in three dimension C.N. is 12.
12. Molecular solids are of three types.
    i) Non polar molecular solids where non-polar molecules are held by weak dispersion forces or London forces e.g. I_2 (s).
    ii) Polar molecular solid - Here the molecules are polar covalent and held by dipole - dipole force. e.g. SO_2 (s), NH_3(s)
    iii) H - bonded molecular solid: Here the covalent molecules are much polar with Hydrogen atom bonded to F or O or N, the highly electro negative atoms. Such bond i.e. H-atom of one molecule with highly electro negative atom (F/O/N) of the same or different molecule is called hydrogen bond. e.g. Ice.

    [or]

    The operating forces among the molecules of molecular solid are London / vander Waals forces, dipole-dipole forces (H - bonding).
13. Characteristics of molecular solids :
    i) These are soft solids
    ii) Non-conductor of electricity. e.g. I_2, H_2O (s)
14. In ionic solids the constituting ions are tightly held by strong interionic force of attraction. Due to immobility ions in solid crystalline state, it fails to conduct electricity, however in solution and in molten state these conduct electricity as the ions moves freely.
15. **Point defect in Crystal .** Point defects are the irregulatities or deviation from ideal arrangement around a point or an atom in a crystalline substance.

    Types : (i) Stochiometric defect
    (ii) Impurity defect
    (iii) non stoichiometric defect

16. Ice – H – bonding, diethylether- London force
NaCl - Ionic interaction, Silicon carbide - covalent bond.

17. FCC - 4 (ii) 2

18. Orthorhombic, $a \neq b \neq c$, $\alpha = \beta = \gamma = 90^0$

These are of primitive, bodycentred, face centred and end centred. (four posible unit cells)

19. There are seven primitive unit cells among crystals :

Cubic, tetragonal, orthorhombic, hexagonal, rhombohedral (or) trigonal, mono-clinic, triclinic.

20. Cubic (Primitive, body centred, face centred)

21. metallic solids.

22. There fourteen types of Bravais lattices out of seven crystal system. These are :

Cubic . (Primitive, body cenred, face centred) = 3
Tetragonal (Primitive, body centred) = 2
Orthorhombic (Primitive, body centred, face centred, end centred) = 4
Hexagonal - Primitive = 1
Rhombohedral - Primitive = 1
Monoclinic - Primitive and end centered = 2
Triclinic - Primitive = 1

23. Glass is called super cooled liquid because glass is an amorphous solid with tendency to flow slowly. It does not form a crystalline solid structure as particles in solids do not move but here it moves in supercooling in the process of chilling a liquid below its f.p. without becoming solid. It is an intermediate between solid and liquid.

24. Graphite.

25. Amorphous solids : Polythene, coke, cellophane, teflon.

26. It is because there is no long range order in the arrangement in amorphous solids. The constituents are randomly arranged i.e., irregular along all directions. Therefore, thevalue of any physical property would be same along any direction.

27. On heating the crystal dislocation of constituents takes place leading to crystal defect. This affects the change phisical properties of crystal, such as conductivity, colour. e.g. ZnO on heating becomes yellow in colour.

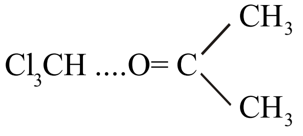
28. Examples of molecular solid. Iodine, Dry ice.

Unit - II

29. The principle of RO is widely used in the process of desalination of sea water ie. to get drinking water from sea-water.

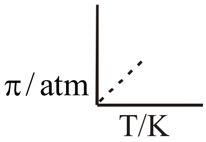
30. Ideal solutions : Benzene + Toluene, n-hexane + n-heptane

31. Non-ideal. (with negative deviation) solute - solvent intraction is greater than solute-solute and solvent - solvent intraction. This is due to H-bonding.



32. For solutions of fixed concentration, the osmitic pressure (π) is directly proportional to absolute temperature of the solution

ie. $\pi \propto T$, $\frac{\pi_1}{\pi_2} = \frac{T_1}{T_2}$,

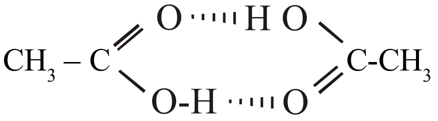


33. Acetic acid is aqueous medium behaves as a weak electrolyte $(i > 1)$, but in benzene it dimerises $(i < 1)$.

$$CH_3COOH(aq) \rightleftharpoons CH_3COO^-(aq.) + H^+(aq)$$

$$CH_3COOH(Benzene) \rightleftharpoons (CH_3COOH)_2$$

i.e.



34. Mole fraction $= \frac{\text{no. of moles of one component}}{\text{Total number of moles}}$

$X_A = \frac{n_A}{n_A + n_B}$, Binary solution having n_A moles of A and n_B moles of B.

It has no unit and indepent of temperature as it involves mass of solute and solvent.

35. Mole fraction, molality and mass %

36. 1 m aqueous solution contains one mole of solute in 1 kg of solvent $\left(\frac{1000}{18} = 55.56 \text{ mole}\right)$. mole fraction $= \frac{1}{1 + 55.56} = 0.0177$.

37. Relative lowering of v.p $= \frac{p^0 - p}{p^0} = \frac{p^0 - 0.8p^0}{p^0} = 0.2$

38. Solubility of gas decreases with rise of temperature.

39. Less is vapour pressure of a liquid greater is its boiling point e.g. B.P (water) > B.P. (alcohol)

40. 95.4% ethanol (positive deviation). BP = 351.15 K

41. 0.01 m urea = 0.01 m sugar < 0.01 m NaCl < 0.01m pot.sulfate

42. $\pi = CRT$ i.e. $\pi \propto c$ and $\pi \propto T$

43. $K_4[Fe(CN)_6]$ Aq., $Al_2(SO_4)_3$ Aq.

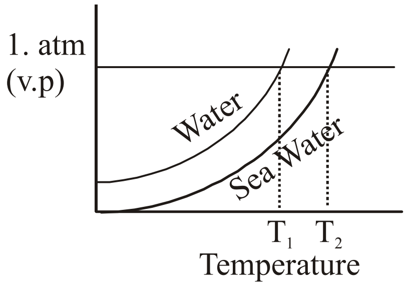
5 moles 5 moles

44. Molarity - moles/L, molality - moles / kg. of solvant
normality – No. of gram equivalent / L (of solution)
Strength – gram / litre
mole fraction. It is a number (with no unit)

45. Camphor has a large K_f value (39.8^0) and therefore causes large depression in m.p. with very small amount of solute (naphthalene).

46. The b.p. is a temperature at which v.p. of the liquid becomes equal to surrounding pressure, but normal b.p. is the temperature at which vapour pressure is 1 atm. pressure.

47. Sea water has lower vapour due to dissolved solute like NaCl, $MgCl_2$ etc and hence shows higher boiling point.



$T_2 > T_1$ (b.p of water)

48. $\Delta T_B \propto \frac{1}{M}$. B has higher boiling point than A.

49. 20.2 % HCl + 79.8% water

50. $\Delta T_B = K_b m = K_b . \frac{W}{M} \times \frac{1000}{W_{(solvant)}}$ i.e. ΔT_B is inversely related to 'M'.

51. (i) F (ii) T

Unit - III

52. It is the mass of substance discharged at an electrode on passage of one coulomb of charge through an electrolyte. Unit of z = gram / coulomb.

53. No, the redox reaction, $Ni(s) + Cu^{2+}(aq) \rightarrow \overset{2+}{Ni}(aq) + Cu(s)$ is feasible.

54. $-\Delta G^0 = nFE^0$

55. No. It is a wrong statement. $E^0_{Cu^{2+}|Cu} > E^0_{H^+|\frac{1}{2}H_2}$.

56. Pt, $\frac{1}{2}H_2(g)$ 1 atm. | $H^+(1M)$(at 298 K), it acts as anode

$H^+_{(1M)} | \frac{1}{2}H_2$ (1 atm, 298) K, Pt if acts as cathode $E^0_{SHE} = 0.0$ volt.

57. SHE

58. specific conductance, $ohm^{-} cm^{-1}$

Equivalent conductance, $Ohm^{-1} cm^2$ gram $eqvt^{-1}$.

Molar conductance, $Ohm^{-1} cm^2 mol^{-1}$.

59. e^- flows from LHE (Anode) to RHE (cathode).

60. Volt. EMF is the number of joules of energy given by the source divided by each coloumb to enable a unit electric charge to move across the circuit. (Joul/coulomb).

61. It is a device where chemical energy is converted to electrical energy i.e. $-\Delta G = nFE$

62. Charge proton = charge on electron = $1.6\times10^{-9}\,C$.

63. Strong electrolytes – acid (HClaq), Base (NaOH aq), Salt (NaCl aq.)
Weak electrolyte - acid (CH_3COOH), base (NH_4OH) in aq. solution.

64. $Zn\,|\,Zn^{2+}(Aq)\vdots Cu^{2+}(Aq)\,|\,Cu$.

65. $+0.34-(-0.76)=1.1V$

66. $Cu\left|Cu^{2+}(Aq)\right|\left|Ag^{+}(aq)\right|Ag$

67. Cl^{-1}or NO_3^- of K^+ or NH_4^+ which have similar ionic mobility in solution.

68. $\Lambda_m=\Lambda_m^0-\left(A+B\Lambda_m^0\right)\sqrt{C}$, A and B are Debye - Huckel constants.

$=\Lambda_m^0-b\sqrt{c}$

69. Specific conductance = cell constant × conductance
In this case cell constant = 1.0 cm^{-1}.

70. (i) 3F (ii) 0.2 F (iii) $6.023\times10^{22}=0.1\,\text{mole},\ 0.5\,F$

(1 mole MnO_4^- need 5F to become Mn^{2+})

71. 11.2 L at NTP = 0.5 mol = 16 gram oxygen ≡ 2F

72. Mg, Zn

73. $-\Delta G^0=RT\ln K=nFE^0$

$$\ln K=\frac{nFE^0}{RT}\ \Rightarrow\ \log K=\frac{nFE^0}{2.303\,RT}$$

$$K=e^{nFE^0/RT}.$$

74. $Cu\left|Cu^{2+}(Aq)\right|\left|Ag^{+}(Aq)\right|Ag$

$E^0_{cell}=E^0_{Ag^+/Ag^-}-E^0_{Cu^{2+}|Cu}=0.80V-0.34V=0.46V$

75. A weak electrolyte is a solution in which a small fraction of dissolved solute exists as ions. There lies an equilibrium between unionised part of molecules and ionised part (ions).

e.g. $NH_4OH(aq)\rightleftharpoons NH_4^+(Aq)+OH^-(Aq)$

76. α, the fraction of the molecule that ionised per mole of electrolyte. 'α' is less for weak electrolytes.

77. The tendency of an electrode to gain or to lose electrons.

e.g. $E^0_{Zn|Zn^{2+}(Aq)}$ (oxidation potential) = $-\,E^0_{Zn^{2+}|Zn}$ (reduction potential)

78. Electrolyte is a substance that can conduct electrocity either in molten state or in solution where ions are mobile.

79. Not. $\frac{W_1}{W_2}=\frac{E_1}{E_2}=\frac{Z_1}{Z_2}$ (Faraday's second law of electrolysis)

80. Cell constant $= \frac{\ell}{a}$, ℓ = length between two electrodes

a = area of cross section of electrode plate.

81. Highly electro- positive metals like Na, K, Mg, Ca, Al etc can be extracted electrolytically on cathodic reduction from their respective electrolyte.

e.g. Na metal from molten NaCl.

82. No. of coulombs = 0.5 amp × 7200 sec

$$96500C = 6.023\times10^{23}\,\overline{e}(s) = 1\,\text{mole of}\,\overline{e}(s)$$

$$3600\,C = \frac{6.023\times10^{23}}{96500}\times3600 = 0.225\times10^{23} = 2.25\times10^{22}\,e(s)$$

83. Anode (oxidation) i.e. the electrode with lower potential

cathode (reduction i.e. the electrode with higher electrode potential.

In concentration cell, the cell potential is due to difference in conc. of the solution

e.g. $Zn\,|\,Zn^{2+}(C_1)\,||\,Zn^{2+}(C_2)\,|\,Zn,\ C_2 > C_1$

Unit - IV

84. Bimolecular, first order

85. Single step reaction

86. Slope $= -\frac{Ea}{2.303R} = -10.7\times10^3$

$$E_a = 2.303\times8.314\times10.7\times10^3 = 204.87$$

87. $\log\frac{k_2}{k_1} = \frac{Ea}{2.303R}.\frac{T_2-T_1}{T_1.T_2}$

88. (i) For zero order reaction no change in rate

(ii) The rate becomes 4-times.

89. First order reaction.

90. T

91. $N_2O_5 \longrightarrow N_2O_4 + \frac{1}{2}O_2$

92. Catalytic decomposition of NH_3, $2NH_{3(g)} \xrightarrow[\Delta]{Pt} N_{2(g)} + 3H_{2(g)}$

$$H_{2(g)} + Cl_{2(g)} \xrightarrow{h\nu} 2HCl_{(g)}$$

93. The reacting species getting activation energy forms an unstable intermediate called activated complex which readily gives rise to products.

94. $k = \frac{0.693}{t_{1/2}} = \frac{0.693}{60} = \frac{2.303}{t}\log\frac{100}{10}$ i.e. $t = \frac{2.303\times60}{0.693} = 199.4$ min.

95. $k = \frac{0.693}{60} = \frac{2.303}{t}\log\frac{100}{1} = \frac{2.303\times2}{t}$

Now, $t = \dfrac{60 \times 2 \times 2.303}{0.693} = 298.8 \text{ min}.$

96. $k = \dfrac{0.693}{60} = \dfrac{2.303}{t} \log \dfrac{100}{0.1}$

$$t = \frac{2.303 \times 3 \times 60}{0.693} = 598.2 \text{ min}.$$

97. No

98. $R = A\,e^{-Ea/RT}$. If E_a is negative,

$= Ae^{+Ea/RT}$ Expansion of $e^x = 1 + x + \dfrac{x^2}{2!}$ where $x = {}^{Ea}\!/_{RT}$

$= A.\left[1 + \dfrac{E_a}{RT}\right]$ Neglecting higher powers of x.

It shows $k > A$ which is impossible.
Hence Ea cann't be negative.

99. For a multistep reaction the slowest step is choosen as rate determining step. The rate of this step is the rate of the reaction.

100. $k = \dfrac{0.693}{t_{1/2}} = \dfrac{0.693}{10 \text{ min}} = 0.0693 \text{ min}^{-1} = 6.93 \times 10^{-2} \text{ min}^{-1}$

101. Ea, is the excess energy required by the reactants to form the activated complex i.e. to surpass the potential barrier leading to product.

$E_{th} = E_r + E_a$ i.e. $E_a = E_{th} - E_r$

E_{th} = threshold energy i.e. energy possessed by the peak of barrier / activated complex.

102. Half life period $(t_{0.5})$. It is the time required to halve the initial concentration of the reactant, $[A]_0$

Relationship with [A] : $t_{0.5} \propto \dfrac{1}{[A]_0^{n-1}}$ where n = order of reaction.

103. The number of collisions per second per unit volume of the reaction mixture is known as collision frequency (Z).

104. The reaction where order of reaction is one but molecularity is two is called pseudo first order reaction.

e.g. $CH_3COOC_2H_5 + H_2O \xrightarrow{H^+} CH_3COOH + C_2H_5OH$

rate of reaction $= k\,[CH_3COOC_2H_5]^1\ [H_2O]^0$

Due to excess of reactant, H_2O the rate is independent of $[H_2O]$ i.e. it is zero order with respect to water.

105. $-\dfrac{1}{2}\dfrac{d[N_2O_5]}{dt} = +\dfrac{1}{4}[NO_2] = \dfrac{d[O_2]}{dt}$

$[N_2O_5] \propto P_{N_2O_5}$ i.e. partial pressure of N_2O_5(g).

106. Rate = $k[x]^2$. The rate will increase by 9 times.

107. Temperature co-efficient (n) is the ratio of rate constants at (T+10] K and T(K).

$$= \frac{\text{Rate constant at}(T+10)\text{K i.e. } 308\text{k}}{\text{Rate constant of}(T = 298\,\text{K say})}$$

For most of the reaction $2 < n < 3$.

108. At $T = \infty$, $K = Ae^{-Ea/RT} = A$.
Rate constant is equal to collision frequency i.e. every collision results into a chemical reaction which can't be true. At $T = \infty$, 'k' is not feasible. No.

109. It is a fractional order reaction. In an elementary process order equals to its molecularities and must have integral values. No.

Unit - V

110. The phenomenon of higher concentration of molecular species (gas/liquid) on the surface of solid than in the bulk is known as adsorption. It is a surface phenomenon e.g. water vapour adheres to the surface of silica gel.

111. It is the amount of heat evolved when 1 mole of gas/liquid (adsorbate) adsorbed on the surface of solid (adsorbent) i.e. $\Delta_{ads.}H$ = negative

112. In physical adsorption the adsobent and adsorbate are held by weak van-der Waals force.

113. Desorption (increasing temperature / decreasing pressure)

114. Animal charcoal is very good adsorbent, it removes the colouring matter (impurities) from the sugar making it colourless by surface action.

115. Colloid particle size 1 nm (10^3 pm) – 1000 nm while pore size of filter paper is bigger than this & hence can pass through the pores of filter paper completely.

116. Colloid particle size 1 nm (10^3 pm) —— 1000 nm (=10^6 pm). Crystalloid < 10^3 pm (1 nm)

117. Milk (o/w), cold cream (w/o).

118. Colloid particles are either positively or negatively charged. When electrolyte is added, the cation part neuralises the –vely charged colloid. Once changes are lost Brownian movement ceases & particle settled / coagulated ?
e.g.potash alum is used in the settling tank during water treatment.

119. $\Delta_{ads.}H$ = negative i.e. the adsorption process is exothermic, to make it spontaneous.

120. The turbid water contain fine colloidal clay particles which are –vely charged i.e. it's a negative sol. when treated with alum ($K_2SO_4.Al_2(SO_4)_3.24H_2O$), Al^{3+} cations neutralise the charge present in dispersed phase. The stability of colloidal solution (turbid water) fails & coagulation of clay particles takes place having clear water (dispersion medium)

121. Extent of adsorption = $\frac{x}{m}$ i.e. mass of adsorbate (x) per gram of an adsorbent (m). In case of physical adsorption, increase of temperature decreases the $\frac{x}{m}$ value while increase of pressure inceases the $\frac{x}{m}$ value.

$$\frac{x}{m} \propto p^{1/n} \quad (n = \text{whole number})$$

For chemisorption $\frac{x}{m}$ increases with rise of temperature initially.

122. Positive adsorption : If the concentration of adsorbate is more on the surface as compared to its concentration in the bulk phase then it's a called positive adsorption.

Negative adsorption : If the concentration of the adsorbate is less than its concentration in the bulk, then it is called negative adsorption. e.g. dilute solution of KCl is shaken with blood charcoal.

123. Catalyst (heterogeneous) taken in finely powered form with greater surface area to which large number of adsorbate molecules (reactants) adhere to.

124. It is the millimoles of an electrolyte that must be added to 1L of a colloidal solution for complete coagulation. Smaller is the flocculation value (FV) greater is the coagulating power.

125. 5 ml of $1\text{m KCl} \equiv 5$ millimoles

100 ml of sol need 5 millimoles

1000 ml (1 L) sol need 50 millimoles = FV of KCl

126. Dilution test : Milk is diluted even with small volume of water i.e. the dispersion medium of milk must be water. Thus, it's an o/w emulsion.

127. Colloidal solution consists of two phases : dispersion medium, dispersion phase e.g. milk power (phase) is dispersed in water (medium). As it consists of two phases it's heterogeneous in nature.

128. It is a heterogeneous solution which contains particles of size 1–1000 nm. e.g. milk.

129. The smoke is colloidal in nature. When viewed at angle to the source of light it appears blue on account of Tyndall effect.

130. Coagulation takes place because the-sols will mutually neutralise their charges.

131. It is colloidal solution of cellulose nitrate in ethylalcohol.

132. Solid (liquid dispersed in solid)

133. 4 ml of 1M NaCl necessary to cogulate 1 L of arsenic sulfide. The amount in mili moles of NaCl = 4×1 = 4 milimoles. Flocculation value of NaCl = 4.

134. Zymase.

135. CO acts a poison for the catalyst. Finely divided iron reduces the catalytic activity & hence the production of NH_3.

Unit - VI

136. Na, Mg
137. Dolomite : Ca $CO_3.MgCO_3$
138. Carbon (Coke)
139. Electrolytic refining
140. Brass Cu (90%) + Zn(10%); Bronze Cu(90%) Sn(10%)
141. German silver Cu(60%), Ni (15%), Zn(25%)

142. Silicon steel : Fe (85%), Si (15%) : Ferrosilicon
Chrome steel : Fe (33%), Cr (67%) : Ferrochrome

143. Zinc blende (ZnS), Green vitriol. ($CuSO_4.5H_2O$)

144. Calamine : $ZnCO_3(s) \xrightleftharpoons{\text{Caleination}} ZnO_{(s)} + CO_2 \uparrow$

145. Flux is a substance added at the time of smelting to remove the impurity from the concentrated ore. If impurity is basic, acidic flux is added & vice versa.
Basic impurity + Acidic flux = slag

$$CaO_{(s)} + SiO_2(s) \longrightarrow Ca\,SiO_3(s)$$

146. Acidic flux : SiO_2, P_2O_5

147. F

148. Slagging is a process where the impurities are removed from the concentrated ore during smelting. It is lighter than molten metal. It is removed first.

$$\text{Impurity} + \text{flux} \longrightarrow \text{slag}.$$

149. Here reducing agent is not added from outside, in furnace it's itself formed.
Example. Bassemerisation : Copper sulfide is partially oxidised to cuprous oxide which reacts with remaining copper sulfide to form Cu and SO_2.

$$2Cu_2S + 3O_2 \longrightarrow 2\,Cu_2O + 2\,SO_2$$

$$Cu_2S + 2\,Cu_2O \longrightarrow 6\,\underbrace{Cu + S}_{\text{Blister Copper}}O_2(g)$$

150. Fe- Haematile (Fe_2O_3)
Al - Bauxite (Al_2O_3 - $2H_2O$)
Cu - Copper pyrites (Cu Fe S_2)

151. Levigation : It is gravity separation method to concentrate heavy oxides ores of lead, tin, iron etc. The lighter gangue particles are washed away.

152. Liquation : The metallurgical process (refining) involves heating the ore until the metal with a lower melting point is separated from the ore with higher melting point. It is carried out in sloping hearth of a furnance. For example. Pb, Sn, Sb, Bi and Hg.

153. F (Magnetite is an ore of iron)

154. Manganin (Cu-86%, Mn 12%, Ni 2%) is an alloy of copper containing lowest percentage of Ni.

155. Matte : During smelting of roasted ore of copper with coke and silica in blast furnace ferrous sulfide changes to FeO which with SiO_2(flux) removed as $FeSiO_3$ (slag).
Part of FeS melts with Cuprous sulfide at high temperature giving rise to matte containing 50% copper. (Matte = Copper + FeS + Cu_2S)

156. Sulfide ore

157. → Pyo-metallurgy : The process of converting a metal oxide into metallic form upon strong heating with a suitable reducing agent is known as pyometalurgy. e.g. iron
→ Electro meallurgy : The process of cathodic reduction molten salt of highly reactive (electro positive) is called electrometallurgy. e.g. electrolysis of molten NaCl to extract sodium.

→ Hydrometallurgy : The process of converting the impure metal present in an ore into suitable complex & then recovering the pure metal from the complex by treating with a more electropositive metal,a stronger reducing agent is known as hydrometallurgy.

$$\text{Silver} \xrightarrow{\text{NaCN}} \text{Na}\left[\text{Ag}\left(\text{CN}\right)_2\right] \xrightarrow{\text{Zn}} \text{Ag}$$

158. Copper matte contains Cu_2O and Fe O(impurity). In the Bessemer converter, silica present as lining acts as a flux which combines with FeO to form iron silicate as slag : $FeO + SiO_2 \longrightarrow FeSiO_3$.

159. They differ by their C-content. Carbon content in pig iron is nearly 4% while in cast iron it's 3%.

160. $Cu_2O < FeO < ZnO < MgO$ (More negative is the value of $\Delta_f G^0$ more is the stability and better as a reducing metal)

Unit - VII

161. Group-15 Bond angle decreases from NH_3 to BiH_3.
Group - 16 H_2O to H_2Te with decrease of electronegativity.

162. Pentoxides are more acidic than trioxide, the acidic character decreases, from top to bottom with decrease of electronegativity. More is the electronegativity more is the electron accepting tendency electron acceptors are acids (Lewis).

$$N_2O_5 > P_2O_5 > As_2O_5 > Sb_2O_5 > Bi_2O_5$$

$$N_2O_5 > N_2O_3 \text{ etc.}$$

163. Reducing nature increases form NH_3 to BiH_3 with decrease M-H bond strength and increase of M-H bond length.

$$NH_3 - PH_3 < AsH_3 < SbH_3 < BiH_3$$

$$BiH_3 \longrightarrow Bi + 3(H)$$

Reducing nature depends on ease of release of 'H'

164. $\underset{(93.4\,\text{ppm})}{Ar} > Ne > He > Kr > \underset{(0.09\,\text{ppm})}{Xe} > Rn(\text{traces})$

165. Uses of XeF_2 (i) Fluorinating agent (ii) Xe can be prepared $XeF_2 + H_2 \longrightarrow Xe + 2HF$

166. It undergoes oxidation to HNO_3 and reduced to NO (nitric oxide)

$$3H\overset{+3}{N}O_2 \longrightarrow H\overset{+5}{N}O_3 + 2\overset{+2}{N}O + H_2O$$

167. Dinitrogen tetroxide (N_2O_4) is used as rocket fuel.

168. Carbogen is a mixture of oxygen and carbondioxide. It is given to the pneumonia patients and patients of carbon monoxide poisoning for artificial respiration.

169. $HClO < HClO_2 < HClO_3 .< HClO_4$. Then $HClO_4 \rightarrow H^+ + ClO_4^-$ (Conjugate base more stable) the stability of conjugate base. $ClO^- < ClO_2^- < ClO_3^- < ClO_4^-.ClO_4^-$ is maximum stable because -ve charge dispersed by four electronegative oxygen atoms.

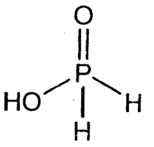
Thus $HClO_4$ has maximum H^+ losing tendency i.e. $HClO_4$ is strongest acid and HClO is least acidic.

$$\text{Thus, } H\overset{+7}{C}lO_4 > H\overset{+5}{C}lO_3 > H\overset{+3}{C}lO_2 > H\overset{+1}{C}lO$$

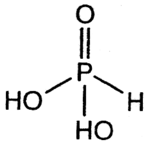
Higher is the positive O.S. greater is the acidic nature (more electron accepting tendency).

170 .'NO' has odd number of electrons (7+8=15) are due to presence of unpair e^- in antibonding orbital, it's paramagnetic in gaseous state. However, in liquid and solid states, the unpaired e^-(s) are involved in the formation of loose dimer. In the absence of any unpair e^-. It is diamagnetic in nature:

171. No. of polar -O-H group determines the proton donating tendency and acidic nature



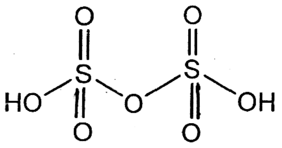
(One polar-OH group)

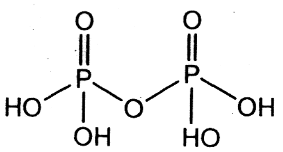


(Two polar-OH group)

172. $Na_2O_2 + 2H_2O \rightarrow 2NaOH + H_2O_2$ On hydrolysis peroxide is formed, hence Na_2O_2 is peroxide further O.N. of peroxide, O_2^{2-} where oxygen has -1 O.S.

173. Pyrosulfuric acid : $H_2S_2O_7$, Pyrophosphoric acid (diphosphoric acid $H_4P_2O_7$)





174. (i) Charring of sugar takes place due to dehydration. Only sugar charcoal is left behind.

$$C_{12}H_{22}O_{11} \xrightarrow{\text{conc.}H_2SO_4} 12C + 11H_2O$$

(ii) Brown gas evolves due to formation of Br_2 (on oxidation of Br_r^-

Here sulfuric acid acts as oxidizing agent.

$$SO_4^{2-} + 4H^+ + 2e^- \rightarrow SO_2 + 2H_2O$$

$$2B\bar{r} \rightarrow Br_2 + 2e^-$$

(iii) When copper turning are heated with conc. H_2SO_4, colourless SO_2 evolves on reduction of SO_4^{2-}.

$$SO_4^{2-} + 4H^+ + 2e^- \longrightarrow SO_2 + 2H_2O$$

$$Cu \rightarrow Cu^{2+} + 2e^-$$

(iv) Yellow powder of sulfur (S_8) disappears liberating a colourless with pungent smelling gas (SO_2)

$$\left[4H^+ + SO_4^{2-} + 2e^- \longrightarrow SO_2 + 2H_2O\right] \times 16e^-$$

$$\underline{16H_2O + S_8 \rightarrow 8SO_2 + 32H^+ + 32e^-}$$
$$32H^+ + 16SO_4^{2-} + S_8 \longrightarrow 24SO_2 + 16H_2O$$

(v) Colourless $HCl_{(g)}$ evolves out.

$$KCl + H_2SO_4 \longrightarrow KHSO_4 + HCl\uparrow$$

175. Nitrogen does not have 'd' obital can't co-ordinate with $H_2\ddot{O}:$ molecule. In case PF_3, P-F bond is stronger than P–O bond. Hence 'P' of PF_3 fails to interact with 'O' of H_2O.

176. $2HNO_3 \xrightarrow{-H_2O} N_2O_5$ (Anhydride of HNO_3)

$2H_3PO_4 \xrightarrow{-3H_2O} P_2O_5$ (anhydride of H_3PO_4)

177. $3Cu + 8HNO_3 \longrightarrow 3Cu(NO_3)_2 + 4H_2O + 2NO$

$$2H\overset{+5}{N}O_3 \longrightarrow H_2O + 2\overset{+2}{N}O_2 + 3(O)$$
$$\underline{3\times\left[Cu + O + 2HNO_3 \longrightarrow Cu(NO_3)_2 + H_2O\right]}$$

(a) $$\left[4H^+ + NO_3^- + 3e^- \longrightarrow NO + 2H_2O\right]\times 2$$
$$\underline{\left[Cu \longrightarrow Cu^{2+} + 2e^-\right]\times 3}$$
$$\underline{8H^+ + 2NO_3^- + 3Cu \longrightarrow 3Cu^{2+} + 2NO + 4H_2O}$$

i.e. $8HNO_3 + 3Cu \longrightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

178. $NH_4Cl_{(s)}$ on heating with quick lime $NH_{3(g)}$, is liberated. Lab. Method:

$2NH_4Cl + CaO \rightarrow 2NH_3\uparrow + CaCl_2 + H_2O$

179. When potassium nitrate in treated with cone. H_2SO_4, nitric acid is formed.

$$KNO_3 + H_2SO_4 \rightarrow KHSO_4 + HNO_3$$

180. $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$ catalyst: Finely divided iron, in presence of promoter-Mo

181. When NH_4NO_3 is strongly heated nitrousoxide is formed

$$NH_4NO_{3(s)} \longrightarrow N_2O_{(g)} + 2H_2O$$

(laughing gas)

182. Drying agent for $NH_{3(g)}$ is quicklime (CaO)

183. P_2O_5 is an acid anhydride which reacts with NH_3 (base) to form ammonium phosphate salt.

$$P_2O_5 + 3H_2O \rightarrow 2H_3PO_4$$
$$\underline{\left[3NH_3 + H_3PO_4 \rightarrow (NH_4)_3PO_4\right]\times 2}$$
$$P_2O_5 + 6NH_3 + 3H_2O \longrightarrow 2(NH_4)_3PO_4$$

184. In the Ostwatd procaine to synthesize HNO_3, Pt-Catalyst is used to oxidize ammonia.

$$2NH_3 + \frac{5}{2}O_2 \xrightarrow[500K,\ a\ bar]{Pt} 2NO + 3H_2O$$

$$2NO + \frac{3}{2}O_2 + H_2O \longrightarrow 2HNO_3$$

185. Thermal decomposition of sodium azide gives dinitrogen.

$$2NaN_3 \xrightarrow{\Delta} 2Na + 3N_2 \uparrow$$

186. On partial and complete neutralization, three types of salts are formed.

$$\underset{1:1}{H_3PO_4 + NaOH} \longrightarrow \underset{\text{acid salt}}{NaH_2PO_4} + H_2O$$

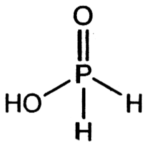
$$\underset{1:2}{H_3PO_4 + 2NaOH} \longrightarrow \underset{\text{acid salt}}{Na_2HPO_4} + 2H_2O$$

$$H_3PO_4 + 3NaOH \longrightarrow \underset{\text{normal salt}}{Na_3PO_4} + 2H_2O$$

187. On heating H_3PO_4 , phosphoric acid and phosphine are formed

$$4H_3PO_3 \longrightarrow 3H_3PO_4 + PH_3$$

188. H_3PO_2 (hypophosphorous acid) is a mono basic acid with one-OH group bonded to 'P' with O.N.+1.
Structure:



Here, there are two P-H bonds. Due to greater bond length it can release 'H'. The compound that can give 'H' is a reducing agent.
Further +1 O.N. can increase to +5 i.e. it is oxidized. The substance getting oxidized is a reducing gent.

189. Pt does not react with Oxygen directly.

190. $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$
(Base) (acid)

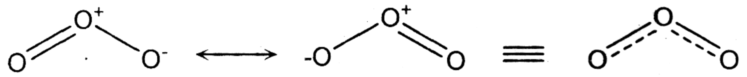
(a) $$Al_2O_{3(s)} + 6HCl + 9H_2O \longrightarrow 2\left[Al(H_2O)_6\right]^{3+}_{aq} + 6Cl^-(aq)$$

$$Al_2O_3(s) + 6NaOH + 3H_2O(l) \longrightarrow 2Na_3\left[Al(OH)_6\right]aq.$$

Sodium hexhaydroxido aluminate (III)

This is the reason way Al_2O_3 is an amphoteric oxide.

191. Bond angle = 117°, Bond length = identical, 128 pm.



192. In vapour state sulfur partly exists as S_2 molecule which has two unpaired electrons n

the antibonding π^* orbital, like O_2 & hence exhibit paramagnetism.

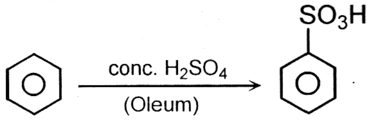
194. SO_2 in a reducing agent. If reducing Fe^{3+} to Fe^{2+} ions

$$\begin{array}{c} SO_2 + 2H_2O \longrightarrow SO_4^{2-} + 4H^+ + 2e^- \\ 2Fe^{3+} + 2e^- \longrightarrow 2Fe^{2+} \\ \hline SO_2 + 2H_2O + 2Fe^{3+} \longrightarrow SO_4^{2-} + 4H^+ + 2Fe^{2+} \end{array}$$

194. (i) Oxidizing agent: $H_2SO_4 \rightarrow H_2O + SO_2 + [O]$

(ii) Dehydrating agent: Charring sugar $C_{12}H_{22}O_{11} \xrightarrow[H_2SO_4]{conc.} 11H_2O + 12C \longrightarrow$

(iii) Sulphonating agent:



195. (i) $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$

(ii) $2KMnO_4 + 16HCl \longrightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$

$$[8H^- + MnO_4^- + 5e^- \longrightarrow Mn^{2+} + 4H_2O] \times 2$$

$$[2Cl^- \longrightarrow Cl_2 + 2e^-] \times 5$$

196. Phosgene : $CO + Cl_2 \xrightarrow{C(active)} COCl_2$

Mustard gas: $S_8 + 4Cl_2 \xrightarrow{\Delta} 4S_2Cl_2$ (1)

$$CH_2 = CH_2 + S_2Cl_2 \longrightarrow Cl - CH_2 - CH_2 - S - CH_2 - CH_2Cl + S$$

197. $\left.\begin{array}{l} Cl_{2(g)} \\ SO_{2(g)} \end{array}\right\}$ – dried on passing through conc. H_2SO_4.

198. $SO_2 + 2Mg \longrightarrow 2MgO + S$. It liberates Iodine from HI

$4HI + SO_2 \longrightarrow 2H_2O + 2I_2 + S$

$SO_2 \longrightarrow S + 2[O]$

$[2HI + O \longrightarrow H_2O + I_2] \times 2$

199. H_2S is a dibasic acid, forming hydrogen sulfide $\left(H\overline{S}\right)$ and sulfide (S^{2-}).

200. The strip turns black due to formation of PbS.

$(CH_3COO)_2 Pb + H_2S \longrightarrow PbS \downarrow + 2CH_3COOH$

201. Allotropic forms of sulfur

(i) Rhombic sulfur $(\alpha - \text{sulfur}), S_8$.

(ii) Monochlinic sulfur $(\beta - \text{Sulfur}), S_8$.

202. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4 \Rightarrow S$

203. $TeO_2 + 2NaOH \rightarrow Na_2TeO_3 + H_2O$ (sodium tellurite)

$2TeO_2 + 2HCl \rightarrow Te_2O_3Cl_2 + H_2O$

204. Due to high electronegativety value of F (4.1). it forms short H-bonding i.e. HF molecules are much associated, less volatile i.e. with greater inter molecular force of attraction.

205. H–F < HCl < HBr < HI

206. F(Due to smaller size and high electronegativity)

207. F ($1s^2$ $2s^2$ $2p^5$) having –1, oxidation number only due to high electronegativety value (4.1).

Unit - VIII

208. $_{24}Cr \quad 1s^2 2s^2 2p^6 3s^3 3p^6 3d^5 4s^1, \quad Cr^{3+}[Ne]2s^2 3p^6 3d^3$

$_{29}Cu \quad 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1, \quad Cu^{2+}[Ne]3s^2 3p^6 3d^9$

209. Zn, Cd, Hg due to presence $18\bar{e}\,s$ in their penultimate shell along with ns^2 electrons in n^{th} shell.

210. In the presence of moist air, a layer of basic copper carbonate (green) is formed on the surface and gets corroded.

$$2Cu + O_2 + H_2O + CO_2 \longrightarrow CuCO_3.Cu(OH)_2$$

211. $Fe^{2+}(Aq)$ green, $Fe^{3+}(Aq)$ yellow.

212. La^{3+}

213. green vitriol, $FeSO_4.7H_2O$ (on crystallisation)

214. General configuration of d-block is $(n–1)d^{1-10}$ ns^{0-2}
and $_{30}Zn = 3s^2\ 3p^6\ 3d^{10}\ 4s^2$

215. Actinoids are f-block, inner transition elements with general electronic configuration $(n–2)\ s^2\ p^6\ d^{10}\ f^{\,1-14}\ (n–1)\ s^2p^6d^{0(or)1}\ ns^2$

216. Low alloys and high alloys of steel, depending on % of alloying elements (1 – 50%). e.g. Ferro – silicon, Ferro – vanadium (low alloys)

217. Wrought (pure iron), pig iron (impure form)

218. Reverberatory furance.

219. SO_2

220. $(FeCl_3)_2$ in vapour phase. Normally as $FeCl_3.\ 6H_2O$

221. Transition metals have more number of unpaired $\bar{e}$ (s) in their valenceshell for which they are able to from strong metallic bond. The strength of bond is responsible for its hardness.

222. Sc

223. Fe_2O_3

224. Metal is heated to higher temperature and then cooled slowly, by such process the metal becomes soft.

225.

Triad elements	group	8 ,	9 ,	10
	Irontriad	Fe	Co	Ni
	Pd-triad	Ru	Rh	Pd
	Pt. triad	Os	Ir	Pt

226. Nickel

227. +3

228. Mn $+2(MnO,), +3(Mn_2O_3)+4(MnO_2), +7(Mn_2O_7)$

229. Os, e.g. OsO_4 (+8) and IrO_4

230. $Cu^{2+}(3d^9), Ni^{2+}(3d^8)$

231. $Hg^+(5d^{10}6s^1)$, due to dimagnetic behaviour of mercurous compounds it's written as Hg_2^{2+} indicating absence of spin free electron.

232. Leser energy differs between 5f and 6d orbitals than between 4f and 5d orbitals in lanthanides. 5f orbital extend further from nucleus than 4f orbital. Its O.S. varies from +3 to +6 (5f, 6d, 7s levels having comparable energy).

233. Metals with highest oxidation can reduce to lower O.S. & Metals undergoing easy reduction can use as better oxidising agent.

234. Fe^{3+} ($3d^5$), due to half filled d-orbitals it's is most stable ion (with stable electronic configuration). Further its can easily be hydrolysed with greater $\Delta_{hyd}H(-ve)$.

235. +7 (Np and Pu)

236. $Cu(3d^{10}4s^1)$ $Cu^+(3d^{10})$, no unpair $\bar{e}$ & hence colourless

$Cu^{2+}(3d^9)$ with unpair $\bar{e}$ looks blue in aq. solution.

237. Due to lanthaxide contraction transition elements of 2nd and 3rd have comparable atomic / ionic size & following almost identical chemical properties.

238. ${}^{r}La^{3+} >{}^{r} Lu^{3+}$ due to lanthamide contraction. Thus, $La(OH)_3$ is more ionic than $Lu(OH)_3$ i.e. $La(OH)_3$ is more basic (alkaline).

239. $MnO_4^- > Cr_2O_7^{2-} > VO_2^+$ (reduced states are more stable)

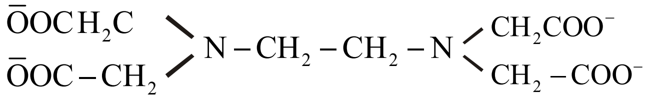
Unit - IX

240. en $= \ddot{N}H_2 - CH_2 - CH_2 - \ddot{N}H_2$, ethane-1, 2-diamine

a bidentate chelating ligand with two donor sites, to form co-ordinate covalent bond with metal or metal ion.

241. $K_4[Fe(CN)_6]$

242.



$$\begin{matrix} \bar{O}OCH_2C \\ \bar{O}OC-CH_2 \end{matrix} \rangle N-CH_2-CH_2-N \langle \begin{matrix} CH_2COO^- \\ CH_2-COO^- \end{matrix}$$

Ethylene diamine tetraacetate $(EDTA)^{4-}$ ion.

It is a hexaentate ligand.

243. $Cr^{3+}(3d^3)$, $Co^{3+}(3d^6)$, $Fe^{3+}(3d^5)$

$n=3$ $n=4$ $n=5$ ($n=$ no. of unpair $\bar{e}$)

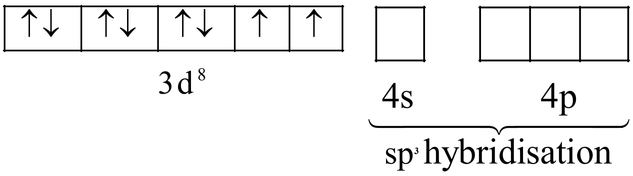
244. Hexaammine chromium (III) ion

Hexafluorido cobaltate (III) ion, Hexacyanidoferrate (III)) ion

245. $\Delta_t = \frac{4}{9}\Delta_0$, conequently, the orbital splitting energies are not sufficiently large for forcing pairing and, therefore, low spin configuration are rarely observed.

246. Pentaammine nitrocoalt (III) nitrate

247. Ni(II),



Outer orbital complex (high spin complex)
Shape. Tetrahedral.

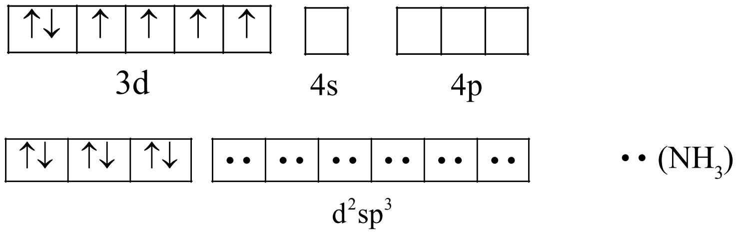
248.Here the complex formed is $\left[Cu(NH_3)_4\right]SO_4$ i.e. presence of tetraamminecopper (II) ion instead of Cu^{2+}.

249. $\Delta_0 < P$, weak field giving high spin complex. i.e $d^4 = t_{2g}^3.e_g^1$ (paramagnetic)

250. $\left[Co(en)_3\right]^{3+}$ is more stable as it's chelated

Tris - (ethane-1, 2-diamine) cobalt (III)

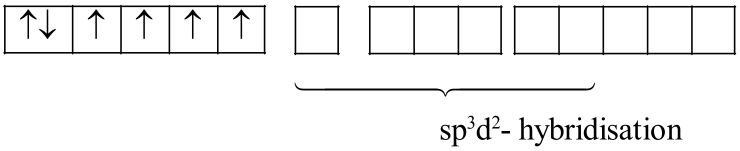
251. Co(III), $3d^6$,



Inner orbital complex, octahedral, diamagnetic.

252. CO (carbonyl) forms more stable complex (due to synergic bonding σ & π)

253. $Co^{3+}(3d^6)$, F^- is a weaker ligand outer orbital complex, sp^3d^2- hybridisation.

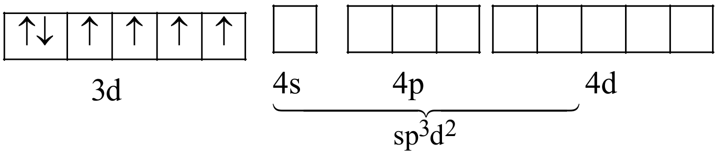


n = no. of unp[air $\bar{e}$ (s) = 4 (Paramagnetic)

$$\mu_{eff} = \sqrt{n(n+2)}\,B.M$$

$$= \sqrt{24}\ BM = 2\sqrt{6}\ BM$$

254. Ni (II) d^8



(Outer orbital complex)

255. Fe (II)). $3d^6$ CFSE inpresence of stronger ligand ((CN^-), $\Delta_0 > P$

$d^6 = t_{2g}{}^6$ (Low spin complex), diamagnetic

In presence of $(H_2O)\,\Delta_0 < P$, high spin complex occurs.

$d^6 = t_{2g}^4\ eg^2$ (Paramagnetic)

$\Delta_0(CN^-) > \Delta_0(H_2O)$

Due difference in absorption causes difference frequency, the complementary emitting frequency differs imparting different colour. Emitting frequency (CN^-) complex is less than that in (H_2O) complex. Former one is yellow while other one is violet.
Violet color has higher frequency than yellow.

256. Ambident ligand species has more than one donor site e.g. CN^-, SCN^-

257. Denticity of a ligand is the number of donor groups in a single molecule / ion that bind to central atom / ion in a coordination complex.

e.g. : NH_3 monodentate, $\ddot{N}H_2 - CH_2 - CH_2 - \ddot{N}$ bidentate

258. There are five degenerate d-orbitals, dxy, d_{yz}, d_{zx}, $d_{x^2-y^2}$ and d_{z^2} on the basis of their orientations.

259. The ligands may be arranged in increasing order of the field strength produced by them in a series known as spectrochemical series.

$I^- < Br^- < SCN^- < Cl^- .... H_2O < NCS^- < edt^{4-}a < NH_3 < en < CN < CO$

260. Hard water contains Ca^{2+}, Mg^{2+} & never gives good lather with soap. Water can be softened with EDTA that form Ca and Mg chelating complex.

261. Gold dissolves in KCN in presence of oxygen (surrounding air) and water forming a complex :

$$4Au + 8KCN + O_2 + 2H_2O \longrightarrow 4K[Au(CN)_2] + 4KOH$$

Pot. dicyanidoaurate (I)

This solution is treated with Zn (more electro +ve) to displace less electropositive, Au from its solution.

$$2K[Au(CN)_2] + Zn \longrightarrow 2Au + K_2[Zn(CN)_4]$$

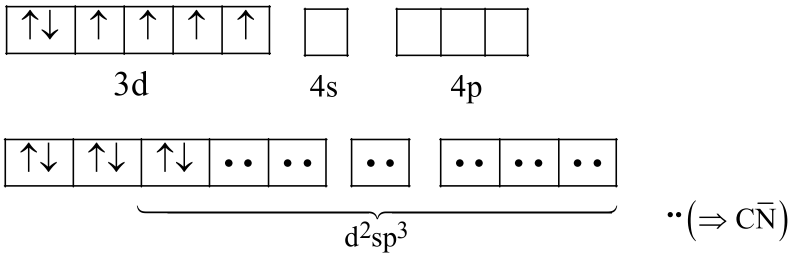
262. Sulfide ore gets soluble in NaCN in the process of leaching forming a soluble complex.

$$Ag_2S + 4NaCN \longrightarrow 2Na[Ag(CN)_2] + Na_2S$$

Sodiumdicyanidoargentate (I)

263. $[Fe(CN)_6]^{4-}$

Fe (II), $3d^6\ 4s^0$



Shape : Octahedral
Magnetic property : diamagnetic

264. $K_2^{2+}\left[Ru^{+4}\left(OH\right)_4^{-4}Cl_2^{-2}\right]^{2-}$, C.N. of Ru=six

O.N. of Ru = Four (tetravalent)

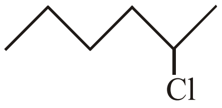
265. $\left[Fe^{3+}\left(C_2O_4\right)_3^{-6}\right]^{3-}$ C.N of Fe^{3+} = six

O.N. = +3 (three)

Unit - X

266. (i) CH_3I (ii) CH_3Cl
(iii) $CH_3–CH_2–CH_2Br$ (iv) $CH_3–CH_2–CH_2\ Br$
(v) $CH_3–CH_2–Br$ (vi) Chlorocyclohexane

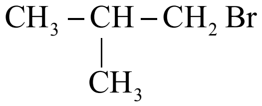
267. (i) $\left(CH\right)_3 CCl$ (3^0) (ii)



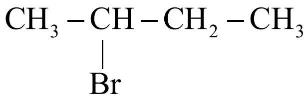
(2^0)

(iii) $C_6H_5CH_2Cl$ (1^0) (iv) $\left(C_6H_5\right)_2 CH-Br$
(v) $CH_2 = CH - CH_2Cl$

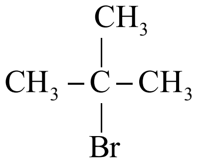
268. $CH_3-CH_2-CH_2-CH_2\,Br\left(1^0\right)$ 1–Bromobutane



$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2\,Br$ (1^0) 1-Bromo-2-methyl propane

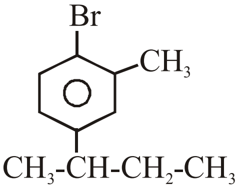


$CH_3-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_2-CH_3$ (2^0) 2-Bromobutane

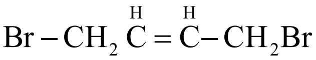


$CH_3-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle Br}{\underset{|}{C}}}}-CH_3$ (3^0) 2-Bromo-2-methyl propane

269. (i)



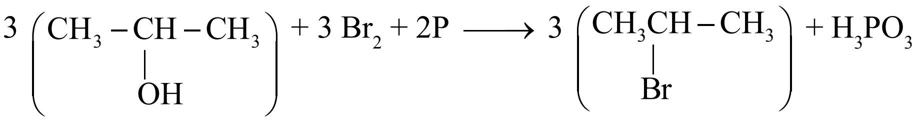
(ii)



$Br-CH_2\overset{H}{C}=\overset{H}{C}-CH_2Br$

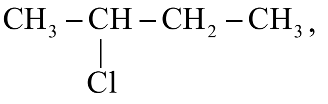
270. (i) $CH_3-CH_2OH+KI+H_3PO_4\longrightarrow CH_3CH_2I+KH_2PO_4+H_2O$

(ii)



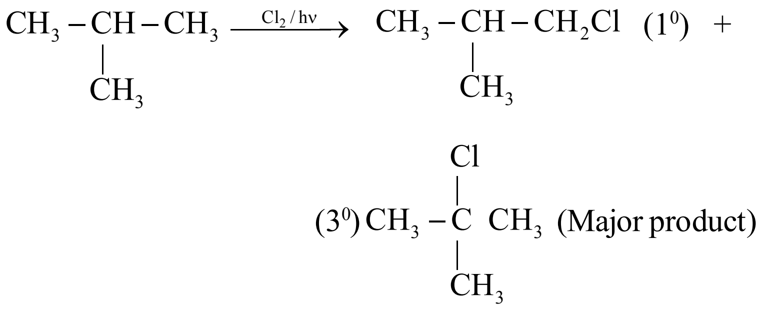
$3\left(CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3\right)+3\,Br_2+2P\longrightarrow 3\left(CH_3\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3\right)+H_3PO_3$

271. (i) $CH_3-CH_2-CH_2-CH_2Cl$, 1-chlorobutane (1^0)



$CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_2-CH_3$, 2–chlorobutane (Major product)

Isobutane :



$$\underset{\displaystyle CH_3}{CH_3-\overset{}{CH}-CH_3} \xrightarrow{Cl_2/hv} \underset{\displaystyle CH_3}{CH_3-CH-CH_2Cl}\ (1^0) + (3^0)\,CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle Cl}{C}}\ CH_3\ \text{(Major product)}$$

2-chloro-2-methyl propane

272. $CH_3-CH_2Br \xrightarrow{AgCN} CH_3-CH_2-NC(A)$

$4(H)\downarrow Na/alc.$

$CH_3CH_2NHCH_3\,(B)$

N-methylethanamine

$$CH_3-CH_2Br \xrightarrow{KCN} CH_3-CH_2-CN \xrightarrow[4(H)]{Na/alc.} CH_3-CH_2CH_2NH_2$$

propanenitrile (A_1) propanamine (B_1)

273. (i) Synthesis of **alkyl fluoride** by heating an alkyl chloride or bromide in presence of metallic fluoride such as AgF, Hg_2F_2, CoF_2 or SbF_3. This reaction is called **Swarts reaction**.

$$CH_3-Br + AgF \longrightarrow CH_3F + AgBr\downarrow$$

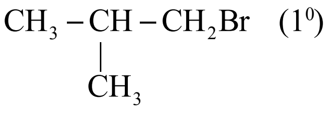
(ii) **Finkelstein reaction** (Preparation of alkyl iodide)
When alkyl chloride on bromide is treated with sodium iodide in presence dry acetone alkyl iodide is formed.

$$\underset{(X = Cl\text{ or }Br)}{RX} + NaI \xrightarrow{\text{dry acetone}} RI + Na$$

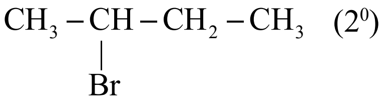
274. (i) Chloromethane < bromomethane < dibromomethane < bromoform
(ii) isopropylchloride < 1-chloropropane < 1-chlorobutane

275. The isomers :

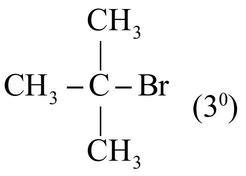
$CH_3-CH_2-CH_2-CH_2Br\ (1^0)$



$$CH_3-\underset{\displaystyle CH_3}{CH}-CH_2Br\quad (1^0)$$



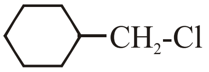
$$CH_3-\underset{\displaystyle Br}{CH}-CH_2-CH_3\quad (2^0)$$



$$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{C}}-Br\quad (3^0)$$

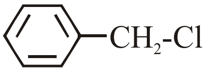
Reactivity : $3^0 > 2^0 > (CH_3)_2CH{-}CH_2Br\ (1^0) > CH_3-CH_2-CH_2-CH_2Br$

276. (i)



(ii)

(iii)



277. (i) HBr in presence of benzoylperoxide (Kharasch effect)

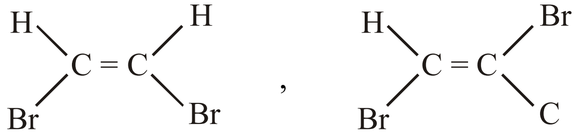
(ii) AgCN

(iii) $AgNO_2$, Sn-HCl / Δ

(iv) CuCN / KCN, $SnCl_2$ + HCl (Stephen's reaction)

(v) $HC \equiv C\,Na$

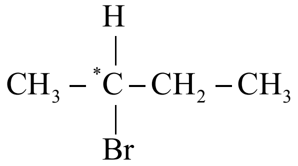
278.



cis, trans-1, 2- dibromoithene

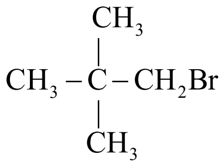
Trans-isomer is much more symmetrical and fit tightly in the crystal lattice, orderly arranged and has higher m.p. CiS - isomer has higher b.p. due to higher polarity experiencing greater dipole-dipole force.

279.



$CH_3-\underset{\underset{Br}{|}}{\overset{\overset{H}{|}}{{}^{*}C}}-CH_2-CH_3$, 2–Bromobutane, containing chiral C.atom.

280.

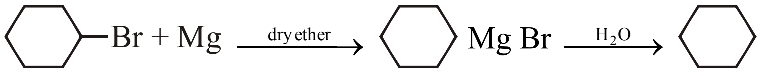


$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2Br$ (1-Bromo-2, 2–dimethyl propane)

The hydrocarbon is 2, 2–methyl propane (C_5H_{12})

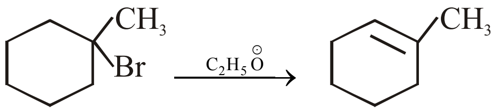
(C_5H_{10}). Cyclopentane $\xrightarrow{Cl_2}$ Cl (Chlorocyclopentane)

281.

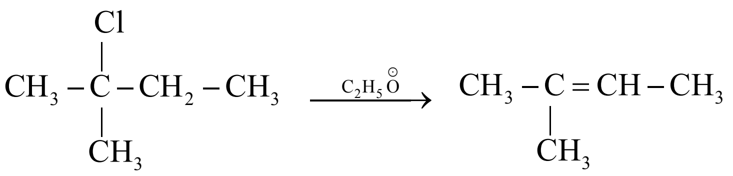


Br + Mg $\xrightarrow{\text{dry ether}}$ Mg Br $\xrightarrow{H_2O}$

282. (i)

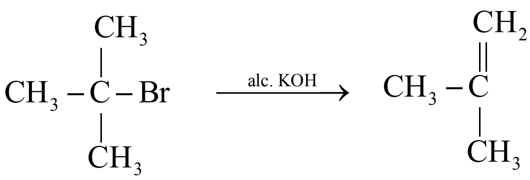


(ii)



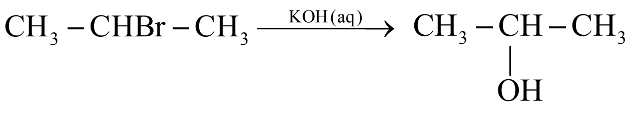
$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{Cl}{|}}{C}}-CH_2-CH_3 \xrightarrow{C_2H_5\overset{\ominus}{O}} CH_3-\underset{\underset{CH_3}{|}}{C}=CH-CH_3$

283. (i)



$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-Br \xrightarrow{\text{alc. KOH}} CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_2}{||}}{C}}$

(ii)



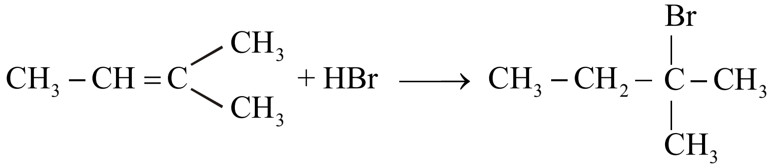
$CH_3-CHBr-CH_3 \xrightarrow{KOH(aq)} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

(iii) $CH_3-CH_2-Br \xrightarrow[\text{alc.(Aq)}]{\text{KCN}} CH_3-CH_2-CN$

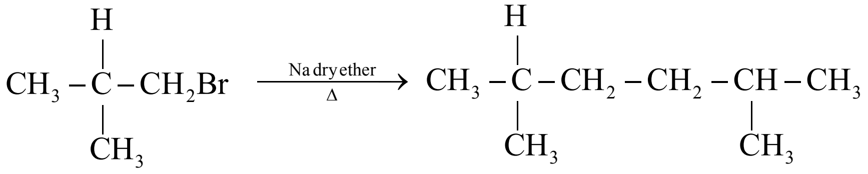
(iv) $C_6H_5ONa + C_2H_5Cl \longrightarrow C_6H_5OC_2H_5$ (Phenetole)

(Phenoxide a weaker base fails to eliminate)

The reaction where ether is formed from 1^0-haloalkane is known as Williamson's synthesis.

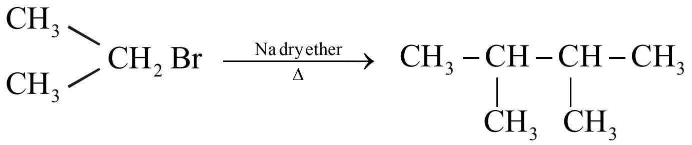
(v) 

$$CH_3-CH=C\begin{matrix}\diagup CH_3\\ \diagdown CH_3\end{matrix} + HBr \longrightarrow CH_3-CH_2-\underset{CH_3}{\overset{Br}{C}}-CH_3$$

284. (i) 

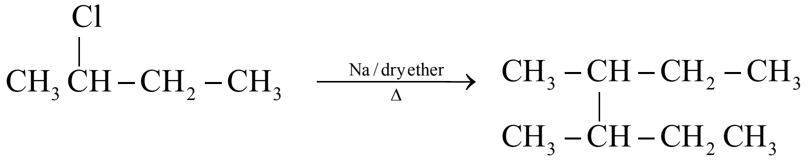
$$CH_3-\underset{CH_3}{\overset{H}{C}}-CH_2Br \xrightarrow[\Delta]{\text{Na dry ether}} CH_3-\underset{CH_3}{\overset{H}{C}}-CH_2-CH_2-\underset{CH_3}{CH}-CH_3$$

2, 5–dimethyl hexane

(ii) 

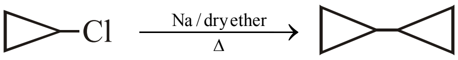
$$\begin{matrix}CH_3\diagdown\\ CH_3\diagup\end{matrix}CH_2\,Br \xrightarrow[\Delta]{\text{Na dry ether}} CH_3-\underset{CH_3}{CH}-\underset{CH_3}{CH}-CH_3$$

2, 3–dimethyl butane.

(iii) 

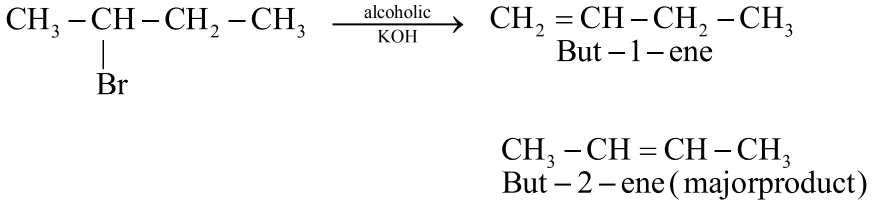
$$CH_3\overset{Cl}{CH}-CH_2-CH_3 \xrightarrow[\Delta]{\text{Na / dry ether}} \begin{array}{l}CH_3-CH-CH_2-CH_3\\ \qquad\;|\\ CH_3-CH-CH_2\,CH_3\end{array}$$

3, 4-dimethyl hexane

(iv) 

Cyclopropyl cyclopropane

285. H-present at the β-position of haloalkane takes part in elimination forming more substituted alkene.



$$CH_3-\underset{Br}{CH}-CH_2-CH_3 \xrightarrow[\text{KOH}]{\text{alcoholic}} \begin{array}{l}CH_2=CH-CH_2-CH_3\\ \quad But-1-ene\\ \\ CH_3-CH=CH-CH_3\\ But-2-ene\,(\,major product)\end{array}$$

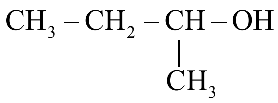
286. Zaitsev (Saytzeff) rule

In dehydrohalogenation / dehydration reactions the more substituted alkene (Less H. at $>C=C<$) is prefered.

Unit - XI

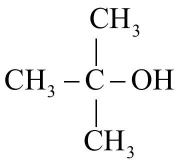
287. $CH_3-CH_2-CH_2-CH_2OH$ (1^0) Butan-1-ol

$CH_3-CH(CH_3)-CH_2OH$ (1^0) 2-methyl propan-1-ol



$$\underset{\displaystyle CH_3}{CH_3-CH_2-\underset{|}{CH}-OH}$$

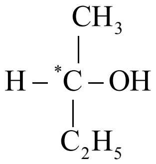
(2^0) Butan-2-ol



$$CH_3-\overset{\displaystyle CH_3}{\underset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-OH$$

(3^0) 2-Methyl propan-2-ol

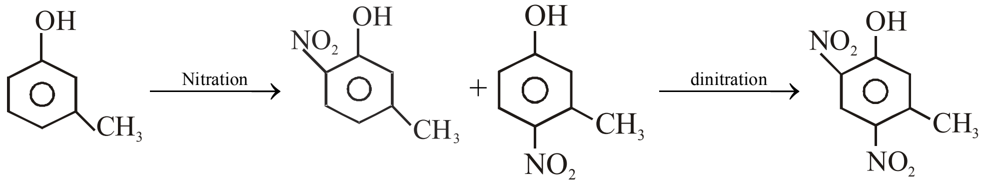
288.



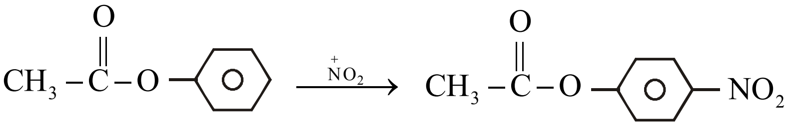
$$H-{}^{*}\overset{\displaystyle CH_3}{\underset{\displaystyle C_2H_5}{\overset{|}{\underset{|}{C}}}}-OH$$

Butan-2-Ol

289. (i)

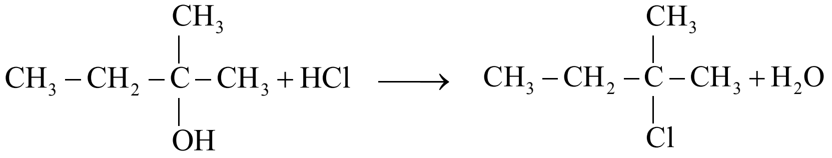


(ii)

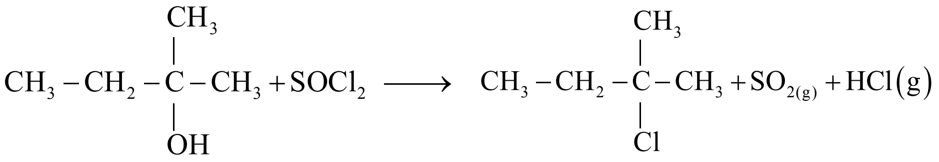


290. $CH_3-CH_2-CH_2-CH_2-OH+HCl\xrightarrow{ZnCl_2(Anhy.)}CH_3-CH_2-CH_2-CH_2-Cl+H_2O$

$CH_3-CH_2-CH_2-CH_2OH+SOCl_2\longrightarrow CH_3-CH_2-CH_2-CH_2Cl+SO_{2(g)}+HCl_{(g)}$

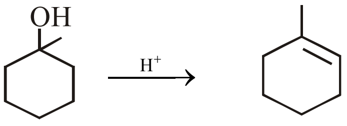


$$CH_3-CH_2-\overset{\displaystyle CH_3}{\underset{\displaystyle OH}{\overset{|}{\underset{|}{C}}}}-CH_3+HCl\longrightarrow CH_3-CH_2-\overset{\displaystyle CH_3}{\underset{\displaystyle Cl}{\overset{|}{\underset{|}{C}}}}-CH_3+H_2O$$



$$CH_3-CH_2-\overset{\displaystyle CH_3}{\underset{\displaystyle OH}{\overset{|}{\underset{|}{C}}}}-CH_3+SOCl_2\longrightarrow CH_3-CH_2-\overset{\displaystyle CH_3}{\underset{\displaystyle Cl}{\overset{|}{\underset{|}{C}}}}-CH_3+SO_{2(g)}+HCl(g)$$

291.

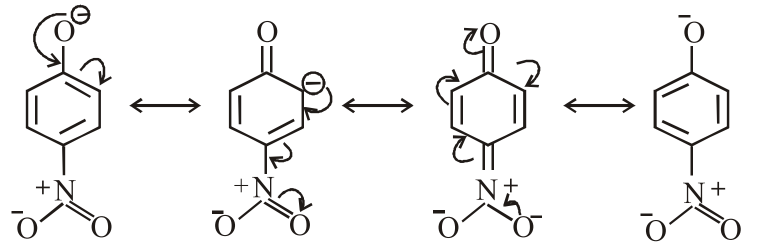


1-Methylcyclohexene

$$CH_3-CH_2-CH_2-CH_2OH\xrightarrow[-H_2O]{H^+}CH_3-CH_2-CH_2-\underset{(1^0)}{\overset{\oplus}{C}H_2}\xrightarrow{hydride\,shift}$$

$$\underset{(2^0)}{CH-CH_2-\overset{\oplus}{C}H-CH_3}\xrightarrow{major\,deprotonation}CH_5-CH=CH-CH_3$$

But – 2 – ene(major product)

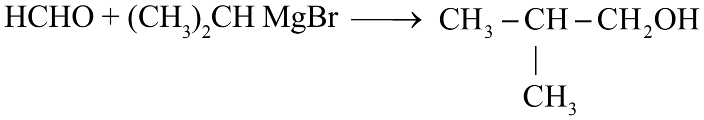
292. 

293. Propan-1-ol < 4-methylphenol < 3-nitrophenol < 3, 5-dinitrophenol < 2, 4, 6 - trinitrophenol.

294. (i) Methanol < ethanol < propan-1-ol < butan-2-ol < butan-2-ol < pentan-1-ol

(ii) n-butane < ethoxyethane < 3-methylbutan-1-ol < pentan-1-ol

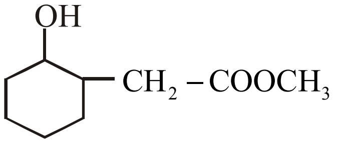
295. (i) 

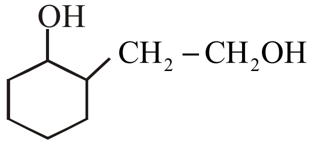
(ii) 

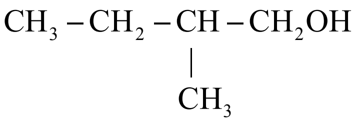
$$HCHO + (CH_3)_2CH\ MgBr \longrightarrow \underset{\displaystyle CH_3}{CH_3 - \underset{|}{CH} - CH_2OH}$$

(iii) $H - CHO + CH_3MgBr \longrightarrow CH_3CH_2OH$

296. (i) $CH_3 - CH(OH).CH_3$

(ii) 

(iii)  + CH_3OH [Na BH_4 fails to reduce ester, –COOH but $LiAlH_4$ can.]

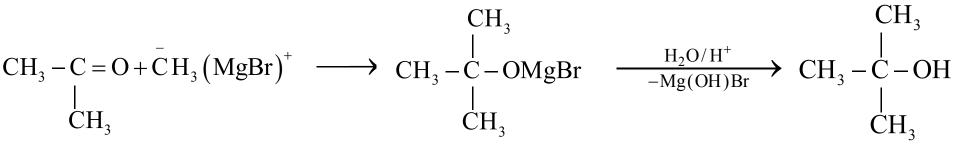
(iv) 

$$CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2OH$$

297. (i) $CH_3 - CO - CH_2 - CH_3 \xrightarrow[\Delta]{H_2/Ni} CH_3 - CH(OH) - CH_2 - CH_3$

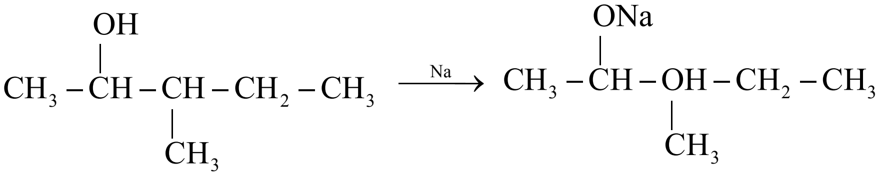
Butan-2-ol

(ii) $CH_3 - CH_2 - CH_2OH \xrightarrow[\Delta]{conc.H_2SO_4} CH_3 - CH = CH_2$, propene

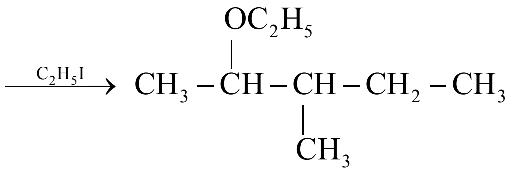
(iii) 

$$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{C}} = O + \bar{C}H_3(MgBr)^+ \longrightarrow CH_3 - \underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}} - OMgBr \xrightarrow[-Mg(OH)Br]{H_2O/H^+} CH_3 - \underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}} - OH$$

2-methylpropan-2-ol

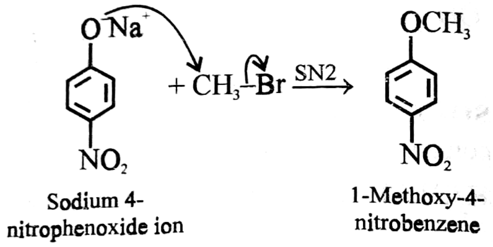
298. 

$$CH_3 - \overset{\displaystyle OH}{\overset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - CH_3 \xrightarrow{Na} CH_3 - \overset{\displaystyle ONa}{\overset{|}{CH}} - \underset{\displaystyle CH_3}{\underset{|}{OH}} - CH_2 - CH_3$$

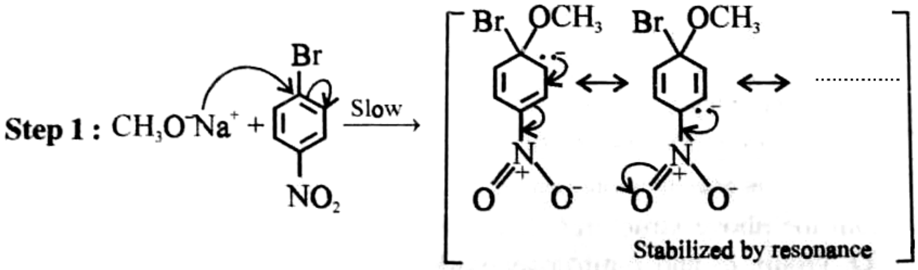


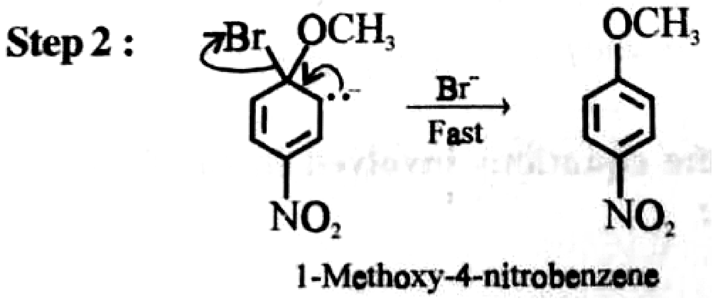
$$\xrightarrow{C_2H_5I} CH_3-\underset{}{\overset{OC_2H_5}{\overset{|}{C}H}}-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3$$

299. (i) Nucleophilic attack of 4-nitrophenoxide on methyl bromide gives the desired product.



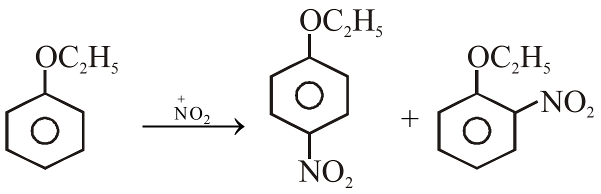
(ii)





300. (i) $CH_3-CH_2-CH_2-O-CH_3+HBr \xrightarrow{\Delta} CH_3-CH_2-CH_2-OH+CH_3Br$

(ii)



(iii) $C_6H_5-O-C_2H_5 \xrightarrow{HBr} C_6H_5-OH+C_2H_5Br$

(iv) $(CH_3)_3\,CI+C_2H_5I$ OH are the products.

(v) $C_6H_6CH_2I+C_6H_5OH$

301. p-nitrophenol > o-nitrophenol > m-nitrophenol

302. HI > HBr > HCl > HF

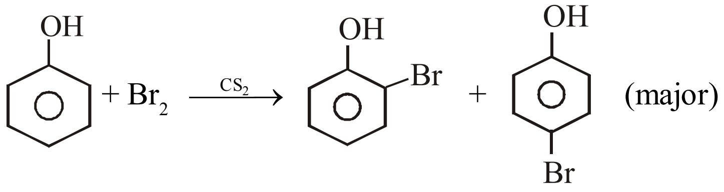
303. (i) acidified / alkaline $KMnO_4$ (or) acidified $K_2Cr_2O_7$
- (ii) Pyridinium chlorochromate (PCC) in CH_2Cl_2
- (iii) aqueous bromine
- (iv) Acidified (or) alkaline $KMnO_4$
- (v) Conc. H_2SO_4 at 413 K
- (vi) $H_2/Ni, \Delta$ or $NaBH_4$
- (vii) $NaBH_4$
- (viii) $LiAlH_4$
- (ix) HI / red P (x) Aq. NaOH / Δ (S_N-2 reaction)

304. $$\underset{\text{(acid)}}{C_6H_5OH} + Na(s) \longrightarrow C_6H_5ONa + \frac{1}{2}H_2\uparrow \text{ (Proton displacement)}$$

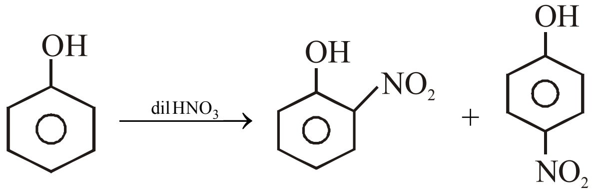
$$C_6H_5OH + NaOH(aq) \longrightarrow C_6H_5ONa + H_2O \text{ (Salt formation)}$$

305. (i)
$$2KMnO_4 + 2KOH \longrightarrow 2K_2MnO_4 + H_2O + O$$
$$\underline{CH_3-CH_2-CH_2OH + 2[O] \longrightarrow CH_3-CH_2-COOH + H_2O}$$

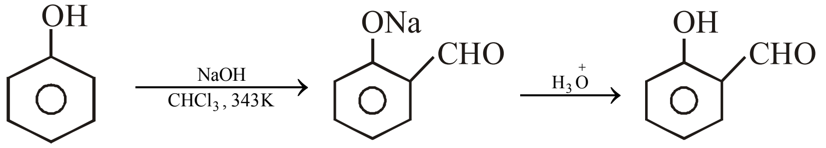
(ii)



(iii)

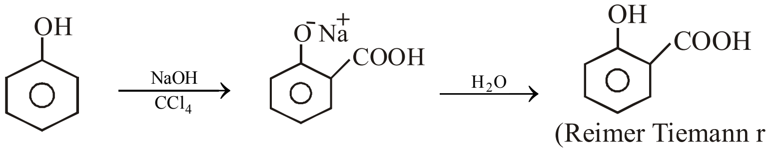


(iv)



(salicylaldehyde),

and



Salicylic acid.

(Reimer Tiemann reaction)

306. Phenol > m - cresol > p-cresol $\simeq$ o– cretol

pKa = 10.0, 10.1 10.17 10.316

307. The reactivity of alcohols in esterification follows in the order :

$$CH_3OH > CH_3 - CH_2OH > (CH_3)_2\,CHOH > (CH_3)_3\,(OH)$$

[It follows in the order of increasing acidic strength.]

308. 3^0-alcohol e.g. $(CH_3)_3C\,(OH)$

Unit - XII

309. Aetophenone is formed with some part of $C_6H_5 - CH_2 - CHO$
(It forms benzoic acid with alkaline $KMnO_4$)

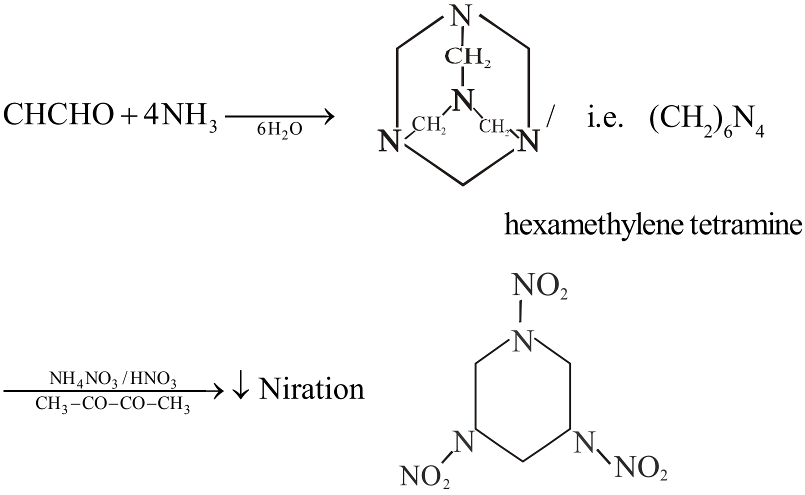
310. Ad_N eg.

$$>C = O + \overset{\ominus}{CN} \longrightarrow > \underset{\displaystyle CN}{\underset{|}{C}} - \bar{O}$$

In > C = 0, C– is short of e⁻ density due to presence of more electronegativity of 'O'.

311. First member of the aldehyde, HCHO is a gas at room temperatuare. The rest numbers of both aliphitic and aromatic are either colourless liquid or solid depending on alkyl or aryl group size. Incease of size increases vander Walls force changing the physical state. First member of ketone (acetone) is liquid at room temperature.

312. RDX. Research developed explosive (or) Royal demolition high explosive.

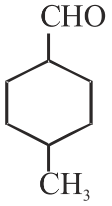


313. (T) two C_6H_5 groups due to their bulky size hinder the nucleophilic nucleophilic i.e. $\overline{S}O_3H$ attack.

314. 

$$CH_3 - \overset{\overset{\displaystyle CHO}{|}}{CH} - CH_2 - \overset{\overset{\displaystyle O}{||}}{C} - CH_3\,,$$

2-methyl-4-oxopentanal

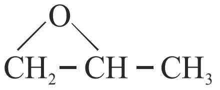
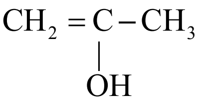


4-methylcyclohexane carbaldehyde

315. C_3H_6O : Functional isomers

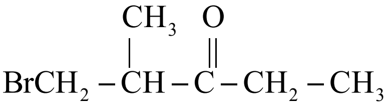
$CH_3CH_2CHO,\ CH_3COCH_3$

Cyclopropanol. propanal Propanone

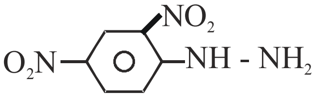
$CH_2=\underset{\underset{OH}{|}}{C}-CH_3$ Prop-1-en-2-ol, etc.

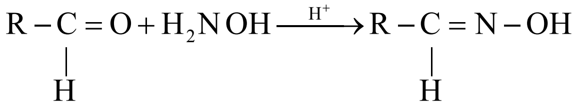
1, 2, – epoxypropane , $CH_2 = CH - OCH_3$ Methoxyethene

316. 

$BrCH_2-\overset{\overset{CH_3}{|}}{CH}-\overset{\overset{O}{||}}{C}-CH_2-CH_3$

317. Tollen's reagent, ammoniacal $AgNO_3$, $[Ag(NH_3)_2](OH)$
Fehling solution. alkaline $CuSO_4$ solution i.e.
(A) $CuSO_4$ solution
(B) Sodium potassium tartarate (Aq)
Brady's reagent : 2, 4-dinitro phenyl hydrazine.

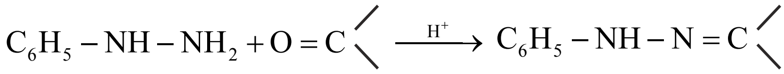


318. (a) Oxime: 

$R-\underset{\underset{H}{|}}{C}=O+H_2NOH\xrightarrow{H^+}R-\underset{\underset{H}{|}}{C}=N-OH$

(aldoxime)

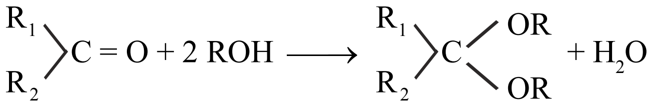
(b) hydrazone : $>C=O+H_2NNH_2\xrightarrow[-H_2O]{H^+}>C=N-NH_2$
hydrazine – hydrazone

(c) 

$C_6H_5-NH-NH_2+O=C\Big< \xrightarrow{H^+} C_6H_5-NH-N=C\Big<$

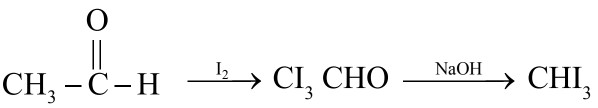
Phenylhydrazine

– phenyl hydrazone

(d) Ketal 

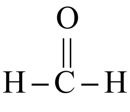
$\begin{matrix}R_1\\R_2\end{matrix}\Big>C=O+2\,ROH\longrightarrow\begin{matrix}R_1\\R_2\end{matrix}\Big>C\Big<\begin{matrix}OR\\OR\end{matrix}+H_2O$

319. $CH_3-CH_3<CH_3-OCH_3<CH_3CHO<C_2H_5OH$

320. 

$CH_3-\overset{\overset{O}{||}}{C}-H\xrightarrow{I_2}CI_3\,CHO\xrightarrow{NaOH}CHI_3$

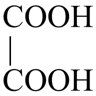
ethanal

321.  $H-\overset{\overset{O}{||}}{C}-H$ does not have $\alpha-C$ atom / no $\alpha-C$-H-atom.

322. HCHO, C_6H_5CHO, Cl_3CCHO (chloral)

323. $CH_3COCH_3<CH_3CHO<HCHO$ (crowding effect)

324. H COOH – Methanoic acid



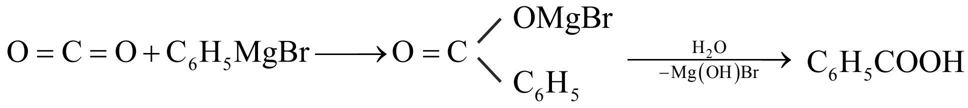
$\begin{matrix}COOH\\|\\COOH\end{matrix}$ – Ethanedioic acid

325. Carboxyl acid is formed

$$RCN + 2H_2O \xrightarrow[\Delta]{H^+} RCOOH + NH_4^+$$

326. $CH_3COOH \xrightarrow{NH_3} CH_3COONH_4 \xrightarrow[-H_2O]{\Delta} CH_3CONH_2$

327. Phenylmagnesium bromide.



$$O=C=O + C_6H_5MgBr \longrightarrow O=C\begin{smallmatrix} \diagup OMgBr \\ \diagdown C_6H_5 \end{smallmatrix} \xrightarrow[-Mg(OH)Br]{H_2O} C_6H_5COOH$$

328. Benzoic acid with PCl_5 / $SOCl_2$ gives benzoyl chloride.

$$C_6H_5COOH + PCl_5 \longrightarrow C_6H_5COCl + POCl_3 + HCl$$

$$C_6H_5COOH + SOCl_2 \longrightarrow C_6H_5COCl + SO_2 \uparrow + HCl \uparrow$$

329. (i) $CH_3COOH < HCOOH < ClCH_2COOH$

(ii) $(CH_3)_3CCOOH < (CH_3)_2CHCOOH < CH_3OOH$

[+I effect decreases acidic strength]

(iii) $Cl\,CH_2COOH < Cl_2CH\,COOH < CCl_3\,COOH$

[–I effect increases acidic strength]

(iv) $(CH_3)_2CHCOOH < CH_3CH_2COOH < CH_3COOH < ClCH_2-CH_2-COOH < ClCH_2COOH$

330. (i) $RCO \wr OH$ (ii) $RCOO \wr H$ (iii) $RCO \wr OH$ (iv) $RCO \wr OH$

331. $C_3H_8 < CH_3CHO < C_2H_5OH < CH_3COOH$

332. CH_3COOH is more soluble in water than benzoic acid.

333. $CH_3COOH < C_6H_5COOH < HCOOH < Cl_3C\,COOH$

334. Na BH_4

335. $CH_3CO\,COOH$, Pyrovic acid; $HOOC-CH_2-CH_2-COOH$ Succinic acid.

336. (i) o-nitrobenzoic acid > p-nitrobenzoicd > m-nitrobenzoicacid > benzoic acid

(ii) o-Toluic and > Benzoic acid > m-Toluic acid > p-toluic acid.

(iii) o-chlorobenzoic acid > m-chlorobenzoic acid > p-chlorobenzoic acid > benzoic acid

(iv) $HCOOH > CH_3COOH > C_2H_5\,COOH > C_3H_7COOH$

(v) o-hydroxy benzoic acid > m-hydroxy benzoic acid > benzoic acid > p-hydroxy benzoic acid.

337. oil of bitter almond : C_6H_5–CHO (Benzaldehdye)

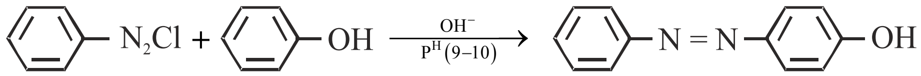
Unit – XIII

338. Balz - Schiemann reaction.

$$Ar\overset{+}{N_2}Cl^- \xrightarrow{HBF_4} Ar\,N_2-BF_5 \xrightarrow[-BF_3-N_2]{\Delta} Ar\,F$$

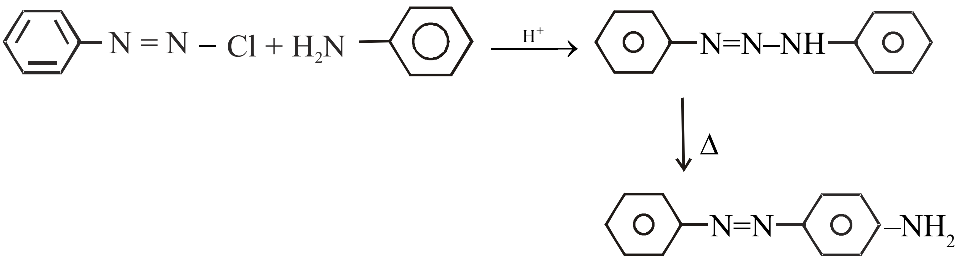
339. HBF_4 and $NaNO_2$ – Cu powder.

$$ArN_2Cl \xrightarrow{HBF_4} ArN_2BF_4 \xrightarrow[\text{Cu power}]{NaNO_2} Ar-NO_2\left(+BF_3+N_2\right)$$

340. 

Electron delocalisation is favourable in making the compound more stable. (Conjugated system).

341. With phenol is alkaline medium (pH, 9–10) with (1^0 and 2^0) aromatic amine in weakly acidic medium (pH, 4-5) to form azodye. Hydrogen atom of amine group $\left(-NH_2\left(1^0\right) \text{or} - NH-R\left(2^0\right)\right)$ is replaced.

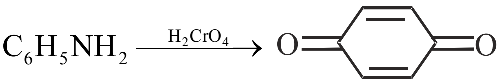


p-aminoazobenzene

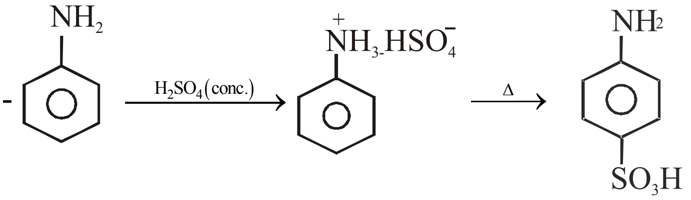
342. $C_6H_5N_2Cl + KI \longrightarrow C_6H_5I + N_2 + KCl$

343. (i) $(CH_3)_2NH < C_2H_5NH_2 < C_2H_5OH$; (ii) $C_6H_5NH_2 < (C_2H_5)_2NH < C_2H_5NH_2$

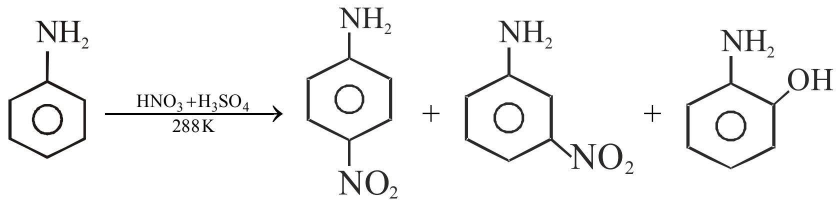
344. $C_6H_5NH_2 \xrightarrow[0^0C]{NaNO_2+HCl} C_6H_5N_2Cl \xrightarrow{CuCN} C_6H_5CN \xrightarrow[\Delta]{H_3\overset{+}{O}} C_6H_5COOH$

345.  (benzoquinone)

346. $C_6H_5CH_2NH_2$ (Benzyl amine)

347. (i) Sulfolation - 

(Sulfanilic acid)

(ii) Nitration 

(minor product)

m-nitro(47%) aniline is obtained due to protonation of $-NH_2$ and becomes m-directing as $\overset{+}{N}H_3$ is a deactivating group.

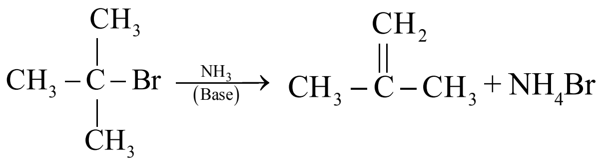
348. $CH_3CH_2NC + 2H_2O \xrightarrow{H^+} CH_3-CH_2-NH_2 + HCOOH$

349. $CH_3CH_2CN \xrightarrow{LiAlH_4} CH_3-CH_2-CH_2NH_2$ (1^0 amine)

$CH_3CH_2NC \xrightarrow{4H} CH_5CH_2NH-CH_3$ (2^0 amine)

isocyanide

(Then 1^0 and 2^0 amines to be distinguished by carbylamine text.

350. 

$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-Br \xrightarrow[(Base)]{NH_3} CH_3-\overset{CH_2}{\overset{\|}{C}}-CH_3+NH_4Br$$

351. $C_6H_5\overset{+}{N}(CH_3)_3 < C_6H_5CH_3 < C_6H_5N(CH_3)_2$

352. alkaline chloroform.

$$C_6H_5NH_2+3KOH+CHCl_3 \xrightarrow{warm} C_6H_5NC+3KCl+3H_2O$$

unpleasant smell.

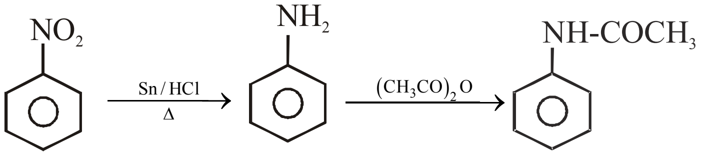
353. $C_6H_5COOH \xrightarrow[ii)\ \Delta]{i)\ NH_3} C_6H_5CONH_2 \xrightarrow{Br_2/KOH} C_6H_5NH_2$

Hoffmann degradation

354. $C_6H_5N_2Cl \xrightarrow[+HCl/\Delta]{Copper\ powder} C_6H_5-Cl+N_2$

355. Due to release of large volume of gases like N_2 H_2 and CO_2.

356. $(C_2H_5)_2NH > C_2H_5NH_2 > C_6H_5CH_2NH_2 > NH_3 > C_6H_5NH_2$

357. 

Unit - XV

358. Macromolecule : It may or may not contain monomer units e.g. chlorophyll ($C_{55}H_{72}O_5N_4Mg$) is a macromolecule but not a polymer, as it does not contain monomer. Thus all polymers are macromoelcules while all macromolecules may not be polymers.

359. Linear chain polymer. PVC
Branched chain polymer: starch
Crossed chain polymer : Bakelite

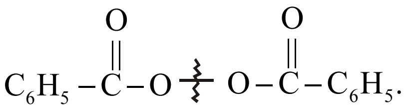
360. i) Buna S < polythene < Nylon - 66
ii) Neoprene < PVC < Nylon - 6

361. Buna -N : Co-polymer of butadiene and acrylonitrile
Buna - S : Copolymer of butadiene and styrene

362. Uses of Buna-N i) Making oil seals as this is resistant to lubricating oil, organic solvents
ii) For lining in tanks, making conveyor belt.

363. Monomers Nylon-2-nylon-6 (biodegradable polyemer)
glycine ($H_2N–CH_2–COOH$) and amino caproic acid $NH_2-(CH_2)_5\,COOH$.

364. It is a homopolymer of  $H_2N-\underset{R}{\underset{|}{CH}}-COOH$ (monomer)

365. Benzoyl peroxide 

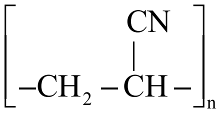
$C_6H_5-\overset{\overset{O}{\|}}{C}-O \nmid O-\overset{\overset{O}{\|}}{C}-C_6H_5.$

(Phenyl radical, chain initiator)

366. Elastomers < Plastic < Fibers
Buna S, Neoprene Polythene (Nylon-6, Nylon 6, 6)

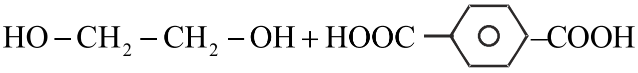
367. $H_2N-(CH_2)_6-NH_2$ (hexamethylene diamine)

$HOOC-(CH_2)_4-COOH$ (Adipic acid)

368. Chain growth (addition polymer) 

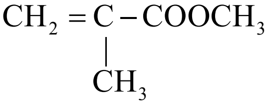
$\left[-CH_2-\underset{|}{\overset{CN}{CH}}-\right]_n$ Polyacrylonitrile (PAN)

Step growth (condensation polymer)
Loss of molecules taking place on condensation of monomers

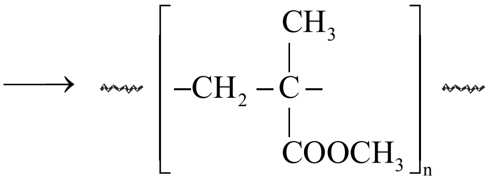
e.g. polyester, (Dacron/terylene) 

Terephthalic acid

369. PMMA (Polymethyl methacrylate)

monomer : methyl methacrylate : 

$CH_2=\underset{\underset{CH_3}{|}}{C}-COOCH_3$



$\longrightarrow \sim\left[-CH_2-\underset{\underset{COOCH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-\right]_n\sim$

(Addition polymer)

370. Inhibitor of free radical polymerisation :
Reagents such as hydro quinone and nitrosoamine

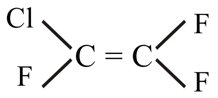
371. Chain initiation $C_6H_5CO-O \longrightarrow C_6H_5^{\cdot}+CO_2$
$(I^{\cdot})$

Chain propagation. $I\bullet+CH_2=CH_2 \longrightarrow I-CH_2-CH_2\bullet \xrightarrow{CH_2=CH_2}$

$I-CH_2-CH_2-CH_2-CH_2^{\cdot}\ldots\ldots\ldots \rightarrow I(CH_2-CH_2)_n CH_2-\dot{C}H_2$

Chain Termination. $2\left[I-(CH_2-CH_2)_n-CH_2-\dot{C}H_2\right]$

$\rightarrow I(CH_2-CH_2)_n CH_2-CH_2-CH_2-CH_2(CH_2-CH_2)_n I$

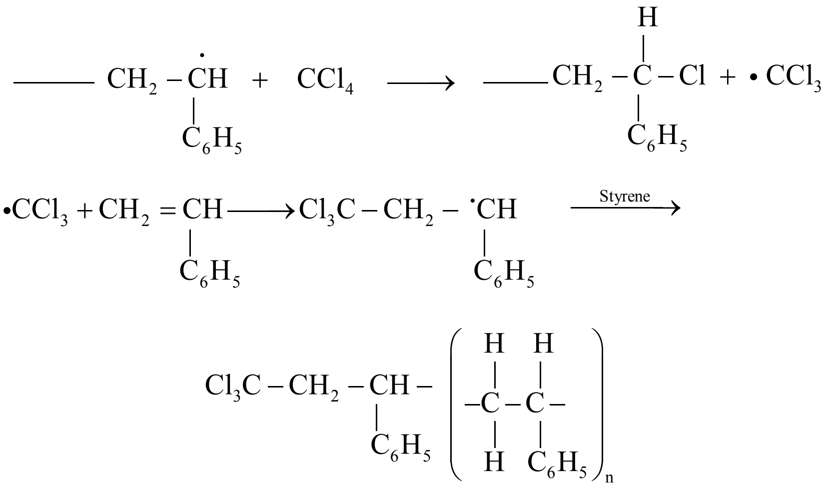
372. PAN polyacrylonitrile (Orlon)
PT FE polytetra fluoroethene (Teflon)
PCTFE polychlorotri fluoroethylene 

PVC polyvinylchloride.

PHBV Poly β hydroxybutyrate - Co- β -hydroxy valerate)

373. The pressure of any other molecule (impurity) during free radical polymerisation can act as chain initiator or inhibitor which will interfere normal polymerisation reaction.

374. CCl_4 as chain transfer agent : The mode of polymerisation in presence of CCl_4 during the polymerisation of styrene.



$$—CH_2-\underset{C_6H_5}{\overset{\bullet}{CH}} + CCl_4 \longrightarrow —CH_2-\underset{C_6H_5}{\overset{H}{C}}-Cl + \bullet CCl_3$$

$$\bullet CCl_3 + CH_2=\underset{C_6H_5}{CH} \longrightarrow Cl_3C-CH_2-\underset{C_6H_5}{\overset{\bullet}{CH}} \xrightarrow{\text{Styrene}}$$

$$Cl_3C-CH_2-\underset{C_6H_5}{CH}-\left(-\underset{H}{\overset{H}{C}}-\underset{C_6H_5}{\overset{H}{C}}-\right)_n$$

This inhibits polymerisation forming lower average mol. mass polymer.

Phenols, quinone, amines etc. promote inhibition.

375.
- HDP (High density polythene) e.g. polymerisation of ethylene in presence of Zeigler Natta catalyst at high temperature and pressure (6–7 atoms) where closely packed linear chains are formed. Therefore called high density polymer.
- LDP (low density polythene)

$$n(CH_2=CH_2)\xrightarrow{\text{temp.375–570K, 1000 to 2000 atm.}}\underset{\text{Polyethene}}{(-CH_2-CH_2-)_n}$$

It consists of branched chain molecules preventing quite close packing and density becomes low with low tensile strength

376. Melamine - formaldehyde polymer (very hard and tough)

Unit - XVI

377. Antibiotic : pencillin, Tetacyclin Analgesic : Aspirin, paracetamol, morphine.

Antiseptic : Mercurochrome, Tinctureiodine Antipyretic : Aspirin, paracetamol

Tranquiliser : Equanil, meprobamate. Antimicrobial : antibacterial antifungal, antiviral

Antacid : $Mg(OH)_2$, $Al(OH)_3$ Antihistamine : Ranitidine, Terfenadine

378. Ranitidine

379. Broad spectrum antibiotic.

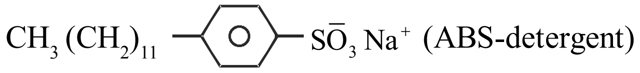
380. 0.2% phenol as antiseptic, 1% aq. solutions disinfectant

381. 2.3% solution iodine in water and alcohol. Used as antiseptic onwards

382. Cationic detergent : cetyltrimethyl ammonium bromide

$$\left[CH_3(CH_2)_{15}-N(CH_3)_3\right]^+ Br^-$$

Anionic detergent : Sodium dodecylbenzene sulfonate.


(ABS-detergent)

383. Biodegradable detergent : (Unbranched chain can easily be bio-degraded).

Sodium laurylsulfate. $CH_3(CH_2)_{10} - CH_2 - O - S\bar{O}_3 Na^+$ (Linear alkylsulfate)

384. Antimicrobial : The drug which are used to cure diseases caused by bacteria, fungi and viruses are called antimicrobal. eg. Erythromycin, tetracyclin, chloramphenecol.

385. Tranquilizer.

386. It is used in diagnosis, prevention & treatment of diseases.

387. Potassium salt of long chain fatty acids like oleic, palmitic and stearic acid.

388. Antacid, antihistamine

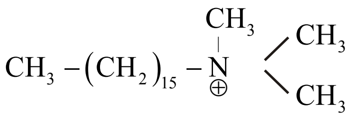
389. Tranquilizer

390. Tranquilizer to releive depression, hypertension.

391. It is an antimicrobial agent to treat disease called Syphills (Arsenic present – As – As – in its composition)

392. Bithional acts as an antiseptic agent.

393. $CH_3(CH_2)_{10} - CH_2^- OS\bar{O}_3 \quad Na^+$


$$CH_3-(CH_2)_{15}-\overset{\oplus}{N}(CH_3)_3 \quad Br^-$$

(nonpolar)hydrophobic hydrophilic (polar) Hydrophobic hydrophilic

394. Fillers are added to laundry soaps : Fillers are added to change the properties of soap in order to make them more useful.

e.g. Sodium rosinate, sodium silicate, borax and sodium carbonate are added to laundry soaps to increase their lather forming ability.

**

Unit-XIV

395. Monosaccherides are simple carbohydrates containing 3 to 7 C-atoms which cann't be hydrolysed into still simple compounds. e.g. glucose, (aldose) frutose (ketose).

396. (i) Cell walls of plants are made up of cellulose.

(ii) In the form of starch, carbohydrates act as storage molecules in plants.

397. RNA. Adenine (A), Guanine (G), Cytosine(C) Uracil (U)

DNA. Adenine (A), Guanine(G), Cytosine(C) Thymine(T) (AGCT)

398. The elements generally present in aminoacids are C, H, O, N.S present in methionine and cysteine

399. Sucrose $\xrightarrow{\text{hydrolysis}}$ glucose + fructose

Lactose $\xrightarrow{\text{hydrolysis}}$ β.D. Galactose + 2.D. Glucose

400. Carbohydrates used as biofuel. Starch and glycogen.

401. This in an inherited disease caused by a defect in a gene. It occcurs if two genes are inherited - one from father & one from mother. A person who inherits just one gene is healthy & said to be a 'Carrier' of the disease.

402. Excess glucose is stored in liver as glycogen.

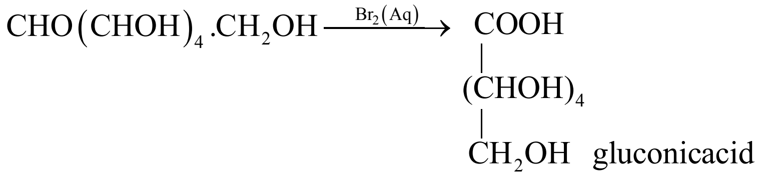
403. Zwitterion is a molecule that contains both positively and negatively charged functional groups, with net charge zero.

e.g. $$\underset{\text{glycine}}{H_2N-CH_2-COOH} \rightleftharpoons \underset{\text{Zwitter (dipolar) ion}}{\overset{+}{N}H_3-CH_2-COO^-}$$

404. Monosaccharides : Ribose, 2-deoxyribose, galactose, fructose

Disaccharides : Maltose, Lactose

405.



$$CHO(CHOH)_4.CH_2OH \xrightarrow{Br_2(Aq)} \begin{array}{l} COOH \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} \text{ gluconicacid}$$

$$OHC-(CHOH)_4-CH_2OH \xrightarrow[\text{red(P)}]{HI} CH_3-(CH_2)_4-CH_3,\ n-\text{hexane}$$

$$\downarrow HNO_3$$

$$HOOO-(CHOH)_4-COOH \text{ (glucaric acid)}$$

406. The aminoacids synthesized in the body are called nonessential aminoacids. e.g. Gly, Ala etc.

The amino acids which cannot be synthesised in the body & must be obtained from diet are known as essential aminoacids.

eg. Valine (Val), Leucine

407. Vitamins : These are organic compounds which are essential nutrient that body may need to get from food. The deficiency causes specific diseases. Plant can synthesise almost all type of vitamins.

Fat soluble vitamins are A, D, E and K

408. RNA molecules are three types & they perform different fucntions.

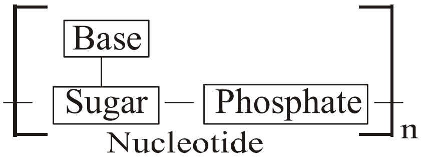
(i) Messanger RNA (m-RNA) : This carries genetic information from template of DNA chain to protein site.

(ii) Transfer RNA (t-RNA) : This is the smallest of all RNAs, single stranded and occur free in cytoplasm of the cell, one for each amino acid of the protein.

(iii) Ribosomal RNA (r-RNA) : This is present in ribosome and constitute 80% of total RNA. It helps in protein synthesis and carries no message to DNA.

409. Nucleoside : It consists of two components : pentose sugar-N. containing heterocyclic base.

Nucleotide : A monomeric unit of nucleic acid consists of phosphoric acid unit and nucleoside.



410.

Deficiency of Vitamins		**Disease caused**
A (Retinol)	–	right blindness, Xerosis (dryskin) Xerophthalamia (Cornea comes opaque)
B_1 (Thiamine)	–	Loss of appetite, Beriberi
B_2 (Riboflavin)	–	Skin diseases, sore tongue, anaemia
B_6 (Pyridoxine)	–	nervous disturbance, convulsions
B_{12} (Cyanocobalamine)	–	form anaemia
C (Ascorbic acid)	_	Scurvy and pain in joints
D. (Calciferols)	_	rickets
E. (α-Tocopherol)	_	Sterility in M and F, muscular weakness,
K. (Phytonadione)	_	Problem in coagulation of blood

411. The possible sequence of the amino acids in tripeptide is :

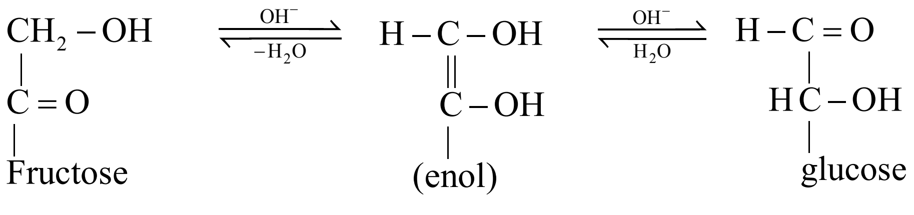
(i) Gly. Ala-Phe (ii) Gly-Phe-Ala (iii) Ala-Gly-Phe (iv) Ala-Phe-Gly

(v) Phe-Gly-Ala, Where Gly-glycine, Ala-Alamine, Phe-Phenylalamine

412. Sources of Vit. A : egg, cod liver oil (carrot, tomatoes, ripe mangoes)

413. Ribosomes are the sites in a cell is which protein synthesis takes place.

414. When fructose is treated with ammoniacal silver nitrate, fructose is converted into enolic form which exists in equilibrium with glucose and hence reduces Tollen's reagent forming silver mirror.



415. Vit. D- on exposure to sunlight.

Vit. K - by bacteria living in gut.

❖ ❖ ❖

Group - B

Short Answer type (2/3 mark each) :

Answer the following :

Unit - I

1. Crystalline solids are anisotropic in nature. What does this statement mean ?
2. What is radius ratio ?
3. Why does the window glasses of the old buildings look milky ?
4. Gold (atomic radius = 0.144 nm) crystallizes in a face centred unit cell. What is the length of a side of the cell ?
5. Why is Frenkel defect not found in pure alkali metal halides ? Explain.
6. Zinc oxide is white but it turns yellow on heating. Explain.
7. Why does presence of excess of lithium makes Li crystals pink ?
8. What are the important consequences of Schottky and Frenkel defects in crystals ?
9. What change occurs when AgCl is doped with $CdCl_2$? Explain.
10. Give important differences between crystalline and amorphous solids.
11. Give the points of differences between Schottky defect and Frenkel defect ?
12. Determine the atomic mass of an unknown metal if you are given the mass, density and dimension of the unit cell of its crystal.
13. Discuss what are unit cells.
14. What is the formula of a compound in which the element 'Y' forms CCP lattice and atoms of 'X' occupy $^1/_3$ of the tetrahedral voids ?
15. The compound CuCl (formula mass = 99 gram / mol has FCC structure like ZnS. Its density is 3.4 gram/cm^3. What is the volume of unit cell ? $\left(N_A = 6.023\times10^{23}\text{mol}^{-1}\right)$
16. An element with density 10 gram / cm^3 forms a cubic cell with edge length 3×10^{-8} cm. What is the nature of cubic unit cell if atomic mass of the element is 81 g/mol ?
17. Gold (atomic radius = 0.144 nm) crystallises in face centred unit cell. What is the edge length ?
18. Why is Frankel defect not occurred in pure alkali metal halide ?
19. Why does presence of excess of Lithium makes LiCl crystal pink ?
20. What are the important consequences of Schottky and Frenkel defect in crystals ?
21. Examine the featues of the defective crystal :

$$\begin{array}{ccccc} x^+ & y^- & x^+ & y^- & x^+ \\ y^- & \square & y^- & x^+ & y^- \\ x^+ & y^- & x^+ & \square & x^+ \\ y^- & x^+ & y^- & x^+ & y^- \end{array}$$

Answer the following :

i) Is it a stoichiometric defect ?

ii) What is name of such defect ?

iii) Name two compounds showing such defect.

iv) How does this defect affect the density of the crystal ?

22. What type of defect when a solid is heated ? Which physical property is affected by it ?

23. Why is non-stoichiometric sodium chloride yellow ?

24. What do you mean by interstitial voids ? Discuss the different types of voids.

25. Compare the characteristics of ionic and metallic crystals.

26. Discuss Rock salt (NaCl) type structure.

27. An element crysallices in a strucure having fcc unit cell of an edge 200 pm. Calculate the density if 400 gram of this element contains 48×10^{23} atoms.

UNIT - II

28. How is equivalent mass of $K_2Cr_2O_7$ related to molar mass in acidic medium ?

29. What is vapour pressure ?

30. Identity any two factors affecting vapour pressure.

31. What is standard solution ?

32. Why ether has lower b.p than alcohol ?

33. What is the effect of pressure on the b.p. of the liquid ?

34. Identity two factors affecting solubility of solid in liquid.

35. What is the relationship between depression in freezing point of a solution and molecular mass solute ?

36. Why is CCl_4 immiscible in water ?

37. When does a liquid start boiling ?

38. Why is vapour pressure of solution is lower than that of pure solvent ?

39. What is the molality of 10% (wt.) urea solution ?

40. Show that total vapour pressure for a solution of volatile liquids is linearly related with molefraction of the solute.

41. Vapour pressure of chloroform and dichloromethane at 298 K are 200 mm Hg and 415 mm Hg respectively calculate the vapour pressure of the solution prepared by mixing 25.5 g of $CHCl_3$ and 40 gram of CH_2Cl_2 at 298 K.

42. Express the composition of the vapour phase in molefraction in the above solution.

43. Between $CHCl_3$ and CH_2Cl_2 which one is more volatile.

44. A solution of acetone and chloroform causes negative deviation. What type of azeotrope does it constitute?

45. 18 gram of glucose (180 gram / mol) dissolved is 1 kg of water. At what temperature will water boil at 1.013 bar ? (K_b for water is 0.52 K kg mol^{-1}.)

46. 1.0 gram of a non-volatile solute in 50 g. of benzene lowered the freezing point of benzene by 0.40 K. K_f for benzene is 5.12 K. kg mol^{-1}. Find the molar mass of solute.

47. What is reverse osmosis ?

48. Vapour pressure of pure water at 298 K is 23.8 mm Hg 50 g of urea (mol-mass 60 g/mole) is dissolved in 850 g of water. Calculate the vapour pressure of water for this solution and its relative lowering.

49. 200 cc. of an equeous solution of a protein contains 1.26 g. of protein. The osmotic pressure of such a solution at 300 K is found to be 2.57×10^{-3} bar. Calculate the molar mass of the protein.

50. Calculate the pressure in pascals exerted by a solution prepared by dissolving 1.0 gram of polymer of molar mass 185000 in 450 ml of water at 37^0C.

51. Mention any two applications of Henry's law.

52. H_2S, a toxic gas with rotten egg like smell is used for qualitative analysis. If the solubility of H_2S in water at STP is 0.195m. Calculate Henry's law constant.

53. Justify that relative lowering in vapour pressure is a colligative properly.

54. What type of deviation from an ideal solution will be shown by solution of cyclohexane and ethanol ?

55. (i) The freezing point of water is reduced on adding solute to it.

    (ii) Show that depression of freezing point, ΔT_f is a colligative property.

56. Why is sometimes abnormal molecular mass of the substance observed by using collogative properties of the solution ?

57. Discuss the significance of K_H.

58. Henry's law constant for CO_2 in water is 1.67×10^8 Pa at 298 K. Calculate the quantity of CO_2 in 500 ml of soda-water when packed under 2.5 atm pressure of CO_2 at that temperature.

59. Define the following terms :

    (i) ideal solution (ii) Azeotrope (iii) Osmotic pressure

60. Why salt is sprinkled on road during winter in cold region ?

61. Match the following :

(a)	Solubility of gas	(i)	Non-ideal solution
(b)	Liquid - Liquid solution	(ii)	Henry's law
(c)	Positive deviation	(iii)	Raoult's law
(d)	Desali nation	(iv)	Heterogeneous
		(v)	Reverse osmosis

62. The vapour pressure of an aqueous solution of glucose is 750 mm of mercury at 100^0C. Calculate the molality and mole fraction of solute.

UNIT - III

63. What is the difference between electrochemical and electrolytic cell ?

64. Relate cell potential with electrode potential with example.

65. How does electro-chemical series predict the feasibility of redox reaction ?

66. What is the function of a salt bridge ?

67. Design a cell without use of salt bridge.

68. What is the relation between standard EMF and equilibrium constant.

69. Write down Nernst equation for-

(i) $Fe^{3+}_{(C_1)} + 2e \longrightarrow Fe$

(ii) $Zn + 2Ag^{+}(C_1) \longrightarrow Zn^{2+}(C_2) + 2Ag$

($Zn–AgNO_3$ – Cell)

70. The molar conductance of a solution of $AlCl_3$ is found to 130 $Ohm^{-1}\ cm^2\ mol^{-1}$ at 298 K. Calculate the equivalent conductance.

71. Distiguish between strong electrolytes & weak electrolytes.

72. Define specific conductance, equivalent cnductance and molar conductance.

73. Predict the electrolytic product of

(i) fused NaCl

(ii) NaCl (Aq)

(iii) $CuSO_4(Aq)$ taking Pt. electrodes

(iv) $CuSO_4(Aq)$ taking copper electrodes.

(v) $AgNO_3$ taking Ag electrodes

(vi) $AgNO_3$ taking Pt-electrodes

(vii) Acidulated water taking Pt-electrode.

74. What is the difference between chemical equivalent and electrochemical equivalent ? Explain taking silver example.

75. Explain i) Blue colour of copper sulfate solution is discharged by dipping iron rod in it.

ii) The pH of aqueous of NaCl increases on electrolysis.

76. (i) How much electricity is required in Faraday for oxidation of mole (i) H_2O_2 to O_2?

(ii) 1 mole of FeO to Fe_2O_3

77. (i) Silvre nitrate solution can not be stored in a copper vessel.

(ii) Zinc sulphate solution can be stored in Cu-vessel. ______ explain.

78. What is difference between electrode potential and cell potential ?

79. What is electroplating ?

80. What are main difference between emf of cell and potential difference ?

81. Write down the notations representing cathode, anode and galvanic cell.

82. What are reference electrodes ? What is the electrode potential ?

83. Calculate the time required for a current of 2 amp. to decompose one gram mole of water

84. Write down Nerst equation. How is it useful ?

85. What is a dry cell ?

86. Calculate the Zn-Zn^{2+} electrode in which $[Zn^{2+}] = 0.001\,M,\ E_{Zn^{2+}|Zn} = -0.76V.$

87. Specific conductance of a 0.1 N solution of electrolyte is $2.4 \times 10^{-2}\ ohm^{-1}\ cm^{-1}$. Calculate its equivalent conductance.

88. An electronic current is passed through two solutions (a) $AgNO_3$ (b) solution of 10 gram of blue vitrol 500 ml water using Pt. electrode separately. After 30 minutes it was found that 1.307 gram Ag was deposited. What is the concentration of Cu^{2+} after electrolysis ?

89. A current of 1.7 amp. is passed thrpugh 300 ml of 0.16 M $ZnSO_4$ solution for 230 seconds with current efficiency of 90%. Find the concentration of divalent zinc in solution.

90. $E_{N_i^{2+}|Ni} = -0.236$. If this electrode is coupled with hydrogen electrode, the emf of cell becomes zero. Calculate pH the acid used in the electrode.

91. Calculate the quantity of elecricity needed to quantitatively decolourise the blue colour of copper sulfate 100 ml 0.01M solution.

92. E^0_{values} for $Fe^{3+} + 3e^- \rightarrow Fe$ and $Fe^{2+} + 2e^- \rightarrow Fe$ are –0.036 V and -0.44 V respectively. Calculate the ΔG^0 value for the reaction. $Fe + 2Fe^{3+} \rightarrow 3Fe^{2+}$.

93. Calculate the cell potential of–

$$Fe(s)\left|Fe^{2+}(0.001M)\right|\left|H^+(1M)\right|H_2(1\,atm), Pt \quad E^0_{cell} = 0.44\,V.$$

94. Calculate the log K_c of the reaction –

$$NiO_2 + 2Cl^- + 4H^+ \rightleftharpoons Cl_2 + Ni^{2+} + 2H_2O \text{ at 298 K if } E^0_{Cell} \text{ is 0.320 V.}$$

95. The resistance of conductivity cell containing 0.001 M KCl solution at 298 K is 1500 ohm. What is the cell constant if conductivity of 0.001 M KCl solution is 0.146×10^{-3} ohm^{-1} cm^{-1}? Calculate its molar conductance.

96. How would you determine $E^0_{Mg^{2+}|M}$?

97. The conductivity of 0.001028 M acetic acid is $4.95 \times 10^{-5} S\,cm^{-1}$. Calculate the Ka value if $\Lambda^0_m = 390.5\,S\,Cm^2 mole^{-1}$.

98. Predict the products on electrolysis of dil H_2SO_4 taking Pt-electrodes.

99. What happens to the pH value of copper sulfate solution on electrolysis ?

100. Calculate the standard cell potential of Zn-$AgNO_3$ cell.

101. Show that copper has +ve value of electrode potential while zinc has negative.

102. What current strength (amp./ sec) in amp. will be required to liberate 10g of iodine from KI (Aq).

(Atomic mass of iodine = 127)

(or) Calculate the current strength required to deposit 10 gram of zinc in 2 hours.

103. Three electrolytic cells A, B, C containing solution $ZnSO_4$, $AgNO_3$ and $CuSO_4$ respectively are connected in series. A steady current of 1.5 ampere was passed through than until 1.45 gram of silver deposited at cathode of cell B. How long the current flow ? What mass of Cu and Zn were deposited.

104. Resistance of a conductivity cell filled with 0.1M KCl solution is 100 ohm. If the resistance of the same cell when filled with 0.02M KCl solution is 520 ohm. Calculate the conductivity and molar conductivity of 0.02M KCl solution. (The conductivity of 0.1 M KCl solution is 1.29 ohm^{-1} m^{-1}.

105. Discuss construction SHE and its application.

UNIT - IV

106. Half life period of a substance is 20 days. After 30 days what percentage of the substance will be left ?
107. Identify the factors that affect rate of reaction.
108. What is threshold energy ? How is it related to E_a ?
109. The rate of reaction increases four times when the temperature changes from 300 K to 320 K. Calculate the activation energy assuming that the activation energy is independent of temperature.
110. Show that the time required for $\frac{3}{4}$ th of the reaction to occur is two times that required for half of the reaction.
111. Explain the effect of temperature on the rate constant of a reaction.
112. In a first order reaction, if it takes 15 minutes for 20% of original matter to react. Calculate the rate constant and the time in which 10% of the original matter remain unreacted.
113. Half-life of a 1st order reaction is independent of initial concentration, Justify.
114. A reaction, i.e. of first order with respect to reactant 'A' has a rate constant 6 min^{-1}. If we start with [A] = 0.5 mol L^{-1}, when would [A] reach the value of 0.05 mol L^{-1} ?
115. A chemical reaction $2A \rightleftharpoons 4B + C$ is gas phase occurs in a closed vessel. The concentration of B is found increased by 5×10^{-3} mol / L in 10 seconds. Calculate the rate of disappearance of A.
116. Classify the reactions in respect of rate of reaction.
117. How does catalyst affect the rate of reaction ?
118. Catalysts affect the kinetics (k) but not the equilibrium costant (K).
119. What do you mean by effective collisions?
120. What are instantaneous and average rate of a reaction ?
121. The following data were obtained during the first order thermal decomposition of $N_2O_5(g)$ at constant volume :

$$2N_2O_5(g) \longrightarrow 2N_2O_4(g) + O_2(g)$$

No of observation	Time/s	Total pressure / (atm)
1	0	0.5
2	100	0.512

Calculate the rate constant.

122. A first order is 20% complete in 10 minutes. Calculate the specific rate constant of the reaction & the time taken for completion of 75% of it.
123. A first order reaction takes 69.3 minutes for 50% completion. How much time will be needed for 80% completion ?
124. Starting with different initial amounts of acetone, the half life periods for the decomposition of acetone at 875 K were found to be as follows :

a (mm in Hg)	98	192	230	296
$t_{1/2}$ (sec)	86	84	85	86

What is the order of reaction ? Give reason.

125. Draw the following plots for zero order reaction.

(a) Plots of concentration vs time.

(b) Plot of rate vs concentration

(c) Plots of half-lives vs concentration.

126. Why hydrolysis of ethylacetate with NaOH is of second order while with HCl, it's of first order ?

127. The following data were obtained for the reaction,

$$2A + 2B \longrightarrow \text{Products.}$$

Expt	Concentration		Initial rate mol Litre^{-1} min^{-1}
	[A]	[B]	
I	0.01	0.01	0.005
II	0.02	0.01	0.020
III	0.02	0.03	0.060

Determine the order of reaction and write rate law equation for the reaction.

128. Distinguish between rate of reaction and specific reaction rate.

129. What is order of reaction ?

130. For first order reaction, show that $[R] = [R]_0 e^{-kt}$.

131. A first order reaction takes 40 minutes for 80% decomposition. Calculate its $t_{1/2}$ value.

132. Explain (i) Fuels don't burn by themselves even in plenty of oxygen of air.

(ii) Large fraction of molecules has energy more than E_{th}, yet the reaction is very slow.

133. The rate of decomposition of NH_3 on Pt surface is of zero order. What are rate of production of N_2 and H_2 if $k = 2.5 \times 10^{-4}\ M/sec.$.

UNIT - V

134. What is the cause of Tyndal effect ?

135. Why are colloidal particles charged ?

136. What is electrophoresis ?

137. Classify solutions on the basis of particle size.

138. What are lyophilic colloids ? Provide its characteristics ?

139. Name the factors that goveren adsorption of gas on solid.

140. What is detergent ? How does it work ?

141. How does colloidal solution differ from true solution ?

142. Why are colligative properties almost negligible in case of colloidal solution ?

143. Delta is formed when river meets sea – give reason.

144. Distinguish between homogeneous and heterogeneous catalysts.

145. What is meant by selectivity of a catalyst ?

146. State and explain Hardy - Schulze rule.

147. Colloid is a state of matter. explain.

148. What are catalysts ? Discuss its characteristics.

149. Explain the adsorption theory of heterogeneous catalysis.

150. Adsorption is always exothermic in nature. Explain.

151. Layer of fat on pans can be removed by adding boiling washing soda solution, give reason.

152. Oozing of blood can be clotted by ferric hydroxide, why ?

153. The sol formed by adding $AgNO_3$ (Aq) to excess of potassium iodide solution is –vely charged while same produced by the reverse manner has positive charge. – Explain.

154. Why do colloidal solutions differ in colours ?

155. How can you prepare a sol of ferric hydroxide ?

156. What happens H_2S (g) is passed through an aqueous solution of SO_2 (g).

157. Identify the phase and medium in the following :

(i) smoke (ii) fog (iii) cheese (iv) milk (v) cream (vi) soaplather

158. Why does physisorption decrease with rise in temperature ?

159. What are characteristics of lyophobic sols ?

160. Write down the differences between multimolecular and macromolecular colloids.

161. What are charateristics of associated colloids ?

162. What are enzyme catalyst ? Provide two examples of enzyme catalysts ?

163. Match the following :

	Sec A (process)		**Sec. B (catalyst)**
i)	Haber's process	(a)	$V_2 O_5$ (s)
ii)	Ostwald process	(b)	$CuCl_2$ at 773 K
iii)	Contact process	(c)	Pt- at 573 K
iv)	Deacon's process to manufacture chlorine.	(d)	Finely divided Ni
v)	Bosch process to manufacture H_2 from water gas	(e)	Finely divided Fe-Mo(promoter)
vi)	Hydrogenation of oil to ghee	(f)	ferric oxide – Cr_2O_3 (promoter)

UNIT - VI

164. What is the difference between :

(i) an ore and a mineral

(ii) an alloy and amalgam

(iii) slag and flux

(iv) roasting and smelting

165. Match the following :

	metal		**Its ore**
(i)	Sodium	(a)	limonite
(ii)	Magnesium	(b)	Cryolite
(iii)	Aluminium	(c)	Gypsom
(iv)	iron	(d)	Rock salt
		(e)	Epsom

166.

	Name of the metal		**Refining process involved**
(i)	Mercury	(a)	Hall and Heroult electrolytic process
(ii)	Nickel	(b)	van Arkel process
(iii)	Titanium	(c)	Liquation
(iv)	Aluminium	(d)	Mond's process

167. Name some ores which can be concentrated by magnetic separation method.

168. Discuss leaching during extraction of Aluminium.

169. Aluminothermy does not occur at room temperature. why ?

170. What is the role of depressant in froth floatation process ?

171. Copper can be extracted by hydrometallurgy but not zinc. Explain.

172. Why is extraction of copper from its sulfide ore difficult than that from its oxide through reduction ?

173. Name the elements commonly present in anode mud during electrorefining of copper. Why are they so present ?

174. Write down the reactions taking place in different zones of blast furnace.

175. What is the role of cryolite in the metallurgy of 'Al'?

176. Discuss the refining of Ge / Ga.

177. How does Nickel get purified ?

178. How is leaching carried out in case of low grade copper ores ?

179. (a) Why do metals like Ag, Hg, Zn & Pb mostly occur as sulfide rather than oxide ?

(b) Meta sufides occur mainly in rocks but metal halides mostly is lakes and seas.

180. What happens to the ore during (i) calcination (ii) roasting ?

181. What is the function of lime stone during extraction of iron ?

UNIT - VII

Explain:

182. $BiCl_3$ exists but not $BiCl_5$

183. P can show covalency of five but nitrogen can't.

184. Pt dissolves in aquaregia

185. Nitrogen is a gas but 'P' is solid.

186. Nitrogen is diatomic while 'P' is polyatomic.

187. Nitrogen differs from other elements of the group.

188. Bond angle of $Pl_3 > PBr_3 > PCl_3$

189. Bond angle of hydrides follows in the order $NH_3 > PH_3 > AsH_3 > SbH_3 > B\ iH_3$

190. Basic character of $NH_3 > PH_3 > AsH_3$

191. Boiling point of hydrids of group 15 follows in the order $NH_3 > BiH_3 > SbH_3 > AsH_3 > PH_3$

192. Manufacture of NH_3 by Haber's process follow Lechatelier's Principle.

193. With pure HNO_3 (cone.) iron becomes passive.

194. All N-O bonds in NO^-_3 are identical.

195. H_2SO_4, $CaCl_2$, P_2O_5 fail to dry NH_3

196. Tailing of mercury takes place with Ozone.

197. Conc. Sulfuric acid is a viscous liquid.

198. NaCl with conc. H_2SO_4 gives hydrogen chloride gas, but NaBr and Nal fails to give HBr and HI.

199. Halides are colourless but halogens are coloured.

200. HF is a liquid but other hydrogenhalides are gases.

201. The reducing nature of HX, increases from HF to HI, so also acidic nature.

202. Orthophosporic acid in tribasic while phosphorous acid is dibasic.

203. HNO_3 acts as oxidant but HNO_2 both as oxidant and reductant.

204. Ammonium nitrite never gives sublimate on dry test tube heating.

205. PF_3 does not get hydrolysed.

206. NF_3 is less polar than NH_3.

207. SO_2 turns lime water milky and on excess milkiness disappears.

208. O_2 in a gas but sulfur is a solid.

209. Oxygen acts as reducing agent when acts with fluorine.

210. Oxygen differs form other elements of the group.

211. H_2O is a liquid but H_2S is a gas.

212. H_2O_2 decolorizes $KMnO_4$ but not Ozone.

213. Oxides of nitrogen responsible of Ozone layer depletion.

214. F_2 in a stronger oxidizing agent than Cl_2

215. Bleaching by 'Cl_2' is permanent while by SO_2 in temporary.

216. Interhalogens are more reactive than halogen itself.

217. BrF_3 is slightly bent T-shape.

218. Noble gases have very low b.p. and m.p.

219. Group-18 elements are called areogens to noble gases.

220. Water is not added to cone. H_2SO_4 for.dilution but reverse may be followed.

221. $SO_3(g)$ acts as oxidizing agent but SO_2 acts as both oxidant and reductant.

222. Formatioin of $O_2\,PtF_6$ give idea of formation of xenon compounds.

223. (a) Anhydrous $HCl_{(g)}$ in bad conductor but aq. HCl is a good conductor of electricity.

(b) Iodine is more solubie is Kl solution, than in water.

224. Fluorine differs from other halogens of group 17.

UNIT - VIII

225. A transition metal exhibits highest oxidation state in oxides and fluorides. Explain why.

226. Write some characteristics of transition elements.

227. The chemistry of the actionoid elements is not so smooth as that of the lanthanoids. Justify this statement by giving some examples from the oxidation state of these elements.

228. Explain why transition elements generally form coloured compounds ?

229. Transition metals and their compounds are generally found to be good catalysts.

230. Complete the following chemical equations :

(i) $Cr_2O_7^{2-} + Fe^{2+} + H^+ \longrightarrow$

(ii) $2CrO_4^{2-} + 2H^+ \longrightarrow$

(iii) $MnO_4^- + H^+ + Fe^{2+} \longrightarrow$

231. Of the d^4 species, Cr^{2+} is strongly reducing while Mn(III) is strongly oxidising. Explain.

232. Explain : i) transition elements form complexes.

ii) Most of the transition metal ions are attracted into magnetic field.

233. Scandium forms no coloured ions yet is regarded as a transition metal. Why ?

234. Why oxoanion of metal exhibit highest oxidation state ?

235. Zinc is not regarded as a transition metal. Is it so ?

236. Account for the following :

(i) The transition elements exhibit high enthalpy of atomisation.

(ii) Cu(I) is not known in aqueous solution.

237. Silver atom has completely filled d-orbitals ($4d^{10}$) in ground state. How can you say that it's a transition element ?

238. $E^0_{Cu^{2+}}\Big|Cu$ is +positive. Account for it.

239. Calculate the spin only magnetic moment, meff C_0^{2+}, Fe^{3+}.

240. Copper exhibits as $C_u^{2+}(aq)$ in solution. Why ?

241. Mn exhibits highest O.S. of +7.

242. What is meant by disproportion ? Examplify with Cr(V) and Mn(VI) in aqueous solution.

243. Lowest oxide of transition metal is basic while higher one is acidic. Is it so ?

244. Name the elements of 3d–transition series with their electronic configuration. Show their stability in different O.S.

245. Why $CuSO_4$ is paramagnetic (Coloured) while $ZnSO_4$ is diamagnetic (colourless).

UNIT - IX

246. What are complex compounds ? Explain the terms central metal ion, complexion, ligands co-ordination number.

247. Write the postulates of Werner's co-ordination co-ordination theory.

248. Describe the bonding is $\left[Fe(H_2O)_6\right]^{3+}$ and $\left[Fe(CN)_6\right]^{3-}$ in terms of VBT.

249. Discuss the structure of following complexes on the basis of CFT.

(i) $\left[Co(H_2O)_6\right]^{3+}$ (ii) $\left[Fe(CN)_6\right]^{4-}$

250. The formula $Co(NH_3)Cl\,CO_3$ could represent a comlple that gives curdy white precipitate with $AgNO_3$(aq). Write the structureal formula and name it. Is it an electrolyte ?

251. A comlex with composition $Cr(NH_3)_4\,Cl_2\,Br$ provides pale yellow precipitate with $AgNO_3$(aq) which dissolve in conc. NH_3 forming another complex. Name both the complexes. Find out hybridisation Cr in its complex and μ_{eff} value.

252. Show that $\left[Ni(CO)_4\right]$ dimagnetic with respect to VBT and CFT. Is it tetrahedral ?

253. $\left[Ni(CO)_4\right]^{2-}$ and $\left[NiCl_4\right]^{2-}$ differ in their shape and magnetic property. Justify.

254. Show that $\left[Fe(CN)_6\right]^{4-}$ and $\left[Fe(H_2O)_6\right]^{3+}$ are of different colours is aqueous solutions. Name there complex ions.

255. A solution of $\left[Ni(CN)_4\right]^{2-}$ is colourless but $\left[Ni(H_2O)_6\right]^{2+}$ is green. Give reason.

256. What is CFSE ? How does the magnitude of Δ_0 decide the actual configuration of d-orbitals ?

257. What is spectrochemical series ? Explain high spin and low spin complexes with respect to this.

258. What will be the correct order for the wavelenths of absorption in visible region for following :

$\left[Ni(NO_2)_6\right]^{4-}$, $\left[Ni(NH_3)_6\right]^{2+}$, $\left[Ni(H_2O)_6\right]^{2+}$.

259. Write the formula of the following :
- (a) Tetramine diaqua cobalt (III) sulfate.
- (b) Tris (ethane-1, 2-diammine) chromium (III) phosphate
- (c) Potassium hexacyanidoplatinate (IV)
- (d) Sodium trioxalatoferrate (III)

UNIT - X

B(a). Account for the following :

1. Dipolemoment of chlorobenzene is lower than that of chlorocyclohexane.
2. Chlorobenzene is less reactive than chlorocyclohexane.
3. Alkylhalide though polar fails dissolve in water.
4. Grignard's reagent should be prepared under anhydrous condition.
5. HBr with propene forms 2-bromopropane.
6. Propene with HBr in presence of benzoyl peroxide forms 1-bromopropane.
7. HCl and HI fails to undergo peroxide effect.
8. Iiodination of alkane is carried out in presence of oxidants.
9. Alkyl halide with KCN (aq) gives alkyl cyanide.

10. Alkyl halide with AgCN gives alkyl isocyanide.
11. –CN and –NO_2 groups are ambident nucleophile..
12. Alkyl halide with KNO_2 gives alkyl nitrite while with $AgNO_2$ forms nitrocompound.
13. Arylhalide can't be produced from phenol like alkyl halide from alcohol.
14. The reactivity of alcohols to give alkyl halide follows in the order $3^0 > 2^0 > 1^0$
15. Alcohol in presence of acidfied (H_2SO_4) NaBr gives alkyl bromide, but KI fails to give alkyliodide.
16. 2^0 and 3^0 alcohol are are normally not used to prepare haloalkane.
17. Alcohol with KI in presence of phosphoric acid (95%) gives alkyl iodide.
18. Cyanide is an ambident nucleophile.
19. Finkelstein reaction takes place in presence of dry acetone.
20. 1-Bromobutane on isomerisation gives lower boiling compounds.
21. Tertiary alkyl halides proceed through S_N–1 but not via S_N–2.
22. 2-Bromopropane with sodium ethoxide prefers substitution to elimination. (Williamson's synthesis)
23. The ease of hyrolysis of chlorobenzene depends on presence electron with drawing –NO_2 group.
24. (a) Friedel -Crafts reaction takes place in presence $AlCl_3$ (Anhyd.)
    (b) RS^- is a weaker base and a stronger nucleophile.
25. Chlorobenzene on nitriation gives p-nitro chloro benzene
26. m-Nitrochlorobenzene does not hydrolyse easily.
27. A mixture of HNO_3 and H_2SO_4 acts as nitrating agent.
28. Chlorobenzene undergoes Friedel-Craft's reaction.
29. Neopentylalcohol with HBr gives tertpentyl bromide.
30. $(C_6H_5)_2$ CHCl easily gets hydrolysed in comparison to $C_6H_5CH_2Cl$.
31. Alkyl chloride with KOH (aq) produces alcohol but with alcoholic KOH produces alkene.
32. Hexachloro benzene and benzene hexachloride are two different compounds.
33. Alkyl halide with ammonia does not yield pure amine.
34. (a) n-Propyl chloride is less reactive than allylchloride towards hydrolysis.
    (b) Vinyl chloride is less reactive than ethyl chloride.
35. Lower halide when treated with sodium gives higher alkane.
36. An alkyl halide can be utilised for syntehsis of desired aliphatic compound.
37. CH_3Cl is polar but CCl_4 is non-polar.
38. Melting points of dichloro benzene follow in the order
    p – > o– > m–, p– isomer has less b.p.
39. C–X bond length alkyl and aryl differs.
40. Preparation of phenol from chlorobenzene [Dow's process] needs high temperature and pressure.
41. Iodination of benzene carried out in pressence of oxidant like HNO_3, HIO_3

42. Toluene on alkyl (methyl) substitution gives different intermediates in organic synthesis.

43. S_{N-1} reactions differ from S_N–2 reaction.

44. Hydrolysis RX is rapid with catalytic amount of KI.

45. Alkyl chloride is better used as industrial solvent.

46. $SOCl_2$ is prefered to HCl to prepare alkylhalide from alcohol.

47. Iodoform gives precipitate with $AgNO_3$ while chloroform does not

B(b). Word problem :

(i) An organic compound with molecular formula C_8H_9Br with KOH (aq) forms another compound $C_8H_{10}O$, but with alc. KOH gives a monomer, name the polymer out of it. Provide the functional isomers of $C_8H_{10}O$ of which one turns blue litmus red.

(ii) An alkyl bromide with mol. mass 123 gives two isomers which on treatment with alc. KOH gives alkene with same number of C. Name the compounds of isomer on treatment with KCN and then on reduction with alc. Na.

(iii) RMgBr (A) on reaction with water gives a gas (B) which occupies 1.4L/gram at NTP. What is the product when R–Br react with benzene in persence of anhydrous $AlCl_3$? Identify the name of the last reaction.

(iv) n-butane is produced by monobromination of ethane by Wurtz reaction calculate the volume of ethane required at NTP to produce 55 gram of n-butane.

(v) Primary alkyl halide C_4H_9Br (A) reacts with alc. KOH to give a compounds (B) which reacts with HBr to give (C), an isomer of (A). When (A) was reacted with Na gave a compound (D), C_8H_{18} different from the compound formed from n-butyl bromide on Wurtz reaction. Write the compounds in each steps.

B(c). Name reactions

(i) Balz Schiemann reaction

(ii) Gattermann's reaction

(iii) Sandmeyer reaction

(iv) Wurtz reaction

(v) Fitttig reaction

(vi) Wurtz Fittig reaction

(vii) Friedel Craft's reaction

(viii) Finkelstein reaction

(ix) Hunsdiecker reaction

(x) Swarts reaction

(xi) Frankland reaction

(xii) Corey-House reaction

(xiv) Hofmann ammonolysis reaction.

B(d). What happens when

(i) HBr adds to propene in absence and presence of organic peroxide ?

(ii) Ethyl alcohol is treated with PCl_3 or PCl_5 ?

(iii) Ethylalcohol is heated with I_2 in presence of red phosphorus

(iv) Alkyl halide undergoes reduction ?

(v) Ethyl chloride is treated with silver salt of acetic acid ?

(vi) Ethyl bromide is treated with dry silver oxide ?

(vii) Ethyl iodide is treated with aqueous silver oxide ?

(viii) Ethyl iodide is treated with KCN / Ag CN ?

(ix) Ethyl bromide is treated with KNO_2 / $AgNO_2$?

(x) Ethyl alcohol reacts with iodine in presence of caustic alkali ?

(xi) Chlorobenzene is nitrated ?

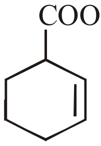
(xii) Chloribenzene is ammoniated ?

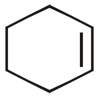
(xiii) Chlorobenzene is sulphonated ?

(xiv) Chlorobenzene is methylated and then oxidised ?

(xv) Benzene is treated with chlorine in presence of U.V. light.

B(e). Conversions / How can you prepare :

(i) 

from 

(ii) But-1-yne from ethanol

(iii) 1-Nitropropane from propene

(iv) Benzylalcohol from benzene

(v) But-2-ene from But-1-ene

(vi) Biphenyl from benzene

(vii) 2-Bromopropane from 1-Bromo propane

(viii) 4-bromonitrobenzene from benzene

(ix) 2-phenylethanoic acid from benzylalcohol

(x) Propenenitrile from ethanol

(xi) Propanoic acid from ethanol

(xii) Propanamine from ethyl chloride.

(xiii) 1-Iodobutane from but-1-ene

(xiv) Chlorobenzene from nitrobenzene

(xv) p-nitrophenol from chloro benzene

(xvi) Isobutyl bromide from Tert-butyl bromide.

(xvii) N-methyl methanamine from methyl bromide

(xviii) Ethanal from methyl bromide

(xix) Benzamide from bromobenzene

(xx) Cumene from chlorobenzene

(xxi) Propan-1-ol from 2-chloropropane

(xxii) Iodoform from isopropylalcohol

(xxiii) But-2-yne from ethylbromide.

UNIT - XI

B(a). Word Problems :

1. An organic compound with molecular mass 46 when heated with alkaline iodine forms a yellowmass (A) which gives a hightly inflamable gas (B) on treatment with silver powder. The gas on passing through dil H_2SO_4 in presence of $HgSO_4$ form another compound (C) which on reduction regains the original compound. Identify the compound A to C and provide the reactions involved.

2. An alcohol (A) is prepared from ethene on acidic hydrolysis. It is heated with PI_3 to give another compound (B). B with $AgNO_2$ gives C. 'C' with nitrous acid ($NaNO_2$ + HCl) forms another typical compound 'D' which gives blood red colour on being treated with sodium hydroxide. Identify compounds A to D with equation in each step.
3. A neutral compound (A) on treatment with Lucas reagent produces another compound (B). 'B' with (alcoholic) KOH yields compound (C), that decolorises bromine water. The compound (C) on reductive ozonolysis gives methanol only. Identify compounds A, B and C.
4. An organic compound A with molecular formula C_6H_6O whch turns bule litmu red but foils to give efferrvescence with sodium bicarbonate solution. The compound is allowed to react with CO_2 is alkaline medium at 400 K and 4 to 7 atom.pressusre to form a sodium salt which on hydrolysis gives an acid. The acid on esterification with methyl alcohol forms a compound which is a constituent of iodex.
5. A compound, $C_4H_{10}O$ (A) is found to be soluble in sulfuric acid. A fails to react with metallic sodium or $KMnO_4$ solution. When A is refluxed HI a single alkyl iodide 'B' is formed. Predict the product if 'B' undergoes Wurtz reaction. and inflamable gas (C)
6. An organic compound, (A) = C_2H_6O, a compound (B). The original compound with conc. H_2SO_4 at 413 K gives another compound (D) ($C_4H_{10}O$) which on hydroiodination at 373 K gives E, E with B also gives the same compound, D

B(b). Account for the following :

1. Butan-1-ol on heating with conc. H_2SO_4 gives but-2-ene.
2. 3, 3- dimethyl but an-2-ol on elimination gives 2, 3-dimethy but -2-ene.
3. Excess of ethanol on acidic dehydration at 413 K gives ether.
4. 1^0, 2^0 and 3^0 alcohols can be distinguished by Victor Meyer's test.
5. Methanol and ethanol can be distinguished by iodoform test.
6. Ease of esterfication follows is the order $1^0 > 2^0 > 3^0$.
7. Solubility of alcohols decreases on moving down the homologus series.
8. Among the isomeric alcohols the boiling points follow in the order $1^0 > 2^0 > 3^0$.
9. Acidic hydration of propene gives propan-2-ol.
10. o-nitrophenol is steam volatile while p-nitrophenol is not.
11. Phenol has higher b.p. than toluene.
12. Phenol is less souble in warter than alcohol.
13. Phenol is acidic while alcohol is neutral.
14. p-nitrophenol is more acidic than o-nitrophenol than m-nitrophenol.
15. Alcohol and phenol can be distinguish by neutral $FeCl_3$.
16. Phenol with Br_2 (Aq.) form tribromophenol but in presence of CCl_4 / CS_2 it gives p-bromophenol.
17. Phenol with alkaline chloroform gives o-salicyaldehyde.
18. Phenol is a colourless substance but turns pink on exposure.
19. Propanol has higher b.p. than butane.
20. o-nitrophenol is more acidic than o-methoxy phenol.

21. Phenol undergoes electrophilic substitution reaction.
22. 3-Methylbutan-2-ol with HBr gives 2-bromo-2-methyl butane.
23. Alcohol can act both acid and base.
24. Hydration of 3-phenyl but-1-ene gives 2-phenyl butan-2-ol.
25. n-butyl alcohol decolorises dil $KMnO_4$ but t-butyl alcohol doesnot.
26. At room temperature t-butyl alcohol gives white turbidity with Lucas reagent.
27. Ethyl alcohol is a liquid but its isomer dimethyl ether is a gas.
28. p-nitrophenol is a stronger acid but p-cresol is a weaker acid.
29. 2, 4-dinitrophenol is soluble in sodium carbonate solution.
30. Phenol fails to react with HCl and PCl_3 to form chlorobenzene.
31. Dehydration of alcohol to alkene is carried out is presence of H_2SO_4 but not with HCl or HNO_3.
32. Phenol is acidic but cyclohexanol is neutral.
33. Phenol is easily attacked by electrophile than chloro benzene.
34. $CF_3 - CH_2OH$ is more acidic than CH_3-CH_2OH.
35. Methanol is more polar than phenol.
36. Alcohol is more easily protonated than phenol.
37. Phenol is acidic but fails to react with $NaHCO_3$ (Aq.).
38. Sodium metal can be used to remove moisture from diethylether but not from ethylalcohol.
39. Ethanol is not dried over calcium chloride.
40. Phenol with alkaline CCl_4 gives salicylic acid.

B(c). Name reactions :

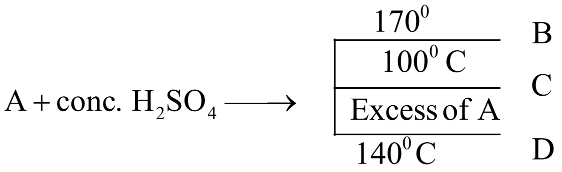
i. Bouveault-Blanc reduction
ii. Hydroboration-oxidation
iii. Oxymercuration demercuration
iv. Lucas test
v. Dow's process
vi. Schotten Baumann reaction
vii. reimer–Tiemann reaction
viii. Williamson synthesis.
ix. Zeisel's method of estimation
x. Kolbe's reaction
xi. Coupling reaction
xii. Fries rearrangement.
xiii. Libermann's test
xiv. Gattermann's reaction (Formylation reaction)

B(d). Answer the following:

1. How can you distinguish alcohols from phenols ?
2. Predict the stronger acid from the following pairs :
   i) Phenol and o– cresol
   ii) p-Nitrophenol and m-nitrophenol

iii) Phenol and cyclohexanol

3. Provide a distinguishing test for alcohol.
4. How does ether differ from alcohol ?
5. What is pyroligneous acid ?
6. How can you prepare ethyl alcohol from starchy materials ?
7. In zeisel's method for determination of $-OCH_3$ group, a sample of 2.68 gram of a compound (A) gave 14.08 gram of AgI. If the molecular mass of A is 134, the number of $-OCH_3$ grops in the compound (A).
8. How to get acetaldehyde from ethylalcohol ?
9. Discuss the methods of preparation of ethylacetate from ethylalcohol.
10. There are three unlabelled bottles containing methylalcohol, ethylalcohol and dimethylether. How will identify each of them ?
11. Ethylalcohol (A) react with conc. H_2SO_4 at different temperatures to give product (B), (C) and (D).



Name the compounds B,C and D.

12. Mention a sensitive test of alcohols.
13. What happens when diethylether reacts with

    (i) dil H_2SO_4 (ii) conc. H_2SO_4 (iii) Acetylating reagent (iv) chlorine

14. Write the names of reagents for the preparation of following ether by Willianson's synthesis.

    (i) Ethoxyethane (ii) ethoxybnzene (iii) Methoxyethane (iv) 1.property propane

15. Write the equation for (1) nitration of anisole (ii) bromination of anisole.
16. Identify the products formed on heating each of the following with HI.

    (i) 1-methoxy-2-methyl butane (ii) 2-methyl-2-propoxybutane
    (iii) Benzyl phenyl ether (Phenyl phenoxymethane)
    (iv) 1-methoxy propane
    (v) Tert butyl ethylther
    (vi) Ethoxybenzene
    (vii) Diphenyl ether
    (viii) Benzylethylether
    (ix) Benzylmethyl ether
    (x) Benzyl tert. butyl ether

17. What happens phenetole is treated with a mixture (1:1) of conc. HNO_3 and conc. H_2SO_4?
18. Why can ethers be cleaved preferentially by hot conc. HI and HBr not by conc. HCl ?
19. How can you prepare picric acid from phenol?
20. Name the reagent (s) used in the following reactions :

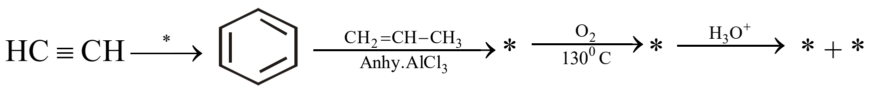
i) Oxidation of 1^0 alcohol to carboxylic acid
ii) Oxidation of 1^0 alcohol to aldehyde
iii) Bromination of phenol to 3, 4, 6 – tribromophenol
iv) Phenol to p-bromophenol
v) Benzyl alcohol to benzoic acid
vi) Butanone to Butan-2-ol

B(e). Identify the missing compounds / reagent (s) in the following steps of reactions:

1. $CH_3-CH_2OH \xrightarrow{PCl_5} * \xrightarrow{KCN} * \xrightarrow[\Delta]{H_3O^+} * \xrightarrow[\Delta]{\text{Soda-lime}} *$

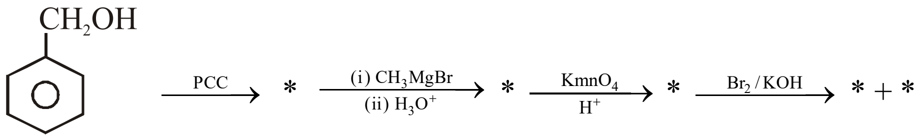
2. $C_2H_5OH \xrightarrow{*} CH_3CHO \xrightarrow{(O)} * \xrightarrow{NH_3} * \xrightarrow{\Delta} * \xrightarrow{\text{Na/alcohol}} * \xrightarrow{NaNO_2+HCl} *$

3.



4. $* \xrightarrow{Sn/HCl} * \xrightarrow[\Delta]{NaNO_2+HCl} * \xrightarrow[\text{warm}]{H_3O^+} * \xrightarrow[\Delta]{\text{Zinc dust}} *$

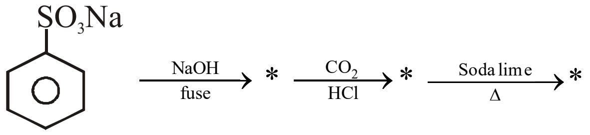
5.



6. $*\,(A) \xrightarrow[CCl_4]{\text{alkaline}} *(B) \xrightarrow[\Delta]{\text{Soda lime}} *\,(A) \xrightarrow{Br_2/CS_2} *(C) + *(D)$

7. $CH \equiv CH \xrightarrow[1:1]{NaNH_2} * \xrightarrow{C_2H_5I} * \xrightarrow[\text{LindLar's Catalyst}]{H_2} * \xrightarrow{B_2H_6/H_2O_2/OH^-} *$

8.



9. $C_6H_6 \xrightarrow[\text{Anhy.}AlCl_3]{CH_3Cl} * \xrightarrow[1:1]{Cl_2/hv} * \xrightarrow{KCN(al)} * \xrightarrow[\Delta]{H_3O^+} *$

B(f). Conversions :

(i) $CH_3\ OH$ to $CH_3–CH_2\ OH$
(ii) $CH_3–CH_2OH$ to CH_3OH
(iii) Propan-2-ol to ter-butyl alcohol
(iv) propan-1-ol to propan-2-ol
(v) Propene to 2-hydroxy-2-methyl propanc acid
(vi) Benzene to m-nitro benzoic acid.
(vii) Benzene to p-nitrophenol
(viii) p-Nitrophenol to phenol
(ix) $CH_3–CH_2OH$ to lactic acid
(x) $CH_3 – CH_2OH$ to acetone
(xi) Prepene to phenol
(xii) benzene to metanitrophenol

UNIT - XII

B(a) Account for the following:

1. Aldehydes and ketones have almost same properties.
2. Carboxylic acids have higher boiling point compared to alcohols comparable to mlecular mass
3. Acetic acid is weaker than formic acid.
4. Chloroacetic is stronger than acetic acid.
5. Nitrobenzoic acid stronger than acetic acid.
6. Benzoic acid stronger than p-Toluic acid.
7. Acetic acid is stronger than ethylalcohol.
8. Carboxylic acid is stronger than phenol.
9. I n acid catalysed reaction and acts as a base.
10. Sodium acetate with soda-lime gives alkane.
11. silver acetate on hunsdiecker reaction gives CH_3Br.
12. Formic acid is reducing in nature
13. Formic acid can be distinguished from acetic acid.
14. Carboxylic acid do not give characteristic reaction of >C=O group.

15 –COOH group in benzoic acid is meta directing.

SELF ASSIGNMENT : [Full Marks - 20]

a. Benzaldehyde responds silver mirror test but fails to respond test with Fehling solution.
b. Carbonyl compounds are more polar than alcohol (–OH)
c. Dialkyl cadmium is used Grignard reagent.
d. Hydrazones of aldehdyes and keton/es are not in acidic medium.
(pH maintained).
e. HX addes to $\rangle C = C \langle$. but not to $\rangle C = O$.
f. Pure HCN fails to react with $\rangle C = O$, better addes to in a alkaline reduction.
g. Ketones are less reactive han aldehyde towards Ad_N.
h. Distinguish between acetaldehyde and acetone.
i. How can you prepare aceticacid from ethene.
j. Prepare crotonaldehyde from ethylalcohol.

B(b) Name Reactions :

1. Rosenmund reduction.
2. Etard reaction.
3. Stephen’s reduction.
4. Gatterman-Koch reaction
5. Friedel Craft’s reaction
6. Aldol condensation
7. Popoff’s rule.
8. Cannizzaro’s reaction

9. Clemenson's reduction
10. Wolff-Kishner reduction

B(c) How can you distinguish between

1. >C = C< and >C=O
2. acetaldehyde and ethylalcohol
3. acetaldehyde and acetone
4. formaldehyde and acetaldehyde
5. acetaldehyde and benzaldehyde
6. formic acid and acitic acid

B(d) Conversions :

1. Acetic acid to malonic acid
2. $HCOOH$ to CH_3COOH
3. CH_3COOH to $HCOOH$
4. CH_3COOH to glycine
5. Ethanoic acid to propanoic acid
6. Acetylene to benzophenone
7. $HCHO$ to CH_3COOH
8. $HCHO$ to CH_3CHO
9. CH_3CHO to $HCHO$
10. CH_3CHO to acetone

B(e) Complete the missing links :

(i) $CH \equiv CH \xrightarrow[H_g^{2+}]{dil H_2SO_4} [A] \xrightarrow[H_3O^+]{CH_3MgBr} [B] \xrightarrow[H^+]{Cr_2O_7^{2-}} [C]$

(ii) $CH_3COCH_3 \xrightarrow[\Delta]{I_2 / NaOH} A \xrightarrow[\Delta]{Ag} [B] \xrightarrow{Sodamide} [C] \xrightarrow[excess]{CH_3I} [D]$

(iii) $(CH_3)_2 CO \xrightarrow{HCN} [A] \xrightarrow[\Delta]{H_3O^+} [B] \xrightarrow[\Delta]{H_2SO_4}$

(iv) $CH_3CHO \xrightarrow[\Delta]{Ag_2O} [A] \xrightarrow{PCl_5} [B] \xrightarrow[Pd-BaSO_4]{H_2} [C] \xrightarrow[H_3O^+]{C_2H_5MgBr} [D]$

(v) $CH_3CH_2 - CH_2Br \xrightarrow{KOH(alc)} A \xrightarrow{Br_2} B \xrightarrow[(alc)]{KOH} [C] \xrightarrow[Hg^{2+}]{dilH_2H_2SO_4} D$

(vi) $CH_3COOH \xrightarrow{LiAlH_4} A \xrightarrow[140^0 C]{Conc.H_2SO_4} B \xrightarrow[\Delta]{HI} C \xrightarrow{Na / dry ether} D$

UNIT - XIII

B(a) Answer the following :

1. Write carbylamine reaction.
2. Write Hofmann bromamide reaction.
3. Illustrate the Sandmeyer reaction with example.
4. What happens when
    (i) Nitroethane is treated with $LiAIH_4$?
    (ii) Diazonium chloride reacts with phenol in basic medium ?
5. What is vapour phase nitration ?

6. Aromatic amines are weaker bases than aliphatic amines. Why ?

7. How will you remove $-NH_2$, $-OH$ and $-COOH$ group from benzene ring ? Give Example.

8. Complete the following reaction.

$$C_6H_5NH_2 + H_2SO_4 \xrightarrow{\text{Heat}}$$

9. Give one chemical test to distinguish between methyl amine and dimethyl amine.

10. (a) Predict the order of basicity of the following compounds in gaseous phase.

$$(CH_3)_3N, (CH_3)_2NH, CH_3NH_2, NH_3$$

(b) Why CH_3NH_2 is less basic than ethyl amine in gaseous phase ?

11. What happens when alkyl isocyanate is treated with KOH (aq) ?

12. How will you distinguish between $(CH_3)_2NH$ and $(CH_3)_3N$?

13. Ethyl amine is soluble in water where as aniline is not. Give reason.

14. Give a chemical test to distinguish between ethyl amine and aniline.

15. Methyl amine with aq. $FeCl_3$ gives reddish brown precipitated. Why ?

16. How will you distinguish 1^0 and 2^0 amine by Liebermann's nitroso amine reaction ?

17. How will you convert aniline to phenol ?

B(b). Write the missing compounds (A, B, C, D)

(i) $CH_3-CH_2I \xrightarrow{NaCN} A \xrightarrow[\text{partialhydrolysis}]{OH^-} B \xrightarrow{KOH+Br_2} C$

(ii) $C_6H_5N_2Cl \xrightarrow{CuCN} A \xrightarrow{H_3O^+} B \xrightarrow[\Delta]{NH_3} C$

(iii) $CH_3CH_2Br \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow[0^0C]{HNO_2} C$

(iv) $C_6H_5NO_2 \xrightarrow{Fe/HCl} A \xrightarrow[0^0C]{NaNO_2+HCl} B \xrightarrow[\Delta]{H_3O^+} C$

(v) $C_6H_5NO_2 \xrightarrow[\Delta]{Sn/HCl} A \xrightarrow[273K]{HNO_2} B \xrightarrow{C_6H_5OH} C$

B(c). Accomplish the following conversions

(i) Ethanol to methanamine

(ii) hexanenitrile to pentan-1-amine

(iii) ethanamine to methanamine

(iv) methanamine to ethanamine

(v) nitromethane to dimethyl amine

(vi) propanoic acid to ethanoic acid

(vii) Nitrobenzene to benzoic acid

(viii) Benzene to m-bromophenol

B(d). Name reactions :

(i) Carbylamine reaction

(ii) Diazotisation

(iii) Hofmann's bromamide reaction
(iv) Coupling reaction
(v) Ammonolysis
(vi) Acetylation
(vii) Gabriel phthalimide synthesis

UNIT - XIV (Additional questions as per original syllabus)

1. D-glucose is an aldohexose ? Why does it react with HCN but not with $NaHSO_3$?
2. What are hormones ?
3. Distinguish between fibrous and globular proteins.
4. What are enzymes ?
5. Define the following: related to protein: (i) peptide linkage (ii) primary structure

   (iii) Denaturation (b) isoelectric point
6. An optically active compound having molecular formula, $C_6H_{12}O_6$ is found in two isomeric forms A & B in nature. When A & B are dissolved in water they show the following equilibrium

$$\underset{[\alpha]_D = 111^0}{A} \rightleftharpoons \underset{52.2^0}{\text{equilibrium mixture}} \rightleftharpoons \underset{19.2^0}{B}$$

   Now answer the following :

   (i) What are such isomers called ?

   (ii) Can they be called enantiomeers ? Justify your answer.

   (iii) Draw the cyclic structure of isomer, A.
7. Signify DNA finger printing.
8. Answer the following :

   (i) Out of sucrose and maltose, when is a reducing sugar ?

   (ii) Can denaturation of egg protein be reversed ?

   (iii) To which class of bio-molecules, pectins belong ?

   (iv) Name the monomer of starch.

   (v) Name three product which can be obtained from cellutose.

   (vi) Classify following into globular and fibrous proteins : insulin, haemoglobin, fibroin, collagen, myosin
9. Write notes on D, L configuration.
10. What is the basic difference between starch and cellulose ?
11. α-glucose differ from β-glucose - explain.
12. Explain why glucose and fructose give same ozazone, on treatment of excess phenyl hydrazine.

13. What are hormones ? Explain its effects.

14. Match the following groups:

Group - A	Group- B
(a) Riboflavin	(i) Plant hormone
(b) Thymine	(ii) Starch
(c) Cytokinin	(iii) Ovary
(d) Estrone	(iv) Heterocyclic base
(e) Diastase	(v) Vitamin
(f) ammonium sulfate	(vi) Peptising agent
	(vii) Renaturation

15. Name the enzymes for following biological processes.
    - (i) Inversion of cane sugar
    - (ii) conversion of milk to curd
    - (iii) Glucose to ethylalcohol
    - (iv) Protein to peptides in stomach
    - (v) Maltose to glucose
    - (vi) Starch to maltose
    - (vii) Protein to aminoacid

16. The melting point and solubility in water of α -amino acids are generally higher than those of cooresponding halo acids. Explain.

17. Fistinguish beteen RNA and DNA.

18. (a) Glucose and sucrose are soluble in water while cyclohexane, benzene being sixmembered compounds are insoluble in water. explain.
    - (b) Vitamin-C is not stored in the body, is it ?
    - (c) Pentaacetyl derivative of glucose does not have –CHO group. Explain.

UNIT - XV

1. How is bakelite made and what is its major use ? Why it is called thermosetting polymer?
2. How are polymers classified on the basis of forces operating between their molecules ?
3. Distinguish between chain growth polymerisation and step growth polymerisation.
4. Distinguish between homopolymer and copolymer.
5. Differentiate between addition polymerization and condensation polymerization.
6. How is dacron prepared ?
7. What are natural and synthetic polymers ? Give two examples of each.
8. What are homopolymers and co-polymers? Give example.
9. Will you prefer to polymerise acrylonitrile under anionic or cationic condition? Explain.
10. What are elastomers ? Write the equation referring preparation of Buna-S.

UNIT - XVI

1. Name the action of (i) Aspirin (ii) Pencillin (iii) Phenacetin (iv) Morphin (v) Analgin (vi) Luminal (vii) Seconal (viii) Streptomycin on human body.
2. How synthetic detergents are better than soap ?
3. Explain the cleansing action of soaps.
4. Both antacids and anti-allergic drugs are antihistamines but they cannot replace each other. Explain why ?
5. Why are detergents non-biodegradable while soaps are biodegradable ?
6. Match the following :

	A		**B**
(a)	Ofloxacin	(i)	Antiseptic
(b)	furacine	(ii)	Bactericidal
(c)	Chlorine	(iii)	Tranquilizer
(d)	Veronal	(iv)	Disinfectant
(e)	Sodium lauryl sulfate	(v)	Laundry soap
(f)	Sodium rosinate	(vi)	detergent

7. What are side effect of drugs ?
8. Explain the following with examples : Analgesics, Antipyretic.
9. What is the structure of chloramphenicol ? What is its use for curing diseases ?
10. What are soaps and detergents ? How do they differ ?
11. How do antiseptic differ from disinfectants ? How does an antibiotic differ from these two ?
12. What is meant by the term ‘broad spectrum antibiotic’? Explain.
13. Indicate the difference between bathing soap and washing soap.
14. What are side effects of aspirin ?

* * *

GROUP - B

ANSWERS

(Short Answer type (2/3) mark each :

Answer the following :

Unit - I

1. This means that crystalline solids have different physical properties such as electrical resistance or refractive index in different directions. This is because of different arrangement of particles in three dimensions.

2. Radius ratio : It is the ratio of radius of cation to that of anion in ionic solids.

This ratio is fixed for a given co-ordination number. Radius ratio = $\frac{r_+}{r_-}$. The radius ratio gives a clue about the structure of ionic crystal. Let us keep cation size fixed arrange different anions around it. If anion of bigger size it can be surrounded by six anion (C.N. = 6), but if of smaller anion it can be touched with 8 anions i.e. $\frac{r_+}{r_-}$ increases increasing the radius ratio. It has been obseved that –

r_+/r_-	**C.N.**	**Structure**	**Example**
0.155 - 0.225	3	Trigonal planer	B_2O_3
0.225 – 0.414	4	tetrahedral	ZnS, SiO_4^{4-}
0.414 - 0.732	6	Octahedral	NaCl
0.732 - 1.0	8	Cubic	CsCl

3. Due to heating during the day and cooling at night (i.e., annealing) over a number of years, glass acquires some crystalline character and hence looks milky.

4. For face centred unit cell, radius of atom

$$r = \frac{a}{2\sqrt{2}}$$

or $a = 2\sqrt{2}.r, \ \ r = 0.144\,\text{nm}$

$$a = 2 \times 1.414 \times 0.144 = 0.407\,\text{nm}.$$

5. Frenkel defect is not found in pure alkali metal halides because the ions cannot get into the interstitial sites due to their larger size.

6. When ZnO is heated it loses oxygen as :

$$ZnO \xrightarrow{\text{Heat}} Zn^{2+} + \frac{1}{2}O_2 + 2e^-$$

The Zn^{2+} ions are entrapped in the interstitial sites and electrons are entrapped in the neighbouring interstitial sites to maintain electrical neutrality. This results in metal excess defect. Due to the presence of electrons in the interstital void the colour is yellow.

7. In metal excess defects, such as lithium excess in LiCl, there are electrons trapped at the anion vacancies, called F-centres. These impart colour to the crystal of LiCl. The colour arises by the excitation of these electrons when they absorb energy from the visible light falling on the crystal. Thus, presence of excess Li makes LiCl pink.

8. Consequences of Schottky and Frankel defects. The important consequences of Schottky and Frankel defects in crystals are given below :

   (i) Because of these defects, the electrical conductivity of the crystals increases. When an electric field is applied, a nearby ion moves from its lattice site to occupy a hole. This creates a new hole and another nearby ion moves into it and so on. This process goes on and a hole moves from one end to the other end. Thus, it conducts electricity.

   (ii) Due to the presence of holes in the crystal, its density decreases.

   (iii) The presence of holes also decreases the lattice energy of the crystal. Consequently, the crystal becomes less stable.

9. $CdCl_2$ on adding to AgCl introduces impurity defect. The addition of one Cd^{2+} ion will replace two Ag^+ ions to maintain electrical neutrality. One of the positions of Ag^+ will be occupied by Cd^{2+} ion and the other will be left as a hole. Thus, a hole is created similar to Schottky defect.

10. The crystalline and amorphous solids differ from one another in the following respects :

	Crystalline solids		**Amorphous solids**
(i)	In crystalline solids, the constituent particles are arranged in a definite regular order which extends throughout the crystal.	(i)	The constituents are not arranged in any regular order.
(ii)	They have sharp melting points.	(ii)	They do not have sharp melting points.
(iii)	Crystalline substances are anisotropic.	(iii)	They are isotropic.
(iv)	They undergo cleavage when cut with a knife.	(iv)	They undergo irregular breakage when cut with a knife.

11. The important differences between Schottky and Frenkel defects are given below :

	Schottky defect		**Frenkel defect**
(i)	It is produced because of missing atoms or ions from their normal sites.	(i)	It is produced when some atoms or ions leave their normal sites and occupy interstitial sites.
(ii)	The presence of Schottky defect lowers the density of the crystal.	(ii)	It does not affect the density of the crystal.
(iii)	It is generally exhibited by ionic solids having high coordination number and in which cations and anions are of equal size.	(iii)	It is generally exhibited by ionic solids having low coordination number and in which anions are larger in size than cation e.g., ZnS, AgCl.

12. Volume of unit cell $= (a\,\text{pm})^3 = a^3 \times 10^{-30}\ \text{cm}^3$ $\qquad \because 1\,\text{pm} = 10^{-10}\,\text{cm}$

$$\text{density of unit cell (d)} = \frac{\text{mass of unit cell}}{\text{volume of unit cell}}$$

Mass of the unit cell = (No of atoms / unit cell) × mas of each atom

$$\text{Mass of an atom, } m = \frac{\text{atomic mass, M}}{N_A}$$

Molarr mass = M

$$d(\text{density}) = \frac{Z.m}{a^3} = \frac{Z.M}{N_A.a^3}$$

$$\text{Now, } M = \frac{d.N_A.a^3}{Z}$$

Z = 1 for cubic, = 2 for bcc and 4 for fcc lattices.

13. **Unit cell :** It is the smallest portion of a crystal lattice which, when repeated in different directions, generate the entire lattice.

Characteristics :

i) its dimensions along the three edges, a, b & c.

The edges may or may not be mutually perpendicular.

ii) angles between the edges α (between b & c)

β - between a and c and γ between a & b :

A unit cell is divided into two broad categories

(i) Primitive unit cell : Constituent particles are present only at the corner positions of unit cell.

(ii) Centred unit cell : one / more constituent particles are present at positions other than corners in addition to those at corners.

The centred unit cells are of three types :

(i) Body - centred unit cells : Along with corned one constituent particle at centre of the body of the unit cell (equi distance from all faces)

(ii) Face centred unit cells - Here a unit cell contains one constituent particle present at centre of each face besides the ones at its corners.

(iii) End - centred unit cells : Here one constituent particle is present at the centre of any two opposite faces besides the ones present at the corners.

There are seven primitive unit cells : cubic, Tetragonal, orthoshomic, hexagonal, rhombohedral (Trigonal) monochlic and trichlinic. Considering the centred unit cells there are total number of 14 types of Bravais Lattices.

14. Since Y form CCP, therefore $Y = 8 \times \frac{1}{8} = 1$ (No of atoms)

X occupies $\frac{1}{3}$ of tetrahedral void $X = 2 \times \frac{1}{3} = \frac{2}{3}$

No. of tetrahedral void = $2 \times 1 = 2$

Ratio of X and Y in the occupied = $X_{2/3} : Y_1$ for nul of the compound = X_2Y_3

15. Volume of unit cell = a^3

$$\text{density} = \frac{\text{mass of the unit cell}}{\text{Volume}} = \frac{4 \times \frac{99\,\text{gram mol}^{-1}}{6.02 \times 10^{23}\,\text{mol}^{-1}}}{a^3}$$

$$\text{Volume of the unit cell} = \frac{4\times 99\,\text{gram}}{6.023\times 10^{23}\times 3.4\,\text{gram cm}^{-3}}$$

$$= 19.34\times 10^{-23}\ \text{cm}^3$$

16. $d = \dfrac{Z\times M}{a^3\times N_A}$, $\quad z = \dfrac{d\times a^3\times N_A}{M}$

$$= \frac{10\,\cancel{g}\,\cancel{cm^{-3}}\times\left(3\times 10^{-8}\right)^3\,\cancel{cm^3}\times 6.023\times 10^{23}\,\cancel{mol^{-1}}}{81\,\cancel{g}/\cancel{mol}}$$

$$= \frac{27\times 6.023}{81} = 2$$

$\therefore$ It has a bcc structure.

17. For face centred unit cell, radius of atom,

$$r = \frac{a}{2\sqrt{2}}, \quad \Rightarrow \quad a = 2\times\sqrt{2}\ r$$

$$= 2\times 1.414\times 0.144\ \text{nm}$$

$$= 0.407\ \text{nm}$$

18. Frenkel defect is an interstitial defect. Because of larger size their accomodation in interstices becomes difficult.

19. It is a metal excess defect where Li is excess in LiCl. There are $\overline{e}$ trapped at the anion vacancies, called F-centres. The transition of these $\overline{e}$ (s) on absorbing energy from the visible spectrum, emit pink colour.

$$Li + Cl^- \xrightarrow[\text{surface}]{\text{at the}} Li^+\ Cl^- + e^-$$

$\overline{e}$ occupies the site of Cl^- in the lattice as a result the crystal is neutral but contain excess of Li. Thus, it's a non-stochiometric defect.

20. Refer. answer in Group -C

21. (i) It is a stoichiometric (vacancy) defect.
    (ii) Schottky defect
    (iii) KCl, CsCl
    (iv) Density of defective crystal decreases.

22. When a solid is heated, some atoms or ions may leave the crystal lattice and vacancies are created resulting vacancy defects in the crystal. since number of atoms / ions per unit volume decreases, the vacancy defects lead to decrease in the density.

23. Metal excess defect due to anionic vacancies.

When crystals of NaCl is heated is a vapour of sodium, the sodium atoms are deposited on the crystal surface. The Cl^- ions diffuse to the surface and combine with Na forming NaCl. This happens due to loss of $\overline{e}$ from Na forming Na^+, the released $\overline{e}$ diffuse into the crystal and occupy the anionic sites. These unpair $\overline{e}$ in the anionic site create F–centres / colour centres. When such crystal is exposed to white light emits yellow on absorption in appropriate visible zone. It becomes non-stoichiometric due to excess of Na (Na_xCl). Neutrality is mainted due to presence of $\overline{e}$ in place Cl^-.

$$Na + Cl^- \rightarrow Na^+Cl^- + e^-$$

24. The vacant spaces left among the incompressible lattice points or spheres in crystal lattice are called as interstitial voids. These are of two types :

i) Tetrahedral voids - Where one spherical particle in the second layer is placed above three spherical particles of the first layer, the vacant space formed among four spherical particles in contact with each other is known as tetrahedral void.

Number of tetrahedral void = 2N

N = number of close packed spheres

ii) Octahedral void : When six spherical particles are placed in two layers (three in each layer alternatively) then the vacant space present in between the six spherical particles is known as octahedral void. The size of the octahedral void = 0.414 r

The size of tetrahedral void = 0.225 r where r = radius of the sphere / Lattice points. So size of octahedral void $\simeq 2\times$ size of tetrahedral void. The number of octahedral void = N = no. of lattice points or spheres.

25.

	Ionic Crystal		Metallic crystal
i)	Ionic solid are strongly held by electrostatic force of attraction between oppositely charged ions. Bonds are non-directional.	i)	Electrostatic force of altraction among valence electrons and atomic kernels held by non-directional bonds.
ii)	Here the ions are not free to move hence non-conducting in solid state.	ii)	Due to presence of free delocalised $\bar{e}$ (s) they are good conductors in solid state.
iii)	Ionic bonds are strong due to strong force of attraction between oppositely charged ions.	iii)	Here the strength depends on the number of valence electrons and size of the atomic kernels.
iv)	Ionic crystals are hard but brittle	iv)	These are hard, malleable and ductile

26. **Rock salt type structure.**

Features :

i) It has fcc / ccp arrangement in which Cl^- ions occupy the corners and face centres of a cube & while Na^+ ions are present at the body centre and edge centre / occupying the octahedral voids.

ii) This structure has 6 : 6 co-ordination.

iii) A unit cell of NaCl consists of four Na^+ ions and 4 Cl^- ions.

8 Cl^- are present on the corners and 6 Cl^- ions on the faces i.e. $\left(8\times\frac{1}{8}\right)+\left(6\times\frac{1}{2}\right)=4$ Cl^- ions.

12 Na^+ ions are present on the edges and one Na^+ ions at the body centre per unit cell

$=\left(12\times\frac{1}{4}\right)+1=4$ Na^+ ions.

Examples : (a) Alkali metal halide except CsCl, NH_4Cl

(b) Oxides and sulfides of alkaline earth metals (except BeS)

(c) halides of silver (except Ag I)

27. M = mass of atom × 6.02 × 10^{23}

$$= \frac{400}{48\times10^{23}}\times6.02\times10^{23} = 50.18 \text{ g / mole}$$

for fcc crystal, Z = 4

$$\text{density} = \frac{\text{mass of the uit cell}}{\text{volume of unit cell}} = \frac{Z\times 50.18}{6.02\times 10^{23}\times (200)^3 \times 10^{-30}}$$

$\because$ 200 pm = 200×10^{-12} m

= 41.67 g/cm^3 = 200×10^{-10} cm

Unit - II

28. $\text{Equivalent mass of oxidant / reductant} = \dfrac{\text{Mol mass}}{\text{change in O.N}}$

$$^{+12}Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow {}^{+6}2Cr^{3+} + 7H_2O$$

$\text{Equivalent mass of } K_2Cr_2O_7 = \dfrac{\text{Mol mass}}{6}$

i.e. 1 mole = 6 gram equivalent.

[or]

$$K_2Cr_2O_7 + 4H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + 4H_2O + 3(O)$$

1 Mole 3×16

1 mole of $K_2Cr_2O_7 \equiv 48$ parts of Oxygen

By definition 8 part of oxygen $\equiv \dfrac{1}{6}$ mole of $K_2Cr_2O_7$.

29. Vapour pressure is the pressure exerted by the vapours on the surface of its liquid (state) when both vapour & liquid are in a state of equilibrium at a given temperature.

$$\text{Liquid} \rightleftharpoons \text{Vapour.}$$

30. (i) Nature of the liquid : Less is the inter molecular force of attraction greater is the extent of escaping from the surface i.e. more vapourisation & hence more vapour pressure. e.g. V.P. (ether) > V.p. (water)

(ii) Temperature. Temperature weakens the force of attraction i.e., higher is temperature greater is the vapourisation and vapour pressure.

$$V.P. \propto T$$

31. Solution of known strength is called standard solution,it hleps to standardise other. e.g. potassium permangante (aq) is standardised by oxilic acid of known strength i.e. standard oxalic-acid solution. Such solution of which the strrength (molarity / normality) remains constant i.e. it forms a stable solution never decomposes nor loses / gains water on exposure-nor sticks to weighing bottle. Here oxalic acid is called primery standard and potassium paramangnet is called secondary stanard solution.

32. Stronger is the inter molecular force of attraction less is the vapour pressure. Alcohol molecules are polar and held by stronger dipole-dipole force called H-bond while the ether molecules are less polar & held by weaker force (London dispersion force). Higher is the v.p. less is the boiling point. That is why ether has lower b.p. than alcohol.

$$\cdots H-\underset{\underset{R}{|}}{O}\cdots H-\underset{\underset{R}{|}}{O}\cdots H-\underset{\underset{R}{|}}{O}\cdots$$

(H- bonded alcohols, less extent of vapourisation less is the v.p., higher is the b.p)

33. At higher external pressure the extent of vaporisation (surface phenomenon) reduces reducing the v.p. much less than the atmospheric pressure. The boiling point increases as boiling point is the temperature at which v.p. of the liquid equals to atmospheric pressusre. Less is the v.p. higher is boiling point i.e. why b.p. increases in the pressure cooker reducing the cooking time.

However, at high attitude, pressure is less on the surface of liquid increasing the extent of vapourisation and hence the v.p. Higher the vapour pressure, less is the boiling point. This is reason why it's difficult to cook on the hill top e.g. Rice, potatoo etc never boil as the boiling point of water is reduced (Less than 100^0C)

34. (i) Nature of solute : On the principle of like dissolves like ionic compounds are soluble is polar solvents e.g NaCl in water and covalent solid dissolves in non-polar solvent. e.g. Iodine in CCl_4.

(ii) Temperature : For the solute where heat of solution $\left(\Delta_{\text{soln}}H\right)$ is endothermic, the solubility increases with rise of temperature e.g. sodium chloride, sugar solubility increases with rise of temperature.

35. ΔT_f (Depresion in freezing point) = $K_f m$

K_f = molant depression constant

m = molality of solution.

$$\Delta T_f = K_f . \frac{W_2}{M_2} \times \frac{1000}{W_1}$$

W_2 = weight of solute

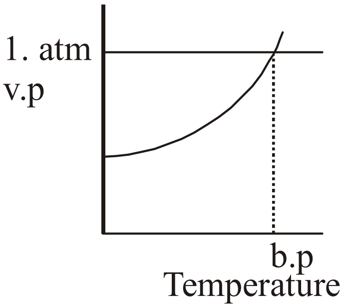
$$M_2 = \frac{K_f}{\Delta T_f} \times \frac{W_2}{W_1} \times 1000$$

W_1 = weight of solvent

M_2 = Mol.mass of solute.

36. Due to tetrahedral symmetry CCl_4 is non-polar. Hence it's insoluble in water which is polar in natue due to its bent structure. Thus, these two liquids are imiscible.

37. A liquid starts boiling when its vapour pressure (vp) becomes equal to atmospheric pressure. v.p increases with rise of temperatur.



38. Vaporisation of solvent takes place from the surface only. In a solution the % of solvent particle on the surface decreases due to presence of non-volatile solute particles and hence escaping tendency of solvent particles or extent of vaporisation decreases. Thus V.P. (solution) < v.p (pure solvent).

39. 10 (wt%) urea $\Rightarrow$ weight of urea = 10 gram, mol. mass of urea = 60

weight of water = 90 gram

$$\text{Molality} = \frac{W_2}{M_2} \times \frac{1000}{W_1} = \frac{10}{60} \times \frac{100}{90} = 1.85\,\text{m.}$$

40. Let us take a solution of two volatile liquids (1 & 2) As per Raoult's law -

$P_1 = X_1\ P_1^0$ P_1 = partial pressure of component –1 in vapour phase.

X_1 = mole fraction of component 1 in solution

$P_2 = X_2 P_2^0$ P_1^0 = v.p. of component-1 (Pure).

$$\text{Total pressure, } P = p_1 + p_2 = X_1\,P_1^0 + X_2\ P_2^0$$

$$= \left(1 - X_2\right) P_1^0 + X_2 P_2^0$$

$$= P_1^0 - X_2 P_1^0 + X_2\, P_1^0$$

$$\boxed{P = P_1^0 + X_2\left(P_2^0 - P_1^0\right)}$$

This is an equation to a straight line where P is linearly related to X_2, the mole fraction of solute with slope $\left(P_2^0 - P_1^0\right)$, the difference of vapour pressure of two miscible, liquids (1 and 2) in pure forms.

41. $P_1 = P_1^0.X_1$ $1 = CHCl_3$ $2 = CH_2Cl_2$

$P_2 = P_2^0.X_2$

$$X_1 = \frac{25.5/119.5}{\frac{25.5}{119.5} + \frac{40}{85}} = \frac{0.213}{0.213 + 0.47} = \frac{0.213}{0.683} = 0.312$$

$X_2 = 1 - 0.312 = 0.688$

$P = \left(200 \times 0.312\right) + \left(415 \times 0.688\right)$

$= 62.4 + 285.52$

$= 347.92$ mm (total pressure)

42. $$p_{CH_2Cl_2} / P_{total} = y_1 = \frac{415 \times 0.688}{347.92} = \frac{285.52}{347.92} = 0.82$$

$$\text{Molefraction of } CHCl_3 = \frac{P_{CHCl_3}}{P_{total}} = \frac{0.312 \times 200}{347.9} = \frac{62.4}{347.1} = 0.18$$

43. Greater is the mole fraction of a component in vapour phase greater is the volatility.

$X_{CH_2Cl_2} > X_{CHCl_3}$ (in vapour phase)

So CH_2Cl_2 is more volatile than $CHCl_3$.

44. Acetone and chloroform, due to greater inter molecular force of attraction causes a non-ideal solution and vapour of the solution is less than expected (Negative deviation). The mole fraction at which it has minimum vapour pressure, it shows maximum b.p.

Such a solution is called maximum boiling azeotrope.

45. $\Delta T_B = K_f\,m$

$$= 0.52\times\frac{18}{180}\frac{1000}{100} = 0.052,\ \text{boiling point water at } 1.013 \text{ bar} = 100.15^0\text{C}$$

Boiling point with glucose = 100.202^0C.

46. $\Delta T_f = K_f.m \Rightarrow 0.40 = 5.12\times\frac{1}{M_2}\times\frac{1000}{50}$

$$\Rightarrow M_2 = \frac{5.12\times \text{K.Kg mol}^{-1}\times 1000\,\text{gram/kg}}{0.40(\text{R})\times 50\,\text{g}} = 256\,\text{g/mol}$$

47. The direction of osmosis (migration of solvent molecules from low concentration to high concentration being separated by semipermeable membrane) can be reversed if a pressure larger of than the osmotic pressure is applied to the solution side. Now the pure solvent flow out of the solution through spm. This reverse migration of solvent from high concentration to low concentration (fresh solvent) in called reverse osmosis.

48. $P^0 = 23.8$ mm

50 gram of urea = $\frac{50}{60}$ mole X_2 = Molefraction of solute

850 gr of water = $\frac{850}{18}$ mole

$$= \frac{50/60}{\frac{50}{60}+\frac{850}{18}} = \frac{0.83}{0.83+47.2}$$

$$= \frac{0.83}{48.03} = 0.017$$

$\frac{P_0 - P}{P^0} = X_2$ (Raoult's law)

$$\Rightarrow \frac{23.8-p}{23.8} = 0.017$$

$\Rightarrow\ 23.8 - p = 23.8\times 0.017$

$P = 23.8 - (23.8 \times 0.017)$

$= 23.8 - 0.4046 = 23.3954$ mm of Hg.

= vapour pressure of the solution.

Relative lowering of v.p $= \frac{23.8-23.954}{23.8} = 0.017$

49. $\pi = 2.57\times 10^{-3}$ bar, $v = 200$ cc $= 0.2$ litre

T = 300 K   R = 0.082   L.atm $\text{mol}^{-1}\,\text{K}^{-1}$

$\pi = CRT$

$$= \frac{n}{V}\times RT = \frac{W}{M}\times\frac{RT}{V}$$

$$M = \frac{W}{\pi} \times \frac{RT}{V} = \frac{126g \times 0.082\, \cancel{L}\, \cancel{atm}\, mol^{-1}\, \cancel{K^{-1}} \times 200\, \cancel{K}}{2.57 \times 10^{-3}\, \cancel{atm} \times 0.2\, \cancel{L}}$$

$$= \frac{1.26 \times 0.082 \times 300}{2.57 \times 10^{-3} \times 0.2} g\, mol^{-1}$$

$$= \frac{30.996}{0.000514} = 60303.5\, g / mol$$

50. $\pi = \frac{W}{M} \times \frac{RT}{V}$

$$= \frac{1\,gram \times 0.082\ L - atm.mol^{-1}\ K^{-1} \times 310\, K}{185000\, g\, mol^{-1} \times 0.450\, L}.(atm)$$

$$= \frac{1 \times 0.082 \times 310}{18500 \times 0.45} = \frac{25.42}{83250} atm = 0.0003\, atm = 30.94\ Pa$$

$R = 8.314\ m^3.Pa,\ K^{-1}\ mol^{-1}$

1 atm = 101325 Pa.

51. Application of Henry's law :

i) In the production of carbonated beverages : To increase the solubility of CO_2 in soft drinks, soda water, beer or champagne, the bottled are sealed under pressure. On opening the bottle, effervescence of CO_2 takes place on reduction of pressure.

ii) In deep sea diving (Scuba diving) the divers breathed compressed air from the tank. The nitrogen present in it dissolved in blood and other body fluids under pressure in the deeper sea water. When the diver comes to the surface the dissolved nitrogen comes out due to reduced pressure causing the disease "bends"

These show the extent of dissolution of gas in liquid increases with rise of pressure.

52. 0.195 m i.e. 0.195 m of H_2S dissolved in 1 Kg of water.

moles of $H_2S = 0.195$, moles of water $= \frac{1000}{18} = 55.55$

moels of water $= \frac{1000}{18} = 55.55$

mole fraction of $H_2S = \frac{0.195}{55.55 + 0.195} = \frac{0.195}{55.745} = 0.0035$

Pressure = 1. bar

$P = K_H X_2$ X_2 = mole fraction of solute (H_2S)

$K_H = \frac{1}{0.0035} bar = 285.7\ bar$

53. According to Raoult's law, relative lowering of vapour pressure is equal to mole fraction of solute.

$\frac{P_0 - P_s}{P_0} = X_2 = \frac{n_2}{n_1 + n_2}$

n_1 = moles of solvent

n_2 = moles of solute

So it depends on quantity of solute particles present in the solution. Hence it's a colligative property, not depending on nature of the particles.

54. When ethyl alcohol and cyclohexane are mixed, the solution formed shows positive deviation from Raoult's law. In this case V.P. of the solution is more than expected for the solution behaving to be ideal. The addition of cyclohexane will tend to break some of the H-bond as a result the intermolecular force of attraction decreases, increasing the extent of vaporisation of alcohol and the v.p. increases.

$P_A > P_A^0.X_A$, the solution will show positive deviation from Raoult;s law.

55. (i) Vapour pressure of solution is less than that of pure solvent. Less is the vapour pressure greater is the depression in freezing point.

(ii) a. For Non-electrolyte- non volatile solute :

$$\Delta T_f = K_f m$$

K_f is the molal depression (Cryoscopic) constant.

$$\Delta T_f \propto m$$

As it's proportional to molality of the solution, it is a colligative property. ΔT_f changes with no moles of solute per Kg of solvent. More is the solute more is the depression is freezing point.

b. For solute undergoing dissociation or association in a given solvent.

$\Delta T_f = i\ K_f m$ where 'i' is the van't Hoff factor. $i > 1$ for electrolyte undergoing dissociation and $i < 1$ for electrolyte (solute) undergoing association. solute undergoing dissociation cause greater lowering of freezing point as no. of particles increases. e.g. saline water freezes at lower temperature. The V.P. also gets reduced.

56. Solutes may be of there types :

(i) non electrolytes ($i = 1$)

(ii) electrolytes under going dissociation e.g.. NaCl in water . ($i > 1$)

(iii) electrolytes undergoing association e.g benzoic acid in benzene solvent ($i<1$)

For particles undergoing dissociation, the particles increases inceasing the colligative property and decreases the molecular mass as colligative property is reciprocal of moelcular mass.

e.g. the elevation of b.p. of one molar NaCl ($i = 2$) is double to that of 1 molar urea ($i = 1$). So molecular mass of NaCl if measured by elevation of b.p. i.e. ebullioscopy is found to be halved (i.e. 29.25 instead of 58.5)

In case of association the number of particles decreases and hence molecular mass increases.

57. Significance K_H (Henry's law constant)

i) **Nature of gas :** Different gases have different values of K_H. Thus K_H is a function of nature gas. Higher the K_H value at a particular temperature, lower is the solubility of the gas in the liquid as $p = K_H.x$, p = partial pressure of the gas in vapour phase.

x = mole fraction of the gas in solution

Exampe. $K_H (CO_2) < K_H (N_2)$

i.e. CO_2 is more soluble in water than N_2

ii) **Temperature :** K_H value increases with increase of temperature, indicating that the solubility of gases decreases with rise of temperature.

e.g. K_H (O_2 at 293) = 34.86 kbar

K_H (O_2 at 303) = 49.82 kbar

58. Henry's law: Mole fraction of $CO_2 = \dfrac{P_{CO_2}}{K_H(CO_2)}$

$$K_H = 1.67\times10^8 \text{ Pa} = \frac{1.67\times10^8}{101325}\text{atm} = 1.648\times10^3 \text{ atm}$$

$$X_{CO_2} = \frac{2.5\,\text{atm}}{1.648\times10^3\,\text{atm}} = 1.52\times10^{-3}$$

$$n_{H_2O}(\text{moles of water}) = \frac{500}{18} = 27.78\,\text{mol} \qquad (500\text{m}\ell \simeq 500\,\text{g})$$

$$X_{CO_2} = \frac{n_{CO_2}}{n_{CO_2}+n_{H_2O}} \simeq \frac{n_{CO_2}}{n_{H_2O}} = \frac{n_{CO_2}}{27.78} \qquad \because\ n_{CO_2} \text{ in water is neglected}$$

$$n_{CO_2} = \text{moles of } CO_2 = 27.98\times1.52\times10^{-3}$$
$$= 0.0422 \text{ mole}$$

$$\text{Mass } CO_2 \text{ dissolved} = 0.0422\,\text{mole}\times44\ \text{gram mol}^{-1}$$
$$= 1.857\ \text{gram}$$

59. (i) Ideal solution :

(a) A solution which obeys Raoult's law over the entire range of concentration $(p_1 = p_1^0 \times X_1)$

(b) Here solute solvent intraction = solute - soute interaction = solvent - solvent intraction.

(c) $\Delta_{sol^n} H = 0$

(d) $\Delta_{sol^n} V = 0$

(ii) A zeotrope : The solutions or liquid mixtures which boil at constant temperature and can distill unchanged in composition are called azeotropes. i.e. composition in solution = composition in vapour state. In such case the components cannot be separated by fractional distillation.

These are of two types : (i) minimum boiling azeotrope

(Solution with positive deviation from Raoult's law) e.g. ethanol at 95%)

(solution with negative deviation, $p_1 < p_1^0 x_1$)

e.g. Nitric acid – water. (68%)

(iii) Osmotic pressure : The excess pressure which must be applied to a solution to prevent the passage of solvent into it through a semipermeable membrane at a given temperature.

Mathematically = π = CRT

$$= \frac{n}{V}RT \qquad = \frac{W}{M}\,\frac{RT}{V}$$

W = weight of solute in gram

M = Mol. masses g / mol

$R = 0.0821\ \ell\ .\ \text{atm}\ -\ \text{mol}^{-1}\ K^{-1}$

T in K and V is litre, π is atm.

60. The freezing point of water is 0^0C. If temperature of the region falls below zero water turns to solid ice causing road blockage preventing transporation, vehicular movement. It needs road clearance by cutting and removing the ice blocks. Such difficulties can be avoided on sprinkling strong electrolytes like salt (NaCl). It reduces the freezing point as a result the water does not freeze at the reduced surrounding temperature.

61. Match the following :

(a)	Solubility of gas	(ii)	Henry's law
(b)	Liquid - Liquid solution	(iii)	Raoult's law
(c)	Positive deviation	(i)	Non-ideal solution
(d)	Desalination	(v)	Reverse osmosis

62. Vapour pressure of pure water at 373 K $\left(P_A^0\right) = 760\,\text{mm Hg}$

Vapour pressure of aq. solution at 373 K (P) = 750 mm Hg

According to Raoult's law $\Rightarrow$ $P = X_1 P^0$ (Solvent)

$$X_1 = \frac{p.}{p_1^0} = \frac{750}{760} = 0.987$$

X_2 (solute) = 0.013. (Mole fraction of solute)

$$X_2 = \frac{n_2}{n_1 + n_2} \simeq \frac{n_2}{n_1} = \left(\frac{W_2}{M_2} \times \frac{M_1}{W_1} \times \frac{1000}{1000}\right)$$

$$\Rightarrow \quad X_2 = m\,\frac{M_1}{1000}$$

Molality of solution : $m = \frac{W_2}{M_2} \times \frac{1000}{W_1}$

$$0.013 = m \times \frac{18}{1000} \Rightarrow m = \frac{0.013 \times 1000}{18}$$

$$= 0.72\ m$$

Unit - III

63.

	Electrolytic cell		**Electro chemical cell**
i.	It is a device which converts electrical energy to chemical energy. Chemical decomposition on passage of electricity.	i.	It is a device where redox reaction is carried indirectly & the decease in free energy appears as electrical energy.
ii.	The redox reaction is non-spontaneous & takes place on supply of electrical energy.	ii.	The redox reaction is spontaneous.
iii.	Both electrodes are immersed in single electrolyte.	iii.	Two electrodes are set up in different vessels with different electrolytes connected through salt bridge or porous partition.
iv.	Only one electrolyte is taken.	iv.	Two electrolytes. The salt bridge also contain another electrolyte.

v. In this cell anode is +ve and cathode is –ve.	v. In electro-chemical cell anode is –ve and cathode is +ve.
vi. The electrons are supplied from external battery enter at cathode move through electrolyte and comes out at anode.	vi. Electrons generated in cell move from anode (–) to cathode (+) in external circuit.

64. Cell potential = Electrode potential of cathode – Electrode potential of anode.
= Sum of the electrode potentials
= Oxidation potential of anode + reduction potential of cathode.

In standard state : $E^0_{\text{Cell}} = E^0_{\text{Cathode}} - E^0_{\text{anode}}$.

Example for Daniell cell, $\mathrm{Zn}\,\Big|\,\overset{2+}{\mathrm{Zn}}\left(1\mathrm{M}\right)\Big|\,\overset{2}{\mathrm{Cu}}\left(1\mathrm{M}\right)\Big|\,\mathrm{Cu}$

$$E^0_{\text{Cell}} = E^0_{\text{Cu}^{2+}|\text{Cu}} - E^0_{\text{An}^{2+}|\text{Zn}} = +0.34-\left(-0.76\right)=1.10\text{V}$$

65. Electro chemical series is the arrangement of electrodes in order of increasing electrode (reduction) potential values. A redox reaction is feasible only when the substance undergoes reduction must have higher reduction potential.

$$\text{Cu} + 2\,\overset{+1}{\text{Ag}}\,\text{NO}_3 \longrightarrow \text{Cu}\left(\text{NO}_3\right)_2 + 2\,\overset{0}{\text{A}}\text{g}$$

$$E^0_{\text{Ag}^+}\text{Ag} \quad > \quad E^0_{\text{Cu}^{+2}|\text{Cu}}$$

$$+0.80\text{V} \qquad 0.34\ \text{V}$$

In the above equation / reaction Ag undergoes reduction, $\text{Ag}^+ + \text{e} \rightarrow \text{Ag}$. hence feasible

66. Function of salt bridge :

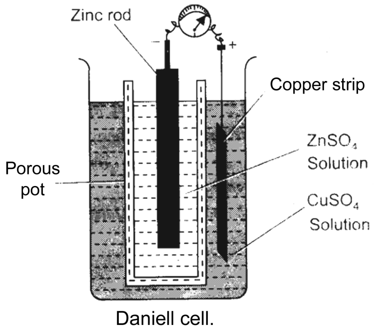
(i) Salt bridge completes the innner cell circuit by migration of ions as it connects two electrolytes.

(ii) A salt bridge prevents transference of electrolyte from one half cell to other. The agar-agar gel does not allow transfer of electrolyte from one electrode vessel to another.

(iii) Salt bridge maintains electrical neutrality of the electrolytes in the two half cells.

(iv) It eliminates liquid junction potential (E_j)

67.



Daniell cell.

In this case copper sulfate solution is taken in a copper vessel (cathode). $ZnSO_4$ solution is taken inside porous pot in which zinc rod is dipped (anode). This porous pot is placed in the copper sulfate solution.

$$\text{Anode } Zn \rightarrow Zn^{2+} + 2\bar{e} \text{ (oxidation)}$$

$$\text{Cathode } Cu^{2+} + 2\bar{e} \rightarrow Cu \text{ (reduction)}$$

68. Let us take a general cell of the types

$$aA_{(Aq)} + bB_{(Aq)} \rightleftharpoons cC_{(Aq)} + dD_{(Aq)}$$

Considering the free energy change

$$\Delta G = \Delta G^0 - RT\ln\frac{[C]^c[D]^d}{[A][B]^h}$$

$$= \Delta G^0 - RT\ln Q \qquad Q = \text{reaction quotient.}$$

At equilibrium $\Delta G = 0$

$\Rightarrow \quad 0 = \Delta G^0 - RT\ln K$ $(K = \text{equilibrium constant})$

Thus $-\ \Delta G^0 = RT\ln K$

$$= 2.303\,RT\ \log K$$

$\Rightarrow \quad nFE^0 = 2.303\,RT\log K$

$$\boxed{\log K = \frac{nFE^0}{2.303\,RT}}$$

$$E^0 = \frac{2.303\,RT\log K}{nF}$$

69. (i) $E_{Fe^{3+}|Fe} = E^0_{Fe^{3+}|Fe} - \dfrac{2.303\ RT}{nF}\log\dfrac{[Fe]}{[Fe^{3+}]}$

$$= E^0_{Fe^{3+}|Fe} + \frac{2.303\ RT}{nF}\log C_1 \qquad \because\ [Fe^{3+}] = C_1 \qquad [Fe(s)] \simeq 1$$

(ii) $Zn + 2Ag^+(C_1) \longrightarrow Zn^{2+}(C_2) + 2Ag$

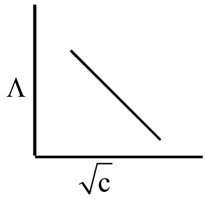
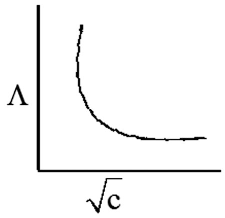
$$E_{cell} = E^0_{cell} - \frac{2.303\,RT}{2F}\log\frac{[Zn^{2+}]}{[Ag^+]^2}$$

$$= E^0_{cell} - \frac{2.303\,RT}{2F}\log\frac{C_2}{(C_1)^2} \quad = \quad E_{cell} = E^0_{cell} + \frac{2.303\,RT}{2F}\log\frac{C_1^{\ 2}}{C_2}$$

70. $\Lambda_m(AlCl_3) = 130\ ohm^{-1}\,cm^2\ mol^{-1}$

$\Lambda eqv. = \dfrac{130}{3} = 43.3\,\underline{ohm^{-1}cm}\,eqv^{-1}$ $\qquad$ Eq. mass of $AlCl_3 = \dfrac{\text{Mol mass}}{3}$

71.

	Strong electrolyte	**Weak electrolyte**
i.	It ionises completely (100%)	It ionises partially (in the order 1–10%)
ii.	It consists of ions $\underset{0}{HA^1} \rightleftharpoons \underset{c}{H^+} + \underset{c}{A^1(-)}$	It consists of ions and undisociated molecules. $HA(Aq) \rightleftharpoons H^+(aq) + A^-(aq)$ C O O $C(1-\alpha)$ $C\alpha$ $C\alpha$
iii.	$\Lambda_m = \Lambda_m^0 - b\sqrt{C}$ C = molar conc^n of the solution. $\boxed{\Lambda_m = \alpha\,\Lambda_m^0}$	$\Lambda_m^0 = n_+\lambda_{m^+}^0 + n_-\lambda_{m^-}^0$ n_+ = no. of cation, n_ – = no of anion.
iv.	HIgher conductivity (Very good conductor)	Less conductivity i.e. weakly conduct electricity.
v.	Graphically-  Λ of strong electrolyte rises linearly with decrease of concentration and when $C \rightarrow 0$ (infinite dilution) Λ has a limiting value i.e., Λ_0 which is constant for a given electrolyte at a given temperature.	 Λ value rises rapidly with decrease of concentration.

72. See text.

73. i) $NaCl(fused) \rightarrow Na^+ + Cl^-$

At anode : $Na^+ + e \longrightarrow Na$

At anode : $Cl^- \longrightarrow \frac{1}{2}Cl_2(g)$

ii) $NaCl(Aq)$

At cathode : $H_2O \longrightarrow H^+ + OH^-$

$$\begin{array}{l} H^+ + e^- \longrightarrow \frac{1}{2}H_2 \\ \hline H_2O + e^- \longrightarrow \frac{1}{2}H_2 + OH^- \\ \hline \end{array}$$

At anode : $Cl^- \longrightarrow \frac{1}{2}Cl_2 + e^-$

iii) $CuSO_4(Aq) \longrightarrow Cu^{2+}_{(Aq)} + SO_4^{2-}(Aq)$

$H_2O \longrightarrow H^+ + OH^-$

At cathode (–) $Cu^{2+} + 2e^- \longrightarrow Cu(s),$ $E^0_{Cu^{2+}|Cu} > E^0_{H^+|\frac{1}{2}H_2}$

At anode (+) $4\,OH^- \longrightarrow O_2 \uparrow + 2H_2O + 4e^-$

iv) $CuSO_4$ (Aq) taking copper electrode :

At cathode - $Cu^{2+} + 2e^- \longrightarrow Cu$
(deposited)

At anode - $Cu + SO_4^{2-} \longrightarrow CuSO_4 + 2e^-$
(Copper anode dissolves)

v) Ag NO_3 (Aq) taking Ag electrode

At cathode - $Ag^+ + e^- \rightarrow Ag$ (Cathode gains weight)

At anode - $Ag + NO_3^- \longrightarrow AgNO_3 + e^-$ (Ag anode loses wt.)

vi) $AgNO_3$ using Pt-electrodes.

At cathode - $4\,Ag^+ + 4e^- \rightarrow 4Ag$

At anode - $4OH^- \longrightarrow O_2 + 2H_2O + 4e^-$

vii) $H_2O \longrightarrow H^+ + OH^-$

At cathode $4\,H^+ + 4e^- \longrightarrow 2H_2$

At anode $4OH^- \longrightarrow O_2 + 2H_2O + 4e^-$

Hydrogen (g) and oxygen (g) in the ratio 2 : 1 by volume.

74. Chemical equivalent is the mass discharged on passage of 1F (=96500C) of electricity or charge.

e.g. 1F discharges 108 gram Ag from $AgNO_3$ (aq.) It is also called the equivalent mass of silver.

Electrochemical equivalent (ECE or Z) i.e. the mass discharges on passage of 1 coloumb of eelctricity. Unit of Z = gram / coulomb

e.g. ECE of silver = 0.001119 g/C

Relationship : 1 C discharges Z gram

$96500(=1F)$ discharges $96500 \times Z = E$ (eqvt. mass)

So, $E = ZF$ (or) $E \propto Z$ (or) $\dfrac{E_1}{E_2} = \dfrac{Z_1}{Z_2}$

75. (i) $E^0_{Cu^{2+}|Cu} > E^0_{Fe^{2+}|Fe}$ i.e. Copper ions undergo reduction.

$CuSO_4 + Fe \longrightarrow FeSO_4 + Cu$

$CuSO_4(Aq)$ is blue due to $\left[Cu(H_2O)_4\right]^{2+}$, but on reduction with Fe it $CuSO_4$(Aq) gets discharged.

(ii) NaCl is a salt of strong acid (HCl) and strong base (NaOH). Its aq. solution does not undergo hydrolysis & pH = 7 (neutral). On electrolysis [OH] inceases as H^+ gets discharged liberating H_2(g), hence the solution becomes alkaline $(pH > 7)$

$$Na\,Cl(Aq) \longrightarrow Nc^+(Aq) + Cl^-(Aq)$$

At cathode. $H_2O + e^- \longrightarrow \frac{1}{2}H_2 + OH^-$

At anode $Cl^- \longrightarrow \frac{1}{2}Cl_2 + e^-$

76. (i) $\overset{+2}{H_2}\overset{-2}{O_2} + O \xrightarrow{2F} H_2O + \overset{0}{O_2}$

$$H_2O_2 \to O_2 + 2H^+ + 2e^-$$

(ii) $2FeO + O \longrightarrow Fe_2O_3\,(1F/mole)$, $2FeO + H_2O \to Fe_2O_3 + 2H^+ + 2e^-$

77. (i) $Cu + 2Ag\,NO_3 \longrightarrow Cu(NO_3)_2 + 2\,Ag$

$$E^0_{Ag^+|Ag} > E^0_{Cu^{2+}|Cu}$$

Ag^+ undergoes reduction forming Ag and Cu oxidises forming $Cu(NO_3)_2$ i.e. it goes into solution. Hole will be formed in copper vessel hence can't be stored.

(ii) $CuSO_4 + Zn \longrightarrow ZnSO_4 + Cu$

$$E^0_{Cu^{2+}|Cu} > E^0_{Zn^{2+}|Zn}$$

$Cu + Zn\,SO_4 \longrightarrow$ No reaction (Not feasible)

i.e. $ZnSO_4$ can be stored in a copper vessel.

78. Electrode potential is the tendency of the electrode to lose or gain electron.

Cell potential is the sum of electrode potentials

i.e. oxidation potential of anode + reduction potential of the cathode.

e.g. $E_{Daniell\,cell} = E_{Zn|Zn^{2+}} + E_{Cu^{2+}|Cu}$

79. Electroplating : It is a process by which a metal gets deposited over another (conducting surface) in presence of a metal salt. The metal to be electroplated is chosen as cathode; the metal deposits on it on reduction of metal ion of the electrolyte.

Objective i) Resistance to corrosion.

ii) To improve hardness and physical appearance of article

iii) To increase the decorative and commercial value of the article.

80.

EMF	**Potential difference**
i) EMF is the maxium potential difference between the two electrodes of the cell. When no current is drawn from the cell.	i) P.D. is the difference of potential between any two points in a closed circuit.
ii) It is measured by a potentionster.	ii) Its value is measured by volt meter.
iii) It is independent of the resistance of the circuit.	iii) It is proportional to the resistance between two given points.

81. Let us take the example of Zn-$CuSO_4$ cell.

Cell notation. $$\overset{-}{\mathrm{Zn}\,|}\mathrm{Zn}^{2+}(\mathrm{Aq})\underset{\text{Saltbridge}}{||}\mathrm{Cu}^{2+}\overset{+}{(\mathrm{Aq})}|\mathrm{Cu}$$

Anode (Oxidation) Cathode (reduction)

82. A reference (RE) eectrode is an electrode with stable and known electrode potential value. It is used as a half cell to calculate the electrode potential of an unknown electrode using a potentiometer.

Saturated calomel electrode, Hg Hg_2Cl_2(s), KCl (Satd.) = +0.241 V at 298 K. Standard hydrogen electrode . SHE Pt, H_2(gas -1atm-298K), H^+(1M) = 0.0 V

Calomel electrode is preferred as SHE is difficult to prepare Ag, AgCl(s), KCl also can be used as reference electrode.

(Potentiometer)

R.E. — Salt bridge — Unknown electrode

Potentiometer (cell potential) = Electrode potential of RE + Electrode potential of unknown.

Thus, unknown electrode potential can be known. Two electrodes are arranged to have positive cell potetial.

83. $H_2O \xrightarrow{\text{electricity}} H_2 + \frac{1}{2}O_2$

To produce 1 mole. H_2 it needs 2 F.

$$2H^+ + 2e^- \longrightarrow H_2$$

$$Q = I \times t$$

$$2 \times 96500C = 2 \times t(\text{sec})$$

$$t = 96500\,\text{sec}$$

= 26 hours 48 minutes and 20 seconds. = 26.81 hour.

84. Nernst equation :

Nernst equation gave a relationship between reduction potential of an electrode and concentration ions at a given temperature. If standard potential in known electrode potential at any concentration and temperature can be calculated.

Let us take a general electrode:

$$M^{n+}_{(aq)} + ne \longrightarrow M_{(S)}$$

As per Nernst equation –

$$E_{M^{n+}|M} = E^0_{M^{n+}|M} - \frac{2.302\,RT}{nF}\log\frac{[M]}{\left[M^{n+}\right]}$$

Taking [M] = 1

$$E_{M^{n+}|M} = E^0_{M^{n+}|M} + \frac{2.303\,RT}{nF}\log\left[M^{n+}\right]$$

Taking $R = 8.31\ J\ K^{-1}\ mol^{-1}$

$T = 298\ K$

$n = \text{no. of } \bar{e}(s) \text{ involved}$

$F = 96500\ C$

Then $$\frac{2.303\,RT}{nF} = \frac{0.0591}{n}$$

Thus $$E_{Mn^{+}|M} = E^0_{M^{n+}|M} + \frac{0.0591}{n}\left[M^{n+}\right]$$

Applications :

(a) Calculation of cell potential :

e.g. Zn-CuSO$_4$ cell

$$Zn\left|Zn^{2+}(C_1)\right|\left|Cu^{2+}(C_2)\right|Cu$$

Cell equation : $Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$

Applying Nernst equation :

$$E_{Cell} = E^0_{Cell} - \frac{2.303RT}{2F}\log\frac{\left[Zn^{2+}\right]}{\left[Cu^{2+}\right]}$$

By convention $[Zn] = [Cu] = 1$

$$= E^0_{Cell} + \frac{2.303\,RT}{2F}\log\frac{C_2}{C_1}$$

$$E^0_{Cell} = E^0_{Cu^{2+}|Cu} - E^0_{Zn^{2+}|Zn}$$

$$= +0.34 - (-0.76)$$

$$= 1.1 \text{ volt.}$$

Substiting the T.value, concentration of two connecting solutions emf of the cell can be calculated.

At 298 K :

$$E_{cell} = 1.1 + \frac{0.0591}{2}\log\frac{C_2}{C_1}$$

(b) Determination of equilibrium constant :

K_C for the above system $= \frac{\left|Zn^{2+}\right|}{\left[C_u^{2+}\right]}$

$$E_{cell} = E^0_{cell} - \frac{2.303\,RT}{2F}\log K_C = 0 \quad \text{(at equilibrium)}$$

$$E^0_{Cell} = \frac{2.303RT}{2F}\log\ K_C$$

$$\boxed{\log K_C = \frac{nF\,E^0_{Cell}}{2.303\,RT}} \quad \text{(in general)}$$

(c) Calculation of concentration and pH of the solution of a half cell :
On application of Nernst equation concention of one electrode vessel is known other can be calculated considering other data. Knowing [H^+], pH can be calculated. Cell designed to know pH :

Pt, H_2(1 atm) H^+ (C, unknown) || KCl (Satd), Hg_2Cl_2(s), Hg.
SCE (saturated calomel electroode)
= 0.2422 volt.

Reduction potential LHE : $H^+(c) + \bar{e} \rightarrow \frac{1}{2}H_2$

Applyinf Nernst equation, $E_{H^+\left|\frac{1}{2}H_2\right.} = 0 - \frac{2.303\,RT}{F}\log\frac{[H_2]^{\frac{1}{2}}}{\left[H^+\right]} = \frac{2.303\,RT}{F}pH$

85. A dry cell is a type of electric battery, commonly used for portable electrical devices. It is a modification of wet Laclanche cell.
Construction : Anode - zinc container
Cathode. Graphite rod surrounded by MnO_2+C. The space between the electrodes is filled by moist paste of NH_4Cl and $ZnCl_2$.

Functioning : Anode : $Zn \longrightarrow Zn^{2+} + 2e^-$

Cathode : $\overset{+4}{Mn}\,O_2 + NH_4^+ + e^- \rightarrow \overset{+3}{Mn}\,O(OH) + NH_3$

$$Zn^{2+} + 4NH_3 \longrightarrow \left[Zn\left(NH_3\right)_4\right]^{2+}$$

Pressure due to evolution of NH_3 is subsided due to formation $\left[Zn\left(NH_3\right)_4\right]^{2+}$ complex.

Potential of the cell = 1.5 V

86. $Zn^{2+} + 2e^- \longrightarrow Zn$

$$E_{Zn^{2+}|Zn} = E^0_{Zn^{2+}|Zn} - \frac{2.303RT}{2F}\log\frac{1}{\left[Zn^{2+}\right]}$$

$$= \quad -0.76 - \frac{0.0591}{2} \log \frac{1}{10^{-3}}$$

$$= \quad -0.76 - \frac{0.0591}{2} 3.\log.10$$

$$= \quad -0.76 - 0.0885$$

$$= \quad -0.8485\,\text{V}$$

87. $\Lambda = k \times \frac{1000}{C}$

$$= \quad 2.4 \times 10^{-2}\ \text{ohm}^{-1}\,\text{cm}^{-1} \times \frac{1000\ \text{cm}^3/\text{L}}{0.12\,\text{gm eqvt}/\text{L}}$$

$$= \quad \frac{2.4 \times 10^{-2} \times 10^{3}}{0.12}\ \text{ohm}^{-1}\,\text{cm}^{2}\,\text{gram eqvt}^{-1}.$$

$\therefore \quad \Lambda = 200\ \text{ohm}^{-1}\,\text{cm}^{2}\,\text{gm eqvt}^{-1}$

88. 1.307 gram of Ag $= \frac{1.307}{108}$ gram eqvt.

i.e. $\frac{1.307}{108}$ gram eqvt. of Cu will be discharged = 0.012 gramqvt.

Equivalent mass of $CuSO_4.5H_2O$ = 124.5

10 gram blue vitriol $= \frac{10}{124.5} = 0.08$ gram eqvt.

$= 0.08$ gram eqvt of Cu^{++}

gram eqvt left in 500 ml = 0.08 – 0.012 = 0.068 gram eqvt.

500 ml contains 0.068 gram eqvt.

1 L contains $0.068 \times 2 = 0.136$ gm eqvt / L

$=$ conc^n of Cu^{++} after electrolysis.

89. Current efficiency 90% $= 1.7 \times \frac{90}{100} = 1.5$ amp.

No. of moles $ZnSO_4 = \frac{3\cancel{00} \times 0.16}{10\cancel{00}} = 0.048$

$$ZnSO_4 = Zn^{2+} + SO_4^{2-} \qquad \text{Eq. mass} = \frac{\text{Mol. mass}}{2}$$

1 mole of $ZnSO_4$ = 2 gram eqvt. No of moles Zn^{2+} = 0.048 moles = 0.096 gram eqvt.

No of Faraday passed = No. of grameqvt discharged

$\Rightarrow \quad \frac{1.5 \times 230}{96500} F = 0.00358\,F =$ 0.00358 gram eqvt of Zn^{2+} gets discharged

No of residual Zn^{2+} $= 0.096 - 0.00358$

$= 0.09242$ gram eqvt

Now 300 ml solution 0.09242 gram eqvt

So normality (gram eqv/L) $= \dfrac{0.09242}{300} \times 1000 = 0.31$

i.e. Normlity of $ZnSO_4$ Solution $= 0.31$ N

$= 0.155$ M $\quad 1M = 2N$

90.

$$\begin{array}{c} Ni \longrightarrow Ni^{2+} + 2e^- \\ 2H^+ + 2e^- \longrightarrow H_2 \\ \hline Ni + 2H^+ \longrightarrow Ni^{2+} + H_2 \\ \hline \end{array}$$

$$E^0_{cell} = 0 - (-0.236)$$

$$= 0.236$$

$$E_{Cell} = E^0_{Cell} - \frac{0.0591}{2} \log \frac{[Ni^{2+}]}{[H^+]^2} \qquad [N^{2+}] = 1M$$

$$0 = 0.236 + \frac{0.0591}{2} \log [H^+]^2$$

$$= 0.236 + \frac{0.0591}{2} \times 2 \log [H^+] \qquad pH = -\log [H^+]$$

$$0 = 0.236 - 0.0591 \text{ pH}$$

$$0.0591 \text{ pH} = 0.236$$

$$pH = \frac{0.236}{0.0591} = 3.99$$

91. no. of moles of $Cu^{2+} = \dfrac{100 \times 0.01}{1000} = 0.001$ mole

$$Cu^{2+} + 2e^- \longrightarrow Cu$$

1 mole needs 2F, So electricity needed = 0.002 F

92. $2[Fe^{3+} + 3e^- \longrightarrow Fe]$ $\qquad \Delta G^0 = 3F \times 0.036 = 0.108 F J$

$(\text{As } \Delta G^0 = -nFE^0)$

$Fe^{2+} + 2e^- \longrightarrow Fe, \ \Delta G^0 = 2F \times 0.44 = 0.88 F J$

(i) $2Fe^{3+} + 6e^- \longrightarrow 2Fe, \ 0.216 F J$

(ii) $3Fe^{2+} + 6e^- \longrightarrow 3Fe, \ 2.64 F J$

(iii $3Fe \longrightarrow 3Fe^{2+} + 6e^- - 2.64 FJ$

Adding (i) & (iii) $Fe + 2Fe^{3+} \longrightarrow 2Fe^{2+}$

$$\Delta G^0 = 0.216F - 2.64F$$
$$= -2.424 \times 96500$$
$$= -233916\,J = -233.916\,kJ$$

93. Cell equation :
$$\begin{array}{l} Fe \longrightarrow Fe^{2+} + 2e^- \\ \underline{2H^+ + 2e^- \longrightarrow H_2} \\ Fe + 2H^+ \longrightarrow Fe^{2+} + H_2 \end{array}$$

Applying Nernst equation –

$$E_{Cell} = E^0_{Cell} - \frac{0.0591}{2}\log\frac{[Fe^{2+}]}{[H^+]^2}$$

$$= 0.44 - \frac{0.0591}{2}\log 10^{-3}$$

$$= 0.44 + \frac{0.0591}{2} \times 3$$

$$= 0.44 + 0.08865 = 0.52865V$$

94. $-\Delta G^0 = nFE^0 = 2.303RT\log K_C$

$$\log K_C = \frac{nF\,E^0}{2.303\,RT} \qquad \left(\frac{2.303\,RT}{F} = 0.059\right)$$

$$\boxed{\log K_C = \frac{n\,E^0}{0.059}}$$

$$NiO_2 + 4H^+ + 2e^- \longrightarrow Ni^{2+} + 2H_2O$$
$$2Cl^- \longrightarrow Cl_2 + 2e \qquad n = 1$$

Now $\log K_C = \frac{2E^0}{0.059} = \frac{2 \times 0.320}{0.0591} = 10.829$

95. Cell constant, $\overset{*}{G} = \frac{\text{Spcific conductance}}{\text{Conductance}}$

$$= \frac{0.146 \times 10^{-3}\ ohm^{-1}\,cm^{-1}}{1/1500\ ohm^{-1}}$$

$$= 1500 \times 0.146 \times 10^{-3}\ cm^{-1} = 0.219\,cm^{-1}$$

Molar conductance $= \frac{\text{Conductivity} \times 1000}{\text{Molarity}}$

$$= \frac{0.146 \times 10^{-3} \times 10^3}{10^{-3}} = 0.146 \times 10^3\ ohm^{-1}\,cm^2\,mol^{-1}$$

$$= 146\ ohm^{-1}\,cm^2\,mol^{-1}$$

96. The electrode to be coupled with SHE (or a reference electrode of known emf). The cell potential is measured by means of potentiometer.

Cell rotation : $\mathrm{Mg}\left|\mathrm{Mg}^{2+}\right|\left|\mathrm{H}^{+}\right|(1\mathrm{M}),\ \frac{1}{2}\mathrm{H}_2(1\mathrm{atm}),\mathrm{Pt}$

$$\text{Now}\quad E^0_{\mathrm{Cell}} = E_{\mathrm{SHE}} - E^0_{\mathrm{Mg^{2+}|Mg}}$$

$$E^0_{\mathrm{Mg^{2+}|Mg}} = 0 - E^0_{\mathrm{Cell}}$$

97. $$\Lambda_m = \kappa \times \frac{1000}{M} = \frac{4.95\times10^{-5}\times1000}{0.001028} = 48.15\ \mathrm{ohm^3\ cm^2\ mol^{-1}}$$

$$\alpha = \frac{\Lambda_m}{\Lambda^0_m} = \frac{48.15}{390.5} = 0.1233$$

$$K_a = \frac{C\alpha^2}{1-\alpha} = \frac{0.001028\,\mathrm{mol\,L^{-1}}\times(0.1233)^2}{1-0.1233}$$

$$= 1.78\times10^{-5}\ \mathrm{mol\,L^{-1}}$$

98. Products on electrolysis of dil H_2SO_4 taking Pt - electrodes.

(i) Electrolysis of very dil. H_2SO_4 liberated H_2(g) at cathode and O_2(g) at anode on discharge of H^+(Aq) and OH^-(Aq) respectively.

(ii) Electrolysis dil H_2SO_4 (50%), strong

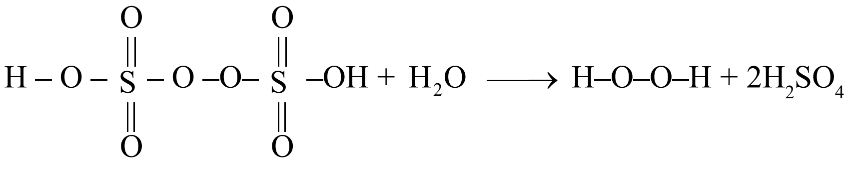
$$H_2SO_4 \longrightarrow 2H^+ + SO_4^{2-}$$

At cathode $2H^+ + 2e \longrightarrow H_2(s)$

At anode $SO_4^{2-} \longrightarrow S_2O_8^{2-} + 2e^-$

$$S_2O_8^{2-} + 2H^+ \longrightarrow H_2S_2O_8\ \text{(Per disulfuric acid)}$$

Which on hydrolysis gives hydrogen peroxide.



$$H-O-\underset{\underset{O}{\|}}{\overset{\overset{O}{\|}}{S}}-O-O-\underset{\underset{O}{\|}}{\overset{\overset{O}{\|}}{S}}-OH + H_2O \longrightarrow H{-}O{-}O{-}H + 2H_2SO_4$$

99. Copper sulfate (Aq) is acidic in nature due to hydrolysis as it's a salt of strong and acid and weak base. But on electrolysis the pH increasingly decreases i.e. becomes more acidic. (taking Pt-electrodes).

$$CuSO_4 \longrightarrow Cu^{2+} + SO_4^{2-}, H_2O \longrightarrow H^+ + OH^+$$

At cathode, $Cu^{2+} + 2e^- \longrightarrow Cu$

At anode, $4(OH)^- \longrightarrow 2H_2O + O_2 + 4e^-$

Discharge of OH^- increases H^+ ions concentration. pH value decreases.

100. Cell notation : $Zn \left| Zn^{2+} \right\| Ag^{+1} \left| Ag \right.$

$$E^0_{Zn^{2+}|Zn} = 0.76\,V, \qquad E^0_{Ag^{+}|Ag} = 0.80V$$

$$E^0_{Cell} = E^0_{Cathode} - E_{Anode}$$

$$= 0.80 - (-0.76) = 1.56\,V$$

101. Pt, $H_2 \left| H^{+} \right\| Cu^{2+} \left| Cu \right.$, $E^0_{Cell} = E^0_{Cu^{2+}|Cu} - SHE$

$= +$ve i.e. cell is spontaneous.

i.e. $E^0_{Cu^{2+}|Cu} = +$ve value .

An electrode is assigned +ve (reduction) electrode potential if undergoes reduction on being coupled with SHE. Similarly –

$Zn \left| Zn^{2+} \right\| SHE$ $\qquad E^0_{Cell} = SHE(= 0.0) - E^0_{Zn^{2+}|Zn}$

$E^0_{Zn^{2+}|Zn}$ must be with –ve value to have E^0_{Cell} positive and ΔG^0 negative.

$(\Delta G^0 = -nFE^0)$

Thus, an electrode undergoing oxidation on being coupled with SHE should have negative electrode potential value.

102. 10 gram of iodine $= \frac{10}{127}$ gram eqv. (Eq. mass of iodine = 127)

quantity of electricity $= \frac{10}{127}$ Faraday $= \frac{10}{127} \times 96500\,C$

Current strength $= \frac{10 \times 96500}{127}$ amp./sec

$= 7598.4$ amp/sec.

$W = Z\,it$

$$= \frac{E}{96500} it$$

(or) Atomic wt of Zn = 65]

$$W = \frac{E\,it}{96500} = Z \text{ it, } z = ECE$$

$$i = \frac{W \times 96500}{E \times t} = \frac{10 \times 96500}{32.5 \times 2 \times 3600} = \frac{9650\cancel{0}\cancel{0}}{2340\cancel{0}\cancel{0}}$$

$$= \frac{96500}{2340} = 4.12 \text{ amp/sec}$$

103. $\frac{W_1}{E_1} = \frac{W_2}{E_2} = \frac{W_3}{E_3}$

$$\Rightarrow \quad \frac{1.45}{108} = \frac{W_{Zn}}{32.5} = \frac{W_{Cu}}{31.75}$$

$$W_{Zn} = \frac{1.45 \times 32.5}{108} = 0.436 \text{ gram of zinc}$$

$$W_{Cu} = \frac{1.45 \times 31.75}{108} = 0.426 \text{ gram of copper}$$

According to first law, $= W_{Ag} = Z_{Ag} I.t$

$$t = \frac{W_{Ag}}{Z.I} \quad \text{Now } Z_{Ag} = \frac{108}{96500} \text{gram / C}$$

$$\text{So,} \quad t = \frac{1.45 \times 96500}{108 \times 1.5} = 864 \text{ s}$$

104. Conductivity = Cell constant × conductance
Cell constant = Condictivity × resistance
= 1.29 ohm^{-1} cm^{-1} × 100 ohm
= 129 cm^{-1}

$$\rightarrow \quad \underset{(0.02\,M\,KCl)}{\text{Conductivity}} = \frac{\text{Cell constant}}{\text{resistance}} = \frac{129\,cm^{-1}}{520\,ohm} = 0.248\,ohm^{-1}\,cm^{-1}$$

$$\rightarrow \quad \text{Molar conductivity} = \frac{\text{Conductivity}(k) \times 1000}{\text{Molarity}}$$

$$= \frac{0.248\,ohm^{-1}\,cm^{-1} \times 1000\,cm^3 / L}{0.02\,mol / L}$$

$$= \frac{248}{0.02}\,ohm^{-1}\,cm^2\,mol^{-1}$$

$$\Lambda_m = 12400\,ohm^{-1}\,cm^2\,mol^{-1}$$

105. SHE : It consists of Pt wire sealed in a gas tube & has a platinum foil attached to it. The foil is covered finaly divided platinum (colloidal platinum).
It is dipped inside 1M HCl i.e. $[H^+]$ = 1M, Pure & dry $H_2(g)$ at 298 K and 1 atm. pressure is bubbled into the solution. The surface of the foil (adsorbent) acts as a site for the cell.

Notation of the electrode (Anode) $Pt.H_2 | H^+ (1M)$
(1 atm 298 K)

Electrode reaction (oxidation) $\frac{1}{2} H_2 \longrightarrow H^+ + e^-$

Under such` condition $E^0_{SHE} = 0.0\,V = E^0_{\frac{1}{2}H_2|H^+} = E^0_{H^+|\frac{1}{2}H_2}$

Measurement of standard electrode potential . E_{Cell} = oxidation potential of LHE + reduction potential of RHE. Choosing SHE = Zero, other can be calculated.

Unit - IV

106. $t_{0.5} = 20 \text{ days} = \dfrac{0.693}{k}$

$$k = \frac{0.693}{20}\text{day}^{-1} = \frac{2.303}{30}\log\frac{100}{X} \qquad X\,\%\text{ left}$$

$$\log\frac{100}{X} = \frac{0.693 \times 30}{2.303 \times 20} = 0.4514$$

$$\log 100 - \log X = 0.4514$$

$$\log X = 2 - 0.4514$$

$$= 1.5486$$

$$X = \text{Antilog } 1.5486$$

$$= 35.37\%$$

107. Factors affecting rate of reaction :

(i) Concentration of the reactant : $-\dfrac{dc}{dt} = kC^n$

n = order of the reaction.

(ii) Presence of catalyst : e.g. +ve catalyst initiates the reaction in forward direction.

(iii) Temperature : Increase of temperature increases the rate constant i.e. the rate increases.

$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

k_1 = rate constant at temperature, T_1

k_2 = rate constant at temperature, T_2

E_a = Activation energy.

R = gas constant = 8.314 J $\text{mol}^{-1}\,\text{K}^{-1}$

(iv) Surface area : Greater is the surface area higher is the rate of reaction.

(v) Nature of reactant. e.g. $NO_{(g)} + \frac{1}{2}O_{2(g)} \xrightarrow{\text{Fast}} NO_2(g)$

$$CO_{(g)} + \frac{1}{2}O_2(g) \xrightarrow{\text{Slow}} CO_2(g)$$

Different reactants do n't proceed in the same speed.

(vi) Exposure to radiation :

$$\text{e.g.} \quad H_{2(g)} + Cl_2(g) \xrightarrow[\text{sun light}]{h\nu} 2HCl(g)$$

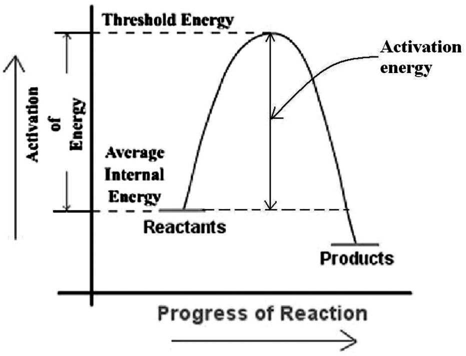
108. Threshold energy is the energy possessed by the activated complex where old bond breaks and new bond forms leading to formation of product i.e. energy to have effective collisions.

This highly unstable state is with energy greater than normal energy of the reactants (E_r) and activation energy (Ea). Relationship with Ea :

$$E_{th} = E_r + E_a.$$

e.g. $$\begin{matrix} H-H \\ I-I \end{matrix} \xrightarrow{+Ea} \begin{matrix} H---H \\ \vdots \quad\quad \vdots \\ I----I \end{matrix} \xrightarrow{-Energy} 2\ HI$$

Activated complex
(Transition state)



109. $$\log\frac{k_2}{k_1} = \frac{Ea}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right]$$

$$\log 4 = \frac{Ea}{2.303 \times 8.314}\left[\frac{20}{300 \times 320}\right]$$

$$Ea = \frac{2 \times 0.301 \times 2.303 \times 8.314 \times 300 \times 320}{20} J$$

$\therefore$ $Ea = 55.328$ kJ

110. Rate constant $k = \dfrac{2.303}{t'}\log\dfrac{a}{a/4}$

$$= \frac{2.303}{t'}2.\log 2$$

We know, $t_{0.5} = \dfrac{2.303}{k}\log 2$

Now t', the time required to complete $3/4$ times

$$t' = \frac{2.303}{k}2.\log 2$$

$$t' = 2.t_{0.5}$$

111. According to Arrheniues equation :

$k = A\,e^{-Ea/RT}$. This equation tells the dependance of temperature on rate constant of a reaction

$$\ln k = \ln A - {}^{Ea}\!/_{RT}$$

At temp T_1, $\ln k_1 = \ln A - {}^{Ea}\!/_{RT_1}$,

At temperature T_2, $\ln k_2 = \ln A - {}^{Ea}\!/_{RT_2}$

Now $\ln k_2 - \ln\ k_1 = \ln\frac{k_2}{k_1} = -\frac{Ea}{RT_2} + \frac{Ea}{RT_1} = \frac{Ea}{R}\left[\frac{T_2 - T_1}{T_1\ T_2}\right]$

i.e. $\log\frac{k_2}{k_1} = \frac{Ea}{2.303\,R}\left[\frac{T_2 - T_1}{T_1\ T_2}\right]$

112. For first order reaction $k = \frac{2.303}{15}\log\frac{100}{80}$

$$= \frac{2.303}{15}\left[\log 10 - 3\log 2\right]$$

$$= \frac{2.303}{15}\left[1 - 0.903\right]$$

$$= \frac{2.303}{15}0.097$$

$$k = 0.015\ \text{min}^{-1}$$

$\rightarrow$ $t = \frac{2.303}{0.015}\log\frac{100}{10} = 153.\ 5\ \text{min.}$

113. $t_{0.5} = \frac{0.693}{k}\left(\text{involves no concentration term}\right)$

$k = \frac{2.303}{t}\log\frac{a}{a-x}$ $\qquad a - x = {}^{a}\!/_{2}$

$t_{0.5} = \frac{2.303}{k}\log\frac{a}{{}^{a}\!/_{2}}$

$t_{0.5} = \frac{2.303\times 0.301}{k} = \frac{0.693}{k}$

114. $t = \frac{2.303}{k}\log\frac{[A]_0}{[A]}$ $\qquad [A]_0 = \text{initial concentration}$

$= 0.5$ mole/L

$[A] = 0.05$ mol/L

$t = \frac{2.303}{6\,\text{min}^{-1}}\log\frac{5\times 10^{-1}}{5\times 10^{-2}}$

$t = 0.38\,\text{min}$. $\qquad [\because\ \log 10 = 1]$

115. $-\frac{1}{2}\frac{d[A]}{dt} = +\frac{1}{4}\frac{d[B]}{dt}$

i.e. $\frac{1}{2}$ (rate of disappearance of (A) = $\frac{1}{4}$ (rate of appearance / formation of B)

$$= \frac{1}{4} \times \frac{5\times10^{-3}}{10}$$

rate of disappearce [A] = $\frac{1}{2} \times 5\times10^{-4} = 2.5\times10^{-4}\ \text{mol}^{-1}\ \text{L}^{-1}\ \text{s}^{-1}$

rate of appearance B = $\frac{5\times10^{-3}}{10}\ \text{mol L}^{-1}\ \text{s}^{-1} = 5\times10^{-4}\ \text{mol L}^{-1}\text{s}^{-1}$

116. Depending on the rate of reactions these are of three types :

(i) Fast / instantaneous reaction. e.g. ionic reactions

(ii) Reaction of moderate rate (rate can be measured) suitably. e.g. acidic hydrolysis of ester.

(iii) Slow reactions. e.g. Rusting, of iron.

117. (i) Positive catalyst accelerates the rate of reaction while negative catalyst slows down the rate.

e.g. fluorination CH_4 is moderated by cobalt catalyst.

(ii) Catalyst lowers the activation energy, accelerating the rate of reaction.

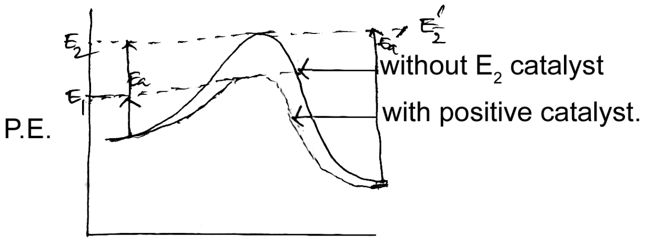
(iii) Catalyst does not take part in the chemical process so it remains unchanged.

e.g. $KClO_{3(g)} \xrightarrow{MnO_2(C)} KCl_{(g)} + \frac{3}{2}\, O_{2(g)}$

(iv) A catalyst doesnot alter Gibbs energy, ΔG of the reaction. It catalyses spontaneous reactions.

118. By affecting the activation energy it activates the reacting colliding molecules to surpass the barrier i.e. it influences the rate constant, of forward (k_f) and backward (k_b) reaction identically i.e.K the equilibrium constants, $kf/k_b = K$, does not change

The decrease in activation energy (+ve catalyst) from forward decreation is same in backward direction.



Progress of reaction

From the plot it's clear that $(E_2 - E_1) = (E_2^1 - E_1)$

So the extent of increase in forward rate is same backward rate.

119. All collisions do n't lead to formation of product(s). The collisions in which molecules collide with sufficient kinetic nergy (i.e. threshold every) and proper orientiation so as facilitate breaking of bonds between reacting species and formation of new bonds to form products are called effective collisions.

Considering effective collision,

$$\text{Rate} = PZ_{AB}\ e^{-Ea/RT}$$

Z_{AB} = collision frequency of reactants A, B.

P = Probability or Sterric factor.

120. For general reaction, $R \longrightarrow P$, at time t_1 the reactant concentration R_1 and $'t_2'$, the concentration of reactant is R_2. Similarly P_1 and P_2 are product concentrations at timing t_1, t_2. Now rate of disappearance of R :

$$\frac{[R]_2-[R]_1}{t_2-t_1} = -\frac{\Delta[R]}{\Delta t}$$

is equal to rate of appearance of 'P'

i.e. $$\frac{[P]_2-[P]_1}{t_2-t_1} = +\frac{\Delta[P]}{\Delta t}$$

Thus, r_{av} (average rate of reaction)

$$= -\frac{\Delta[R]}{\Delta t} = +\frac{\Delta[P]}{\Delta t} = \frac{\text{change in concentration of 'R' or 'P'}}{\text{change in time}}$$

But to express the rate at a particular moment of time is called instantaneous rate i.e. when Δt tends to zero. A tangent is drawn at a particular time to the c vs t plot. Thus,

$$r_{\text{inst.}} = \frac{-d[R]}{dt} = \frac{d[P]}{dt}$$

i.e. $${}_{t\to 0}\frac{-\Delta R}{\Delta t} = \frac{\Delta P}{t \to 0\ \Delta t}$$

121. $$2N_2O_5(g) \longrightarrow 2N_2O_4(g) + O_2(g)$$

Initial (t = 0) 0.5 atm 0 0

(0.5 – 2x) 2x atm x atm

$$P_t = p_{N_2O_5} + p_{N_2O_4} + p_{O_2}$$

$= (0.5 - 2x) + 2x + x = (0.5 + x)$

$x = p_t - 0.5$

$$p_{N_2O_5} = 0.5 - 2x$$

$$= 0.5 - 2(P_t - 0.5) = 1.5 - 2P_t$$

at 100s, $P_t = 0.512$ atm.

$$P_{N_2O_5} = 1.5 - 2 \times 0.512$$

$$= 1.5 - 1025 = 0.476 \text{ atm.}$$

Now for 1st order reaction,

$$k = \frac{2.303}{t = 100s} \log \frac{p_i}{p_{100S}}$$

$$= \frac{2.303}{100} \log \frac{0.5}{0.476}$$

$$= \frac{2.303}{100} \times 0.0216 = 4.98 \times 10^{-4} \text{ s}^{-1}.$$

122. $\therefore k = \dfrac{2.303}{10\,\text{min}} \log \dfrac{10\cancel{0}}{8\cancel{0}} \quad = \dfrac{2.303 \times 0.097}{10}$

$= 0.0223 \text{ min}^{-1}$ [log 10 - log 8 = 1-3 log 2=1-0.903=0.97]

$\therefore t = \dfrac{2.303}{0.0223} \log \dfrac{100}{25}$

$= \dfrac{2.303}{0.0223} \times 2 \times 0.301 = 62.2\,\text{min}.$

123. $k = \dfrac{0.693}{69.3} = 0.01 \text{ min}^{-1}$

$t = \dfrac{2.303}{0.01} \times \log \dfrac{100}{20} \quad = \dfrac{2.303 \times 0.699}{0.01} = 160.97\,\text{min}.$

124. We know that $t_{1/2} \propto \dfrac{1}{a^{n-1}}$

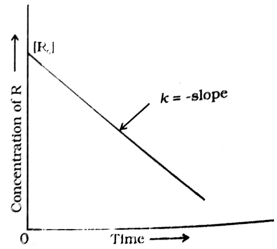
for $n = 1$, $t_{1/2}$ is constant.

As data are constant, independent of initial concentration, the said reaction is first order.

125. For zero order reaction, $\dfrac{d[R]}{dt} = k$ and the integral form is $kt = [R]_0 - [R]$.

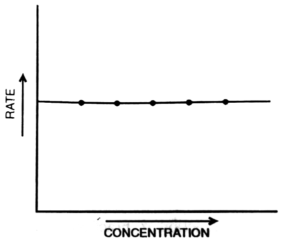
Here $t_{1/2} = \dfrac{[R]}{2k}$.

(a)



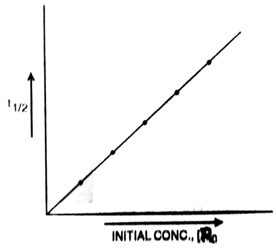
Variation in the concentration vs time plot for a zero order reaction

(b)



Plot of Rate versus concentration for reactions of zero order.

(c)



Plot of half-life ($t_{1/2}$) versus initial concentration for a zero order reaction.

126. $CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$

rate = k $[CH_3COOC_2H_5][NaOH]$, rate depends on concentrations of both, hence second order $CH_3COOC_2H_5 + H_2O \xrightarrow{HCl} CH_3COOH + C_2H_5OH$

In HCl (aq) the rate depends on only conc. of ethylacetate. It is first order with respect to ethylacetate and zero order with respect to H_3O^+.

127. rate of the reaction = $K\,[A]^x\,[B]^y$

Thus, $0.005 = k\ (0.01)^x\ (0.01)^y$ --------- I

$.020 = k\ (0.02)^x\ (0.01)^y$ --------- II

$.060 = k\ (0.02)^x\ (0.03)^y$ ----------III

$$\frac{I}{II} = \frac{0.005}{0.020} = \left(\frac{0.01}{0.02}\right)^x$$

$$\Rightarrow \frac{1}{4} = \left(\frac{1}{2}\right)^x \qquad \text{i.e. } x = 2,$$

second order with respect to ‘A’.

$$\frac{II}{III} \Rightarrow \frac{.020}{0.060} = \left(\frac{0.01}{0.03}\right)^y$$

$$\Rightarrow \frac{1}{3} = \left(\frac{1}{3}\right)^y,$$ $y = 1$, first order with respect yo ‘B’.

Thus, order reaction = x + y = 3.

128.

Rate of reaction	**Specific reaction rate**
i) It is the speed with which the reactants are converted to product.	i) It is the proportionality constant in the rate low. $-\frac{d[A]}{dt} = k[A]$ $k = -\frac{d[A]/dt}{[A]}$
ii) It is change in concentration of reactant or product per unit time e.g. $A \longrightarrow B$ $-\frac{d[A]}{dt} = +\frac{d[B]}{dt}$	ii) It is the change in concentration of reactant / product per unit time and unit concentration of the reactant or product. dt = 1 sec, [A] = 1 mol/L k = d[A] change in concentration. – ve for reactant & +ve for formation of product.
iii) It depends on initial concentration of the reactants	iii) It is independent of initial concentration.

iv) Unit : mol L^{-1} $time^{-1}$	iv) Its unit depends on order of reaction e.g. for 1st order reaction it's $time^{-1}$.

129. Order of reaction :

(i) It is the sum of the powers of the concentration terms in the rate law expression.

(ii) It is determined experimentally.

(iii) Its value never exceeds there.

(iv) It need not be whole number, it may be fraction or even zero.

130. $R \longrightarrow P$

For first order reaction , $-\frac{d[R]}{dt} = k[R]$

$$\Rightarrow \quad -\frac{d[R]}{[R]} = kdt$$

on integration : $-\ln R = kt + I$

when t = 0, i.e. initially $-\ln R_0 = I$ (integration constant)

substituting in the above equation :

$$-\ln R = kt - \ln R_0$$

$$\Rightarrow \quad -kt = -\ln R_0 + \ln R$$

$$\Rightarrow \quad \ln\frac{[R]}{[R]_0} = -kt$$

Antilog of this - $\frac{[R]}{[R]_0} = e^{-kt}$ i.e. $[R] = [R]_0 e^{-kt}$.

131. $40(=t) = \frac{2.303}{k}\log\frac{100}{20}$

$$k = \frac{2.303}{40}0.699$$

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693 \times 40}{2.303 \times 0.699} = 17.22\,\text{min}.$$

132. (i) The activation energy for combustion of fuel is very high at room temperature therefore they don't burn by themselves.

(ii) Though the reacting molecules may be having energy more than E_{th}, yet they may not be effective due to lack of proper orientation. Energy barrier and orientation barrier must to be satisfied to have the reaction leading to product.

133. $2NH_3 \rightarrow N_2 + 3H_2$

Rate expression :

$$-\frac{1}{2}\frac{d[NH_3]}{dt} = \frac{d[N_2]}{dt} = \frac{1}{3}\frac{d[H_2]}{dt},$$

$$\text{rate of reaction} = k \times [NH_3]^0 = 2.5 \times 10^{-4}\ M\,s^{-1}$$

$$\frac{d[N_2]}{dt} = 2.5 \times 10^{-4}\ M\ s^{-1}$$

$$\frac{d[H_2]}{dt} = 7.5 \times 10^{-4}\ M\ s^{-1}$$

Unit - V

134. When a strong convergent beam of light is passed through a colloidal solution and the path of rays is viewed at right angle to the direction of propagation of light, a bright cone of scattered light is observed. The cone is called Tyndal cone and the effect of scattering light is called Tyndal effect.

Condition : i) The wavelength of light must greater than the diameter of the particles constituting dispersed phase.

ii) The difference in value of refractive indices of the dispersed phase and dispersion medium must be appreciable.

True solution particles fail to scatter the light because of smaller size than size of colloidal particles.

135. Colloidal particles of dispersed phase are equally charged either positive or negative. The particles repel each other & this is the reason as to why they do not coalesce to form larger particle. This causes Brownian motion and gives stability to the colloidal solution.

Reason for charge on colloidal particle :

(i) Due to frictional electrification:

Rubbing of dispersed phase particle with those of dispersion medium result in some charge on the colloidal particle.

(ii) Due to association of surface molecules :

eg. $$C_{15}H_{31}COONa \rightleftharpoons C_{15}H_{31}COO^- + Na^+$$

Sodium palmitate (soap)

The anions aggregate by weak attractive force to have a colloidal sized particles (associated colloid) with negative charge.

(iii) Due to preferential adsorption of ions :

The particles constituting the dispersed phase adsorb only those ions preferentially which are common with their own lattice.

e.g. $Fe(OH)_3$ precipitate converts to Fe $(OH)_3$ colloidal sol adding $FeCl_3$ (Aq).

$$FeCl_3 \longrightarrow Fe^{3+} + 3Cl^-$$

$$Fe(OH)_3 + Fe^{3+} \longrightarrow Fe(OH)_3.F_e^{3+}\ sol$$

Cl^{-1} ions are taken up by the dispersion medium.

136. **Electrophoresis / Cataphoresis :** The movement of colloidal particles (dispersion phase) not the medium under the influence of an electric field is called electrophoresis.

e.g. $\left[Fe(OH)_3.Fe^{3+}\right]$sol on application of electric field move towards cathode (–) and coagulate on being discharged.

Applications : i) To findout nature of charge on colloidal particle.

ii) Dust precipitator :- In inductrial chimney dust can be precipitated by electro phoresis leaving pure air. The soots are negatively charged and stick to the +vely charged plates during electrophoreois.

iii) Sewage disposal : Colloidal particles of dirt, mud etc. carry electrical charge (–ve). Sewage water (a negative sol) passed through the plates kept at high potential, the dirt particles coagulate leaving water (medium) due to electrophoresis.

137. There are three types of solutions on the basis of particle size of the solute / dispersed phase particles.

i) True solution which is homogeneous one where solute particles are of size normally less than 1. nm.

e.g. solution of crystalloids (salt, sugar, urea etc.)

ii) Colloidal solution. It is a heterogeneous solution where the dispersed particles are of size 1–1000 nm (diameter).

iii) Suspension : It is a heterogeneous mixture containing large insoluble particles. e.g. muddy water.

138. Lyophilic (liqid loving) colloid / Intrinsic colloid.

There is a loving tendency between phase and medium, hence

i) Easily prepared by simply mixing.

ii) These are stable and not easily coagulated.

iii) Reversible in nature

iv) Viscosity of the sol is greater than the solvent.

v) Surface tension is less than the medium.

139. Factors affecting adsorpttion of gas on solid.

i) Nature if the adsorbent - More is the surface area more is the extent of adsorption e.g. catalysts are choosen in powdered form.

ii) Nature of the gas (adsorbate) easily liquifable gas i.e. exhibiting greater vander Waals force of attraction.

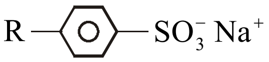
iii) Heat of adsorption : More negative $\Delta_{adp}H$ more is the extent of adsorption.

iv) Temperature. As its exothermic the adosrption is favourable at lower temperature. Higher is the T_C greater is the extent of adsorption.

v) Pressure : Extent of adsorption $\left(\frac{x}{m}\right)$ increases with rise in pressure at a constant temperature.

$$\frac{x}{m} = K\,p^{1/n}$$ (Freundlich's adsorption isotherm)

n = whole number

140. Detergent is a surafce active agent or surfactant which lowers the surface tension of the medium facilitating cleansing action. e.g. 

(Sodium alkylbenzene sulfonate)

It also fucntions as an emulsifier reducing inerfacial tension between fat and water thus removing fat along with dirt from fabric.

141.

	Colloidal solution		True solution
i)	Hetergeneous	i)	Homogeneous (a single phase)
ii)	Particle size 1–1000 nm	ii)	Particle size less than 1 nm.
iii)	Opaque	iii)	transperent
iv)	Coagulate	iv)	never settle
v)	Shows Tyndal effect	v)	Does not show
vi)	Undergo electrophoresis	vi)	If the solute is an electrolyte, true solution undergoes electrolysis.

142. Colloidal solution shows small value of colligative properties due to bigger size, the number of particles is small in comparision to true solution. Colligative properties depend on number of particles.

143. River water is muddy and carries colloidal dust particles which are charged. Sea water contains a large number of electrolytes. When river comes in contact with the sea water, colloidal particles get discharged by oppositely charged ion of the electrolyte present in sea water and are coagulated (settled). Over the time a hard solid deposit of delta in formed.

144.

	Homogeneous catalysis		Heterogeneous catalysis
→	Catalyst functions in the same phase as that of reactants.	–	Here Catalysts are in different phases (generally solid state)
→	It proceeds through different steps with approved mechanism	–	It proceeds through adsorption theory.
	$2SO_2 + O_2(g) \xrightarrow{NO(g)} 2SO_3(g)$		$H_{2(g)} + CH_2 = CH_2(g) \xrightarrow{Ni(s)} CH_3 - CH_3(g)$
	Mechanism.		Reaction takes place on the catalytic surafce

$$2H_2O + NO \longrightarrow HNO_3 + 3H$$

$$2HNO_3 + 2SO_2 \longrightarrow 2SO_3 + NO + NO_2 + H_2O$$

Berzelius mechanism :

$$2NO + O_2 \longrightarrow 2NO_2$$

$$SO_2 + NO_2 \longrightarrow SO_3 + NO$$

NO reappeared.

In solution :

$$CH_3COOC_2H_5 \xrightarrow{H^+} CH_3COOH + C_2H_5OH$$

–	Catalyst is involved in chemical reaction.		Catalyst adsorbs the reactants & new chemical bond is formed.
→	Faster	→	slower

145. **Selectivity of catalyt :** It is the ability of the catalyst to direct a reaction to give specific product.

Selectivity of different catalysts for the same reactants is different.

e.g. CO and H_2 (water gas) with different catalyst gives different product.

(i) $CO_{(g)} + 2H_{2(g)} \xrightarrow{Cu/ZnO-Cr_2O_3} CH_3OH(g)$

(ii) $CO_{(g)} + 3H_{2(g)} \xrightarrow{Ni} CH_4(g) + H_2O(g)$

(iii) $CO + H_2(g) \xrightarrow{Cu} HCHO(g)$

146. **Hardy – Schultze rule** According to it

(i) The ions carrying charge opposite to that on sol particles are effective in causing the coagulation of the sol. These are called active ions.

e.g. Negative sol ($A_2 S_3$) can be cogulated in the decreasing order of the charge of cation i.e.

$$Al^{3+} > Mg^{2+} > Na^{+}$$

The flocculation value increases in the order : $Al^{3+} < Mg^{2+} < Na^{+}$

(ii) The coagulating power of an electrolyte is directly proportional to valency of the active ion.

e.g. To coagulate +ve sol e.g. Fe $(OH)_3$. Fe^{3+}

$$\left[Fe(CN)_6\right]^{4-} > PO_4^{3-} > SO_4^{2-} > Cl^{-}$$

More is the coagulating power smaller is the flocculation value of an electrolyte.

(iii) Not only electrolytes, when equimolar proportions of two oppositely charged sols are mixed they mutually neutralise their charge and both gets coagulated.

147. Colloid is the state of substance as it depends on particle size (1–1000 nm), if the particle size falls less than it changes to crystalline state.

148. A catalyst may be defined as the substance which when present in the chemical reaction accelerate (in case of +ve catalyst) the speed and recovered unchanged in amount and chemical character when reaction is over. The chemical process involving the catalyst is called catalysis.

Characteristics :

(a) It can't initiate the reaction but accelerate the rate of reaction i.e. it can catalyse the spontaneous reaction with negative ΔG.

(b) Small amount of catalyst is sufficient to catalyse a particular reaction.

(c) Its quantity (mass), chemical property remain unchanged after the reaction. It may however, undergo certain physical changes such as state, colour, structure etc.

(d) A particular catalyst is not in a position to catalyse all reaction. It is specific in nature.

(e) It is more effective in finely powdered form / colloidal form due to increase of surface area.

(f) Catalyst lowers down the activation energy accelerating both forward and backward rate equally as a result equilibrium constant (K) remains unchanged but equilibrium is reached quickly.

149. Modern Adsorption theory :

The mechanism follows five steps such as :

(i) Diffusion of reactants to the surface of the catalyst (adsorbent).

(ii) Some association (adhering) of reactants to the surface of the catalyst (adsorption)

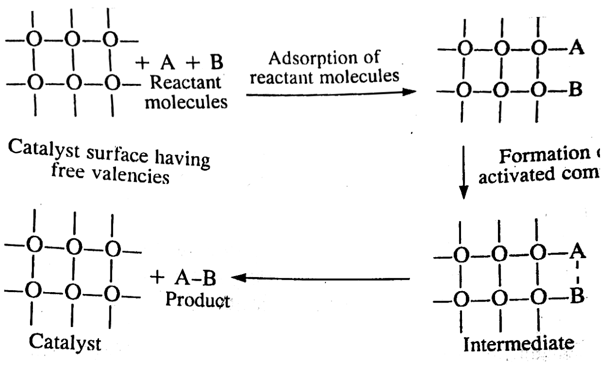
(iii) Occurrence of chemical reaction on the catalyst's surface through formation of intermediate.

(iv) Desorption of product from the catalyst surface and there by making the surface available again for more reaction to occur.

(v) Diffusion of reaction products away from the surface of the catalyst. The surface of the catalyst has free valencies which provide the seat for chemical forces of attraction.

Merit & limitations. This theory explains why the catalyst remains unchanged in mass and chemical composition at the end of the reaction and effective even in small quantities.

– It fails to explain the action of catalytic promoters and catalytic poisons.

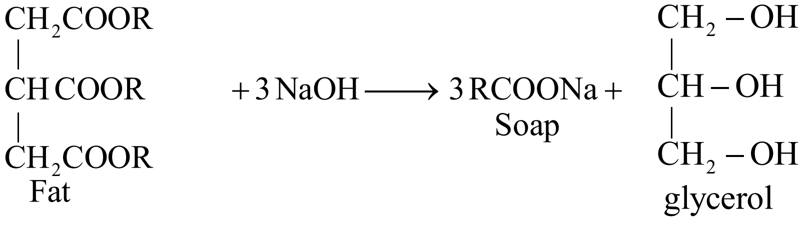


150. According to Gibbs-Helmholtz equation, $\Delta G = \Delta H - T\Delta S$. On being adsorbed the disorderdness decreases i.e. $\Delta S = -ve$, Now, ΔG the free energy change must also be negative incase adsorption to take place. As $(-T\Delta S)$ is positive at a given temperature, ΔH must be negative to have adsrption spontaneous, $\Delta G = -ve$. Thus, the adsorption process is exothermic nature.

$$\underset{-(ve)}{\Delta G} = \underset{(-ve)}{\Delta H} - T\Delta S$$

$\rightarrow$ Further, adsorption arises because of attraction between particles or molecules of adsorbent and adsorbate. This follows decrease of energy in the system i.e. exothermic in nature.

151. Boiling washing soda, $Na_2CO_3 + H_2O \xrightarrow{boil} 2NaOH + CO_2$ sodium hydroxide formed on hydrolysis react with fat (triglyceride) to form soap and glycerol by saponification reaction. Fats get disposed in water by emulsification (soap- emulsifying agent) and helps in cleaning, the pan.



$$\underset{\text{Fat}}{\begin{array}{l} CH_2COOR \\ | \\ CHCOOR \\ | \\ CH_2COOR \end{array}} + 3\,NaOH \longrightarrow \underset{\text{Soap}}{3\,RCOONa} + \underset{\text{glycerol}}{\begin{array}{l} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-OH \end{array}}$$

152. Blood is a colloidal system consisting of the positively charged particle, haemoglobins (Hb). When it (blood) comes in contact with an electrolyte, the charge gets discharged by– vely charged part of the electrolyte and blood clots on coagulation.

153. The charge on the colloidal particles depend on preferntial adsorption of the ions from the electrolyte that are common with their own lattice ions. When silver nitrate solutin is added with excess KI aqueous, I^- adsorbs on the surface of yellow AgI precipitate and makes it a –ve sol.

$$AgI + KI \longrightarrow \underset{\text{(fixed part)}}{[AgI]I^-} + \underset{\text{diffused part}}{K^+}$$

When KI (aq) is added to Ag NO_3, positively charged Ag^+ ions are adsorbed from the electrolyte & colloidal particles acquire +ve charge i.e. a positive sol is formed.

$$AgI + AgNO_3 \longrightarrow \underset{\text{fixed part}}{[AgI]Ag^+} \vdots \underset{\text{diffused part}}{NO_3^-}.$$

154. Colloidal solutions are generally coloured on account of scattering of light by the particles of the dispersed phase. i.e. colloidal particles. Since the particles in different colloidal solution differ in sizes, they impart specific colours to these solutions on passing light.
e.g. colour of gold sol is red, on increasing the particle size the solution colour changes to purple, blue & finally becomes golden yellow. As the particle size changes the wavelength of scattered light also changes resulting in different colours.

155. The $Fe(OH)_3$ solution prepared by the hydrolysis of $FeCl_3$ has a positive charge because it preferentially adsorbs Fe^{3+} ions on its surface from solution.

$$FeCl_3 \longrightarrow Fe^{3+} + 3Cl^-$$

$$Fe(OH)_3 + Fe^{3+} \longrightarrow Fe(OH)_3.Fe^{3+}(sol).$$

Cl^- ions are taken up by the dispersion medium. Fe^{3+} acts as peptising agent.

156. When H_2S gas is passed through an aqueous soluton of SO_2, colloidal sulfur is formed on oxidation of H_2S or S^{2-}

$$2H_2S + SO_2 \longrightarrow 2H_2O + 3S(Colloid)$$

The sol looks yellow due to dispersion of sulfur.

157.

	Example	**Phase**	**Medium**	**System**
(i)	Smoke	C-particles	air (gas)	Aerosol of solid.
(ii)	FOG	liquid	air (gas)	Aerosol of liquid.
(iii)	cheese	liquid	solid	Gel
(iv)	milk	liquid	liquid	emulson (oil/water)
(v)	cream	liquid	liquid	W/O
(vi)	Soaplather	gas	liquid	Foam

158. Adsorption (Physical) of a gas on surface of solid is exothermic in nature.

$$Solid + gas \rightleftharpoons Gas\ adsorbed + heat$$

When temperature inceases, the equilibrium shifted in the backward direction to cancel the effect of increase of temperatuare as per Le-chatelier's principle. Consequently, physisorption decreases with rise of temperature. It is favoured at low temperature & high pressure.

159. Lyophobic colloids :

(i) It is formed by special methods.
e.g. metal sols are formed by Bredig's arc method.

(ii) It is irreversible.

(iii) As unstable easily gets coagulated.

(iv) Viscosity is same as that of dispersion medium.

(v) It exhibits Tyndal effect.

160.

	Multi molecular colloids		**Macromolecular colloids**
(i)	The particle size is less than colloidal range range (1 nm)	(i)	The particle size falls in colloidal (1–1000 nm)
(ii)	They exist as aggregate of smaller (Polymeric) particles	(ii)	These are already macromoelcular in nature.
(iii)	Mostly lyophobic colloids e.g. gold sol, sulfur sol (S_8) etc.	(iii)	These are mostly lyophilic colloids. e.g. starch, cellolose, proteins, nylon
(iv)	Molecular masses are not high	(iv)	Molecular masses are high.

161. Associated colloids : Characteristics :

(i) Micelles are formed in dispersed phase.

(ii) These behave as strong electrolyte at low concentration but colloidal at higher concentration i.e. above a particular concentration called CMC (critical micelle concentration) and above a particular temperature called Kraft temperature, T_K.

(iii) It lowers surface tension and raises the visocity of water.

(iv) Their molecules contain both lyophilic and lyophobic groups e.g. $C_{15}H_{31}COO^-Na^+$.

(v) vander Waals force increases with increase of concentration.

162. Enzymes are nitrogeneous compounds / proteins produced by living system and catalyse certain biological reaction. Hence these are called biocatalysts.

→ Without these living process would be too slow to sustain life.

→ Like other catalysts these are species and highly efficient. e.g. (a) one molecule of carbonic anhydrase enzyme in RBC can catalyse the decomposition of about 36 million molecules of carbonic acid in one minute.

$$H_2CO_3 \xrightleftharpoons{\text{carbonicanhydrase}} CO_2 + H_2O$$

(b) $$C_{12}H_{22}O_{11}\,(\text{Sucrose}) \xrightarrow{\text{Invertase}} \text{glucose} + \text{fructose}$$

163.

i)	Haber's process	(e)	Finely divided Fe-Mo (promoter)
ii)	Ostwald process	(c)	Pt- at 573 K
iii)	Contact process	(a)	V_2O_5 (s)
iv)	Deacon's process to manufacture chlorine.	(b)	$CuCl_2$ at 773 K
v)	Bosch process to manufacture H_2 from water gas	(f)	ferric oxide – Cr_2O_3 (promoter)
vi)	Hydrogenation of oil to ghee	(d)	Finely divided Ni

Unit - VI

164\. (i) Ore is a mineral of the metal from which metal can be extracted / isolated easily and economically. Mineral is the compound of the metal.

e.g. FeS and $FeSO_4$ are minerals of iron where FeS mineral is an ore. Thus, all ores are minerals but all minerals are not ores.

(ii) An alloy is a solid - solid solution of more than one Metal. This is homogneous. e.g. Brass (Cu + Zn). Amalgam is an alloy if mercury in one of the components e.g. Zn-Hg (Zinc amalgam)

(iii) Flux is a substance added during smelting to remove the impurities. If impurity is acidic basic flux is added and vice versa. It results formation of fusible slag drained out first leaving the molten metal as slag has lower density.

$$\underset{\text{impurity(acidic)}}{P_2O_5} + \underset{\text{(Basic flux)}}{3CaO} \longrightarrow \underset{\text{Slag}}{Ca_3(PO_4)_2}$$

(iv) Roasting – Smelting :

Roasting is a process of heating the concentrated ore in excess of air in reverberatory furnace at a temperature insufficient to melt it. (below the m.p. of the metal)

$$\underset{\text{iron pyrite}}{2FeS} + 3O_2 \longrightarrow 2FeO + 2SO_2 \uparrow$$

Smelting : It is a process to extract the metal reducing the oxide of the metal with suitable reducing agent (say-carbon) in presence of flux which combine with impurities, removed as fusible slag from the lower part of the blast furnace.

165\. Matching:

Sodium	———	Rock salt
Magnesium	———	Epsom
Aluminium	———	Cryolite
Iron	———	Limonite

166\.

(i)	Mercury	———	Liquation
(ii)	Nickel	———	Mond's process
(iii)	Titanium	———	van Arkel process
(iv)	Aluminium	———	Hall and Heroult electrolytic process.

167\. **Magnetic separation process :**

Here ore particles or gangue is magnetic in nature. e.g. (i) ores of iron haematte, (Fe_2O_3), magnetite (Fe_3O_4), siderite (Fe CO_3) subjected to rotating magnet – wheel / roller, the ore are concentrated on being attracted to the magnetic wheel while the nonmagnetic impurity will be repelled to another point.

(ii) **Concentration of casseterite (SnO_2)** ore is non-magnetic while gangue particles $Fe(CrO_2)$, (Chromite) are magnetic.

168\. Leaching is a process of concentration of the ore where ore gets dissolved in the leaching agent but not the gangues.

(i) Baeyer's process : Ore is digested with custic soda at 150^0–170^{0}C.

$$\text{Red Bauxite, } Al_2O_3.\,2H_2O + 2NaOH \longrightarrow \underset{\text{solution}}{2\,NaAlO_2} + H_2O$$

$$NaAlO_2 + 2H_2O \longrightarrow Al(OH)_3 + NaOH + \text{gangue(s), (iron oxide)}$$

(ii) White bauxite (One containing silicon oxide), Serpeck's process.

$$\text{ore} + N_2 + \text{Carbon} \xrightarrow{\Delta} AlN + CO$$

$$AlN + 3H_2O \longrightarrow Al(OH)_3 + NH_3$$

Aluminium nitride is water soluble.

169 Aluminothermy: $Cr_2O_3(s) + 2Al(s) \longrightarrow Al_2O_3(s) + 2Cr(s) \qquad \Delta G^0 = -431\text{ kJ}$

The reaction is feasible, but does not proceed at room temperature as reactants and products are solids, At elevated temperature when chromium starts melting the reaction becomes feasible. (From Elingham diagram it can better be explained.)

170. The sulfide ore contains - copper pyrites ($CuFeS_2$), galene (PbS), Zinc blende (ZnS) etc. In the froth floatation the ore particles are wetted by oil (pine oil) and frothed out to the surface.

Collector - pine oil. Froth stabiliser - aniline, cresols. Depressant - NaCN.

Role of depressant : The reagent that depresses the formation of froth. e.g. ZnS and PbS can be separated from each other adding NaCN as depressant. As NaCN forms a soluble complex with ZnS never getting wet with oil but with water, while PbS getting frothed and surfaced out.

$$4NaCN + ZnS \longrightarrow \underset{\text{water soluble complex}}{Na_2\left[Zn(CN)_4\right]} + Na_2S$$

171. $E^0_{Cu^{++}|Cu} = +0.34\text{ V} > E^0_{Zn^{2+}|Zn} = -0.76\text{ V}$

The reduction potential value shows that $Cu^{2+}_{(Aq)}$ easily be reduced to Cu, but not Zn^{2+} to Zn. Thus, Zn can reduce $Cu^{2+}(Aq)$ to Cu

$$Cu_2S(\text{one}) \xrightarrow{KCN} K\left[Cu(CN)_2\right] \xrightarrow{Zn} Cu$$

In order to reduce $Zn^{2+} \longrightarrow Zn$ more electro +ve metals like Ca, Mg or Al, stronger reducing agent (i.e. lower E^0 value) needed, but these metals react with water to liberate hydrogen and hence can't be used.

172. Sulfide ore of copper (Cu_2S) cannot be directly reduced by either coke (C) or hydrogen because $\Delta_f G^0$ of Cu_2S more negative than those of CS_2 and H_2S

Thus, $\quad 2Cu_2S + C \longrightarrow CS_2 + 4Cu, \Delta G = +ve$, not feasible.

$$\Delta_r G = \Delta_f G(CS_2) - 2 \times \Delta_f G(Cu_2S)$$

$$\underset{\text{more negative}}{Cu_2S + H_2} \longrightarrow \underset{\text{less negative}}{Cu + H_2S}, \quad \Delta G = +ve, \text{ not feasible.}$$

while $2Cu_2O + C \xrightarrow[\text{feasible}]{} 4Cu + CO_2$

From Elinghan diagran : At temperature > 1500 K :

$$\left[2Cu_{(s)} + \frac{1}{2}O_{2(g)} \rightarrow Cu_2O_{(s)}\right] \quad \Delta G^0 = -300\text{ kJ(say)} \quad \text{(i)}$$

$$C_{(s)} + \frac{1}{2}O_{2(g)} \longrightarrow CO_{(g)} \qquad \Delta G^0 = -700\,kJ\,(say) \;.............\; (ii)$$

Noe (ii) – (i) will be –

$$C_{(s)} + Cu_2O_{(s)} \underset{(feasible)}{\longrightarrow} CO_{(g)} + 2Cu \quad \Delta G^0 = -ve\,,\ (-700\ kJ + 300\ kJ)$$

173. Anode mud contains metal like Ag, Au, Pt etc which are less reactive than Cu. Actually, they are not in a position to lose $\bar{e}$, though they constitute the electrode (anode). Cu gets oxidised at anode but other (Ag, Au, Pt) fails due to their higher reduction potential.

$$\left[E^0_{Cu^{++}|Cu} = +0.34\,V\ E^0_{Au^{3+}|Au} = +1.40V,\ E^0_{Ag^+|Ag} = +0.80\,V\right]$$

Copper due to less reduction potential, it undergoes oxidation preferably & others remain in metal form.

$$Cu(s) \longrightarrow Cu^{2+}(Aq.) + 2\bar{e}$$

174. Reactions in different zones of blast furnace during extraction of iron :

A mixture of calcined ore (8 - parts) + coke (4 parts) + lime (1-part) is charged from the top of the furance and blast of hot air is blown upwards. Coke serves as fuel as well as reducing agent. Lime stone $\left(CaCO_{3\,(s)} \xrightarrow{\Delta} CaO_{(s)}\right)$ acts as flux to remove the impurities as slag.

The following reactions take place in the furnace :

(i) Combustion zone : It is at the base of the furnace where coke burns attaining a temperature of about 1775 K.

$$C_{(s)} + O_{2(g)} \longrightarrow CO_2(g)\ \Delta H = -393.4\,kJ\,.$$

(ii) Fusion zone (1475 – 1575 K)

$$CO_{2(g)} + C_{(s)} \longrightarrow 2CO \qquad \Delta H = +163.2\ kJ$$

The temperature of the system is reduced. Reduction of iron oxide take place.

$$Fe_2O_3(s) + 3C_{(s)} \longrightarrow 2Fe + 3CO + heat$$

(iii) Slag formation zone (1075 – 1275 K)

This is the middle portion of the furance. Lime stone decomposes here forming lime, CaO, used as flux.

$$CaCO_3 \longrightarrow CaO + CO_2$$

$$CaO + SiO_2 \longrightarrow \underset{(Cal.silicate-slag)}{CaSiO_3}$$

Being lighter the slag floats on the molten layer of the metal. Slag is removed.

(iv) Reduction Zone (500 – 800 K).

The temperature near the top of the furnace is 875 K. The oxide of iron gets reduced by carbon monoxide.

$$Fe_2O_3 + 2CO \longrightarrow 2\,FeO + CO_2$$

$$FeO + CO \longrightarrow Fe + CO_2$$

$$Fe_3O_4 + 4CO \longrightarrow 2\,Fe + 4\,CO_2$$

The spongy iron produced in the upper reduction zone moves down slowly and melts in the upper reduction zone moves down slowly and melts in the fusion zone. The melt is removed from the lower part of the furance through the tapping hole from time to time. The iron, thus obtained is called cast iron or pig iron.

175. In the metallurgy of aluminium, the metal to be isolated from alumina (Al_2O_3) by carrying out electrolytic reduction. The melting point of alumina is 2323 K. It is there mixed with cryolite, Na_3AlF_6 which reduces the m.p. to 1173 K. Further, Cryolite also increases the electrical conductivity of the melt.

$$Na_3\,Al\,F_6 \longrightarrow 3\,NaF + Al\,F_3$$

$$AlF_3 \longrightarrow Al^{3+} + 3F^-$$

At cathode (graphite) : $Al^{3+} + 3\overline{e} \longrightarrow Al_{(s)}$

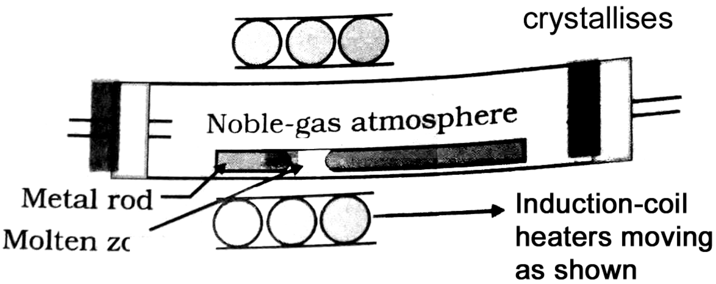
At anode : $F^- \rightarrow F + e^-$

(iron vessel) $2Al_2\,O_3 + 12F \longrightarrow 4\,AlF_3 + 3O_2$

176. Refining of Germanium : Zone refining based on fractional crystallisation principle : Here the impurities are more soluble in the melt than in the solid (crystallised) state.

A circular mobile heater is fixd at one end of a rod of impure metal. The molten zone moves along with the heater which moves forward. As the heater moves forward the pure metal crystallises out of the melt & the impurities passed on to the adjacent molten zone. The same process is repeated several times & the heater is moved in the same direction, the impurities concentrated at one end which is finally cut off.

This process is useful for producing semiconductor and other metals of very high purity e.g. Ge, Si, B, Ga and ln.



Zone refining process

177. Mond's process for refining of nickel :

Nickel is heated in a stream of CO forming a volatile complex, nickel tetracarbonyl.

$$Ni + 4CO \xrightarrow{330-350K} Ni(CO)_4$$

The complex is subjected to higher temperature so that it's decomposed giving pure nickel.

$$Ni(CO)_4 \xrightarrow{450-470K} Ni + 4CO$$

This is vapour phase refining process.

178. Leaching of low grade copper ores :

Copper is leached out from low grade copper by using acid in presence air, where copper goes into the solution as Cu^{2+} ions.

$$Cu(s) + 2H^+(aq) + \frac{1}{2}O_2(g) \longrightarrow Cu^{2+}(aq) + H_2O(\ell)$$

The solution containing Cu^{2+} ions is treated with scarp iron or $H_2(g)$ to get copper metal.

$$Cu^{2+}(aq) + Fe(s) \longrightarrow Cu(s) + Fe^{2+}(aq)$$

$$Cu^{2+}(aq) + H_2(g) \longrightarrow Cu(s) + 2H^+(aq)$$

179. (a) S^{2-} ions due to bigger size can more easily be polarised than smaller oxide ion. Ag^+, Hg^{2+}, Zn^{2+} and Pb^{2+} have high polarising power due to presence of d-subshell. Thus the sulfides ore more stable than oxides.

(b) Metal sulfides are insoluble in water and occur mostly in rocks but halides are highly soluble and get dissolved in rain water and carried to lakes and seas.

180. Calcination : It is a process of heating the ore strongly either in a limited supply of air or in the absence of air During the process –

(i) moisture is removed
(ii) volatile impurities are removed.
(iii) the ore becomes porous
(iv) water from hydrated oxide removed.

$$Al_2O_3.2H_2O \longrightarrow Al_2O_3 + 2H_2O$$

(v) Carbonates decompose to oxide.

$$Zn\,CO_3 \longrightarrow ZnO + CO_2$$

Roasting : It is the process of heating the ore strongly in the presence of excess of air at a temperature below the melting point of the metal. It is mainly employed in case of sulfide ores. During the process :

(i) S, As and P are removed as their volatile oxides, SO_2, As_2O_3, P_2O_5 respectively.

(ii) Ores of the metal are converted to their oxides e.g. sulfide ores on roasting give metal oxide and sulfurdioxide.

$$2\,ZnS + 3O_2 \longrightarrow 2\,ZnO + 2SO_2$$

Both calcination and roasting generally done in the reverberatory furnace. In roasting the air holes are kept opened, while in calcination these are half opened or closed.

181. (i) Lime stone as flux to remove impurities as slag.

$$Ca\,CO_3 \xrightarrow{\Delta} CaO + CO_2$$

$$CaO(lime) + SiO_2\ (impurity) \longrightarrow CaSiO_3\ (slag)$$

(ii) To act as reducing agent in blast furnace.

Fusion zone : $CO_2 + C(Coke) \longrightarrow 2\,CO$

Reduction zone : $Fe_2\,O_3 + 2\,CO \longrightarrow 2\,FeO + CO_2$

$FeO + CO \longrightarrow Fe + CO_2$

Unit - VII

182. Bi : $6s^2\ 6p^3$ (valence shell configuration)

$$\boxed{\uparrow\downarrow}\quad\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}$$

The three unpair e^- (s) easily take part in bonding giving +3 O.S. Due to strong 'inert pair effect' the 6-s (paired) electron are quite reluctant (inert) in forming bond.

183. P_{15} : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3\ 3d^0$. 3s electrons on being unpaired take part in bonding favouring penta-covalency e.g. PCl_5.

$$\boxed{\uparrow}\quad\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}\ \boxed{\uparrow}\boxed{\ }\boxed{\ }\boxed{\ }$$

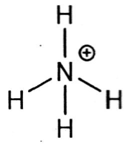
(sp_3d-hybridisation)

N (Z = 7) $1s^2\ 2s^2\ 2p^3$ (does not have d-orbitals). The available three unpair electrons take part in bonding exhibiting covalency state three.

$$\boxed{\uparrow\downarrow}\quad\boxed{\uparrow}\boxed{\uparrow}\boxed{\uparrow}$$

e.g. NCl_3 (sp^3- hybridized) 'N' has maximum valency state four where its N^+ (iso electronic with C) e.g.

N^+H_4 ·



184. Aquaregia is a mixture of conc. HNO_3 and conc. HCl in the ratio (1:3). The liberated (nascent chlorine) oxidizes Pt and dissolves forming $PtCl_4$.

$$\underset{}{HNO_3 + 3HCl \longrightarrow \underset{\text{nitrosylchloride}}{NOCl} + 2H_2O + 2Cl}$$

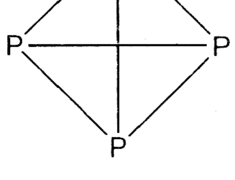
$$Pt + 4Cl \longrightarrow PtCl_4$$

$$PtCl_4 + 2HCl \longrightarrow H_2[PtCl_4],\ \text{chloroplatinic acid}$$

With gold: $Au + 3Cl \rightarrow AuCl_3$

$AuCl_3 + HCl \rightarrow HAuCl_4$, Chloroauric acid.

185. $N \equiv N$



N($2s^2\ 2p^3$) being of smaller size can for $P_\pi - P_\pi$ bond and hence can form multiple bond. It is a discrete molecule held by weak vanderWaals force, exhibits in gaseous state. P($3s^2 3p^3$), being of bigger in size fails to form multiple (π -) bond, but form stronger covalent bond. They exhibit in polymeric form P_4 units.

Because of nature of bonding molecular nitrogen is a gas which the molecular form of other members (P_4, As_4 and Sb_4 are solids.)

186. Nitrogen gas is diatomic $:N::N:$ with electronic configuration as per MOT $^{\sigma}1s^2\ ^{\sigma^*}1s^2\ ^{\sigma}2s^2\ ^{\sigma^*}2s^2\ \pi 2p_x^{\ 2}\ \pi 2p_y^{\ 2}\ ^{\sigma}2p_z^{\ 2}$ and the bond order is three.

On the other hand 'P' is tetra atomic due to bigger size fails to for π-bond; but can form σ-bond and represented as P_4.

(Due to higher bond dissociation energy of $N \equiv N$ (946 kJ / mol.), bond cleavage is not so easy and behaves all most as inactive gas.

187. Anomalous behaviour of nitrogen:

Basis of non-identical behaviour.

i) Smaller size

ii) high electronegativity (3.0) and high $\Delta_i H$

iii) non-availabitity of d-orbitals ($2s^2 2p^3$)

iv) tendency to form $P_\pi - P_\pi$ bond i.e. multiple bond.

The aoimat(oos-behaviour is supported by following characteristics.

(a) Nitrogen is a gas but others are solids.

(b) Nitrogen is diatomic, but others are tetra-atomic

(c) Hydrogen bond is exhibited by NH_3

(d) Except NF_3 other tri halides' of 'N' are unstable due to longer bond length, N–I > N–Br > N– Cl.

(e) Due to small size and high electronegativity nitrogen forms nitride ion N^{3-}, P to some extent also forms phosphide ion.

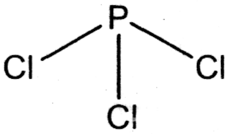
(f) Nitrogen fails to form penta valency due to absence of d-orbitals.

(g) It fails to form $d_\pi - p_\pi$ bond (due to absence of d-orbitals).

Therefore compounds of the type $R_3N = O$ and $R_3N = CH_2$ are not possible however, phosphours and other members can be involved in the multiple bonding due to availability of d-orbitals.

(h) Nitrogen is chemically inert under normal conditions because of high bond dissociation energy ($N \equiv N$), other molecules are reactive $\left(\rangle P - P\langle\right)$ due to in ability to forms multiple bond and there present more fissionable single bond.

188. The atomic size in the order I > Br > Cl.



The lone pair effect in the tetrahedral geometry of PCl_3, PBr_3 and Pl_3 in dominated by steric factor where due to bigger size of I, the bond angle, < I PI in bigger as follows in the order $Pl_3 > PBr_3 > PCl_3$ with decrease of steric factor.

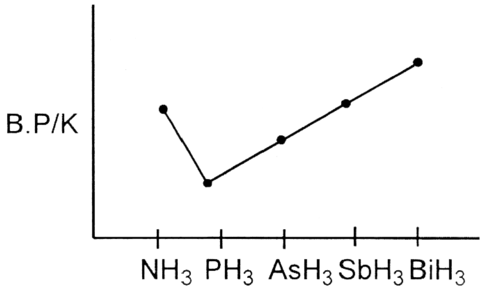
189. $NH_3(107.8^0)$,$PH_3(93.6^0)$,$AsH_3(91.8^0)$,$SbH_3(91.3^0)$,$BiH_3(90^\circ)$.

The difference in bond angles is based on the electronegativity and size of the central atom. For example 'N' is smallest in size with maximum electronegativity (3.0). The electron density is very high around nitrogen causing greater repulsion between the bond pairs, on moving down the group the electronegativity decrease and size increases. As a result there is gradual decrease in the force of repulsion among the shared electron pairs on the central atoms resulting decrease in bond angle.

190. Basic strength of hydrides of group-15 : These hydrides are Lewis bases due to presence of lone electron pairs on the central atom. The basic strength decrease in the order $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$. Nitrogen atom has smallest size and NH_3 is less voluminous and having greater electron density i.e- tendency to release electron & better base. On the other hand higher e(–) density also has greater tendency to accept proton, $: NH_3 + H^+ \longrightarrow NH_4^+$. The tendency gradually decreases on moving down group with increase of size, volume of the hydrides EH_3 decreasing the density.

191. Boiling point:

	NH_3	PH_3	AsH_3	SbH_3	BiH_3
	238.5	185.5	210.6	256.6	290



B.P. depends or intermolecular force' of attraction arising out of

i) H-bonding ii) Vander walls force

The boiling point of NH_3 is greater than that of PH_3 as there present stronger H-bonding between NH_3 molecule because of smaller size and high electro negativity of N(3.0). The boiling point suddenly decreases and increases form PH_3 to BiH_3 due to increase of size. Greater is the size greater is the vander walls force. With increase of vander Walls force the b.p. increases from PH_3 to BiH_3.

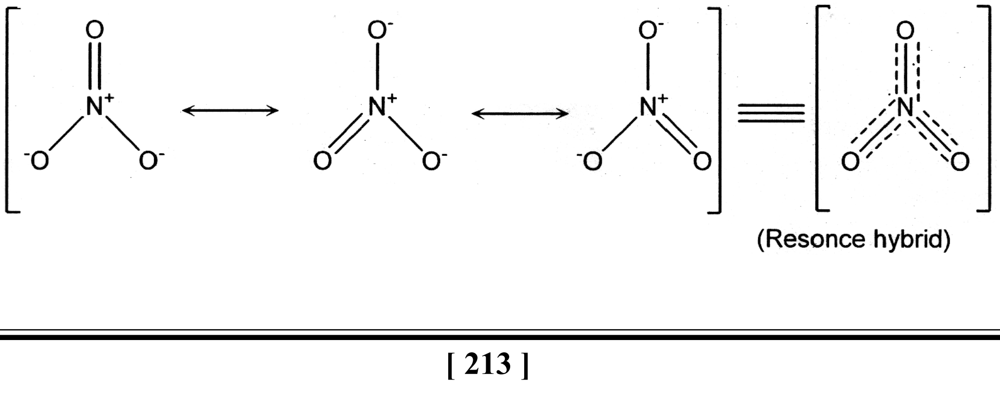
192. (a) Temperature: As the reaction is exothermic, low temperature on 700 K (optimum) is needed to keep the reaction in progress

(b) Pressure : $\Delta n = -2$. Increase of pressure helps the reaction to proceed in a direction of decrease of volume i.e.
External pressure favours better yield. In Haber's pressure about 200 atm. is applied.

(c) Catalyst: Finely divided iron in presence of traces of H_2O or Al_2O_3 or Mo as promoter.

193. Metals like Al, Ni, Cr, Fe and Co become inreactive passive in presence of cone. HNO_3 as it's an oxyacid. Pure conc. HNO_3 on reacting with these metals forms protective coating of their oxides on the surface of the metal which prevents the metals reaction with the reagent coming in contact. This is called passivity of the metal. The proctetive layer formed on surface of iron is Fe_3O_4 ($Fe_3O + Fe_2O_3$).

194. Resonating structure of NO_3^- :


(Resonce hybrid)

195. Though H_2SO_4 conc), $CaCl_2$ and P_2O_5 are dehydrating agents, fail to dehydrate NH_3, as these chemically react with ammonia.

. $2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$

. $8NH_3 + CaCl_2 \longrightarrow CaCl_2.8NH_3$ (addition compound)

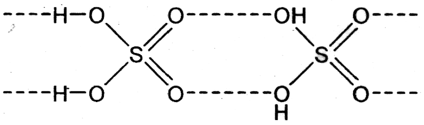
. $P_4O_{10} + 6H_2O \longrightarrow 4H_3PO_4$

. $3NH_3 + H_3PO_4 \longrightarrow (NH_4)_3PO_4$

196. Mercury never stick to the surface of the glass. However mercurous oxide (Hg_2O) forms as result of the reaction with Ozone starts sticking to the glass surface. It is known as tailing of mercury.

$$O_3 + 2Hg \rightarrow Hg_2O + O_2$$

197. The high viscosity and high b.p. can be accounted for the existence of intermolecular H-bonding in the molecules.



198. Reducing agent HI > HBr > HCl.

H_2SO_4 is not only an acid, but an oxidant (mild). It can oxidize better reducing agents like HI and HBr but not HCl. So the hydra-acid formed subsequently gets oxidized liberating halogen (Br_2/I_2).

$NaCl_{(s)} + H_2SO_4\,(conc) \longrightarrow NaHSO_4 + HCl\uparrow$ (not oxidized further by H_2SO_4)

$$NaBr_{(s)} + H_2SO_4(conc) \longrightarrow NaHSO_4 + HBr_{(g)}$$

$$H_2SO_4 \longrightarrow H_2O + SO_2 + O$$

$$2HBr_{(g)} + O \longrightarrow Br_2\,(g) + H_2O(l)$$

Instead of colourless HBr, reddish brown coloured (Br_2 - gas) is obtained.

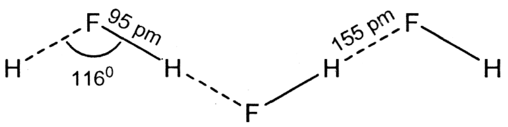
199. X^- (ns^2p^6) colourless due to non-availability of unpair (e^-), but the colour of the halogens (X_2) deepens on moving down the group.

F_2 (light yellow), Cl_2, (greenish yellow) Br_2 (reddish brown), Iodine (deep violet).

The cause of colour is due to absorption of energy from the visible light by the molecules for the excitation of outer non-bonded electrons to higher energy levels. $:\underset{\cdot\cdot}{\overset{\cdot\cdot}{X}}\cdot\cdot\underset{\cdot\cdot}{\overset{\cdot\cdot}{X}}:$

The excitation energy depends upon the size of the atom. Fluorine has the smallest size and the force of attraction between the nucleus and electron is very large. As a result, it requires very large excitation energy and thus, absorps radiation corresponding to violet & transmits light yellow (complementary colour) Iodine due to large size, needs very less excition energy and absorbs radiations corresponding to yellow light of visible spectra and transmits violet colour (complementary). That is why Iodine is violet in colour.

200. H–F(l)



H–F = 95 pm covalent bond

H-------F (H-bond) = 155 pm

HF(l) also consists of chains of HF molecules but the chains are shorter, consisting of only five or six molecule on average.

HCl, HBr and HI fails to exhibit H-bonding, hence exhibit in gaseous state experiencing vanderWaals force.

201. This depends on the bond dissociation energy which depends on bond length. Longer is the bond length lower in the bond dissociation energy. (BDE).

$$\text{Eq. } H-F > \ldots\ldots\ldots < H-I$$
$$574\,\text{kJ} \qquad 200\,\text{kJ}$$

Thus, HI is a better reducing agent as it has greater tendency to lose H, 2HI $\rightarrow I_2$ +2(H). Thus the reducing nature increases from HF to HI i.e. HF < HCl < HBr < HI.

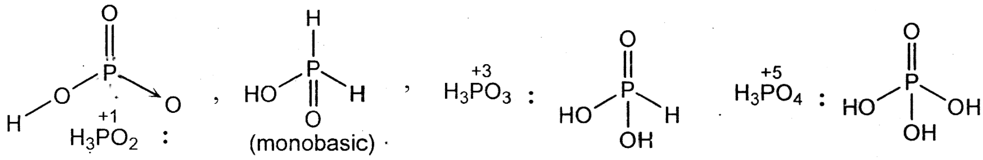
Acidic nature: In gaseous state, HX(g) are covalent in nature but becomes ionic in aq solution & behaves as acids. The acidic strength follows in the order:

$$HI > HBr > HCl > HF$$

This trend follows with the trend of increasing (BDE). HF is the weakest halogen acid due to:

i) high B.D.E   ii) Intermolecular H-bonding

202. The acidic strength can be explained on the basis of unprotonated 'O',



In spite of change in O.S. H_3PO_2, H_3PO_3 and H_3PO_4 with varying basicity, these have identical number of unprotonated 0 atoms. The greater electrio-vity influences -I effect which is same for all these molecules and hence almost have identical strength.

203. Nitrogen has maximum O.N. +5, As O.N. can decrease in it undergoes reduction and acts as oxidizing agent.

$$\text{e.q. } 2H\overset{+5}{N}O_3(\text{conc.}) \longrightarrow H_2O + 2\overset{+4}{N}O_2 + (O)$$

$$H\overset{+5}{N}O_3 \qquad H\overset{+5}{N}O_2$$

On the other hand N- exhibits + 3 O.S. in HNO_2, that can increase as well as decrease so it can act as reducing and oxidizing agent.

HNO_2 behaving as oxidizing agent i.e. 'N' undergoes decrease in O.N.

$$2H\overset{+3}{N}O_2 \longrightarrow H_2O + 2\overset{+2}{N}O + (O)$$

HNO_2 as reducing agent i.e. 'N' changes its O.N. form +3 to +5.

Oxidation : $HNO_2 + O \longrightarrow HNO_3$ [Addition of 'O']

(or) $NO_2^- + H_2O \longrightarrow NO_3^- + 2H^+ + e^-$ [Removal of $\bar{e}$]

(or) $2HNO_2 + H_2O \longrightarrow N_2O_5 + 4(H)$ [Removal of H]

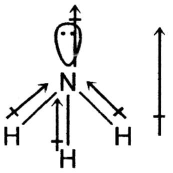
204. NH_4NO_2 never sublimes rather decomposes gives N_2(g).

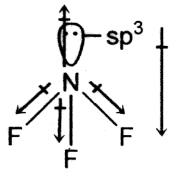
$$NH_4NO_2(s) \longrightarrow N_{2(g)} + 2H_2O(l)$$

205. The bond between P—F is stronger due shorter bond length as 'F' size is smaller. So 'P' fails to bond with 'O' of H_2O, on the other hand PCl_3 gets hydrolysed,

$PCl_3 + 3H_2O \longrightarrow H_3PO_3 + 3HCl$

206. Both NF_3 and NH_3 are sp^3-hybridised and of pyramidal shape. But due to high electronegativity of F,.the unshared pair of e^- in sp^3 hybrid orbital of N are strongly pulled towards F-atoms in the pyramidal NF_3 resulting low dipole moment $(\mu = 0.2\,D)$ hence less polar. In NH_3 , N(3.0) is more electro -ve than H (2.1), as shown the lone pair effect is aligned with the dipolement of N–H bond in pyramidal geometry.





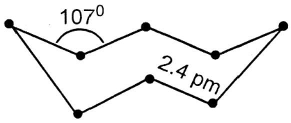
207. On passage of SO_2 through lime water first milkiness appears then disappears on excess passage of SO_2.

i) $Ca(OH)_2 + SO_2 \longrightarrow CaSO_3 + H_2O$ milkiness and $CaSO_3$ is insoluble in water

ii) With excess of SO_2, soluble $Ca(HSO_3)_2$ is formed removing the milkiness.

$$CaSO_3 + H_2O + SO_2 \longrightarrow Ca(HSO_3)_2 \text{ soluble}$$

208. O = O, (O_2) diatomic. (S_8) Octa - Atomic



Puckered ring structure (shape)

Oxygen is a small sized atom ($1s^2\,2s^2\,2p^4$). Oxygen is diatomic i.e. when two oxygen atoms come closer to each other, they don't encounter much repulsion from the e^- in inner core . On coming close there exists π-bond $(P\pi\ P\pi)$ between two smaller 'O' atoms where sidewise overlapping of p-orbital is possible, π-bond is not possible in bigger 'S' atoms where there exists repulsion between core e^- (s) S = $1s^2\,2s^2\,2p^6\,3s^2\,3p^4$. However, there present stronger σ-bond between -S-S- i.e 2 σ-bonds per atom to form puckered ring structure of eight atoms.

Thus, (O = O) molecules are discrete and held by, vander waals forces, hence gas. On the other hand polymeric 'S' (catenated) exist in solid form.

209. Fluorine has high positive reduction potential (+2.87V) and acts as a more powerful oxidizing agent than oxygen.

It oxidizes oxygen making O positive (OF_2, O_2F_2) and itself gets reduced to F^- (fluoride).

$$E^0_{O_2/H_2O} = 1.23\ V < E^0_{\frac{1}{2}F_2/F^-} = 2.87\,V$$

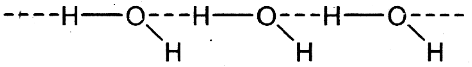
210. Anomalous behaviour of oxygen is due to

(a) It has smaller size high electro negativity (3.5).

(b) Non availability of d. orbitals ($1s^2\,2s^2\,2p^4$).

- affect of smaller size. Due to small size and high and high electro negativity it has tendency to form H-bond for which H_2O is a liquid but H_2S is a gas.
- Absence of d-orbitals : It can maximizes its covalency to four where other can expand valency state maximizes to six.
- Physical state oxygen is a gas but others are solids.
- Due to smaller size 'O' forms multiple (π) bond but other can't.

211. Water is liquid due to presence of inter molecular H–bonding

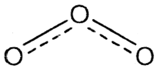


H_2S (bigger size) held by vander Waals force, hence in gaseous state.

212. H_2O_2 is a reducing agent and can react with $KMnO_4$ (Oxidising agent).
On reduction the purple colour gets discharged.

$$\left[H_2O_2 \longrightarrow O_2 + 2H^+ + 2e^-\right] \times 5$$

$$\left[MnO_4 + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O\right] \times 2$$



bond length = 128 pm in ozone, Bond length O = O is 122 pm.
Larger in the bond length less is stability i.e. O_3 has tendency to lose oxygen, [O]. Hence a powerful oxidizing agent.

$$O_3 \longrightarrow O_2 + [O]$$

Ion – electron process:

$$2H^+ + O_3 + 2e^- \longrightarrow O_2 + H_2O$$

213. Without Ozone layer, no life could exist on earth, as it prevents harmful ultraviolet radiations from reaching our planet. UV radiation harmful to animal life on earth. Ozone depleting substance (ODs) are being released in atmosphere by high flying jets and rockets. These are converting Ozone to Oxygen. (ODs)s are CFC, nitrogen oxides, chlorine, carbon tetrachloride etc.

$$NO_2 + O_3 \longrightarrow NO + 2O_2$$

The concentration in the stratospheric Ozone decrease leading to the formation of Ozone hole, through which U.V rays are in a position to pass through the Ozone layer and have a direct access to our planet. Such U.V. impact can cause skin cancer, loss of sight and affect the immune system.

214. $E^0_{\frac{1}{2}F_2/F^-} = 2.87\ V,\ E^0_{\frac{1}{2}Cl_2/Cl^-} = 1.36\,V$

Greater is the reduction potential greater is tendency to be reduced$\left(F_{(g)} + e^- \longrightarrow F^-\right)$ & more powerful as oxidizing agent this the reason why 'F' is a better oxidizing agent than 'Cl'.
Even it can oxidize oxygen and noble gases.

$$O_{(g)} + F_{2(g)} \longrightarrow OF_{2(g)}$$

$$Xe_{(g)} + F_{2(g)} \longrightarrow XeF_{2(s)}$$

215. $Cl_2 + H_2O \longrightarrow 2HCl + [O]$

Coloured matter + [O] → colourless / bleached $\xrightarrow{air(O_2)}$ Further bleached.

$$SO_2 + H_2O \longrightarrow SO_3 + 2[H]$$

Coloured matter + [H] → Bleached (colourless) $\xrightarrow[\text{oxygen}]{\text{atm.}}$ colour reappears

Thus, chlorine water bleaches by oxidation while SO_2 bleaches in aqueous condition by reduction. As surrounding atmosphere is a mild oxidant the bleached matter on coming in contact with atmospheric oxygen may regain its colour.

Thus, bleaching by 'Cl_2' is permanent while by 'SO_2' is temporary.

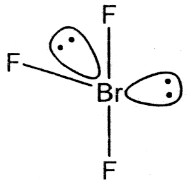
216. Inter halogen compounds of general formula AXn (n = 3, 5, 7) are more reactive than A_2 and X_2. This is due to fact that (a) A–X is much polar due to difference in electronegativity, while A-A and X-X are non-polar, (b) Weakness of covalent bond between dis-similar atoms. (A-X bond is weaker than A-A or X-X bond.

217. Br(III)

$$\underbrace{\boxed{\uparrow\downarrow}\ \boxed{\uparrow\downarrow}\boxed{\uparrow}\boxed{\uparrow}\ \boxed{\uparrow}}_{sp^3d}\boxed{}\boxed{}\boxed{}$$

AB_3L_2 – type 2- lone pair, 3 - bond pair.

Lone pair placed at an angular distance of 120° to minimize repulsion.



As L-L repulsion is greater than b-b repulsion it's slightly bent T-shaped

218. The m.p and b.b. of noble gases are very low.

This is due to noble gases (atoms) are held together only by weak vander waals forces of attraction both in solid and liquid state. However this increases on moving down the group with increase of atomic size. Greater in the size greater in the extent of vander walls forces.

219. Group 18 elements are called aerogens (generated from air) as these are isolated form liquid air by fractional evaporations. These gases have no unpair e^- in its valence shell having s^2p^6 configuration $\left(\boxed{\uparrow\downarrow}\ \boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\right)$ except He ($1s^2$) for this. These are 'zero valent having very less combining capacity, under exceptional conditioin some of these (e.q. Kr, Xe) form oxyfluorides, oxides and fluorides. This is due to low ionisation energy (ΔiH) of Kr and Xe and high reduction potential of F and O.

220. Heat of solution of sulfuric acid is highly exothermic and temperature suddenly rises causing bumping of acid, where acid is thrown upward. Therefore, reverse process is followed i.e. acid in added slowly to water to avoid bumping accident. Acid has high affinity for water.

221. Sulfur present in group 16 or VI with six e^- (s) in valence shell. Its maximum O.N = + 6 & minimum is –2. In SO_3 sulfur exhibits maximum O.N. + 6 which can decrease but can't increase further i.e. SO_3 can be reduced but can't be oxidized. As it is reduced, can act as oxidizing agent.

$$SO_3 \longrightarrow SO_2 + O$$

$$2HBr + O \longrightarrow H_2O + Br_2$$

On the other hand, in SO_2 sulfur has + 4. O.N. which can increase and decrease behaving both as reducing and oxidizing agent.

$SO_2\,(\text{as oxidant}).\qquad SO_2 \rightarrow S + 2(O)$

$SO_2\,(\text{as reductant})\quad 2H_2S + 2(O) \rightarrow 2S + 2H_2O$

222. $\Delta iH(O_2) = 1166\,kJ/mol$

$\Delta iH(Xe) = 1170\ kJ/mol$

The data shows the ionization enthalpies of O_2 and Xe are comparable: Dioxygen (O_2) forms compound with PtF_6, i.e. $O_2^+[PtF_6]^-$, So Bartlell (1962) thought Xe with comparable $\Delta_i H$ value should forms compound with PtF_6(g)

$$Xe(g) + PtF_{6(g)} \longrightarrow Xe^+[PtF_6]^-$$

Here Pt Fc is very powered oxidizing agent oxidizing O_2 to O_2^+ and Xe to Xe^+

223. (a) HCl(g) is a covalent compound which fails to conduct electricity while on hydration it ionizes and conducts electricity. A HCl(aq) is an electrolyte.

$$HCl_{(g)} + H_2O(l) \longrightarrow H_3O^+(aq) + Cl^-(aq)$$

(ii) Iodine, a covalent nonpolar moleucle less affinity for water, slightly soluble. It dissolves in 40% aq. solution of KI due o formation of KI_3.

224. Anomalous behavior of fluorine:

Reason : → Its size in small

→ It has high electronegative value (4.0)

→ ${}_9F(1s^2\,2s^2\,p^5)$ does not have d-orbitals.

→ Bond dissociation enthopy is less due to L-L repulsion in spite of small bond length. $:\underset{..}{F}:-:\underset{..}{F}:$

→ High reduction potential. $E^0_{\frac{1}{2}F_2/F^-} = 2.87\,V$

Points of difference:

(a) F has ore O.S. i.e. -1 (mostly), but other can have O.S. -1 to +7. in both having the +ve and -ve O.S.

(b) ‘F’ is most reactive non-metal due to its low bond dissociation enthalpy of F_2 and high electronegativity.

(c) H-F is a liquid due to presence of inter molecular H-bonding but other hydrogen halides are gases.

(d) HF acid generally exists in dimeric form H_2F_2 but others are as monomer.

(e) F due to absence of d-orbitals fails to form polyfluoride ion others can form Cl_3^-, Br_3^-, I_3^-, I_5^- etc.

(f) F^- acts as better ligand $[AlF_6]^{3-}$, $[FeF_6]^{3-}$, $[AgF_2]^-$ etc.

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Unit - VIII

225. A transition metal exhibits higher oxidation , states in oxides and fluorides because oxygen and fluorine are of small size and high electronegativity, high reduction potential and hence can readily oxidise the metals. For example, OsF_6, V_2O_5

226. (a) They form complex compounds.

(b) They act as good catalysts.

(c) They are paramagnetic in nature.

(d) They show variable oxidation state.

(e) The elements and their salts are coloured.

227. Lanthanides show limited number of oxidation states, such as +2, +3 and +4 (+3 is the principal oxidation state). This is because of large -energy gap between 5d and 4f subshells. On the other hand, actinides also show principal oxidation state of +3 but show a number of other oxidation states also.

For example, uranium (Z = 92) exhibits oxidation states of +3, +4, +5, +6, and +7 and neptunium (Z = 94) shows oxidation states of+3, +4, +5, +6 and +7. This is because of small energy difference between 5f and 6d orbitals.

228. Most of transition metal ions are coloured both in the solid state and in aqueous solutions. The colour of these ions is attributed to the presence of incomplete (n - 1) *d*-subshell. The electrons in these metal ions can be easily promoted from one energy level to another in the same *d*-subshell. The amount of energy required to excite the electrons to higher energy states within the same d-subshell corresponds to energy of certain colours of visible light. Therefore, when white light falls on a transition metal compound, some of its energy corresponding to a certain colour, is absorbed causing promotion of *d*-electrons. This is known as *d*- d transitions. The remaining colours of white light are transmitted and the compound appears coloured.

229. Some transition metals and their compounds act as good catalysts for various reactions. This is due to their ability to show multiple oxidation states. The common examples are Fe, Co, Ni, V, Cr, Mn, Pt, etc.

The transition metals form reaction intermediates with the substrate by using empty *d*-orbitals. These intermediates give reaction paths of lower activation energy and therefore, increase the rate of reaction. For example, during the conversion of SO_2 to SO_3, V_2O_5 is used as a catalyst. Solid V_2O_5 absorbs a molecule of on the surface forming V_2O_4 and the oxygen is given to SO_2 to form SO_3. The divanadium tetraoxide then converted to V_2O_5 by reaction with oxygen :

$$\underset{\text{Catalyst}}{V_2O_5} + SO_2 \longrightarrow SO_3 + \underset{\substack{\text{Divanadium}\\\text{tetraoxide}}}{V_2O_4}$$

$$2V_2O_4 + O_2 \longrightarrow 2V_2O_5$$

230. (i) $6Fe^{2+} + CrO_7^{2-} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

(ii) $2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$

(iii) $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

$5Fe^{2+} \longrightarrow 5Fe^{3+} + 5e^-$

231. E^0 values of Cr^{3+}/Cr^{2+} is negative while for Mn^{3+}/Mn^{2+}, it is positive [E^0Cr^{3+}/Cr^{2+}) = –0.41V and E^0 (Mn^{3+}/Mn^{2+}) = +1.37 V]. Thus, Cr^{2+} can undergo oxidation to Cr^{3+} readily and is a reducing agent while Mn^{3+} can undergo reduction and hence is an oxidizing agent.

232. (i) Complex formation :

- (a) Small size of the atoms or ions of transition metal.
- (b) high nuclear charge.
- (c) availability of vacant d-orbitals of suitable energy to accept lone pairs of $\bar{e}(s)$ donated by ligands.

(ii) Most of the compounds of transition elements are paramagnetic in nature i.e. attracted by the magnetic field. Partial filling d-orbitals ranges from d^1 to d^9 electronic configuration with d^0 (Sc^{3+}) and d^{10} (Zn^{2+}) are diamagnetic with zero effective magnetic moment, μ_f.

In addition to this (paramagnetic or diamagnetic) few substances such as iron metal, iron oxide which are highly magnetic. These are call ferromagnetic.

233. $_{21}Sc, 3d^1 4s^2$, $Sc^{3+}\left(3d^0\right)$ is isoelectronic with $Ar\left(Z = 18\right)$ so its compounds are diamagnetic and colourless, however, this is included in the d-block as (i) it exhibits variable valency due to involvement 3d as well as 4s $\bar{e}(s)$, Sc^{2+}, Sc^{3+}

(ii) General electronic configuration $\left(3d^{1-14}\ 4s^{0\ (or)1}\right)$ confirms its existence in d-block $\left(S_C = 3d^1 4s^2\right)$. (iii) It forms no colour compounds due to non-availability of $\bar{e} - 3d.\left(3d^0\right)$

234. Oxoanion of metals have highest O.S. e.g. +7 in MnO_4^-. This is because high electronegative 'O' i.e. oxidising the metal bonded. Deelectronation increases O.S.

235. $_{30}Zn$, $_3d^{10}4s^2$, (i) it does not have partially filled d-orbials (ii) forms colourless salt, (iii) Zn^{2+} is diamagnetic.

However, this is included in 3d-series as

- (a) it responds to general electronic configuration of transition elements.
- (b) Complex formation tendency like other transition metals.

e.g. $\left[Zn\left(NH_3\right)_4\right]^{2+}$

236. (i) These are held by strong inter-atomic forces & have high enthalpies of atomisation. These are maximum at about middle of each series indicating that one unpair $\bar{e}$ per d-orbital is particularly favourable for strong inter atomic attraction.

(ii) Hydration of ion depends on (1) smaller size of cation. (2) higher charge of the cation (3) presence of vacant orbitals to co-ordinate with water molecule. Cu^{2+}. due to its smaller size and higher charge can form aqua complex as well as experience greater ion-diople force of attraction.

e.g. $\left[Cu\left(H_2O\right)_4\right]^{2+}, \left[Cu\left(NH_3\right)_4\right]^{2+}$ stable complexes. Disproportionation of Cu^+.

$$2Cu^+ + water \longrightarrow Cu^{2+} + Cu + water$$

Hydration energy Cu^{2+} is greater than Cu^+. Cu^{2+} more soluble in water.

237. Ag $\left(4d^{10}5s^1\right)$ $\overset{+}{Ag}\left(4d^{10}\right)$

i) electronic configuration corresponds to general electronic configuration.

ii) high heat of atomisation

(iii) Ag^+ can form complex e.g. $\left[Ag(NH_3)_2\right]Cl$

238. The oxidation potential of a metal depends on following factors as explained in the cycle.

$$\begin{tikzcd} M(s) \arrow[r] \arrow[d, "\Delta_{subl.}H"] & M^+(aq) \\ M(g) \arrow[r, "\Delta_i H"] & M^+(g) \arrow[u, "\Delta_{hyd.}H"'] \end{tikzcd}$$

i) Heat of sublimation / atomisation (+ve)

ii) $\Delta_i H$ is the ionisation enthalpy (+ve)

iii) enthalpy $\Delta_{hyd.}H$ = hydranation enthalpy.

If $M_{(s)} \longrightarrow M^+(Aq)$ is the oxidation potential. If it's –ve (exothermic), the oxidation is favouravle. To make at –ve,

$$\Delta_{sub}H + \Delta_i H + \Delta_{hyd.}H = \Delta H$$

Smaller the value of ΔH greater is the tendency to be oxidised in aq. solution & greater is stability in that oxidation state $\left(Cu^{2+}\right)$. $E^0_{Cu/Cu^{2+}(Aq)} = -0.34V$. $E^0_{Zn|Zn^{2+}(Aq)} = +0.76\,V$.

The high value of atomisation (+339 kJ) and low hydration energy (–2121 kJ/mol) may account for low value of oxidation potential.

239. $\mu_{eff} = \sqrt{n(n+2)}$, n is the number of unpair e^-

$C_0^{2+}(3d^7)$ i.e. $n = 3$, $Fe^{3+}(3d^5)$ i.e. $n = 5$.

240. High hydration energy due to smaller cationic size and higher charge.

241. $Mn(z = 25)$ has $\bar{e}$-configuration $3d^5\,4s^2$. Because of small energy difference between 3d & 4s subshell all the seven $e^-(s)$ participate in bonding for which highest oxidation state is +7. Mn_2O_7 (other oxidies are MnO, Mn_3O_4, Mn_2O_3, MnO_2, MnO_3)
Oxygen is a better oxidising agent due to its higher reduction potential $E^0_{O_2|H_2O} = 1.23\,V$ and deelectronate Mn changing the O.S. +2 to +7.

242. The process where same element undergoing oxidation and reduction is called disproportionation.

$$3\overset{+5}{Cr}O_4^{3-} + 8H^+ \longrightarrow 2\overset{+6}{Cr}O_4^{2-} + Cr^{3+} + 4H_2O$$

$$3\overset{+5}{Cr}O_4^{3-} + 8H^+ \longrightarrow 2\overset{+6}{Cr}O_4^{2-} + Cr^{3+} + 4H_2O$$

243. High is the positive O.S. greater is the electron accepting tendency and electron acceptors are acids (Lewis)

244. Ref. text (for configuration)
stability of transition metal ion : stability of metal ion is directly proportional to the unpair electron.The exactly half filled (d^5) and completely filled d-orbitals (d^{10}) are extra-stable.

In aq. transitional metal ion exist as complex ion, $\left[M(H_2O)_6\right]^{n+}$. Since H_2O is a weak field ligand $\Delta_0(\text{CFSE})$ is less and $\bar{e}(s)$ keep them unpaired as far as possible e.g. $Cr^{3+}(H_2O)$, $t_{2g}^3\, e_g^0$ (half filled t_{2g} level), hence more stable.

245.

→ Cu(2+) $3d^9$	Zn (2^+) $3d^{10}$
n = 1	n = 0
→ Paramagnetic	diamagnetic
→ Coloured	Colourless (no unpair d electron)

Low frequency (Orange zone) absorbed $(\Delta_0 \text{ less})$ emitting colour complimentary to it (high frequency), Blue zone.

Unit - IX

246. The compounds where metal atoms or ions are bonded to a number of ligands, anion or neutral molecule with excess pair of electron to form co-ordinate covalent (or) dative bond (non-ionisable)

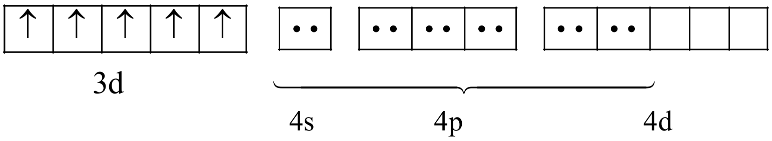
$$\left[Fe(H_2O)_6\right]^{3+}$$

Fe^{3+}, Central metal ion, $\left[Fe(H_2O)_6\right]^{3+}$ complex ion, $\left(H_2\ddot{O}:\right)$ Ligand

6 (six) co-ordination number

247. Refer text.

248. • $Fe^{3+}(3d^5)$

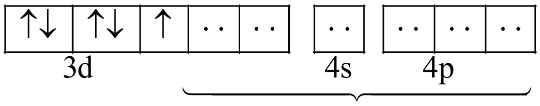


Outer orbital complex $\left(sp^3d^2 - \text{hybridisation}\right)$ six ligands $\left(\ddot{\underset{\cdot\cdot}{O}}H_2\right)$ formed co-ordinative covalent bond on donating electron pair • • to the six vacants sp^3d^2 d hybrid orbitals of Fe^{3+}

Shape : octahedral, Nature : Paramagnetic

• $\left[Fe(CN)_6\right]^{3-}$ Inner orbital complex, as $C\bar{N}$ ligand attack pairs up the d-electron leaving only one e^- unpaired.

Fe^{3+}



$d^2 s p^3$ (six vacant hybrid orbitals to coordinate with six $\underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}H_2$ molecules with electron pair donor.

Shape - Octahedral, Nature – paramagnetic withless (μ_{eff})

249. • $\left[Co(H_2O)_6\right]^{3+}$ Co(0) $3d^7 4s^2$, Co (III) $3d^6\ 4s^0$

H_2O weaker ligand as per spectrochemical series it forms high spin complex as $\Delta_0 < P$, Paramagnetic with configuration $t_{2g}^4\ e_g^2$

- $\left[Fe(CN)_6\right]^{4-}$ Fe(O) $3d^6\ 4s^2$ Fe (II) $3d^6\ 4s^0$

$C\bar{N}$, strong field ligand with higher Δ_0 (CFSE) value as $\Delta_0 > P$, it forms low spin complex with configuration t_{2g}^6, e_g^0, dia-magnetic.

250. $\left[Co(NH_3)_5 CO_3\right]Cl \xrightarrow{AgNO_3} AgCl\downarrow$

It is an electrolyte forming ions $\left[Co(NH_3)_5 CO_3\right]^+ Cl^-$

Name : pentaammine carbonato cobalt (III) chloride.

251. Complex $\left[Cr(NH_3)_4 Cl_2\right]Br \longrightarrow \left[Cr(NH_3)_4 Cl_2\right]^+ + Br^-$

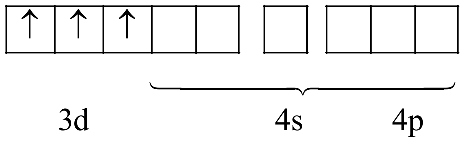
$\xrightarrow{AgNO_3} Ag\,Br\downarrow$ (pale yellow)

$Ag\,Br + 2NH_4\,OH \text{ (conc.)} \longrightarrow \left[Ag(NH_3)_2\right]Br + 2H_2O$

Soluble

Cr, (0), $3d^5\ 4s^1$

Cr (III) $3d^3$ $d^2\ sp^3$



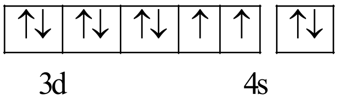
d^2sp^3 paramagnetic (n = 3)

$$\mu_{eff} = \sqrt{n(n+2)}\ BM$$

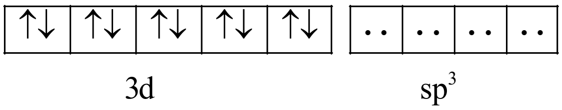
$$= \sqrt{15}\ BM$$

252. Ref. Text

253. Ni(0) $3d^8\ 4s^2$



$\left[Ni(CO)_4\right]$

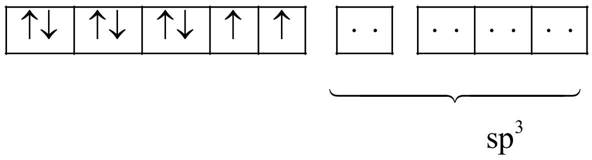


Pairing occurs in presence of CO $(\bullet\bullet)$

Shape- Tetrahedral,

μ_{eff} = zero (diamagnetic)

$[NiCl_4]^{2-}$, Ni^{2+} $3d^8\ 4s^0$



Paramagnetic. $\mu_{eff} = \sqrt{n(n+2)}$ BM $= \sqrt{8}$ BM

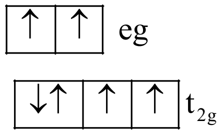
254. In the order of field strength $C\overline{N} > H_2O$, thus in presence of $C\overline{N}$ low spin complexes occur.

$[Fe(CN)_6]^{4-}$

(VBT) d^2sp^3 - hybridisation Fe (II) $3d^6$ i.e. $\Delta^0 > P$, $t_{2g}^6\ t_{eg}^0$, $n = 0$

$[Fe(H_2O)_6]$ $t_{2g}^4\ e_g^2$ (two unpair $\overline{e}$ i.e. $n = 2$)

$sp^3\ d^2$ - hybridisation (VBT)

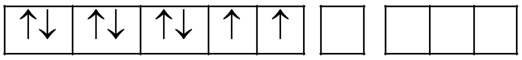


(n = 4)

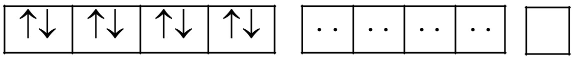
High spin complex, Due to pesence of different number of unpair $\overline{e}$, these have different colours. Different values Δ_0 also support this.

255. $[Ni(CN)_4]^{2-}$ Ni (0) $3d^8\ 4s^2$

Ni (II) $3d^8\ 4s^0$



$[Ni(CN)_4]^{2-}$



Inner orbital complex dsp^2 hybridisation

$n = 0$ (no unpair $\overline{e}$) diamagnetic

As there is absence of unpair $(\overline{e})$ it is colourless.

$[Ni(H_2O)_6]^{2+}$ Inpresence of H_2O, pairing does not occur and an outer orbital complex is formed with sp^3d^2 hybridisation. Thus, the complex undegoes d-d transition absorbing $(t_{2g}^6\ eg^2)$ low frequency (red light) and emitting its complementary colour, green.

256. Ref text (Page - 392)

[The electronic configuration of $\overline{e}(s)$ in t_{2g} and eg depends on Δ_0 value .

If $\Delta_0 < P$ ($P =$ the energy required for $\overline{e}$ pairing in a single orbital) high spin complexes (paramagnetic) are obtained. Low energy difference between t_{2g} and eg) absorbes less frequency in the visible zone emitting high frequency corresponding to its complementary colour.

257 Refer text (Page - 392)

258. $\left[Ni(NO_2)_6\right]^{4-}$, $\left[Ni(NH_3)_6\right]^{2+}$, $\left[Ni(CH_2)_6\right]^{2+}$

As per spectrochemical series. $N\bar{O}_2 > NH_3 > H_2O$

Energy absorption : $\left[Ni(NO_2)_6\right]^{4-} > \left[Ni(CH_3)_6\right]^{2+} > \left[Ni(H_2O)_6\right]^{2+}$

Since $E = \frac{hc}{\lambda}$, wavelength of energy absorbed will be in the order

$$Ni(H_2O)_6 < \left[Ni(NH_3)_6\right]^{2+} < \left[Ni(H_2O)_6\right]^{2+}$$

259. (a) $\left[Co(NH_3)_4(H_2O)_2\right]_2(SO_4)_3$

(b) $\left[Cr(en)_3\right]PO_4$

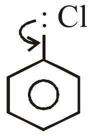
(c) $K_2\left[Pt(CN)_6\right]$

(d) $Na_3\left[Fe(C_2O_4)_3\right]$

Unit - X

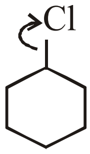
B (a) Account for the following :

1.



Chlorobenzene

- C is sp^2 hybridised
- Due to greater s-character (33.3%) releases less $\bar{e}$ towards 'Cl' and C-Cl bond becomes less polar.
- C-Cl bond developes double bond character due to delocalisation of lone pair in 'Cl'.
- C–Cl bond length is less (due to greater 's' character) dipolemoment = charge × distance. Less dipolemoment makes the bond less polar.



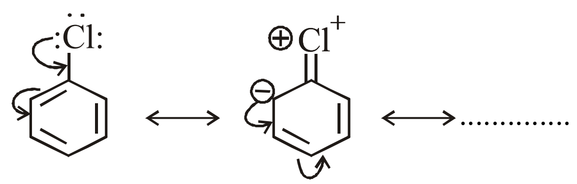
Chlorocyclohexane

- sp^3- hybridised.
- s-character 25%. partial (–ve) charge on 'Cl' is more getting the bond (C–Cl) polar.
- No. resonating structures
- C-Cl bond length is more and hence greater dipolemoment and C–Cl bond is more polar.

2. Chlorobenzene is extremely less reactive and fails to undergo nucleophilic substitution reaction generally.

Because –

(i) Resonance effect developes π-character in C–Cl bond.



(ii) Difference in hybridisation reduces the bond length
e.g. C–Cl bond length in chlorobenzene 168 pm (sp^2) while C–Cl bond length in chlorocyclohexane is about 177 pm due greater 'p' character out of sp^3 hybridisation.

Shorter in the bond length, greater is the bond dissociation energy and less is the reactivity.

(iii) Instability of phenyl cation.

(iv) The ring in chlorobenzene is $\overline{e}$-rich and hence not attacked by nucleophiles ($\overline{e}$ rich species)

3. Alkyl halides are polar & held by dipole force. On the otherhand water moelcles are held by stronger H-bonding. When alkyl halides are added to water the new forces of attraction (solute-solvent) between water and alkyl halide molecules is less than water-water molecules (solvent-solvent interaction). As halogen fails to form H-bond, the halides are not soluble (immiscible) in water.

4. Grignards reagents are very reactive and react with moisture forming alkane. So it must be prepared in anhydrous condition.

$$RMgX + HOH(\text{moisture}) \xrightarrow{\text{dry ether}} RH + Mg(OH)X$$

5. $$CH_3-CH=CH_2+H^+ \xrightarrow{Ad_E} \left[\begin{array}{l} CH_3-CH_2-\overset{\oplus}{C}H_2\ (1^0)\ \text{less stable.} \\ CH_3-\overset{\oplus}{C}H-CH_3\ (2^0-\text{more stable})\ \text{greater} \end{array}\right.$$

$$CH_3-\overset{+}{C}H-CH_3+Br^- \longrightarrow CH_3–CHBr-CH_3$$

2–Bromoprane major product.

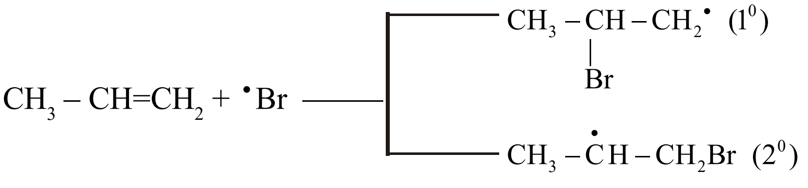
Markownikoff's rule :

The negative part of the addendum (Br^- here) goes to C atom of the $C=C$ containing less number of H–atoms.

6. Free radical oddition reaction.

$$C_6H_5\ CO–O\ \wr\ O–CO–C_6H_5 \longrightarrow 2\ C_6H_5CO.O. \longrightarrow C_6H_5\bullet + CO_2$$

$$C_6H_5. + HBr \longrightarrow C_6H_6 + Br^{\bullet}\ \text{(chain initiation)}$$



$$CH_3-CH=CH_2+{}^{\bullet}Br \longrightarrow \left[\begin{array}{l} CH_3-\underset{\displaystyle Br}{\underset{|}{C}H}-CH_2^{\bullet}\ (1^0) \\ CH_3-\overset{\bullet}{C}H-CH_2Br\ (2^0) \end{array}\right.$$

more stable with better yield.

Propagation :

$$CH_3-{}^{\bullet}CH-CH_2Br+HBr\longrightarrow CH_3-CH_2-CH_2Br+Br^{\bullet}$$

(2⁰) free radical 1-Bromopropane (major product)

Thus, when HBr adds to propene (unsymmetrical alkene) 1-Bromopropane is formed as peroxide effect or Kharasch effect.

7. (i) HCl fails to form Cl. (free radical) as (smaller bond length)

   H–Cl has greater bond strength to undergo bond fission.

   (ii) In case H–I termination step predominates over propagation liberating iodine.

   i.e. $C_6H_5COO^{\bullet}+HI\longrightarrow C_6H_5COOH+I^{\bullet}$

   Propagation : $CH_3-CH=CH_2+I^{\bullet}\longrightarrow CH_3-\dot{C}H-CH_2I$

   Termination : $I\bullet+\bullet I\longrightarrow I_2$

8. Iodination of alkanes being reversible and endothermic reaction, it's carried out is presence of oxidising agent like HIO_3 / HNO_3. The product HI gets oxidised liberating I_2 (reactant). The reactant concentration increases to favour better yield or the reaction proceeds in forward direction as per Le-Chatelier's principle.

$$RH+I_2\rightleftharpoons RI+HI$$

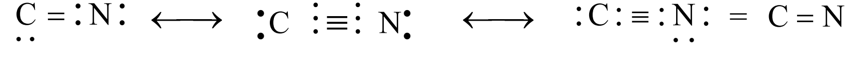
$$5HI+HIO_3\longrightarrow 3I_2+3H_2O$$

$$2HI+2HNO_3\longrightarrow I_2+2NO_2+2H_2O$$

$$\begin{array}{l} 2IO_3^-+12H^++10e^-\longrightarrow I_2+6H_2O \\ \left[\quad 2HI\qquad\qquad\longrightarrow I_2+2H^++2e^-\right]\times 5 \\ \hline 2IO_3^-+2H^++10HI\longrightarrow 6I_2+6H_2O \\ \hline \end{array}$$

i.e. $HIO_3+5HI\longrightarrow 3I_2+3H_2O$

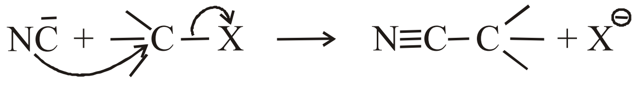
9. Alkyl halide with KCN gives alkyl cyanide. Cyanide ion is a resonance hybrid of following structures:



$$\overset{-2}{\ddot{\underset{\cdot\cdot}{C}}}=\,:\overset{+}{N}:\;\longleftrightarrow\;:\overset{-}{C}\;\vdots\!\equiv\!\vdots\;N\!:\;\longleftrightarrow\;:C:\equiv:\underset{\cdot\cdot}{\overline{N}}:\;=\;\overset{\delta-}{C}=\overset{\delta+}{N}$$

It is clear that cyanide can attack nucleophilic site through 'C' as well as N. Hence it's an ambident nucleophile.

KCN in an electrovalent compound $\left(KCN\longrightarrow K^++\bar{C}N\right)$ with $\bar{C}N$ nucleophile and the attack mostly occurs through 'C' atom of the cyanide group as C–C bond is stronger than C–N bond.



10. AgCN is predominately covalent. Therefore, in this case only N-atom is free to donate the e^- pair and the nucleophilic attack mostly occur through the N-atom of the cyanide group forming isocyanide as major product.

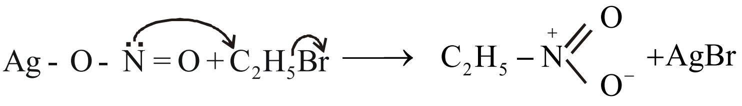
$$RX + Ag-\dot{C}=\bar{N}: \longrightarrow R-\overset{+}{N}\equiv\bar{C}: + AgX$$

11. C and N can form multiple bond. In CN bond can be made through 'C' to form cyanide and through 'N' to form isocyanide. Similarly 'N' and 'O' also can form multiple bond. 'N' of the group $-NO_2$ bonded to C. It's nitrocompound while 'O' of $-NO_2$ bonded to 'C', $>C-O-N=O$ organic nitrite is formed. Group with more than one attacking site is called ambident nucleophile.

12. KNO_2 is an ionic compound giving nitrite ion, $O=N-\bar{O}$. Here the linkage through oxygen takes place giving alkyl nitrite.

$$RX + \bar{O}-N=O \longrightarrow R-O-N=O+X^-.$$

On the other hand $AgNO_2$ is mainly a covalent compound and attack can take place through nitrogen atom which has a lone pair of $e^-(s)$,



$$Ag-O-\ddot{N}=O+C_2H_5Br \longrightarrow C_2H_5-\overset{+}{N}(=O)O^- + AgBr$$

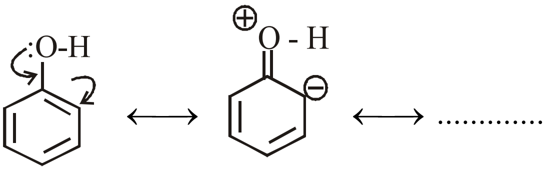
Nitroethane

13. Alkyl halide can be prepared from alcohol breaking $C \wr OH$ bond where C– is sp^3 – hybridised. Due to greater p-character (75%), the bond length is tending more towards fissionability and substitutive nature.

e.g. $ROH + HCl \xrightarrow{ZnCl_2\ (Anh.)} RCl + H_2O$

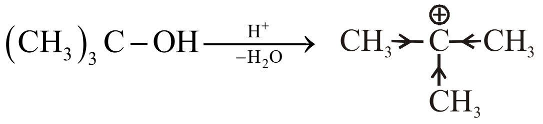
$ZnCl_2$ (Anhy) is a Lewis acid its e^- – attracting tendency makes the C–O bond weaker favouring formation of carbo-cation. This results the reactivity of alcohols follows in the order $3^0 > 2^0 > 1^0$ ($ZnCl_2$ even not necessary in case of 3^0 alcohol). In case of 3^0-alcohol the 3^0-carbocation better stabilised by +I effect and hyperconjugation.

On the other hand in phenol due to resonance, there developes – C = O, $(\pi-\text{character})$, making stronger bond between C & O and substitution by –X is not possible.



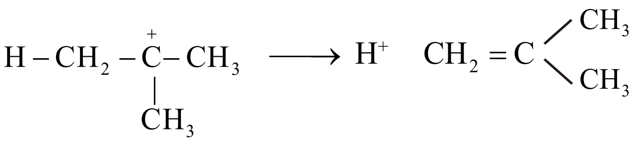
Further protonation of phenol is not possible, as 'O' already acquired (+) charge due to delocalisation of its lone pair of e^-.

14. 3^0– alcohol is preferred for protonation as 3^0–carbocation is more stable due to (i) +I effect (ii) hyperconjugation effect.



$$(CH_3)_3C-OH \xrightarrow[-H_2O]{H^+} CH_3 \rightarrow \overset{\oplus}{C}(\downarrow CH_3) \leftarrow CH_3$$

(+I effect)



$$H-CH_2-\overset{+}{C}(CH_3)-CH_3 \longrightarrow H^+ \quad CH_2=C(CH_3)_2 \longleftrightarrow$$

Nine hyper conjugative structure.

15. $NaBr + H_2SO_4 \longrightarrow NaHSO_4 + HBr$

$ROH + HBr \longrightarrow RBr + H_2O$

But HI is a better reducing agent (HI > HBr > HCl) due to bigger size and longer H–I bond length.

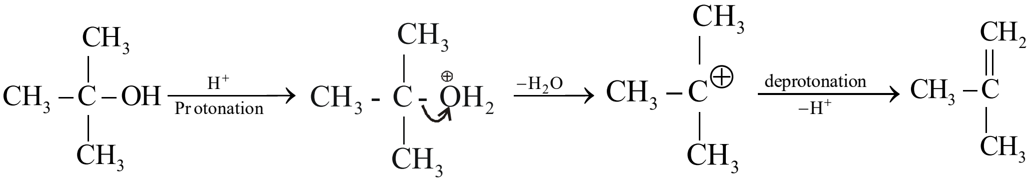
So HI (not HBr and HCl) can easily be oxidised by H_2SO_4.

$H_2SO_4 \longrightarrow H_2O + SO_2 + O$

$2HI + O \longrightarrow H_2O + I_2$

Due to absence of HI, alcohol fails to give RI in presence of conc. H_2SO_4.

16. Conc. H_2SO_4 used to prepare HX ($NaX + H_2SO_4$) caused dehydration of 3^0 and 2^0 alcohols forming alkene as the by - products. The order of dehydration of alcohol : $3^0 > 2^0 > 1^0$.



$$CH_3-C(CH_3)_2-OH \xrightarrow[\text{Protonation}]{H^+} CH_3-C(CH_3)_2-\overset{\oplus}{O}H_2 \xrightarrow{-H_2O} CH_3-\overset{\oplus}{C}(CH_3)_2 \xrightarrow[-H^+]{\text{deprotonation}} CH_3-C(CH_3)=CH_2$$

17. H_3PO_4 is an acid but not an oxidant like H_2SO_4. HI is obtained when H_3PO_4 acid reacts with KI

$KI + H_3PO_4 \longrightarrow KH_2PO_4 + HI$

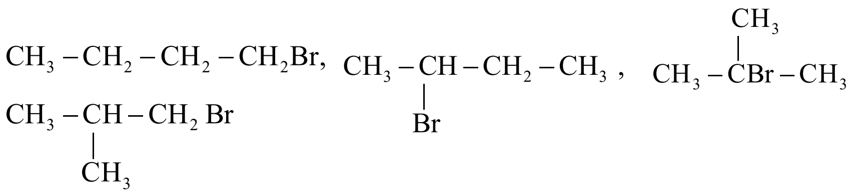
$CH_3CH_2OH + HI \longrightarrow CH_3-CH_2I + H_2O$

18. Cyanide is an ambident nucleophile as it can bond through 'C' foming cyanide (nitrile) and through 'N' forming isocyanide. (Two different bonding sites).

19. $CH_3-CH_2-(Cl/Br) + NaI \xrightarrow[\Delta]{\text{acetone or } CH_3OH} CH_3-CH_2-I + Na(Cl/Br)$

Such preparation of alkyl iodide from alkyl chloride or bromide in presence of acetone or methyl alcohol is called Finkelstein reaction. Both NaCl & NaBr are very little soluble in acetone or CH_3OH. They get precipitated living alkyl iodide and reaction proceed in forward direction with better yield of iodoalkane (RI).

20. Isomers of Bromobutane :

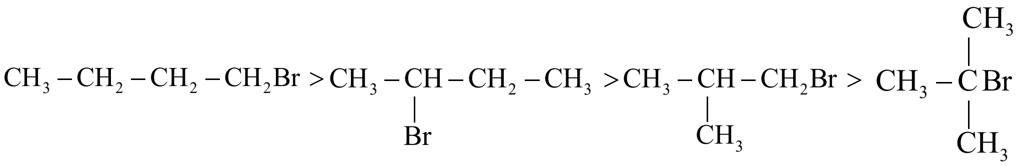


$CH_3-CH_2-CH_2-CH_2Br$, $CH_3-\underset{\underset{Br}{|}}{CH}-CH_2-CH_3$, $CH_3-\overset{\overset{CH_3}{|}}{C}Br-CH_3$

$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2\,Br$

(1^0) (2^0) (3^0)

B.P. : $CH_3-(CH_2)_2-CH_2Br > CH_5CHBr-C_2H_5 > (CH_3)_2\,CHCH_2Br > (CH_3)_3\,C\,Br$

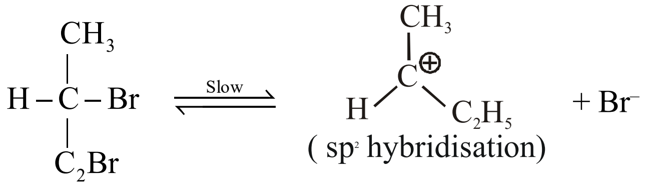


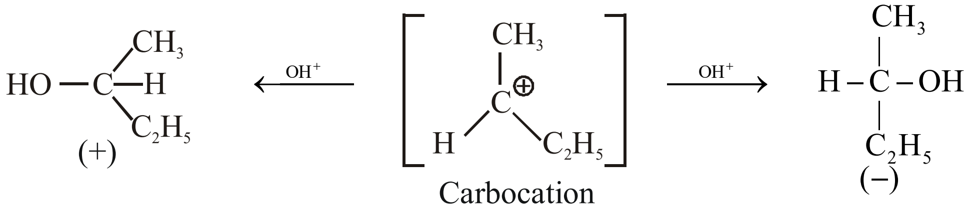
$$CH_3-CH_2-CH_2-CH_2Br > CH_3-\underset{\underset{Br}{|}}{CH}-CH_2-CH_3 > CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2Br > CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}Br$$

The b.p. decreases with decrease of vanderWaals force which depends on size and volume of the moelcule.

21. Due to sterric effect in 3^0 – alkyl halide the back side approach of the nucleophile becomes hindered as a result 3^0alkyl halide becomes less reactive.

It can proced through S_N-1 mechanism where a carbocation intermediate is formed. Due to planarity (sp^2) of the intermediate the nucleophile can approach from either side resulting (optically inactive) racemic mixture e.g.

I. 

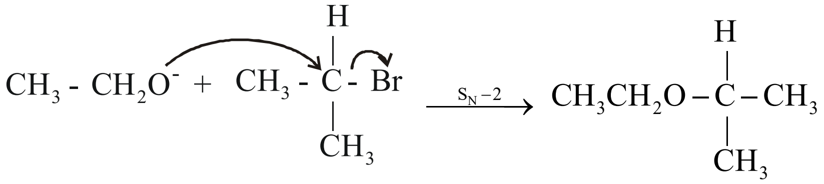
II. 

As slow step (rate determining) involves only alkyl halide it's a first order reaction.

rate = k [alkylhalide]

The second step is fast (ionic reaction)

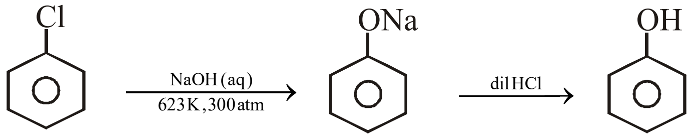
22. 2–Bromo propane with sodium ethoxide undergoes substitution as the smaller ethoxide acts as a nucleophilie (weaker base)



$$CH_3-CH_2O^- + CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{H}{|}}{C}}-Br \xrightarrow{S_N-2} CH_3CH_2O-\underset{\underset{CH_3}{|}}{\overset{\overset{H}{|}}{C}}-CH_3$$

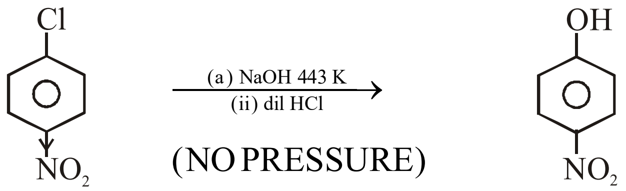
23. Ease of Hydrolysis of chlorobenzene.

i) When chlorobenzene is heated with aq. NaOH solution at a temperature of 623 K and a pressure of 300 atm., phenol is formed. (Dow's process)

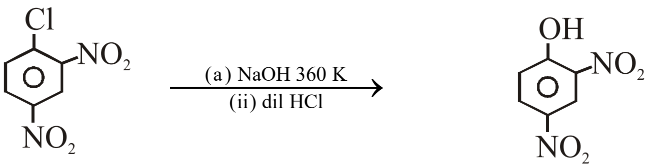


The presence of an electron with drawing $-NO_2$ group at O– and p–position increases the tendency to be hydrolysed. The EWG increases the nucleophilicity of 'C' joined to –Cl.

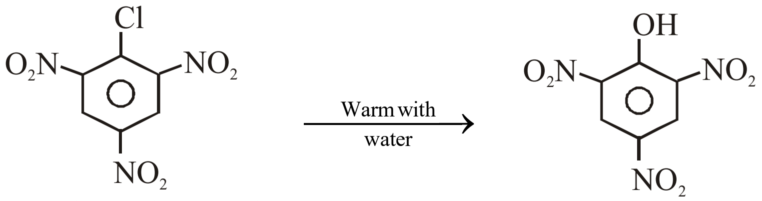
(ii)



(iii)



(iv)



(o- and p- substituted)

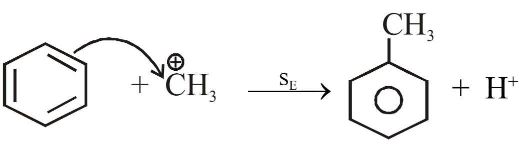
(v) No effect if electron withdrawing $-NO_2$ is substituted at m-position.)

The condition shows that the conversion of–Cl to –OH increases with substitution of $-NO_2$ group at o– and p– position. More is the presence of $-NO_2$ group more is the ease of S_N reaction.

24. (a) Benzene undergoes electrophilic substitution reaction.

In Friedal-Craft's reaction benzene undergoes alkylation and acylation. The electrophile is produced in presence of a Lewis acids ($\overline{e}$ acceptors) like $AlCl_3$ (Anhy.) or $FeCl_3$ (Anhydrous).

e.g. $CH_3Cl + AlCl_3 \longrightarrow \overset{+}{C}H_3(\text{electrophile}) + [AlCl_4]^-$

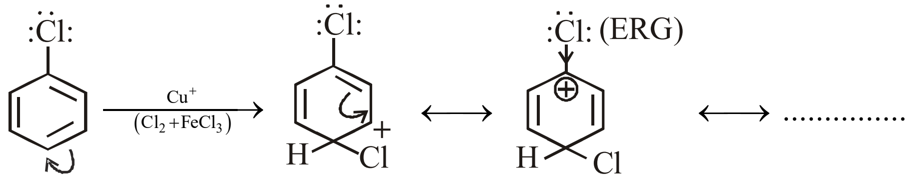


$$[Al\,Cl_4]^- + H^+ \longrightarrow AlCl_3 + HCl$$

(b) In thiol R–S–H the bond dissociation nergy of S–H is less than O–H because 'S' is less electronegative and of bigger sizer. i.e. RSH is a stronger acid than ROH. Stronger is the acid weaker is the conjugate base i.e. RS^- is a weaker base.

Due to less electrongativity of 'S', ^-SH is a better nucleophile i.e. having greater e^- releasing tendency.

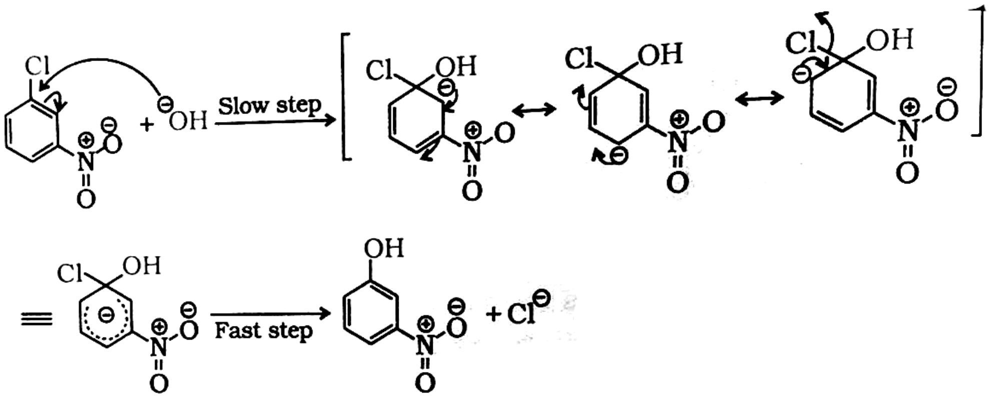
25. –Cl is a ring activating reagent & hence -o/p- directing so chlorobenzene on nitration gives o– and p– nitro chlorobenzene where p– nitro chlorobenzene predominates due to less steric factor (position effect).



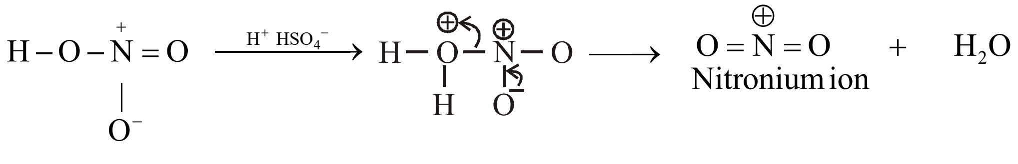
In the resonating structure the +ve charge rests on the 'C' to which the electron releasing –Cl is linked and makes it stable i.e. on substitution of 'Cl' at p- position gives stable structure.

26. $-NO_2$ group shows its effect at –o and p– position and not at m-position. So m-nitrochlorobenzene not easily hydrolysed.

In case of m-mitro chloro benzene, none of the resonating structure bears the negative charge on the C– atom linking to $-NO_2$ group. Therefore, the presence of $-NO_2$ group at m-position does not stabilise the –ve change (contrary to $-NO_2$ group at o– and p– position) and no effect on reactivity is observed by the presence of $-NO_2$ group at m-position.



27. Nitrating agent is a mixture (1:1) of conc. HNO_3 and Conc. H_2SO_4.
As H_2SO_4 is stronger HNO_3 acts as base, the proton acceptor.



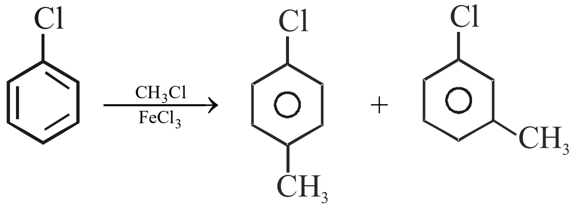
$$H-O-\underset{\underset{O^-}{|}}{\overset{+}{N}}=O \xrightarrow{H^+\ HSO_4^-} H-\underset{\underset{H}{|}}{\overset{\oplus}{O}}-\underset{\underset{O^-}{|}}{\overset{\oplus}{N}}-O \longrightarrow \underset{\text{Nitronium ion}}{\overset{\oplus}{O=N=O}} + H_2O$$

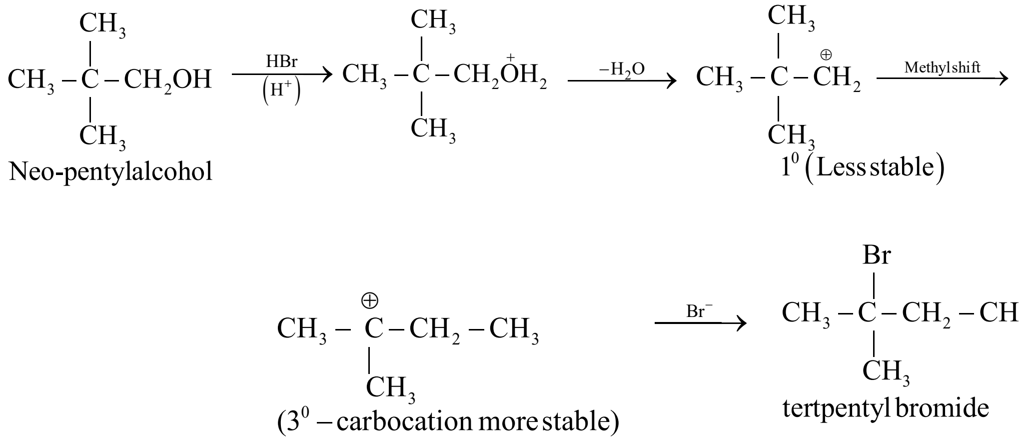
i.e. $HNO_3 + H_2SO_4 \longrightarrow \underset{\text{electrophile}}{\overset{+}{N}O_2} + HS\overline{O}_4 + H_2O$

$\overset{+}{N}O_2$ (electrophile) attacks the benzene ring, rich of $\pi(\overline{e}s)$ favouring S_E.

28. Chlorobenzene undergoes electrophilic substitution reactions like chlorination, nitration, sulfonation and Friedel- Crafts reaction. Halogen atom (–Cl) inspite of greater electronegativity it imparts electron releasing tendency due to presence of lone pair of $\overline{e}(s)$ conjugative with σ and π bonds. It activates the ring and further substitution occurs at o– and p– positions with respect to halogen atom .

Thus, chlorobenzene when heated with CH_3Cl in presence of $FeCl_3$(Anhy.) o– and p–chloro toluene are formed. Due to –I effect of -Cl, the ring gets some what deactivated as compared to benzene & hence S_E reaction in halo-arenes –occur slowly and require more drastic condition as compared to those in benzene. Thus, alkylation of chlorobenzene is slower than alkylation of benzene.



29. 

$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-CH_2OH \xrightarrow[(H^+)]{HBr} CH_3-\underset{CH_3}{\overset{CH_3}{C}}-CH_2\overset{+}{O}H_2 \xrightarrow{-H_2O} CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\overset{\oplus}{C}H_2 \xrightarrow{\text{Methyl shift}}$$

Neo-pentylalcohol $\qquad$ 1^0 (Less stable)

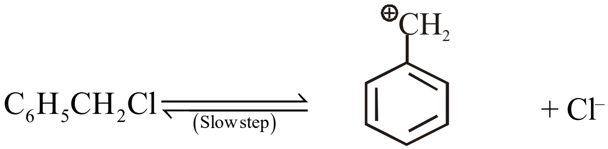
$$CH_3-\underset{CH_3}{\overset{\oplus}{C}}-CH_2-CH_3 \xrightarrow{Br^-} CH_3-\underset{CH_3}{\overset{Br}{C}}-CH_2-CH_3$$

(3^0 – carbocation more stable) $\qquad$ tertpentyl bromide

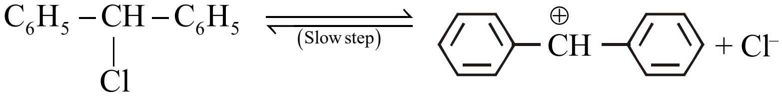
30. $C_6H_5CH_2Cl$ (Benzyl chloride) is a primary alkyl chloride while $(C_6H_5)_2CH\ Cl$ is a secondary one. The hydrolysis of both these compounds with aq. KOH (Polar) is likely to proceed by S_N –1 mechanism due to ___

(i) by ionisation the carbocation in both the cases & are resonance stabilised.

(ii) In water, a polar solvent the ionisation is favoured leading to S_N1 mechanism



1^0-Carbocation



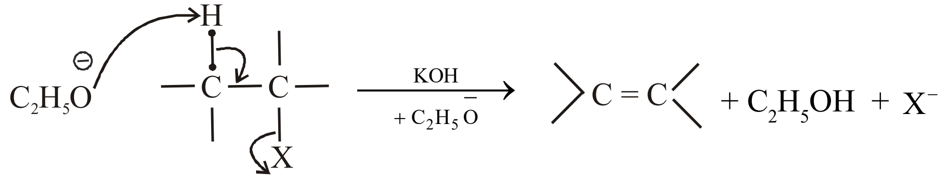
2^0-Carbocation (more stable)

The secondary carbocation is more stable as the +ve charge dispersed/ delocalised on two phenyl groups. Thus C_6H_5 CHCl–C_6H_5 is more easily hydrolysed by KOH (aq.) as compared to $C_6H_5CH_2Cl$.

31. $R-Cl+KOH(aq)\xrightarrow{S_N}ROH+KCl$

Here OH^- is the nucleophilie and alkylchloride undergoes nucleophilic substitution reaction.

But in presence of alcoholic KOH, alkyl chloride undergoes elimination reaction forming alkene.



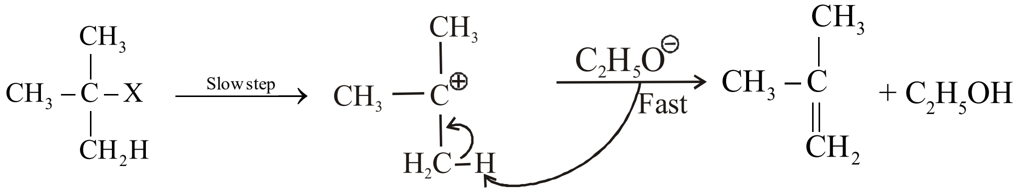
(β-elimination)

This is a biomolecular β -elimination reaction, (E_2).

Reactivity (E_2) : $1^0 > 2^0 > 3^0$

Reactivity (E_1): Proceeds through carbocation.

$3^0 > 2^0 > 1^0$

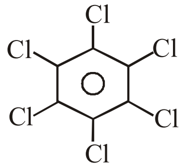


32. Hexachlorobenzene : (Perchlorobenzene)

It is prepared by chlorination of benzene at 150 – 200^{0}C with $FeCl_3$ catalyst. It undergoes electrophilic substitution reaction.

$$C_6H_5 + 6Cl_2 \xrightarrow[\Delta]{FeCl_3} C_6Cl_6 + 6HCl,$$

Use : Used as pesticide to protect seeds of onion, wheat etc. against fungus. It has been banned for agriculture purposes since 1981.



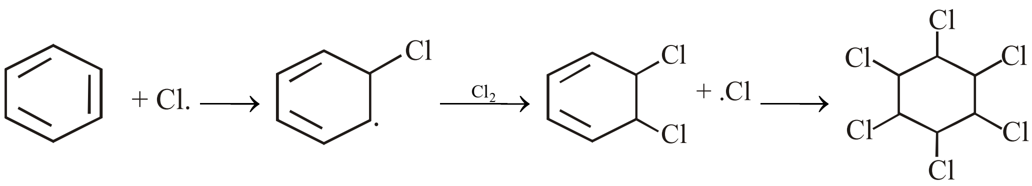
Benzene hexachloride (BHC), (Lindane)

Actually it's gamma – hexachloro cyclohexane. ($C_6H_6Cl_6$)

$$C_6H_6 + 3Cl_2 \xrightarrow[\Delta]{h\nu} C_6H_6Cl_6$$

It is out of free radical addition reaction

$$Cl_2 \xrightarrow[\Delta]{h\nu} 2Cl\bullet$$



It is used as insecticide under the name gammaxane.

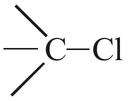
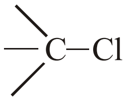
(It is not an aromatic compound)

33. Ammonolysis of alkyl halide :

In ammonia, $\bar{N}H_2$ acts as a nucleophile. On subsequent ammonolysis it forms a mixture amines along with quarternary salt. So particular amine can't be obtained in pure form.

$$RX + HNH_2 \xrightarrow[-HX]{} \underset{1^0\ \text{amine}}{RNH_2} \xrightarrow[-HX]{RX} \underset{2^0}{R_2NH} \xrightarrow[-HX]{RX} \underset{3^0}{R_3N} \xrightarrow{RX} \underset{\text{Tetraalkyl ammonium halide.}}{R_4\overset{+}{N}X^-}$$

34. (a) $\underset{n-\text{propylchloride}}{CH_3-CH_2-CH_2Cl}$ $\qquad$ $\underset{\text{allyl chloride}}{CH_2=CH-CH_2\,Cl}$

 sp³ hybridised,  bond length is more and easily

fissionable & can undergo $S_N(2)$ reaction

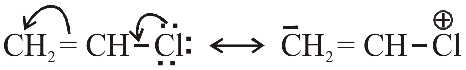
$$CH_2=CH-CH_2-Cl \xrightarrow{\text{slow}} CH_2=CH-\overset{+}{C}H_2+Cl^-$$

$$\updownarrow$$

$$CH_2=CH-CH_2OH \xleftarrow[\text{(fast)}]{OH^-} \overset{+}{C}H_2-CH=CH_2$$

Allyl chloride shows high reactivity as the carbocation formed is stabilised by resonance while no such stabilisation of carbocation exists in case of n-propyl chloride.

(b) CH_3-CH_2-Cl



$$CH_2=CH-\ddot{\underset{..}{Cl}}: \longleftrightarrow \bar{C}H_2=CH-\overset{\oplus}{Cl}$$

Ethyl chloride more reactive	vinyl chloride, less reactive
(sp³-hybridised)	(sp² – hybridised)
C – Cl single bond and bigger bond length, easily fissioned and substitution favoured.	Between $\rangle C=\overset{+}{Cl}$, π character developes reducing C–Cl bond length and substitution fails to take place.

35. Lower alkyl halide when refluxed with sodium in ether medium higher alkane preferably containing even number C–atoms is formed. This is called Wurtz reaction. It helps to enhence C-atoms in chain.

$$2RX + 2Na \xrightarrow[\text{ether}]{\text{reflux}} R\text{–}R + 2NaX.$$

Mechanism. Na (highly electropositive one) $\longrightarrow Na^+ + e^-$

 $\longrightarrow R. + X^-$

Free radical is highly reactive due to presence of unpair $\bar{e}$.

$R\bullet + \bullet R \longrightarrow R-R$ (higher alkane)

e.g. $2\ C_2H_5Br + 2Na \xrightarrow[\text{reflux}]{\text{ether}} \underset{\text{Butane}}{C_2H_5-C_2H_5} + 2Na\,Br$

36. Desired aliphatic compounds can be synthesized by suitable nucleophilic substitution reaction.

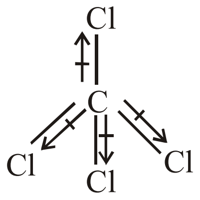
e.g. (a) Preparation of alcohol, $R-X+KOH \longrightarrow ROH+KX$

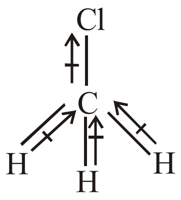
(b) ether $RX + NaOR \longrightarrow ROR + NaX$

(c) thiol $RX + NaHS \longrightarrow RSH + NaX$

(d) amine $RX + HNH_2 \xrightarrow{\text{alcohol}} RNH_2 + HX$

37. Electronegativity of $C = 2.5$, $H = 2.1$, $Cl = 3.0$



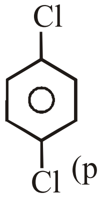


(i) sp^3 hybridised, tetrahedral

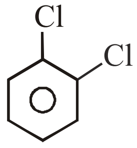
(ii) Symmetrical — assymetrical

(iii) $\mu = 0$ (non polar) — $\mu > 0$ (polar)

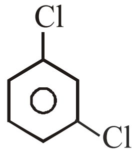
38.



(p-)



(o-)



(m-)

m.p 325 K 256 K 249 K. [p –> o –> m–]

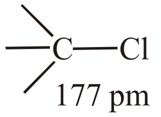
The structure of para isomer is more symmetrical (Less entropy), the molecules are more closely packed in solid state than the corresponding o- and m- isomer.

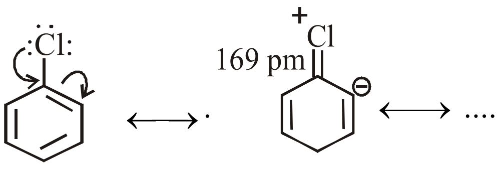
The attractive forces are more resulting in higher melting point compared to o– and m– dichloro benzene.

The b.p. follows in the order of decreasing vander Waals force.

The b.p.decreases in the order : o– > p– > m– dichlorobenzene.

39. Nature of C – X bond in alkyl and arylhalide.





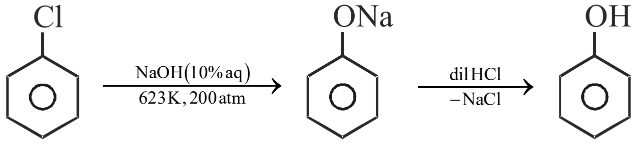
(i) In alkyl halide ‘C’ is sp^3 hybridised has C – Cl bond is bigger due to less s-character and higher p-character

(ii) C–Cl bond is having only σ character.

(i) Here in aryl chloride ‘C’ is sp^2 hybridised. hence C–Cl bond length is lessened.

(ii) C–Cl bond acquires partial - π. Character i.e. C-Cl bond is stronger than C–Cl bond of alkyl chloride.

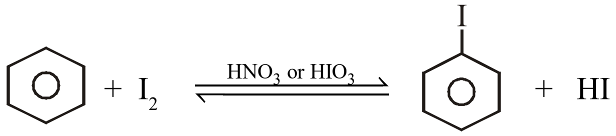
(iii) Polarity - C –Cl bond is more polar (2.05 D)	(iii) Less polar (1. 73 D)
(iv) Reactivity : More reactive.	(iv) Less reactive. higher bond dissociation energy.
(v) Alkyl halide undergoes nucleophilic substitution reaction.	(v) It fails to give S_N reaction ordinarily rather undergoes electrophilic substitution reaction.

40. 

Chlorobenzene is less reactive fails to undergo nucleophilic substitution reaction as incase of alkyl halide / chlorocyclohexane.

(See answer. Q.2 of b(a))

41. Iodination of benzene :



Here the reaction is slow and reversible and carried out in presence of an oxidant. The HI formed is a powerful reducing halogenacid (HI > HBr > HCl > HI), due to low bond dissociation enthalpy (299 kJ/ mole), greater bond length. On oxidation with HNO_3 or HIO_3, the liberated iodine favours the reaction in forward direction.

$$2HNO_3 + 2HI \xrightarrow{\Delta} 2NO_2 + 2H_2O + I_2$$

$$5HI + HIO_3 \xrightarrow{\Delta} 3H_2O + 3I_2$$

$$K = \frac{[C_6H_5I][HI]}{[C_6H_6][I_2]}$$

Increase of $[I_2]$ increases the dr. as K is consant the nr. must have to increase i.e. more yield of C_6H_5I also following the oxidation decrease of HI takes place. [HI] decreases i.e. $[C_6H_5I]$ increases favouring forward reaction [Lechatelier's principle].

42. $$C_6H_5CH_3 + Cl_2 \xrightarrow[\Delta]{hv} \left[\begin{array}{ll} C_6H_5CH_2Cl & \text{(Benzyl chloride)} \\ C_6H_5CHCl_2 & \text{(Benzal chloride)} \\ C_6H_5CCl_3 & \text{(Benzotrichloride)} \end{array}\right.$$

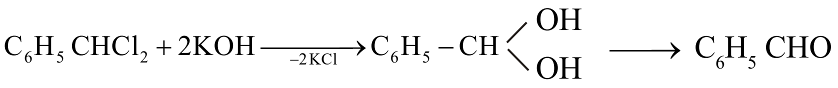
Benzyl carbocation, $C_6H_5\overset{\oplus}{C}H_2$ is stabilised by resonance hence undergoes S_N–1 reaction easily. Due to more favourable substitution reaction these chain substituted chloro compounds of toluene acts as intermediate to get many other products.

examples : (a) preparation of benzyl alcohol

$$C_6H_5\,CH_3 + Cl_2 \xrightarrow{hv} C_6H_5CH_2Cl + HCl$$

$$C_6H_5\,CH_2\,Cl + KOH(aq) \longrightarrow C_6H_5 - CH_2OH + KCl$$

(b) Preparation of benzaldehyde

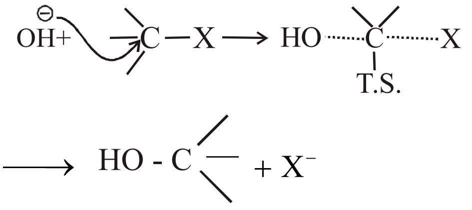


$$C_6H_5\,CHCl_2 + 2KOH \xrightarrow[-2KCl]{} C_6H_5 - CH\begin{matrix} OH \\ OH \end{matrix} \longrightarrow C_6H_5\,CHO$$

(c) Preparation of benzoic acid :

$$C_6H_5CCl_3 \xrightarrow[-3KCl]{3KOH} C_6H_5 - C(OH)_3 \xrightarrow[-H_2O]{} C_6H_5COOH\,(or)\,C_6H_5COOK$$

43.

S_N-1	**S_N-2**
→ Unimolecular nucleophilic substitution reaction	→ Biomolecular substitution reaction
→ Here rate of reaction depends on concentration of the substrate. rate = k[RX]	→ rate depends on concentration of both substrate and and nucleophile. rate = $k[RX]\left[\overset{-}{Nu}\right]$
→ Proceeds through two steps of which first one is slow and second step is fast. $(CH_3)_3CBr + OH^- \longrightarrow$ I. $(CH_3)_3\,CBr \xrightarrow{slow} (CH_3)_3\,C^+ + Br^-$ II. $(CH_3)_3\,C^+ + OH^- \xrightarrow{Fast} (CH_3)_3\,C\,OH$ Slow step is the rate determining step.	→ It is a single step process.
→ It proceeds through formation of an intermediate i.e. carbocation. The ease of reaction depends on stability of the carbocation. Therefore $\underset{3^0}{R_3\overset{+}{C}} > \underset{2^0}{R_2\overset{+}{C}H} > \underset{1^0}{R\overset{+}{C}H_2}$	→ It proceeds through an unstable transition state where bond breaking and bond making take place simultaneously.  The reactivity follows in the order : $1^0 > 2^0 > 3^0$ 1^0 is more feasible due to less crowding effect favouring attack of the nucleophile from the back opposite to the side of Br
→ Racemic mixture (optically inactive) is formed as the intermediate carbocation is planar where nucleophilic attack can occur from front and back in almost equal ease.	→ Inversion of configuration takes place

44. Due to bigger size of Iodide, bond fission takes place easily hence the substitution follows in the order $R-I > R-Br > RCl$.

Any alkyl halide in presence of KI and dry acetone forms RI increasing the reactivity towards, substitution reaction.

$$RX(X = Cl \text{ or } Br) + KI \xrightarrow{\text{acetone}} R-I + KX. \quad \text{(Filkenstein reaction)}$$

Thus, with KI, the reactivity of alkyl halide ($Cl^{-}Br^{-}$) increases.

45. Alkyl halides (polar) are used as solvent for relatively non-polar compounds. Among the halide the better industrial solvent is chloride rather than bromide an iodide because chlorides have less boiling point (Less vander Waals force due to smaller size) and are more volatile.

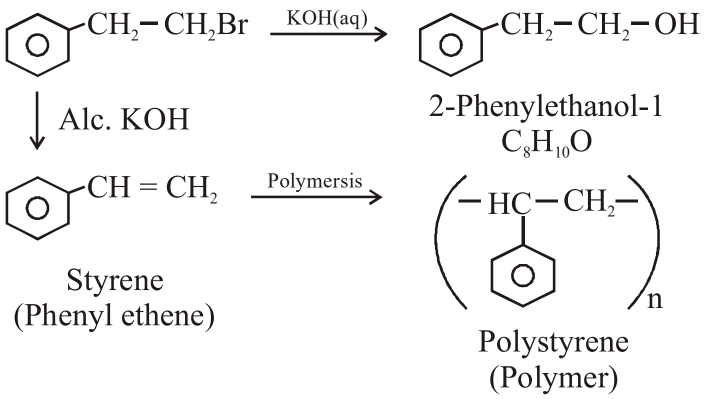
46. $ROH + SOCl_2$ (thionyl chloride) $\rightarrow RCl_{(\ell)} + SO_2\uparrow + HCl\uparrow$

Here $SO_2(g)$ and $HCl_{(g)}$ left the system as gas leaving RCl in situ. Thus it gets easily purified.

47. Carbon-iodine bond is quit weaker due to bigger bond length. The bond dissociation energy falls in the order C–Cl > C–Br > C–I. Therefore, when iodoform (CHI_3) is heated with $AgNO_3$ solution C–I bond gets cleaved easily producing AgI (yellow) precipitate, the C–Cl bond does not get cleaved.

B(b). Word Problem :

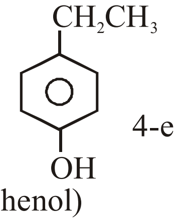
(i) C_8H_9Br,



$C_8H_{10}O$ (1) $C_6H_5CH_2-CH_2-OH$
(alcohol)

(2) $C_6H_5-O-CH_2-CH_3$ (ethoxy benzene)
(ether)

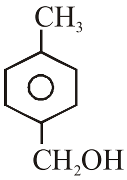
(3)



4-ethyl phenol

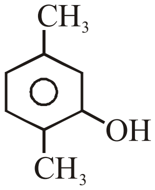
(Phenol)

(4) (alcoholic)



(4-methyl phenyl) Methanol

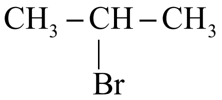
(5) (Phenol)



2, 5-dimethyl phenol

Out these functional isomers (3) and (5) are phenols, changing blue litmus to red due to their acidic nature.

(ii) $CH_3-CH_2-CH_2-Br$ (Mol.mass = 123)



$$\underset{\text{Br}}{CH_3-\overset{|}{CH}-CH_3}$$

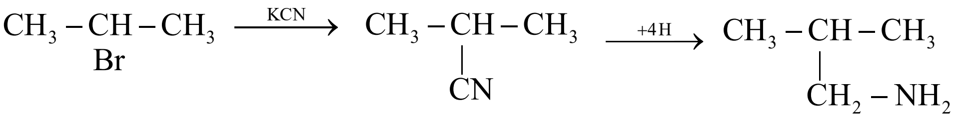
1-Bromo propane 2-Bromo propane

alc. KOH alc. KOH

$$\underset{\text{(Propene)}}{CH_3-CH=CH_2}$$

$$CH_3-CH_2-CH_2Br \xrightarrow{KCN} CH_3-CH_2-CH_2CN \xrightarrow[(+4H)]{Na/alc} CH_3-CH_2-CH_2CH_2NH_2$$

Butanamine



$$\underset{Br}{CH_3-CH-CH_3} \xrightarrow{KCN} CH_3-\underset{CN}{\underset{|}{CH}}-CH_3 \xrightarrow{+4H} CH_3-\underset{CH_2-NH_2}{\underset{|}{CH}}-CH_3$$

2-Methyl propan-1-amine

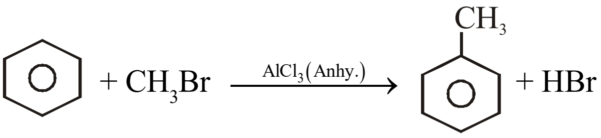
(iii) $RMgBr + H_2O \longrightarrow RH_{(g)} + Mg(OH)Br$

1.4 L at NTP weigh 1 gram

22.4 L at NTP weigh $\xrightarrow[1.4]{22.4} = 16\,\text{gram} = 1\,\text{mole}$

i.e. the alkane is CH_4 (methane)

$RBr = CH_3Br$ & Grignard's reagent is CH_3MgBr.



The last reaction, methylation of benzene to toluene is called Friedel Craft's reaction.

(iv) $2CH_3-CH_3 + 2Br_2 \longrightarrow 2CH_3-CH_2Br + 2HBr$

2×30 218

$$2CH_3-CH_2Br+2Na \longrightarrow CH_3-CH_2-CH_2-CH_3+2NaBr$$

$$(2\times109)=218\,g \qquad\qquad 58\,g$$

58 gram needs 218 gram bromoethane = 60 gram of ethane

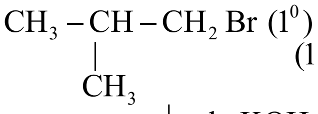
55 gram of n-butane from $\frac{60}{58}\times 55 = 56.8\,\text{gram}$ (ethane)

30 gram of ethane (1 mole) occupies 22.4 L at NTP

56.8 of ethane will occupy $\frac{22.4\times56.8}{30}=42.5\text{ L}$

(v) C_4H_9Br, $CH_3-CH_2-CH_2-CH_2Br\ (1^0)$

(A)

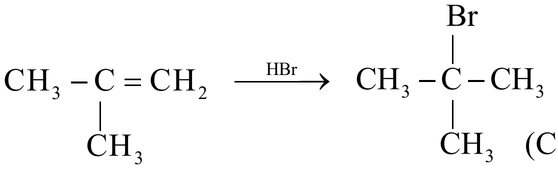


$$\underset{\displaystyle CH_3}{CH_3-\underset{|}{C}H-CH_2\,Br}\ (1^0)$$

(1 – Bromo – 2 – methyl propane

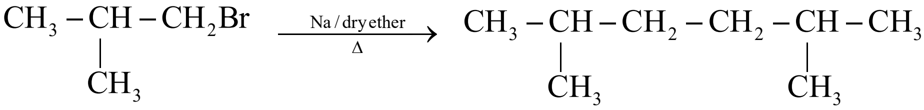
↓ alc.KOH

(B)



$$CH_3-\underset{\underset{\displaystyle CH_3}{|}}{C}=CH_2 \xrightarrow{HBr} CH_3-\overset{\overset{\displaystyle Br}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-CH_3$$

(C) isomer of (A)



$$CH_3-\underset{\underset{\displaystyle CH_3}{|}}{CH}-CH_2Br \xrightarrow[\Delta]{Na/dry\,ether} CH_3-\underset{\underset{\displaystyle CH_3}{|}}{CH}-CH_2-CH_2-\underset{\underset{\displaystyle CH_3}{|}}{CH}-CH_3$$

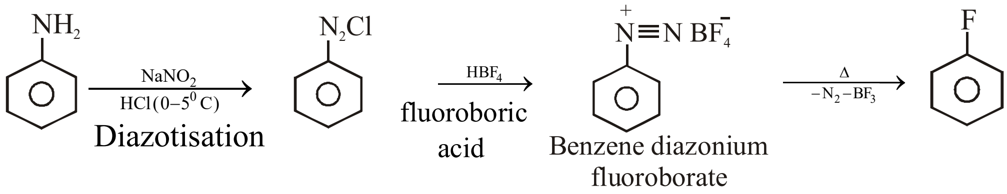
(D)

2,5-dimethyl hexane

B(c) Name Reactions :

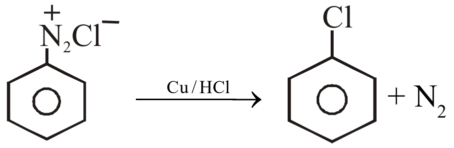
(i) Balz - Schiemann reaction

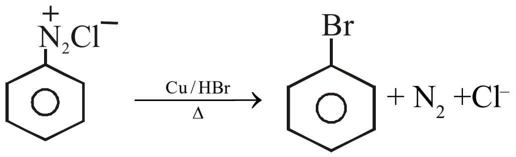
The preparation of fluorobenzene form aniline is called Balz-Schiemann reaction.



(ii) Gattermann reaction :

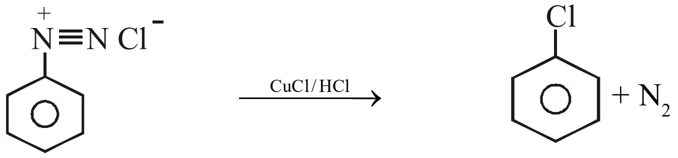
When benzene dizonium chloride is heated with a mixture of copper power and halogen acid (HCl or HBr) halo (–Cl or – Br) arene is formed.

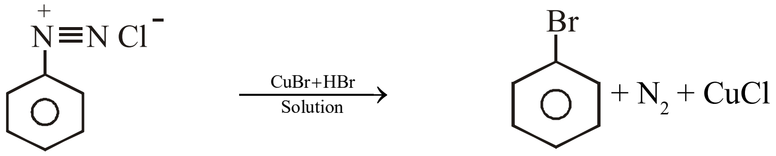


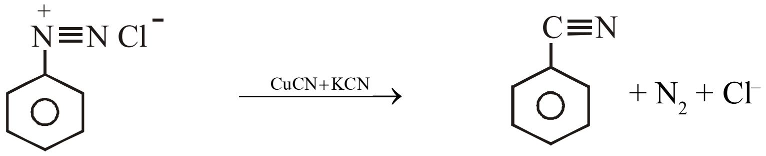


(iii) **Sandmeyer reaction :**

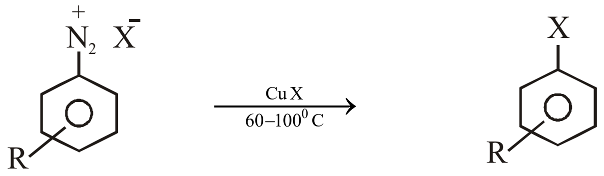
Preparation chloro, Bromo and cyano benzene (Benzonitrile) from benzene diazonium chloride is called Sandmeyer's reaction.







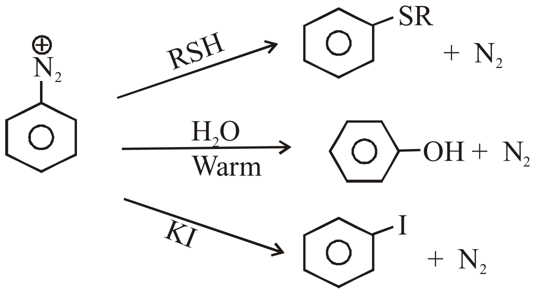
In general :



⟶ $X = -CN, -Br, -Cl, -SO_3H$

⟶ with catalyst Cu(I), e.g. Cu_2Cl_2 etc.

⟶ Without catalyst Sandmeyer type reaction takes place with thiols, water and KI.



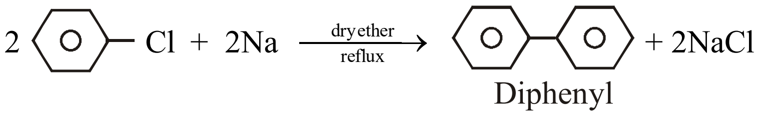
This is an aromatic transformation reaction, where substition reaction takes place which are not achievable by direct substitution.

(iv) **Wurtz reaction** involves the combination of haloalkane (RX) molecules only.

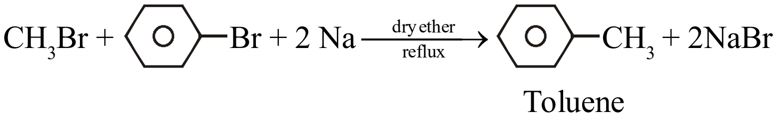
$$2RX + 2Na \xrightarrow[\text{reflux}]{\text{dry ether}} R-R + 2\,NaX$$

(v) **Fittig reaction** (haloarene only)

When chloro benzene is refluxed with sodium in anhydrous ether diphenyl is formed.

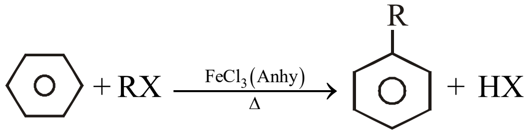


(vi) **Wurtz - Fittig reaction** (haloalkane + halo arene)

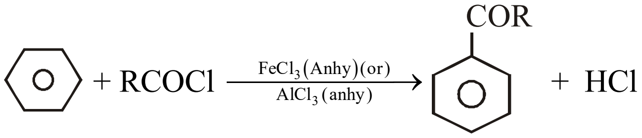


(vii) **Fridel-Craft's reaction** (Electrophilic aromatic substitution reaction)

→ alkylation :

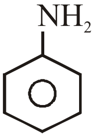


→ Acylation :



→ Benzene ring substituted with electron with drawing deactivating groups. (eg. nitrobenzene, benzaldehyde etc fails to undego Friedel–Crafts reaction.

→ Friedel-Crafts acylation is preferred to alkylation in case of acylation an oxygen with double bond along with –R, $\left(\begin{matrix}-C=0\\ |\\ R\end{matrix}\right)$ which leads to decrease in the density of the $\overline{e}$ (better electrophile)

→ 

, never undergo F.C. reaction inspite of presence of activating NH_2 group (Lewis base) which predomilately reacts with Lewis acid, $AlCl_3$ / $FeCl_3$ as a result formation electrophile $\overset{+}{C}H_3$, $R\overset{+}{C}O$ gets hindered.

$$\underset{\text{(Base)}}{C_6H_5-\ddot{N}H_2} + \underset{\text{(acid)}}{AlCl_3} = C_6H_5-H_2N:\rightarrow AlCl_3$$

$$CH_3Cl + Al\,Cl_3\ \text{(anhy.)} \longrightarrow \overset{+}{C}H_3 + [AlCl_4]^-$$

(viii) **Finkelstein reaction :**

Formation of iodoalkane : As formation of iodoalkane by direct iodination is not favourable it's slow and reversible, the formation of RI is carried out fom RCl and RBr on treating with NaI or KI in presence of acetone.

$$RX(X = Cl \text{ or } Br) + NaI \xrightarrow{\text{acetone}} RI + NaX$$

(ix) **Hunsdiecker reaction :**

When silver salt of a monocarboxylic acid is refluxed with bromine in presence of CCl_4 (solvent) alkyl bromide is formed with loss of one C. atom.

$$CH_3-CH_2\,COOAg+Br_2\xrightarrow[\text{reflux}]{CCl_4}CH_3-CH_2Br+CO_2\uparrow+AgBr\downarrow$$

$CH_3\,CH_2\,Br$ is isolateted easily.

(x) **Swarts reaction :** (Preparation of fluoroalkane from alkyl chloride or bromide)

$$RX\left(X-Cl\,\text{or}\,\,Br\right)+AgF\left(\text{or}\,\,Hg_2\,F_2,C_oF_2\,\text{or}\,\,SbF_3\right)$$

$$\longrightarrow\,\,RF+AgCl$$

This method is preferred as fluorination of alkane with F_2 is explosive.

i.e. $CH_3Br+AgF\,\,\rightarrow\,\,CH_3F+AgBr$

(xi) **Frankland reaction :** (Replacement of zinc is place of Na in Wurtz reaction)

$$C_2H_5Br+Zn\longrightarrow C_2\,H_5\,Zn\,Br\,\,\xrightarrow{C_2H_5Br}\,\,\left(C_2H_5\right)_2Zn+ZnBr_2$$

$$2\,C_2\,H_5\,Zn\,Br\longrightarrow\underset{\text{butane}}{C_2\,H_5\,C_2H_5}+Zn\,Br_2$$

(xii) **Corey - house Reaction** (Preparation of unsymmetrical alkane)

$$CH_3I\xrightarrow{Li}CH_3Li\xrightarrow{CuI}\left(CH_3\right)_2Cu\,Li$$

$$\left(CH_3\right)_2Cu\,Li\xrightarrow{C_2H_5I}CH_3-C_2H_5+LiI+CH_3\,Cu$$

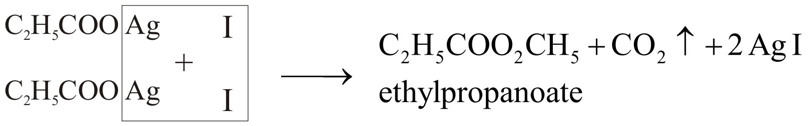
In general $RX+R^{/}X\longrightarrow R-R^{/}$

Note : $R^{/}$ must be CH_3X or a primary alkyl halide, $R-CH_2-X$.

(xiii) **Bibaum - Simonin reaction**

When siver salt monocarboxylic acid heated with iodine, an ester is formed.

$$2\,CH_3\,COOAg+I_2\rightarrow CH_3COOCH_3+CO_2+2AgI$$



$$\begin{array}{l}C_2H_5COO\boxed{Ag\quad I}\\ \qquad\qquad\quad +\\ C_2H_5COO\boxed{Ag\quad I}\end{array}\longrightarrow\underset{\text{ethylpropanoate}}{C_2H_5COO_2CH_5}+CO_2\uparrow+2\,Ag\,I$$

(xiv) **Hofmann ammonolysis reaction :**

When haloalkanes are heated with ethanolic ammonia in a sealed tube mixture of amines is formed.

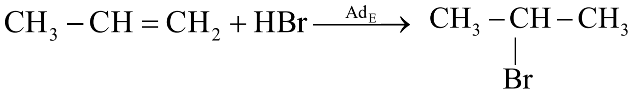
$$RX+HNH_2\xrightarrow{\text{ethanol}}RNH_2+HX$$

$$RNH_2+RX\longrightarrow R_2NH+HX$$

$$R_2NH+RX\longrightarrow\,R_3N+HX$$

B(d) What happens when : $\boxed{\begin{array}{l}\text{Statement}-01\text{ mark}\\ \text{Equation}-01\text{mark}\end{array}}$

(i) When HBr adds to propene 2-bromopropane appears as major product as per Markownikoff's rule.



$$CH_3-CH=CH_2+HBr\xrightarrow{Ad_E}\,CH_3-\underset{\underset{Br}{|}}{C}H-CH_3$$

But in presence of organic peroxide (benzoyl peroxide) 1-Bromo propane is formed due to peroxide effect or Kharasch effect. This is free radical addition reaction.

$$\mathrm{CH_3-CH=CH_2+HBr\xrightarrow[\text{Peroxide}]{\text{Benzoyl}}CH_3-CH_2-CH_2Br}$$

(Major product)

(ii) When ethyl alcohol is treated with PCl_3, ethylchloride is formed.

$$\mathrm{PCl_3+3\,C_2H_5OH\longrightarrow 3\,C_2H_5Cl+H_3PO_3}$$

Phosphorus acid

with PCl_5 : $\mathrm{C_2H_5OH+PCl_5\longrightarrow C_2H_5Cl+POCl_3+HCl}$

(iii) Here PI_3 is produced in situ which refluxed with ethyl alcohol to form ethyliodide.

$$\mathrm{P_4+6I_2\xrightarrow{\Delta}4PI_3}$$

$$\mathrm{CH_3-CH_2OH+PI_3\longrightarrow 3CH_3\,CH_2\,OH+H_3\,PO_3}$$

(iv) Alkylhalide is reduced in presence of $LiAlH_4$ or Zn–Cu couple &ethanol, alkane is formed.

$$\mathrm{RX+2H\longrightarrow RH+HX}.$$

(v) When ethylchloride is treated with silver salt of acetic acid (CH_3COOAg) ester, ethyl acetate is formed.

$$\mathrm{CH_3-CH_2Cl+CH_3COOAg\longrightarrow CH_3COOC_2H_5+AgCl}$$

(ester)

(vi) Formation of ether : When ethyl bromide is heated with dry silver oxide ethoxy ethane is formed.

$$\mathrm{2\,C_2H_5Br+Ag_2O\longrightarrow C_2H_5OC_2H_5+2Ag\,Br}$$

diethylether

(vii) Ethyliodide with aqueous silver oxide ethyl alcohol is formed.

$$\mathrm{2C_2H_5I+Ag_2O+H_2O\longrightarrow 2\,C_2H_5OH+2AgI}$$

(yellow)

(viii) Ethyl iodide with aqueous or alcoholic KCN, ethyl cyanide is formed with increases of one C-atom in chain.

$$\mathrm{\underset{Iodoethane}{C_2H_5I}+KCN\xrightarrow{SN}\underset{Pr\,opanenitrile}{CH_3-CH_2-CN}+KI}$$

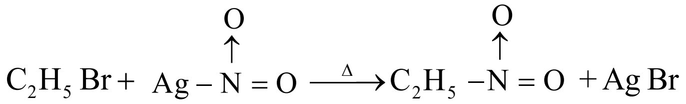
But with silver cyanide (alcoholic) it forms ethyisocyanide as –CN is an ambident nucleophile.

$$\mathrm{C_2H_5\,I+Ag\,CN\longrightarrow CH_3-CH_2\,NC+Ag\,I(s)}$$

(ix) Ethybromide with alcoholic KNO_2 forms alkyl nitrite

$$\mathrm{C_2H_5\,Br+K.O-N=O(alc)\xrightarrow{\Delta}C_2\,H_5-O-N=O+KBr}$$

But with Ag NO_2 (alc) it produces nitroalkane.



$$\mathrm{C_2H_5\,Br+Ag-\overset{\overset{O}{\uparrow}}{N}=O\xrightarrow{\Delta}C_2H_5-\overset{\overset{O}{\uparrow}}{N}=O+Ag\,Br}$$

nitroethane

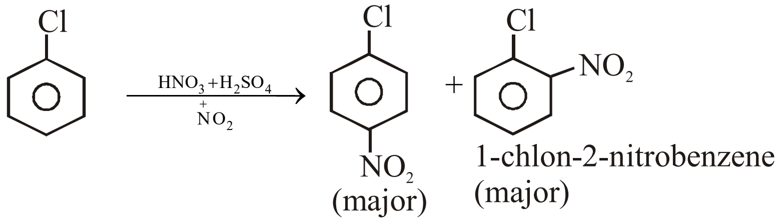
(x) Ethyl alcohol with iodine in presence of sodium hydroxide, separates yellow mass of iodoform.

$$CH_3-CH_2OH+I_2 \longrightarrow CH_3CHO+2HI$$

$$CH_3CHO+3I_2 \longrightarrow CI_3\,CHO+3HI$$

$$CI_3CHO+NaOH \longrightarrow CHI_3+HCOONa$$

(xi) Chlorobenzene on nitration with a mixture of conc. HNO_3 and conc. H_2SO_4 forms –o and p– chloro nitro benzene

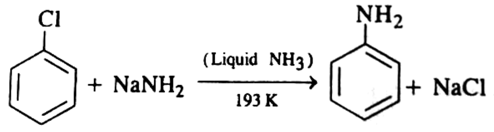


(xii) Chlorobenzene reacts with ammonia (aq.) at 200°C and 60 atm. presure in presence of cuprous oxide to form aniline.

$$2C_6H_5-Cl+2NH_3+Cu_2O \longrightarrow 2\,C_6H_5-NH_2+Cu_2Cl_2+H_2O$$

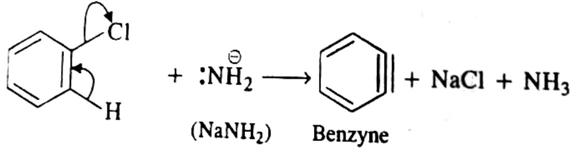
Further, chlorobenzene with sodamide ($NaNH_2$) in $NH_3(l)$ gives aniline by the process of elimination - addition reaction via benzyne (intermediate) formation.

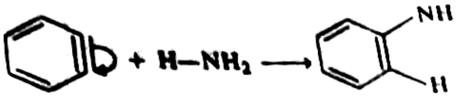
Haloarenes can also be converted into aniline by reacting with a mixture of **sodamide** and liquid ammonia at about 193K.



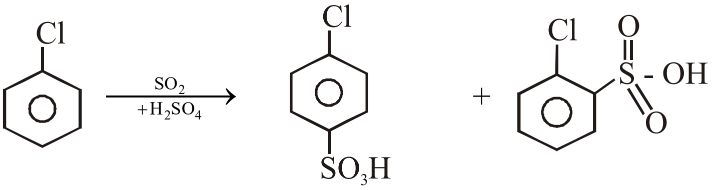
Chlorobenzene Aniline

The reaction with NH_3 described above is **nucleophilic substitution**. But the reaction with $NaNH_2$ occurs through the formation of a **benzyne intermediate** as follows :

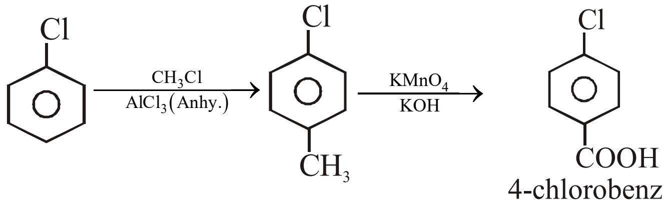




(xiii) Chlorobenzene with fuming sulfuric acid gives 4-chlorobenzene sulfonic acid as major product.

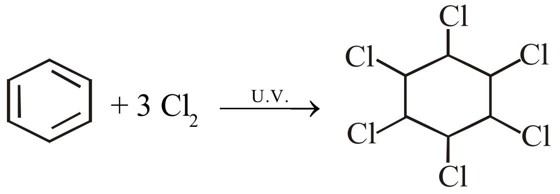


(major product)

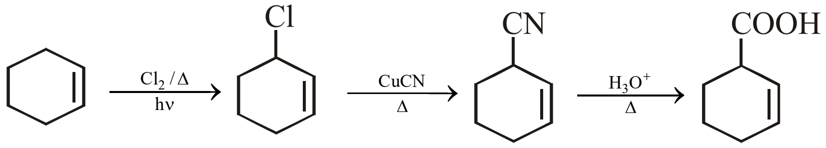
(xiv) 

4-chlorobenzene carboxylic acid.

(xv) Benzene hexachloride is formed as an addition product.



B(e). Conversions / How can you prepare :

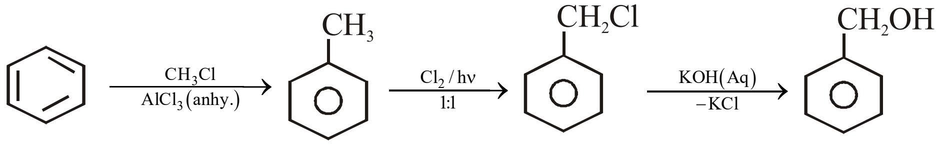
(i) 

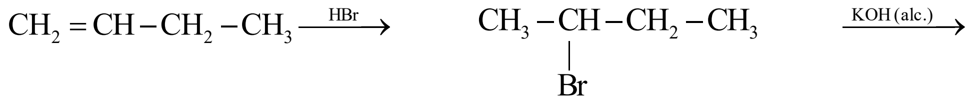
(ii) $CH_3-CH_2-OH \xrightarrow{SOCl_2} CH_3-CH_2Cl \xrightarrow[S_N]{HC\equiv CNa}$,

$CH\equiv C-CH_2-CH_3$

(iii) $CH_3-CH=CH_2 \xrightarrow[\text{Benzoyl peroxide}]{HBr} CH_3-CH_2-CH_2Br$

$\xrightarrow[(Alc)]{AgNO_2} CH_3-CH_2-CH_2-NO_2$

(iv) 

(v) 

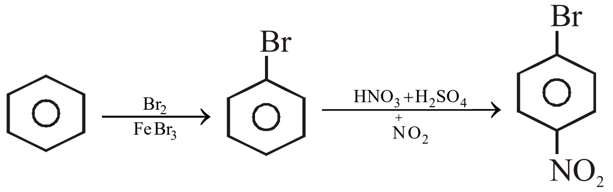
$CH_2=CH-CH_2-CH_3 \xrightarrow{HBr} CH_3-\underset{\displaystyle Br}{\underset{|}{C}H}-CH_2-CH_3 \xrightarrow{KOH(alc.)}$

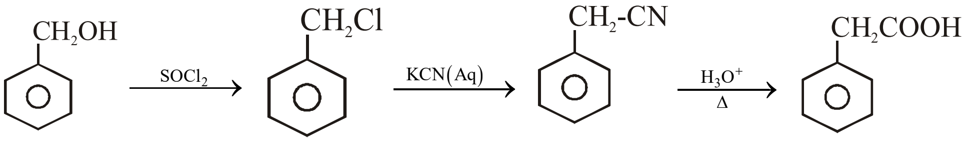
$CH_3-CH=CH-CH_3$

(vi) $C_6H_6 \xrightarrow[FeCl_3(Anhy)]{Cl_2} C_6H_5Cl \xrightarrow[\text{Na / dry ether}]{\text{Fittig reaction}} C_6H_5-C_6H_5$

(vii) $CH_3-CH_2-CH_2Br \xrightarrow{alc.KOH} CH_3-CH=CH_2$

$\xrightarrow[\text{Markownikoff}]{HBr} CH_3-CHBr-CH_3$

(viii) 

(ix) 

$$CH_2OH\text{-}C_6H_5 \xrightarrow{SOCl_2} C_6H_5CH_2Cl \xrightarrow{KCN(Aq)} C_6H_5CH_2\text{-}CN \xrightarrow[\Delta]{H_3O^+} C_6H_5CH_2COOH$$

(x) $CH_3-CH_2-OH \xrightarrow[\Delta]{Conc\,H_2SO_4} CH_2=CH_2 \xrightarrow[CCl_4]{Br_2} CH_2Br-CH_2Br \xrightarrow{alc.KOH}$

$H-C\equiv CH \xrightarrow{HCN} CH_2=CH-CN$ (Propene nitrile)

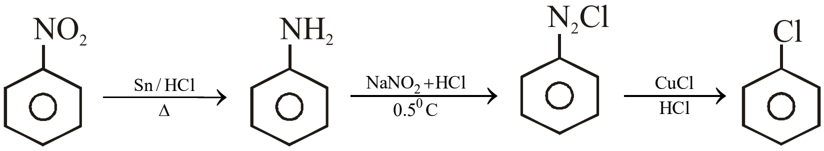
(xi) $CH_3-CH_2-OH \xrightarrow[ZnCl_2(Anhy)]{HCl} CH_3-CH_2Cl \xrightarrow{KCN} CH_3-CH_2-CN$

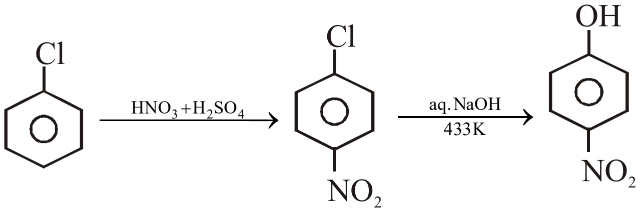
Propane nitrile

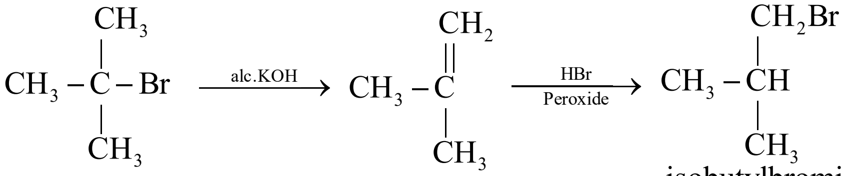
$\xrightarrow[\Delta]{H_3O^+} CH_3CH_2COOH$

(xii) $CH_3-CH_2-Cl \xrightarrow{KCN(aq)} CH_3-CH_2-CN \xrightarrow[\Delta]{H_3O^+} CH_3-CH_2COOH$

(xiii) $CH_3-CH_2-CH=CH_2 \xrightarrow[Peroxide]{HBr} CH_3-CH_2-CH_2-CH_2Br \xrightarrow[acetone]{NaI} CH_3-CH_2-CH_2-CH_2I$

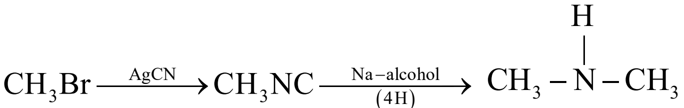
(xiv) 

(xv) 

(xvi) 

$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-Br \xrightarrow{alc.KOH} CH_3-\underset{CH_3}{\overset{CH_2}{\overset{\|}{C}}} \xrightarrow[Peroxide]{HBr} CH_3-\underset{CH_3}{\overset{CH_2Br}{CH}}$$

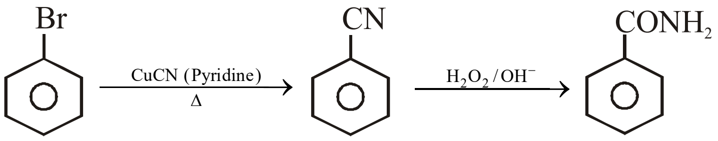
isobutylbromide

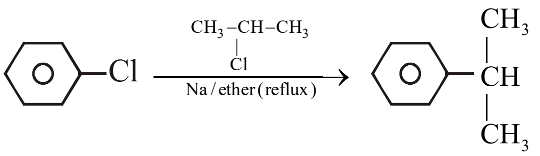
(xvii) 

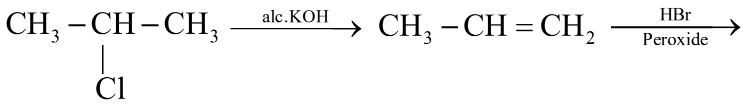
$$CH_3Br \xrightarrow{AgCN} CH_3NC \xrightarrow[(4H)]{Na-alcohol} CH_3-\overset{H}{N}-CH_3$$

dimethylamine

(xviii) $CH_3Br \xrightarrow{KCN} CH_3-CN \xrightarrow[-NH_3]{SnCl_2+HCl} CH_3-CHO$ (Stephen's)

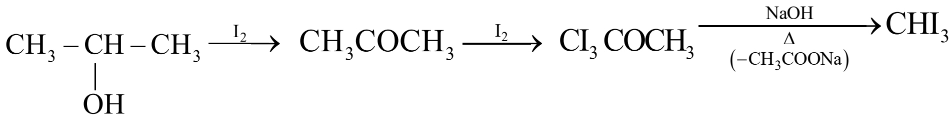
(xix) 

(xx) 

(xxi) 

$$CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3 \xrightarrow{alc.KOH} CH_3-CH=CH_2 \xrightarrow[Peroxide]{HBr}$$

$$CH_3-CH_2-CH_2Br \xrightarrow{KOH(aq)} CH_3-CH_2-CH_2OH$$

(xxii) 

$$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{I_2} CH_3COCH_3 \xrightarrow{I_2} CI_3\,COCH_3 \xrightarrow[\substack{\Delta\\(-CH_3COONa)}]{NaOH} CHI_3$$

(xxiii) $CH_3-CH_2Br \xrightarrow{alc.KOH} CH_2=CH_2 \xrightarrow[\text{ii) alc.KOH}]{\text{i) }Br_2/CCl_4} HC\equiv CH \xrightarrow{Na(NH_3)}$

$$Na\,C\equiv C\,Na \xrightarrow[excess]{CH_3Br} CH_3-C\equiv C-CH_3$$

Unit - XI

B(a) Word problem :

1. Organic compound = C_2H_5OH

$\rightarrow$ $C_2H_5OH + I_2 \longrightarrow CH_3CHO + 2HI$

$CH_3CHO + 3I_2 \longrightarrow CI_3CHO + 3HI$

$CI_3\,CHO + NaOH \longrightarrow \underset{\text{iodoform (yellow)}}{CHI_3} + H\,COONa$

$A = CHI_3$

$\rightarrow$ $HCI_3 + 6Ag + I_3CH \longrightarrow \underset{(B)}{HC\equiv CH} + 6AgI$

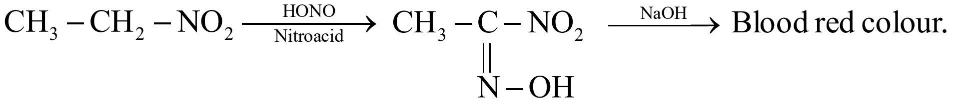
$\rightarrow$ $HC\equiv CH + H_2O \xrightarrow[H_2SO_4\,60^0C]{HgSO_4} \underset{\text{ethanal (C)}}{CH_3CHO}$

$\rightarrow$ $CH_3\,CHO + H_2 \xrightarrow[\Delta]{Ni} CH_3\;CH_2\;OH$ (Original compound)

2. $CH_2=CH_2 + H_3O^+ \longrightarrow CH_3CH_2OH$ (A)

$CH_3CH_2OH + PI_3 \longrightarrow \underset{(B)}{CH_3CH_2I} +$

$CH_3CH_2I + Ag\,NO_2 \longrightarrow CH_3\,CH_2\,NO_2$

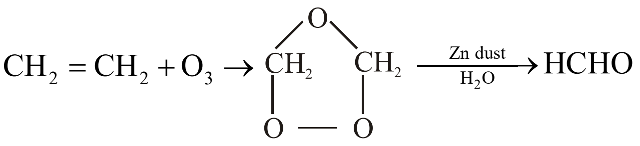


$$CH_3-CH_2-NO_2 \xrightarrow[Nitroacid]{HONO} CH_3-\underset{\underset{N-OH}{||}}{C}-NO_2 \xrightarrow{NaOH} \text{Blood red colour.}$$

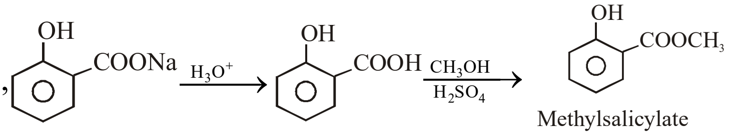
Pseudonitrol

3. $A \Rightarrow C_2H_5-OH$ $B \Rightarrow C_2H_5Cl$

$C \Rightarrow CH_2 = CH_2$



4. $A = C_6H_5OH$(phenol),



5. $$\underset{(A)}{C_2H_5-O-C_2H_5} + 2HI \longrightarrow \underset{(B)}{2\,C_2H_5I} + H_2O,$$

$$C_2H_5I + Na \xrightarrow[\text{(Wurtz)}]{\text{dry ether}} C_4H_{10}\,(n-\text{butane})$$

6. $$C_2H_5OH + Na \longrightarrow \underset{(B)}{C_2H_5O\,Na} + \frac{1}{2}H_2(g)$$

$$2C_2H_5OH \xrightarrow[413K]{\text{Conc.}H_2SO_4}, \underset{(D)}{C_2H_5O\,C_2H_5} \xrightarrow{HI} C_2H_5I(E)$$

$$\underset{(B)}{C_2H_5ONa} + \underset{(E)}{C_2H_5I} \longrightarrow \underset{(D)}{C_2H_5O-C_2H_5} + NaI$$

B(b) Account for the following :

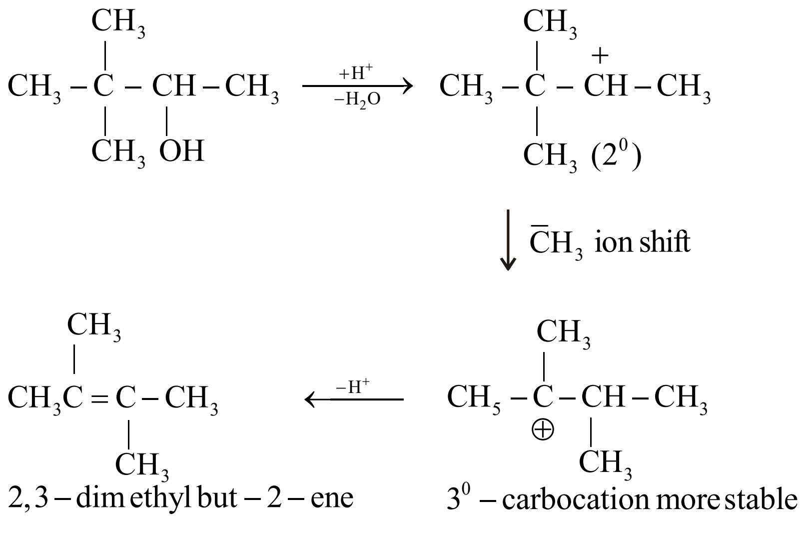
1. $$CH_3-CH_2-CH_2-CH_2OH \xrightarrow[\text{Protonation}]{H^+} CH_3-CH_2-CH_2-\overset{+}{C}H_2 + H_2O$$

$\downarrow$ Hydride shift

$$CH_3-CH=CH-CH_3 \xleftarrow[\text{deprotonation}]{-H^+} CH_3-CH-\overset{+}{C}H-CH_3$$

2^0 – carbocation (More stable)

2.



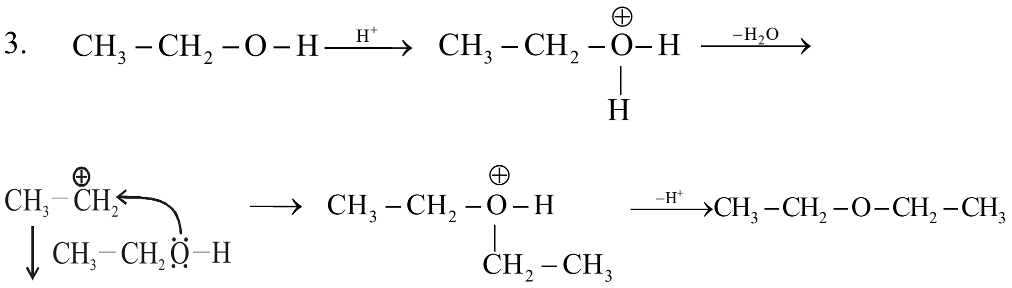
$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\underset{OH}{CH}-CH_3 \xrightarrow[-H_2O]{+H^+} CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\overset{+}{CH}-CH_3 \ (2^0)$$

$\downarrow \bar{C}H_3$ ion shift

$$CH_3C=\underset{CH_3}{\overset{CH_3}{C}}-CH_3 \xleftarrow{-H^+} CH_5-\underset{\oplus}{\overset{CH_3}{C}}-\underset{CH_3}{CH}-CH_3$$

2,3 – dim ethyl but – 2 – ene $\qquad$ 3^0 – carbocation more stable

3.



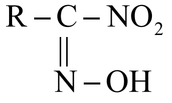
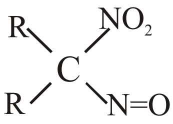
$$CH_3-CH_2-O-H \xrightarrow{H^+} CH_3-CH_2-\overset{\oplus}{\underset{H}{O}}-H \xrightarrow{-H_2O}$$

$$CH_3-\overset{\oplus}{C}H_2 \quad \downarrow CH_3-CH_2\ddot{O}-H \longrightarrow CH_3-CH_2-\overset{\oplus}{\underset{CH_2-CH_3}{O}}-H \xrightarrow{-H^+} CH_3-CH_2-O-CH_2-CH_3$$

2 moles of alcohol gives one mole of ether.

$$2CH_3-CH_2OH \xrightarrow[413K]{Conc.H_2SO_4} CH_3-CH_2-O-CH_2-CH_3$$

4. Victor Meyer's test :

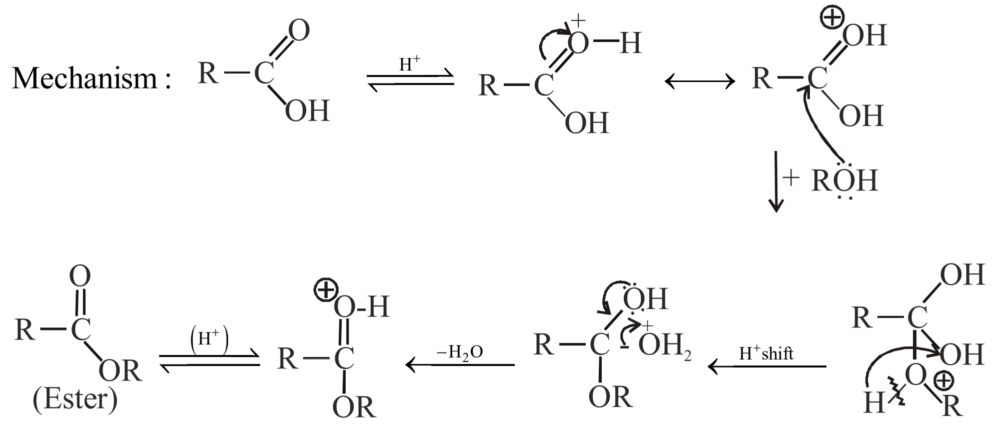
Reagents	**1^0 alcohol**	**2^0-alcohol**	**3^0 alcohol**
i) I_2/red P	R CH_2 OH	R_2 CHOH	R_3COH
	$\downarrow$ I_2/red P	$\downarrow$	$\downarrow$
	R CH_2 I	R_2 CHI	R_3C I
ii) Ag NO_2	$\downarrow$	$\downarrow$	$\downarrow$
	R CH_2–NO_2	R_2 $CHNO_2$	R_3 C–NO_2
iii) $NaNO_2$ + HCl = HONO	$\downarrow$ HONO	$\downarrow$ HONO	$\downarrow$ HONO
	 $R-\underset{N-OH}{\underset{\Vert}{C}}-NO_2$ (Nitrolic acid)		No reaction
		$\downarrow$ NaoH (or) KOH	$\downarrow$ KOH (dil)
iv) NaOH	$\downarrow$ NaOH (Aq)	Blue colour	colourless
	Blood red colour.		

5.

Reagents	CH_3OH	CH_3–CH_2OH
I_2/KOH	Does not respond	When ethyl alcohol is warmed with alkaline iodine yellow mass of iodoform results. CH_3–$CH_2OH + I_2 \rightarrow CH_3CHO + 2HI$ $CH_3CHO + 3I_2 \rightarrow CI_3CHO + 3HI$ $CI_3CHO + KOH \xrightarrow{-CHOOK} CHI_3$ (s) yellow

6. Estrification follows fission of $-O\nmid H$ bond, with increase of alkyl group +I effect increases increasing electrodensity around 'O'-atom. consequently the bond cleavage in O–H bond becomes difficult i.e. alkyl group decreases the polarity of the O–H bond. This adversely affect the reactivity of alcohol. So the reactivity during esterification following in the order $-CH_3 > 1^0 > 2^0 > 3^0$.

Mechanism :

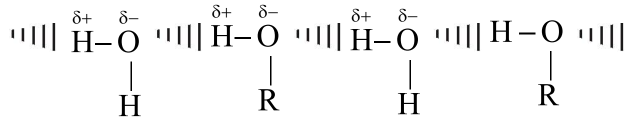


This can further be confirmed by isotopic 1-labelling taking $R-\overset{18}{O}-H$

$RCOOH + RO^{18}:H \longrightarrow RCOO^{18}R + H_2O, H_2O^{18}$ is not formed.

7. The polar – OH group forms inter molecular H–bond with water. The solute (alcohol) solvent (water) attraction releases energy that favours the dissolution process. With increase of non-polar alkyl group the polarity decreases & the solubility decreas e.g. n-heptyl alcohol is almost insoluble. Thus, the solubility decreases in the homologous series. Among the different trops of alcohols the solubility decreases in the order $1^0 > 2^0 > 3^0$.

H–bonding :

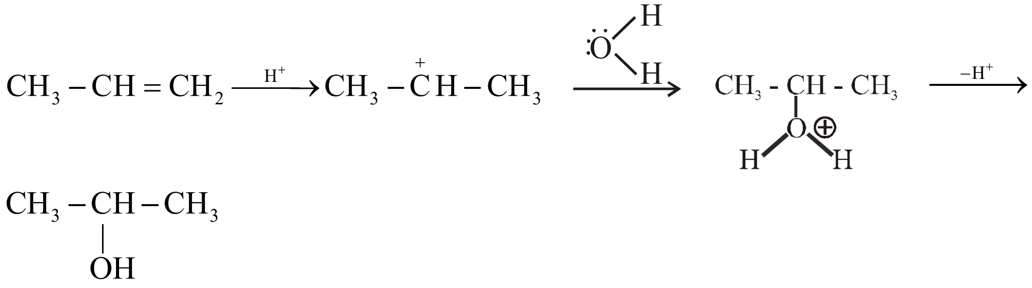


$$\text{||||}\ \underset{\mathrm{H}}{\overset{\delta+\ \ \delta-}{H-O}}\ \text{||||}\ \underset{\mathrm{R}}{\overset{\delta+\ \ \delta-}{H-O}}\ \text{||||}\ \underset{\mathrm{H}}{\overset{\delta+\ \ \delta-}{H-O}}\ \text{||||}\ \underset{\mathrm{R}}{H-O}\ \text{||||}$$

8. Among the isomeric alcohols, the boiling point decreases with increase of branching due to decease of vander Waals forces of attraction

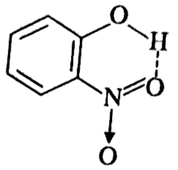
e.g. Butan-1-ol (1^0) > Butan–2–ol (2^0) > 2-methyl propan-2-ol (3^0)

9. Acidic hydrolysis of alkene (e.g. propene)

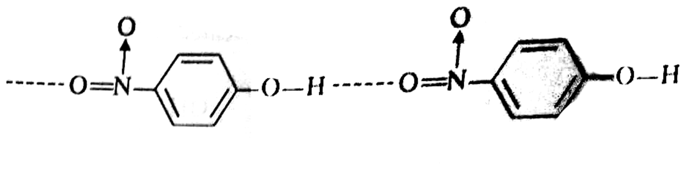


$$CH_3-CH=CH_2 \xrightarrow{H^+} CH_3-\overset{+}{C}H-CH_3 \xrightarrow{H_2\ddot{O}} \underset{\overset{|}{\overset{+}{O}H_2}}{CH_3-CH-CH_3} \xrightarrow{-H^+} \underset{\overset{|}{OH}}{CH_3-CH-CH_3}$$

10.



o–nitrophenol



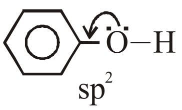
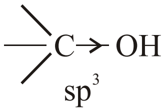
p–nitrophenol

→ Intramolecular H-bondng	Intermolecular H-bonding
→ Moelcules are held by weak vander Waals force and hence volatile.	Here these molecules are held by stronger H-bonding & having higher b.p

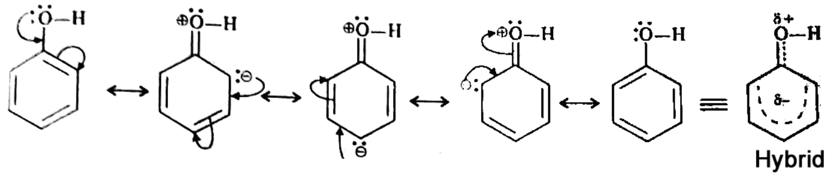
11.

C_6H_5-O-H (phenol)	$C_6H_5-CH_3$ (Toluene)
→ has polar $\overset{3.1}{-O}-\overset{2.1}{H}$ group	→ $-CH_3$ group is non-polar
Electronegativity of 0, 3.1 and that of H = 2.1.	→ Molecules are held by weaker vander Waals force.
→ Molecules are much associated by stronger H-bonding (inter molecular)	→ Molecules are held by weaker vander Waals force.
→ Greater molecular association accounts for higher b.p.	

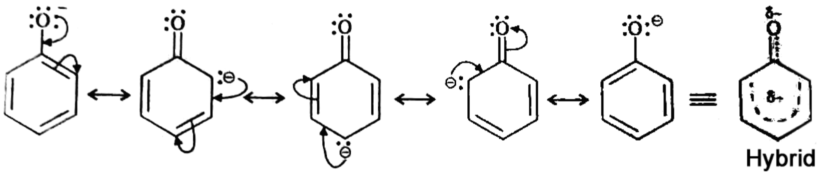
12.

	
→ $\mu = 1.54D$	$\mu = 1.71D$
→ Less polar	more polar
→ C-OH shorter bond length (sp^2 hybridised)	C – OH longer bond length (sp^3-hybridised)
→ less solute - solvent attraction and less soluble.	→ more dipole-dipole attraction (H–bonding) i.e. alcohol is more soluble in water.

13. Resonance in phenol



Resonance in phenate ion



Resonating structure of phenol :

less stable resonating structure of phenol as

(i) positive charge rests on more electronegative 'O' atom.

(ii) Charge separation involves expense of energy.

Thus, phenol is less stable, However, phenoxide or phenate ion is morestable as :

(i) all the forms contribute to the resonance hybrid.

(ii) These do n't involve charge separation rather charge delocalisation.

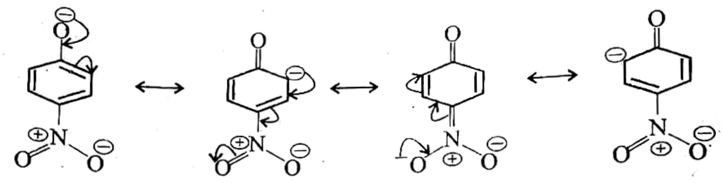
Therefore the equibilibrium shifts more towards right favouring ionisation increasing more of $\left[H^+\right]$ or $\left[H_3\overset{+}{O}\right]$ and hence more acidic.

In alcohol: $ROH \underset{\text{eqbm.}}{\rightleftharpoons} \underset{\text{alkoxide}}{R\bar{O}} + H^+$

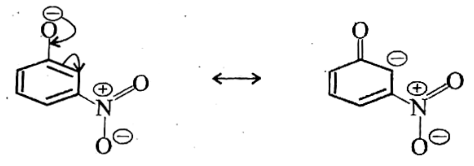
The alkoxide ion $R-\bar{O}$ is unstable due to +I effect and the equilibrium is more towards left reducing the $\left[H^+\right]$ and hence less acidic / neutral.

14. Acids are $\bar{e}$ acceptors (Lewis concept), the electron accepting tendency increases with the presence of electron withdrawing group $-NO_2$ group is an ewg as N & O are both more electronegative. This is the reason why nitrophenols are more acidic than phenols. Further more is the stability of conjugate base more is the acidic nature. Here p-nitro phenoxide has more resonating structures hence more stable the phenoxide itself. At p-position greater dispersal of (–) charge on 'O' takes place than $-NO_2$ group at o–position.

That is the reason why p-nitrophenol is more acidic than phenol i.e. p- > o – > m – nitro phenol

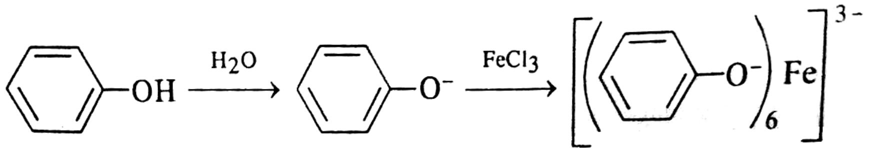


The lower acidity of metanitro isomer is due to the fact that m-nitro phenoxide anion is stabilised by inductive effect only and no resonance effect is operating due to absence of conjugate system.



(no further resonance with NO_2 group)

15. Phenols with neutral $FeCl_3$ generally give violet colouration or even red depending on the structure due to formation a complex salt.

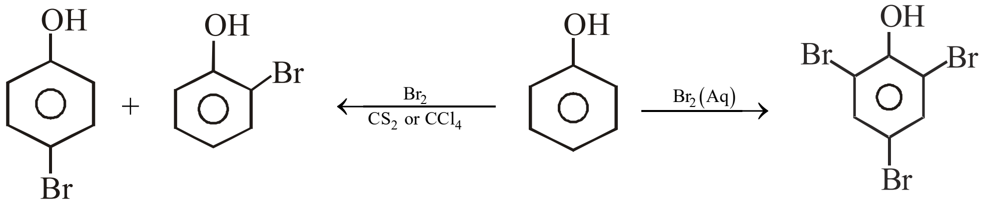


Phenol

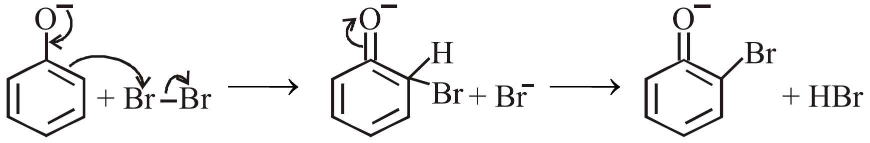
Hexa-co-ordinated complex compound (Violet)

→ Alcohols generally do not produce such deep coloration when treated with ferric chloride soliution.

16.

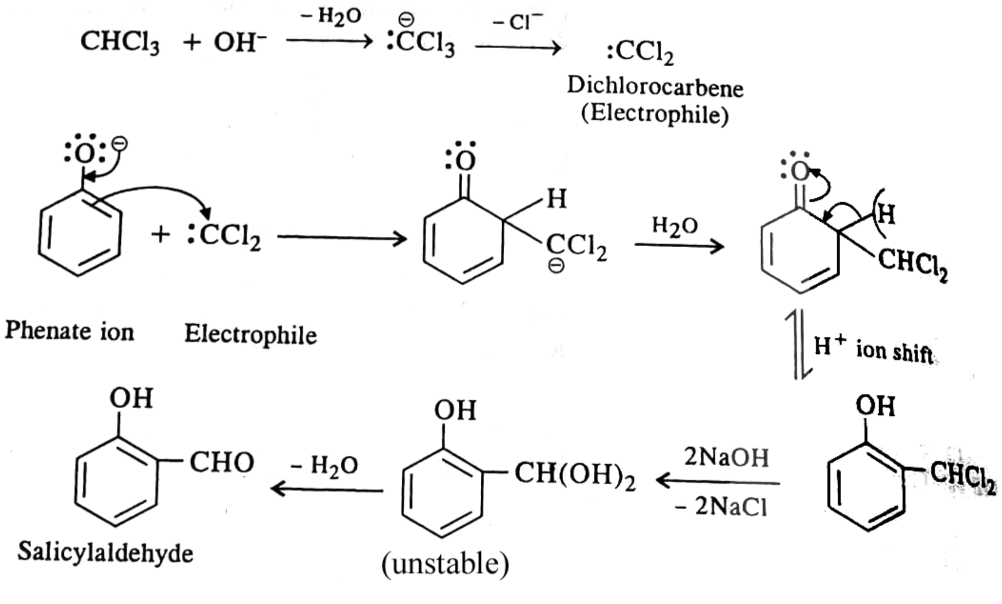


In aqueous medium, phenol ionises to give phenate / phenoxide ion. The presence of negative charge on the oxygen atom activates the ring to a large extent towards electrophilic substitution resulting in trisubstitution

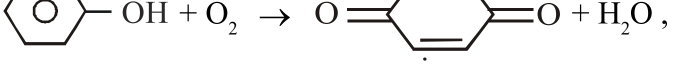


However in non-polar solvent, phenate ion is not formed. This means that the activation of the ring gets suppressed since the oxygen has no –ve charge on it (as no ionisation takes, place in non-polar solvents like CCl_4 or CS_2). As a result –OH group donates the $\bar{e}$ – pair to the ring only to a small extent and mono substitution (o– or p–) takes place.

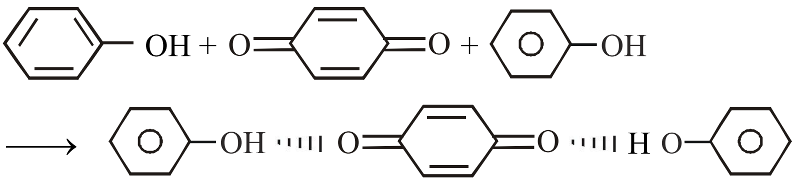
17. **Mechanism.** It is an example of electrophilic substitution byt the electrophile is dichlorocarbene (:CCl_2)



18. Phenol turns pink in colour on exposure to air due to slow oxidation. It oxidises to quinone & quinone combines with phenol to give an addition product, phenoquinone which is pink in colour.

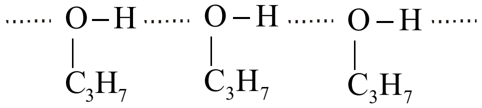


quinone



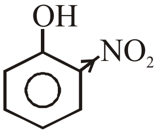
dipheno.quinone pink / red colour.

19. Propanol with polar alcoholic (–OH) group exhibits inter molecular H–bonding Due to stronger interaction it shows higher b.p. while the butane$_{(g)}$ is non-polar &-experience weaker vander Waals force with lower b.p.

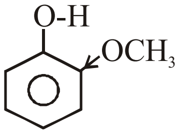


$$\cdots\cdots \underset{C_3H_7}{\underset{|}{O}}-H \cdots\cdots \underset{C_3H_7}{\underset{|}{O}}-H \cdots\cdots \underset{C_3H_7}{\underset{|}{O}}-H \cdots\cdots$$

20.



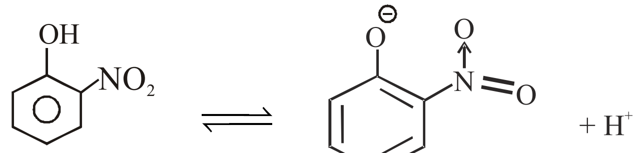
-I effect



+I effect

$-NO_2$ electronwithdrawing group (EWG) while $-\ddot{\underset{..}{O}}CH_3$ $\overline{e}$-releasing group.

EWG ($-NO_2$) group decreases the $\overline{e}$-density on "O"-atom as a result proton release becomes easier i.e. more acidic. Further o-nitrophenoxide ion is more stable due to greater dispersal of –ve charge on 'O'. More is the stability of conjugate base more is the acidic nature.



(Less stable)

(More stable)

Equilibrium shifts towards right.

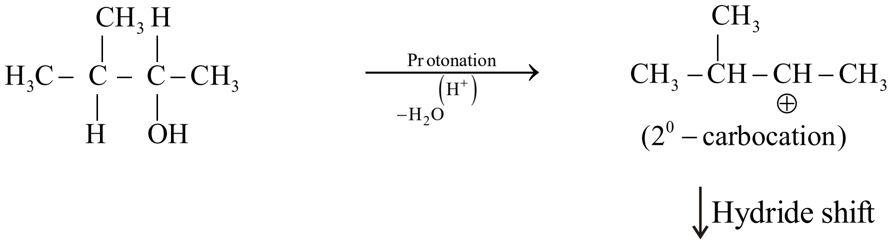
The reverse is the case for o–methoxyphenol.

21. Phenol –OH group is an electron releasing i.e. activating group. It activates o– and | p–position of the benzene ring due to conjugation or +R effect. E^+ attacks more at p–position and a mixture of isomeric products obtained on halogenation, nitration and sulfonation i.e. electrophilic substitution, S_E reaction.

Reaction of phenol is favourable in alkaline / aqueous medium as phenoxide is more reactive than phenol itself.

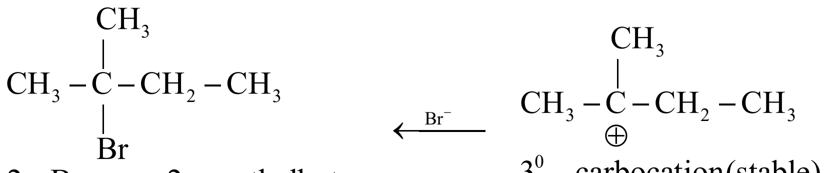
* The resonating structures show greater $\overline{e}$-density (–ve) at o– and p-position to be favourably attacked by electrophile, E^+, (Cl^+, $\overset{+}{N}O_2$ etc.)

22.



$$H_3C-\underset{H}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-\underset{OH}{\underset{|}{\overset{H}{\overset{|}{C}}}}-CH_3 \xrightarrow[-H_2O]{\text{Protonation } (H^+)} CH_3-\overset{CH_3}{\overset{|}{C}H}-\underset{\oplus}{CH}-CH_3 \quad (2^0-\text{carbocation})$$

$\downarrow$ Hydride shift



$$CH_3-\underset{\underset{Br}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-CH_3 \xleftarrow{Br^-} CH_3-\underset{\oplus}{\overset{\overset{CH_3}{|}}{C}}-CH_2-CH_3$$

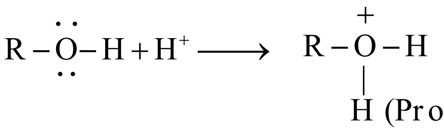
2 – Bromo – 2 – methylbutane $\qquad$ 3^0 – carbocation(stable)

23. Alcohol as acid : acids are proton donor which can be possible on fission of–O ≀ H bond. It liberates $H_2(g)$ on treatment with active metals like Al, Na etc.

$$ROH + Na \longrightarrow RONa + \frac{1}{2}H_2\uparrow$$

Strength : $CH_3OH > 1^0 > 2^0 > 3^0$.

Alcohol as base : Base is defined as proton acceptor (Bronsted-Lowry) (or) $\bar{e}$, donor (Lewis concept)



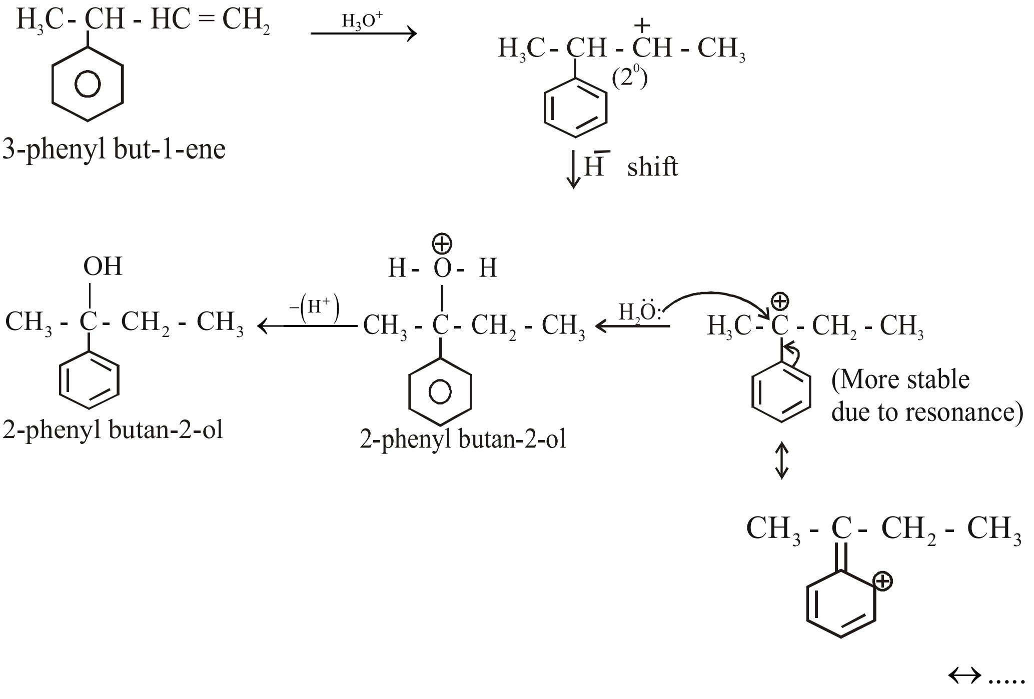
$$R-\ddot{\underset{\cdot\cdot}{O}}-H+H^+ \longrightarrow R-\underset{\underset{H}{|}}{\overset{+}{O}}-H \text{ (Protonated alcohol)}$$

It is a very weak base with pH value 7.33.

Alcohol cann't be defined as acidic or alkaline rather designed as amphiprotic because the nature of bond between C–OH is non-ionic but slightly polar in nature.

Aliphatic alcohol acts as a weak acid in presence of strong base. Aromatic alcohols (Phenols) behaves as weakly acidic due to resonance stabilisation of conjugate base.

24.



dispersal of +ve charge

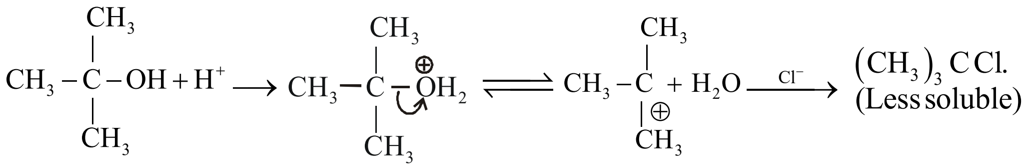
25. n-butylalcohol easily oxidises to aldehyde (further to acid) but tertiary alcohol undergoes drastic oxidation to ketone with less number of C-atom. Thus n-butyl alcohol is a better reductant to decolorise $KMnO_4$.

$$2\times\left[MnO_4^- + \bar{e} \longrightarrow MnO_4^{2}\right]$$

$$\underset{\text{Butanal}}{C_3H_7 - CH_2OH \longrightarrow C_3H_7CHO + 2H^+ + 2e^-}$$

or with acidified $KMnO_4$: $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

26. Tertiary butylalcohol with, Lucas reagent follows fission C ⌇ OH bond and in the order $3^0 > 2^0 > 1^0$. The alkyl groups are electron releasing group and influence + I effect. This polarised C–O bond and stabilised the 3^0-carbocation which readily gives turbidity with Cl^- ($HCl - ZnCl_2$).

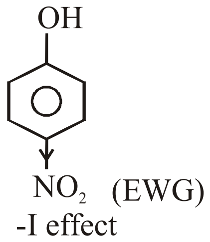


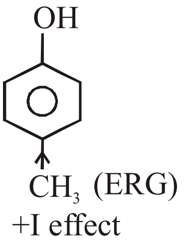
$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-OH + H^+ \longrightarrow CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\overset{\oplus}{O}H_2 \rightleftharpoons CH_3-\underset{CH_3}{\overset{CH_3}{\overset{\oplus}{C}}} + H_2O \xrightarrow{Cl^-} \underset{\text{(Less soluble)}}{(CH_3)_3CCl.}$$

27. Ethyl alcohol is polar and exhibits dipole-dipole interaction i.e. H–bond. Due to much association or greater intermolecular force of attraction it exhibits in liquid form.

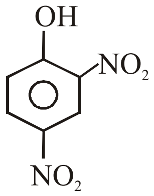
$CH_3–O–CH_3$, ether is non-polar, molecular association is less stronger due to weaker vander Walls force dimethyl ether exhibits in gaseous state.

28. [Ref. Q. 20]



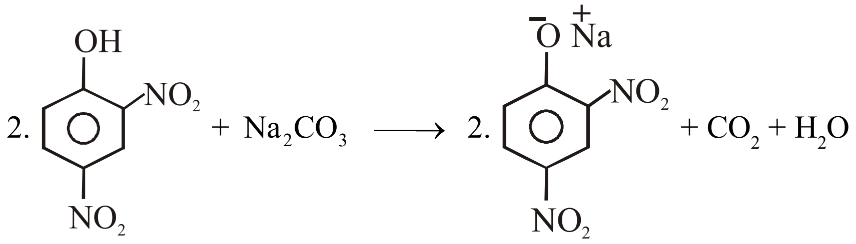


29.



Two electron withdrawing $–NO_2$ groups at o– and p– position make the phenol more acidic due less $\bar{e}$ density at 'O' favouring release of H^+. Further o-p dinitrophenoxide is more stable due to greater extent of dispersal of –ve change on 'O'. (more canonical structures)

Due to greater acidic nature it gets soluble in sodium carbonate solution. (alkaline)



Sodium 2, 4-dinitrophenoxide (Water soluble)

30. Due to resonance : (i) C–O bond developes π-charate

(ii) O– acquire +ve charge

(iii) C–O bond length decreases increasing bond strength.

By Such substitution is denied.

Resonating structures of phenol;

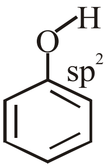
Fig : Ref. question no. 13.

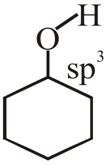
31. Dehydration of alcohol is an elimination reaction via formation of carbocation. But with HCl alcohol it gives alkylchloride (R–Cl)

HNO_3 is a better oxidising agent, it may oxidise alcohol to carboxylic acid via aldehyde, further nitroester may be formed.

On the other hand conc. H_2SO_4 is a better dehydrating agent.

32. →





→ Phenoxide ion the conjugatebase is stabilised by resonance.

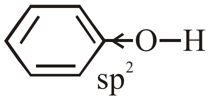
33. For reactivity i.e. attack of electrophile the ring must be rich in $\overline{e}(s)$ i.e. electron releasing group like –OH, $-CH_3$ activates the ring and favours attack of electrophile (E^+). Chlorobenzene is least reactive as Cl (3.0) is more electronegative than H (2.1), thus it has tendency to act as EWG, reducing $\overline{e}$ density of the ring making chlorobenzene least ractive.

On the other hand the hydroxyl group in phenol can delocalise one of the lone pairs on ‘O’ atom into the ring activating the ring favouring S_E. Thus, phenol > Toluene > benzene > chlorobenzene.

34. Acidic nature : $CF_3\,CH_2OH > CH_3-CH_2\,OH$

– I effect (F = 4.0) increases the acidic nature as it reduces the $\overline{e}$ density ‘O’ atom of the alcohol favouring release of proton.

35.



The lone pair on ‘O’ is used for delocalisation in the benzene ring of phenol developing a π- character between C–OH bond & +ve charge on ‘O’ as well for which is less polar.

→ Dipole moment, $\mu = 1.54\,D$

→ Benzene ring shows $\overline{e}$ with drawing effect.

$$\underset{sp^3}{\overset{\delta+}{CH_3}} \rightarrow \overset{\delta-}{O}H$$

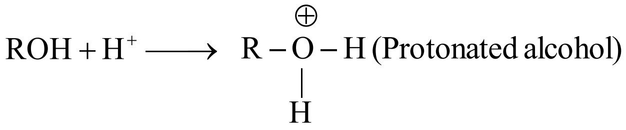
Here in methanol C–OH bond is longer as C is sp^3 hybridised. Here C is partially +vely charged $(\delta+)$ & ‘O’ is partially negatively charged $(\delta-)$ is ‘O’ (3.5) has higher electronegativily than C(2.5). Hence methanol is much polar.

Dipolemoment, $\mu = 1.71\,D$

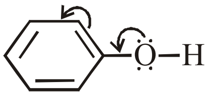
→ $-CH_3$ group shows electron releasing effect.

36. R → OH

Alkyl group (–R) is electron releasing & increases $\overline{e}$ – density on 'O'–atom favouring protonation.



$$ROH + H^+ \longrightarrow R-\overset{\oplus}{\underset{\substack{| \\ H}}{O}}-H \text{ (Protonated alcohol)}$$



Electron with drawing effect of ring decreases $\overline{e}$-dnsity on 'O', hence can't be protonated.

37. Phenol is a weaker acid. It is weaker than carbonic acid (H_2CO_3) and hence fails to liberate CO_2 from sodium bicarbonate. Had it been stronger one,

$$HC\overline{O}_3 + \left(H^+\right) \longrightarrow CO_2 + H_2O$$

38. Ether $\left(C_2H_5O\,C_2H_5\right)$ does not have replaceable hydrogen. Hence ether can be dried by sodium whereas alcohol can't be dried by sodium metal as it reacts to liberate hydrogen (g).

$$ROH + Na \longrightarrow RONa + \frac{1}{2}H_2\left(g\right)$$

39. Anhydrous calcium chloride with ethanol / alcohol forms addition compounds, i.e. alcoholates, for which it's not used to dry alcohol.

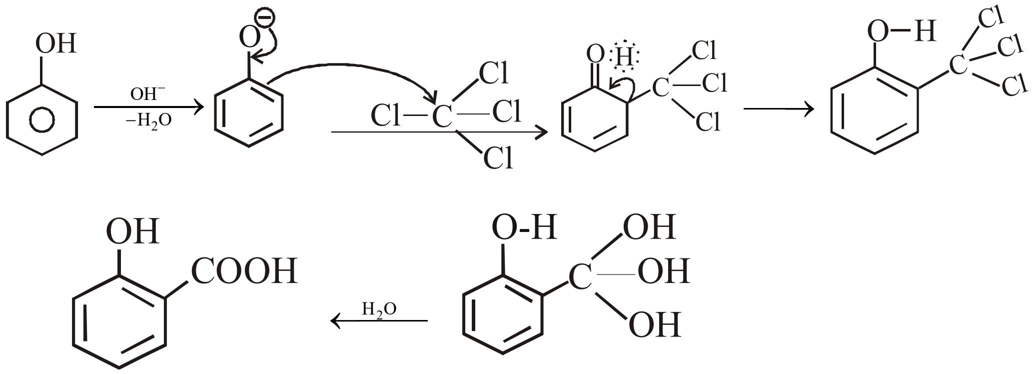
e.g. $CaCl_2 + 4\ C_2H_5OH \longrightarrow CaCl_2.4\,C_2H_5OH$

No removal of water molecule   Addition compound

No removal of water moelcule.

40. Reimer - Tiemann reaction :

When phenol react with alkaline carbon tetrachloride forms salicyclic acid.



B(c) Name reactions :

(For these refer text book)

Group- B (d) Answer the following :

1.

Alcohols :	**Phenols**
a. Alcohols don't have any action on litmus.	a. Phenols turn blue litmus red as these behave acidic
b. Don't react with NaOH/KOH	b. Phenols are neutralised by NaOH to form sodium phenoxide (salt)
c. Alcohols don't respond dye test.	c. Phenols form coloured dye (azodye)
d. Liberman's test : Don't respond.	d. When phenol is treated with $NaNO_2$ dissolved in conc. H_2SO_4 a red colour appears which turns blue on treating with NaOH(Aq.)

2. (i) Phenol (ii) p-nitrophenol (iii) Phenol

3. * Victor Meyer's test Refer Group-B(b). Q. No. 4

* Lucas Test :

Reagent	1^0 alcohol	2^0 alcohol	3^0 alcohol
Conc HCl Anhy. $ZnCl_2$	When Lucas reagent is added to 1^0 alcohol turbdity appears on heating.	Turbidity appears after five minutes alcohol turbidity	When Lucas reagent is added to 3^0-alcohol turbidity appears instantly.

$$RCH_2OH + HCl \xrightarrow[\Delta]{ZnCl_2} RCH_2Cl + H_2O$$

$$R_3C(OH) + HCl \rightarrow R_3C\ Cl + H_2O$$

4.

Alcohols (R–OH)	**Ethers (ROR)**
i) Alcohols are readily soluble in water due to intermoelcular H-bonding	(i) Except dimethyl ether the rest are not miscible with water.
ii) H_2 (g) is liberated out when alcohols reacts with active metals like Na. $ROH + Na \longrightarrow RONa + \frac{1}{2}H_2 \uparrow$	(ii) Ethers don't react.
iii) Alcohols readily combine with PCl_5 to giver alkyl chloride. $ROH + PCl_5 \longrightarrow RCl + POCl_3 + HCl$	(iii) Ethers react with PCl_5 at high temperature $ROR + PCl_5$ $\longrightarrow 2RCl + POCl_3$
iv) Alcohols are readily oxidised to aldehyde or ketone depending on the nature of alcohol.	(iv) Ethers are resistant to oxidation.

5. During destructive distillation of wood the condensate(*l*) collected over wood tar is called pyroligneous acid. In addition to water it contains methyl alcohol (2–4%), acetone (0.5%) acetic acid (10%)

6. Ethyl alcohol is commercially prepared from starchy grains, such as potatoes, barley, rice, wheat etc. by fermantation which is a process of slow decomposition of complex organic compounds into simpler compounds by catalytic action of enzymes. The whole synthetic process involved (i) Saccharification (ii) alcoholic fermentation (iii) distillation

$$2(C_6H_{10}O_5)_n \quad + nH_2O \xrightarrow{\text{diastase}} n\ C_{12}H_{22}\ O_{11}$$

paste of starch materials (Mash) Maltose

Fermentation:

$$C_{12}H_{22}\ O_{11}\ + H_2O \xrightarrow[\text{Present in east}]{\text{Maltase}} 2\ C_6\ H_{12}\ O_6$$

Maltose (glucose)

$$C_6H_{12}\ O_6\ + H_2O \xrightarrow[\text{(In yeast)}]{\text{Zymese}} 2\ C_2\ H_5\ OH + 2CO_2 \uparrow$$

7. $ROCH_3 \xrightarrow{HI} CH_3I \xrightarrow{AgNO_3} AgI_{(s)}$

From weight of AgI the no. of $-OCH_3$ in the given compound can be calculated quantitatively.

2.68 gram of compound (A) gives 14.08 gram of AgI

134 gram (1 mole) of 'A' gives $\frac{14.08}{2.68} \times 134 = 704$ gram AgI

704 gram AgI $= \frac{704}{235}$ moles = 3 moles (mol. mass AgI = 235 g.mol^{-1})

$\therefore$ The number of $-OCH_3$ group in A = 3.

8. Preparation of acetaldehyde from ethylalcohol :

(i) Oxidation : Primary alcohol upon oxidation with $(MnO_4^- + H^+)$ or $(Cr_2O_7^{2-} + H^+)$.

Aldehyde formed by this process is to be removed by distillation from reaction mixture as soon as it's formed in order to avoid further oxidation to carboxylic acid. Aldehyde is fractionated first as it has less b.p. than alcohol

$$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$$

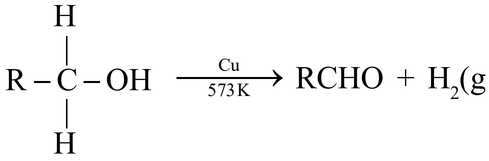
$$R\,CH_2OH \longrightarrow RCHO + 2H^+ + 2(\bar{e})$$

Mild oxidising agent like Collin's agent ($CrO_3.2C_5H_5N$) or PCC, pyridinium chloro chromate,

$CrO_3.\ C_5H_5N.HCl$ can be choosen as selective oxidising agent which converts 1^0 alcohol to aldehyde prefearably.

(ii) Catalytic dehydrogenation : When 1^0 alcohol is heated with copper at 573 K

aldehydeis formed on removal of $H_2(g)$.



$$R-\overset{\overset{\large H}{|}}{\underset{\underset{\large H}{|}}{C}}-OH \xrightarrow[573K]{Cu} RCHO + H_2(g$$

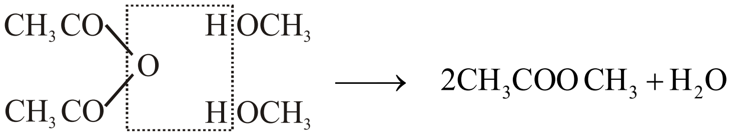
9. Alcoholysis of acid & its derivatives :

When acid or its derivatives are allowed to react with alcohol ester is formed.

$$CH_3-CH_2OH + CH_3COOH \xrightarrow{H_2SO_4\text{(conc.)}} CH_3COO\ C_2\ H_5 + H_2O$$

Ethylethanoate

$$CH_3-CH_2OH + CH_3COCl \longrightarrow CH_3COO\ C_2\ H_5 + HCl$$



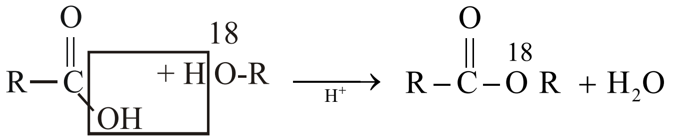
(Anhydride)

$$CH_3-CH_2OH + CH_3CONH_2 \longrightarrow CH_3COC_2H_5 + NH_3$$

ethylethanoate

Ease of esterification : 1^0 alcohol > 2^0 > 3^0
and among the acid derivates : acid chloride > > acid anhydride > ester > amide.

Mechanism :

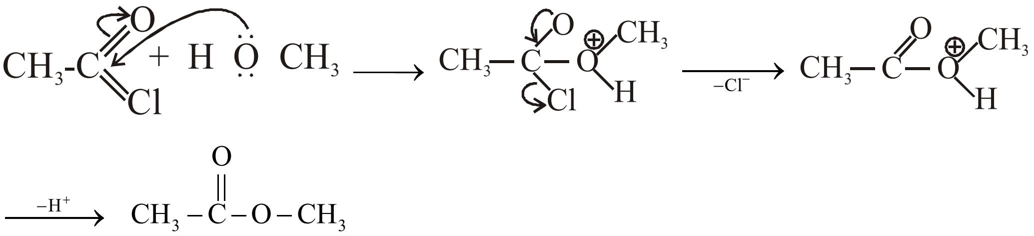


$$R-\overset{\overset{O}{||}}{C}-OH + H\overset{18}{O}-R \xrightarrow[H^+]{} R-\overset{\overset{O}{||}}{C}-\overset{18}{O}R + H_2O$$

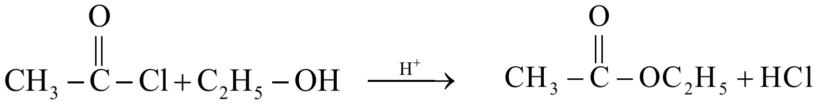
This shows that in $\overset{18}{RO} \wr H$, $O \wr H$ bond fission occurs not $C \wr OH$ of alcohol. so it depeds on acidic nature of alcohol, so the ease of esferification is

$$CH_3OH > CH_3CH_2OH > (CH_3)_2CHOH > (CH_3)_3COH$$

(This is also order of their acidic nature)
Thus, esterification involves –OH of acid and –H of alcohol. This process is called isotopic labelling.
Refer Q.No. - 6 [Group B (B)]



$$\xrightarrow{-H^+} CH_3-\overset{\overset{O}{||}}{C}-O-CH_3$$



$$CH_3-\overset{\overset{O}{||}}{C}-Cl + C_2H_5-OH \xrightarrow{H^+} CH_3-\overset{\overset{O}{||}}{C}-OC_2H_5 + HCl$$

Ethylacetate

10. Cold ethanol is taken as the reaction is exothermic.

Sample-I. Methanol : Sample is heated with salicylic acid and conc. sulfuric acid, a chatacteristic smell of oil of wintergreen (amritanjan smell)

Sample II Ethanol. If the sample responds to iodoform test it's to be labelled sample-II . i.e. ethanol with alkaline iodine is warmed to form yellow mass of iodoform.

Sample III If the sample does not respond to above two tests, it's to be labelled Sample-III.

11. $(CH_3-CH_2OH + conc.H_2SO_4) \xrightarrow{170^0} CH_2 = CH_2\,(B)$

$$\xrightarrow{100^0C} CH_5-CH_2HSO_4\,(C)$$

Ethyl hydrogen sulfate

$$\xrightarrow[140^0]{\text{Excess of } C_2H_5\,OH} C_2H_5O-C_2H_5\,(D)$$

Diethylether

12. Ceric ammonium nitrate test :

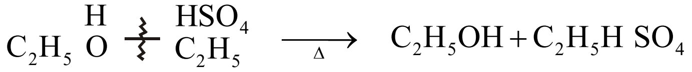
When a few drops of alcohol (–OH group) is added to the aqueous solution of ceric ammonium nitrate, the orange colour changes to red.

$$\underset{\text{(orange)}}{(NH_4)_2\,Ce(NO_3)_6} + 2\ ROH \longrightarrow \underset{\text{(red)}}{Ce(NO_3)_4\,(ROH)_2} + 2NH_4NO_3$$

13. (i) Diethylether on acidic hydrolysis gives ethyl alcohol.

$$C_2H_5OC_2H_5 + H_2O \xrightarrow[\text{pressure}]{\text{dil } H_2SO_4,\Delta} 2\,C_2H_5-OH$$

(ii) With cold conc H_2SO_4 it forms oxonium ion, but on heating cleavage of C–O bond takes place to form alcohol and – hydrogen sulfate



$$C_2H_5\overset{H}{O}\;\overset{HSO_4}{C_2H_5} \xrightarrow[\Delta]{} C_2H_5OH + C_2H_5H\ SO_4$$

(iii) With acetylacting agents : (i) CH_3COCl (ii) $(CH_3CO)_2O$

$$C_2H_5O-C_2H_5 + CH_3COCl \xrightarrow[ZnCl_2\Delta]{\text{anhydrous}} C_2H_5Cl + \underset{\text{(ester)}}{CH_3COOC_2H_5}$$

$$C_2H_5-O-C_2H_5 + (CH_3CO)_2\,O \longrightarrow 2CH_3COOC_2H_5$$

(iv) Diethyl ether reacts differently with Chlorine in dark and in presence of light (with excess chlorine)

$$CH_3-CH_2-O-CH_2-CH_3 \xrightarrow{Cl_2/\text{dark}} \underset{\alpha-\text{chlorodiethyl ether}}{CH_3CHCl-O-CH_2CH_3}$$

$$\xrightarrow{Cl_2/\text{dark}} \underset{\alpha,-\alpha'\ \text{dichloroethyl ether}}{CH_3CHCl-O-CHCl\ CH_3}$$

$$CH_3-CH_2O-CH_2CH_3 \quad +$$

$$\underset{\text{excess}}{10Cl_2} \xrightarrow{h\nu} CCl_3CCl_2-O-CCl_2CCl_3 + 10\,HCl$$

14. (i) $CH_3-CH_2Br + CH_3\,CH_2\,ONa \longrightarrow CH_3-CH_2-O-CH_2CH_3 + NaBr$

Bromoethane Sod. ethoxide

(ii) $CH_3-CH_2Br + C_6H_5ONa \longrightarrow CH_3-CH_2-O-C_6H_5 + NaBr$

Bromoethane Sod. phenoxide

(iii) $CH_3Br + C_2H_5ONa \longrightarrow CH_3-O-C_2H_5 + NaBr$

(Least crowding effect for S_N-2 reactoon)

(iv) $CH_3-CH_2-CH_2Br + \overset{+}{Na}\,\bar{O}-CH_2-CH_2-CH_3$

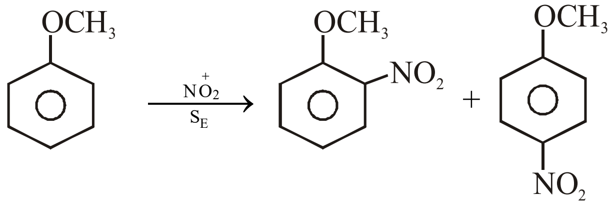
1 – Bromo propane Sod. propoxide

$$\longrightarrow CH_3-CH_2-CH_2-O-CH_2-CH_2-CH_3$$

15. (i) When anisole is treated with a mixture of conc. HNO_3 and conc. H_2SO_4 a mixture of ortho and para-nitroanisole is formed where p-nitroanisole appears as major product.

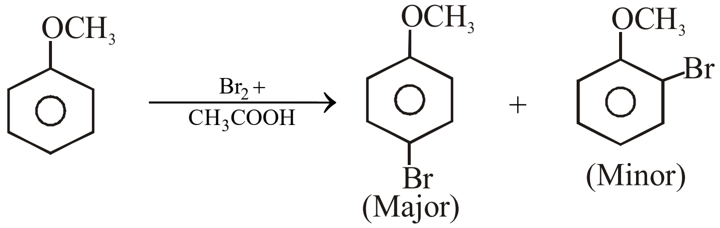
$$HNO_3 + H_2SO_4 \longrightarrow \overset{+}{N}O_2 + HS\overset{-}{O}_4 + H_2O$$

electrophile

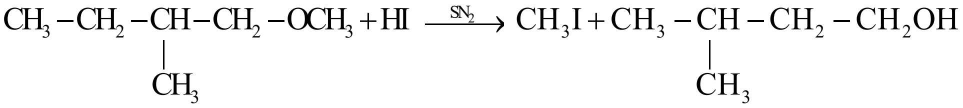


Here –OCH_3 is an electron releasing group that activates the ring facilitating attack of $\overset{+}{N}O_2$ (electrophile) at o– and p– positions.

(ii) Bromination of anisole in presence of ethanoic acid and Bromine even in absence of Fe^{3+} bromide catalyst p-isomer is obtained in 90% yield due to less steric factor.



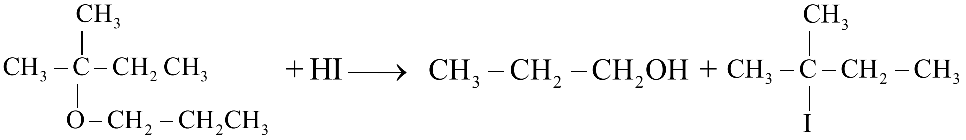
16. (i)



$$CH_3-CH_2-\underset{\substack{|\\CH_3}}{CH}-CH_2-OCH_3 + HI \xrightarrow{S_N2} CH_3I + CH_3-\underset{\substack{|\\CH_3}}{CH}-CH_2-CH_2OH$$

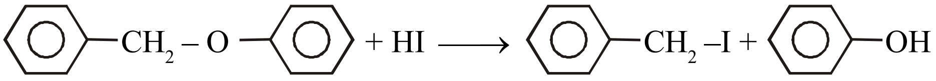
I^- is a good nucleophile. Due to steric hindrances it attacks the smaller alkyl group following S_N–2 mechanism.

(ii)



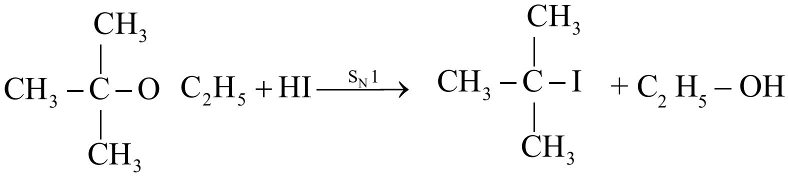
$$CH_3-\underset{\substack{|\\O-CH_2-CH_2CH_3}}{\overset{\substack{CH_3\\|}}{C}}-CH_2CH_3 + HI \longrightarrow CH_3-CH_2-CH_2OH + CH_3-\underset{\substack{|\\I}}{\overset{\substack{CH_3\\|}}{C}}-CH_2-CH_3$$

(iii)

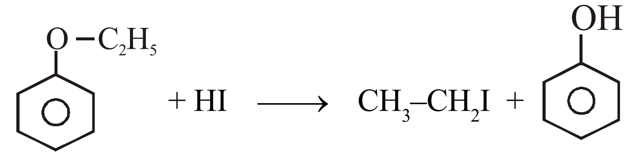


(iv) $CH_3-O-CH_2-CH_2-CH_3 + HI \longrightarrow CH_3I + CH_3-CH_2-CH_2-OH$

(v)



$$CH_3-\underset{\substack{|\\CH_3}}{\overset{\substack{CH_3\\|}}{C}}-O\ C_2H_5 + HI \xrightarrow{S_N1} CH_3-\underset{\substack{|\\CH_3}}{\overset{\substack{CH_3\\|}}{C}}-I + C_2H_5-OH$$

(vi) 

(vii) $C_6H_5OC_6H_5 + HI \longrightarrow$ No reaction

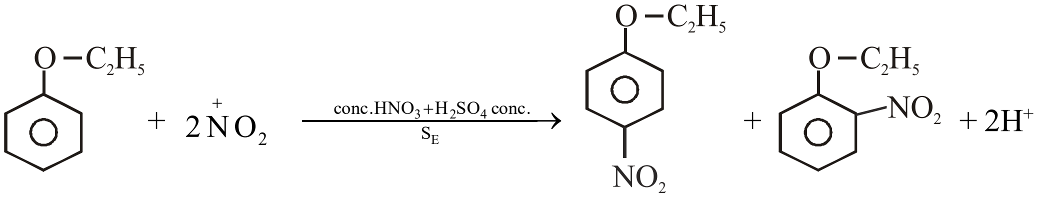
(viii) $C_6H_5CH_2OC_2H_5 + HI \xrightarrow{SN_1} C_6H_5CH_2I + C_2H_5OH$

(ix) $C_6H_5CH_2 - O - CH_3 + HI \xrightarrow{SN_1} C_6H_5CH_2I + CH_3OH$

(x) $C_6H_5 - CH_2 - O - C(CH_3)_3 + HI \xrightarrow{S_{N_1}} C_6H_5 - CH_2OH + (CH_3)_3 CI$

[$(CH_3)_3 C^+$ is more stable than $C_6H_5 - \overset{\oplus}{C}H_2$

In former +I effect as well as hyperconjugative effect.]

17. 

p-nitrophenetole
(major product)

18. Strength halogen hydra acids follows in HI > HBr > HCl in order of bond length and ease of cleavage. Thus, the nucleophilicity of halide ions follow in the ordr $I^- > Br^- > Cl$.

As HCl is a weak acid, ease of formation Cl^- is difficult and Cl^- is not a better nucleophile ($\overline{e}$ releasing species) Hence no cleavage of O–C bond with conc. HCl.

19. Phenol is first sulphonated with conc. H_2SO_4 at 373 K to form isomeric (o– and p–) hydroxybenzene sulfonic acid. This is followed by nitration with conc HNO_3 where simultaneously replacement of $-SO_3H$ groups by $-NO_2$ group takes place. The prsence of $-SO_3H$ group in the ring checks its oxidation to a great extent during nitration (with HNO_3)

20. (i) $K_2Cr_2O_7 + H_2SO_4$
(ii) PCC (or) Jone's reagent
(iii) Bromine water
(iv) Br_2 / CS_2
(v) alkaline $KMnO_4$
(vi) $LiAlH_4$ or $NaBH_4$

B(e) Identify the missing compounds / reagent (s) in the following steps of reactions :

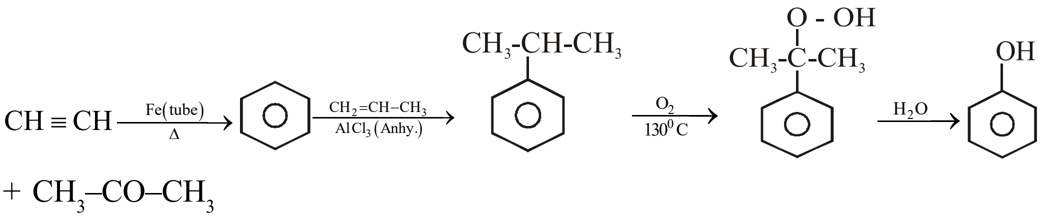
Missing compounds :

1. $CH_3-CH_2Cl,\ CH_3CH_2CN \longrightarrow CH_3COOH \longrightarrow CH_4$

2. $C_2H_5OH \xrightarrow{PCC} CH_3CHO \xrightarrow{(O)} CH_3COOH \xrightarrow{NH_3} CH_3COONH_4 \xrightarrow{\Delta} CH_3CONH_2$

$\xrightarrow{Na-alcohol} CH_3-CH_2-NH_2 \xrightarrow{HONO} CH_3-CH_2OH$

3.



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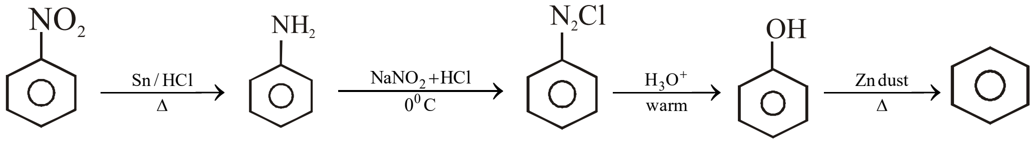

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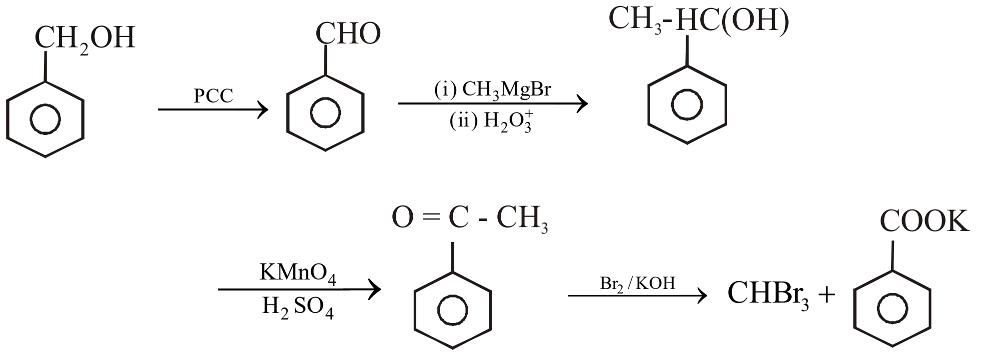

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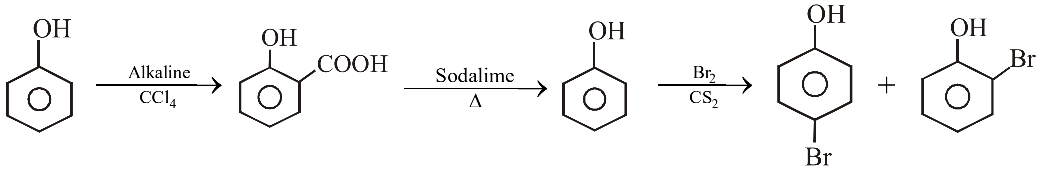
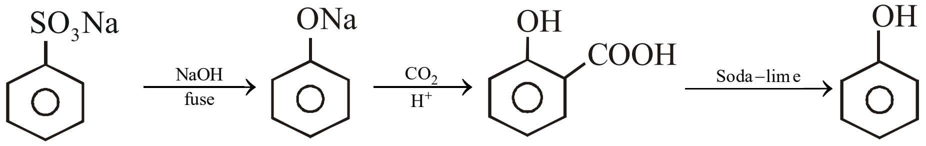


7. $CH \equiv CH \longrightarrow HC \equiv C\ Na \longrightarrow HC \equiv C-CH_2-CH_3 \longrightarrow CH_2=CH-CH_2-CH_3$

$\longrightarrow HOCH_2-CH_2\ CH_2-CH_3$

8.



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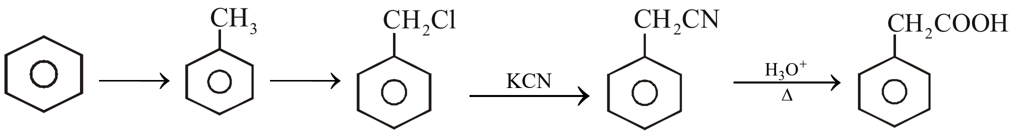


B(f) Conversions :

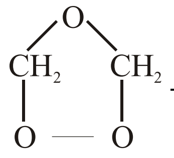
i) $$CH_3OH \xrightarrow{SOCl_2} CH_3Cl \xrightarrow{KCN(aq)} CH_3-CN \xrightarrow[+4(H)]{NaBH_4} CH_3-CH_2NH_2 \xrightarrow[dil\,HCl]{NaNO_2(s)}$$

CH_3CH_2OH

$\downarrow$ PCC

$$HCHO \xrightarrow[(ii)\ H_3O]{(i)\ CH_3MgBr} CH_3-CH_2OH$$

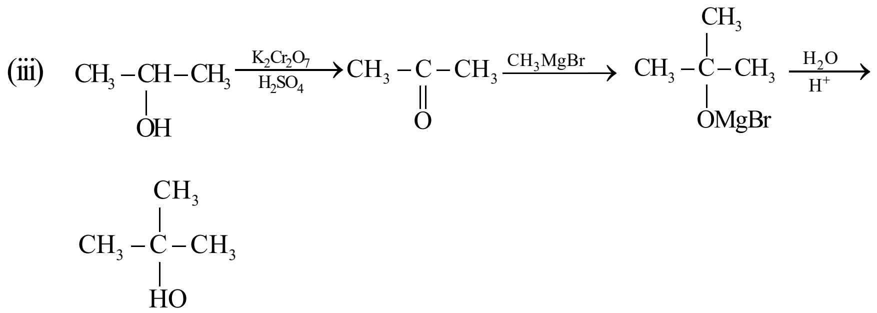
ii) $$CH_3-CH_2OH \xrightarrow[170^0\ C]{Conc.H_2SO_4} CH_2=CH_2 \xrightarrow{O_3}$$



$$\xrightarrow[(Zinc\,dust)]{H_2O}$$

$$HCHO \xrightarrow[2(H)]{LiAlH_4} CH_3OH$$

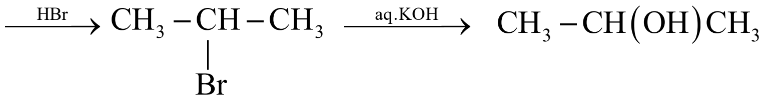
(iii)



$$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3-\underset{\underset{O}{||}}{C}-CH_3 \xrightarrow{CH_3MgBr} CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{OMgBr}{|}}{C}}-CH_3 \xrightarrow[H^+]{H_2O}$$

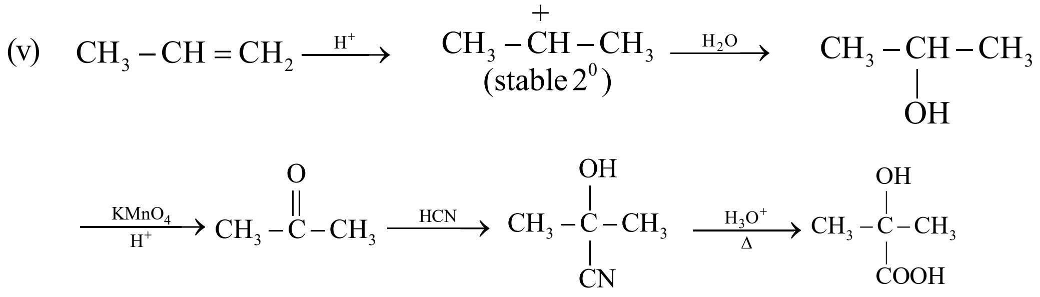
$$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{HO}{|}}{C}}-CH_3$$

(iv) $$CH_3-CH_2-CH_2-OH \xrightarrow[\Delta]{Conc.H_2SO_4} CH_3-CH=CH_2$$



$$\xrightarrow{HBr} CH_3-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow{aq.KOH} CH_3-CH(OH)CH_3$$

(v)

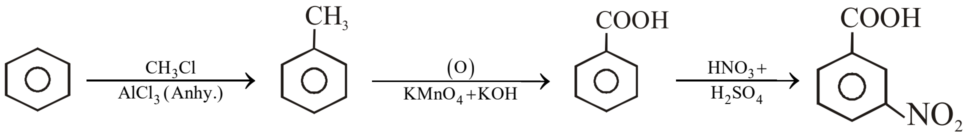


$$CH_3-CH=CH_2 \xrightarrow{H^+} \underset{(stable\ 2^0)}{CH_3-\overset{+}{CH}-CH_3} \xrightarrow{H_2O} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$$

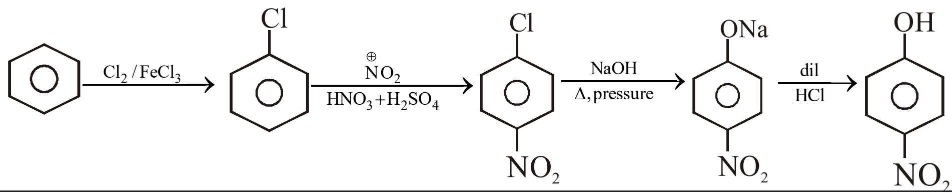
$$\xrightarrow[H^+]{KMnO_4} CH_3-\overset{\overset{O}{||}}{C}-CH_3 \xrightarrow{HCN} CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CN}{|}}{C}}-CH_3 \xrightarrow[\Delta]{H_3O^+} CH_3-\overset{\overset{OH}{|}}{\underset{\underset{COOH}{|}}{C}}-CH_3$$

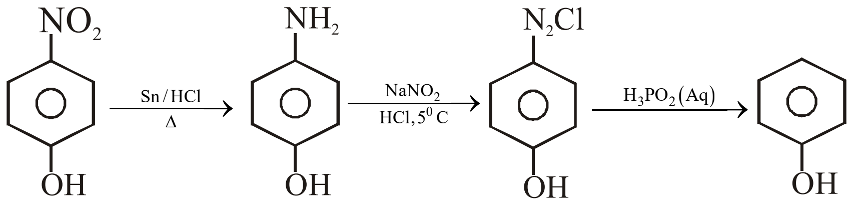
(2-Hydroxy-2-methyl propanoic acid)

(vi)



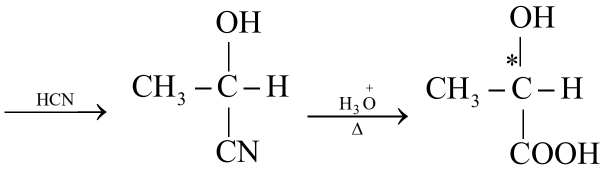
(vii)



(viii) 

$$\boxed{C_6H_5N_2Cl + H_3PO_2 + H_2O \rightarrow C_6H_6 + N_2 + H_3PO_3 + HCl}$$

(ix) $CH_3-CH_2OH \xrightarrow{PCC} CH_3-CHO$

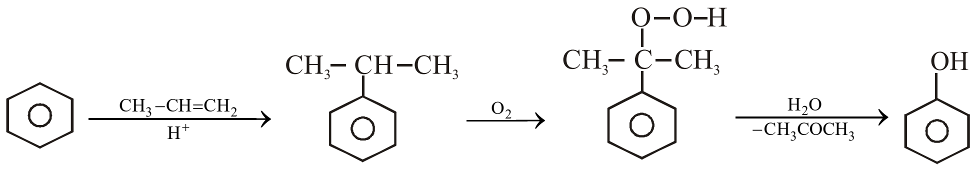


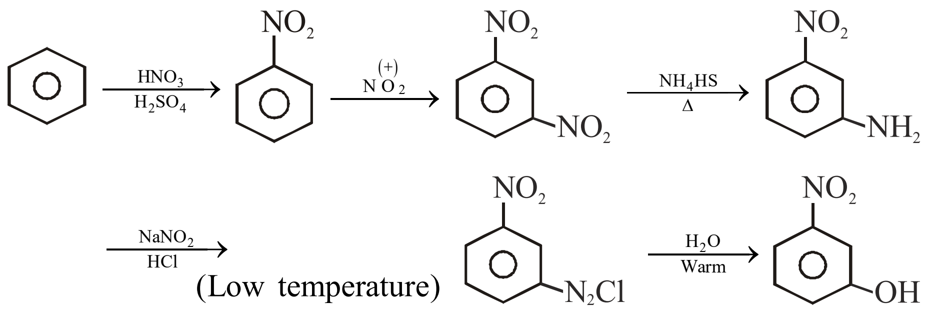
$$\xrightarrow{HCN} CH_3-\underset{CN}{\overset{OH}{C}}-H \xrightarrow[\Delta]{H_3\overset{+}{O}} CH_3-\underset{COOH}{\overset{OH}{\overset{*}{C}}}-H$$ (Lactic acid)

(x) $2CH_3CH_2OH \xrightarrow[H^+]{K_2Cr_2O_7} 2CH_3COOH \xrightarrow[\Delta]{MnO} CH_3COCH_3 + CO_2 + H_2O$

$\downarrow CaCO_3$

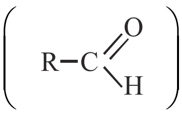
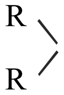
$(CH_3COO)_2Ca \xrightarrow[\Delta]{} CH_3COCH_3\ (+CaCO_3)$

(xi) 

(xii) 

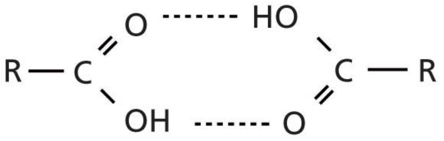
UNIT - XII

B(a) Account for the following:

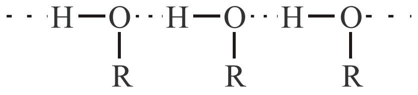
1. Both aldehydes  and ketones  $>C=O$ have $>C=O$ (carbonyl) group. So they have almost identical properties, it undergoes nucleophilic addition (ad_N) reaction as 'C' in carbonyl group has less $\overline{e}$ - density due to higher electronegativity of 'O' atom (3.5).

e.g. 

2. Carboxylic acid exhibits as a dimer having higher boiling point. Two molecules of carboxylic acids get inked by H-bond. The size increases increasing vander Waals force as a result b.p. increases.



Dimer



(Inter molecular H-bonding in alcohol)

e.g. propan-1-ol (mol. mass 60), CH_3COOH (mol. mass=60)

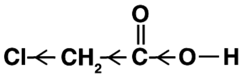
B.P. 37 K. B.P. 391 K.

3. H–COOH CH_3COOH

– CH_3 group is an electron releasing group which experiences +I effect. By such the $\overline{e}$ density on the oxygen atom increases decreasing its $\overline{e}$-accepting tendency and H^+ (proton) release (donating tendency) decreases resulting decrease of acids character. Acids are better proton donor (Bronsted - Lowry) and $\overline{e}$-acceptor (Lewis)

HCOOH never experiences +I effect.

→ The $\overline{e}$ - releasing group` also destablilises – COO^- (anion) Less stable is the conjugate base less is the acidic nature.

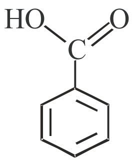
4. 

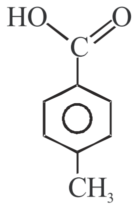
$Cl \leftarrow CH_2 \leftarrow \overset{O}{\overset{\|}{C}} \leftarrow O-H$ –I effect i.e. electron withdrawing effect decreases $\overline{e}$ density on oxygen atom resulting easy release of H^+. Thus, chloroacetic acid is stronger than acetic acid.

5. $-NO_2$ group is electron withdrawing group (EWG). It decreases the $\overline{e}$ density an benzoacteion. This results easy loss of proton, and more acidic. Further the nitro benzoate ion becomes more stable than benzoate ion (the conjugate base) The stabilty favours release of H^+ and more acidic. The acidic strengthening effect is more prominent when substitution takes place at p-position than at m-position thus, the sequence of acidic strength o– > p– > m - > benzene.

Figure : refer text.

– I effect and resonating effect to be considered for acidic strength of benzoic acid.

6. 



+I effect.

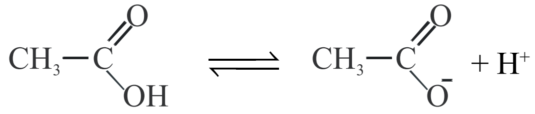
Sequence order of acidic strength.

o-toluic acid > benzoic acid > p-toluic acid.

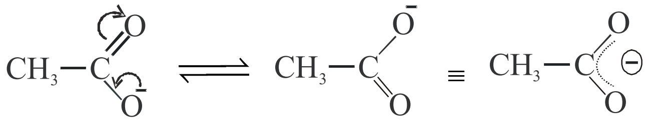
– CH_3 group is an ERG influencing +I effect decreasing acidic strength. Further, he electron releasing substituent intensifies the –ve charge of the carboxylate anion & destabilises and deceases the acidic nature.

Hence, p-toluic acid is less acidic than benzoic acid.

The ortho-isomer of every substituted benzoic acid is strongest acid due to ortho effect.

7. 

The conjugate base CH_3COO^- is stabilised by resonance and the equilibrium shifts towards right. The proton donating tendency increases and becomes acidic.

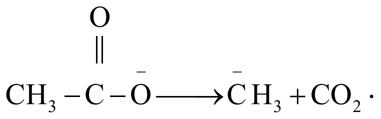


In alcohol – $R-OH \rightleftharpoons RO^- + H^+$

RO^- is unstable due to +I effect. Equilibrium shifts towards left and less acidic.

8. Resonance effect. In carboxylate (more stable conj. base) the –ve charge dispersed between two electronegative o-atom.

9. Here the carbonyl groups gets protonated and gets stabilised by resonance. So a base.

10. Decarboxylation takes place,  $CH_3-\overset{\overset{O}{\|}}{C}-\bar{O}\longrightarrow \bar{C}H_3+CO_2\cdot$

11. Decarboxylation. $RCOO. \longrightarrow .R + CO_2, R + Br_2 \longrightarrow RBr + Br.$

12. $HCOOH + O \longrightarrow CO_2 + H_2O.$ As oxidises easily acts as reducing agent.

13. Formic acid (reductant) responds test with Fehling solution, mercuric chloride.

$$HCOOH + 2HgCl_2 \longrightarrow CO_2 + Hg_2Cl_2 \downarrow + 2HCl$$

14. Due to resonance.

15. – COOH is an EWG. de-activating group and m-directing

B(b) For name reactions refer text.

B(c) For distinctions refer text.

B(d) Conversion :

1. $CH_3COOH \xrightarrow[\text{controlled}]{Cl_2\text{red P}} Cl-CH_2COOH \xrightarrow{KCN} CN-CH_2COOH \xrightarrow[\Delta]{H_3O^+}$

$HOOC-CH_2-COOH$ (propane-1, 3-dioicacid)

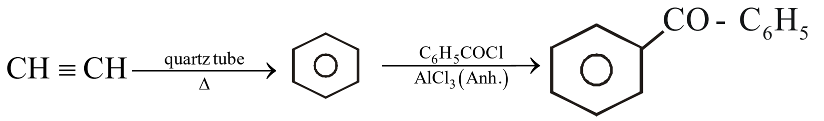
2. $HCOOH \xrightarrow{Ca(OH)_2} \begin{matrix} HCOO^- \\ HCOO^- \end{matrix} Ca^{2+} \xrightarrow[\Delta]{(CH_3COO)_2Ca} CH_3CHO \xrightarrow[\text{reagent}]{\text{Tollen's}} CH_3COOH$

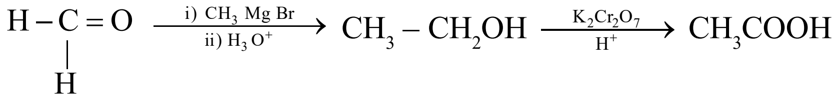
3. $CH_3COOH \xrightarrow{LiAlH_4} CH_3-CH_2OH \xrightarrow[\Delta]{Conc.H_2SO_4} CH_2=CH_2 \xrightarrow[H_2SO_4]{KMnO_4} HCOOH$

4. $CH_3COOH \xrightarrow[\text{red P}]{Cl_2} Cl-CH_2COOH \xrightarrow{NH_3\,(\text{alc.})} NH_2-CH_2COOH$

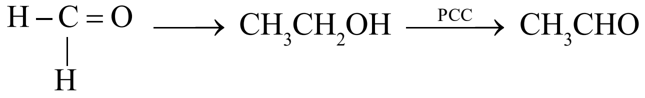
5. $CH_3COOH \xrightarrow{LiAlH_4} CH_3-CH_2OH \xrightarrow{SOCl_2} CH_3CH_2Cl$

$\xrightarrow{KCN} CH_3-CH_2-CN \xrightarrow[\Delta]{H_3O^+} CH_3-CH_2COOH$

6. 

7. 

$$H-\underset{\underset{H}{|}}{C}=O \xrightarrow[\text{ii) } H_3O^+]{\text{i) } CH_3\,Mg\,Br} CH_3-CH_2OH \xrightarrow[H^+]{K_2Cr_2O_7} CH_3COOH$$

8. 

$$H-\underset{\underset{H}{|}}{C}=O \longrightarrow CH_3CH_2OH \xrightarrow{PCC} CH_3CHO$$

9. $CH_3-CHO \xrightarrow{LiAlH_4} CH_3-CH_2OH \xrightarrow[\Delta]{Conc.H_2SO_4} CH_2=CH_2 \xrightarrow[\text{ii) } H_2O/Zn]{\text{i) } O_3} HCHO$

10. $CH_3-CHO \xrightarrow{(O)} CH_3COOH \xrightarrow{Ca(OH)_2} (CH_3COO)_2\,Ca \xrightarrow{\Delta} CH_3COCH_3$

B(e) Complete the missing links :

(i) $CH \equiv CH \xrightarrow[H_g^{2+}]{dil H_2SO_4} CH_3CHO \xrightarrow[H_3O^+]{CH_3MgBr} CH_3-CH(OH)-CH_3 \xrightarrow[H^+]{Cr_2O_7^{2-}} CH_3COCH_3$

(ii) $CH_3COCH_3 \xrightarrow[\Delta]{I_2/NaOH} CHI_3 \xrightarrow[\Delta]{Ag} CH \equiv CH$

$\xrightarrow{Sodamide} NaC \equiv CNa \xrightarrow[excess]{CH_3I} CH_3C \equiv C-CH_3$

(iii) $(CH_3)_2\,CO \xrightarrow{HCN} CH_3-C(OH)(CN)-CH_3$

$\xrightarrow[\Delta]{H_3O^+} CH_3C(OH)(CH_3)-COOH \xrightarrow[\Delta]{H_2SO_4} CH_2=C(CH_3)-COOH$

(iv) $CH_3CHO \xrightarrow[\Delta]{Ag_2O} CH_3COOH \xrightarrow{PCl_5} CH_3COCl$

$\xrightarrow[Pd-BaSO_4]{H_2} CH_3-CHO \xrightarrow[H_3O^+]{C_2H_5MgBr} CH_3C(OH)H(C_2H_5)$

(v) $CH_3CH_2-CH_2Br \xrightarrow{KOH(alc)} CH_2=CH-CH_3 \xrightarrow{Br_2} CH_2Br-CHBr-CH_3$

$\xrightarrow[(alc)]{KOH} CH \equiv C-CH_3 \xrightarrow[Hg^{2+}]{dil H_2H_2SO_4} CH_3-CO-CH_3$

(vi) $CH_3COOH \xrightarrow{LiAlH_4} CH_3-CH_2-OH \xrightarrow[140^0\,C]{Conc.H_2SO_4} CH_2=CH_2$

$\xrightarrow[\Delta]{HI} CH_3-CH_2-I \xrightarrow{Na/dry ether} CH_3-CH_2-CH_2-CH_3$

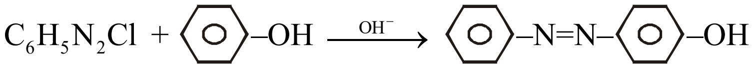
Unit - XIII

B(a) Answer the following :

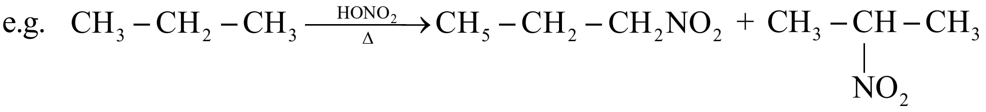
1. Refer text.
2. Refer text
3. Refer text
4. (i) When nitroethane is treated with $LiAlH_4$ in presence of ether it's reduced to ethanamine.

$$CH_3-CH_2\,NO_2+6(H)\xrightarrow[\text{ether}]{LiAH_4}CH_3-CH_2-NH_2+2H_2O$$

   (ii) BDC couples with phenol in weekly alkaline medium (pH=9-10) orange dye of parahydroxy azobenzene is formed



5. Vapourphase nitrition : Lower members of alkanes can be nitrated by vapourphase nitration i.e. by heating a gaseous mixture of hydrocarbon and nitric acid vapours at 673 – 773 K

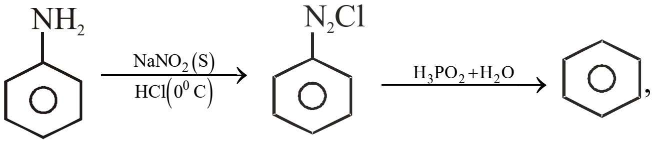


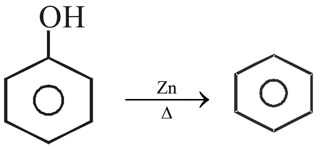
$$\text{e.g.}\quad CH_3-CH_2-CH_3\xrightarrow[\Delta]{HONO_2}CH_5-CH_2-CH_2NO_2+CH_3-\underset{\displaystyle NO_2}{\underset{|}{CH}}-CH_3$$

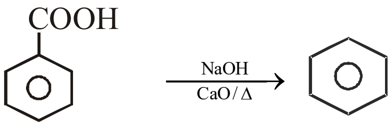
$$+CH_5-CH_2NO_2+CH_3\,NO_2$$

(a mixture of nitroalkanes)

6. Base is $\bar{e}$ donor, in aromatic case the lone pair on N-gets declocalised reducing the basic nature on resonance. Aliphatic amine more basic due to +I effect.
   Resonating structures : (See text)

7. 
, deamination


, Redox reaction


, decarboxylation

8. Refer text. (Sulfanilic acid is formed)
9. Methylamine responds to carbylamine test.
10. (a) $(CH_3)_3N$ (g) > $(CH_3)_2NH$ > CH_3NH_2 > NH_3
    (b) More is the +I effect more is basic nature in gaseous phase.
11. 1^0-amine is formed. $RNCO+2KOH\longrightarrow RNH_2+K_2CO_3$
12. Hinsberg test. (3^0 amine fails to react with Hinsberg reagent, $C_6H_5SO_2Cl$.)
13. Greater extent of H-bonding in aliphatic 1^0-amine. Aniline due to its higher molecular mass and incease of size of hydrophobic aryl part aromatic amine less soluble. (More soluble in presence of HCl due to formation of salt, aniline hydrochoride)

14. Azodye test is responded by aniline.

15. $CH_3NH_2 + H_2O \longrightarrow CH_3\overset{+}{N}H_3(OH)^- \xrightarrow{FeCl_3(aq.)} Fe(OH)_3\downarrow$
reddish brown

16. Refer text. 2^0 amine $\xrightarrow{HONO}$ nitrosoamine $\xrightarrow[Conc.H_2SO_4]{phenol}$ green solution $\xrightarrow{dilute}$ red colour $\xrightarrow{NaOH}$ deep blue.

17. $C_6H_5NH_2 \xrightarrow[HCl(0^0C)]{NaNO_2} C_6H_5N_2Cl \xrightarrow[warter]{warm} C_6H_5OH$

B(b) Missing compounds (ABCD):

i) $CH_3-CH_2I \longrightarrow CH_3CH_2CN(A) \longrightarrow CH_3CONH_2(B) \longrightarrow CH_3NH_2$

ii) $C_6H_5N_2Cl \longrightarrow \underset{(A)}{C_6H_5CN} \longrightarrow \underset{(B)}{C_6H_5COOH} \longrightarrow \underset{(C)}{C_6H_5CONH_2}$

iii) $CH_3-CH_2Br \longrightarrow CH_3-CH_2CN(A) \longrightarrow CH_3-CH_2-CH_2NH_2$
$\longrightarrow CH_3-CH_2-CH_2OH$

iv) $C_6H_5NO_2 \longrightarrow C_6H_5NH_2(A) \longrightarrow C_6H_5N_2Cl(B) \longrightarrow C_6H_5OH(C)$

v) $C\ H_5NO_2 \rightarrow C_6H_5NH_2(A) \rightarrow C_6H_5N_2Cl(B) \rightarrow C_6H_5-N=N$  OH

p-hydroxyazobenzene

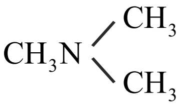
B(c) Conversions :

i) $CH_3-CH_2OH \xrightarrow{K_2Cr_2O_7} CH_3COOH \xrightarrow[ii)\ \Delta]{i)\ NH_3} CH_3CONH_2 \xrightarrow[Br_2]{KOH} CH_3NH_2$

ii) $CH_3-(CH_2)_4-C\equiv N \xrightarrow[\Delta]{H_3O^+} CH_3(CH_2)_4-COOH \xrightarrow[ii)\ \Delta]{i)\ NH_3}$
$CH_3(CH_2)_4-CONH_2 \xrightarrow{KOH+Br_2} CH_3-(CH_2)_4-NH_2$ (Pentan-1-amine)

iii) $CH_3-CH_2-NH_2 \xrightarrow[HCl]{NaNO_2(s)} CH_3-CH_2-OH \xrightarrow[H^+]{K_2Cr_2O_7} CH_3COOH$
$\xrightarrow[ii)\ \Delta]{i)\ NH_3} CH_3CONH_2 \xrightarrow[Br_2]{KOH} CH_3NH_2$

iv) $CH_3-NH_2 \xrightarrow[HCl]{NaNO_2} CH_3OH \xrightarrow{SOCl_2} CH_3Cl \xrightarrow{KCN} CH_3CN$
$\xrightarrow{LiAlH_4} CH_3-CH_2-NH_2$

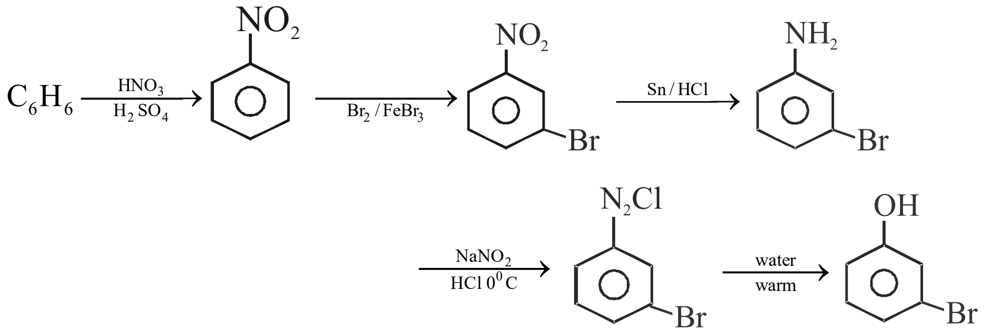
v) $CH_3-NO_2 \xrightarrow[\Delta]{Sn/HCl} CH_3-NH_2 \xrightarrow{2CH_3Br}$ 
$CH_3N\begin{array}{l} CH_3 \\ CH_3 \end{array}$

vi) $CH_3-CH_2COOH \xrightarrow[ii)\ \Delta]{i)\ NH_3} CH_3-CH_2-CONH_2 \xrightarrow[Br_2]{KOH} CH_3-CH_2-NH_2$
$\xrightarrow{HONO} CH_3-CH_2-OH \xrightarrow[H^+]{K_2Cr_2O_7} CH_3COOH$

vii) $C_6H_5NO_2 \xrightarrow[\Delta]{Sn/HCl} C_6H_5NH_2 \xrightarrow[0^0C]{NaNO_2+HCl} C_6H_5N_2Cl \xrightarrow{CuCN} C_6H_5CN$

$\xrightarrow[\Delta]{H_3O^+} C_6H_5COOH$

viii)

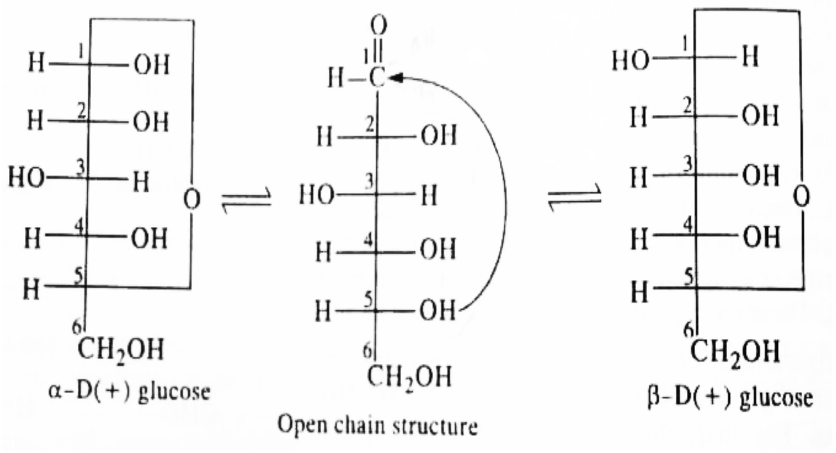


B(d) Name reactions :

(Refer text)

Unit-XIV

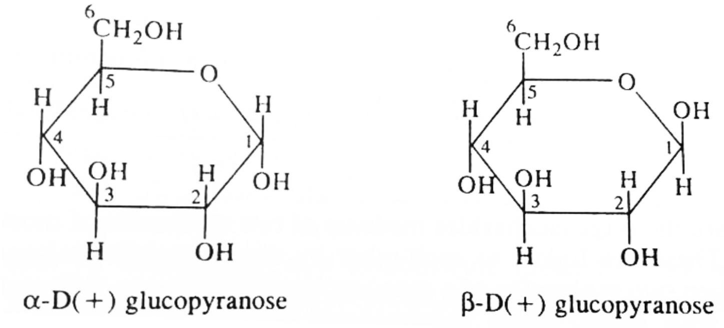
1. D. glucose exists in two cyclic forms α - and β- in which aldehyde group is involved in the ring formation and is not free. Therefore, it does not react with $NaHSO_3$, However, with reagents like HCN and phenylhydrazine, the ring structure cleaves and the aldehyde group becomes free and does react with HCN.



(react ith HCN)

(does not react with $NaHSO_3$)

or



2. Hormones : A hormone is any member of a class of signalling molecules in multicellular organisms, that are transported by intricate biological process to distant organs to regulate physiology and behaviour. Hormone are required for the correct development of animals, plants and fungi.

e.g. testosterone male sex hormone.

3.

	Fibrous proteins		Globular protein
i)	Polypeptide chains run parallel to each other, held by hydrogen and disulfidebonds	(i)	Polypeptide chains are arranged as coils.
ii)	They have thread like structure	(ii)	They have spherical shape.
iii)	These are insoluble in water	(iii)	These are water soluble.
Ex.	Keratin (in hair wool, silk), Myosin (present in muscles)	Ex.	Insulin, albumin

4. Enzymes : Virtually all reactions that are taking place in the body are calalysed by enzymes. Thus, these may be called bio-catalyst. So enzymes are biocatysts affecting bio chemical reactions in living beings. These are proteins produced in the cell functions within the cell itself, called endoenzymes, e.g. endoalmylase breaks down large amylose molecule to shorter dextrin chains. However exoenzymes are extra cellular. e.g. enzymes related to digestive system.

Characteristics of enzyme :

(i) Chemical nature. These are complex macromolecules (proteins) with high molecular mass.

(ii) Specificity : Each enzyme catalyse only one specific reaction. Thus enzymes are large in number (3000 enzymes) to catalyse biological reactions.

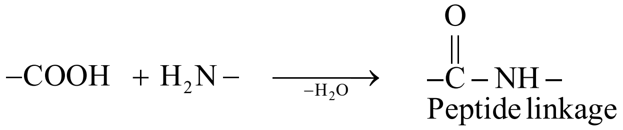
Some examples :

Enzyme	Reaction catalysed
Urease	Urea $\rightarrow O_2 + NH_3$
Invertase	sucrose $\rightarrow$ glucose + fructose
Maltase	Maltose $\rightarrow$ glucose + fructose
Lactase	Lactose $\rightarrow$ glucose + galactose
Anylase	Star $\rightarrow \alpha -$ glucose
Carbonic anhydrase	$H_2CO_3 \rightarrow CO_2 + H_2O$
Pepsin	Protein $\rightarrow$ amino acid
Trypsin	Protein $\rightarrow$ amino acid
Nucleases	DNA, RNA $\rightarrow$ nucleotide

(iii) Temperature and pH sensitivity : The enzymes function, best at an optimum temperature (25^0C – 40^0C). The activity stops at 0^0 and 80^0C. Similarly optimum pH is (6–7.7)

(iv) Efficiency : Efficiency of an enzyme is measured by turn over number i.e. the number of molecules of a substance acted by one molecule of enzyme per minute. These are efficient catalysts speeding up the bio-reaction by a factor upto 10^{20} (times).

5. (i) Peptide linkage : The chemical bond formed between the carboxyl group (–COOH) and amino ($-NH_2$) groups of neighbouring aminoacid, constituting primary linkage of all protein structure. Living organisms use peptide bonds to form long chains of amino acids known as proteins.



$$-COOH + H_2N- \xrightarrow[-H_2O]{} -\overset{\overset{\large O}{||}}{C}-NH-$$

Peptide linkage

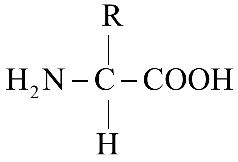
(ii) **Primary structure :** Proteins may have one more polypeptide chains. Each polypeptide in a protein has aminoacids linked with each other in a specific sequence and it is this sequence of amino acids i.e. said to be primary structure of that protein. Change in sequence of amino acids creates a different protein.

e.g. haemoglobin of blood that carries oxygen consists of 574 amino acid units

Normal haemoglobin : –val – His – Leu – Thr–Pro–(Glu)–Glu-lys–

Sickle cell haemoglobin : –val – His – Leu – Thr – Pro – Val – Glu – Lys

Val – Valine



$$H_2N-\overset{\overset{\large R}{|}}{\underset{\underset{\large H}{|}}{C}}-COOH$$

$R = (CH_3)_2CH-$

His – Histidine

Leu-Leucine

Thr–Threonine

Pro-Proline

Glu–Glutamic acid

Lys–Lysine

(iii) Denaturation :

Native protein : Protein found in biologycals ystem with unique three dimensional structure and biological activity is called a native protein.

When a protein in native state is subjected to physical changes like change is temperature, chemical changes like change is pH, bacterial effect disruption in H-bond takes place. Due to this, globules unfold and helix get uncoiled and protein loses its biological activity.

This is called denaturation of protein.

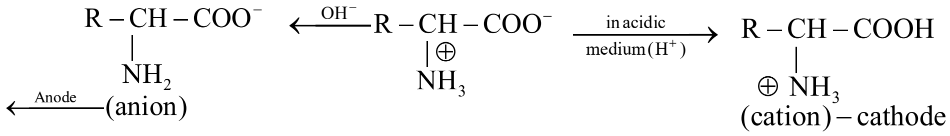
During denaturation 2^0 and 3^0 structures are destroyed but 1^0 structure remains intact

Example : (i) Curdling of milk due to formation of Lactic acid by bacteria present in milk.

(ii) Coagulation of egg while on boiling.

(iv) Isoelectric point

α – amino acid



$$\xleftarrow{\text{Anode}} \underset{\text{(anion)}}{\underset{\substack{|\\ NH_2}}{R-CH-COO^-}} \xleftarrow{OH^-} \underset{\substack{|\oplus\\ NH_3}}{R-CH-COO^-} \xrightarrow[\text{medium}(H^+)]{\text{in acidic}} \underset{\text{(cation)} - \text{cathode}}{\underset{\substack{|\\ \oplus\ NH_3}}{R-CH-COOH}}$$

on a passage of electricity through amino acid, it moves towards cathode(-) in acidic medium ($p^H < 7$) and towards anode (+) is alkaline medium ($p^H > 7$). At certain the p^H the zwitter ion (dipolar ion) behaves neutral never migrates to any eelctrode on passing electricity. The p^H at which no migration takes place is called **isoelectric point.**

The isoelectric points of different α-amino acids are in the p^H range of 5.5 to 6.3.

6. α and β - forms of D(+) glucose are interconvertible through open chain structure. α. form with specific rotation (111^0), β form has specific rotation 19.2^0 on being dissolved in water. Due to inter conversion in aq. medium the specific rotation increases or decreases till the equilibrium mixture acquires specific rotation of about + 52.2^0 (36% α form and 63.5% β form and 0.5% open chain structure). This change of specific rotation when two anomeric forms (α and β) are dissolved in water is known as **mutarotation**.

(i) α and β - forms of D(+) glucose are called anomers.

(ii) No, these are not enantiomers since these are not non-super impossible mirror images of each other. They don't rotate the plane polarised light in opposite direction but in the same direction.

(iii) $\alpha -$ D (+) glucose (glucopyranose)

(Haworth structure) refer Q. No. 01

7. Significance of DNA finger printing:

Each person has unique finger prints which occur at the tips of fingers being used for identification. A sequence of bases on DNA is also unique for a person and information regarding this is called DNA finger printing. It is same for every cell and cann't be altered by any known treatment. It is now used:

(i) to determine the paternity of an individual.

(ii) in forensic laboratories to identify criminals.

(iii) to identify the deadbodies in road accident, fire accident etc. compairing DNA's of the parents or children.

(iv) To identify racial groups to rewrite biolgical evolution.

8. (i) Maltose is a reducing sugar.

(ii) No, it cann't be generally reversed.

(iii) Pectins are carbohydrates. (its man component is galacturonic acid a sugar acid derived from galactose)

(iv) The monomer units of starch are α-D(+) glucose.

(v) Products obtained from cellulose : rayon, cellulose acetate & ethyl cellulose

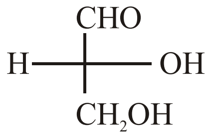
(vi) Gobular protein : Insulin haemoglobin, albumin

Fibrous protein : Fibroin, Collagen, myosin

9. D, L-Configuration :

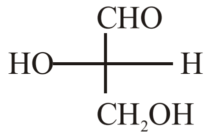
– D, L notation represent the relative positions of atoms or groups around the chiral C-atom. It has no relation with optical activity i.e dextro (d) and Laevo (*l*) rotation of plane polarised light.

– The compound glycereldehyde (aldotriose) has one chiral c-atom exists in two enantiomeric forms with certain specific configuration (as established by Fischer). The enantiomer with H-atom on left assigned D. configuration and -H on right (–OH on left) denoted as L.



$$\begin{array}{c} CHO \\ H - C - OH \\ CH_2OH \end{array}$$

(D. glyceraldehyde)



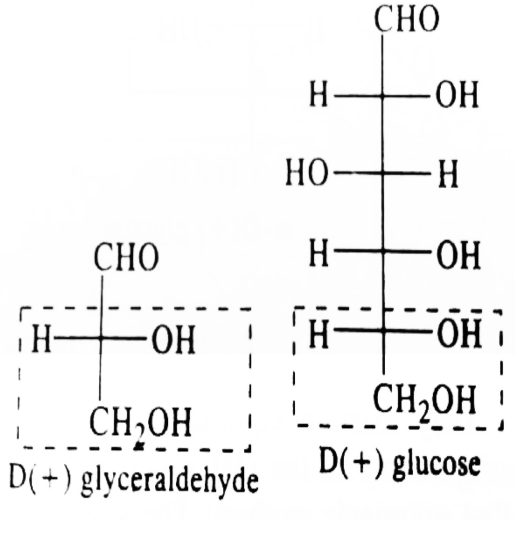
$$\begin{array}{c} CHO \\ HO - C - H \\ CH_2OH \end{array}$$

(L-glyceraldehyde)

These are regarded as absolute configuration.

The configuration of a;; other monosaccharides are related to these glycraldehyde. These are called relative cofiguration.

+ and – signs indicate dextro and laevo natatory respectively. Let us write D(+) glucose in respect of relative configuration (D–glyceraldehyde)



10. **Starch**

It is a major source of carbohydrates to supply energy on consumption by mamals. e.g. wheat, maiz, rice etc.

Structure : It is a polymer of α-glucose and consists of two components : amylose amylopectin. Amy lose in water soluble component which constitutes 15-20% starch. Here glucose units are held by C_1–C_4 glycosidic linkage.

Anylopectin is insoluble in water consistues about 80-85% of starch. It is a branched chain polymer of α-D glucose units (25-30) held by C_1–C_4– glucosidic linkage linearly but branched by C_1-C_6 linkage (C_1–C_4 chains linked by C_1–C_6 linkage)

Cellulose

Not for human consumption but acts as source of shelter, clothing etc.

e.g. Cotton (Cellulose 90%)

Structure

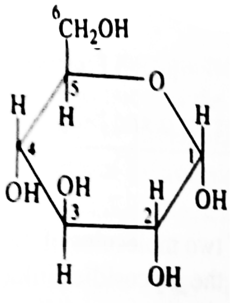
Exclusively occurs in plants and the most abundant in plant kingdom. It constitutes of cell wall of plant

It is a straight chain polysaccharide of D-glucose (monomer) joined by β-glycosidic link between C_1 one and C_4 of other unit.

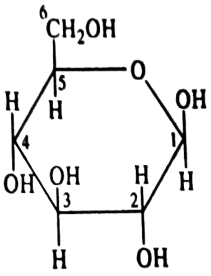
D-glucose unit in cellulose ranges from 300-2500. β.D(+) glucose molecules lying side by side in the form of bundles held by H-bonding.

Refer Text for Figures:

11. [α – and β – glu cos e : Difference in orientation of hydroxyl –OH group attached to C_1 atom, α-glucose is higher in energy than β-glucose.



α-D(+) glucopyranose

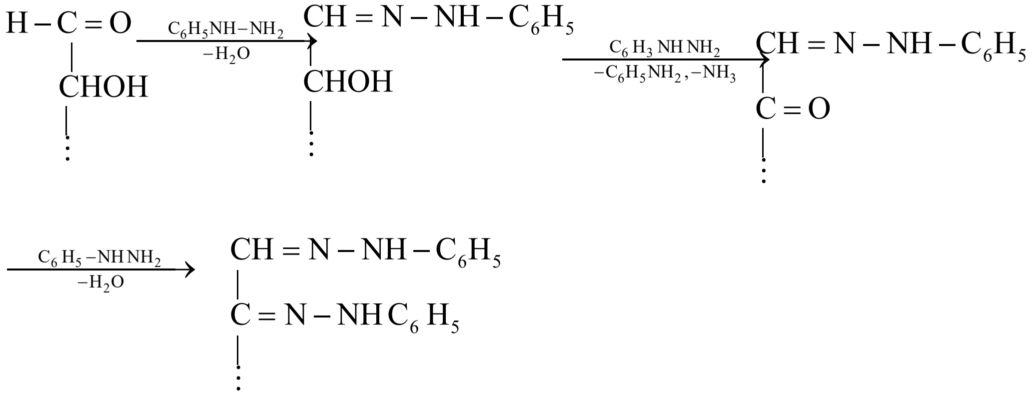


β-D(+) glucopyranose

– less stable due to steric hindrance, low m.p	
– specific rotation 112.2	– Specific rotation 18.7.
– polymerisation gives starch	– Polymerisation yields cellulose.
Source :	Source :
e.g. Potato, beans, corn etc.	Mushroom, nuts, legumes etc.

12. **Osazone formation:**

During the reaction of glucose and fructose withn excess of phenylhydrazine to form osazone only the C_1 and C_2 atoms of glucose & fructose participate in the reaction. The rest of the molecule remains intact. Hence glucose & fructose produce the same osazone.



$$\begin{array}{l} H-C=O \\ | \\ CHOH \\ | \\ \vdots \end{array} \xrightarrow[-H_2O]{C_6H_5NH-NH_2} \begin{array}{l} CH=N-NH-C_6H_5 \\ | \\ CHOH \\ | \\ \vdots \end{array} \xrightarrow[-C_6H_5NH_2,-NH_3]{C_6H_3NHNH_2} \begin{array}{l} CH=N-NH-C_6H_5 \\ | \\ C=O \\ | \\ \vdots \end{array}$$

$$\xrightarrow[-H_2O]{C_6H_5-NHNH_2} \begin{array}{l} CH=N-NH-C_6H_5 \\ | \\ C=N-NHC_6H_5 \\ | \\ \vdots \end{array}$$

13. **Hormones :**

A hormone is a chemical released by one or more calls that affect cell in other part of the organism (chemical messanges). Only a small amount of hormone to alter the cell metabolism. Cells respond to a hormone when they express a specific receptor for hormone. Hormone binds to the recoptor protein, resulting in the activation of a signal transduction mechanism that ultimately leads to cell type specific responses.

Some important effects of hormones :

(i) Mood swing

(ii) Stimulation or inhibition of growth of sexual desire.

(iii) Regulating body's processes like hunger, blood pressure,

(iv) Activation or inhibition of immune system

(v) Regulating metabolism.

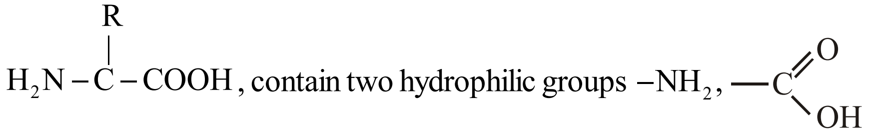
14.

	Group-A		**Group-B**
(a)	Riboflarin	(v)	Vitamin
(b)	Thymine	(iv)	Heterocyclic base
(c)	Cytokinins	(i)	Plant hormone
(d)	Estrone	(iii)	ovary
(e)	Diastase	(ii)	starch
(f)	ammonium sulfate	(vi)	Renaturation (agent)

15. (i) Invertase (ii) Lactobacilli (iii) zymase

(iv) pepsin (v) maltose (vi) diastase

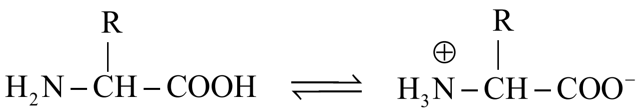
(vii) trypsin (pancreas)



16. (i) $H_2N-\overset{\overset{\large R}{|}}{C}-COOH$, contain two hydrophilic groups $-NH_2$, $-C\begin{smallmatrix} \nearrow O \\ \searrow OH \end{smallmatrix}$

Which can have polar $-NH_2$ amd –O–H groups. These form H–bonding with water and becomes water soluble. Halo acids have hydrophobic ends as halogen (–Cl, Br, -I) fails to form H–bonding, alkyl group (–R) is also non-polar and hydrophobic.

(ii) Further in case of amino acid formation of Zwitter ion initiates solubility due to ion–dipole interaction.



$$H_2N-\underset{}{\overset{R}{\overset{|}{C}}}H-COOH \rightleftharpoons \overset{\oplus}{H_3N}-\overset{R}{\overset{|}{C}}H-COO^-$$

Zwitter ion

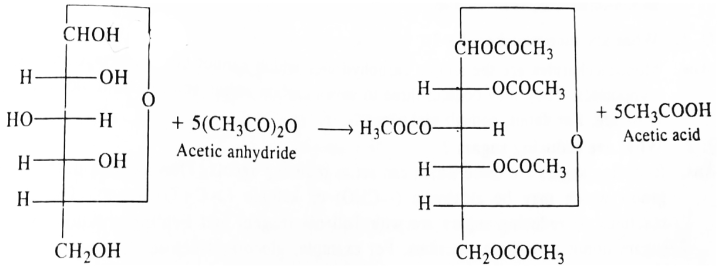
17.

RNA (Ribonuclic acid)	DNA (Deoxyribonucleic acid)
a. The pentose sugar present in RNA is D-ribose.	a. The pentose sugar in DNA is D-2-deoxyribose.
b. RNA contains cytosine and uracil as pyrimidine base and guanine and ademine as purine base.	b. Pyrimidine-base : Cytosine and thymine purine base: Guanine & adenine
(CUGA)	(CTGA)
c. It is a single chain of polynucleotide	c. It is a double chain of polynucleotide
d. It is formed by DNA and can not replicate itself.	d. It can replicate itself
e. The molecule is relatively short with low molecular mass.	e. Relatively long with high mol. mass
f. It regulates protein synthesis.	f. It controls structure, metabolism, differentiation and transfer the characters from one generation to other.
g. It is essential genetic material of plant viruses	g. It is an essential material of lukaryotic cells.

18. (a) These are polyhydroxy compound with –OH groups which can form inter molecular H–bond with water and soluble. Cyclohexane and benzene though six membered but non-polar and insoluble in water.

(b) Vitamin C is mainly ascorbic acid which is water soluble. It is readily excreted through urine and can't be stored in body.

(c) Glucose is an aldehexose and expected to give characteristic reactions of –CHO group. i.e. it can react with NH_2OH, HCN, Tollen's reagent, Fehling solution etc. However, on acetylation with acetic anhydride the penta-acetyl glucose is formed and does not give these reactions showing the absence of –CHO as present in open chain structure. This reaction supports ring structure of glucose.



D(+) glucose   Penta-acetyl derivative.

UNIT - XV

1. The preparation is a multistage process beginning with heating of phenol and formaldehyde in presence of catalyst such as HCl, $ZnCl_2$ or NH_3 base. This a condensation, Co-polymerisation.

   Uses : (i) adhesive binding agent

   (ii) protective purposes

   (iii) making utensils

   It is a thermosetting plastic as upon heating gets hardened and cann't soften again as it contains cross links or heavily branched polymer.

2. Refer text.

3. Chain growth polymerisation : Addition polymer e.g. Teflon

   Step-growth polymerisation : Step wise mechanism achieving high molecular mass e.g. polyster, polyamides (condensation polymer)

4. Homo polymer (polythene)

   Co-polymer : polyster is co-polymer of ethylene glycol and terepththolic acid.

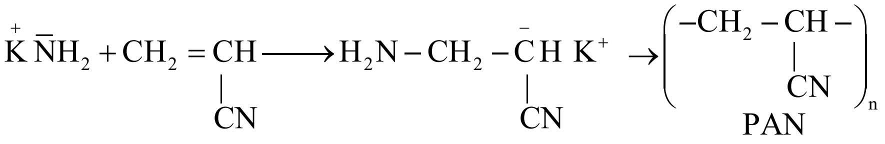
5. Ref. text

6. Decron (polyester - thermoplastic linear polymer used as fibres for clothing.)

7. Refer text

8. Refer text

9. It must be carried out as anionic polymerisation as carbanion intermediate is formed, getting stablised by electron withdrawing (–CN) group.



$$\overset{+}{K}\overset{-}{N}H_2 + CH_2 = \underset{\underset{CN}{|}}{CH} \longrightarrow H_2N - CH_2 - \underset{\underset{CN}{|}}{\overset{-}{C}H}\ K^+ \rightarrow \underset{PAN}{\left(\begin{array}{c} -CH_2 - CH - \\ \qquad | \\ \qquad CN \end{array}\right)_n}$$

10. Refer text

UNIT - XVI

1. Refer text.

2. Refer text.

3. Refer text.

4. Antihistamine are drugs which prevent allergy and release of lesser amount of acid. Antacid neutralises excess acid in the stomach. Use of antacid may trigger the production of more acid. Now a days antihistamine drugs like ramitidine, terfenadine, are in use.

5. Non-biodegradability is due to branched hydrocarbon chain as aresult bacteria cann't act on them. These are one of the sources of pollution. e.g. cetylmethyl ammonium bromide.

   Soaps are sodium / potassium salt of long chain fatty acid which can be degraded.

6. A — B

(a) Ofloxacin ———— bactericidal

(b) furacine ———— antiseptic

(c) chlorine ———— disinfectant

(d) Veronal ———— tranquilizer

(e) sodium lauryl sulfate (SLS) ——— detergent

(f) sodium rosinate ———— laundry soap

7. Side effects of drug :

- It may bind to more than one type of receptor.
- Side effect if the drug interacts with histamine.
- The degraded product of drug which is biologically active may interact with some other receptor.
- One desease is cured giving path way to another disease.

8. Refer text.

9. Refer text.

10. Difference between soaps and detergents.

11. Refer text

12. Refer text

13. Bathing soap : K-salt of long chain fatty acid. These are soft and free from unused alkali.

Washing soap . Sodium salt of long chain fatty acid.

Usually hard also contain some residual alkali.

14. i) It is toxic to liver.

ii) Due to hydrolysis salicylic acid is formed affecting badly the stomach wall. Thus acts as gastric irritant producing ulcer in long run.

* * *

GROUP - C

LONG ANSWER TYPE QUESTIONS

Long Questions : (Seven Mark Each)

1. Explain the following :
   - (a) Crystalline solids are anisotropic.
   - (b) ZnO on heating becomes yellow.
   - (c) NaCl on heating in sodium vapour becomes yellow.
   - (d) Sodium chloride (s) behaves as a non-conductor.

   [1 +2 x 3]

2. Derive an expression to calculate the edgelength of a unit cell.

   A metal crystallises into two cubic faces i..e, fcc and bcc whose unit cell edge lengths are 3.5^0 A, 3.0 ^{0}A respectively. Densities of fcc and bcc are in the ratio —.

   [4 + 3]

3. Write notes : –
   - (a) Stochiometric defect
   - (b) Amorphous solids [4 + 3]

4. (a) Classify the solids on the basis of bonding with example.
   - (b) Three dimensional lattice

5. (a) State and explain Raoult's law. How is it related to Henry's law ?
   - (b) What are ideal and non-ideal solutions.

6. What are colligative properties ? Show that relative lowering of vapour pressure is a colligative property.

   The vapour pressure of pure benzene at certain temperature is 0.850 bar. A non volatile- non electrolyte solute of 0.5 g added to 39.0 gram of benzene (78 g/mol) lowers the vapour pressure of the solution to 0.845 bar. Calculate the molar mass of solute.

7. (a) Show that molecular mass of a non volatile, non-electrolyte can be calculated from the measurement of elevation of boiling point of a solution containing the non-electrolyte.

   (b) The boiling point of a solution containing 50 g of a non volatile solute in 1 Kg of solvent in 0.5^0 higher than that of pure solvent. Determine the molecular mass of solute. Given that molecular mass of solvent = 78 gm/mol and K_b of the solvent = 2.53 Km^{-1}.

8. What is molalcryoscopic constant ? How depression in freezing point related to molecular mass of the solute.

   Ethylene glycol is a common automobile antifreeze. Calculate the freezing point of a solution containing 12.4 g of this substance in 100 gram of water. K_f = 1.86 K.kg mol^{-1}

9. What is osmotic pressure ? Discuss the laws involving it. Osmotic pressure is a colligative property - explain. Calculate the osmotic pressure of 5% solution of cane sugar (mol. mass = 342 gram / mol) at 17^0C.

10. Explain the following :

(i) Molecular mass of NaCl determined by colligative property method is found abnormal.

(ii) Sea water can be desalinated to get potable water.

(iii) It is difficult to cook on hill top.

(iv) Determination of molecular mass of a solute is preferably done by osmotic pressure method.

11. What do you mean by molality of a solution. How is it related to elevation of boiling point ? Calculate the molality of 1 liter solution of 93% H_2SO_4 (Weight / volume). The density of solution is 1.84 g/ml.

12. Explain the following :

(i) Doctor advises to gurgle saline water

(ii) Sea water never quenches thirst.

(iii) During packaging of fish, salt is added to ice.

(iv) At the time of boiling eggs salt is added to water.

13. Write notes on :

(i) Galvanic cell

(ii) Standard hydrogen electrode. [4 + 3]

14. Explain Nernst equation. How can you calculate equilibrium constant of a cell reaction.

Calculate the cell potential of a Daniell cell –

$$\mathrm{Zn} \mid \mathrm{Zn}^{2+}(0.01\mathrm{M}) \parallel \mathrm{Cu}^{2+}\, 0.1\mathrm{M} \mid \mathrm{Cu}\text{, given } E^0_{\mathrm{Cell}} = 1.1\mathrm{V}$$

15. Define and explain equivalent conductance and specific conductance. Find a relation between them.

0.1N solution has a specific conductance 0.0011g ohm^{-1} cm^{-1}.

Find out its equivalent conductance. [2 + 2 + 2]

16. State and explain Kohlraush law of independent migration of ions. How can you determine the dissociation constant of CH_3COOH ?

The conductivity of 0.001028 molar acetic acid is $4.95 \times 10^{-5}\ \mathrm{ohm}^{-1}\ \mathrm{cm}^{-1}$. Calculate the dissociation constant if Λ^0_m values of NaCl, HCl and NaAc are 126.4, 425.9 and 091.0 ohm^{-1} cm^2 mol^{-1} respecively.

17. Write notes on :-

(i) Electrochemical series (ii) Dry cell

18. State and explain Faraday's laws of electrolysis. How many grams of Aluminium can be produced by electrolysis of molten alumina with a current of 3 ampres for 10 mts ?

19. Discuss the terms :

(i) Rate of reaction and specific reaction rate

(ii) Order of reaction and molecularity. [3 + 4]

20. (i) Discuss the factors affecting rate of reaction.

(ii) What is a pseudo unimolecular reaction. [4 + 3]

21. Discuss the kinetics of zero order reaction with one example. Show that the half life period of the reaction is directly propertional to initial concentration.

Determine the order with respect to the reaction $A + B \longrightarrow P$ from the following data.

Expt.	[A]	[B]	Initial rate
1	0.1	1.0	2.1×10^{-3} mol L^{-1} s^{-1}
2	0.2	1.0	8.4×10^{-3} mol L^{-1} s^{-1}
3.	0.3	2.0	8.4×10^{-3} mol L^{-1} s^{-1}

22. Derive an expression for the rate constant of first order reaction. Show that its half life period is independent of initial concentration.

A first order reaction takes 69 g minutes for 50% completion. How long will it take for 80% completion.

23. How does rate constant change with temperature ?

What is activation energy ? How can you find it out ?

The rate of a reaction doubles for change in temperature from 298 K to 308 K. Calculate the activation energy for the reaction. [2 + 1 + 2 + 2]

24. (a) Discuss collision theory of chemical reaction. [5]

(b) How does catalyst affect activation energy ? [2]

25. What is adsorption ? How does physical adsorption differ from chemisorption ? Discuss the factors affecting adsorption of gases on solids. [1 + 3 + 3]

26. Name the catalyst for the following reactions :

(i) $CO_2 + 2H_2 \longrightarrow CH_3OH_{(g)}$

(ii) $CO + 3H_2 \longrightarrow CH_4(g) + H_2O(g)$

(iii) $CO + H_2(g) \longrightarrow HCHO$

(iv) $C_{12}H_{22}O_{11}(aq) + H_2O(l) \longrightarrow \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$

(v) $C_6H_{12}O_6(aq) \longrightarrow 2\ C_2H_5OH + 2CO_2$

(vi) $\underset{\text{Starch}}{2(C_6H_{10}O_5)\ aq} + 4\ H_2O \longrightarrow \underset{\text{maltose}}{n\ C_{12}\ H_{22}\ O_{11}\ (aq)}$

(vii) Maltose ⟶ glucose

(viii) $NH_2\ CONH_2(aq) + H_2O \longrightarrow 2NH_3(g) + CO_2(g)$

(ix) Protein ⟶ peptide

(x) Protein ⟶ amino acid

(xi) Milk ⟶ Curd

(xii) $H_2 + \frac{1}{2} O_2 \longrightarrow H_2O$

(xiii) $2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_3$ (Homogeneous)

(xiv) $4\ NH_3 + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6\ H_2O(g)$ (heterogeneous) [7]

27. What are colloids ? Classify them. [2 + 5]

28. Explain the following :
   (a) Brownian movement provides stability to colloidal solution.
   (b) Tyndal effect is the optical property of colloids.
   (c) Arsenic sulfide sol undergoes electrophoresis

29. What happens when –
   (i) Oil is added to water in presence of soap ?
   (ii) An electrolyte, NaCl is added to Ferric oxide sol ?
   (iii) $FeCl_3$ is added to excess of hot water or NaOH is added to $FeCl_3$ solution.
   (iv) $AgNO_3$ solution is added to KI solution and vice vesra ?

30. (a) How does nitrogen differ from other elements of the group ?
   (b) Discuss the properties of hydrides of group-15.

31. (a) How can you prepare dinitrogen in the laboratory ? A solid mass is formed on action of air with magnesium. What happens when the mass is hydrolysed ? [3 + 4]
   (b) Discuss the favourable condition for better yield of NH_3 by Haber's process.

32. Lab - methods of preparing NH_3, and SO_2. Explain the reducing action of NH_3 & SO_2 [3 + 2 + 2

33. Discuss the principle of synthesis of
   (i) Nitric acid by Ostwald process
   (ii) Sulfuric acid by contact procesws. [3 + 4]

34. Discuss Siemen's ozoniser to synthesis pure ozone. How does ozone react with
   (i) KI (aq) (ii) Potassium ferrocyamide

35. Explain the following :
   (i) Bleaching by SO_2 is temporary
   (ii) Oxygen differs from other elements of the group 16.
   (iii) SO_3 is an oxidant but SO_2 behaves both as oxidant and reductant.
   (iv) O–O Bond lengths in ozone are identical.

36. (a) Discuss the properties of hydrides of gr. 17.
   (b) Fluorine is the most reactive nonmetal- explain.

37. Write notes on –
   (a) Inner halogen compounds
   (b) Fluorides of Xenon.

38. What are transition elements ? Describe any four important properties of transition elements.

39. (a) State and explain Werner's cordination theory. [4

(b) Discuss any three structural isomers of co-ordination compounds. [3

40. Discuss valence bond theory. What are inner and outer orbital complexes. Show the magnetic behaviour of $[Fe(CN)_6]^{3-}$, $[Ni(CO)_4]$ [3 + 2 + 2]

41. Discuss the crystal field theory. How does it differ from VBT. Explain the fact that $[CoF_6]^{3-}$ is paramagnetic where as $[Co(NH_3)_6]^{3+}$ is diamagnetic although both are octhedral. [5 + 2]

42. How can you prepare ethyl bromide from ethyl alcohol and ethene ? What happens when it reacts with (i) Ag CN (ii) KNO_2 (iii) KOH (alc.) ?

43. Write notes on :

(a) Wurtz reaction, (b) Sandmeyer's reaction.

44. How can you prepare chlorobenzene ? Cl is a deactivating group but undergoes O-P-substitution – explain. Prepare phenol and picrylchloride from it. [2 + 2 + 3]

45. How can you prepare ethylalcohol from

(i) ethanamine (ii) suitable ester (iii) methanol. Discuss its reaction with

(i) conc. H_2SO_4 (ii) Cl_2 red P. [7]

46. Name the alcohols with general formula $C_4H_{10}O$. Distinguish them from one another in the laboratoty. Discuss their reactions with heated copper. [2+2+3]

47. Notes on :

(a) Acidic nature of phenol -

(b) Reimer Tieman reaction

(c) Williamson's synthesis.

48. How can you prepare phenol from benzene, aniline and cumene. Mention method to prepare salicylic acid from phenol. What is its oxidation product ? $[4\frac{1}{2}+1\frac{1}{2}+1]$

49. How can you prepare ether from alcohol ? State its reaction with (i) HI (ii) PCl_5 (iii) CH_3COCl.

50. How can you prepare acetaldehyde from

(i) ethanol (ii) acetylchloride (iii) acetylene

What happens when it reacts with

(i) dil NaOH (ii) hydroxyl amine [3 + 4]

51. (a) Give the reagent(s) to preparate

i) CH_3CHO from CH_3CN

ii) CH_3–CH=CH–CH_2CHO from CH_3–CH=CH–CH_2–CN

iii) Pentanol from ethylpentanoate (ester)

iv) p-bromophenol from phenol

v) CH_3COOH from CH_3–CH_2OH

vi) 2, 4, 6 – tri bromophenol from phenol [3

(b) How can you prepare acetone from

(i) acetic acid (ii) acetylene (iii) acetyl chloride ? (iv) $CH_3C \equiv N$ [4

52. Write notes on :

(a) Aldol condensation

(b) Cannizzaro's reaction

(c) Iodoform (Haloform) reaction

53. How can you prepare benzoic acid by carboxylation and from toluene and benzamide. What happens when it reacts with (i) $NaHCO_3$ (ii) PCl_5

54. How can you prepare acetic acid from (i) alcohol. (ii) alkyl halide (iii) ester. Mention a test to distinguish it from formic acid. Convert acetic acid to formic acid.

55. Explain i) Effect of substituents on acidic nature of carboxylic acid.

ii) Hoffman's bromamide reaction

iii) HVZ - reaction

56. An organic compound with molecular mass 86 doesnot reduce Tollen's reagent but forms an addition compound with $NaHSO_3$ and responds to iodoform test. On vigorous oxidation it gives ethanoic acid and propanoic acid. Write the structure of the compound with equation is each state. Calculate the % of C in it.

57. An organic compound with molecular formula C_7H_7ON, on treatment with alkaline bromine gives a compound which undergoes diazotisation with sodium nitrite (s) and dil HCl but on reduction of (A) with $LiAH_4$ gives another compound (C) which fails to produce diazominum salt but with same reagent gives another cmpound (D).

The compound (A) on heating with P_2O_5 gives compound (E) which on boiling with dil HCl gives compound (F), the ammonium salt (G) of which on heating gives back (A). Identify the compounds A to G. [7

58. How can you prepare amines by (i) ammonolysis (ii) Reduction. Discuss its reaction with benzoyl chloride. Why are aliphatic amines more reactive than aromatic amines ? [4 + 1 + 2]

59. Write notes on

(i) Gabriel phthalimide synthesis.

(ii) Carbylamine reaction

(iii) Basic nature of aliphatic amines. [2 + 2 + 3]

60. Name the amines with formula C_3H_9N. Distinguish one from another. Show that amines are more basic than amides. [2 + 3 + 2]

61. How is benzene diazonium chloride prepared ? Write down two reaction favouring displacement of N_2 and one reaction retaining diazo group. [2+4+1]

62. Write notes on :-

(i) Schmidt reaction

(ii) Mendius reaction

(iii) Hofmann's reaction

(iv) Protection $-NH_2$ group in aniline

(v) Bromination and sulfonation of aniline

63. Explain the action of nitrous acid (HONO) on primary, secondary and tertiary amines. How aniline differs from methyl amine in its reaction with nitrous acid.

64. What are polymers ? How are they classified on the basis of (i) structure (ii) synthesis (ii) molecula forces involved, (iv) microorganism degradable polymer, Give example in each case.

65. Write notes on - (i) Vulcanisation of rubber
(ii) Free radical addition polymerisation

66. Write notes on
(i) Antibiotics
(ii) Antiseptic
(iii) Analgesic

67. What are soaps and detergents ? Discuss their cleansing action.

68. What are proteins ? How are they classified ? Discuss 1^0, 2^0 and 3^0 structures. [1+1.5+4.5]

69. What are vitamins ? Classify vitamins along with their roles of various vitamins in our body. [2 + 5]

70. Classify carbohydrates. Discuss the importance of starch, cellulose and glycogen. [1+6]

❖ ❖ ❖

ANSWERS

GROUP - C (LONG ANSWER TYPE)

1. (a) Due to definite three dimensional geometric arrangement the physical property if studied through a crystal its value resolved in to three components. e.g. if velocity of light (v) studied in a crystal, $V^2 = v_x^{\,2} + v_y^{\,2} + v_z^{\,2}$, V_x = velocity along x-direction ....

(b) $ZnO \xrightarrow{\Delta} Zn^{2+} + \frac{1}{2}O_2 + 2e^-$

This is a metal excess defect. The excess Zn^{2+} ions move to interstitial sites & the e^- (s) to neighbouring interstices.

(c) $Na + Cl^- \longrightarrow NaCl + e^-$

Electron occupies the anion (Cl^-) vacancy site. This is called F– centre. The colour results by excitation of these e^-(s) on exposure of visible light.

(d) Due to inter ionic force of attraction ions fail to move on application of electric field.

2.

$$\rho = \frac{Z.M}{N_A.a^3}$$

$$\rho_{\,fcc} = \frac{4 \times M}{N_A \times (3.5A^0)^3}$$

$$\rho_{\,bcc} = \frac{2 \times M}{N_A \times (3.0 \times {}^0A)^3}$$

$$\frac{\rho_{fcc}}{\rho_{bcc}} = \frac{4}{2} \times \left(\frac{3}{3.5}\right)^3 d$$

3. (a) (i) Vacancy defect
   (ii) Interstitial defect
   (iii) Schoottky defect
   (b) Refer Text.

4. Refer Text (Bravais lattices)

5. Raoult's law as a special case of Henry's law.

Raoult's law : $P_A = X_A.P_A^0$

Vapour pressure of the volatile component in directly proportional to the mole fraction that component in solution.

Henry's law $\Rightarrow$ $P_A = K_H.\,X_A$

Gas is the solute and liquid is the solvent. Here the partial pressure of the volatile ecomponent (gas) is proportional to the mole fraction of that component (gas) in the solution.

The two laws are identcal, except the proportionality constants.

$P_A^{\,0}$ in case of Raoult's law.

K_H is the case of Henry's law.

6. $\dfrac{P_A^0 - P_s}{P_A^0} = \dfrac{n_B}{n_A + n_B} = \left(\dfrac{W_B}{M_B} \times \dfrac{M_a}{W_a}\right)$ A = solvent, B = solute

.... For dilute solution P_S = v.p. of solution.

$$\frac{P_A^0}{P_A^0 - P_S} = 1 + \frac{n_A}{n_B}$$

$$\frac{P_A^0}{P_A^0 - P_S} - 1 = \frac{n_A}{n_B}$$

$$\Rightarrow \frac{P_A^0 - P_A^0 + P_S}{P_A^0 - P_S} = \frac{n_A}{n_B}$$

$$\Rightarrow \boxed{\frac{P_A^0 - P_S}{P_S} = \frac{n_B}{n_A} = \frac{W_B}{M_B} \times \frac{M_A}{W_A}} \text{ o}$$

Problems :

All types of solution, dilute or concentrated. $\dfrac{0.850 - 0.845}{0.845} = \dfrac{0.5}{M_B} \times \dfrac{78}{39}$ ro

M_B can be calculated.

7. $\Delta T_b = K_b.m\,b$

$$= k_b \times \frac{W_B}{M_B} \times \frac{1000}{W_A}$$

8. $K_f = \dfrac{MR\left(T_f^0\right)^2}{1000 \times \Delta_{fus}H}$

K_f = molal cryoscopic constant.
M = Molar mass of solvent in gram/mole.
T_f^0 = freezing point of solvent
R = gas constant

$\Delta_{fus}H$ = molar latent heat of fusion of solvent.

* $\Delta T_f = k_f.m$

9. Boyle - van't Hoff law $\pi \propto C$, at constant temperature. C = mol/L (molar concentration)
van't Hoff equation : $\pi V = nRT$

$$\pi = \frac{n}{V} RT \text{ i.e., } CRT$$

$$\Rightarrow \pi = \frac{W_B}{M_B} \times \frac{RT}{V}$$

$$M_B = \frac{W_B.R.T}{\pi.V} \quad R = 0.0821 \text{ L. atm. mol}^{-1}\text{ K}^{-1}.$$

10. (i) NaCl is an electrolyte for which i = 2 i.e, with higher colligative properties and hence molecular mass is reduced.

(ii) See text.

(iii) Due to lower surrounding pressure vapour pressure of water increases reducing the boiling point of water. As a result food material becomes difficult to boil.

(iv) The osmotic pressure of the solution can be recorded suitable while $\Delta T_f, \Delta T_b, \Delta p / p^0$ measurements are not better noticiable.

11. Molality (m) = $\frac{\text{no. of moles of solute}}{\text{mass of solvent in kg}}$

It is independent of temperature.

$\text{wt of solute} = 93\,\text{gram}$
$\text{wt of solution} = 100 \times 1.84 = 184\,\text{gram}$

$\text{wt of solvent} = 184 - 93 = 91\,\text{gram}$

$$\text{Molality} = \frac{w}{M} \times \frac{1000}{w^{/}} = \frac{93}{98} \times \frac{1000}{91}$$

12. (i) Saline water has higher osmotic pressure than the the fluid of infected cell of the mouth.

(ii) Sea water has higher osmotic pressure as a result water from cell moves to high osmotic pressure.

Thus, the cell gets dehydrated to feel more thirsty.

(iii) Lower of freezing point.

(iv) Elevation of boiling point to reduce time. [2 x 3 + 1]

13. (i) It is a device where the decrease in free energy $(-\Delta G)$ is converted to electrical work (energy) i.e., $-\Delta G = nFE$

Cell notation - Cell equation- Cell potential.

(ii) $H^+ + e^- \rightarrow \frac{1}{2}H_2, \underset{(1M)}{E_{H^+}} \Big| \frac{1}{2}H_2(1\,atm), Pt = 0.0\ V$

14. $\rightarrow aA + bB \xrightarrow{n_e} cC + dD$

$E_{cell} = E^0_{Cell} - \frac{RT}{nF} \ln Q$ [Q is the reaction quotient)

$= E_{cell} = E^0_{Cell} - \frac{RT}{nF} \ln Q, \quad -\Delta G^0 = nFE^0 = RT \ln K$

$\rightarrow \quad E^0_{Cell} = \frac{2.303}{nF} \log K_C$

15. $\Lambda = K.V = K\frac{1000}{C}$

(V is the volume of solution containing 1 gram eqvt. of the electrolyte.
C - the nomality of solution)

Problem : $\Lambda = 0.0019 \times \frac{1000}{0.1}$

$= 19$ ohm^{-1} cm^{2} gran eqvt^{-1}.

16. Statement, Explanation –

Expl. $\Lambda^0_{KCl} - \Lambda^0_{NaCl} = \Lambda^0_{NaBr} = \Lambda^0_{KNO_3} - \Lambda^0_{NaNO_3}$

$= \lambda^0_{k^+} - \lambda^0_{Na^+} = 23.41\,\text{ohm}^{-1}\text{cm}^2\ \text{mol}^{-1}$

It indicates Cl^-, Br^- or nitrate have definite contribution towards the equivalent conductance of respective electrolyte irrespective of their association with differ anions such as Cl^-, Br^- or NO_3^-.

Similarly (keeping cation fixed) $\Lambda^0_{KBr} - \Lambda^0_{KCl} = \Lambda^0_{LiBr} - \Lambda^0_{LiCl} = \Lambda^0_{NaBr} - \Lambda^0_{NaCl}$

$= \lambda^0_{Br^-} - \lambda^0_{Cl^-} = 2.06$ ohm^{-1} cm^{2} mol^{-1}.

It show that irrespective of association with different anions (Br^- or Cl^-), the cation K^+, Li^+ or Na^+ has fixed conductance at infinite dilution and at a given temperature.

Problem : $\Lambda^0_{CH_3COOH} = 425^0 g + 91.0 - 126.4 = 390.5\,\text{ohm}^{-1}\ \text{cm}^2\ \text{mol}^{-1}$

$$\alpha = \frac{\Lambda_m}{\Lambda^0_m} \text{ and } \Lambda_m = k \times \frac{1000}{C}$$

$$= 4.95 \times 10^{-5} \times \frac{1000}{0.001028}$$

$= \quad 48.15$ ohm^{-1} cm^{2} mol^{-1}

$$\alpha = \frac{48.15}{390.15} = 0.1233$$

$$K_a = \frac{C\alpha^2}{1-\alpha} = \frac{0.001028 \times (0.1233)^2}{1 - 0.1233}$$

17. (i) Series of arrangement of electrodes arranged in order of their standard reduction potential on hydrogen scale. Applications of electro chemical series.

(ii) Dry cell (Leclanche cell)

Graphite carbon cathode in zinc container (anode) with a paste of NH_4Cl, $ZnCl_2$. The graphit rod is surrounded by MnO_2 & C.

Anode - $Zn \rightarrow Zn^{2+} + 2e$

cathode. $MnO_2 + NH_4^+ + 2e \quad \rightarrow \quad MnO(OH) + NH_3(g)$

Pressure due to $NH_3(g)$ is reduced by formation of $[Zn(NH_3)_4]^{2+}$

Cell potential = 1.5 V

18. First law :

W = ZQ, Z = electrochemical equivalent of the substance, gram / coulomb.

2nd law - $\frac{W_1}{W_2} = \frac{E_1}{E_2} = \frac{Z_1}{Z_2}$

problem - $Q = (3 \times 10 \times 60) = 1800\,C.$

$1F = 96500$ C discharges 9 gram of Al

1800 C discharges $\frac{9}{96500} \times 1800 = 0.17$ gram

19. $-dc/dt$ i.e, moles/litre/sec

Instantaneous and average rate of reaction. Specific reaction rate i..e., k

$$A \longrightarrow B$$

$$-\frac{d[A]}{dt} = +\frac{d[B]}{dt} = k[A]$$

$$k = -\frac{d[A]}{dt}\Big/[A] \qquad [A] = 1 \text{ mole}$$

dt = 1 sec

i..e, k is the change in concentration of the 1 mole reactant under going reaction for 1 sec. Higher is the k value faster the reaction rate.

20. (i) Factor : (a) Nature of reactant (b) Effect of concentration (c) presence of catalyst (d) Effect of temperature (e) Surface area of the reactant (f) effect of radiations.

(ii) Pseudounimolecular reaction. Molecularity = 2, order of reaction = 1

e.g. Hydrolysis of ester. The reaction is first order with respect to ester but zero order with respect to water.

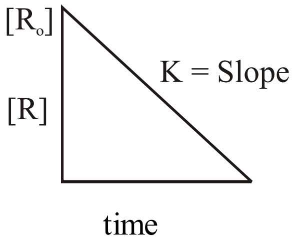
$$\text{Ester} + \text{water} \longrightarrow \text{acid} + \text{alcohol}$$

rate = k [ester] [water]^0

21. Discuss the kinetics of zero order reaction with one example. Show that the half life period of the reaction is directly propertional to initial concentration.

Determine the order with respect to the reaction $A + B \longrightarrow P$ from the following data.

Expt.	[A]	[B]	Initial rate
1	0.1	1.0	2.1×10^{-3} mol L^{-1} s^{-1}
2	0.2	1.0	8.4×10^{-3} mol L^{-1} s^{-1}
3.	0.3	2.0	8.4×10^{-3} mol L^{-1} s^{-1}



* Variation in the concentration vs time plot for a zero order reaction.

* Variation of concentration with rate in zero order reaction

Rate = k [A]^x [B]^y

$$8:4\times10^{-3} = k\,(0.2)^x\,(1.0)^y$$

$$8:4\times10^{-3} = k\,(0.2)^x\,(2.0)^y$$

Dividing one by another.

$$1 = k(1)^x.\left(\frac{1}{2}\right)^y \quad \text{i..e, } y = 0$$

$$2.1\times10^{-3} = k\left(0.1\right)^x \times\left(1.0\right)^y$$

$$8.4\times10^{-3} = k\left(0.2\right)^x \times\left(1.0\right)^y$$

Dividing one by another.

$$\frac{1}{4} = \left(\frac{1}{2}\right)^x$$

$$\Rightarrow \left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^x \quad \text{i..e, } x = 2$$

Rate = $k[A]^2[B]^0$

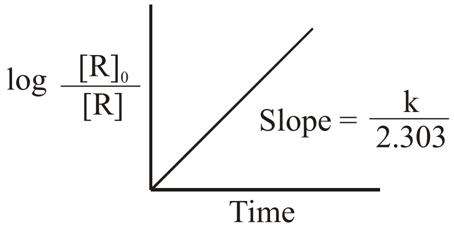
i..e, The reactioin is second order with respect to A & zero order with respect to B.

The overal order of reaction = 2 (second order)

Example (zero order reaction)

$$H_{2(g)} + Cl_{2(g)} \xrightarrow{h\nu} 2HCl_{(g)},\ 2N_2O_{(g)} \xrightarrow[\Delta]{Pt} 2N_{2(g)} + O_{2(g)}$$

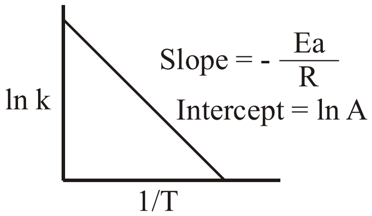
22.



$$k = \frac{1}{t}\ln\frac{[R]_0}{R}$$

Problem : $t_{1/2} = \frac{0.693}{k}$ So $k = \frac{0.693}{69.3} = \frac{2.303}{t}\log\frac{100}{20}$

23.



$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303\,R}\left[\frac{T_2 - T_1}{T_1T_2}\right]$$

Problem : $\log 2 = \frac{Ea}{2.303\times8.134}\times\frac{308-298}{308\times298}$

24. (a) Z_{AB} = collision frequency,

Considering the probability or steric factor –

rate = P. $Z_{AB}\ e^{-Ea/RT}$

(b) Positive catalyst lower the activation energy

e.g., $2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$

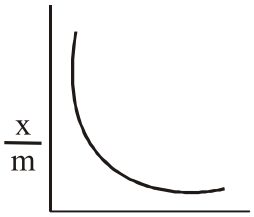
25. Factors affecting adsorption.

(i) Nature of the gas (adsorbate)

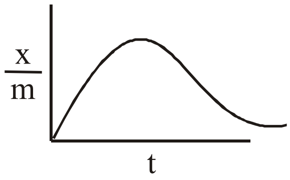
(ii) Nature of the solid (adsorbent)

(iii) Surface area

(iv) Temperature

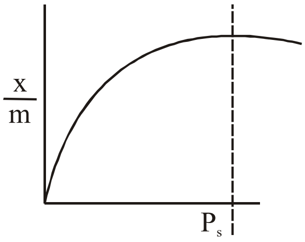


Temp. (Physical adsorption)



(chemisorption)

(v) Effect of pressure –



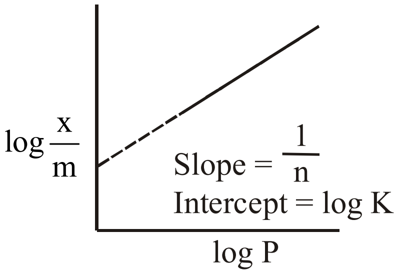
Adsorption isotherm

P_s - saturation pressure

$$\frac{x}{m} = K\,p^{1/n}$$

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

Freundlich's adsorption isotherm :



($\frac{1}{n}$ lies between 0 and 1)

26. (i) $Cu / ZnO - Cr_3O_3$ (ii) Ni

(iii) Cu (iv) Invertase

(v) Zymase (enzyme) (vi) Diastase

(vii) Maltase (viii) urease

(ix) Pepsin (stomach) (x) Trypsin

(xi) Lacto bacilli (xii) Pt

(xiii) NO (Lead chamber process) (xiv) Pt(s)

27. Colloidal solution is a heterogeneous solution containing particles (colloids) between 1. nm and 100 nm in dispersed phase. On the basic of affinity of dispersed phase for dispersion medium colloidal solution is of two types –

(i) Lyophilic colloids

(ii) Lyophobic colloids.

On the basic of Molecular size colloids are of three types

(i) Multimolecular colloids

(ii) Macromolecular colloids

(iii) Micelles or Associated colloids.

28. (a) Continuous Zig-zag motion of colloids is called Brownian movement when such motion stops phase, medium separate & the solution is not a colloidal solution i.e., coagulation occurs. Thus so long as such motion continues a stable colloidal solution is seen.

(b) This property is viewed when converged light is allowed to pass through colloidal solution. The path of the beam is illuminated by bluish light as colloidial particles scatter the hight in all direction (in space). This scattering of light illuminates the path of beam in colloidal dispersion.

Reason :

(i) the diameter of the dispersed particles is not much smaller the wavelength of light used.

(ii) The refractive indices of the dispersed phase and dispersion medium differ greatly in magnitude.

(c) As_2S_3 is –ve sol. when subjected to electric potential the –vely charged particle of the dispersed phase migrates towards anode.

29. (i) Emulsification. Soap is an emulsifying agent.

(ii) Coagulation

(iii) A positively charged sol of hydrated ferric oxide is formed due to preferntial adsorption of Fe^{3+}.

$Fe_2O_3.xH_2O / Fe^{3+}$, $Fe_2O_3.\ x\ H_2O \mid OH^-$

Positively charged Negatively charged (adsorption of OH^- ions)

(iv) $AgI \mid I^-K^+$, $AgI \mid Ag^+ I^-$

–ve sol. +ve sol.

30. (a) (i) Small size and high electronegativity value (3.0)

(ii) Non availability of d-orbitals. $_7N\ 1s^2 2s^2\ sp^3$

(iii) N is diatomic (N_2), phosphorous is polyatomic (P_4)

(iv) N – N is weaker due to repulsion between non-bonding e^-(s) hence is not catenating, 'P' unable to form π-bonding but can form strager p-p σ-bond, hence catenating as in red 'P'

(v) 'N' has maximum covalency- four, but other can expand their valency state upto six due to presence of d-orbital.$[PCl_6]^-$ 'P' can form $d_\pi - p_\pi$ bond with transition metals, $R_3P = O\ (d_\pi - p_\pi \text{ bond})$.

(b) Hydride of Nitrogen family :

NH_3, PH_3, AsH_3, BiH_3, SbH_3 (stibine)

→ Basic character decreases as the e^- density decreases with increase of molecular volume.

→ Bond angle decreases due to greater lane-bond pair repulsion.

→ Boiling point $BiH_3 > SbH_3 > NH_3 > PH_3 > AsH_3$ NH_3 has higher boiling point than PH_3 and As Hg due to formation of ntemolecular H-bonding. BiH_3, SbH_3 have higher b.p. due to stronger vander waals force arising out of bigger molecular size.

→ Reducing character $NH_3 < PH_3 < As\ H_3 < BiH_3 < SbH_3$ is attributed to their E – H bond dissociation energy. (E = element of group-15)

31(a). $NH_4Cl\ (aq) + NaNO_2\ (aq) \longrightarrow N_2\uparrow + 2H_2O + NaCl\ (aq)$

Impurities : NO and HNO_3. The compuities can be removed by passing through aq. sulfuric acid containing pot. dichromate

(b) Favourable conditions for better yield of NH_3

Condition for better yield of NH_3 by Haber's process.

(i) Optimum temperature of 500^0C

(ii) High pressure of 200– 900 atom.

(iii) Finely divided iron as catalyst with Mo as prmotor

(iv) High concentration of pure and dry N_2 and H_2.

32. → $2NH_4Cl + CaO \xrightarrow[\Delta]{} 2NH_3\uparrow + CaCl_2 + H_2O$

NH_3 is to be dried by quick lime tower.

Collection : Down ward displacement of air.

→ $Cu + 2H_2SO_4 \xrightarrow{\Delta} CuSO_4 + SO_2 + 2H_2O$

$$4H^+ + SO_4^{2} + 2\bar{e} \longrightarrow SO_2 + 2H_2O$$

$$Cu \longrightarrow Cu^{2+} + 2e^-$$

Dried on passing through conc. H_2SO_4.

Collection : upward displacement of air.

→ Reducing action of SO_2

SO_2 on passing through acidfied $K_2Cr_2O_7$ solution turns green, $Cr_2(SO_4)_3$

$$Cr_2\overset{=}{O}_7 + 14H + 6e^- \longrightarrow Cr^{3+} + 7H_2O$$

$$SO_2 + 2H_2O \longrightarrow SO_4^{2-} + 4H^+ + 2e^-$$

→ Reducing action of NH_3. $3CuO + 2NH_3(g) \xrightarrow{\Delta} 3Cu + N_2 + 3H_2O$

33. (i) $4NH_3 + 5O_2 \xrightarrow[800^0 C]{Pt} 4NO + 6H_2O$

$2NO + O_2 \longrightarrow 2NO_2$

$4NO_2 + 2H_2O + O_2 \longrightarrow 4HNO_3$

(ii) $2SO_2 + O_2 \overset{V_2O_5}{\rightleftharpoons} 2SO_3 + 45.2\,\text{K cal}$

$SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

(Oleum or fuming sulfuric acid)

Conditions for better yield : (It obeys Le-chatelier's principle)

(i) Excess of dry oxygen and air

(ii) high pressure (~ 2 atm. pressure)

(iii) Optimum temperature of 450 – 500⁰C.

As the process is exothermic high temperature to be avoided.

34. Principle. $3O_2 \xrightarrow[\text{electric discharge}]{\text{silent}} 2O_3$

The product is ozonised oxygen (O_3+O_2).

$$O_3 + O_2 \xrightarrow{\text{liquid air}} \text{condensed to deep blue liquid} \xrightarrow[\text{evaporation}]{\text{fractional}} \left[\begin{array}{l} 90\text{ K (oxygen)} \\ 161.1\text{ K} \end{array}\right.$$

→ (Less volatile O_3) $\xrightarrow{\text{evaporation}}$ pure ozone.

(i) $O_3 + H_2O + 2e^- \longrightarrow 2OH^- + O_2$

$$\begin{array}{l} 2I^- \longrightarrow I_2 + 2e^- \\ \hline O_3 + 2I^- + H_2O \longrightarrow I_2 + 2OH^- + O_2 \\ \hline \end{array}$$

(ii) $\left[Fe(CN)_6\right]^{4-} \longrightarrow \left[Fe(CN)_6\right]^{3-} + e^-$

35. (i) $SO_2 + H_2O \longrightarrow SO_3 + 2(H)$

Coloured matter $\xrightarrow{[H]}$ colouless $\xrightarrow[\text{oxidn}]{\text{air}}$ regains colour.

Bleaching by reduction

(ii) (a) Small size and high electronegativity (3.5)

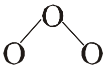
(b) Absence of d-orbital, hence maximum valence state is three (even four) other can expand upto six.

(c) O- exhibit H-bonding e.g. $H_2O(l)$ but $H_2S(g)$

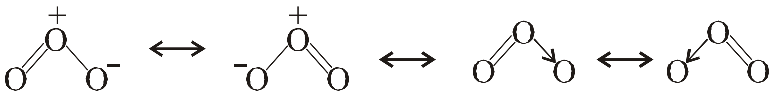
(d) Physical state- O_2 is a gas but others are solids

(e) Multiplicity of bond. Due to smaller size oxygen can form π-bond.

(iii) $\overset{+6}{SO_3}$, $\overset{+4}{SO_2}$. In SO_2, + 4 state can increase to +6 also reduces, hence both can behave as oxidant and reductant. But in SO_3, sulfur has maximum valence state +6, it can decrease only.

(iv) Ozone is not paramagnetic, all e^-(s) in paired state. Three atoms are at the apices of an equilateral triangle. It has got sp^2 hybridisation with  bond angle 116.5^0 and bond length $1.28\ ^0A$.

It is resonance hybrid of



36. (a) Hydrides are HF, HCl, HBr, HI

Acidic nature / reducing nature	HI > HBr > HCl > HF
Thermal stability Bond dissoctation enthalpy.	HI < HBr < HCl < HF
Physical state.	HF is a liquid due to inter molecular H-bonding, others are gases.

(b) (i) Small size, high electronegaivity value (4.0), having O.S. –1 (others ranges from –1 to +7)

(ii) Low bond dissociation enthalpy due to electronic repulsion between lone pair of e^- (s) (non-bonding pairs,

(iii) High value of reduction potential, $E^O_{F_2 \mid F^-} = +2.87\,V$, powerful oxidant.

37. (a) The possible compounds are XY, XY_3, XY_5 and XY_7 prepared by directly combination of halogens (X & Y) under specific conditions.

e.g. $Cl_2 + F_2 \xrightarrow{437K} 2\,ClF$

$Cl_2 + 3F_2 \xrightarrow{573K} 2\,ClF_3$

$Br_2 + 5F_2 \longrightarrow 2\,BrF_5$

Compounds	**hybridisation**	**Type**	**Shape**
$Cl\,F_3$	sp^3d^2	AB_3L_2	T-shape
$Br\,F_5$	$sp^3\,d^2$	$A\,B_5L$	Square pyramide
$I\,F_7$	$sp^3\,d^3$	AB_7	Pentagonal bipyramidal

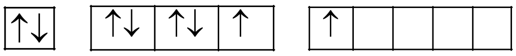
→ As the molecules are polar, these compounds are more reactive than non-polar respective halogens.

(b) These compounds are possible due to

(i) low $\Delta_i H$ value of Xe

(ii) very high electronegativity of F.

Under suitable conditions Xe and F_2 react forming XeF_2, XeF_4 and XeF_6 with variation in O.S. +2, +4 and +6.

O.S.= +2, 

XeF_2	sp^3d hybridisation	AB_2L_3 :	 $\underset{\mathrm{F}}{\overset{\mathrm{F}}{\mathrm{Xe}}}$: Linear
XeF_4	sp^3d^2 hybridisation	AB_4L_2	square planar
XeF_6	sp^3d^3 hybridisation	AB_6L	distorted octahedral

$$\mathrm{Xe} + \mathrm{F_2} \xrightarrow[\text{673K}]{\text{Nickel vesel}} \mathrm{XeF_2}$$

$$\mathrm{Xe} + 2\mathrm{F_2} \xrightarrow[\text{193 K, Pressure}]{\text{Electronic discharge}} \mathrm{XeF_4}$$

$$\mathrm{Xe} + 3\mathrm{F_2} \xrightarrow[\text{50 atm. pressure}]{\text{Ni, 573K}} \mathrm{xeF_6}$$

38. Transition elements are d-block elements with general electronic configuration (n-1) $s^2 p^6 d^{1-10} ns^{1\text{ or }2}$ where n = 4 to 7.Thus there are four rows (3d, 4d, 5d, 6d series) each of 10 transition elements. Their properties transit between more electro positive s-block and more electro -ve p-block of elements.

Properties : (a) variable oxidation states

(b) Formation of coloured compounds
(due to d – d transition)

(c) Formation of complex compound
- (i) Small size of highly charged cation
- (ii) Vacant d-orbitals
- (iii) High effective nuclear change in cation
- (iv) Magnetic behaviour $\mu_{eff} = \sqrt{n(n+2)}$ B.M.

Where n = no. of unpair $\bar{e}$.

Fe, Co, Ni are ferromagnetic metals.

39. (a) → Postulates of Werner's co-ordination theory with explanation.
→ Limitations

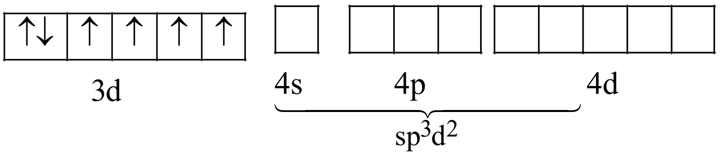
(b) (i) Ionisation isomers $[Co(NH_3)_5SO_4]Br$ red
$[Co(NH_3)_5Br]SO_4$ purple

(ii) Linkage : CNS^- or : SCN^-
: CN^- or : NC^-
: $C \equiv O$, $C \equiv O$:
: NO_2, ONO:

(iii) Co-ordination isomerism $[Co(NH_3)_6][Cr(CN)_6]$
$[Cr(NH_3)_6][Co(CN)_6]$

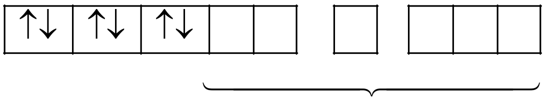
40. Postulates-

$[FeF_6]^{4-}$ Fe^{2+} $3d^6$



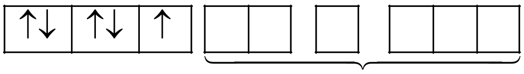
Outer orbital complex - paramagnetic.

$[Fe(CN)_6]^{4-}$



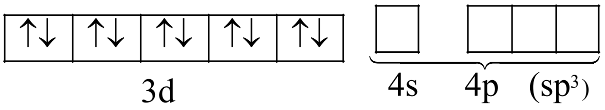
d^2sp^3, inner orbital complex, diamagnetic

$[Fe(CN)_6]^{3-}$



d^2sp^3- paramagnetic, n = 1

$[Ni(CO)_4]$

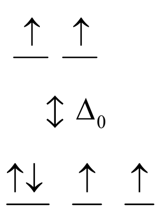


n = 0, diamagnetic

41.

	VBT		**CFT**
i)	Metal - ligand bonds arised by donation e^- pair to metal from ligands forming covalent bonds.	i)	Metal ligand bond considered to be ionic arising out of purely electrostatic interaction.
ii)	Ligands are considered to be e^- pair donor, Lewis bases.	ii)	Ligands are treated as point of –ve charges and approach the metal to minimise repulsion.
iii)	Suitable number of d-orbitals is to be made vacant to accomodate the e^- pair from ligands through dative bond. Depending on the C.N. and nature of ligand hybridisation takes place.	iii)	Splitting of d-orbitals takes place.
e.g.	CN = 4, sp^3 or dsp^2 CN = 6 sp^3d^2 (or) d^2sp^3		
iv)	No satisfactory explanation to colour of the complexes / absorption spectra.	iv)	Explains absorption spectra providing the colour of the complexes.
	F⁻ weaker field		While NH_3 - strong field.

* $\left[C_o(F_6)\right]^{3-}$ $\underline{Co^{3+} = 3d^6}$

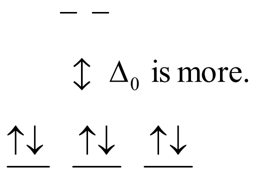


Δ_0 is less.

$t_{2}^{4}g$ $e^{2}g$

n = 1 (paramagnetic)

* $\left[Co(NH_3)_6\right]^{3+}$



$t_{2}^{6}g$

n = 0 (diamagnetic)

42. Preparation :

(i) $3\ C_2H_5OH + PBr_3 \rightarrow 3\ C_2H_5Br + H_3PO_3$

$C_2H_5OH + PBr_5 \rightarrow C_2H_5Br + POBr_3 + HBr$

$C_2H_5OH + SOBr_2 \rightarrow C_2H_5Br + SO_2 + HBr$

(ii) $CH_2 = CH_2 + HBr \longrightarrow CH_3 - CH_2\ Br$

Properties :

$C_2H_5Br + AgCN \longrightarrow C_2H_5NC + AgBr \downarrow$

$C_2H_5Br + KNO_2 \longrightarrow C_2H_5ONO + KBr$

$C_2H_5Br + KOH\ (alc.) \longrightarrow CH_2 = CH_2 + KBr + H_2O$

43. (i) Statement -

(ii) Merits -

(i) To prepare higher alkane

(ii) To ascend C. atom in chain.

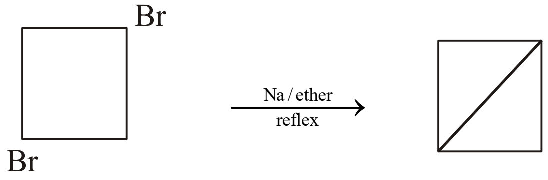
e.g., C_2H_5OH to butane

$C_2H_5OH \xrightarrow{SOCl_2} C_2H_5Cl \xrightarrow{Na/dry}$ ether C_4H_{10}

(iii) To prepare alkyl benzene (Wurtz - Fittig reaction)

$CH_3Br + C_6H_5Br \xrightarrow[\Delta]{Na/dry ether} C_6H_5CH_3$

(iv) To prepare bicyclo compound.



1, 3-dibromocyclo butane   bicyclobutane

(iii) Limitations :

i) Methane can't be prepared.

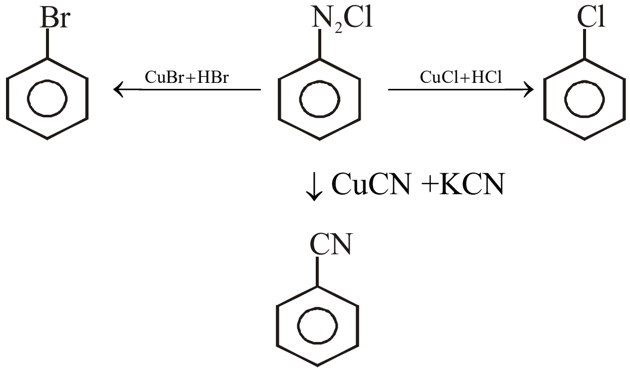
ii) Difficult get alkane with odd no. of C- atom in pure form.

$CH_3Br + C_2H_5Br \xrightarrow[reflux]{Na/dry ether} CH_3\text{–}CH_3 + C_2H_5\text{–}C_2H_5 + C_2H_5CH_3$

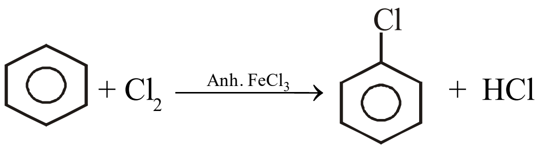
ethane   butane   propane

(iv) Mechanism

(b) SandMeyer's reaction



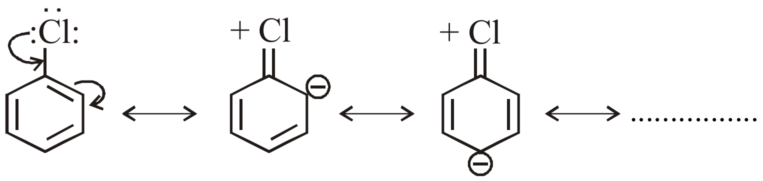
44. (i)



$$Cl-Cl+FeCl_3 \longrightarrow [FeCl_4]^- + Cl^+$$

Benzene undergoes S_E.

Electron pair on Cl is in conjugation and undergoes resonating effect dominating over –I effect (deactivating effect).

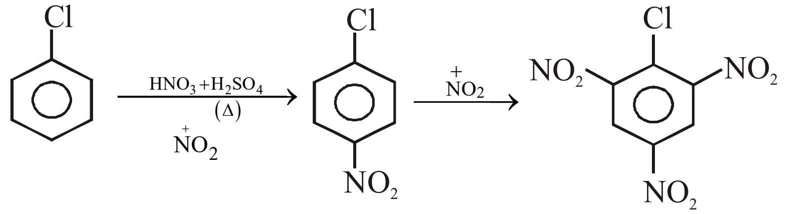


o/p - position susceptible to electrophilic attack.

(ii) Raschig process : $2\,C_6H_6 + 2HCl + O_2 \xrightarrow[\Delta]{CuCl_2} 2C_6H_5Cl + 2H_2O$

→ i) $C_6H_5Cl + NaOH \xrightarrow[Pressure]{300^0\,C} C_6H_5ONa \xrightarrow[-NaCl]{dil\,HCl} C_6H_5OH$

ii)



2, 4, 6 - trinitrochlorobenzene

45. → $C_2H_5NH_2 + HONO \xrightarrow[dil.HCl]{NaNO_2(s)} C_2H_5OH + N_2 + H_2O$

→ $CH_3COOC_2H_5 \xrightarrow[H_2O]{H^+} CH_3COOH + C_2H_5OH$

→ $CH_3OH \xrightarrow{SOCl_2} CH_3Cl \xrightarrow{KCN} CH_3CN$

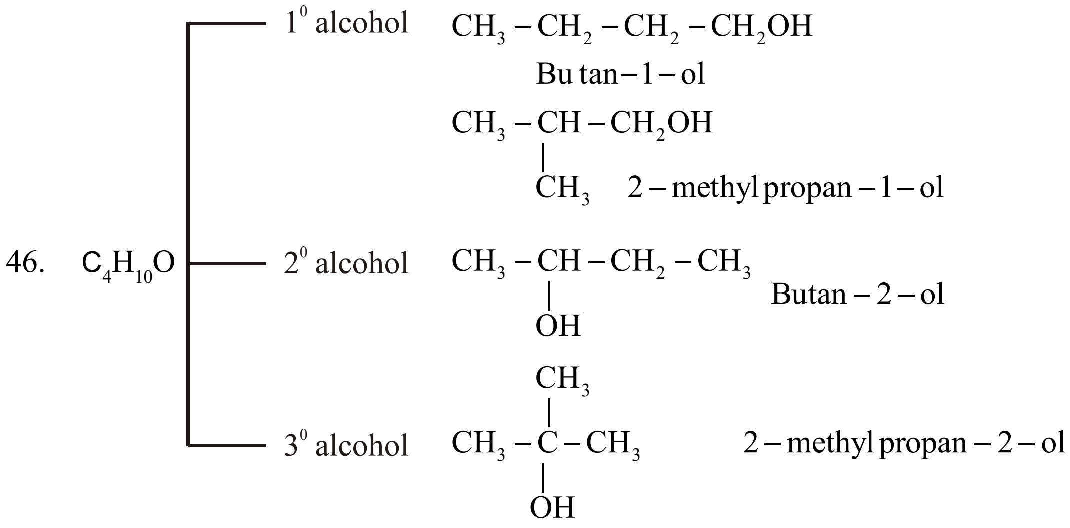
$\xrightarrow{LiAlH_4} CH_3\text{–}CH_2NH_2 \xrightarrow[NaNO_2+dil\,HCl]{HNO_2} CH_3\text{–}CH_2OH$

→ $CH_3-CH_2OH \xrightarrow[-H_2O]{H^+} CH_5\overset{\oplus}{C}H_2 \xrightarrow{-H^+} CH_2=CH_2$

→ $CH_5CH_2OH \xrightarrow{Cl_2/red\,P} CH_3\text{–}CH_2Cl$

$$3Cl_2 + 2P \longrightarrow 2\,PCl_3$$

$$3\,C_2H_5OH + PCl_3 \longrightarrow 3C_2H_5Cl + H_3PO_3$$



46. $C_4H_{10}O$

1^0 alcohol $CH_3-CH_2-CH_2-CH_2OH$ Bu tan−1−ol

$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2OH$ 2 − methyl propan − 1 − ol

2^0 alcohol $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CH_3$ Butan − 2 − ol

3^0 alcohol $CH_3-\underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_3$ 2 − methyl propan − 2 − ol

Lucas test

Reagent	**1^0 alcohol**	**2^0 alcohol**	**3^0 alcohol**
conc. HCl & $ZnCl_2$ (Anhy.)	Turbidity appears on boiling with conc. and $ZnCl_2$. $CH_3CH_2-CH_2-CH_2OH+HCl \xrightarrow[\Delta]{ZnCl_2} CH_3-CH_2-CH_2-CH_2Cl+H_2O$	Turbidity appears after some time. $CH_3CH(OH)C_2H_5+HCl \longrightarrow CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-C_2H_5 +H_2O$	Turbidity appears instantaseouly on addition of reagent $(CH_3)_3C(OH)+HCl \rightarrow (CH_3)_3CCl+H_2O$

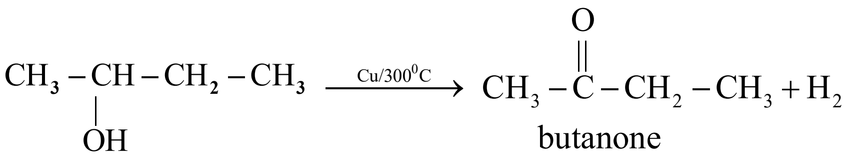
Action Cu at 300⁰C (Dehydrogenation)

1^0 alcohol, butan-ol on heating with Cu at 300^0C, gives butanal.

$$CH_3-CH_2-CH_2-CH_2OH \xrightarrow{Cu/300^0C} CH_3-CH_2-CH_2CHO+H_2$$

butanal

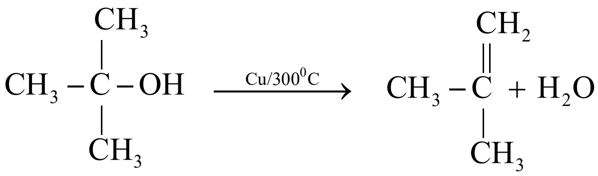
2^0 alcohol give ketone.



$$CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CH_3 \xrightarrow{Cu/300^0C} CH_3-\overset{\displaystyle O}{\overset{||}{C}}-CH_2-CH_3+H_2$$

butanone

3^0 alcohol under the same condition gives alkene on dehydration.

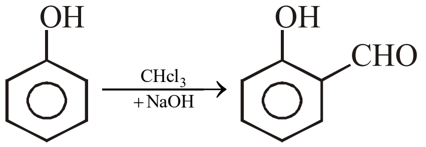


$$CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-OH \xrightarrow{Cu/300^0C} CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_2}{\overset{||}{C}}}}+H_2O$$

2-methyl propene

47. (a) (i) Resonance showing more stability of pheroxide than phenol itself.

(ii) Electron with drawing group – (-NO_2 group) increases the acidic nature. However cresols are less acidic due to +I effect.

(b) 

o-isomer predominated due to intramolecular H-bonding).

(c) Williamson's synthesis (Preparation of ether)

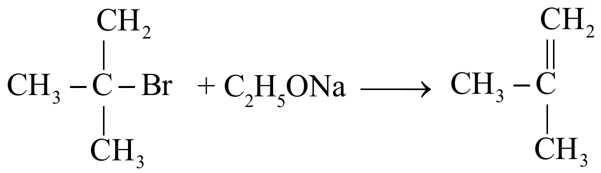
Phenol to anisole

$$C_6H_5OH \xrightarrow{Na} C_6H_5ONa \xrightarrow{CH_3I} C_6H_5OCH_3$$

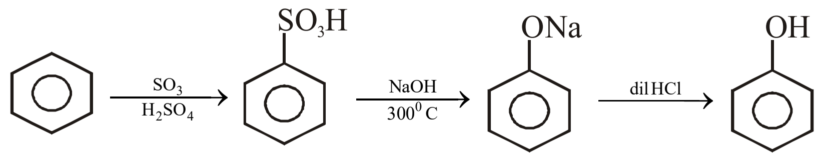
$$RX + RONa \longrightarrow \underset{\text{ether}}{ROR} + NaX$$

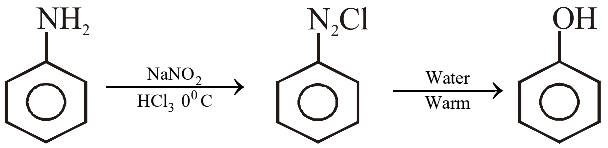
This is a SN_2 reaction, however in case of 2^0 & 3^0 alkyl halide alkene results where alkoxide ion acts as base favouring elimination reaction.

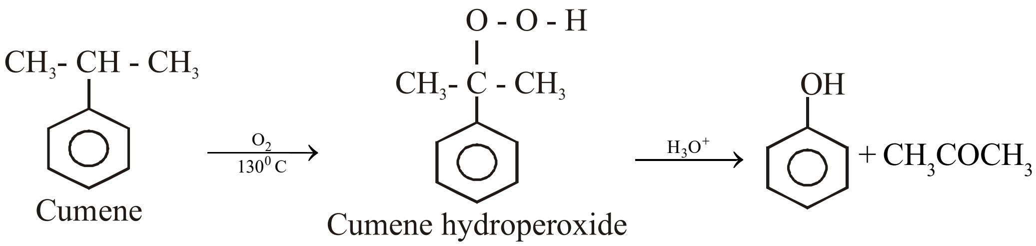
$$CH_3 - CH_2Br + (CH_3)_3\ CONa \longrightarrow CH_3 - CH_2O\,C(CH_3)_3$$



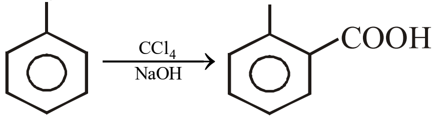
$$CH_3 - \overset{CH_2}{\underset{CH_3}{C}} - Br + C_2H_5ONa \longrightarrow CH_3 - \overset{CH_2}{\underset{CH_3}{C}}$$

48. → 



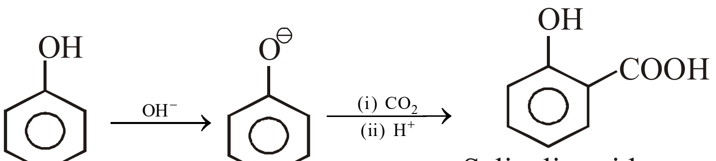


Carboxylation phenol

→ (i) 

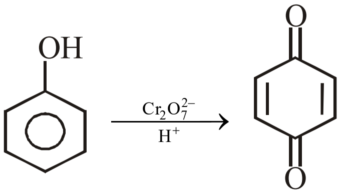
(Reimer Tiemann reaction)

(ii) Kolbe's reaction :



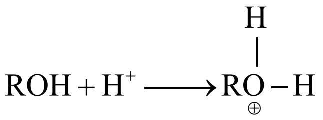
Salicylic acid

→ Phenol on oxidation with acidified sodium dichromate gives benzoquinone.

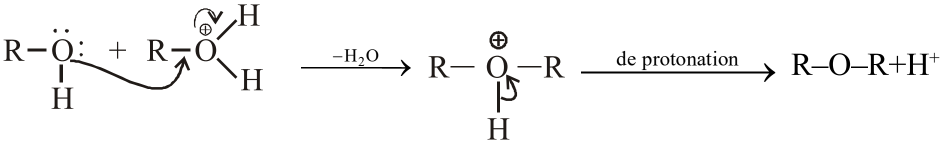


49. $$\begin{matrix} ROH \\ ROH \end{matrix} \xrightarrow[140^0 C]{Conc\,H_2SO_4} R–O–R + H_2O$$

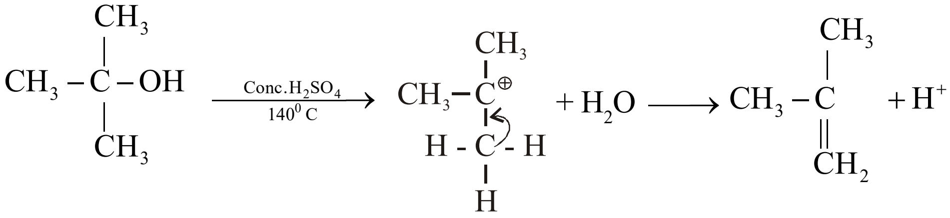
is excess



$$ROH + H^+ \longrightarrow R\overset{\overset{H}{|}}{\underset{\oplus}{O}} - H$$



The order of dehydration of alcohol forming ether follows in the order $1^0 > 2^0 > 3^0$
2^0 and 3^0 prefer to form alkene

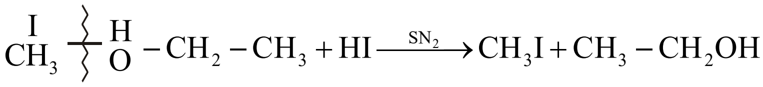


Demerit :

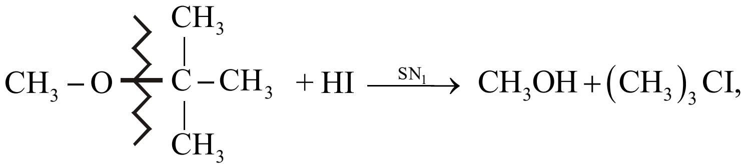
This method is not suitable for preparation of unsymmetrical ether.

$$ROH + R'OH \longrightarrow ROR' + ROR + R'OR'$$

→ **Hydro Iodination :**



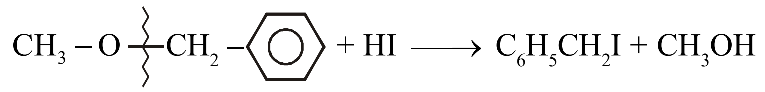
$$\overset{I}{CH_3} - \overset{H}{O} - CH_2 - CH_3 + HI \xrightarrow{SN_2} CH_3I + CH_3 - CH_2OH$$



$$CH_3 - O - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_3 + HI \xrightarrow{SN_1} CH_3OH + (CH_3)_3CI,$$

$(CH_3)_3 C^+$ is more stable.

$$CH_3 \wr O - C_6H_5 + HI \longrightarrow CH_3I + C_6H_5{-}OH$$



$$CH_3 - O \wr CH_2 - C_6H_5 + HI \longrightarrow C_6H_5CH_2I + CH_3OH$$

$C_6H_5\overset{+}{C}H_2$ (Benzyl) carbocation is more stable to undergo S_N–1 reaction.

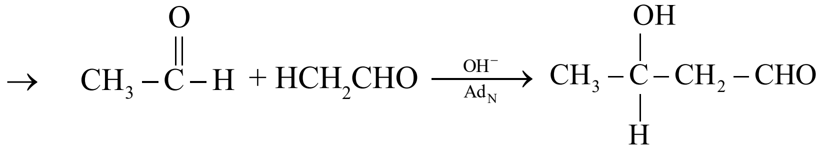
→ $ROR' + PCl_5 \longrightarrow RCl + POCl_3 + R'Cl$

→ $ROR' + CH_3COCl \longrightarrow CH_3COOR + R'Cl$

50. → $CH_3 - CH_2OH + [O] \xrightarrow{PCC} CH_3CHO + H_2O$

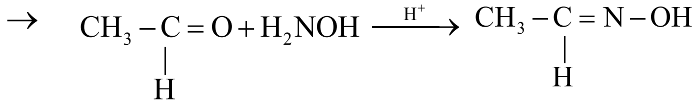
$CH_3COCl + H_2 \xrightarrow[\text{Rosenmund's reduction}]{Pd-BaSO_4} CH_3CHO + HCl$

$CH \equiv CH + H_2O \xrightarrow[HgSO_4,\,60^0\,C]{H_2SO_4} CH_3CHO$



→ $$CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - H + HCH_2CHO \xrightarrow[Ad_N]{OH^-} CH_3 - \underset{\underset{\displaystyle H}{|}}{\overset{\overset{\displaystyle OH}{|}}{C}} - CH_2 - CHO$$

aldol, 3-hydroxy butanal



→ $$\underset{\underset{\displaystyle H}{|}}{CH_3 - C} = O + H_2NOH \xrightarrow{H^+} \underset{\underset{\displaystyle H}{|}}{CH_3 - C} = N - OH$$

acetaldehyde oxime

51. (a) (i) $SnCl_2 + HCl$ (ii) DIBAL - H (iii) DIBAL-H/H_2O

(iv) Br_2/CS_2 (v) $\xrightarrow[\Delta]{Cr_2O_7^{2-}+H^+}$ (vi) Br_2(aq.)

(b) (i) $$\begin{matrix} CH_3COOH \\ CH_3COOH \end{matrix} \xrightarrow[\Delta]{MnO} CH_3COCH_3 + CO_2 + H_2O$$

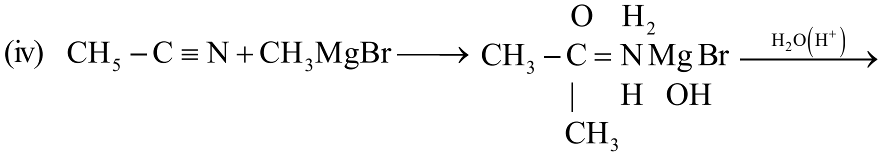
$$CH_3COOH \xrightarrow{Ca(OH)_2} (CH_3COO)_2\,Ca \xrightarrow[-CaCO_3]{\text{dry distillation}} CH_3COCH_3$$

(distillate)

(ii) $CH \equiv CH \xrightarrow{NaNH_2} CH_3 \equiv CNa \xrightarrow{CH_3Br} HC \equiv C - CH_3$

$\xrightarrow[HgSO_4,\,60^0]{dil\,H_2SO_4} CH_3COCH_3$

(iii) $2CH_3COCl \xrightarrow[-CdCl_2]{(CH_3)_2Cd} CH_3COCH_3$



(iv) $$CH_5 - C \equiv N + CH_3MgBr \longrightarrow \underset{\underset{\displaystyle CH_3}{|}}{CH_3 - C} = N\,Mg\,Br \quad \begin{matrix} O & H_2 \\ H & OH \end{matrix} \xrightarrow{H_2O(H^+)}$$

$CH_3COCH_3 + NH_3 + Mg\,(OH)Br$

52. (a) Self aldol.

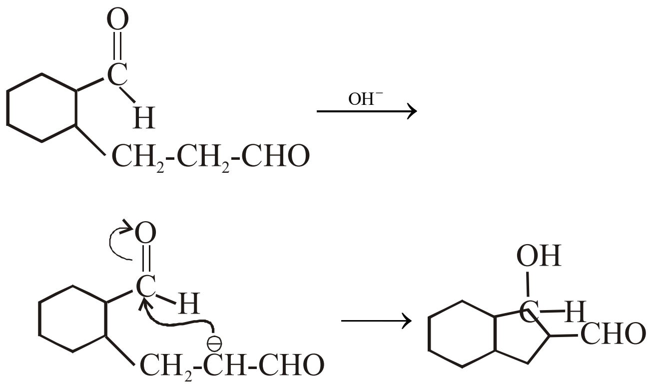
$$\rightarrow CH_3\text{–}CHO + CH_3CHO \xrightarrow{OH^-} CH_3-\overset{\overset{OH}{|}}{C}H-CH_2-CHO$$

3-hydroxy butanal

$$\rightarrow \text{Crossed aldol } \underset{\underset{H}{|}}{H}C=O + HCH_2CHO \xrightarrow{OH^-} CH_2(OH)-CH_2-CHO$$

3 – hydroxy propanal

→ Intra molecular aldol



(b) Cannizzaro's reaction (disproportionation)

→ Self Cannizzaro's reaction :

$$C_6H_5CHO + C_2H_5CHO + \xrightarrow{NaOH} C_6H_5COONa + C_6H_5CH_2OH$$

→ Cross Cannizzaro's reaction :

$$HCHO + C_6H_5CHO \xrightarrow{NaOH\,(conc.)} HCOONa + C_6H_5CH_2OH$$

→ Intra molecular Cannizzaro's reaction :

$$\begin{matrix} CHO \\ | \\ CHO \end{matrix} \xrightarrow{NaOH} \begin{matrix} COONa \\ | \\ CH_2OH \end{matrix}$$

glyoxal Sodium glycolate

(c) Iodoform reaction (Reagent - I_2 + KOH)

Compound with $\xrightarrow{CH_3CO-}$ group or $\xrightarrow{CH_3CH(OH)-}$-group when treated with alkaline iodine provides yellow mass of iodoform. Thus $CH_3\text{–}CH_2OH$,

$$\underset{\underset{OH}{|}}{CH_3-CH-R} \text{ (Alkan-2-ol) } CH_3-\overset{\overset{O}{||}}{C}-H \text{ and } CH_3-CO-R \text{ (alkan -2-one)}$$

responds to this test.

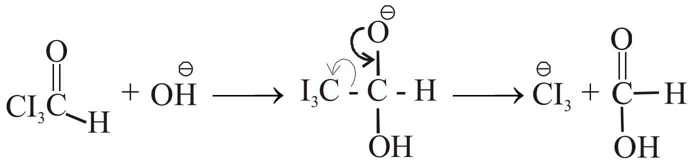
e.g. $CH_3-CHO \xrightarrow{OH^-} \overset{\ominus}{C}H_2CHO + H_2O$

$\overset{\ominus}{C}H_2CHO + I - I \longrightarrow CH_2I - CHO + \overset{\ominus}{I}$

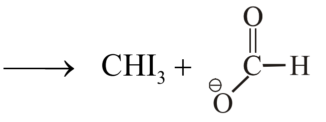
$CH_2I\ CHO + OH^- \longrightarrow \overset{\ominus}{C}HI - CHO + H_2O$

$\bar{C}HICHO + I - I \longrightarrow CHI_2CHO + \overset{\ominus}{I}$

$CHI_2CHO \xrightarrow[+I_2]{OH^-} CI_3CHO$

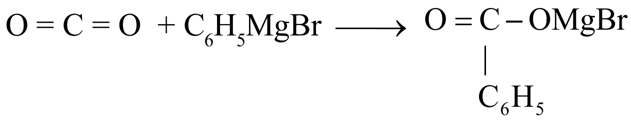


$$CI_3C(=O)H + \overset{\ominus}{O}H \longrightarrow I_3C - C(\overset{\ominus}{O})(OH) - H \longrightarrow \overset{\ominus}{C}I_3 + HO-C(=O)-H$$



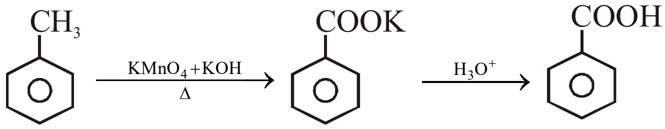
$$\longrightarrow CHI_3 + \overset{\ominus}{O}-C(=O)-H$$

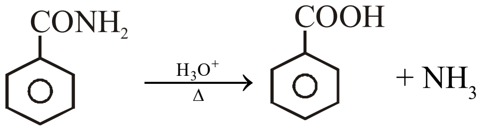
formate

53. 

$$O = C = O + C_6H_5MgBr \longrightarrow O = C(C_6H_5) - OMgBr$$

$\xrightarrow{H_3O^+} C_6H_5COOH + Mg(OH)Br$





→ $C_6H_5COOH + NaHCO_3 \rightarrow C_6H_5COONa + CO_2 + H_2O$ (Test for - COOH group)

→ $C_6H_5COOH + PCl_5 \rightarrow C_6H_5COCl + POCl_3 + HCl$

Benzoylchloride

54. → (i) $CH_3–CH_2OH + \boxed{O} \xrightarrow[\Delta]{MnO_4^- + H^+} CH_3COOH + H_2O$

(ii) $CH_3Br \xrightarrow{KCN} CH_3CN \xrightarrow[\Delta]{H_3O^+} CH_3COOH$

$CH_3Br \xrightarrow{Mg\,ether} CH_3MgBr \xrightarrow[(ii)\ H_3O^+]{(i)\ O=C=O} CH_3COOH$

(iii) $CH_3COOC_2H_5 + H_2O \xrightarrow{H^+} CH_3COOH + C_2H_5OH$

→ HCOOH easily oxidises to CO_2, hence as a better reducing agent. On this property it is distinguished from acetic acid which is not a reducing agent.

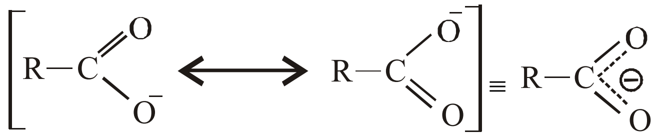
It reduces Tollen's reagent (silver mirror test).

$HCOOH + 2[Ag(NH_3)_2]OH \longrightarrow CO_2 + 2H_2O + 2Ag + 4\,NH_3$

$CH_3COOH \xrightarrow{LiAlH_4} CH_2\text{-}CH_2OH$

$\xrightarrow[170^0C]{Conc.H_2SO_4} CH_2{=}CH_2 \xrightarrow{M\bar{n}O_4 + H^+} HCOOH$

55. (i) $RCOOH + H_2O \rightleftharpoons H_3\overset{+}{O} +$



(a) –I effect increases acidic nature

(b) +I effect decreases acidic nature.

CH_3COOH is less acidic than HCOOH

(c) Resonance effect : Greater is the stability of conjugate base greater is the acidic nature.

e.g. Benzoic acid is stronger than acetic acid.

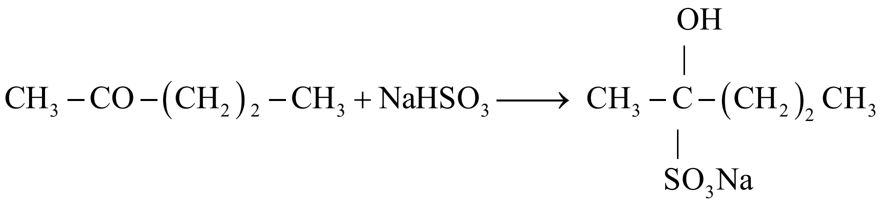
(ii) $RCONH_2 + 4\,KOH + Br_2 \longrightarrow RNH_2 + K_2CO_3 + 2KBr + 2H_2O$

Significance : (a) Preparation of 1^0 - amine

(b) Descending C. atom is chian.

(iii) Substitution of halogen at $\alpha - C.$ atom of the acid.

e.g $CH_3COOH + Cl_2 \xrightarrow{red\ 'P'} ClCH_2COOH + HCl$

56. → 

$$CH_3 - CO - (CH_2)_2 - CH_3 + NaHSO_3 \longrightarrow CH_3 - \underset{SO_3Na}{\overset{OH}{C}} - (CH_2)_2\,CH_3$$

$CH_3CO(CH_2)_2CH_3 + 3I_2 \longrightarrow CI_3CO\,(CH_2)_2CH_3 + 3HI$

$CI_3\,CO(CH_2)_2CH_3 + KOH \longrightarrow CHI_3 + CH_3 - CH_2–CH_2COOK \xrightarrow{dil\ HCl}$

$CH_3CH_2 - CH_2COOH$

$CH_3CO \wr CH_2–CH_2CH_3 \xrightarrow[H_3SO_4,\,\Delta]{K_2Cr_2O_7} CH_3COOH + CH_3CH_2COOH$

Popoff's rule

→ %C, 86 mass contains 60 mass of C

100 mass contains $\frac{60}{86} \times 100 = 69.77\%$

57. $A = C_6H_5CONH_2$

$$C_6H_5CONH_2 \xrightarrow{KOH+Br_2} C_6H_5NH_2(B) \xrightarrow[HCl]{NaNO_2} C_6H_5N_2Cl$$

$$\underset{}{C_6H_5CONH_2} \xrightarrow{LiAlH_4} \underset{(C)}{C_6H_5CH_2NH_2} \xrightarrow[+HCl]{NaNO_2} \underset{(D)}{C_6H_5CH_2OH}$$

$$C_6H_5CONH_2 \xrightarrow[\Delta]{P_2O_5} \underset{(E)}{C_6H_5CN} \xrightarrow[\Delta]{dil\,HCl} \underset{(F)}{C_6H_5COOH}$$

$$C_6H_5COOH \xrightarrow{NH_3} C_6H_5COONH_4 \xrightarrow{\Delta} \underset{(A)}{C_6H_5CONH_2}$$

58. → Ammonolysis of (i) alkylhalide (ii) alcohol $ROH + HNH_2 \xrightarrow{Al_2O_3} RNH_2 + H_2O$

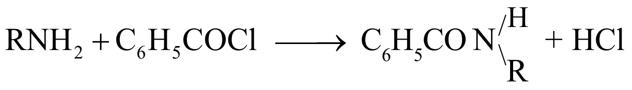
→ Reduction :

(a) $RC \equiv N \xrightarrow{H_2/Ni} RCH_2\,NH_2$

$RNC + 2H_2 \xrightarrow{Ni/\Delta} R\text{–}NH\text{–}CH_3$ (2^0-amine)

(b) $RCONH_2 + 4H \longrightarrow RCH_2\,NH_2 + H_2O$

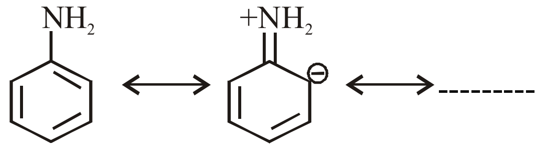
(c) $RNO_2 + 6H \xrightarrow{Sn/HCl} RNH_2 + 2H_2O$



→ $RNH_2 + C_6H_5COCl \longrightarrow C_6H_5CON\begin{smallmatrix}H\\R\end{smallmatrix} + HCl$

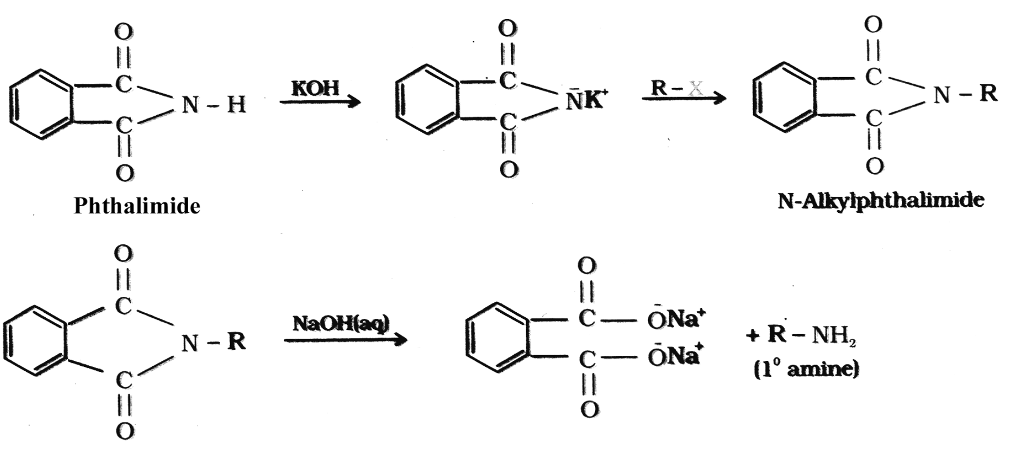
N-alkyl benzene carboxamide

→ $R \rightarrow NH_2$, more basic due to +I effect.

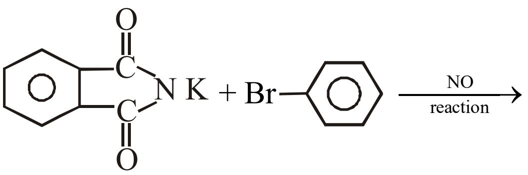


Electron donating tendency is reduced due to presence of +ve charge on Nitrogen as lone pair gets delocalised by resonance.

59. i)



It fails to give aromatic amine e.g. aniline R–X can be substituted but not arylhalide due to double bond character between $\rangle C = X^+$



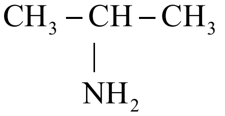
(ii) This is a test to distinguish 1^0 amine from 2^0 and 3^0 amines.

$$RNH_2 + CHCl_3 + 3KOH \longrightarrow R-\overset{+}{N} \equiv \overline{C} + 3KCl + 3H_2O$$

It provides very unpleasant smell.

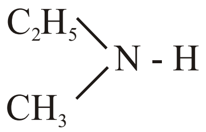
(iii) The basic strength of amines follows in the order:
$2^0 > 1^0 > 3^0$. This can be compared in respect of (a) +I effect (b) Steric effect (c) solvation effect
In non-aqueous solvents such as benzene and also in vapour phase, relative basic strength of methyl amine is in the order:
$(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$

60. 1^0 amine $CH_3-CH_2-CH_2-NH_2$ Propan-1-amine



$CH_3-\underset{NH_2}{\underset{|}{CH}}-CH_3$ Propan-2-amine

2^0 amine



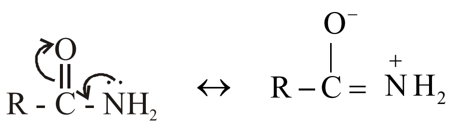
$(C_2H_5)(CH_3)N-H$ N-methylethanamine

3^0 amine $(CH_3)_3N$ N, N-dimethyl methanamine

Distinction :

Reagent	1^0 amine	2^0 amine	3^0 amine
Hinsberg test (i) $C_6H_5SO_2Cl$ (ii) NaOH	$C_3H_7NH_2 + C_6H_5SO_2Cl$ $\rightarrow C_6H_5SO_2N\langle^{H}_{C_3H_7}$ N – propyl benzene sulfonamide soluble in NaOH	$^{CH_3}_{C_2H_5}\rangle NH + C_6H_5SO_2Cl$ $\rightarrow C_6H_5SO_2N\langle^{CH_3}_{C_2H_5}$ N- ethyl N-methyl benzene sulfonamide, insluble in NaOH	Due to absence of N – H Hinsberg reagent fails to react.

→ $R-NH_2$ +I effect increases basic behaviour.



$R-\overset{O}{\overset{||}{C}}-\ddot{N}H_2 \leftrightarrow R-\overset{O^-}{\overset{|}{C}}=\overset{+}{N}H_2$

(a) $\rangle C = O$ group is an electron withdrawing group.

(EWG) group. Due to resonance $\bar{e}$ density at 'N' decreases decreasing its $\bar{e}$-donating tendency hence lowering the basic nature.

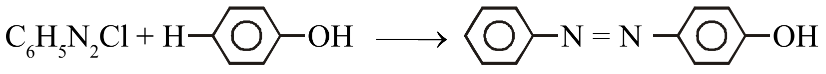
61. → $C_6H_5NH_2 + NaNO_2 + 2HCl \xrightarrow[0-5^0 C]{\text{diazotisation}} C_6H_5N_2Cl + NaCl + 2H_2O$

→ Balz - Schiemann reaction

$$C_6H_5N_2Cl + HBF_4 \longrightarrow C_6H_5N_2BF_4 \xrightarrow{\Delta} C_6H_5F + N_2 + BF_3$$

→ $C_6H_5N_2Cl + H_3PO_2 + H_2O \longrightarrow C_6H_6 + N_2 + H_3PO_3 + HCl$

→ Coupling reaction.



P-hydroxyazobenzene (orange dye)

62. (i) $RCOOH + HN_3 \longrightarrow RNH_2 + N_2 + CO_2$

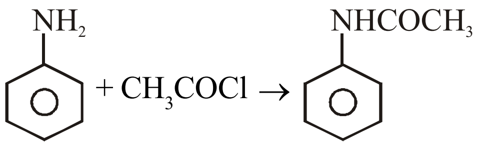
(ii) $RCN + 4H \xrightarrow[LiAlH_4]{Na+alcohol} RCH_2\ NH_2$

(iii) Ammonolysis of alkyl halide-

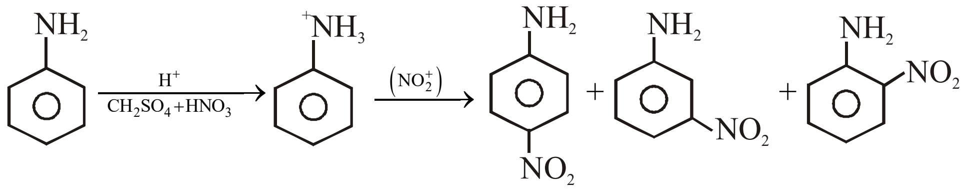
$$RX \xrightarrow{alc.NH_3} RNH_2 \xrightarrow{RX} R_2NH \xrightarrow{RX} R_3N \xrightarrow{RX} R_4\overset{+}{N}X$$

Tetraalkylamminium halide (which on heating) forms alkene, termed as Hofmann's elimination reaction)

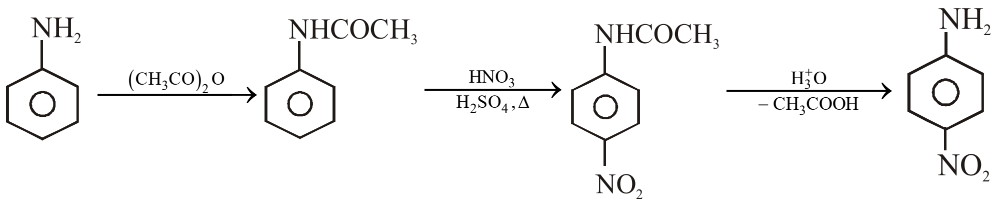
(iv) Acylation -



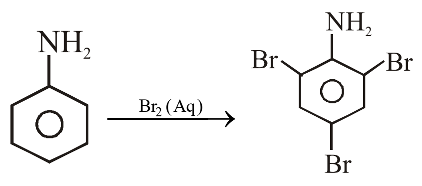
For the process of nitration of aniline, to avoid protonation of $-NH_2$ group.



To get p-NO_2 aniline from aniline protection is necessary.

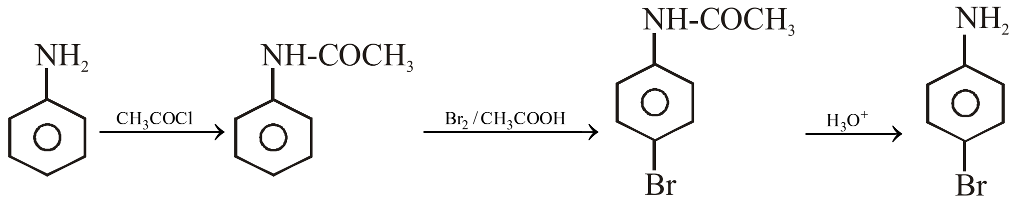


v)

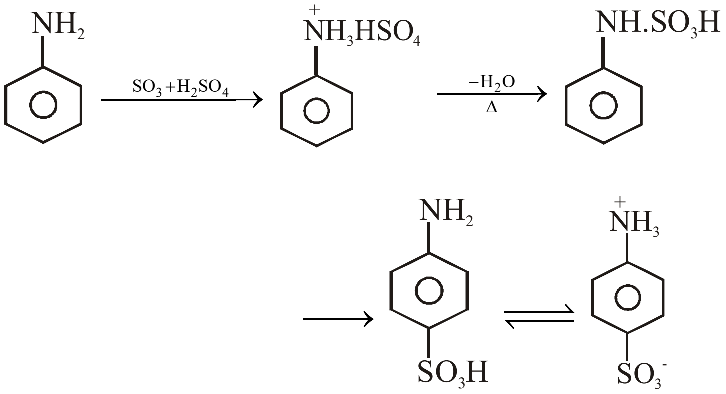


(2, 4, 6– tribromoaniline)

To prepare only p-bromo aniline protection of $-NH_2$ group (deactivated by acetylation) necessary.



Sulfonation :



Sulfanilicacid (Zwitterion)

Zwitter ion is a dipolar ion where proton transfer takes place with basic group at one end and acidic group at other.

This is a special type of salt where proton donation by $-SO_3H$ and accepted by $-NH_2$ group at other end.

63. 1^0 amine : $RNH_2 + HONO \xrightarrow{NaNO_2\_HCl} ROH + N_2 + H_2O$

2^0 amine $R_2NH + HONO \longrightarrow R_2N - N = O$

(insoluble yellow oil)

Libermann's nitroso reaction :

$R_2N - N = O + \text{Phenol} + \text{Conc.}\, H_2SO_4 \xrightarrow{\Delta}$ Brown or red colour

$\xrightarrow{NaOH}$ Blue or violet color

3^0 amine. $R_3N + HNO_2 \longrightarrow R_3\overset{+}{N}H\ NO_2^-$

(Salt formation)

Reagent

(Diazotisation)

$NaNO_2 + HCl$

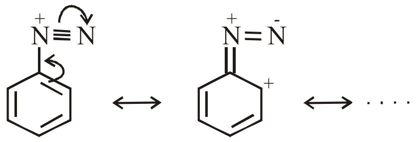
CH_3NH_2

$CH_3NH_2 \xrightarrow{NaNO_2 + HCl} CH_3OH$

No dye is formed

$C_6H_5NH_2$

Aniline forms diazonium chloride due to greater stability (by resonance) of benzolicazonium ion while $CH_3N_2^+$ is unstable



This diazonium salt couples with alkaline solution of β-naphthol to orange/red colour dye.

64. (i) Linear, branched chain polymer, cross linkaed (Bakelite)
    (Nylon) (Polythene)
    (ii) Addition polymer (PVC)
    Condensation polymer (Nylon 6, 6)
    (iii) Elastomer (Rubber) Thermoplastic polymer (Polypropylene, polystyrene)
    Fiber (Nylon 6, 6) Thermosetting polymer (Bakelite)

Bio-degradable polymer (posing no threat to environment.

Example : (i) PHPV - copolymer of 3-hydroxybutanoic acid and pentanoic acid
(ii) dextron - co polymer of glycolic acid and lactic acid
(iii) Nylon-2, 6 co-polymer of glycine & 6-aminohexanoic acid.

Non-biodegradable polymer : Not degraded by micro-organisms leading to environmental pollution.

polythene, PVC, bakelite & other commercially synthesised polymers.

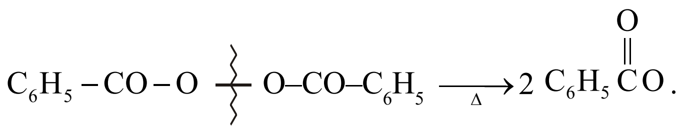
65. → (i) The procss of heating natural rubber with sulfur & important additive like ZnO at 373 to 415 K to improve the properties is called vulcanisation.

Properties :

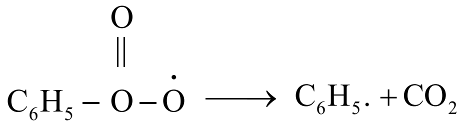
(a) excellent elasticity
(b) low water absorbing tendency
(c) Resistant to action of organic solvents, oxiding agents

Quality of rubber (natural rubber) changes with % of sulfur.

→ (ii) **Initiation** - Benzoylperoxide



$$C_6H_5-CO-O \wr O\text{–}CO\text{–}C_6H_5 \xrightarrow[\Delta]{} 2\;C_6H_5\overset{O}{\overset{\|}{C}}O.$$



$$C_6H_5-\overset{O}{\overset{\|}{O}}-\dot{O} \longrightarrow C_6H_5.+CO_2$$

$$C_6H_5^{\bullet}+CH_2=CH_2 \longrightarrow C_6H_5CH_2-CH_2^{\bullet}$$

Propagation.

$$CH_2 \overset{\bullet\bullet}{=} CH_2+C_6H_5-CH_2-CH_2^{\bullet} \rightarrow C_6H_5-CH_2-CH_2-CH_2-CH_2^{\bullet}$$

$$\xrightarrow{(n-1)CH_2=CH_2} C_6H_5-(CH_2-CH_2)_n-CH_2-CH_2^{\bullet}$$

Termination : The growing chain radical diactivates either by combination or by disproportionation to form a dead polymer.

Disproportionation : $C_6H_5–(CH_2–CH_2)_n–CH_2–CH_2^{\bullet} \longrightarrow C_6H_5(CH_2–CH_2)_n$

$–CH=CH_2 + C_6H_5 – (CH_2–CH_2)_n – CH_2–CH_3$

Dead polymers.

Combination : $X^{\bullet} + X^{\bullet} \longrightarrow X – X$

66. **Antibiotics** refers to substances produced wholly or partly by chemical synthesis, which in low concentrations inhibits the growth or destroy micro organisms intervening in their metabolic processes without harming the host.

Antibiotics have either cidal (killing) effect or a static (inhibitory) effect on microbes.

Bactericidal	**Bacteriostatic**
Pencillin	Erythomycin
Amingo glycosides	Tetracyclin
Offloxacin	Chloramphenicol

Antibiotics which kill or inhibit a wide range of bacteria gram positive and gram negative. or other micro-organisms are said to be broad (e.g. ampicillin and amoxicilline chloramphenicol) spectrum antibiotics . Those which are effective for gram positive or gram negative bacteria are narrow spectrum antibiotic. If effective against a single organism or disease, the antibiotic is called limited spectrum antibiotic e.g. Pencillin-G.

ii) **Antiseptic :** Antiseptic and disinfectants are the chemicals which either kill or prevent the growth of micro organisms.

Antiseptics are applied to the living tissues such as wounds, cuts, ulcers and diseases skin surfaces. e.g. Dettol, (it's a mixture of chloro xylenol, soframycine, furacine tincture iodine, bithionol, 0.2% phenol solution [(0.2%) solution of phenol is antiseptic whereas 1% solution is disnfectent.]

Analgesic (Pain killers)

Narcotic - Releive pain and produce sleep.

Heavy intaketo be avoided.

Morphine (opiate), Heroin, codemine

Non - narcotic – paracetamol, aspirin (both are antipyretic also prevent platelet coagulation)

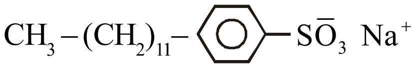
Due to anti blood clotting action aspirin finds use in prevention of heart attacks.

67. Soap - sodium or potassium salts of higher fatty acids (stearic acid, palmitic acid, oleic acid)

Types of soap -

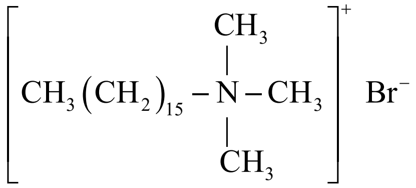
Synthetic detergents - (functions both in hard and soft water)

Classification :

→ Anionic detergent -  $CH_3 – (CH_2)_{11} – C_6H_4 – S\bar{O}_3\ Na^+$, dodecylbenzene sulfonate.

There are ABS (alkyl benzene sulfonate) detergent.

→ Cationic detergent –



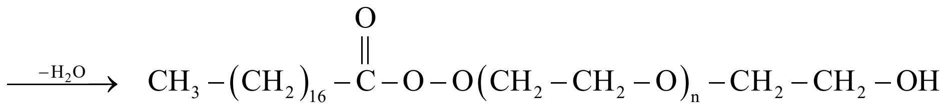
$$\left[CH_3(CH_2)_{15}-\overset{\overset{\large CH_3}{|}}{\underset{\underset{\large CH_3}{|}}{N}}-CH_3\right]^+ Br^-$$

These have germicided properties and are expensive and of limited use.

→ Non-ionic detergents.

$$CH_3(CH_2)_{16}CO\boxed{OH+H}O(CH_2-CH_2O)_n\ CH_2-CH_2-OH$$

Stearic acid Polyethylene glycol



$$\xrightarrow{-H_2O} CH_3-(CH_2)_{16}-\overset{\overset{O}{||}}{C}-O-O(CH_2-CH_2-O)_n-CH_2-CH_2-OH$$

Dishwashing detergents are non-ionic.

Cleansing action

$$\begin{matrix}\text{oil}\\ \text{+dust}\end{matrix}\ \xleftarrow[\text{hydrophobic}]{R-}\ \xrightarrow[\text{hydrophilic}]{COO^-Na^+}\ \begin{matrix}\text{water}\\ \text{part}\end{matrix}$$

Emulsification / micelle formation favour cleansing.

68, 69 & 70 - refer Text.

* * *