Q&A

WORK BOOK
CUM
QUESTION BANK WITH ANSWERS

CHEMISTRY

CLASS - XII

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

Work Book
cum
Question Bank with Answers

CHEMISTRY

CLASS-XII

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

2020

FOREWORD

An innovative education program has been initiated by ST & SC Development Department, Govt. of Odisha for the students appearing in +2 Science and Commerce examination pursuing studies in the ST & SC Development Department Schools (EMRS & HSS) to ensure quality education at +2 level.

In this regard it is to mention that an Academic Performance Monitoring Cell (APMC)has been set up in SCSTRTI to monitor the Training and Capacity Building of Teachers of SSD Higher Secondary Schools and Ekalabya Model Residential Schools (EMRS) to enhance quality education for better performance of the students appearing +2 Science and Commerce examination.This effort by APMC will certainly help the students to equip themselves for appropriate answering the question in the examination in an efficient manner.

In order to materialize the effort, thebest ofsubject experts of the state have been roped into formulate self-contained and self-explanatory "Work book cumQuestions Bankwith Answers" as per the syllabi of CHSE,Odisha.They have tried to make the material as far as activity based and solution based as possible.This novel effort is first of its kind at +2 level in Odisha.

I would like to extend my thanks to Prof.(Dr.) A.B. Ota, Advisor-Cum-Director and Special Secretary, SCSTRTI and the team of Subject experts for their sincere effort for bringingout the study materials in quick time.

Hope, these study materials will be extremely useful for the students appearing the +2 examination in Science and Commerce of our SSD Schools.

Ranjana Chopra
Principal Secretary
ST & SC Development Department
Govt. of Odisha

PREFACE

The ST and SC Development Department, Government of Odisha, has initiated an innovative effort by setting up an Academic Performance Monitoring Cell (APMC) in Scheduled Castes and Scheduled Tribes Research and Training Institute (SCSTRTI) to monitor the Training and Capacity Building of teachers of SSD Higher Secondary Schools and Ekalavya Model Residential Schools (EMRS) and to ensure quality education of students studying at +2 level under the administrative control of the ST & SC Development Department. This innovative programme is intended to ensure quality education in the Higher Secondary Level of the schools of the ST & SC Development Department.

Since the introduction of +2 Science and +2 Commerce stream by the Council of Higher Secondary Education, Odisha, there was a great demand to cater to the needs of the students appearing the +2 Examination. But no organisation or institute has taken the initiative to fulfil the needs of the students appearing the +2 examination. Realizing the necessities and requirements of students to perform better and secure better marks in the examination and proper pattern of answering the question in a scientific way, the APMC under the banner of SCSTRTI has taken the initiative for the first time in Odisha to prepare Questions Banks in Physics, Chemistry, Botany, Zoology, Mathematics, IT, English & Odia of the Science Stream and all the disciplines of the Commerce stream in line with the Syllabus of the Council of Higher Secondary Education (CHSE).

These questions banks are first of this kind in Odisha, as per syllabi of CHSE and are self contained and self explanatory. The subject expert, who are the best in their respective subjects in the state have been roped in for the exercise. They have given their precious time to make the question banks as activity based and solution based as possible.

I take this opportunity to thank all the subject experts of different subjects for rendering help and assistance to prepare the question banks within a record time. I hope, this material will be extremely useful for the students preparing for the +2 examination in different subjects of Science & Commerce streams.

Prof. (Dr.) A.B. Ota
Advisor cum Director & Special Secretary
SCSTRTI, Govt. of Odisha

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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A.H.S. EXAMINATION PAPERS WITH ANSWERS

ANNUAL - 2019

Group - A

All questions are compulsory.

1. Choose and write the correct answer of the following : [1 x 7 = 7]

(a) Sulphur dioxide gas does not act as

i) oxidising agent ii) reducing agent
iii) dehydrating agent iv) bleaching agent

b) Which of the following solutions of KCl will have highest specific conductance ?

i) 0.0001 N ii) 0.001 N iii) 0.01 N iv) 1.0 N

c) Which base is present in RNA but not in DNA?

i) Uracil ii) Cytosine iii) Guanine iv) Thymine

d) Which of the following electrolytes is most effective in the coagulation of gold sol ?

i) $NaNO_3$ ii) $K_4 [Fe(CN)_6]$
iii) Na_3PO_4 iv) $MgCl_2$

e) The compound that reduces Tollens' reagent is

i) CH_3COCH_3 ii) CH_3CHO
iii) CH_3COOH iv) CH_3CH_2OH

f) Which of the following noble gases is abundant in air ?

i) He ii) Ne iii) Ar iv) Kr

g) Which one is the ore of copper ?

i) Haematite ii) Chalcopyrite iii) Dolomite iv) Bauxite

2. Answer the following questions : [1 x 7 = 7]

a) When the value of van't Hoff factor is less than one, this shows that the solute undergoes ________ in the solution.

b) What are the monomers of Nylon 6,6?

c) How many atoms are present per unit cell of a body centred cubic crystal ?

d) The general electronic configuration of lanthanoids is _________ .

e) Which product is obtained when methyl cyanide is reduced by sodium and ethyl alcohol ?

f) Write the names of two oligosaccharides.

g) Name the catalyst used in the contact process of manufacture of H_2SO_4 .

Group - B

3. Answer any sayen questions of the following : [2 x 7 = 14]

a) The osmotic pressure of a solution containing 50 g of a solute in one litre of solution at 300 K is 20.5 atmosphere. Calculate the molecular mass of the solute.

b) What are freons ? What are their harmful effects on the environment ?

c) What happens when KI solution is added to acidified $K_2Cr_2O_7$ solution ?

d) Under which condition the rate of reaction becomes equal to the specific reaction rate ? Write the expressions for the rate of reaction of $PCl_5 \rightarrow PCl_3 + Cl_2$.

e) What happens when yellow phosphorus is heated with dilute NaOH solution ?

f) What are bidentate ligands ? Give an example.

g) $CuSO_4$ solution is electrolysed for 20 minutes with a current of 3 amperes. What mass of copper will be deposited at the cathode ?
(Eq. mass ofCu = 31.75)

h) What are antioxidants ? Give two examples.

i) How does Schottky defect arise ? In which type of ionic compounds does this defect arise ?

j) Match the diseases of Group (A) with the vitamins of Group (B) correctly :

Group (A)	**Group (B)**
a) Xerophthalmia	i) Vitamin D
b) Scurvy	ii) Vitamin K
c) Coagulation of blood	iii) Vitamin A
d) Rickets	iv) Vitamin, C

4. Answer any seven questions of the following : [3 x7 = 21]

a) Explain what are ionic and covalent solids. Give one example of each.

b) Discuss Reimer-Tiemann reaction.

c) Elucidate the differences between soaps and detergents.

d) The rate constants of a reaction at 500 K and 700 K are 0.025 sec^{-1} and 0.075 sec^{-1} respectively. Calculate the energy of activation of the reaction. ($R=8.314\ JK^{-1}$ and $\log 3 = 0.477$)

e) What do you mean by biodegradale and non-biodegradable polymers ? Give an example of a synthetic biodegradable polymer.

f) What is the action of chlorine with (i) cold and dilute NaOH and (ii) hot and concentrated NaOH ?

g) Discuss the structure of $[Co(NH_3)_6]^{3+}$ ion on the basis of valence bond theory. Whether it is an inner orbital or outer orbital complex ion ?

h) Discuss Van-Arkel Boer method for ultrapurification of Zirconium.

i) Write a note on hydrogen-oxygen fuel cell.

j) An organic compound having molecular formula C_3H_7Br on treatment with aqueous KOH solution gave the compound (A). When the vapour of the compound (A) was passed over red hot copper at 300°C compound (B) was formed. The compound (B) on treatment with I_2 and dil. NaOH, formed a yellow solid (C). Identify the compounds A, B and C.

Group - C

Answer any three questions. [7 x 3 = 21]

5. How is acetic acid prepared from methyl magnesium bromide ? What happens when acetic acid is (i) reduced by lithium aluminium hydride and (ii) treated with ammonium hydroxide and the resulting product is heated at high temperature ? [2+2+3

6. Starting from nitrobenzene how will you prepare benzene diazonium chloride ? Give the method of synthesis of (i) p-hydroxy azobenzene and (ii) fluorobenzene from benzene diazonium chloride. [3+2+2

7. With diagram, discuss the Siemen's ozoniser method of preparation of ozone. What happens when ozone reacts with (i) PbS and (ii) acidified $FeSO_4$ solution ? [3 + 2 + 2

8. a) Name four factors affecting adsorption of gases by solids. [2

b) What are oil in water and water in oil type of emulsions ? Give one example of each type. [2+1

c) What are enzyme catalysts ? Give a reaction involving an enzyme catalyst. [2

9. a) A solution contains 72% water and 28% methyl alcohol. Calculate the mole fraction of each component in the solution.

b) State Raoult's law. How is the molecular mass of a solute determined from lowering, of vapour pressure measurement ? [2+3+2

ANNUAL - 2019 (ANSWERS)

1. (a) iii - dehydrating agent
   (b) iv - 1.0 N
   (c) i - Uracil
   (d) iv - $MgCl_2$
   (e) ii - CH_3CHO
   (f) iii - Ar
   (g) ii - Chalcopyrite

2. (a) Whan the value of van't Hoff factor is less than one, this shows that the solute undergoes association in the solution.

   (b) Monomers of Nylon 6,6 : $H_2N–(CH_2)_6–NH_2$, $HOOC–(CH_2)_4–COOH$
   Hexamethylene diamine adipic acid

   (c) Body centred cubic crystal contains 2 atoms per unit cell.

   (d) The general electronic configuration of Lanthanoid is
   2, 8, 18 $4s^2 4p^6 4d^{10}\ 4f^{1-14}\ 5s^2\ p^6\ d^{0 \text{ or } 1}\ 6s^2$.
   [Kr] $4d^{10}\ 4f^{1-14}\ 5s^2\ 5p^6\ 5d^{0 \text{ 0r } 1}\ 6s^2$.

   (e) On reduction of CH_3CN, ethanamine is formed

$$CH_3C \equiv N \xrightarrow[(4H)]{Na+C_2H_5OH} CH_3 - CH_2 - NH_2$$

   (f) Two oligosaccharides : sucrose, Maltose, (Lactose or Trehalose)

   (g) V_2O_5 is used as catalyst in contact process. (Platinised asbestos)

3. (a)

$$\pi = CRT\,, \quad \pi = \frac{n}{v}RT = \frac{W}{M} \times \frac{RT}{V}$$

$$20.5 = \frac{50}{M} \times \frac{0.0821 \times 300\,(K)}{1L}$$

$$M = \frac{50\,\text{gram} \times 0.0821\,\text{L.atm.mol}^{-1}\,K^{-1} \times 300\,K}{20.5\,\text{atom} \times 1L}$$

$$= M = \frac{50 \times 0.0821 \times 300}{20.5}\text{gram / mole}$$

   Molecule mass of solute = 60.07 g/mol.

   (b) Freons are refigerant containing C, Cl, F and some times Br. e.g. Freon-10 CCl_4,
   Freon - 12, CCl_2F_2 (CFC)
   It is a significant environmental pollutant causing depletion of the ozone layer.

   (c) When KI solution is added to acidified $K_2Cr_2O_7$ violet vapours iodine come out.

$$K_2Cr_2O_7 + 4H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + 4H_2O + 3(O)$$

$$\begin{array}{c} 3 \times \left[2KI + O + H_2SO_4 \rightarrow K_2SO_4 + I_2 \uparrow + H_2O \right] \\ \hline K_2Cr_2O_7 + 4H_2SO_4 + 6KI \rightarrow 4K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3I_2 \end{array}$$

$$Cr_3O_7^{2-} + 14H^+ + 6I \longrightarrow 2Cr^{3+} + 7H_2O$$

$$\left[2I^- \longrightarrow I_2 + 2c^-\right] \times 3$$

$$\underline{\overline{Cr_3O_7^{2-} + 14H^+ + 6I^- \longrightarrow 3I_2 + 2Cr^{3+} + 7H_2O}}$$

d) –dc/dt = K C^n

i) n = 0 (zero order reaction)

$$-\frac{dc}{dt}\text{ (rate of reaction) } = k \text{ (specific reaction rate)}$$

ii) C = 1 molar reactant solution at time 't'.

$$-\frac{dc}{dt} = K,$$

$$\frac{dx}{dt} = k(a-x)', \text{ i.e., } (a - x) = 1 \text{ M.}$$

$$PCl_5 \rightarrow PCl_3 + Cl_2$$

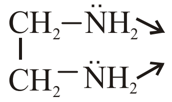
$$-\frac{d(PCl_5)}{dt} = +\frac{d[PCl_3]}{dt} = +\frac{d[Cl_2]}{dt}$$

e) When yellow phosphorous is heated with dil. NaOH solution phosphine gas is evolved.

$$P_4 + 3NaOH + 3H_2O \longrightarrow 3NaH_2PO_2 + PH_3 \uparrow$$

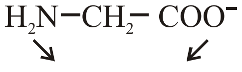
f) Bidentate ligand : Molecule / ion with atoms that co-ordinate directly to the central atom/ion in a complex.

Example :



$$\begin{array}{l} CH_2-\ddot{N}H_2\searrow \\ | \\ CH_2-\ddot{N}H_2\nearrow \end{array}$$

(Two teeth - ethane-1, 2-diamine)



$$H_2N-CH_2-COO^-$$

glycinate (aminoethanoate)

(g) Coulomb of electricity = $3 \times 20 \times 60$

$= 3600$ C

96500 C deposit 31.75g of copper

3600 C will deposit $\frac{31.75}{96500} \times 3600 = 1.18\,g$

$\therefore$ 1.18 g of copper will be deposited at cathode.

(h) A substance that inhibits oxidation, especially one used to counteract deterioration of stored food products. In body these are anti-aging chemicals reduce the risk of cancer.

Example : Vitamin - C or E, beta carotene Antioxidants used to preserve food are BHT (butylated hydroxytoulene), BHA

(i) This defect arises on missing of equal number of cations and aninos from their lattice sites so that electrical neutrality is maintained.

Types of compounds : (i) Ionic compound with high co-ordination number.

(ii) Small difference of r_+ and r_-.

Example : NaCl, KCl

(j)

(a)	Xerophthalmia	(i)	Vitamin A
(b)	Scurvy	(ii)	Vitamin C
(c)	Coagulation of blood	(iii)	Vitamin K
(d)	Rickets	(iv)	Vitamin D

4. (a) **Ionic solid**

i) Constituents are ions held by ionic bond

ii) Strong force, rigid with high melting point

iii) In solution and molten state these conduct electricity. In solid state these are insulators as the ions do not move.

e.g. Na^+Cl^+, K^+Cl^-.

Covalent solid

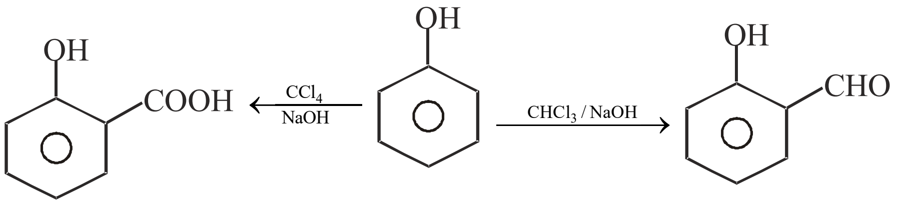
i) Constituents are atoms held by covalent bond

ii) Weaker force, less melting point. (Exception-diamond)

iii) Non conductor even as melt. (except - graphite)

e.g. C (diamond, graphite..) SiC

(b) When phenol reacts with alkaline chloroform salicylal dehyde is formed where as with alkaline carbon tetrachloride it give salicyclic acid.



salicylic acid Salicylaldehyde

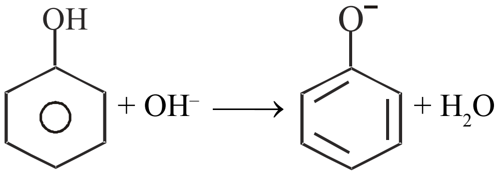
Mechanism : $CHCl_3 + OH^- \longrightarrow \bar{C}Cl_3 + H_2O$

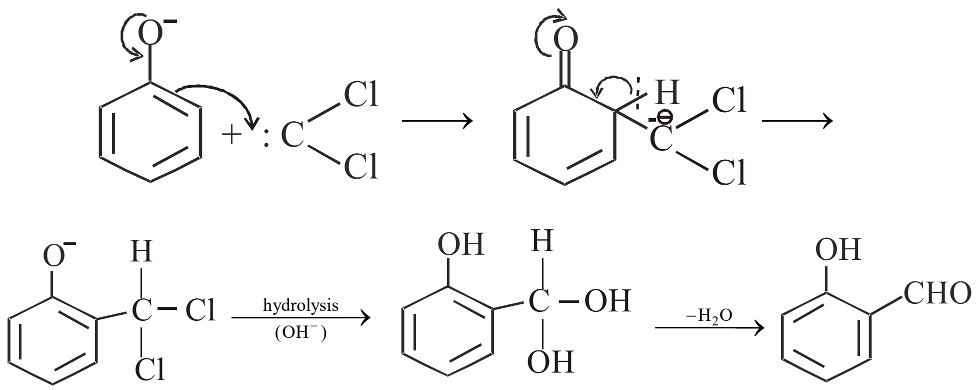
$CCl_3^- \longrightarrow :CCl_2 + Cl^-$

Introduction of - CHO group. (dichloro carbene as an electrophile)

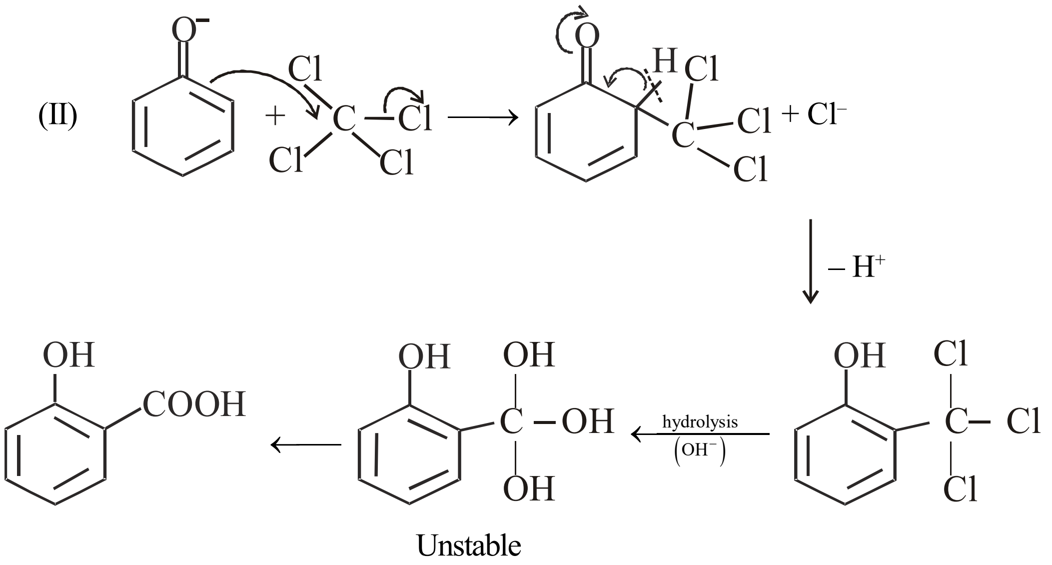
(I)

E_E :





(II)



(c)	Soap		Detergents
i)	Sodium or potasium salt of high fatty acids. e.g. Sodium stearate ($C_{17}H_{35}COONa$) Sodium palmitate ($C_{15}H_{31}COONa$) Sodium oleate ($C_{17}H_{33}COOONa$)	i)	These are surface active reagents, sodium alkyl benzene sulfonates. (soft detergent), if it contains branched chain alkyl group these are hard detergents shortly called ABS detergent.
ii)	Does not give good lather with hard water as calcium/magnesium salts of palmitic / stearic / oleic acid are insoluble.	ii)	Operates suitably in both hard and / soft water - so a better cleansing agent.
iii)	Biodegradable	iii)	Non-biodegradable

(d) $$\log\frac{k_2}{k_1}=\frac{Ea}{2.503R}\times\frac{T_2-T_1}{T_1T_2}$$

$$\log\frac{0.075}{0.025}=\frac{Ea}{2.303\times8.314}\times\frac{200}{350000}$$

$$Ea=\frac{0.477\times2.303\times8.314\times3500}{2}=15.985\,kJ$$

$\therefore$ The energy of activation of the reaction is 15.983 kJ.

(e) **Non-biodegradable polymer**

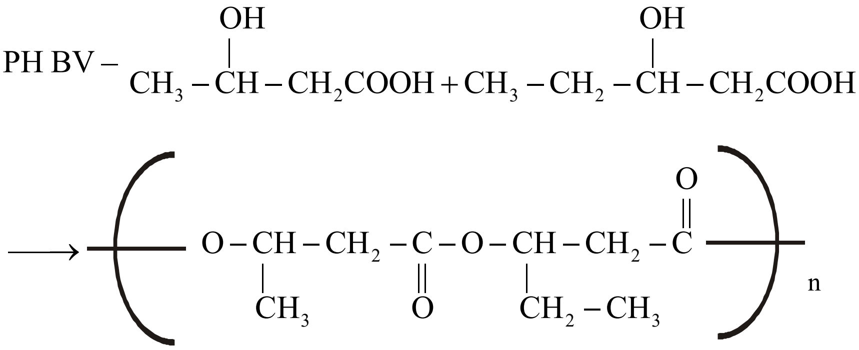
A large number of polymers are quite resistant to environmental degradation process and are thus responsible for accumulation polymeric solid waste materials. These cause acute environmental problems and remain undegraded for quite a long time. e.g. polythene, PVC, polyster, teflon etc.

Biodegradable polymer :

These are ecofriendly and degradable does not create environmental hazards. These polymers contain functional groups similar to those present in bio-polymers.

e.g. Aliphatic polyster.

PH BV –



$$CH_3-\underset{}{\overset{\overset{\displaystyle OH}{|}}{C}H}-CH_2COOH+CH_3-CH_2-\overset{\overset{\displaystyle OH}{|}}{C}H-CH_2COOH$$

$$\longrightarrow\left(O-\underset{\underset{\displaystyle CH_3}{|}}{C}H-CH_2-\underset{\underset{\displaystyle O}{||}}{C}-O-\underset{\underset{\displaystyle CH_2-CH_3}{|}}{C}H-CH_2-\overset{\overset{\displaystyle O}{||}}{C}\right)_n$$

(PH BV) Poly-β hydroxybutyrate – CO – β-hydroxy valerate.

These degrade in to natural by products such as O_2, N_2, CO_2 water and bio-mass, also containing inorganic salts.

(f) When chlorine is passed through cold NaOH, NaCl and NaOCl are formed but with hot NaOH, it forms sodium chlorate and NaCl.

$$Cl_2+H_2O\longrightarrow HCl+HOCl$$

$$NaOH+HCl\longrightarrow NaCl+H_2O$$

$$HOCl+NaOH\longrightarrow NaOCl+H_2O$$

In. cold : $Cl_2+2NaOH\longrightarrow NaCl+NaOCl+H_2O$

$$3\,NaOCl\xrightarrow{\Delta}2NaCl+NaClO_3$$

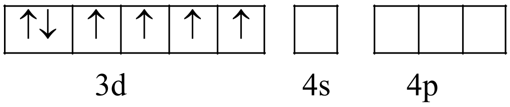
$$3Cl_2+6NaOH\longrightarrow 3NaCl+3NaOCl+3H_2O$$

In hot : $3Cl_2+6NaOH\xrightarrow{\Delta}5NaCl+NaClO_3+3H_2O$

(g) $\left[Co(NH_3)_6\right]^{3+}$

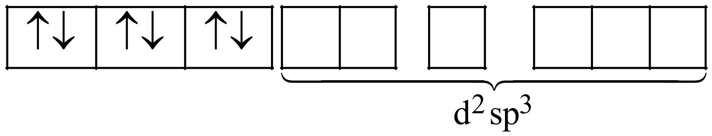
$C_O\,(Z=27)$ $3d^7\,4s^2$

Co (III) $3d^6$



Inner orbital complex.

In presence of NH_3 (ligand)



Diamagnetic

(h) Van - Arkel Boer method : (Purification of metal, Zr, Ti

$$\underset{\text{Impure}}{Zr} + 2I_2 \longrightarrow ZrI_4 \xrightarrow[1800^0 C]{\Delta} \underset{\text{Pure}}{Zr} + 2I_2 \uparrow$$

(i) H_2–O_2 fuel cell :

Here in the fuel cell the decrease in free energy $(-\Delta G)$

on combustion hydrogen (fuel), $H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$ is directly converted

to electrical energy. $(-\Delta G = nFE)$

Cathode (Porous C – electrode incorporated with divided Pt or Pd) is contact with O_2 (g).

Anode - [porous C – Pt or Pd in contact with passage of H_2(g)]

Electrolyte - KOH (aq).

Cell equation : Cathode - $O_{2(g)} + 2H_2O(l) + 4e^- \longrightarrow 4OH^-(aq)$

Anode - $2H_2(g) + 4OH^-(aq) \longrightarrow 4H_2O + 4e^-$

$$2H_2(g) + O_2(g) \longrightarrow 2H_2O(\ell)$$

$$E^0_{Cell} = +1.23V \quad [+0.40 - (-0.83)]$$

In acidic electrolyte (H_2SO_4)

Anode $H_2 \longrightarrow 2H^+ + 2e^-$

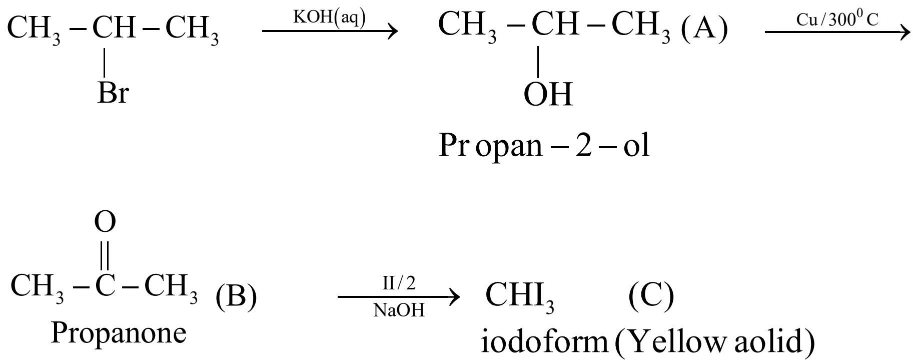
Cathode $O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O$

$$2H_2 + O_2 \longrightarrow 2H_2O$$

$$E^0_{Cell} = E_{RHE} - E_{LHE}$$

$$= +1.23 - 0 = 1.23\ V$$

(j)



$$CH_3-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3 \xrightarrow{KOH(aq)} CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3\ (A) \xrightarrow{Cu/300^0C}$$

Propan-2-ol

$$CH_3-\overset{\displaystyle O}{\overset{||}{C}}-CH_3\ (B) \xrightarrow[NaOH]{II/2} CHI_3 \quad (C)$$

Propanone

iodoform (Yellow aolid)

GROUP - C

(Only Hints given)

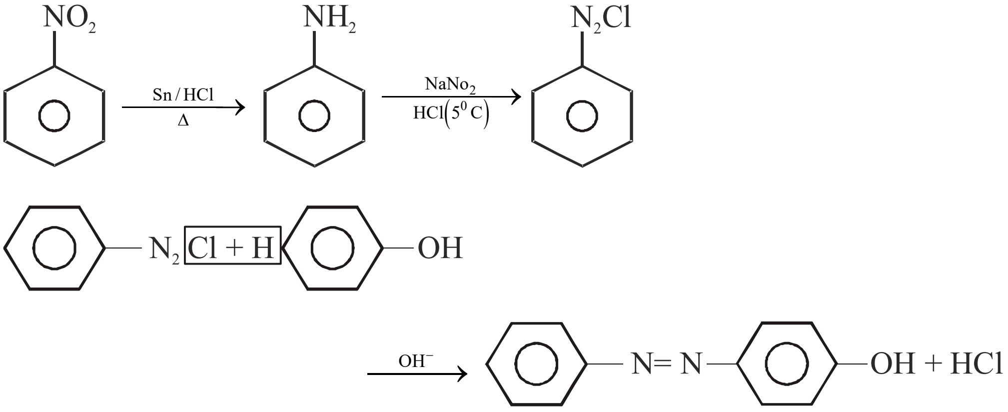
5.

$$CH_3MgBr + O=C=0 \rightarrow O=\underset{\displaystyle CH_3}{\underset{|}{C}}-OMgBr \xrightarrow{H_3O^+} CH_3COOH + Mg(OH)Br$$

$$CH_3-COOH + 4(H) \xrightarrow{LiAlH_4} CH_5CH_2OH + H_2O$$

$$CH_3COOH + NH_4OH \longrightarrow CH_3COONH_4 \xrightarrow{\Delta} CH_3CONH_2 + H_2O$$

6.



Coupling reaction p.hydroxy azo benzene

$$C_6H_5N_2Cl + HBF_4 \longrightarrow C_6H_5F + N_2 + BF_3 + HCl$$

Fluoro boric acid fluro benzene

7.

$$3O_2(g) \xrightarrow[\text{electric discharge}]{\text{silent}} 2O_3$$

purification-ozonised oxygen $(O_3 + O_2) \xrightarrow[\text{liquid air}]{\text{Passed through}} O_3(l) + O_2(g) \uparrow$ at -112.4^0C

dark blue

$$\xrightarrow[\text{evaporation}]{} O_3(g)$$

Pale blue

(i) $O_3 \longrightarrow O_2 + O$

$PbS + 4(O) \longrightarrow PbSO_4(s)$

Black white

(ii) $O_3 \longrightarrow O_2 + O$

$2FeSO_4 + H_2SO_4 + O \longrightarrow Fe_2(SO_4)_3 + H_2O$

Ferric sulfate

8. (a) Nature of adsorbate - Easily liquifiable gas

(b) Naturel of adsorbent- Finely livided : More the surface area more is the extent of adsorption.

(c) Temperature – Physical adsorption takes place at low temperature.

(d) Pressure - Extent of adsorption increases with pressure, $\frac{x}{m} = k\,p^{1/n}(n > 1)$.

(b) o/w type - Emulson where oil is dispered in water (medium)

e.g. Milk

w/o type - water (phase) is dispersed in oil (medium)

e.g. ointment, eggyolk, butter, cold cream.

(c) enzyme catalyst - Enzymes are complex nitrogeneous organic compounds (proteins) which are product by living plants and animals. These are biochemical catalysts catalysing a many bio-chemical reactions.

e.g. Inversion of cane sugar.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{enzyme}]{\text{invertase}} C_6H_{12}O_6(Aq) + C_6H_{12}O_6(Aq)$$

glucose fructose

9. (a) 100 gram solution = 72 gram (water) + 28 gram (CH_3OH).

$$X_{water} = \frac{72/18}{72/18 + 28/32} = \frac{4}{4+\frac{7}{8}} = \frac{4\times 8}{39} = \frac{32}{39} = 0.82$$

$$X_{CH_3OH} = 1 - 0.82 = 0.18$$

(b) Raoult's law (Volatile liquid) $\longrightarrow p_1 = X_1 P_1^0$

Relative lowering of vapour pressure is equal to mole fraction of the solute

$$\frac{P_1^0 - p_1}{p_1^0} = X_2 = \frac{n_2}{n_1 + n_2} = \frac{W_2/M_2}{\frac{W_1}{M_1} + \frac{W_2}{M_2}}$$

Neglecting the solute portion in the dr.

$$\frac{P_1^0 - p_1}{p_1^0} = \frac{W_2/M_2}{W_1/M_1} = \frac{W_2}{M_2} + \frac{M_1}{W_1}$$

From this equation knowing all other quantities, the molar mass of solute (M_2) can be calculated.

❖ ❖ ❖

ANNUAL - 2018

Time - 3 Hours **Full Marks - 70**

The figures in the right-hand margin indicate marks.
Answer all the bit questions of a particular question serially at one place to ensure effective evaluation.
Uses of calculator is prohibited.
Answer from all Groups as directed.

GROUP - A

All questions are compulsory.

1. Choose and write the correct answer of the following : [1 x 7]

(a) The total number of atoms per unit cell of a face centred cubic crystal is :

(i) 01 (ii) 02 (iii) 03 (iv) 04

(b) The overall order of reaction which has rate expression Rate = $K[A]^{\frac{1}{2}}[B]^{\frac{3}{2}}$ is :

(i) 01 (ii) 02 (iii) 03 (iv) Zero

(c) The alloy containing a non-metal is :

(i) Brass (ii) Bronze (iii) Steel (iv) White metal

(d) A transition metal ion has configuration [Ar]3d^4 is in tripositive oxidation state. Its atomic number is :

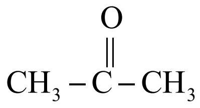
(i) 25 (ii) 26 (iii) 32 (iv) 19

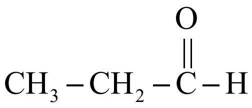
(e) Vitamin B_{12} is known as :

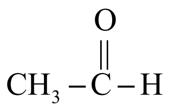
(i) Thiamine (ii) Riboflavin
(iii) Pyridoxine (iv) Cyano Cobalamine

(f) What is the product of the following reaction ?

$$CH_3 - C \equiv CH + H_2O \xrightarrow[60^0 C]{HgSO_4 / dil.H_2SO_4}$$

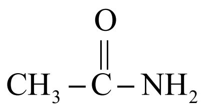
(i) 
$CH_3 - \overset{\overset{O}{||}}{C} - CH_3$

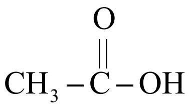
(ii) 
$CH_3 - CH_2 - \overset{\overset{O}{||}}{C} - H$

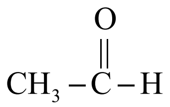
(iii) 
$CH_3 - \overset{\overset{O}{||}}{C} - H$

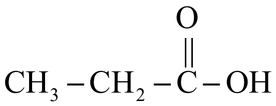
(iv) $CH_3 - CH_2 - CH_3$

(g) The product formed during hydrolysis of methyl nitrile in acid medium is :

(i) 
$CH_3 - \overset{\overset{O}{||}}{C} - NH_2$

(ii) 
$CH_3 - \overset{\overset{O}{||}}{C} - OH$

(iii) 
$CH_3 - \overset{\overset{O}{||}}{C} - H$

(iv) 
$CH_3 - CH_2 - \overset{\overset{O}{||}}{C} - OH$

2. Answer the following questions. **[1 x 7]**

(a) What is the IUPAC name of isopropy alcohol ?

(b) Between formaldehyde and acetaldehyde which gives Cannizzaro's reaction.

(c) What is molarity of 10% NaOH (W/V) solution ?

(d) What is the value of spin only magnetic moment of Fe^{2+} ion ?

(e) In ZnS Crystal, Zn^{2+} ions occupy ________ void.

(f) The inert gas used in beacon lights is _______ .

(g) The unit of rate constant of zero order reaction is _______.

GROUP -B

3. Answer any seven questions of the following : **[2 x 7]**

(a) Explain why HCl is a gas and HF is a liquid at room temperature.

(b) How can you convert ethanol to ethene ?

(c) What are Tranquilizers ? Give two examples.

(d) Prove that for a first order reaction the time required for 99% completion of the reaction is twice the time required for the completion of 90% of the reaction.

(e) What happens when calcium acetate is dry distilled ?

(f) Give two differences between Crystalline and Amorphous solids.

(g) What are antibiotics ? Write down the names of two antibiotics.

(h) Write the IUPAC name of the following compounds :

(i) $[Co(NH_3)_6]Cl_3$ and (ii) $Fe(CO)_5$

(i) With one example, explain roasting.

(j) 50 ml of $\frac{N}{10}$ NaOH solution, 100 ml of $\frac{N}{5}$ NaOH solution and 500 ml of $\frac{N}{2}$ NaOH solution are mixed together. What is the strength of the resultant solution ?

4. Answer any seven questions of the following : **[3 x 7]**

(a) What is lanthanide contraction ? Write any two of its consequences.

(b) $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution in 1 : 1 molar ratio gives the test for Fe^{2+} ion but $CuSO_4$ solution mixed with aqueous ammonia in 1 : 4 molar ratio does not give the test for Cu^{2+} ion. Explain why ?

(c) Why phenol is acidic in nature ?

(d) Explain the Hofmann bromamide reaction with one example.

(e) What are addition and condensation polymerisation. Give one example of each.

(f) What is a semiconductor ? What are n-type and p-type semiconductors ?

(g) Explain why transition metal ions are usually coloured.

(h) Explain the amphoteric behaviour of amino acids.

(i) Differentiate between multimolecular and macromolecular colloids.

(j) Boiling point of water is 100^0 C. Calculate the boiling point of an aqueous solution containing 5g urea (Mol. mass = 60) in l00g water (K_b for water = 0.52 K kgmol^{-1}).

GROUP -C

Answer any three questions.

5. State and explain Kohlrausch's law of independent migration of ions. The equivalent conductance at infinite dilution ($\wedge_0$) for sodium acetate, sodium chloride and hydrochloric acid are 78,109 and 384 ohm^{-1} cm^2 g. eq^{-1} respectively. Calculate $\wedge_0$ of acetic acid. [2+2+3

6. Write the assumptions of crystal field theory. Discuss the pattern of splitting of d-orbitals under the effect of an octahedral crystal field. [3+4

7. Derive an expression for the rate constant of a first order reaction. Define half-life period. A first order reaction takes 69.3 minutes for 50% completion. How much time will be needed for 80% completion ? [3+1+3

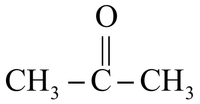
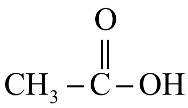
8. How can you distinguish between primary, secondary and tertiary alcohols ? With equation explain how does ethyl alcohol reacts with (i) acidified $K_2Cr_2O_7$ solution and (ii) phosphorus pentachloride. [3+2+2

9. (a) An organic compound (A) with molecular formula C_8H_8O forms an orange red precipitate with 2,4 dinitrophenyl hydrazine and gives yellow precipitate on heating with iodine in presence of sodium hydroxide. It neither reduces Tollen's reagent nor Fehling solution and it also does not decolourise bromine water or Baeyer's reagent. On drastic oxidation with chromic acid, it gives a carboxylic acid (B) having molecular formula $C_7H_6O_2$. Identify the compound (A) and (B) and explain in detail the reactions involved. [5

(b) What is the Willamson synthesis ? [2

ANNUAL - 2018 (ANSWERS)

1. (a) (iv) 04 (b) (ii) 02 (c) (iii) Steel (d) (i) 25,

(e) (iv) Cyano Cobalamine (f) (i)  $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ (g) (ii)  $CH_3-\overset{\overset{O}{\|}}{C}-OH$

2. (a) Propan-2-ol is the IUPAC name of isopropyl alcohol.

(b) Formaldehyde gives Cannizzaro's reaction.

(c) Molarity (M) of 10% NaOH $= \frac{10}{40} \times \frac{1000}{100} = 2.5\,M$

(d) Fe^{2+} is a $3d^6$ system and has four unpaired electrons (n = 4).

Hence, $\mu_s = \sqrt{n(n+2)} = \sqrt{4 \times 6} = \sqrt{24} = 4.9\,BM$

(e) In ZnS Crystal, Zn^{2+} ions occupy <u>tetrahedral</u> void.

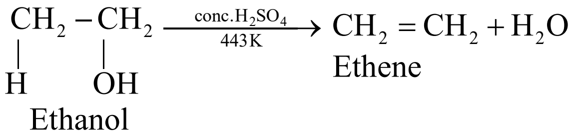
(f) The inert gas used in beacon lights is Neon (Ne).

(g) The unit of rate constant of zero order reaction is <u>concentration/time i.e. moles/ l/sec i.e. M/s.</u>

GROUP -B

3. (a) Due to high electronegativity of fluorine (4.0), the bond pair of electrons in H-F molecule is largely attracted towards fluorine and thus, HF forms hydrogen bonds. As a result of intermolecular hydrogen bonding in HF, the molecules remain in the associated state (HF) and exist as liquid. On the other hand, chlorine, having lower electronegativity (3.2) and bigger size does not form hydrogen bonding in HCl. Hence, HCl is a gas at room temperature, held by vander Waals force.

(b) Ethanol on heating with excess amount of conc. H_2SO_4 gives ethene at 443 K.



$$\underset{\text{Ethanol}}{\underset{\text{H}\quad\;\;\text{OH}}{CH_2-CH_2}} \xrightarrow[443\,K]{conc.H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$$

(c) The chemicals used to release mental tension and reduce anxiety for curing mental diseases are called tranquilizers. These are the constituents of sleeping pills. Examples : (i) Barbituric acid and its derivatives such as seconal and luminal (ii) Equanil is used in depression and hypertension.

(d) For a first order reaction, time required for 99% completion of the reaction,

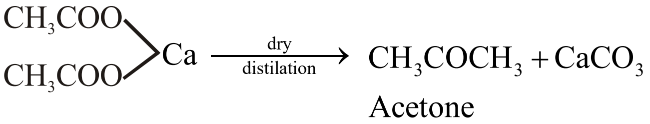
$$t_{0.99} = \frac{2.303}{k}\log\frac{100}{100-99} = \frac{2.303}{k}\times \log 100 = \frac{2.303}{k}\times 2 \quad \text{...........} \; (i)$$

Time required for 90% completion of the reaction,

$$t_{0.99} = \frac{2.303}{k}\log\frac{100}{100-90} = \frac{2.303}{k}\times \log 10 = \frac{2.303}{k}\times 1 \quad \text{............} \; (ii)$$

Dividing Eqn. (i) by (ii), we get, $\frac{t_{0.99}}{t_{0.9}} = \frac{\frac{2.303}{k}\times 2}{\frac{2.303}{k}\times 2} = 2$ or, $t_{0.99} = 2\times t_{0.9}$

(e) When calcium acetate is dry distilled alone, acetone is formed.



$$\begin{matrix}CH_3COO\\CH_3COO\end{matrix}\!\!>\!Ca \xrightarrow[distilation]{dry} \underset{\text{Acetone}}{CH_3COCH_3} + CaCO_3$$

Calcium acetate

(f) Main differences between crystalline and amorphous solids are given below.

	Crystalline solids		**Amorphous solids**
1.	In crystalline solids the constituent particles are arranged in a definite regular geometric order, which extends throughout the crystal over a long range.	1.	In amorphous solids the constituent particles are not arranged in any regular order i.e, randomly arranged.
2.	They have sharp melting points.	2.	They do not have sharp melting points i.e., having wide range of m.p.
3.	Crystalline solids exhibit anisotropy.	3.	Amorphous solids exhibit isotropy.
4.	The surface of cleavage is plane and smooth, when cut with a knife.	4.	The surface of cleavage is irregular, when cut with a knife.

(g) The chemical substances which are produced by micro-organism, and are capable of destroying or inhibiting the growth of other bacteria or micro-organism that cause infection are called antibiotics. *Examples :* penicillin, ampicillin, streptomycin, tetracyclin, chloramphenicol, amoxycillin etc.

(h) (i) IUPAC name of $[CoCNH_3)_6]Cl_3$ is : Hexaamminecobalt (III) chloride

(ii) IUPAC name of $[Fe(CO)_5]$ is : Pentacarbonyliron (O)

(i) Roasting is a process of heating the ore strongly in presence of excess of air at a temperature below the melting point of the metal. It is mainly employed in case of sulphide ore. As a result of roasting, (a) moisture and volatile impurities (S, P, As) are removed as their oxides (SO_2, As_2O_3, P_2O_5), (b) ores of the metal are converted to their oxides.

$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$$

$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$$

$$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$$

(j) Strength in terms of normality (N_{mix}) of the resultant solution can be expressed as:

$$N_{mix} = {\sum}^{N_iV_i}\Big/ V_{mix} = \frac{N_1V_1 + N_2V_2 + N_3V_3 + \ldots}{V_1 + V_2 + V_3 + \ldots}$$

$$= \frac{\left[(N/10)\times 50\right]\left[(N/5)\times 100\right]\left[(N/2)\times 500\right]}{50 + 100 + 500}$$

$$= \frac{5N + 20N + 250N}{650} = \frac{275N}{650} = 0.42\,N$$

4. (a) The overall decrease in atomic and ionic radii from lanthanum to lutetium in lanthanide series is called **Lanthanoid contraction**, which is a unique feature in the chemistry of lanthanoids. This is attributed to the imperfect shielding of one electron by another in the same subshell.

Consequences of Lanthanoid Contraction :

(i) Similarity of 2nd and 3rd transition series and difficult, in separation : The lanthanoid contraction causes the radii of the members of the third transition (5d) series to be very similar to those of the corresponding members of the second transition (or 4d) series. The almost identical radii Zr (160 pm) of 4d-series and Hf (159 pm) of 5d-series is an illustrative consequence of lanthanoid contraction, which accounts for their occurrence together in nature and the difficulties encountered in their separation.

(ii) Basic strength of Hydroxides : Due to the lanthanide contraction, the size of M^{3+} ions decreases and there is increase in covalent character of M-OH bond and hence the basic character gradually decreases from $La(OH)_3$ to $Lu(OH)_3$.

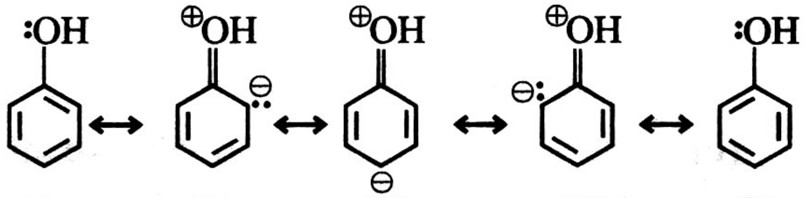
(b) $FeSO_4 + (NH_4)_2SO_4 + 6H_2O \rightarrow FeSO_4.(NH_4)_2SO_4.6H_2O$

Mohr's salt (a double salt) Mohr's salt is a double salt of two simple salts ($FeSO_4$ and $(NH_4)_2\,SO_4$) in equimolar proportion, which exists only in solid state, but completely dissociates into its constituent ions in aqueous solution and thus, gives test for Fe^{2+}, NH_4^+ & SO_4^{2-} ions. But copper sulfate with NH_3 (aq) in the molar ratio 1 : 4 forms a complex i..e, Tetraammine copper (II) sulphate.

$$CuSO_4 + \underset{\text{(Aqueous ammonia)}}{4NH_4OH} \longrightarrow [Cu(NH_3)_4]SO_4 + 4H_2O$$

Tetraamine copper (II) complex cation does not give test for Cu^{2+} ion.

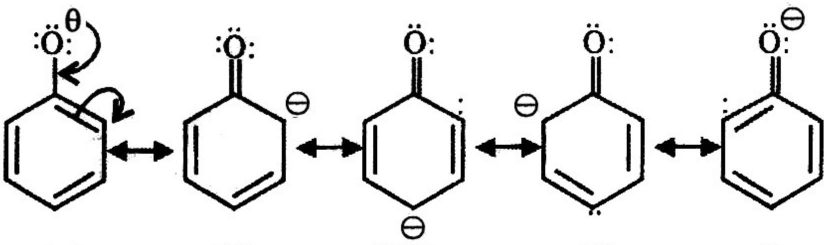
(c) The greater acidic nature of phenols as compared to alcohols can be explained on the basis of resonance. Phenol is a resonance hybrid of the following structures involving charge separation.



I II III IV V

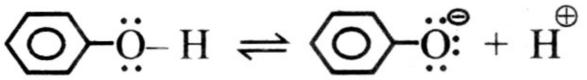
Out of five, three structures of phenol (II, III and IV) involve **charge separation** and have less contribution towards resonance hybrid.

On the other hand, the phenoxide ion is more resonance stabilised because the resonating structures involve **no charge separation.**



VI VII VIII IX X

Since phenoxide, the conjugate base is more stabilised by resonance, the equilibrium between phenol and phenoxide ion,



Phenol Phenoxide ion

is shifted towards right facilitating the release of proton (H^+) and causing phenol acidic.

(d) Primary amines can be prepared from amides by treatment with Br_2 and KOH. The amine formed contains one carbon atom less than the parent amide.

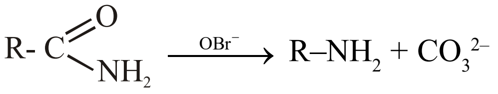
Therefore, this method is used for stepping down the series in organic conversions.

$$\underset{\text{Alkanamide}}{R\text{–}CONH_2} + Br_2 + 4KOH \longrightarrow \underset{\text{Primary amine}}{R\text{–}NH_2} + 2KBr + K_2CO_3 + 2H_2O$$

$$\underset{\text{Acetamide}}{CH_3CONH_2} + Br_2 + 4KOH \longrightarrow \underset{\text{Methyl amine}}{CH_3NH_2} + 2KBr + K_2CO_3 + 2H_2O$$

Mechanism of Hofmann's degradation reaction.

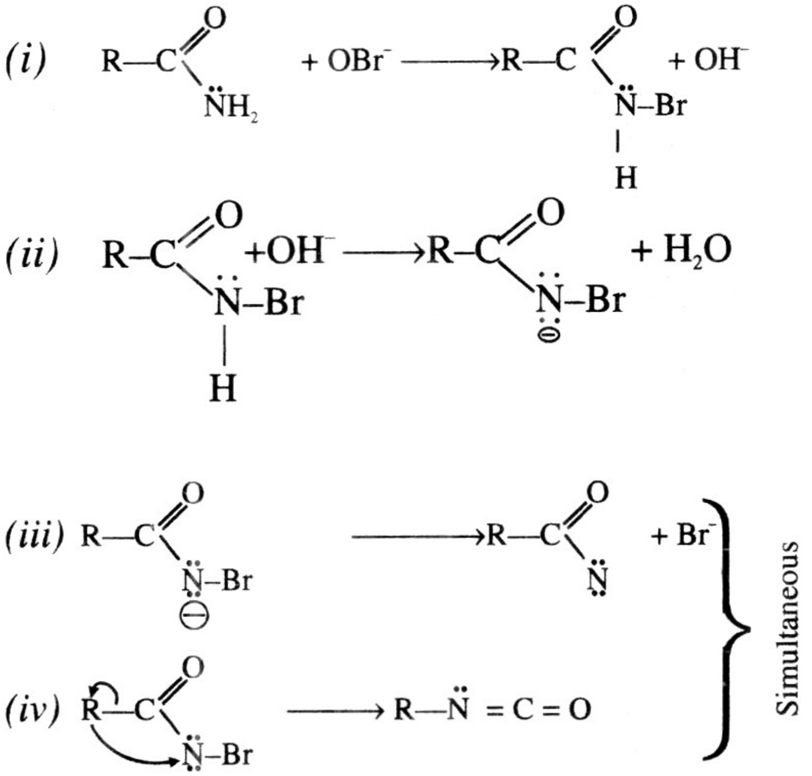
In Hofmann degradation of amide to primary amine,



$$\text{R-}C(=O)NH_2 \xrightarrow{OBr^-} R\text{–}NH_2 + CO_3^{2-}$$

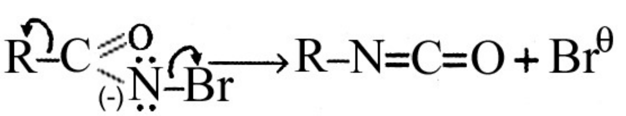
Acid amide 1°amine

$(Br_2 + 2\,KOH \rightarrow KBr + K^+OBr^- + H_2O)$ the rearrangement occurs due to migration of alkyi group (-R) attached to carbonyl carbon atom in amide to nitrogen atom in the product. Therefore, the reaction is believed to proceed through the following steps :



(v) $R - \ddot{N} = C = O + 2OH^- \xrightarrow{H_2O} R - \ddot{N}H_2 + CO_3^{2-}$

The actual rearrangement occurs in Step (iv), where Step (iii) and Step (iv) are generally believed to occur simultaneously because the attachment of R to nitrogen helps in pushing out the bromide ion. This simultaneous rearrangement can be represented as :



The last Step (v) is just the hydrolysis of alkyl isocyanate (R-N=C=O).

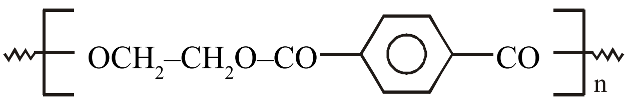
(e) In addition polymerisation, the molecules of same or different monomers combine to form a large polymer without the elimination of some other molecules.

$$\underset{\text{Ethene}}{nCH_2 = CH_2} \xrightarrow{\text{Addition Polymerisation}} \underset{\text{Polythene}}{\sim\!\!\left[CH_2 - CH_2 \right]_n\!\!\sim}$$

PVC, teflon, orlon, styron, Buna-S, neoprene are other examples of addition polymers, or chain growth polymers.

In condensation polymerisation, the molecules of two or more bifunctional monomers undergo a series of condensation reactions with the elimination of simple molecules (water, ammonia, alcohol, etc.).

Ethylene glycol Terephthalic acid



Terylene (or dacron)

Nylon 6,6, nylon 6,10, bakelite, glyptal, melamine etc. are other examples of condensation polymers or step growth polymers.

(f) A semiconductor is a solid material that has an intermediate range of conductivity (10^{-6} to 10^{4} ohm^{-1} m^{-1}) between that of an insulator (10^{-20} to 10^{-10} ohm^{-1} m^{-1}) and that of a conductor (10^{4} to 10^{7} ohm^{-1} m^{-1}).

On the basis of the energy gap or band gap, a semiconductor is defined as a solid substance that has an intermediate band gap (in the range 4~0.1 eV) between insulator and conductor.

The conductivity as well as the band gap range can be maintained either due to the addition of an impurity or because of temperature effect. When silicon (Si) or germanium (Ge) i.e. an element of group 14 is doped with a group 15 element like phosphorus (P) or arsenic (As) as impurity having five valence electrons (i.e. doped with an electron rich impurity), n-type semiconductor is obtained, where ‘n’ stands for ‘negative’ (with electrons are charge carriers).

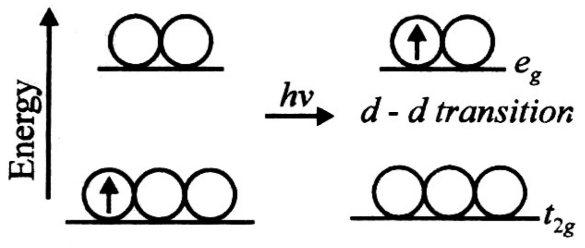
On the other hand, when Si or Ge (an element of group 14) is doped with an electron deficient impurity i.e. with a group 13 element like B, Al, Ga or In, a p-type semiconductor is obtained, where ‘p’ stands for **‘positive’** (with positive holes as charge carriers).

(g) Most of the compounds of transition metals are coloured in the solid form or solution form. This is in contrast to the compounds of s- and p-block elements which are usually white.

Explanation. The colour of the compounds of transition metals may be attributed to the presence of incomplete (n-1) *d*-orbitals. In the case of compounds of transition metals, the energies of the five d-orbitals no longer remain equal. Under the influence of approaching ions towards the central metal ion, the d-orbitals of the central metal split into different energy levels.

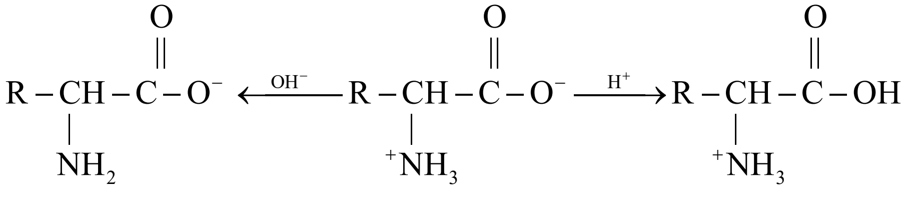
This phenomenon is called crystal field splitting. For example, when the six ions or molecules approach the metal ion (called octahedral field), the five d-orbitals split up into two sets : one set consisting of two d-orbitals $\left(d_{x^2-y^2}, d_{z^2}\right)$ of higher energy called e_g set and the other set consisting of three d-orbitals (d_{xy}, d_{yz}, d_{zx}) of lower energy called t_{2g} set.

In the case of the transition metal ions, the electrons can be easily promoted from one energy level to another within the same d-orbitals. These are called **d-d transitions**. The amount of energy required to excite some of the electrons to higher energy states within the same d-orbitals 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 and the electron gets raised from lower energy set of orbitals to higher energy set of orbitals as shown below :



The excess of other colours constituting white light are transmitted and the compound appears coloured. The observed colour of a substance is always complementary colour of the colour which is absorbed by the substance. For example, Ti^{3+} compounds contain one electron in d-subshell (d^1). It absorbs green and yellow portions from the white light and blue and red portions are emitted. Therefore, Ti^{3+} ions appear purple. Similarly, hydrated cupric compounds absorb radiations corresponding to red light and the transmitted colour is greenish blue (which is complementary colour to red colour). Thus, cupric compounds have greenish-blue colour.

(h) Amino acids are generally colourless, salt like crystalline high melting solid soluble in water but insoluble in organic solvents. This salt like behaviour is due to its dipolar or Zwitter ion form (amphoteric nature). In acidic medium, the carboxylate, –COO group accepts a proton and gets converted to –COOH group. (Showing basic nature of $-COO^-$ group). While in basic medium, $-NH_3^+$ group loses its proton and gets converted to $-NH_2$ group (showing acidic nature of $-NH_3^+$ group)



$$R-\underset{\displaystyle NH_2}{\underset{|}{CH}}-\overset{\displaystyle O}{\overset{\|}{C}}-O^- \xleftarrow{OH^-} R-\underset{\displaystyle {}^+NH_3}{\underset{|}{CH}}-\overset{\displaystyle O}{\overset{\|}{C}}-O^- \xrightarrow{H^+} R-\underset{\displaystyle {}^+NH_3}{\underset{|}{CH}}-\overset{\displaystyle O}{\overset{\|}{C}}-OH$$

Negative ion Zwitter ion Positive ion

Thus, in amino acids, the basic character is due to $-COO^-$ group and acidic character is due to $-NH_3^+$ group. As a result, amino acids show amphoteric behaviour.

(i) Depending upon the size of the particles, the colloids can be classified as :

(i) Multimolecular colloids : When on dissolution, a large number of atoms or smaller molecules of a substance (having size less than 1 nm) aggregate together to form particles of colloidal size, then the particles so formed are called multimolecular colloids.

In these sols the dispersed phase consists of aggregates of atoms or molecules with molecular size less than 1 nm. For example, in sols of gold atoms or sulphur (S_8) molecules in water form multimolecular colloid. These particles are held together by van der Waals forces.

(ii) Macromolecular colloids : When substances having larger size molecules (called macro molecules) on dissolution form colloidal solution in which the dispersed phase particles have size of colloidal dimension, then the colloid so formed are called macromolecular colloids.

These macromolecules forming the dispersed phase are usually polymers of very high molecular masses. Examples of naturally occurring macro-molecules are starch, cellulose, proteins, enzymes, gelatin, etc. Examples of artificial macromolecules are nylon, polythene, plastics, polystyrene, etc. Since these macromolecules have large sizes comparable to those of normal colloidal particles, the solutions of such molecules are called macromolecular colloids. Their solutions are quite stable and resemble true solution in many respects.

Differences between multimolecular colloids and macromolecular colloids.

	Multimolecular colloids		**Macromolecular colloids**
1.	These are formed by the aggregation of atoms or molecules which generally have diameter less than 1 nm Ex. sols. of S_8 and gold sol.	1.	These are molecules of large size. Ex. starch, nylon, rubber.
2.	Molecular masses are not high.	2.	Molecular masses are high.
3.	The atoms or molecules are held by weak van der Waals' forces.	3.	The large molecules are held by stronger van der Waals' forces.
4.	They have usually lyophilic character.	4.	They have usually lyophobic character.

(j) We know that,

$$\Delta T_b = \frac{K_b \times w_B \times 1000}{M_B \times w_A}$$

$K_b = 0.52$ K kg mol^{-1}, $w_B = 5$g.

$M_B = 60$, $w_A = 100$ g

$$\therefore \quad \Delta T_b = \frac{0.52 \times 5 \times 1000}{60 \times 100} = 0.433^0\text{C}$$

Thus, boiling point of the solution = $(100 + 0.433)^0$ C = 100.433^0C.

Group - C

5. Kohlrausch studied the molar conductances,

statement :

Λ^0_m at infinite dilution, for a number of pairs of strong electrolytes having a common cation or anion. The difference of Λ^0_m of different pairs of electrolytes having a common cation or a common anion are found almost same. For example, the difference between the molar ionic conductances of K^+ and Na^+ is found 23.4 ohm^{-1} cm^2 mol^{-1} irrespective of the nature of anion, as calculated below:

$$\Lambda_{KCl}^0 - \Lambda_{NaCl}^0 = \Lambda_{KBr}^0 - \Lambda_{NaBr}^0 = \Lambda_{KNO_3}^0 - \Lambda_{NONO_3}^0$$

$$= \lambda_{K^+}^0 - \lambda_{Na^+}^0$$

$$= 23.4 \text{ ohm}^{-1} \text{ cm}^2 \text{ gram eqvt.}^{-1}$$

Similarly keeping cation fixed it's found that

$$\Lambda_{KCl}^0 - \Lambda_{KNO_3}^0 = \Lambda_{NaCl}^0 - \Lambda_{NaNO_3}^0 = \Lambda_{LiCl}^0 - \Lambda_{LiNO_3}^0$$

$$= \lambda_{Cl^-}^0 - \lambda_{NO_3^-}^0 = 4.9 \text{ ohm}^{-1} \text{ cm}^2 \text{ gram eqvt}^{-1}.$$

Conclusion :

Cl^{-1}, Br^{-1} or NO_3^- ions have definite contribution towards Λ_{eqv} of respective electrolyte irrespective of their association with K^+ or Na^+ or Li^+.

If molar conductivity of the cation is denoted by $\lambda_{m(+)}^0$, and that of anion by $\lambda_{m(-)}^0$, then Kohlrausch law is expressed as follows :

$$\Lambda_m^0 = n_+\lambda_m^0 + n\_\,\lambda_{m-}^0$$

where n^+ and $n\_$ are the number of cations and anions per formula unit of electrolyte (for HCl, $n_+ = n_- = 1$, and for $MgCl_2$, $n_+ = 1$ and $n\_ = 2$). λ_{m+}^0 and λ_{m-}^0 are also called molar ionic conductances at infinite dilution. For example,

For HCl : $\Lambda_m^0(HCl) = \lambda^0(H^+) + \lambda^0(Cl^-)$

For KNO_3 : $\Lambda_m^0(KNO_3) = \lambda^0(K^+) + \lambda^0(NO_3^-)$

For $MgCl_2$: $\Lambda_m^0(MgCl_2) = \lambda^0(Mg^{2+}) + 2\lambda^0(Cl^-)$

For $Al_2(SO_4)_3$: $\Lambda_m^0\left[Al_2(SO_4)_3\right] = 2\lambda^0(Al^{3+}) + 3\lambda^0(SO_4^{2-})$

Problem :

Given that

$\wedge_{eq}^0(CH_3COONa) = 78 \text{ ohm}^{-1} \text{ cm}^2 \text{ g.eq}^{-1}$

$\wedge_{eq}^0(NaCl) = 109 \text{ ohm}^{-1} \text{ cm}^2 \text{ g.eq}^{-1}$

$\wedge_{eq}^0(HCl) = 384 \text{ ohm}^{-1} \text{ cm}^2 \text{ g.eq}^{-1}$

$\therefore \wedge_{eq}^0(CH_3COOH)$

$= \wedge_{eq}^0(CH_3COONa) + \wedge_{eq}^0(HCl) - \wedge_{eq}^0(NaCl)$

$= 78 + 384 - 109 = 353.0 \text{ ohm}^{-1} \text{ cm}^2\text{g.eq}^{-1}$

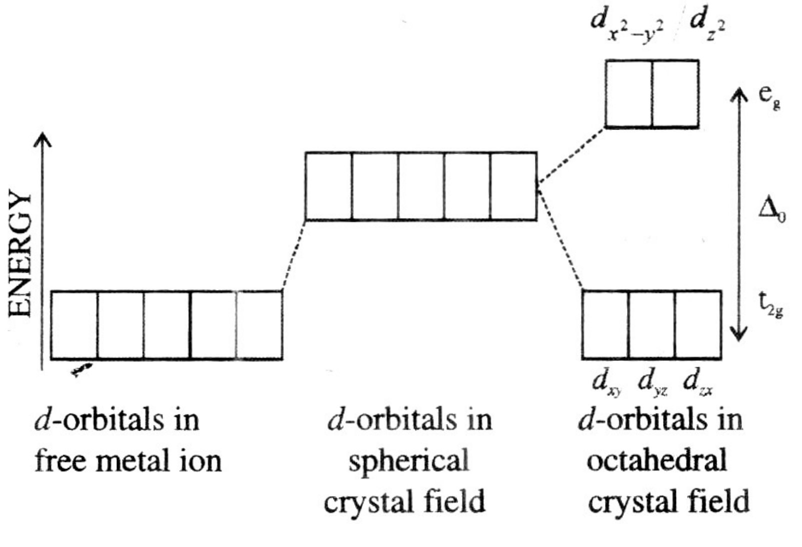
Postulates :

6. (i) CFT considers the anionic ligands (F^-, Cl^-, CN^- etc.) as point charges and neutral ligands (H_2O, NH_3 etc.) as point dipoles.

   (ii) It does not consider the covalent bonding in complexes by orbital overlapping but it assumes the interaction between central metal cation and the ligands (point charges) to be electrostatic in nature. Thus, the bond between cation and ligand is considered as purely ionic.

(iii) In a complex, the degeneracy (i.e. equality in energy) of five d-orbitals is removed due to unequal approach of ligands (point charges) to the lobes of the d-orbitals of central metal atom/ion (i.e. along the axes and between axes). This lifting of degeneracy results in splitting of the five d-orbitals of metal atom or ion into two sets of orbitals (e_g set and t_{2g} set) having different energies and this separation is called **crystal field splitting**. The energy difference between two sets of d-orbitals is called **crystal field splitting energy** and is denoted by Δ_0 (for octahedral crystal field) or Δ_t (for tetrahedral crystal field).

Octahedral Crystal field : When the six ligands approach the central metal atom/ion, the average energy of d-orbitals increases relative to that of the free ion (as expected in a spherically symmetrical crystal field without lifting of degeneracy). As the electrons in $d_{x^2-y^2}$ and d_{z^2} orbitals lying along the axes get repelled by the electrons of the ligands more strongly than those in d_{xy}, d_{yz} and d_{zx}, whose lobes are directed in between the axes, the $d_{x^2-y^2}$ and d_{z^2} orbitals (called e_g set) acquire higher energy and d_{xy}, d_{yz} and d_{zx}, orbitals (called t_{2g} set) acquire lower energy as compared to the hypothetical average energy of degenerate *d*-orbitals of metal ion in the spherical crystal field.

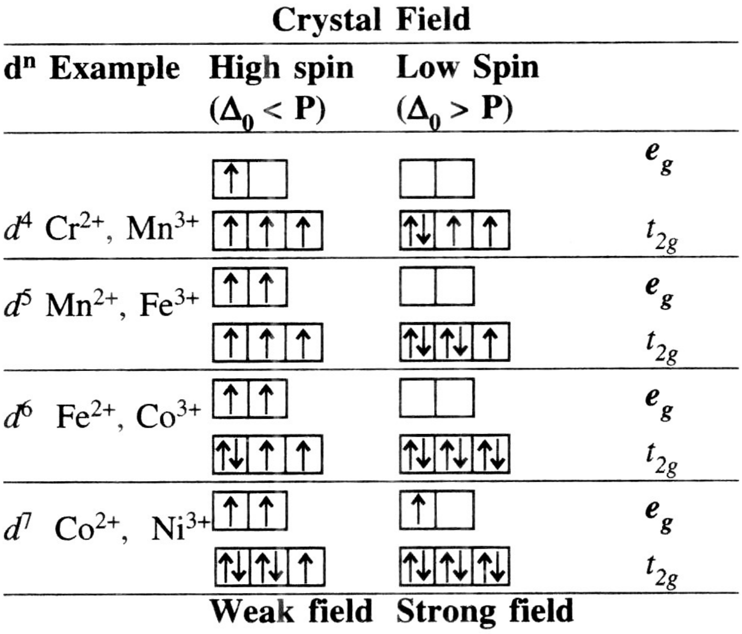


Splitting of *d*-orbitals in an octahedral crystal field.

High spin and low spin states (weak and strong crystal field) :

The *d*-electrons of the metal ion in an octahedral complex tend to occupy lower energy orbitals of t_{2g} set in preference to the higher energy orbitals of eg set (as per Aufbau principle), which stabilise the complex. In the octahedral complexes with d^1 (Ti^{3+}), d^2 (Ti^{2+}, V^{3+}), d^3 (V^{2+}, Cr^{3+}) system, the *d*-electrons occupy only triple degenerate t_{2g} orbitals (single filled as per Hund's rule). But for octahedral complexes with d^4 (Cr^{2+}, Mn^{3+}), d^5 (Mn^{2+}, Fe^{3+}), d^6(Fe^{2+}, Co^{3+}) and d^7(Co^{2+}, Ni^{3+}) systems, two possible patterns of electron distribution arise in two different situations, namely high spin situation in weak crystal field (if $\Delta_0 < P$) and low spin situation in strong crystal field (if $\Delta_0 > P$), P, the energy required for pairing of electrons in a single orbital) as shown in table.

High and Low spin configuration in Octahedral



Crystal Field

d^n Example	High spin ($\Delta_0 < P$)	Low Spin ($\Delta_0 > P$)	
	[↑][ ]	[ ][ ]	e_g
d^4 Cr^{2+}, Mn^{3+}	[↑][↑][↑]	[↑↓][↑][↑]	t_{2g}
d^5 Mn^{2+}, Fe^{3+}	[↑][↑]	[ ][ ]	e_g
	[↑][↑][↑]	[↑↓][↑↓][↑]	t_{2g}
d^6 Fe^{2+}, Co^{3+}	[↑][↑]	[ ][ ]	e_g
	[↑↓][↑][↑]	[↑↓][↑↓][↑↓]	t_{2g}
d^7 Co^{2+}, Ni^{3+}	[↑][↑]	[↑][ ]	e_g
	[↑↓][↑↓][↑]	[↑↓][↑↓][↑↓]	t_{2g}
	Weak field	Strong field	

For d^1 to d^3 and d^8 to d^{10} ions in octahedral complex have the same electronic configuration in presence of weak field ligands like I^-, Br^-, Cl^-, F^-, OH^-, etc. with small value of Δ_0 as well as strong field ligands like NH_3, ethylenediamine (en), NO_2^-, CN^-, CO, etc. with large value of Δ_0.

Magnetic Character and spin state of complex in Octahedral Crystal field : On examining two different types of electronic configuration in table for Co^{3+} (d^6), the paramagnetic character of $[CoF_6]^{3-}$, a high spin complex (with weak field ligand, F^-) and diamagnetic character of $[Co(NH_3)_6]^{3+}$, a low spin complex (with strong field ligand, NH_3) is clearly understood. The relative values of Δ_0 and P (electron pairing energy) is the basis of prediction of magnetic nature of complexes using the principle that strong ligands cause pairing of electrons in t_{2g} orbitals (because $\Delta_0 > P$) resulting the formation of low spin complex with less unpaired electrons. The effective magnetic moments (μ_{eff}) is calculated by using the relation, $\mu_{eff} = \sqrt{n(n+2)}$ BM, where n is number of unpaired electrons. (BM = Bohr magneton, $1\,BM = \frac{eh}{4\pi mc}$)

7. A first order reaction is that reaction in which the rate of reaction is directly proportional to the molar concentration of the single reacting species.

Consider the general first order reaction $A \longrightarrow$ Products

Let [A] is the concentration of the reactant A at time '*t*' and k_1 is the rate constant for the first order reaction. For the first order reaction, the rate of this reaction is directly proportional to the concentration of the reactant A. Thus,

$$\text{Rate} = -\frac{d[A]}{dt} = k_1[A] \qquad ....(1)$$

This form of rate law is known as **differential rate equation**. Rearranging the above equation :

$$-\frac{d[A]}{[A]} = k_1\, dt \qquad \text{........ (2)}$$

Integrating the above equation, we get

$$-\int \frac{d[A]}{[A]} = k_1 \int dt$$

$$-\ \ln [A] = k_1 t + I \qquad \text{.........(3)}$$

where I is the constant of integration. The value of I can be calculated by imposing limiting condition. When, the initial concentration of A be $[A]_0$ at $t = 0$, then Eqn. (3) becomes $-\ln [A]_0 = k_1 \times 0 + I$

$\therefore\ I = -\ln [A]_0$

Substituting the value of I in Eqn. (3), we get

$$-\ln [A] = k_1 t - \ln [A]_0$$

Rearranging,

$\ln[A]_0 - \ln [A] = k_1 t$

$$\Rightarrow \qquad \ln\frac{[A]_0}{[A]} = k_1 t$$

$$\Rightarrow \qquad \boxed{k_1 = \frac{1}{t}\ \ln\frac{[A]_0}{[A]}} \qquad \text{............. (4)}$$

Changing the above expression to log base 10 ($\ln x = 2.303 \log x$), we get

$$\boxed{k_1 = \frac{2.303}{t}\log\frac{[A]_0}{[A]}} \qquad \text{.............. (5)}$$

The Eqn. (5) is integrated rate expression for the first order reaction.

Alternatively, the above equation can also be written in another form. Let the initial concentration of A is 'a' moles per litre. Suppose in time t, x moles of reactants get changed to products. Then the concentration of A left after time t is a - x. Hence,

$[A]_0 = a$ and $[A] = a - x$

Thus, Eqn. (5) becomes

$$\boxed{k_1 = \frac{2.303}{t}\log\frac{a}{a - x}} \qquad \text{.......... (6)}$$

Half-life period : Half-life period ($t_{0.5}$) of a reaction is defined as the time in which the concentration of a reactant falls to the half of its initial concentration.

Half life period and rate constant : t = 0, the concentrat of A = [A] at $t_{0.5}$ it reduces to $[A]_{0/2}$. Putting the values of equation –5, we get

$$k_1 = \frac{2.303}{t_{0.5}}\log\frac{[A]_0}{[A]_{0/2}} = \frac{2.303 \times 0.301}{t_{0.5}}.$$

Thus, $t_{0.5} = \dfrac{0.693}{k}$

Problem :

Given that time required for 50% completion, $t_{0.5} = 69.3$ min

For a first order reaction,

Half-life period, $t_{0.5} = \dfrac{0.693}{k}$

$\Rightarrow$ Rate constant, $k = \dfrac{0.693}{t_{0.5}} = \dfrac{0.693}{69.3} = 10^{-2}\ \text{min}$

Hence, time required for 80% completion of the reaction,

$$t_{0.8} = \frac{2.303}{k}\log\frac{100}{100-80} = \left\{\frac{2.303}{10^{-2}} \times \log\frac{100}{20}\right\}\ \text{min}$$

$$= 2.303 \times 100 \times \log 5$$

$$= 230.3 \times 0.699 = 160.98 \ \text{min}$$

8. Primary, secondary and tertiary alcohols can be distinguished by the following tests : **Lucas Test:** In this test, an alcohol is treated with an equimolar mixture of concentrated hydrochloric acid and anhydrous $ZnCl_2$ (called Lucas reagent). The alcohols get convened into alkyl halides. Since the alkyl halides are insoluble in water, their formation is indicated by the appearance of turbidity in the reaction mixture. Since the order of reactivity of alcohols with halogen acids is tertiary > secondary > primary, the time required for the appearance of cloudiness will be different in different alcohols and this test helps to distinguish them from one another.

(a) A tertiary alcohol produces cloudiness immediately.

(b) A secondary alcohol produces cloudiness within five minutes.

(c) A primary alcohol produces cloudiness only upon heating.

$$\gt C-OH + HCl \xrightarrow{\text{Anhyd.}ZnCl_2} \gt C-Cl + H_2O$$

Alkyl chloride

Distinction

Reagent	1^0 alcohol	2^0 alcohol	3^0 alcohol
Lucas reagent. Conc. HCl $+$Anhy.$ZnCl_2$	Turbidity appears on heating $RCH_2OH + HCl \xrightarrow{\Delta}$	Turbidity appears after some time.$R_2CHOH + HCl$ $\longrightarrow R_2CHCl + H_2O$	Turbidity appears immediately $R_3C(OH) + HCl$ $\rightarrow R_3CCl + H_2O$

Victor Meyer's Test : This test involves the following steps :

(i) The given alcohol is treated with red phosphorus and iodine resulting in the formation of corresponding alkyl iodide.

(ii) The alkyi iodide is treated with silver nitrite to form corresponding nitroalkane.

(iii) The nitroalkane is finally reacted with nitrous acid (i.e., $NaNO_2$ + dil H_2SO_4) and the resulting solution is made alkaline.

Formation of a blood red colour indicates the primary alcohol.

Formation of a blue colour shows the original alcohol to be secondary while, a colourless solution means that the alcohol is a tertiary alcohol.

The difference reactions taking place are shown below :

Primary alcohol	**Secondary alcohol**	**Tertiary alcohol**
RCH_2OH	R_2CHOH	$R_3C–OH$
$\downarrow P + I_2$	$\downarrow P + I_2$	$\downarrow P + I_2$
RCH_2I	R_2CHI	R_3CI
$\downarrow AgNO_2$	$\downarrow AgNO_2$	$\downarrow AgNO_2$
RCH_2NO_2	R_2CHNO_2	R_3CNO_2
$\downarrow$ HONO ($NaNO_2$ + HCl)	$\downarrow$ HONO	$\downarrow$ HONO
$R-\underset{\underset{NOH}{\Vert}}{C}-NO_2$	$R_2\underset{\underset{NO}{\vert}}{C}-NO_2$	No reaction as α – hydrogen is absent
(Nitric acid) Give **blood red colour** when made alkaline)	Pseudo nitrol Gives **blue colour with alkali**	**Colourless solution**

Properties of ethyl alcohol :

(i) **With acidified $K_2Cr_2O_7$** solution : Ethyl alcohol is readily oxidised by acidified $K_2Cr_2O_7$ solution to form first acetaldehyde and then acetic acid.

$$\underset{\text{Ethyl alcohol}}{CH_3CH_2OH} \xrightarrow[Cr_2O_7^{-2}/H^+]{[O]} \underset{\text{Acetaldehyde}}{CH_3CHO} \xrightarrow{[O]} \underset{\text{Acetic acid}}{CH_3COOH}$$

$$\left[Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2\ Cr^{3+} + 7H_2O\right] \times 2$$

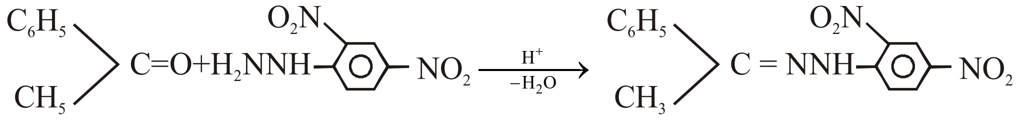
$$3 \times \left[CH_3 - CH_2OH + H_2O \longrightarrow CH_3COOH + 4H^+ + 4e^-\right]$$

(ii) **With Phosphorus pentachloride (PCl_5) :**

Ethyl alcohol reacts with PCl_5 to form ethyl chloride.

$$\underset{\text{Ethyl alcohol}}{C_2H_5OH} + PCl_5 \rightarrow \underset{\text{Ethyl chloride}}{C_2H_5Cl} + POCl_3 + HCl$$

9. **(a)** The given organic compound (A) with molecular formula C_8H_8O is acetophenone, $CH_3COC_6H_5$. It forms an orange red precipitate with 2,4-dinitrophenyl hydrazine (Brady's reagent).



Acetophenone 2,4-Dinitrophenyl hydntzine — Acetophenon 2,4-dinitrophynyl hydrazone (Orange red precipitate)

Acetophenone ($CH_3COC_6H_5$) being a methyl ketone gives a yellow precipitate of iodoform (CHI_3) on heating with iodine in presence of NaOH.

$$CH_3COC_6H_5 + 3I_2 \xrightarrow{NaOH} CI_3COC_6H_5 + 3HI$$

Acetophenone

(Yellow)

Acetophenone ($CH_3COC_6H_5$) being a ketone

(i) fails to reduce Tollen's reagent

(ii) fails to reduce Fehling solution

(iii) fails to decolourise bromine water or Baeyer's reagent.

Acetophenone ($CH_3COC_6H_5$) being a ketone gives benzoic acid, C_6H_5COOH, having molecular formula $C_7H_6O_2$, a carboxylic acid (B) on drastic oxidation with chromic acid (H_2CrO_4).

$$\underset{\text{Acetophenone}}{C_6H_5COCH_3 + 4[O]} \xrightarrow[\text{Oxidation}]{\text{Drastic}} \underset{\text{Benzoic acid (B)}}{C_6H_5-COOH} + CO_2 + H_2O$$

(b) Alkyl halide on treatment with sodium alkoxide gives ether. This method of preparation of ether is known as Williamson synthesis.

$$\underset{\text{Alkyl halide}}{R\text{–}X} + \underset{\text{Sodium alkoxide}}{R'ONa} \rightarrow \underset{\text{Ether}}{R\text{-}O\text{-}R'} + NaX$$

$$\underset{\text{Ethyl halide}}{C_2H_5Br} + \underset{\text{Sodium ethoxide}}{CH_3ONa} \rightarrow \underset{\text{Ethyl methyl ether}}{C_2H_5OCH_3} + NaBr$$

❖ ❖ ❖

ANNUAL - 2017

Time - 3 Hours **Full Marks - 70**

Answer all Groups as indicated.
The figures in the right-hand margin indicate marks.
Answer all the bit questions of a particular question serially at one place to ensure effective valuation.

GROUP-A

All questions are compulsory.

1. Choose and write the correct answer of the following : [1 x 10

(a) Which kinds of isomeris m are exhibited by octahedral $Co(NH_3)_4Br_2Cl$?

(i) Geometrical and ionization (ii) Geometrical and optical

(iii) Optical and ionization (iv) Geometrical only

(b) Benzylchloride can be prepared from toluene by reacting with :

(i) HCl (ii) SO_2Cl_2 (iii) $SOCl_2$ (iv) NaOCl

(c) Aspirin is :

(i) Sedative (ii) Antipyretic (iii) Anti-biotic (iv) Antiseptic

(d) Which amino acid has phenolic-OH group as its backbone ?

(i) Glycine (ii) Leucine (iii) Serine (iv) Tyrosine

(e) One of the following is a cross-linked polymer :

(i) Bakelite (ii) Glycogen (iii) Nylon (iv) Polythene

* (f) For the process, $H_2O(l)$ (1 bar, 273K) $\rightarrow$ $H_2O(g)$ (1 bar 373 K), the correct set of thermodynamic parameters is :

(i) $\Delta G = O, \Delta S = +ve$ (ii) $\Delta G = O, \Delta S = -ve$

(iii) $\Delta G = +ve, \Delta S = O$ (iv) $\Delta G = -ve, \Delta S = +ve$

* (g) When two reactants, A and B are mixed to give products C and D, the reaction quotient, Q at the initial stages of the reaction :

(i) is zero (ii) decreases with time

(iii) is independent of time (iv) increases with time

* (h) The solubility of $Ca(OH)_2$ is s mol L^{-1}. The K_{sp} under the same conditions is :

(i) $4s^3$ (ii) $3s^4$ (iii) $4s^2$ (iv) s^3

* (i) Uranium (A = 238, Z = 92) emits an α -particle. The product has mass number (A) and atomic number (Z), respectively, are:

(i) 238 and 92 (ii) 234 and 90

(iii) 238 and 90 (iv) 236 and 90

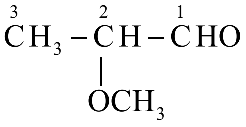
* (j) XeF_4 and XeF_6 are expected to be :

(i) oxidising (ii) reducing

(iii) unreactive (iv) strongly basic

2. (A) Answer the following questions : **[1 x 5]**

(a) Write the IUPAC name of the following compound :



$$\overset{3}{C}H_3-\underset{\substack{|\\ OCH_3}}{\overset{2}{C}H}-\overset{1}{C}HO$$

(b) Write the unit of cell constant.

(c) What happens when nitrobenzene reacts with conc. HNO_3 in the presence of conc. H_2SO_4 ?

(d) Esterification does not take place between ethyl alcohol and excess H_2SO_4 at 170°C. Explain.

(e) Identify A and B in the following reaction:

$$CH_3Br \xrightarrow{Mg/ether} [A] \xrightarrow[(ii)\ H_2O/H^+]{(i)\ CO_2} [B]$$

(B) Fill in the blanks : **[1 x 5]**

(a) Concentrated hydrogen fluoride exists in the molecular formula of_______.

(b) Phenol on oxidation with air gives________.

(c) If the activation energy of a reaction is low, the reaction is relatively_______.

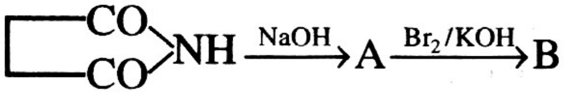
(d) For the gaseous reaction, $aA + bB \rightleftharpoons cC + dD$, Δn is equal to ______.

(e) The thermal stability of the hydrides of Group 16 _______ down the group.

GROUP -B

3. Answer any ten questions : **[2 x 10]**

(a) Complete the following reaction and write the names of A and B.



(b) Using EAN rule predict the molecular formula of nickel carbonyl.

* (c) How does copper metal react with ammonia ? Give the reaction with the product formed.

* (d) State Le-Chatelier's principle and explain the effect of temperature on the synthesis of NH_3.

* (e) What are pesticides ? What are different types of pesticides ? Name one of each type.

(f) What is Stephen's reduction reaction? Give equation.

(g) Calculate the entropy change involved in the conversion of one mole of water at 373K to vapour at the same temperature.

(Latent heat of vaporisation of water at this temperature, $\Delta H_{vap} = 2.257\ kJg^{-1}$).

(h) What is, the equilibrium constant expression for the reaction ?

$$P_4(s) + 5O_2(g) \rightleftharpoons P_4O_{10}(s)$$

(i) The concentration of hydrogen ion in a sample of soft drinks is 3.8×10^{-3} M. What is its pH ?

(j) How is benzoic acid converted to benzaldehyde ?

(k) What is Benzoin condensation ? Give equation.

(l) Identify A and B in the following reaction :

$$C_6H_5 - CH_2 - CHBr - CH_3 \xrightarrow[\Delta]{\text{alc. KOH}} A \xrightarrow{\text{HBr}} B$$

4. Answer any three questions : [3 x 3]

(a) Derive the Nernst equation of electrode potential at 25^0C for the electrode reaction,

$$M^{n+}(aq) + ne \rightleftharpoons M(s)$$

(b) A compound 'A' having molecular formula $C_2H_5O_2N$ on reaction with Sn and conc. HCl gives a compound. B which when treated with $NaNO_2$ and dil HCl gave compound C having molecular formula C_2H_6O. The compound C when treated with Na metal gives effervescence and when reacts with CrO_2 gives a saturated aldehydes having 2 carbon atoms. Determine the structures and names of A, B and C along with the sequence of reaction.

(c) Give one method of preparation of XeF_4. Mention one reaction in which it acts as an oxidising agent. Give its structure.

(d) How are the slovents classified on the basis of proton transfer ?

(e) If one mole of water and one mole of CO are taken in a 10 litre vessel and heated to 986°C, 40% of water reacts with CO as in

$$H_2O(l) + CO(g) \rightleftharpoons H_2(g) + CO_2(g).$$

Calculate the equilibrium constant for the reaction at the temperature mentioned.

GROUP - C

Answer All questions.

5. Write notes on :

(a) Faraday's second law of electrolysis

* (b) Nuclear fission

Or,

* (a) Predict the nature of the aqueous solutions of the following substances. **[3**

(i) NaCN (ii) Na_2CO_3 (iii) CH_2COONH_4 (iv) Na_2SO_4 (v) $FeCl_3$ and (vi) $CuCl_2$

(b) In a first order reaction, the reactant concentration decreases from 0.8M to 0.4M in 15 min. What is the time taken for the concentration to change from 0.1M to 0.025 M?

6. (a) How do you prepare benzoic acid from
   (i) n-propyl benzene,
   (ii) Phenylcyanide and
   (iii) Benzene [3

(b) What is Schmidt reaction ? Write the structure of the product of this reaction. [2

(c) Explain Carbylamine reaction. [2

Or, (a) What are soap and detergents ? How do they differ ?

(b) Bring out the following conversions :
   (i) Benzene to m-dichlorobenzene
   (ii) Nitrobenzene to Benzamide
   (iii) Benzene to n-Butane

7. Describe the Dennis method of preparation of fluorene with a neat diagram. How does it react with glass ? [3+2+2

Or, Discuss the principles of extraction of copper from its sulphide ores. How does it react with dil and cone. HNO_3 ? Give reactions. [5+2

[* marked questions at present are no included in class XII course.]

ANNUAL - 2017 (ANSWERS)

1. (a) (i) Geometrical and ionization cis - isomer exhibits optical isomerism.

(b) (ii) SO_2Cl_2

(c) (ii) Antipyretic

(d) (iv) Tyrosine

(e) (i) Bakelite

*(f) (iv) $\Delta G = -ve, \Delta S = +ve$

*(g) (i) is zero

*(h) (i) $4s^3$

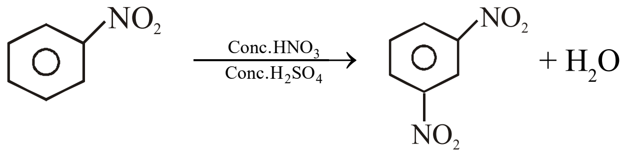
*(i) (ii) 234 and 90

*(j) (i) oxidising

2.(A) (a) 2-Methoxypropanal

(b) cm^{-1} or m^{-1}

(c) Metadinitrobenzene is formed.



Nitrobenzene m-dinitrobenzene

(d) Ethyl alcohol on heating with excess H_2SO_4 at 170°C forms ethylene.

$$C_2H_5OH \xrightarrow[170^0 C]{\text{Excess } H_2SO_4} CH_2 = CH_2 + H_2O$$

Ethyl alcohol Ethylene

(e) $CH_3Br \xrightarrow{Mg/Ether}$

$$\underset{(A)}{CH_3MgBr} \xrightarrow[(ii)\,H_2O/H]{(i)\,CO_2} \underset{(B)}{CH_3COOH}$$

Methyl magnesium Bromide Acetic acid

A is CH_3MgBr (methyl magnesium bromide)

B is CH_3COOH (Acetic acid)

(B) (a) H_2F_2

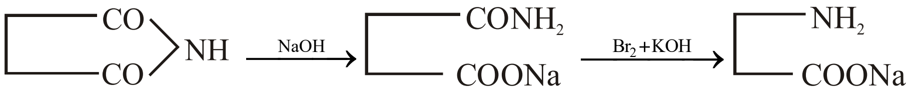
(b) quinone

(c) faster

(d) (c+d)-(a+b)

(e) decreases

3. (a)



Sodium 3-amido propanoate Sodium-3-amino propanoate

(b) $\text{EAN} = (Z - \text{ON}) + 2.\text{CN} = \text{Nearest noble gas configuration}$

$$\text{Ni(CO)}_x = 28 + 2x = 36(\text{Kr})$$

$$x = 4 \text{ i.e., C.N. of Ni} = 4$$

So the molecular formula of nickel carbonyl is $[\text{Ni(CO)}_4]$

(c) Copper is disolved by aqueous NH_3 is presence of air to form tetra ammine copper complex.

$$2Cu + 8NH_3 + 2H_2O + O_2 \longrightarrow 2[Cu(NH_3)_4](OH)_2$$

Tetraammine copper (II) hydroxide (Blue).

* (d) Statement :

Formation of NH_3 is an exothermic reaction. It is carried out at an optimum temperature of 500°C. High temperature favours backward reaction.

* (e) Pesticides : Substance used for destroying insects or other organism harmful to cultivated plants. They can also harm people's health.

These are : fungicides, herbicides, insecticides, Rhodenticides

* fungicide : captan, sulfur and mancozeb
* Herbcide - altrazine
* insecticides - DDT, BHC
* Rhodenticide - methyl bromide, zinc phosphide

(f) Stephen's reduction

$$SnCl_2 + 2HCl \longrightarrow SnCl_4 + 2H$$

$$RCN + H_2O + 2H \longrightarrow RCHO + NH_3$$

* (g) $\Delta S = \dfrac{\Delta H_{vap}}{T} = \dfrac{2.257 \times 18}{373\,K} kJ/mol = 0.10\,kJ/mol/K$

* (h) $K = \dfrac{[P_4O_{10}]}{[P_4][O_2]^5} = \dfrac{1}{[O_2]^5}$ $\quad$ [Solid] = 1

* (i) $[H^+] = 3.8 \times 10^{-3} M$

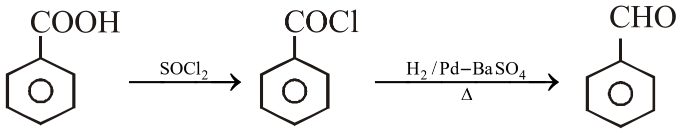
$$pH = -\log[H^+] = -\log(3.8 \times 10^{-3})$$

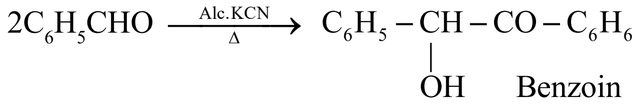
$$= 3 - \log 3.8$$

$$= 3 - 0.58$$

$$pH = 2.42.$$

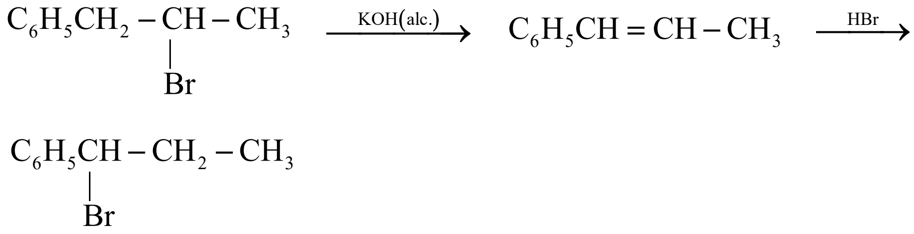
(j)



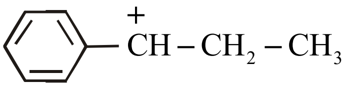
(k) 

$$2C_6H_5CHO \xrightarrow[\Delta]{Alc.KCN} C_6H_5-\underset{\displaystyle OH}{\underset{|}{CH}}-CO-C_6H_6$$

Benzoin

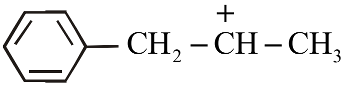
l) 

$$C_6H_5CH_2-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3 \xrightarrow{KOH(alc.)} C_6H_5CH=CH-CH_3 \xrightarrow{HBr} C_6H_5\underset{\displaystyle Br}{\underset{|}{CH}}-CH_2-CH_3$$



More stable cabocation

due to resonance



Less stable

4. (a) The exact relationship among electrode potential at a given concentration, standard electrode potential and absolute temperature (T) is known as Nernst equation.

Significance : i) Calculation electrode potential and hence cell potential

ii) E_{el} / E_{cell} can be evaluated theoritically at any temperature and any concentration if E^0_{el}. or E^0_{cell} is known.

Expression :

(i) $M^{n+}_{(aq)} + ne^- \longrightarrow M(s)$

Now the Nernst equation is _______.

$$E_{M^{n+}_{(aq)}|M} = E^0_{M^{n+}|M} - 2.303\frac{RT}{nF}\log\frac{1}{[M]} \qquad [M(S)] = 1$$

$R = 8.314\ JK^{-1}\ mol^-$

$T = 298\ K$

$F = 96500\ C,$ On substitution –

$$\boxed{E_{M^{n+}|M} = E^0_{M^{n+}|M} - \frac{0.0591}{n}\log\frac{1}{\begin{bmatrix}M^{n+}\\ aq\end{bmatrix}}}$$

$\begin{bmatrix}M^{n+}\\ aq\end{bmatrix}$ =Conc. of the ions in contact with the electrode, M

(ii) For a reversible cell

$$e.g.\ Zn_{(s)} + Cu^{++}{}_{(aq)}(C_1) \rightleftharpoons Zn^{2+}_{(aq)}(C_2) + Cu(s)$$

$$E_{cell} = E^0_{cell} - \frac{0.0591}{2}\log\frac{[Zn^{2+}]}{[Cu^{+2}]}$$

E^0_{cell} can be referring the electro chemical series i.e.,

$= E^0_{cathod} - E^0_{anode}$ (Reduction potential values)

$\left|Zn_{(s)}\right| = \left[Cu_{(s)}\right]$ are arbitarily taken to be unity.

(b) $\underset{(A)}{C_2H_5NO_2} \xrightarrow{Sn/Conc.HCl} \underset{(B)}{C_2H_5NH_2} \xrightarrow{NaNO_2+HCl} \underset{(C)}{C_2H_5OH}$

$\xrightarrow{CrO_3} CH_3CHO$

$$C_2H_5OH \xrightarrow{Na} C_2H_5ONa + \frac{1}{2}H_2$$

(effervescence)

(c) $Xe + 2F_2 \xrightarrow[300^0C,\ 6atm]{Nickel\,vesel} XeF_4$

$\overset{+4}{Xe}F_4 + 2H_2 \longrightarrow \overset{o}{Xe} + 4\overset{+1}{H}F$

$\overset{+4}{Xe}F_4 + 4KI^{-1} \longrightarrow X_e^0 + 4kF + 2I_2^0$

It liberates iodine from KI on oxidation.

* (d) $HCl + H_2O(Solvent) \longrightarrow H_3O^+ + Cl^-$

Protophilic solvent i.e., it accepts proton acting as Bronsted base other examples ammonia, pyridine protogenic solvent (portic solvent), Capable of acting as a proton donor. e.g. CH_3COOH, H_2SO_4

$$NH_3 + \underset{Solvent}{CH_3COOH} \longrightarrow NH_4^+ + CH_3COO^-$$

* (e) $H_2O_{(\ell)} + CO_{(g)} \rightleftharpoons H_2(g) + CO_2(g)$

$40\% = \frac{40}{100} = 0.4$	1	1	0	0
	0.4	0.4	0.4	0.4
	0.6	0.6	0.4	0.4
Conc.	$\frac{0.6}{10}$	$\frac{0.6}{10}$	$\frac{0.4}{10}$	$\frac{0.4}{10}$

$$K_C = \frac{[H_2][CO_2]}{[H_2O]\left[CO_{(g)}\right]} = \frac{0.04 \times 0.04}{0.06 \times 0.06} = 0.44$$

Group - C (Hints on long questions)

5. (a) Faraday's 2nd law : $\frac{W_1}{E_1} = \frac{W_2}{E_2}$

* (b) Nuclear fission - Heavy nuclei divided into two halves releasing a huge quantity of energy

or

(a) – NaCN, Na_2CO_3 – alkaline

– Na_2SO_4, CH_3COONH_4 neutrol almost nutral

– $FeCl_3$, $CuCl_2$ – acidic (Salts of strong acid & weak base)

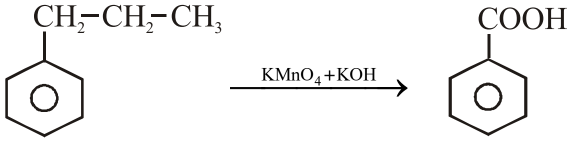
(b) Set - I $K = \frac{2.303}{15}\log\frac{0.8}{0.4}$

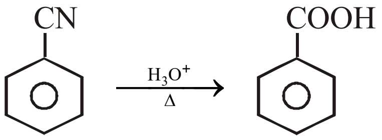
Set - II $K = \frac{2.303}{t}\log\frac{0.1}{0.05} = \frac{2.303}{15}\log\frac{0.8}{0.4} = \frac{0.301}{15}$

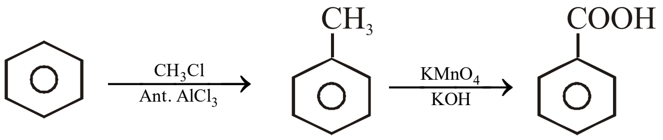
$$\frac{2 \times 0.301}{t} = \frac{0.301}{15}$$

t = 30 minutes.

6. (a)







(b) **Schmidt reaction :**

$$RCOOH + HN_3 \xrightarrow{Conc.H_2SO_4} RNH_2 + CO_2 + N_2$$

e.g. $C_6H_5COOH + HN_3 \xrightarrow{Conc.H_2SO_4} C_6H_5NH_2 + CO_2 + N_2$

(preparation of 1^0-amine)

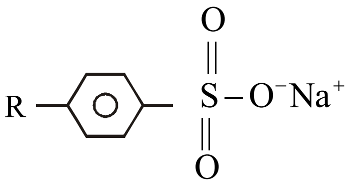
(c) Test of 1^0 ammine

$$RNH_2 + CHCl_3 + 3KOH \longrightarrow CH_3NC + 3KCl + 3H_2O$$

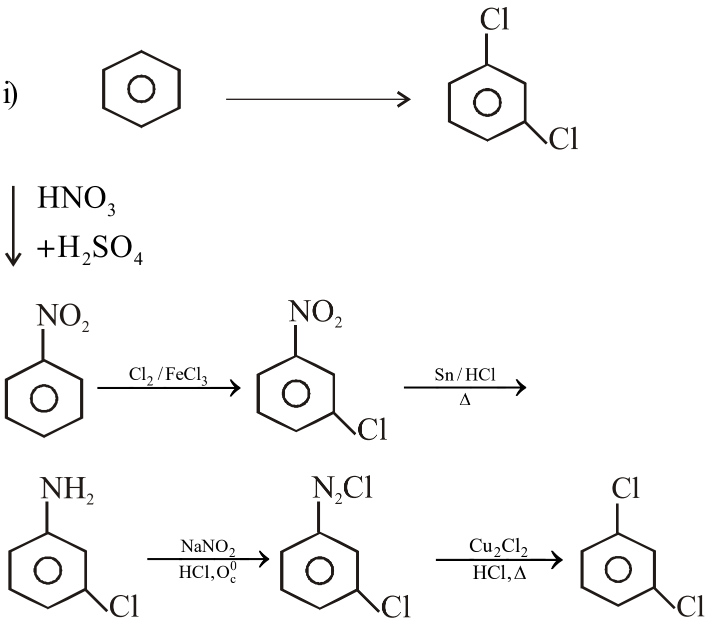
Carbylamine with foul smell.

(or)

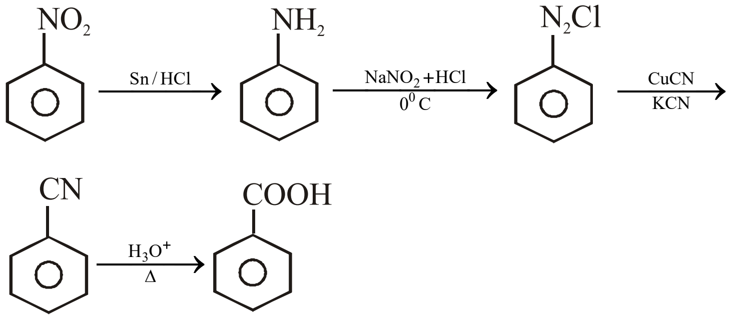
(a) Soap	**(b) Detergent**
i) Sodium salt (Potassium) of long chain fatty acid, steoric acid, palnitric acid, oleic acid.	i) Detergents are sodium salt of long chain alkyl benzene sulfonic acid or sodium salts of sulfuric acid esters of long chain alcohols.
ii) Soap are injurious to delicate wool, silk fibres.	ii) Effectively clean wool, silk fibers.
iii) Only applicable in soft water.	iii) Applicable in soft and hard water
iv) In soluble in hard water.	iv) Soluble in hard water containing Ca^{2+} or Mg^{2+} ions
v) Biodegradable without causing water pollution.	v) Non-biodegradable & cause water pollution.
e.g $C_{17}H_{35}COONa$	e.g. ABS detergent.



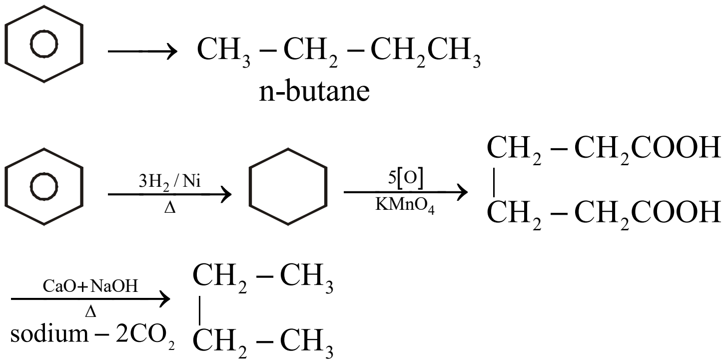
(b) i)



ii)



iii)



7. * (a) Electrolysis of KHF_2 (Dennis method).

$$8HF + Na_2SiO_3 \longrightarrow 2NaF + H_2SiF_6 + 3H_2O$$

(b) **Flow chart of extraction copper**

ore Copper pyrites

$CuFeS_2$

↓

Crushed & seived

↓

concentration by froth floatation

↓

Concentrated ore roasted in a reverberatort furnace

$\downarrow -(SO_2, As_2O_3)$

Roasted ore, Cu_2S, FeS smelted with coke & silica in a blast furnace

$\downarrow -FeSiO_3(\text{slag})$

Copper matte, Cu_2S, FeS

↓ Bassemerisation

Bassmer converter in presence of air FeO, Cu_2O, Cu_2S

Auto reduction $Cu_2S + 2CH_2O \longrightarrow 6Cu + SO_2$

↓

Blister copper (98% Cu)

↓ Electrolytic refining

Anode: Impure copper,

Electrolyte : ($CuSO_4 + H_2SO_4$), cathode pure copper (99.9%)

With dil HNO_3: ——— $2HNO_3 \longrightarrow H_2O + 2NO + 3[O]$

$$\left[Cu + 2HNO_3 + O \longrightarrow Cu(NO_3)_2 + H_2O\right] \times 3$$

$$\overline{3Cu + 8HNO_3 \longrightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O}$$

with conc. HNO_3 :-

$$2HNO_3 \longrightarrow H_2O + 2NO_2 + O$$

$$Cu + 2HNO_3 + O \longrightarrow Cu(NO_3)_2 + H_2O$$

$$Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

❖ ❖ ❖

GROUP - A (1)

MULTIPLE CHOICE QUESTION

UNIT - 01

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. Which substance shows antiferromagnetism ?
(a) ZrO_2 (b) CdO (c) CrO_2 (d) Mn_2O_3

6. 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

7. Which arrangement of electrons leads to ferromagnetism ?
(a) ↑↑↑↑↑ (b) ↑↓↑↓ (c) ↑↑↑↓↓ (d) None of these

8. Which species is diamagnetic ?
(a) Ca^{2+} (b) Hg_2Cl_2 (c) Sb^{3+} (d) All

9. Which crystal has the largest lattice energy ?
(a) KCl (b) MgO (c) LiBr (d) NaF

10. The oxide that possesses electrical conductivity:
(a) V_2O_5 (b) CrO_2 (c) NiO (d) MnO

11. 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

UNIT - 02

12. Molality is expressed in :
(a) Grams/litre (b) Litres/moles (c) Moles/litre (d) Moles/kg.

13. 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

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

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

15. 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

16. 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) $\Delta T_b/10$

17. Which is not affected by temperature ?

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

18. 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.

19. 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.

20. 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.

21. 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.

22. 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

23. 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.

24. 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}

25. 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

UNIT - 03

26. 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

27. 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

28. 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}

29. 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

30. 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

31. —— 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

32. 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

33. 96500 coulomb will deposit — of metal.

(a) one electrochemical equivalent (b) one gm

(c) one gm equivalent (d) one gm molecular mass

34. 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

35. 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}

36. 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) $\Delta G^0 = -nF\log k_C$

37. 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

38. Electrolytes conduct electricity due to movement of

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

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

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

40. The metal with greater oxidation potential is

(a) stronger oxidant (b) stronger reductant

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

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

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

42. 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

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

(a) –ve (b) +ve

(c) zero (d) any one of these

44. 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

45. 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) $\mu_\infty\left(H_2SO_4\right) = 2\mu_\infty\left(H^+\right) + \mu_\infty\left(SO_4^{-2}\right)$

UNIT - 04

46. 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

47. 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

48. 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) $r = \frac{d[A]}{dt}$

49. 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

50. 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 = $[A]^2[B]^0$

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

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

52. 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}

53. $T_{1/2}$ 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

54. 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

55. Rate of reaction depends upon

(a) temperature (b) catalyst

(c) concentration (d) all of these

56. $t_{1/2}$ 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.

57. Molecularity of a reaction is determined by

(a) stoichiometric representation of a reaction.

(b) reaction of atoms

(c) both (d) none

58. The equation for rate constant is given by $k = p.Z.\exp(-E_a/RT)$, a chemical reaction will proceed more rapidly if there is a decrease in

(a) E_a (b) Z (c) P (d) T

59. 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

60. 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}

61. A catalyst has no effect on

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

(c) threshold energy (d) heat of reaction

UNIT - 5

62. Tyndall effect is observed in :

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

63. 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

64. 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

65. 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

66. 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.

67. How many layers are involved in chemical adsorption ?

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

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

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

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

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

70. Action of catalyst depends upon :

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

71. At CMC, the surface molecules :

(a) Decompose (b) Become completely soluble

(c) Associate (d) Dissociate.

72. A biological catalyst is essentially :

(a) An enzyme (b) A carbohydrate

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

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

(a) Electrons (b) Electrolytes

(c) Positively charged ions (d) Compounds.

74. 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.

75. Fog is an example of colloidal system of:

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

(c) Solid in liquid (d) Liquid in liquid.

76. In the following, the hydrophobic colloid is :

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

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

(a) Formic acid solution (b) Formaldehyde solution

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

78. Which of the following is the example of heterogeneous catalysis ?

(a) $2SO_2(g) + O_2(g) \xrightarrow{NO} 2SO_3(g)$

(b) Sucrose + $H_2O \xrightarrow{H^+}$ Glucose + Fructose

(c) $2H_2O_2(aq) \xrightarrow{MnO_2} 2H_2O(l) + O_2(g)$

(d) All are correct.

UNIT - 6

79. 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
80. Which of the following processes is used for the concentration of Bauxite ?
    (a) Froth floatation (b) Leaching
    (c) Liquation (d) Magnetic separation
81. The earthy impurities associated with mineral used in metallurgy are called ?
    (a) Slag (b) Flux (c) Gangue (d) Ore
82. Aluminothermic process is used in the metallurgy of:
    (a) Pb (b) Ag (c) Cr (d) None of these
83. In the electrorefining of copper, some gold is deposited as :
    (a) Anode mud (b) Cathode mud (c) Cathode (d) Electrolyte
84. A basic lining is given to a furnace by using
    (a) Calcined dolomite (b) Limestone
    (c) Haematite (d) Silica
85. Most abundant metal on the surface of earth is :
    (a) Iron (b) Aluminium (c) Calcium (d) Sodium
86. The important ore of iron is :
    (a) Siderite (b) Haematite (c) Pyrites (d) Bauxite
87. 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
88. Malachite is an ore of:
    (a) Iron (b) Copper (c) Mercury (d) Zinc
89. 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.
90. Which is known as blister copper ?
    (a) Pure copper (b) 98% copper
    (c) Ore of copper (d) Alloy of copper
91. 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
92. 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

93. Heating of pyrite ores in air to remove sulphur is known as :

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

94. Out of the following, which cannot be obtained by electrolysis of aqueous solution of the salt ?

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

95. 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

UNIT - 7

96. Superphosphate of lime is used in:

(a) Cement industry (b) Glass industry

(c) Agriculture (d) Metallurgy

97. 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

98. The lightning bolts in atmosphere cause the formation of:

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

99. Calcium carbide when heated with nitrogen forms:

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

100. Which hydride is most stable ?

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

101. Which is a poison ?

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

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

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

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

103. Basic oxide is:

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

104. NaOH can absorb:

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

105. Which sulphide is insoluble in yellow ammonium sulphide ?

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

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

(a) Bums 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

107. 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

108. Tailing of mercury is due to formation of

(a) mercuric oxide (b) mercurous oxide

(c) mercuric hydroxide (d) mercurous chloride

109. 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

110. About H_2SO_4 which is incorrect ?

(a) Reducing agent (b) Dehydrating agent

(c) Sulphonating agent (d) Highly viscous

111. 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

112. 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

113. Structure of SF_4 is

(a) octahedral (b) trigonal bipyramidal

(c) square planar (d) tetrahedral

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

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

115. Correct order of bond angle of H_2O, H_2S, H_2Se, H_2Te 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) $H_2Se > H_2S > H_2Te > H_2O$

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

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

117. 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

118. 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.

119. When natural rubber is heated with Sulphur, it is called

(a) vulcanisation (b) sulphonation

(c) sulphurization (d) none of these

120. 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

121. Which one is the strongest reducing agent ?

(a) HF (b) HCl (c) HBr (d) HI

122. The most powerful oxidising agent is

(a) Fluorine (b) Chlorine (c) Bromine (d) Iodine

123. Chlorine acts as a bleaching agent only in the presence of:

(a) dry air (b) sunlight (c) moisture (d) pure oxygen

124. 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

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

126. 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

127. 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

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

129. The total of lone pairs in $XeOF_2$ is :
(a) 0 (b) 1 (c) 2 (d) 3

130. 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

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

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

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

134. 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

135. 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.

136. The coloured discharge tubes for advertisement mainly contain:
(a) Xenon (b) Helium (c) Neon (d) Argon

137. Shape of $XeOF_4$ is
(a) octahedral (b) square pyramidal
(c) pyramidal (d) T-shaped

138. Bond angle in XeO_3 is
(a) 107° (b) 119° (c) 92° (d) 103°

139. 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)

UNIT - 8

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

141. 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)

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

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

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

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

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

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

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

149. 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 $HgCl_2$

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

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

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

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

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

155. 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+}

156. 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) $(n-1)d^5ns^1$

157. 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) $K_2SO_4 + CuI_2 + I_2$

158. Passivity of iron is due to the formation of thin film of its:
(a) Oxide (b) Carbonate (c) Nitride (d) Hydroxide

159. Mn belongs to:
(a) s-block (b) p-block (c) d-block (d) *f*-block

160. $K_3[Co(NO_2)_6]$ is:
(a) Fischer's salt (b) Thenard's blue
(c) Rinman's green (d) Blue vitriol

161. 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

162. Which match is incorrect ?

(a) Ammonia soda process—manufacture of potassium carbonate

(b) Bessemer's process—manufacture of steel

(c) Mac Arther and Forrest process—extraction of silver

(d) Dow's process—manufacture of phenol

163. Wood's metal is an alloy of:

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

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

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

165. Other forms of iron can be produced from:

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

UNIT - 9

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

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

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

(a) $Ni(CN)_2^{2-}$ 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

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

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

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

(a) Ionisation isomerism   (b) Hydration isomerism

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

170. EDTA is a .... ligand:

(a) Monodentate   (b) Hexadentate

(c) Bidentate   (d) Tridentate

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

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

172. 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

173. 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) $[PtCl_3, C_6H_6]^-K^+$

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

(a) Linkage isomers (b) lonisation isomers

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

175. 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) $[Co(NH_3)_6]Cl_2$

176. 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

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

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

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

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

179. All ligands are:

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

180. 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

UNIT - 10

181. The hydrogen atom in chloroform is:

(a) Acidic (b) Basic (c) Neutral (d) None

182. Solvent used in dry cleaning of clothes is:

(a) Alcohol (b) Acetone

(c) Carbon tetrachloride (d) Freon

183. 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

184. 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

185. Which alkyl halide is preferentially hydrolysed by S_{N^1} mechanism:

(a) CH_3Cl (b) CH_3CH_2Cl (c) $CH_3CH_2CH_2Cl$ (d) $(CH_3)_3C.Cl$

186. The alkyl group of Grignard reagent acts as:

(a) Free radical (b) Carbonium ion (c) Carbanion (d) None

187. 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

188. Which compound is used in cooling:

(a) $CHCl_3$ (b) CCl_4 (c) CF_4 (d) CCl_2F_2

189. 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

190. Grignard reagent shows addition on:

(a) $>C=O$ (b) $-C\equiv N$ (c) $>C=S$ (d) All

191. Non-sticking frying pans are coated with:

(a) Ethylene (b) Styrene

(c) Tetrafluoro ethylene (Teflon) (d) Chlorofluoro methane

192. Which reagent is useful in increasing the carbon chain of an alkyi halide:

(a) HCN (b) KCN (c) NH_4CN (d) AgCN

193. Which product is obtained when bleaching powder is distilled with acetone:

(a) CCl_4 (b) $CHCl_3$ (c) CH_2Cl_2 (d) CH_3Cl

194. The compound that will not give iodoform on treatment with alkali and iodine is:

(a) Acetone (b) Ethanol

(c) Diethyl ketone (d) Isopropyl alcohol

195. Ethyl alcohol gives ethyl chloride on treatment with:

(a) NaCl (b) $SOCl_2$ (c) Cl_2 (d) KCl

196. 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

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

(a) Chloromethane (b) Methane

(c) Chloroform (d) Methylene chloride

198. Vicinal and geminal dihalides can be distinguished by:

(a) KOH (aq.) (b) KOH (alc.) (c) Zndust (d) None

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

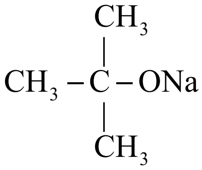
(a) Fe (b) Mg (c) Proteins (d) Na

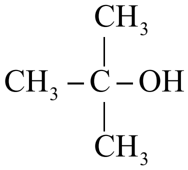
200. CO_2 on reaction with C_2H_5MgBr and H_2O gives:

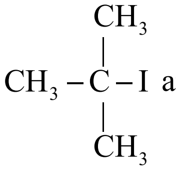
(a) Ethane (b) Propionic acid (c) Acetic acid (d) None

UNIT - 11

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

(a) CH_3I and 
$CH_3-C(CH_3)_2-ONa$

(b) CH_3ONa and 
$CH_3-C(CH_3)_2-OH$

(c) 
$CH_3-C(CH_3)_2-I$ and CH_3ONa

(d) None of the above

202. 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) $CH_3CH(OH)CH_2CH_2CH_3$

203. Primary, secondary and tertiary alcohols can be distinguished by employing :

(a) Oxidation (b) Victor Meyer's test
(c) Lucas test (d) All of these

204. Compound A reacts with PCl_5 to give B which on treatment with KCN followed by propanoic acid as the product. What is A ?

(a) Ethane (b) Propane
(c) Ethyl chloride (d) Ethyl alcohol

205. Ethanol is soluble in water due to :

(a) Ethyl group (b) Hydrogen bonding
(c) Its neutral, nature (d) Dissociation in water

206. Alcohols are isomeric with

(a) Acids (b) Ethers (c) Esters (d) Aldehydes

207. Reaction of t-butyl bromide with sodium methoxide produces:

(a) Isobutane (b) Isobutylene
(c) Sodium t-butoxide (d) t-butyl methyl ether

208. Dehydration of ethanol gives:

(a) Acetic acid (b) Ethane (c) Ethylene (d) Acetylene

209. Which alcohol is most acidic:

(a) Methanol (b) Ethanol
(c) Isopropyi alcohol (d) *t*-butyl alcohol

210. Methylated spirit is:

(a) Methanol containing some pyridine (b) Ethanol containing some methanol
(c) Pure methanol (d) 95% methanol

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

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

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

212. When isopropyi alcohol vapours are passed over heated copper it gives:

(a) Acetone (b) Ethyl alcohol
(c) Methyl alcohol (d) Acetaldehyde

213. 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

214. The product formed in the following reaction

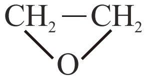
$$C_6H_5 - O - CH_3 + HI \xrightarrow{\text{Heat}} \text{ are :}$$

(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

215. In the reduction,

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

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

216. Reaction of  with RMgX followed with hydrolysis produces:

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

UNIT - 12

217. 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

218. Formic acid and acetic acid can be distinguished by

(a) Baeyer's reagent (b) $NaHCO_3$

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

219. Which of the following compounds does not have a carboxyl group ?

(a) Benzoic acid (b) Palmitic acid

(c) Picric acid (d) Oleic acid

220. 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 salt of carboxylic acid (d) saponification

221. Monocarboxylic acids show functional isomerism with

(a) esters (b) alcohols (c) ethers (d) aldehydes

222. 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

223. HVZ reaction is used to prepare

(a) aldehyde (b) ketones (c) primary amine (d) bromo acids

224. Acetamide is

(a) amphoteric (b) acidic (c) basic (d) neutral

225. Ammonium formate on heating gives

(a) formamide (b) ammonium acetate

(c) formic acid (d) acetamide

226. 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) $C_nH_{2n}O_2$

227. In Rosenmund reduction the catalyst used is

(a) $Pd-BaSO_4$ (b) Sn – HCl (c) Zn – HCl (d) none of these

228. 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.

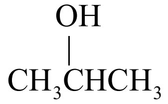
229. The function of conc. H_2SO_4 in esterification process is

(a) catalyst (b) dehydrating agent

(c) hydrolysing agent (d) none of these

230. 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  $CH_3\overset{\overset{\displaystyle OH}{|}}{C}HCH_3$ 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

231. 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

232. 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

233. 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

UNIT - 13

234. Primary amine is not given by

(a) reduction of amides
(b) reduction of nitroalkanes
(c) reduction of alkyl cyanides
(d) reduction of isonitriles

235. Primary and secondary amines are distinguished by

(a) Br_2 (b) NH_2 (c) Co (d) $CHCl_3$/KOH

236. 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

237. The reactive species during nitration of benzene is:

(a) NO_2^+ (b) NO_2^- (c) N_2O_4 (d) HNO_3

238. 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

239. 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

240. Nitration is easy in case of

(a) toluene
(b) nitrobenzene
(c) chlorobenzene
(d) sulpho benzene

241. 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

242. Reduction of nitroalkane in neutral medium is made with

(a) H_2/Ni (b) LiA/H_4 (c) Zn/NH_4Cl (d) $NaBH_4$

243. 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

244. Which of the following amines cannot be acylated using acetyl chloride ?
(a) Methylamine (b) Dimethylamine (c) Trimethylamine (d) Ethylamine

245. The colour of the product obtained by reacting 2° nitroalkane with HNO_2 is:
(a) white (b) blue (c) red (d) yellow

246. Hinsberg's reagent is:
(a) benzene sulphonyl chloride (b) benzene sulphonic acid
(c) phenyl isocyanide (d) benzene sulphonamide

UNIT - 14

247. The degradation of biomolecules in cells is termed as:
(a) catabolism (b) anabolism (c) metabolism (d) none of these

248. Which one is regarded as energy currency of living cells?
(a) ATP (b) ADP (c) AMP (d) CO_2

249. Which one is a pentose sugar ?
(a) glucose (b) fructose (c) arabinose (d) galactose

250. Glucose and fructose are :
(a) optical isomers (b) functional isomers
(c) chain isomers (d) position isomers

251. Which one is used in silvering of mirrors ?
(a) Sucrose (b) Cellulose (c) Fructose (d) Glucose

252. The sweetest of all sugars is :
(a) glucose (b) lactose (c) sucrose (d) fructose

253. Starch is a polymer of:
(a) fructose (b) glucose (c) both (a) & (b) (d) none of these

254. Which one is a hormonal protein ?
(a) Myosin (b) Keratin (c) Trypsin (d) Insulin

255. Male sex hormones are known as :
(a) androgens (b) esterogens (c) progestins (d) carticosteroids

256. Deficiency of vitamin A causes :
(a) beri-beri (b) scurvy (e) night-blindness (d) goitry

257. Which differs from the rest:
(a) Glucose (b) Maltose (c) Sucrose (d) Lactose

258. Artificial sweetener used in soft drinks is:
(a) Glucose (b) Fructose (c) Cellulose (d) Asparatame

259. The sugar present in honey is:
(a) Sucrose (b) Glucose (c) Fructose (d) Maltose

260. Which are not the essential constituents of balanced diet:
(a) Carbohydrates (b) Fats
(c) Proteins (d) Hormones

261. Which one is a test for proteins:
(a) Beilstein test (b) Biuret test
(c) Benedict's test (d) Molisch's test

262. Which of the following biomolecules always contain nitrogen:
(a) Carbohydrates (b) Proteins
(c) Oils and fats (d) Waxes

263. Point out the wrong statement about proteins:
(a) They are nitrogenous organic compounds of high molecular mass.
(b) They on hydrolysis by enzymes give ammo acids.
(c) Many of them are enzymes.
(d) They do not contain polypeptide linkages.

264. Vitamin A is also known as:
(a) Xerophythol (b) Thiamine (c) Riboflavin (d) Pyridoxin

265. Deoxyribonucleic acid (DNA) is a polymer of units called:
(a) Sugars (b) Ribose (c) Amino acids (d) Nucleotides

266. The antisterility or anti reproductory vitamin is:
(a) B (b) C (c) D (d) E

267. Which is fat soluble vitamin:
(a) Vitamin A (b) Pyridoxin (c) Riboflavin (d) Thiamine

268. Nucleotides and nucleosides mainly differ from each other in:
(a) Presence of phosphate units (b) Presence of base units
(c) Presence of nucleic acids (d) None

269. The vitamin that is most readily manufactured in our bodies is:
(a) Vitamin A (b) Vitamin B (c) Vitamin C (d) Vitamin D

270. Vitamin B, is chemically known as:
(a) Ascorbic acid (b) Riboflavin (c) Pyridoxine (d) Thiamine

271. Which enzyme hydrolyses triglyceride to fatty acids and glycerol:
(a) Amylase (b) Maltase (c) Lipase (d) Pepsin

272. Which is not a poison for enzymes:
(a) CN^- (b) Fe^{3+} (c) Pb^{2+} (d) AsO_4^{3-}

273. The best source of vitamin A is:
(a) Beans (b) Wheat (c) Carrots (d) Oranges

274. Which of the following hormones helps in the conversion of glucose into glycogen in the body:
(a) Insulin (b) Cortisone (c) Thyroxin (d) Oxytocin

UNIT - 15

275. Which of the following fibres are made of polyamides ?
(a) Dacron (b) Orlon (c) Nylon (d) Rayon

276. Which of the following is not a condensation polymer ?
(a) Bakellite (b) Nylon (c) Dacron (d) Teflon

277. Neoprene is a polymer of

(a) chloroprene (b) chloroquine (c) propylene (d) isoprene

278. Natural rubber is a polymer of

(a) cis-isoprene (b) neoprene (c) chloroprene (d) trans-isoprene

279. Which of the following is not an example of addition polymer ?

(a) Polystyrene (b) Polyethylene (c) Polypropylene (d) Terylene

280. Which one is a protein fibre ?

(a) Rayon (b) Polyester (c) Silk (d) Cotton

281. Orlon is a polymer of

(a) Styrene (b) Vinyl chloride

(c) Acrylonitrile (d) Butadine and adipic acid

282. 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

283. Bakelite is obtained by

(a) Substitution Reaction (b) Condensation Reaction

(c) Addition Reaction (d) Elimination Reaction

284. Caprolactum can be obtained from:

(a) Benzaldehyde (b) Cyclohexane

(c) Benzophenone (d) Adipicacid

285. A polymer of prop-2-ene nitrile is called:

(a) Saran (b) Orlon (c) Dacron (d) Tetron

286. Peptide bond is a key feature in:

(a) Polysaccharide (b) Proteins

(c) Nucleotide (d) Vitamins

287. 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

288. The widely used PVC is a polymerised product of:

(a) $CH_2 = CH_2$ (b) $CH_2 = CCl_2$

(c) CH_2ClCH_2Cl (d) $CH_2 = CHCl$

289. Which of the following is a step growth polymer:

(a) Bakelite (b) Polyethylene (c) Teflon (d) PVC

290. Rubber is heated with sulphur and the process is known:

(a) Galvanization (b) Vulcanization

(c) Bessemerization (d) Sulphonation

291. 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

292. Thermoplastics are:

(a) Linear polymers (b) Soften or melt on heating

(c) Molten polymer can be moulded in desired shape

(d) All

293. 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

UNIT - 16

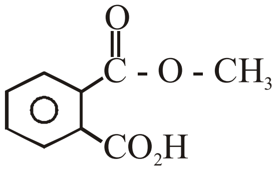
294. Morphine is

(a) Antiseptic (b) Antibiotics (c) Analgesic (d) Antimalaria

295. Novalgin is a common name of

(a) Analgesic (b) Antibiotic (c) Antipyretic (d) Antimalaria

296. The following compound is



(a) An anti-inflemmatory compound (b) Analgesic

(c) Hypnotic (d) Antiseptic

297. 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

298. D.D.T. is used as

(a) Disinfectant (b) Insecticide (c) Anaesthetic (d) Antipyretics

299. Medicine which is an antibiotic is

(a) ampicilin (b) aspirin (c) calmpose (d) chloroquine

300. A detergent is :

(a) drug (b) catalyst

(c) surface active agent (d) soap

301. Metal lauryl sulphate acts as:

(a) Soap (b) Disinfectant (c) Antiseptic (d) Detergent

302. Digestion of fat in intestine is aided by:

(a) Diffusion (b) Protection (c) Peptization (d) Emulsification

303. 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

304. Which of the following is molecular disease ?

(a) Allergy (b) Cancer

(c) German measeles (d) Sickel-cell-anaemia

305. Salol can be used as:

(a) Antiseptic (b) Antipyretic (c) Analgesic (d) None of these

306. The drug which is effective in curing malaria, is:

(a) Quinine (b) Aspirin (c) Analgin (d) Equanil

307. A substance which can act both as antiseptic and disinfectant is:

(a) Aspirin (b) Chloroxylenol (c) Bithional (d) Phenol

308. The first viral disease detected in human being was:

(a) Cold (b) Influenza (c) Small pox (d) Yellow fever

309. The insecticide, germicide gammexane is a formulation for:

(a) DDT (b) Benzene hexachloride

(c) Hexachlorobenzene (d) Chloral

310. Heroin is a derivative of:

(a) Cocaine (b) Morphine. (c) Caffeine (d) Nicotine

311. Phenacetin is used as:

(a) Antipyretic (b) Antiseptic (c) Antimalarial (d) Analgesic

312. 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

313. An antibiotic contains nitro group attached to aromatic nucleus. It is:

(a) Penicillin (b) Streptomycin

(c) Tetracycline (d) Chloramphenicol

314. 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

❖ ❖ ❖

ANSWERS TO MCQ, GROUP A (1)

1.	b	46.	c	91.	b	136.	c	181.	a	226.	b	271.	c
2.	c	47.	d	92.	b	137.	b	182.	c	227.	a	272.	b
3.	c	48.	b	93.	d	138.	c	183.	a	228.	a	273.	c
4.	c	49.	b	94.	b	139.	a	184.	a	229.	a	274.	a
5.	d	50.	b	95.	b	140.	d	185.	d	230.	b	275.	c
6.	a	51.	b	96.	c	141.	c	186.	c	231.	c	276.	d
7.	a	52.	c	97.	d	142.	c	187.	b	232.	a	277.	a
8.	d	53.	a	98.	a	143.	c	188.	d	233.	b	278.	a
9.	b	54.	a	99.	c	144.	d	189.	d	234.	d	279.	d
10.	b	55.	d	100.	d	145.	d	190.	d	235.	d	280.	c
11.	a	56.	b	101.	b	146.	b	191.	c	236.	a	281.	c
12.	d	57.	a	102.	c	147.	a	192.	b	237.	a	282.	a
13.	b	58.	a	103.	a	148.	d	193.	b	238.	d	283.	b
14.	a	59.	d	104.	a	149.	b	194.	c	239.	b	284.	b
15.	a	60.	b	105.	d	150.	c	195.	b	240.	a	285.	b
16.	c	61.	d	106.	b	151.	d	196.	d	241.	c	286.	b
17.	b	62.	c	107.	c	152.	d	197.	c	242.	c	287.	d
18.	b	63.	c	108.	b	153.	a	198.	a	243.	d	288.	d
19.	c	64.	c	109.	b	154.	d	199.	b	244.	c	289.	a
20.	d	65.	b	110.	a	155.	b	200.	b	245.	b	290.	b
21.	c	66.	d	111.	d	156.	b	201.	a	246.	a	291.	b
22.	d	67.	a	112.	c	157.	c	202.	d	247.	a	292.	d
23.	c	68.	d	113.	b	158.	a	203.	d	248.	a	293.	d
24.	b	69.	c	114.	b	159.	c	204.	d	249.	c	294.	c
25.	c	70.	c	115.	b	160.	a	205.	b	250.	b	295.	a
26.	b	71.	c	116.	a	161.	a	206.	b	251.	d	296.	b
27.	b	72.	a	117.	d	162.	a	207.	b	252.	d	297.	a
28.	a	73.	b	118.	c	163.	a	208.	c	253.	b	298.	b
29.	b	74.	b	119.	a	164.	b	209.	a	254.	d	299.	a
30.	a	75.	b	120.	c	165.	c	210.	b	255.	a	300.	c
31.	a	76.	d	121.	d	166.	a	211.	b	256.	c	301.	d
32.	b	77.	b	122.	a	167.	a	212.	a	257.	a	302.	d
33.	c	78.	c	123.	c	168.	b	213.	c	258.	d	303.	a
34.	a	79.	c	124.	d	169.	b	214.	a	259.	c	304.	b
35.	a	80.	b	125.	d	170.	b	215.	d	260.	d	305.	a
36.	a	81.	c	126.	a	171.	a	216.	b	261.	b	306.	a
37.	a	82.	c	127.	a	172.	a	217.	c	262.	b	307.	d
38.	b	83.	a	128.	d	173.	c	218.	c	263.	d	308.	d
39.	d	84.	a	129.	c	174.	b	219.	c	264.	a	309.	b
40.	b	85.	b	130.	c	175.	a	220.	c	265.	d	310.	b
41.	c	86.	b	131.	d	176.	d	221.	a	266.	d	311.	a
42.	d	87.	d	132.	b	177.	c	222.	c	267.	a	312.	b
43.	b	88.	b	133.	a	178.	a	223.	d	268.	a	313.	d
44.	a	89.	a	134.	a	179.	b	224.	a	269.	d	314.	a
45.	a	90.	b	135.	a	180.	b	225.	a	270.	d		

ANSWERS TO MCQ, GROUP A (1) [HINTS]

18. (b) $\frac{w_B}{M_B}\times\frac{RT}{V}=\frac{w_B^{/}}{M_B^{/}}$, $\Rightarrow$ $\frac{5}{342}=\frac{1}{M_B^{/}}$ $\Rightarrow$ $M_B^{/}=\frac{342}{5}=68.4$

20. (d) $\Delta T_b=K_b m$, $\Delta T_f=K_f m$, $\frac{\Delta T_b}{0.186}=\frac{0.512}{1.86}$, $\Delta T_b=0.0512$

23. (c) $\frac{2.5\times 1M+3\times 0.5}{5.5}=0.73\,M$

31. (a) $10\times 10\times 60=6000\,C$, $96500\longrightarrow 35.5.g\,Cl$,

$6000\longrightarrow\frac{35.5\times 6000}{96500}=2.2\,\text{gram Chlorine}$

35. (a) $\Lambda=\frac{k\times 1000}{N}$

39. (d) Salt bridge may be replace by porous partition.

44. (a) $1\,\text{gram eqvt of oxygen}=\frac{1}{4}\text{mole}$.

47. (d) $k=\frac{2.303}{t=32}\log\frac{100}{25}=\frac{0.693}{16}$, $t_{\frac{1}{2}}=\frac{0.693}{0.693}\times 16=16$

53. (a) $k=\frac{0.693}{5770}=0.00012$, $=\frac{2.303}{t}\log\frac{100}{80}$

$0.00012=\frac{2.303}{t}\times 0.097$, $t=1861$ years

102. (c) $NH_2COONH_4\xrightarrow{\Delta}(NH_2)_2CO$

107. (c) It dimerises to N_2O_4 making it diamagnetic.

108. (b) $2Hg+O_3\longrightarrow Hg_2O+O_2$

111. (d) $Pb + PbO_2 + H_2SO_4 \longrightarrow 2PbSO_4 + 2H_2O$

113. (b) Sp^3d hybridisation , AB_4L type. Shape See-saw.

123. (c) $Cl_2+H_2O\longrightarrow HCl+O$, coloured matter $\xrightarrow{[O]}$ colour less.

137. (b) sp^3d^2 hybridisation, AB_5L type , shape square pyramidan.

141. (c) $Hg_2Cl_2+2NH_4OH\longrightarrow Hg+Hg(NH_2)Cl+NH_4Cl+2H_2O$

154. (d) $Zn\xrightarrow{NaOH}Na_2ZnO_2+H_2$, $Al\xrightarrow{NaOH}NaAlO_2+H_2$

157. (c) $CuSO_4+2KI\longrightarrow CuI_2+K_2SO_4$, $CuI_2\longrightarrow Cu_2I_2+I_2$

160. (a) Rinman's green = CoO and ZnO.

163. (a) Alloy of Bi, Pb, Sn and Cd.

198. (a) $CH_3-CHCl_2\xrightarrow{KOH}CH_3CHO$, $CH_2ClCH_2Cl\xrightarrow{KOH}(CH_2OH)_2$, diol

207. (b) Tertiary alkylhalide never undergoes Willamson's synthesis. It undergoes elimination reaction in presence of methoxide base.

213. (c) $2C_2H_5OH+6O_2\longrightarrow 4CO_2+6H_2O$

238. (d) $CHCl_3+HONO_2\longrightarrow CCl_3(NO_2)$

GROUP - A (2)

VERY SHORT QUESTIONS (FILL IN THE GAPS)

(One mark each)

UNIT - 1

1. Iodine is ——— type of solid.
2. In ZnS crystal, Zn^{2+} ions occupy ———.
3. Na_2O crystal shows ——— structure.
4. Rock salt type structure has ——— coordination.
5. ——— solids are isotropic in nature.
6. In most cubic close-packed lattices, ———% of space is filled.
7. Two types of voids are ——— and ———.
8. The point defect in a crystal that does not change the density of a solid is ———.
9. Graphite is ______ boned type of solid.
10. In NaCl crystal, ——— ions occupy all the octahedral sites.
11. Co-ordination numbers of Cs^+ and Cl^- in CsCl crystal are in the ratio ———.
12. In NaCl crystal, Na^+ ion is surrounded by ——— Cl^- ions.
13. The number of nearest neighbours with which a given sphere is in contact is called ———.
14. Face-centred cubic unit cell has ——— atoms.
15. Glass is a example of ——— solid.
16. Cesium chloride has ——— structure.

UNIT - 2

17. With the increase of temperature, the vapour pressure of a liquid ———.
18. Solubility of a gas in a liquid, ——— with rise of temperature.
19. At the boiling point of a liquid, its vapour pressure is equal to ———.
20. Colligative properties are inversely proportional ti ———.
21. With increase of altitude, the boiling point of water ———.
22. Solutions having same osmotic pressure are called ———.
23. On adding a solute, boiling point of solution ———.
24. At m.p. the vapour of solid is ——— that of liquid.

UNIT - 3

25. ΔG is related to ——— of the cell by the expression ———
26. In electrochemical cell oxidation takes place at ———.
27. The best electronic conductor is ———.
28. EMF of the cell when the cell reaction attains equilibrium is ———. Where ΔG is also equal to ———
29. Galvanic cell converts ——— into ———.
30. Specific conductance = ——— x cell constant.
31. Unit of cell constant is ———.

32. Molar conductance for weak electrolyte on dilution ————.
33. Charge on one mole of electrons is ————.
34. 1 mole of electrons ———— coulomb.
35. Oxidation takes place at — during electrolysis.
36. The electrolysis of molten sodium hydride liberate ———— gas at the ————.
37. Specific conductance for weak electrolyte on dilution ————.
38. Unit of specific conductance is ————.
39. pH value of aqueous solution of NaCl after electrolysis is ————.
40. Unit of electrochemical equivalent is ————.
41. For strong electrolytes degree ofionisation is ————.
42. Spoon to be silverplated is taken as ———— during electrolysis.

UNIT - 4

43. For a first order reaction, the $t_{0.5}$ is equal to ————.
44. Photochemical reaction between hydrogen and chlorine is ———— order reaction.
45. Arrhenius equation is given by ————.
46. Unit of rate constant for first order reaction is ————.
47. Alkali hydrolysis of ester is a ———— order reaction having molecularity ————.
48. Molecularity cannot be greater than ————.
49. The 1 st order reaction having molecularity greater than one is called ————.

UNIT - 5

50. Ferric hydroxide sol has ———— charge.
51. Boot polish is ———— type of colloid.
52. The zig-zag motion of colloidal particles is called ————.
53. The scattering of light on the surface of colloidal particle is ————.
54. The colloidal system of liquid dispersed solid is called ————.
55. The method of removal of soluble impurities of solutions is called ————.
56. ———— is used to remove coloured matter from solution of sugar.
57. Milk is an example of ———— type emulsion.
58. Lyophilic colloids are ———— stable than lyophobic colloids.
59. Sols of Sg and gold are examples of ———— colloids.

UNIT - 6

60. Chemical method of concentration is called ————.
61. Paramagnetic character of transition elements is due to ————.
62. Composition of copper matte is ————.
63. Copper obtained from Bessemer's converter is called ————.
64. Cast iron contains maximum percentage of ————.
65. Azurite is the ore of ————.
66. Bell metal is an alloy of ———— and ————.
67. Mohr's salt is ————.
68. Galvanised iron has a coating of ————.

69. $FeSO_4$ 7 H_2O is known as ———.

70. Brass contains ———.

71. Purest form of iron is ———.

72. Fe_3O_4 is known as ———.

73. Titanium is purified by ———.

74. Extra pure germanium is obtained by ———.

75. Aluminium is refined by ———.

UNTIT - 7

76. Anhydride of nitric acid is —— and anhydride of phosphuric acid is ———.

77. HMH bond angles in MH_3 molecules of group- VI —— down the group.
    (a) remain same (b) decrease (c) increase

78. Pentoxides of all the elements of nitrogen family are ——— in nature.

79. In the synthesis of NH_8 by Haber's process, catalyst is —— and promoter is ——.

80. —— is used as catalyst by Ostwald process for manufacture of nitric acid.

81. Oxygen and Ozone are —— of each other.

82. The least reducing hydride of oxygen family is ———.

83. $H_2S_2O_7$ is known as ———.

84. The general electronic configuration of elements of group VIA is ———.

85. The acidic strength of halogen hydra acids are follows in the order _______.

86. $4\ NaOH + 2F_2 \rightarrow 4NaF + 2H_2O +$ ______.

87. In aquaregia —— is responsible for dissolving gold and platinum.

88. ——— has highest electron affinity in halogen family.

89. $Cl_2 + 2\ NaOH \rightarrow$ _______ $+ NaClO + H_2O$

90. $3\ Cl_2 + 6\ NaOH \rightarrow$ ——— $+ NaClO_3 + H_2O$

91. $P_4 + 6Br_2 + 12\ H_2O \rightarrow 4\ H_3PO_3 +$ ———.

92. The halogen acid which does not give precipitate with $AgNO_3$ solution. is ———.

93. HF is ——— volatile than HCl due to presence of ———.

94. Noble gases have ——— electron affinity.

95. Hybridisation of Xenon in Xenon tetrafluoride is ——— .

96. Hybridisation of xenon in xenon hexafluoride is

97. Shape of XeF_6 molecule is ———.

98. ——— inert gas is most abundant in air.

99. Zero group elements are ——— gases and known as ———

100. General electronic configuration of zero group element is ———.

101. Hybridisation of XeF_2 is ———.

102. XeF_4 is used as ——— and ——— .

UNIT - 8

103. Composition of chalcopyrite ore is ———.

104. German silver consists of ———.

105. Bronze consists of ———.

106. Oxidation number of Mn in potassium manganatie is ———.

107. Fe_2O_3 $3H_2O$ is known as ————.

UNIT - 9

108. IUPAC name of $[Co\ (en)_3]_2\ (SO_4)_3$ is ————.

109. The composition of carnallite is ———.

110. Oxidation state of Ni in $[Ni\ (CO_4)]$ is ———.

111. Denticity of EDTA is ————.

112. IUPAC name of $[Fe\ (CO)_5]$ is ————.

113. $[Co(NH_3)_5Br]SO_4$ 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.

114. Stable complex is formed if EAN is equal to the ———.

115. Chemical formulae of nitropentaminecobalt (III) chloride is ———.

116. According to Werner types of valencies present for metals in complexes are — and — ————.

117. The coordination number of cobalt in $[Co\ (en)_2Cl_2]$ is ———.

UNIT - 10

118. Commercial name 1,1,2, 2-tetrachloroethane is ——.

119. Methyl bromide on treatment wih sodium ethoxide togive ——— .

120. Bromopropane reacts with alcoholic KOH to give ———.

121. HBr is added to propene in according to ———.

UNIT-11

122. Complete the following reaction :

$CH_3CH_2OH + SOCl_2 \rightarrow$ .... + ... + HCl.

123. Tertiary alcohol is not ordinarily oxidised, but on restrict oxidation, it yields —— having one —— carbon atom.

124. $CH_3COCl + C_2H_5OH \rightarrow$ ——— + ———

125. Acid chloride on reduction with $LiAlH_4$. gives ——— .

126. Phenol gives violet colouration with ——— solution.

127. When phenol is distilled with zinc dust the main product is ————.

128. C_6H_5OH when dissolved in water gives a solution with pH ————.

UNIT - 12

129. Aqueous solution of formaldehyde is called _______ .

130. The formation of cyanohydrin from a ketone is an example of ———.

131. Aldehydes are obtained by the catalytic dehydrogenation of ———.

132. Aldehydes and Ketones are collectively known as ——— compound.

133. Acetaldehyde + conc. H_2SO_4 polymerises to ————

134. Rosenmond's reduction ——— and ——— used as catalyst.

135. At room temp., formaldehyde is a ————.

136. ——— being an aldehyde, does not react with Fehling's solution.

137. Formaldehyde with NH_3 forms —————

138. Test that distinguishes between pentan-2-one and pentan-3-one is ________.

139. Between acetal dehyde and acetone ______ is more reactive.

140. ——— distinguishes between acetaldehyde and acetone.

141. Reduction of Ag^+ ions, provided by Tollen's reagent to silver metal is known as ——— test.

142. Aldehydes restore the — colour of Schiff's reagent.

143. Calcium acetate when heated with calcium formate forms ————.

144. $2HCHO + NaOH \rightarrow HCOONa +$ ———.
This reaction is called _______.

145. When acetaldehyde reacts with hydroxylamine ——— is formed.

146. When calcium acetate is heated dry 400°C it forms ———.

147. Ammoniacal solution of silver nitrate is known as ———— .

148. The precipitate formed when aldehyde reacts with Fehling's solution is ————.

149. $CH_3COOH + PCl_3 \rightarrow 3\ CH_3COCl +$ ————.

150. ——— is the strongest of all aliphatic monocarboxylic acid.

151. Vinegar is ———— solution of acetic acid.

152. ———— is the only aliphatic carboxylic acid which acts as a reducing agent

153. When acetic acid is treated with PCl_5 ——— results.

154. IUPAC name of $CH_3CH = CHCOOH$ is ———.

155. General formulae of aliphatic monocarboxylic acid is ————.

156. Sodium acetate is subjected to electrolysis to produce —— at anode.

157. When sodium formate is heated upto 390°C, the product is ————.

158 . When sodium salt of formic acid reacts with sodalime ——— and acid deparately and ______ gas evolve respectively..

159. Dehydration of an amide with P_2O_5 gives ———.

UNIT-13

160. General formula of aliphatic saturated amine is ————.

161. Carbylamine action is shown by ————.

162. $CH_3NH_2 + CH_3COCl \rightarrow$ ——— + HCl

163. Amine have — B.P. comparedto corresponding alcohols.

164. Ammonia is ———— basic than aliphatic amines.

165. ——— on reduction with Na/C_2H_5OH gives ethylamine.

166. Primary amine is produced, when an amide is treated with ——— .

167. Quaternary ammonium salt is used in production of ————.

168. Primary amine is treated with nitrous acid to form ————.

UNIT - 14

169. Amino acids are building blocks of ———— .

170. Monomeric units of glycogen are ———— .

171. ——— of plant cell absorbs light energy during photosynthesis.

172. All monosaccharides and disaccharides are reducing sugars except ————.

173. The monosaccharides with a –CHO group are called ———

174. The monosaccharides with a ketonic group are called ———.

175. Proteins acting as catalyst of biochemical reactions are ———.

176. Fibrous protein found in nail, hair and skin is ————.

177. Amino acids which are not synthesised in human body are called ——— amino acids.

178. Salt like behaviour of amino acid is due to its ——— form.

179. ——— is the major male sex hormone.

180. ——— is the most important pregnancy hormone.

181. Vitamin C is known as ———.

182. Deficiency of Vitamin D causes ————.

183. Deficiency of Vitamin A causes ————.

UNIT - 15

184. Monomers of terylene (decron) is ——— and ———.

185. The polymer used for making non stick utensils is ———.

186. Teflon is a type of ——— containing the monomer.

187. Polymerisation of ethene is ———.

188. Nylon-6,6 is synthetic polymer, co-polymer of —— and ———.

189. Nylon – 6, 10 is a copolymer of ——— and ———.

190. Momoner of neoprene is ________

191. Condensation of phenol with formaldehyde produces a polymer called ———.

192. Monomer of Nylon-6 is ———.

193. Buna - S rubber is also known as ————.

194. Neoprene is a polymer of ————.

UNIT - 16

195. ———— used as both antiseptic as well as disinfectant.

196. Natural rubber is a polymer of ————.

197. —— act as both an analgesic and antipyretic.

198. Morphine is used as ———.

199. Pencillin has a ——— spectrum.

200. Medicines against harmful micro organisms are called ———.

201. Chemicals which prevent the growth of micro - organisims are called ———.

202. Paracetamol is used as ———.

203. Mercurochrome is an example of ————.

204. Polyethyleneglycol is treated as ___________ type of detergent.

205. Tincture iodine is ——— drugs.

206. Novalgin is an ——— drug.

❖ ❖ ❖

GROUP - A (2) ANSWERS

VERY SHORT QUESTIONS (FILL IN THE GAPS)

(One mark each)

UNIT - 1

1. molecular
2. tetrahedral void
3. antifluorite
4. 6:6
5. Amorphous solids
6. 74%
7. octahedral voids and tetrahedral voids
8. Frenkel defect.
9. diamond and graphite.
10. Na^+.
11. 8 : 8
12. 6 (six)
13. Co-ordination number.
14. 4
15. amorphous
16. bcc

UNIT - 2

17. increases
18. decreases
19. atmospheric pressure
20. molar mass of solute
21. decreases.
22. isotonic solution.
23. elevates (i.e. increases)
24. equal to

UNIT - 3

25. EMF
26. anode
27. silver
28. zero
29. chemical energy, electrical energy, $\left(-\Delta G = nFE\right)$
30. observed conductance
31. cm^{-1}
32. increases rapidly
33. one faraday or 96500C
34. 96500
35. anode
36. oxygen, anode
37. decreases slowly
38. ohm^{-1}, cm^{-1}
39. greater than 7
40. gram/coulomb
41. =1
42. cathode

UNIT - 4

43. 0.693/k
44. zero
45. $(k = A\ e^{-Ea/Rt})$
46. sec^{-1}
47. second, two
48. three
49. pseudo - unimolecular reactions

UNIT - 5

50. positive
51. gel
52. Brownian movement.
53. Tyndall effect.
54. gel
55. dialysis
56. activated charcoal
57. o/w.
58. more
59. multimolecular

UNIT - 6

60. leaching
61. presence of unpaired electrons
62. 50% Cu + 50% Cu_2S and FeS
63. Blistered Copper
64. carbon
65. copper

66. 80% of Cu, 20% of Sn
67. $[FeSO_4\ (NH_4)_2,\ SO_4\ 6\ H_2O]$
68. zinc
69. green vitriol
70. 90% Cu and 10% Zn
71. wrought iron
72. Magnetite
73. Van Arkel method
74. Zone refining
75. Hoop's electrolytic method

UNTIT - 7

76. N_2O_5 and P_2O_5
77. decrease
78. **Acidic** due to highest oxidation state (+5) of the central atom, where acidic character decreases down the group, N_2O_5 (strongest) > P_2O_5 > As_2O_5 > $Sb_2\ O_5$ > Bi_2O_5 (weakest), due to gradual decrease of electronegativity.
79. Finely divided iron (catalyst) and molybdenum (promoter).
80. Platinum (oxidation of NH_3 to NO)
81. allotropes
82. H_2O
83. oleum
84. $ns^2\ np^4$
85. HI > HBr > HCl > HF
86. O_2
87. Nascent chlorine
88. Chlorine
89. NaCl
90. 5NaCl
91. 12 HBr
92. HF
93. less, hydrogen bonding
94. zero
95. sp^3d^2
96. sp^3d^3
97. distorted pentagonal bipyramidal
98. Argon
99. monoatomic, rare gases or aerogens
100. ns^2np^6
101. sp^3d
102. oxidising agent, fluorinating

UNIT - 8

103. $CuFeS_2$
104. Cu, Zn, Ni
105. Cu, Sn
106. +6
107. Limonite

UNIT - 9

108. tris (ethylenediamine cobalt (III) sulphate
109. $MgCl_2.\ KCl.\ 6\ H_2O$
110. zero
111. Hexadentate ligand
112. Pentacarbonyl Iron (o)
113. ionisation, linkage or functional.
114. atomic number of next inert gas
115. $[Co(NH_3)_5NO_2]Cl_2$
116. primary valency, secondary valence
117. six

UNIT - 10

118. Westron.
119. dimethyl ether
120. propene
121. Markonikov rule.

UNIT-11

122. CH_3CH_2Cl, SO_2
123. Ketone, less.
124. $CH_3COOC_2H_5$ + HCl
125. Primary alcohol.
126. ferric chloride solution
127. benzene
128. less than seven

UNIT - 12

129. formalin
130. nucleophilic addition
131. primary alcohols
132. carbonyl compound
133. tetramer, metaldehyde
134. Paladium, Barium Sulphate

(CH_3COCl to CH_3CHO)

135. gas
136. Benzaldahyde
137. Urotropine
138. iodoform test
139. acetal dehyde
140. Tollen's reagent
141. silver mirror
142. pink
143. acetaldehyde
144. [CH_3OH (Methyl alcohol)], Cannizzare's reaction.
145. Oxime
146. acetone
147. Tollen's reagent
148. Cu_2O (Red)
149. H_3PO_3
150. Formic acid or Methanoic acid
151. 7–8%
152. Methanoic acid
153. acetyl chloride
154. But-2-enoic acid
155. RCOOH, $CnH_{2n}O_2$
156. ethane
157. sodium oxalate
158 . hydrogen and methane
159. alkyl cyanide

UNIT-13

160. RNH_2, $CnH_{2n+3}N$
161. primary amine
162. $CH_3CONHCH_3$
163. lower
164. less
165. methyl cyanide
166. lithium aluminium hydride
167. detergents
168. alcohol

UNIT - 14

169. protein
170. glucose
171. chlorophyll
172. sucrose
173. aldoses
174. ketoses
175. enzymes
176. α-keratin
177. essential or indispensible
178. Zwitter ion or dipolar
179. Testosterone
180. Progesterone
181. ascorobic acid
182. rickets
183. night blindness.

UNIT - 15

184. ethylene glycol, terephthalic acid
185. Teflon
186. additional polymer, $CF_2 = CF_2$
187. Polythene
188. Hexamethylene diamine and adipic acid.
189. Hexamethylene - diamine, sebacoyl chloride
190. chloroprene
191. bakelite
192. caprolactum
193. Butadiene styrene Rubber
194. 2 - chloro –buta-1,3-diene or chloroprene

UNIT - 16

195. Phenol
196. Isoprene or 2 - methyl – buta-1,3-diene
197. Aspirin
198. analgesic
199. narrow
200. broad spectrum antibiotics
201. antiseptic
202. antipyretic
203. antiseptic
204. Non-ionic
205. antiseptics
206. analgesic

❖ ❖ ❖

GROUP - A (3)

VERY SHORT QUESTIONS (ANSWER THE FOLLOWING)

(One mark each)

UNIT -1

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 each sphere in a body centred close packed structure ?
4. What make alkali metal halides sometimes coloured which are otherwise colourless ?

UNIT - 2

5. How is Henry's Law constant related to the solubility of a gas in a solvent ?
6. The bottle of liquid ammonia is generally cooled before opening the seal. Assign reason.
7. Why does the solubility of NaCl in water increase with the rise in temperature ?
8. Does solubility of CO_2 in water increase on increasing the temperature ?
9. What is the value of van't Hoff factor for a dilute solution of K_2SO_4 in water ?

UNIT - 3

10. What is electrochemical equivalent ?
11. Can a nickel spatula be used to stir a solution of copper culphate ? Explain.

    (Given $E^0_{Ni^{2+}/Ni} = -0.25\,V;\ E^0_{Cu^{2+}/Cu} + 0.34V$)
12. What is the relation between Gibbs Free energy change and cell potential ?
13. In the electrolysis of a solution containing H^+ and Cu^{2+} ions, at the cathode H^+ ions are liberated in preference to Cu^{2+} ions. Is the statement correct ?

    $$E^0_{Cu^{++}|Cu} = 0.34\ V \qquad E^0_{H^+\left|\frac{1}{2}H_2\right.} = 0.0\ V$$

UNIT - 4

14. Identify the reaction order from each of the following .

    (i) $k = 2.3\times10^5\ L\,mol^{-1}s^{-1}$ (ii) $k = 3.1\times10^{-4}s^{-1}$
15. For a reaction $A + H_2O \longrightarrow B$; Rate $k \propto [A]$. What is its (i) Molecularity (ii) Order.
16. What is the order of a photochemical reactions.
17. What is an elementary reaction ?

UNIT - 5

18. What is emulsion ?
19. What is the name given to the zig-zag path of the colloidal particles ?

20. Which of the following is more effective in coagulating positively charged ferric hydroxide sol (i) KCl (ii) $FeCl_3$ (iii) $K_4[Fe(CN)_6]$?

21. What will happen if gelatin is added to a gold sol ?

UNIT - 6

22. Which types of ores are concentrated by froth floatation process ?

23. What is leaching ?

24. Give one main difference between calcination and roasting ?

25. What is the percentage of carbon in steel ?

UNIT - 7

26. What are the products formed when nitrous acid undergoes disproportionation ?

27. What happens when an aqueous solution of ammonium chloride is heated with sodium nitrite ?

28. Which oxide of nitrogen is used as rocket fuel ?

29. PCl_5 is ionic in the solid state. Why ?

30. What is carbogen ? What is its use ?

31. Arrange the following in order of increasing acidic strength and assign reason : HCIO, $HCIO_2$, $HCIO_3$, $HCIO_4$.

32. NO is paramagnetic in the gaseous state but diamagnetic in the solid and liquid states. Justify.

33. Why does H_3PO_2 act as monobasic acid ?

34. Give the geometry of XeF_4.

UNIT - 8

35. Write the electronic configuration of Cr^{3+} and Mn^{2+}

36. Which elements of transition series do not resemble the rest of the members in characteristics ?

37. In moist air, copper corrodes to produce a green layer on its surface. Explain.

38. What are the colours of Fe^{2+} and Fe^{3+} ions ?

39. Write the general electronic configuration of

    (i) Lanthanoids (ii) Actionoids

40. What are the main ores of lanthanoids ?

41. Which trivalent ion has the maximum size in the Lanthanoid series ?

UNIT - 9

42. What does 'en' represent ? How many co-ordinate sites does it have ?

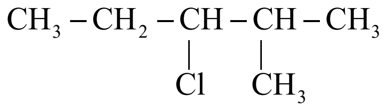
43. Give the chemical formula of potassium hexacynoferrate(II).

44. What does EDTA stand for ?

45. Calculate number of unpair electrons in the following complexes :

    (i) $[Cr(NH_3)_6]^{3+}$ (ii) $[CoF_6]^{3-}$ (iii) $[Fe(CN)_6]^{4-}$

UNIT-10

46. Give IUPAC name of 

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

47. Write the structural formula of 1-Bromo-2-methyl butane.

48. What organic compound is obtained when ethyl bromide reacts with aqueous NaOH solution ?

49. What happens when ethyl iodide is heated with alcoholic KOH.

50. CH_3CH_2Cl $[CH_3]CH_2Cl$ $(CH_3)_3CCl$, arrange in order of SN_2 reactivity.

51. What happens when CH_3–Br is treated with AgCN and then reduced ?

52. Why halobenzene and haloarenes are less reactive than haloalkanes ?

53. What happens when benzene is heated with chlorine in presence of sunlight ?

UNIT - 11

54. Name the primary alcohol that responds iodoform test.

    (CH_3OH, CH_3COCH_3, CH_3CHO, C_2H_5OH)

55. Name the alcohol present in pyroligneous add.

56. What happens when acetone is reduced by H_2/Ni ?

57. What happens when a secondary alcohol is oxidised ?

58. What happens when ethanol is heated with cone. H_2SO_4 at 140°C ?

59. Name the process in which ethanol is oxidised to ethanoic acid in the presence of bacterium acetic.

60. What is the product formed when ethyl acetate is reduced with Na/alcohol ?

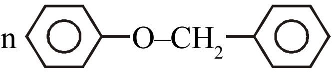
61. Arrange in order of increasing acidic nature.

    Phenol, p-nitrophenol, CH_3OH, Isopropyl alcohol.

62. How is phenol prepared from aniline ?

63. How will you convert propan-1-ol to propan-2-ol ?

64. How will you prepare tert-butyl alcohol from acetic acid ?

65. What products are obtained when  is treated with HI ?

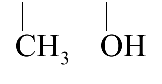
66. What is Schotten – baumann reaction ?

67. Phenols and methanol on action with Na liberates $H_2(g)$ (T/F)

68. Name the reaction in which formylation of phenol is made.

UNIT - 12

69. Write the IUPAC name of compound.



$$CH_3-CO-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2Cl$$

70. Aldehydes and ketones are functional isomers of each other. (True/False)

71. What type of hybridization is present in carbon atom of carbonyl group ?

72. Name any aldehyde other than formaldehyde that respond to Cannizzaro's reaction.

73. Arrange HCHO, CH_3CHO and CH_3COCH_3 in order of increasing reactivity towards HCN.

74. What is Tollen's reagent ?

75. HCHO undergoes Cannizzaro's reaction.

76. Write the IUPAC name of oxalic acid.

77. Name the product formed when acetone is warmed with sodium hypoiodite solution.

UNIT - 13

78. Write the IUPAC name of the following compounds.

(i) Ethylcyanide (ii) Isopropylamine

(iii) Ethylamine (iv) Dimethylamine

79. Aromatic amines are weaker bases than aliphatic ainioes. (True / False)

80. Write an equation for Hofmann's bromamide reaction.

81. What is vapour phase nitration ?

82. Why nitroalkanes are used as explosives ?

83. (i) Convert Aniline to chlorobenzene, (ii) Aniline to benzoic acid.

84. What is Gattermann's reacdon ?

85. How is phenyl methanamine obtained from phenyl cyanide ?

86. How is aniline obtained from benzoic acid ?

87. Arrange the following in increasing order of their basic strength in aqueous solution :

CH_3NH_2, $(CH_3)_3N$, $(CH_3)_2NH$

88. *tert*-Butylamine cannot be prepared by action of ammonia on tert-butyl bromide. Why? Explain.

UNIT - 14

89. Which acts as control house of the cell ?

90. What is milk sugar ?

91. Name two globular proteins.

92. Name two essential amino acids.

93. Hormones are secreted by which glands in the body ?

94. Name two water soluble vitamins.

95. Name four fat soluble vitamins.

96. Which type of protein is found in haemoglobin ?

97. Energy stored in the body is in which form ?

98. Name the bond in protein.

99. What is a "Zwitter ion ?"

100. Name the sugar present in DNA.

101. What type of bonds hold a DNA double helix together ?

102. Define mutation.

103. What is isoelectric point ?

104. Name the purines present in DNA.

105. Which α-amino acid can cross link peptide chains ?

106. Give one example each of reducing sugar and non-reducing sugar.

107. What are the products of hydrolysis of lactose ?

UNIT - 15

108. What is Teflon ? Write some of its uses.

109. Define elastomer.

110. Define thermoplastic.

111. What is neoprene ?

112. Provide an example of a co-polymer.

UNIT - 16

113. Write some names of antibiotics.

114. What are fillers ?

115. What oils are used for making of (i) hard soap (ii) soft soap.

116. Write names of analgesic drugs ?

117. Write names of antiseptics.

118. Write two names of antipyretics.

119. What is LAS detergent / ABS detergents ?

120. Write the name of two narcotics which are used as analgesics ?

121. Which substance is used as both antiseptic as well as disinfectant ?

122. Why is bithional added to soap ?

123. Why is use of aspartame limited to cold foods and drinks? Identify two artificial sweeteing agent.

124. Name two anti histamines.

125. What type of drug is equonil ?

126. Provide the name of a broad spectrum antibiotic.

127. What are the consequences of using non-biodegradable detergents ?

❖ ❖ ❖

GROUP - A (3) ANSWERS

VERY SHORT QUESTIONS (ANSWER THE FOLLOWING)

(One mark each)

UNIT -1

1. Simple cubic < Body centred cubic < Face centred cubic
2. The C.N. of octahedral void is six.
3. The C.N. of each sphere is 8.
4. It happens because of metal excess defects on account of anion vacancies that are filled by electrons.

UNIT - 2

5. K_H is inversely proportional to the solubility of a gas in a solvent.
6. On colling, the gas will tend to liquefy and its vapour pressure will decrease. Therefore, the gas will not come with force upon opening the seal.
7. Because the process of dissolution is of endothermic nature.
8. No, it decreases as the dissolution process is exothermic in nature.
9. K_2SO_4 dissociates completely in water as :

$$K_2SO_4 \xrightarrow{(aq)} 2K^+(aq) + SO_4^{2-}(aq)$$

$$i = 2 + 1 = 3$$

UNIT - 3

10. It is the mass of the substance deposited at the electrode (cathode) by passing a charge of one coulomb through the molten or aqueous solution of the electrolyte.
11. No, because the redox reaction will immediately take place as Ni is placed below Cu in the electrochemical series.

$$Ni(s) + Cu^{2+}(aq) \longrightarrow Ni^{2+}(aq) + Cu(s)$$

12. $\Delta G^0 = -nF E^0_{cell}$
13. No, it is wrong, Cu^{2+} ions are discharged in preference to H^+ ions because E^0 value of Cu^{2+}/Cu is more than that of $2H^+/H_2$.

UNIT - 4

14. (i) second order (ii) first order
15. (i) Pseudo unimolecular reaction (ii) order = 1
16. Photochemical reactions are generally of zero order.
17. The reaction taking place in a single step is an elementary reaction. For example

$$N_2(g) + O_2(g) \longrightarrow 2NO(g)$$

UNIT - 5

18. It is a collodial solution where both phase and medium are liquid. eg. milk, o/w emulsion.
19. It is known as Brownian Movement.
20. $K_4[Fe(CN)_6]$ is the most effective because $[Fe(CN)_6]^{4-}$ has the maximum coagulating power.
21. It will check coagulation when as electrolyte is added to the sol.

UNIT - 6

22. Sulphide ores like ZnS and HgS etc. concentrated by this process.
23. It may be defined as the formation of a soluble compound of the ore excluding the impurity by reacting with a suitable chemical compound.
24. Calcination is carried in the absence of air while roasting is carried with excess of air or oxygen.
25. The percentage of carbon in steel ranges from 0.15 to 1.5.

UNIT - 7

26. It undergoes oxidation to nitric acid and reduction to nitric oxide

$$3H\overset{+3}{N}O_2 \longrightarrow H\overset{+5}{N}O_3 + 2\overset{+2}{N}O + H_2O$$

27. Nitrogen gas is evolved in the reaction.

$$NH_4Cl(aq) + NaNO_2(g) \xrightarrow{\text{heat}} N_2(g) + 2H_2O(\ell) + NaCl(aq)$$

28. Dinitrogen tetraoxide (N_2O_4) is used as rocket fuel.
29. In the solid state. PCl_5 exists as $[PCl_4]^+ [PCl_6]^-$ in which the cation is tetrahedral and anion is octahedral. Because of the presence of strong attractive forces, it is a solid.
30. Carbogen is a mixture of oxygen and carbon dioxide. It is given to the pneumonia patients and patients of carbon monoxide poisoning for artificial respiration.
31. The order of increasing acidic strengths is : $HCIO < HCIO_2 < HCIO_3 < HCIO_4$. This is justified on the basis of the relative stabilities of conjugate base (anion) formed after losing H^+ ion. The order is : $CIO^- < CIO_2^- < CIO_3^- < CIO_4^-$. The ion CIO_4^- is maximum stable because negative charge dispersed by four electronegative oxygen atoms. At the sametime CIO^- ion is least stable since it has only one oxygen to accommodate the negative charge. Thus, $HCIO_4$ has the maximum H^+ ion losing tendency and is the strongest acid while HCIO because of similar reason is the least acidic in nature.

    $H\overset{+7}{Cl}O_4 > H\overset{+5}{Cl}O_3 > H\overset{+3}{Cl}O_2 > H\overset{+1}{Cl}O$: Higher is the positive o.s. greater is the acidic nature.

32. NO has odd no. of electrons (7+8=15) and due to the presence of unpaired electron, it is paramagnetic in the gaseous state. However, in the liquid and solid states, the unpaired electrons are involved in the formation of loose dimer. In the absence of any unpaired electron, it is diamagnetic in nature.

```
N-----O
|     |
O-----N
```

33. H_3PO_2 (hypophosphorus acid) acts as monobasic acid because it has only one replaceable hydrogen atom present as OH group which it can easily release.
34. Square planar shape, $sp^3 d^2$ hybridisation, octahedral geometry (AB_4L_2)

UNIT - 8

35. Cr^{3+} (Z = 24) $[Ar]^{18}\ 3d^3$; Mn^{2+} (Z = 25) $[Ar]^{18}\ 3d^5$.
36. These are the last elements of the first three transition series with $(n-1)d^{10}ns^2$ configuration. The elements are Zn, Cd and Hg. These belong to group 12.
37. In the presence of moist air, a layer of basic copper carbonate is formed on the surface of the metal which is green in colour. Therefore, the metal is corroded.

$$2Cu + O_2 + H_2O + CO_2 \longrightarrow CuCO_3.Cu(OH)_2$$

Basic copper carbonate
(Green)

38. Fe^{2+} ions (green), Fe^{3+} ions (yellow).

39. $4s^2 4s^6 4d^{10} 4f^{1-14} 5s^2 5p^6 4d^{0 \text{ or } 1} 6s^2$ / 2, 8, 18, 32 $5s^2 sp^6 5d^6 5f^{1-14} 6s^2 6p^6 6d^{0 \text{ (or) } 1} 7s^2$.

40. The main ores of lanthanoids are : Monazite and Gadolinite.

41. Lanthanum (La^{3+}).

UNIT - 9

42. 'en' represents ethane-1, 2-diamine $\left[H_2\ddot{N}-CH_2-CH_2-\ddot{N}H_2\right]$. It has two co-ordinate sites, bidentate ligand/chelating ligand.

43. $K_4[Fe(CN)_6]$.

44. It is a hexadentate ligand and its name is ethylenediaminetetraacetate.

45. The magnetic moment may be determined by applying the formula : $\mu = \sqrt{n(n+2)}$ BM. Here n = no. of unpaired electrons.

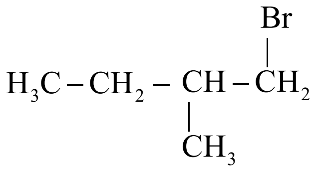
(i) $[Cr(NH_3)_6]^{3+}$; $n = 3$; $\mu = \sqrt{3(3+2)} = \sqrt{15} = 3.87\,\text{BM}$.

(ii) $n = 4$, $\mu = \sqrt{24} = 4.89$

(iii) $n = 0,\ \mu = 0$ (diamagnetic)

UNIT-10

46. 3-Chloro-2-methylpentane

47. 

$$H_3C-CH_2-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{Br}{|}}{CH_2}$$

48. Ethyl alcohol is obtained.

49. Ethene is formed.

50. CH_3Cl is more reactive than $(CH_3)_3CCl$ because of stearic hindrance in case of $(CH_3)_3CCl$.

51. Ethane nitrile is formed.

$$CH_3Br + AgCN \longrightarrow CH_3NC + KBr$$

$$\downarrow$$

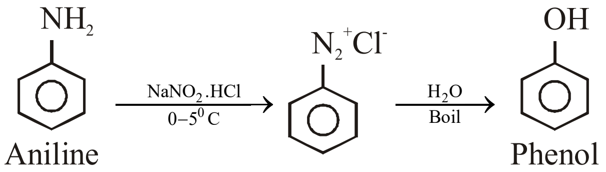
$$CH_3NH-CH_3$$ N-methyl methanamine.

52. Due to resonance stability.

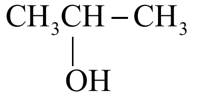
53. $C_6H_6 + 3Cl_2 \xrightarrow{\text{Sunlight}} C_6H_6Cl_6$

(Benzene hexachloride)

UNIT - 11

54. $CH_3{-}CH_2OH$
55. CH_3OH (Destractive distillation of wood)
56. Propan-2-ol or isopropyi alcohol is formed.
57. A ketone is obtained
58. Diethylether is formed.
59. Quick Vinegar Process.
60. Ethyl alcohol.
61. isopropylalcohol < CH_3OH < phenol < p-nitro phenol.
62. 

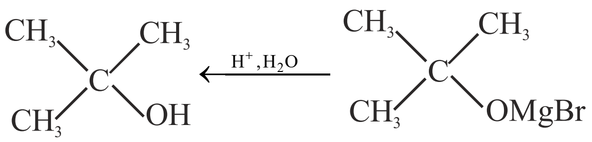
63. $CH_3CH_2CH_2OH \xrightarrow{P.Br_2} CH_3CH_2CH_2Br \xrightarrow{Alc.KOH} CH_3CH = CH_2 \xrightarrow{H^+.H_2O}$



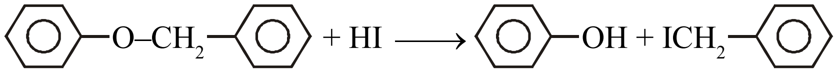
$$\underset{\displaystyle OH}{CH_3CH} - CH_3$$

propan – 2 – ol

64. $CH_3COOH \xrightarrow{Ca(OH)_2} (CH_3COO)_2Ca \xrightarrow{Heat} CH_3COCH_3 \xrightarrow{CH_3MgBr}$



tert-butyl alcohol

65. 

66. Phenols react readily with acyl chlorides or anhydrides in aqueous alkali to form esters.

e.g. $C_6H_5OH + C_6H_5COCl \xrightarrow{NaOH} C_6H_5COOC_6H_5 + HCl$

(Phenyl benzoate)

67. TRUE
68. Reimer - Tiemann's reaction.

UNIT - 12

69. 5-chloro-4-hydroxy-3-methyl pentan-2-one.
70. True
71. sp^2 hybridisation.
72. Chloral (2,2,2-trichloroethanal)

$[CCl_3 - CHO]$

73. $HCHO > CH_3CHO > CH_3COCH_3$
74. Ammoniacal solution of silver nitrate. $[Ag(NH_3)_2](OH)$

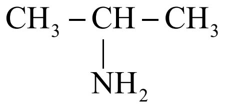
75. TRUE

76. Ethanedioic acid

77. Iodoform and sodium acetate.

UNIT - 13

78. (i) $CH_3CH_2C \equiv N \rightarrow$ Propane nitrile

(ii)  $\underset{\displaystyle NH_2}{CH_3-\underset{|}{CH}-CH_3}$ $\rightarrow$ propan-2-amine

(iii) $CH_3 — CH_2 — NH_2 \rightarrow$ Ethanamine

(iv) $CH_3 — NH — CH_3 \rightarrow$ N - methyl methanamine

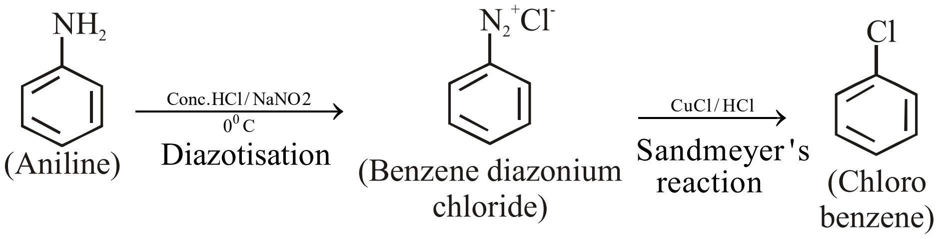
79. True

80. $RCONH_2 + Br_2 + 4\ KOH \rightarrow RNH_2 + 2KBr + K_2CO_3 + 2H_2O$

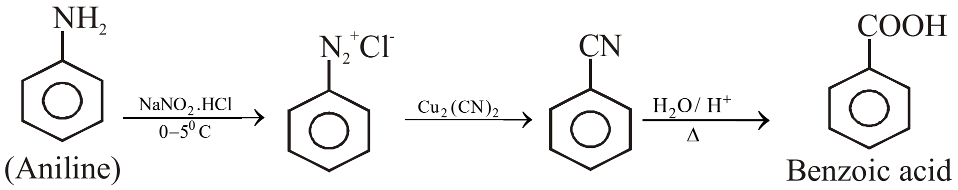
81. Reaction of alkanes with nitric acid in the vapour phase at 350°C to form nitro alkanes is called vapour phase nitration.

82. Because on heating it releases large volume of gaseous products like N_2, CO_2 and H_2.

83. (i)

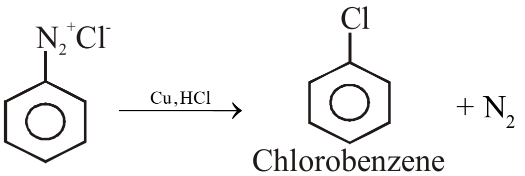


(ii)



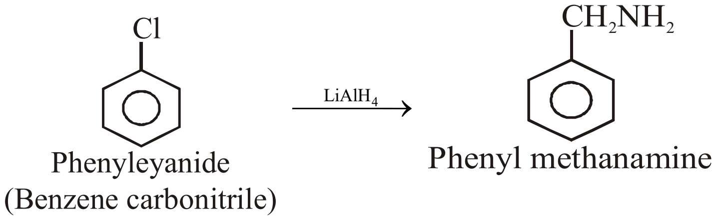
84. This is a modified Sandmeyer's reaction in which diazonium salts are heated with copper powder andhydrogen halides to give haloarene.

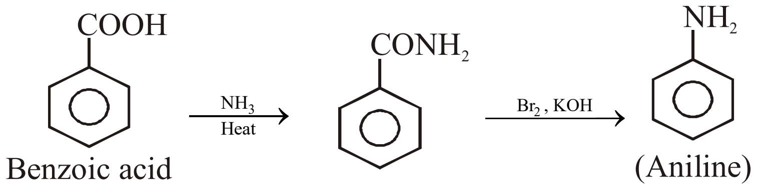
For example:



Chlorobenzene

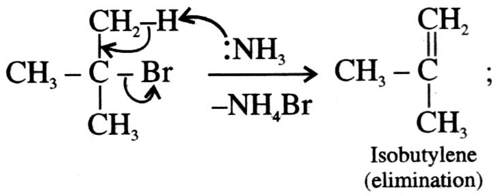
85.



86. 

87. $(CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$

88. *tert*-Butylamine is a 3^0 alkyi halide. On treatment with a base like NH_3, it prefers to undergo elimination reaction rather than substitution. Therefore, the product is isobutylene instead of *tert*-butylamine.



Elimination prefers to substitution.

UNIT - 14

89. Nucleus.

90. lactose

91. Albumin and globulin.

92. Valine and Leucine.

93. Ductless (endocrine) glands.

94. Vitamin B complex and Vitamin C.

95. Vitamin A, D, E and K are fat soluble vitamins.

96. Globular protein.

97. ATP (Adenosine triphosphate). It is the carrier of chemical energy in all the living organisms.

98. Peptide bond.

99. Zwitter ion is dipolar ion having both the and -ve charges on the molecules.
For Ex: Amino acids and Proteins.

$$\underset{\text{glycine}}{NH_2-CH_2COOH} \rightleftharpoons \underset{\text{dipolarZwitterion}}{\overset{+}{N}H_3-CH_2-COO^-}$$

100. Deoxyribose.

101. Hydrogen bonds.

102. It is the change in a DNA molecule that could lead to the synthesis of proteins with different amino acid sequence.

103. The pH at which no net migration of amino acid takes place under the influence of an applied electric field is called isoelectric point. For example, soelectric point ot glycine is 6.1.

104. Adenine and guanine.

105. Cysteine can cross link peptide chains through disulphide bonds.

106. Reducing sugar : D-fructose
Non-reducing sugar: Sucrose

107. Lactose on hydrolysis gives glucose and galactose.

UNIT - 15

108. It is a polymer of tetra - fluroethylene, $CF_2 = CF_2$
It is used in non - stick cooking utensils and also as insulator for making valves.

109. These are the polymers which on application of an external force get elongated but on removal of the force regain their original position. For example : Rubber.

110. A plastic which softens on heating is called a thermoplastic. For example : PVC, Polythene etc.

111. It is a synthetic rubber and its monomer is chloroprene.

112. Copolymer is formed from two or more different monomerswhile homopolymer is formed from one type of monomer. Nylon-66 is copolymer while polythene is homopolymer.

UNIT - 16

113. (i) Pencillin (ii) Tetracycline (iii) Streptomycin (iv) Ampicilline

114. It increases the weight or make the soap bulky.
For example : talc, starch, pearl ash, glauber salt etc.

115. (i) Hard Soap - (a) Animal fats (b) Coconut oils.
(ii) Soft Soap - (a) Linseed oil (b) Casfor oil

116. (i) Novalgin (ii) Morphine (Narcotic) (iii) Analgin.

117. (i) Dettol (ii) Savlon (iii) Bithional
(iv) Iodoform (v) Boric Acid (vi) Alcohol.

118. (i) Aspirin (ii) Paracetamol.

119. Linear alkyl sulphonate detergent. ABS = Alkyl benzene sulfonates.

120. Morphine and Heroin.

121. 0.2% phenol solution is an antiseptic whereas 1% phenol solution is used as disinfectant.

122. Bithional acts as an antiseptic and reduces the odour produced by bacterial decomposition of organic matter on th eskin.

123. Aspartame, sucrolose, it is used as sugar and soft drinks. Aspartame is unstable at cooking temperature.

124. Ranitidine, Terfenadine

125. It is used is controlling depression and hypertension.

126. Chloramphenical is a broad spectmm antibiotic and can be used for diseases like typhoid, acute fever,s dysentery, urinary infections, etc.

127. Non-biodegradeble detergents are degraded very slowly by microorganisms. Therefore, they get accumulated in rivers and water ways causing water pollution.

❖ ❖ ❖

GROUP - B (1)

SHORT TYPE QUESTIONS

(Two marks each)

UNIT - I

1. Crystalline solids are anisotropic in nature. What does this statement mean ?
2. What are ferromagnetic substances ?
3. What are n-type semiconductors ?
4. Why does the window glasses of the old buildings look milky ?
5. Gold (atomic radius = 0.144 nm) crystallizes in a face centred unit cell. What is the length of a side of the cell ?
6. Why is Frenkel defect not found in pure alkali metal halides ? Explain.
7. Zinc oxide is white but it turns yellow on heating. Explain.
8. How many atoms can be assigned to its unit cell if an element forms, (a) face cntred cubic cell (b) body centred cubic cell ?

UNIT - 2

9. State Henry's law about the solubility of a gas in a liquid.
10. Which will have higher boiling point: 0.1 M NaCl or 0.1 M $BaCl_2$ in water ? Explain.
11. Define azeotropic mixture.
12. Why cannot water be separated completely from ethanol by fractional distillation ?
13. What do you understand by osmotic pressure ?
14. 5.85 g of NaCl is dissolved in 90 g of water. What is the mole fraction of NaCl ?
15. What is freezing point of a liquid ?
16. What is ebullioscopic constant ?
17. What is an ideal solution ?

UNIT - 3

18 State Faraday's First law of electrolysis.

19. State Faraday's Second law of electrolysis.
20. Define electrochemical equivalent. (Z)
21. Which factors affect the conductivity of electrolytic solution ?
22. How do molar conductivity and specific conductance vary with dilution of the solution?
23. What is significance of salt bridge ?
24. What is meant by standard electrode potential ?
25. What is galvanization ?

26 What is relation between cell potential and equilibrium constant ?

27. Define molar conductance.
28. If a current strength of 1 amp. is passed for 10 minutes in $AgNO_3$ solution, 4 gm. Ag metal is deposited, Find the ECE of Ag.
29. Explain standard hydrogen electrode (SHE).
30. Write the overall cell reaction for lead storage battery.

31. The conductivity of 0.20 M solution KCl at 298 K is 0.025 S cm^{-1}. Calculate its molar conductivity.

32. How many moles of electrons are required to produce 10 gm. of Al from molten Al_2O_3?

33. What are fuel cells ? How do they resemble and differ from galvanic cell ?

34. Define average rate of reaction.

35. How catalyst affects the rate of reaction ?

36. What is activated complex in the reaction ? State its relation with activation energy.

37. What is order of reaction ?

38. Whatis molecularity of a reaction ?

39. Define threshold energy and activation energy. How are they related ?

UNIT - 5

40. Name the catalytic promoter or activator used in Haber's process for the synthesis of ammonia.

41. What are the characteristics of Lyophobic sols

42. Define adsorption with example.

43. What is the difference between multi-molecular and macromolecular colloids ?
    Give one example of each.

44. Define Emulsion with example.

45. What is the 'difference between multimolecular and macromolecular colloids ? Give one example of each. How are associated colloids different from these two types of colloids ?

46. What are enzyme catalyts ? Give two examples of enzyme catalysis reactions.

UNIT - 6

47. What is slag ?

48. Why is it that only sulphide ores are concentrated by 'froth floatation process' ?

49. Distinguish between calcination and roasting?

50. What is self reduction in metallurgy ? Give one example.

51. What is the role of depressant in froth floatation process ?

52. What is zone refining ?

53. Describe a method for refining nickel.

UNIT - 7

54. NH_3 has higher b.p. than PH_3.

55. Why is red phosphorus less reactive than white phosphorus ?

56. Why is BiH_3, the strongest reducing agent amongst all the hydrides of group 15 ?

57. Why does NO_2 dimerise ? Explain.

58. Why is N_2 less reactive at room temperature ?

59. Explain why NH_3 is basic while BiH_3 is only feebly basic.

60. Why is cone. H_2SO_4 not diluted by adding water to the acid ?

61. What happens when conc. H_2SO_4 is passed on potassium bromide ?

62. What happens when cone. HNO_3 reacts with Sulphur ?

63. Ozone is used for purifying air in crowded places such as cinema halls, tunnels, etc. Explain.

64. Oxygen is a gas (diatomic) but sulphur is a solid (Octa atom.) Why ?

65. Why flourine cannot be prepared by electrolysis of hydrofluoric acid ?

66. HF is less volatile than HCl. Why ?

67. Explain oxidising nature of halogens.

68. What happens when NH_3 is treated with chlorine ?

69. Arrange the following in the order of property indicated for each set:

    (a) F_2, Cl_2, Br_2, 1_2, increasing bond dissociation enthalpy.

    (b) HF, HCl, HBr, HI, increasing acid strength.

    (c) NH_3, PH_3, AsH_3, SbH_3, BiH_3, increasing base strength / bond angle.

    (d) Reducing nature of hydrides of group-15 & 17.

70. Fluorine exhibits only - 1 oxidation state whereas other halogens exhibit positive oxidation states also such as +1, +3, +5 and +7. Why ?

71. Electron gain enthalpy with negative sign of fluorine is less than that of chlorine. Explain.

72. Bond enthalpy of F, is lower than that of Cl_2. Explain.

73. What is the shape of XeF_2 molecule ?

    Ans. The shape of XeF_2 molecule is linear because of repulsion between three lone pairs and two bond pairs. The F - Xe - F bond angle is 180° and Xe – F bond length is 2.0 $\overset{0}{A}$. Here Xe undergoes sp^3d hybridisation with AB_2L_3 type.

74. Write some uses of arogon.

UNIT-8

75. What are transition elements.

76. Which is a stronger reducing agent Cr^{2+} or Fe^{2+} and why ?

77. Which of the 3d series of the transition metals exhibits the largest number of oxidation states and why ?

78. Why does $KMnO_4$ lose its purple colour with oxalic acid ?

79. Why is hydrochloric acid not used to acidify permanganate solution in volumetric estimations of Fe^{2+} ?

80. Assign reasons for the following : Cu(I) is not known in aqueous solution.

81. Write steps involved in the preparation of $K_2Cr_2O_7$ from Na_2CrO_4.

82. Why is europium (II) more stable than cerium (II) ?

83. Zirconium and Hafnium exhibit almost similar properties. Explain why ?

84. Compare the electronic configuration of actinoids and lanthanoids.

85. Of the lanthanoides, cerium (atomic no. 58) forms tetrapositive ion Ce^{4+} in aqueous solutions. Explain why ?

86. The highest oxidation state is exhibited in oxoanions of a metal. Explain.

87. Transition metals exhibit variable oxidation states. Explain why ?

88. Transition metals have high enthalpy of atomization. Explain.

89. Explain why mercury (I) ion exists as Hg_2^{2+} ion while copper (I) exists as Cu^+ ion.

UNIT-9

90. Define coordination number.

91. Write the IUPAC name of following coordination compounds.

(i) $[Cr(NH_3)_6]^{3+}$ (ii) $[Mn(H_2O)_6]^{2+}$
(iii) $[Fe(CN)_6]^{4-}$ (iv) $[Ni(NH_3)_6]Cl_2$
(v) $[CoCl(en)_2NH_3]^{2+}$

92. What is double salt ? Give an example.

93. What is chelating ligand ?

94. What is EAN rule ?

95. Explain the Werner's theory for the complex $K_4[Fe(CN)_6]$

96. Write the types of isomerism exhibited by the following complexes:

(i) $[Co(NH_3)_5Cl]\,SO_4$ (ii) $[Co(en)_3]^{3+}$
(iii) $[Co(NH_3)_6]\,[Cr(CN)_6]$

97. $Cu(OH)_2$ is soluble in NH_4OH but not in NaOH solution, why ?

98. Write the state of hybridisation, the shape and the magnetic behaviour of the following complex entities:

(a) $[Cr(NH_3)_4Cl_2]Cl$ (b) $[Co(en)_3]Cl_3$
(c) $K_2[Ni(CN)_4]$

99. Nickel does not form low spin octahedral complexes. Explain why ?

100. Co^{2+} is easily oxidised to Co^{3+} in the presence of a strong ligand. Explain why ?

101. The molecular shape of $Ni(CO)_4$ is not the same as that of $[Ni(CN_4)]^{2-}$. Explain why?

102. What is meant by crystal field splitting energy ? On the basic of crystal field theory, write the electronic configuration of d^4 in terms to t_{2g} and e_g in an octahedral field when

(i) $\Delta_0 > P$ (ii) $\Delta_0 < P$

UNIT-10

103. What happens when ethyl iodide is treated with (a) Aqueous KOH and (b) Alcoholic KOH ?

104. How will you prepare ethylamine from methyl iodide ?

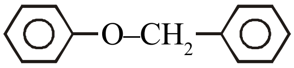
105. **Correctly Match A & B.**

	A		B
(i)	Fruit	(a)	Glucose
(ii)	Milk	(b)	Sucrose
(iii)	Grape	(c)	Lactose
(iv)	Cane Sugar	(d)	Fructose

106. **Correctly Match A & B.**

	A		B
(i)	Vitamin A	(a)	Scurvey
(ii)	Vitamin B_1	(b)	Rickets
(iii)	Vitamin C	(c)	Night blindness
(iv)	Vitamin D	(d)	Beri-beri

107. llustrate (i) Wurtz-Fittig reaction and (ii) Fittig reaction in haloarine.
108. What are products of chlorination of toluene under different conditions ?
109. What are ambident nucleophiles ? Explain with an example.
110. An organic compound C_8H_{18} on monochlorination gives a single monochloride. Write the name of the hydrocarbon.
111. RCl is hydrolysed to ROH slowly but the reaction is rapid if a catalytic amount of KI is added to the reaction mixture. Explain.
112. C– X bond length in halobenzene is smaller than C – X bond length in CH_3 – X. Explain why?
113. Chlorobenzene is less reactive than chloro alkane.
114. Write the chemical reaction equation of Reimer-Tiemann reaction.
115. Convert phenol to salicyclic acid.
116. How are the following conversions carried out ?
    (i) Ethanol to 2-propanol ?
    (ii) Phenol to Acetophenone ?
117. What is Williamson's synthesis ?
118. How to convert
    (i) Phenol to 2, 4, 6-tribromo phenol ?
    (ii) Phenol to benzene ?
    (iii) Phenol to toluene ?
    (iv) Phenol to picric acid ?
    (v) Phenol to 1, 3, 5- tribromo benzene
119. What is Lucas test ?
120. How can you prepare phenol by using benzene diazonium chloride ?
121. Name the compounds A to D.
122. What is Reimer-Tiemann reaction ?
123. How is phenol prepared from (i) aniline and (ii) Cumenl ?
124. How is phenol prepared by cummene process ?
125. What products are obtained when



is treated with HI ?

126. Ethers can be prepared by Williamson synthesis in which an alkyl halide is reacted with sodium alkoxide. Di-tert-butyl ether can't be prepared by this method. Explain.

UNIT-12

127. What happens when carbonyl compound reacts with phenyl hydrazine ?
128. What are the similarities of C = C and C = O bonds ?
129. "What is Popoff's Rule ?
130. What happens when acetic acid reacts with $NaHCO_3$?
131. What hapens when acetic acid is heated with ethyl alcohol in presence of conc. H_2SO_4?
132. What happens when sodium acetate is heated with sodalime ?
133. What is Etard's reaction ?

134. Why benzoic acid is a stronger acid ?

135. Write one chemical equation for each, to illustrate the following reactions.
   (a) Rosenmund reduction
   (b) Cannizzaro reaction
   (c) Fischer esterification

136. Write about the following conversions.
   (a) Propanal to butanone
   (b) Benzaldehyde to benzophenone
   (c) Benzoyl chloride to benzonitrile.

137. Write chemical tests to distinguish between Acetaldehyde and Acetone.

138. Write the chemical tests to distinguish between Acetaldehyde and Benzaldehyde.

139. What is Fehling's solution ? Write its use.

140. Complete the following reactions.
   (d) $6HCHO + 4NH_3 \rightarrow$
   (e) $CH_3COCH_3 + HCN \rightarrow A \xrightarrow{H_3O^+} B$
   (f) $2CH_3CHO \xrightarrow{NaOH}$
   (g) $2HCHO + NaOH \rightarrow$
   (h) $HCHO + CH_3MgBr \longrightarrow \xrightarrow{H_3O^+}$

141. How propanol and propanone may be distinguished ?

142. What happens when acetone reacts with
   (a) Sodium-bisulphite
   (b) Phenyl hydrazine
   (c) Hydroxy amine

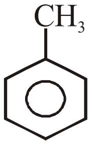
143. How carboxylic Acid will be prepared (a) from primary alcohols and aldehydes (b) from nitriles (c) from amides (d) from acid halides (e) from acid anhydrides.

144. Distinguish between formic acid and acetic acid.

145. How will you get methyl alcohol and carbon monoxide, from formic acid ?

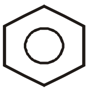
146. Acetic acid is weaker than formic acid. Explain.

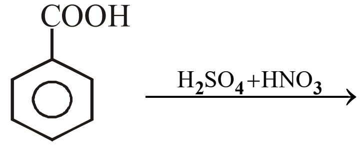
147. Complete the following equations.

   (i)  $\xrightarrow{air/V_2O_5}$

   (ii) $C_6H_5CH_3 + 3(O) \xrightarrow{hot\,KMnO_4}$

   (iii) $C_6H_5COOH + conc.\ H_2SO_4 \longrightarrow$

   (iv)  $+\ CH_3COCl \xrightarrow{Anhy.AlCl_3}\ * \xrightarrow[HCl]{Zn-Hg}$

(v) 

148. What happens when o-Toluic acid reacts with Br_2 + Fe ?

UNIT - 13

149. Write carbylamine reaction.

150. Write Hofmann bromamide reaction.

151. Illustrate the Sandmeyer reaction with example.

152. What happens when

  (i) Nitroethane is treated with $LiAlH_4$?

  (ii) Diazonium chloride reacts with phenol in basic medium ?

153. State the reaction for obtaining benzoic acid from aniline.

154. Convert (i) Ethyl isocyanide to ethylamine

  (ii) Aniline to N-phenylethanamide.

155. What is vapour phase nitration ?

156. Aromatic amines are weaker bases than aliphatic amines. Why ?

157. How will you remove – NH_2, – OH and – COOH group from benzene ring ? Give Example.

158. Complete the following reaction.

$$C_6H_5NH_2 + H_2SO_4 \xrightarrow{\text{Heat}}$$

UNIT - 14

159. What is denaturation of proteins ? Explain with example.

160. Amino acids behave like salts rather than simple amines or carboxylic acids. Explain.

UNIT - 15

161. How is bakelite made and what is its major use ? Why it is called thermosetting polymer?

162. How are polymers classified on the basis of forces operating between their molecules ?

163. Distinguish between chain growth polymerisation and step growth polymerisation.

UNIT - 16

164. Name the action of (i) Aspirin (ii) Pencillin (iii) Phenacetin (iv) Morphin (v) Analgin (vi) Luminal (vii) Seconal (viii) Streptomycin on human body.

165. How synthetic detergents are better than soap ?

166. Explain the cleansing action of soaps.

167. Why do we require artificial sweetening agents ?

168. Name a substance which can be used as an antiseptic as well as disinfectant.

169. State the function along with one example each of :

  (i) Antihistamines (ii) Antioxidants

170. Give one example each of cationic and anionic detergents.

171. (a) Which one of the following is a food preservative ?

Equanil, morphine. Sodium benzoate

(b) Why is bithional added to soap ?

(c) Which class of drugs is used in sleeping pills?

172. Both antacids and anti-allergic drugs are antihistamines but they cannot replace each other. Explain why ?

173. Why are detergents non-biodegradable while soaps are biodegradable ?

174. Match the following :

	A		**B**
(a)	Ofloxacin	(i)	Antiseptic
(b)	furacine	(ii)	Bactericidal
(c)	Aspartame	(iii)	Food presservative
(d)	Salt of sorbic acid	(iv)	Sweetener
(e)	Sodium lauryl sulfate	(v)	Laundry soap
(f)	Sodium rosinate	(vi)	detergent

* * *

GROUP - B (1)

SHORT TYPE QUESTIONS (ANSWERS)

(Two marks each)

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. The substances which are attracted by the magnetic field and show permanent magnetism even when the magnetic field is removed. For example, iron.

   (In presence of magnetic field

   [↑ ↑ ↑ ↑] Domains arrange in the direction of magnetic field. On removal of the field it turns into a permanent magnet.)

3. These are the semiconductors in which the current is carried by the electrons in the normal way. For example germanium doped with impurity containing 5 valence electrons (e.g., P)

4. 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.

5. For face centred unit cell, radius of atom

$$r = \frac{a}{2\sqrt{2}}$$

or $$a = 2\sqrt{2}.r, \quad r = 0.144\,\text{nm}$$

$$a = 2 \times 1.414 \times 0.144 = 0.407\,\text{nm}.$$

6. Frenkel defect is not found in pure alkali metal halides because the ions cannot get into the interstitial sites due to their larger size.

7. When ZnO is heated it loses oxygen as :

$$\text{ZnO} \xrightarrow{\text{Heat}} \text{Zn}^{2+} + \frac{1}{2}\text{O}_2 + 2e^-$$

   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.

8. (a) If face centred cubic arrangement, number of atoms

   = (at corners) + 6 (at face centres)

   Atoms per unit cell = $8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 4$

   (b) In body centred cubic arrangement, number of atoms

   = (at corners) + 1(at body centre)

   Atoms per unit cell = $8 \times \frac{1}{8} + 1 = 2$

UNIT - 2

(i) The Henry's law states that the mass of a gas dissolved per unit volume of the solvent at given temperature is proportional to the pressure of the gas in equilibrium with the solution.

$$m \propto p$$

$$m = kp$$

where k is proportionality constant.

(ii) $p = K_H X$

The partial pressure of gas in vapour phase (p) is proportional to mole fraction of gas (X) in solution.

10. 0.1 M $BaCl_2$ solution will have higher boiling point because of large number of particles on dissociation.

$$NaCl \longrightarrow Na^+ + Cl^- (2\,\text{particle})$$

$$BaCl_2 \longrightarrow Ba^{2+} + 2Cl^- (3\,\text{particle})$$

11. A mixture of liquids which has a definite composition and boils like a pure liquid is called azeotropic mixture, common boiling mixture.

12. Ethanol and water (95.4% ethanol and 4.6% H_2O) form a constant boiling mixture (azeotrope) boiling at 351.5 K. Hence, further water cannot be removed by fractional distillation.

13. Osmotic pressure is the excess pressure which must be applied from the solution side to prevent the spontaneous flow of solvent molecules from lower to higher concentration, when both are separated by a semipermeable membrane at a given temperature.

14. Mole fraction, $x = \dfrac{(5.85/58.5)}{(90/18)+(5.85/58.5)}$

$$= \frac{0.1}{6+0.1} = 0.02$$

15. Freezing point is the temperature at which the vapour pressure of the liquid and the solid state become identical i.e. both solid and liquid states coexist. The liquid and solid are in equilibrium state. The freezing point of a solution is less than the freezing point of a pure solvent.

16. The elevation in boiling point of solvent containing 1 mole of non-volatile non-electrolyte solute in 1kg solvent is called ebullioscopic constant or molar elevation constant and is denoted by K_b.

$$\Rightarrow \quad \Delta T_b = K_b \text{ when molality(m)} = 1,$$

$$\text{since } \Delta T_b = K_b m. \text{ Unit} = \text{K kg mol}^{-1}$$

17. Features i) $\Delta_{mixing}H = 0$, (ii) $\Delta_{mixing}V = 0$ (iii) Obeys Raoult's law

iv) Solute solvent interaction =

Solut - solute and solvent - solvent interaction.

e.g. Benzene + Tuluene.

UNIT - 3

18 It states that the mass of substance discharged at the electrode is directly proportional to the amount of charge passed through the solution.

Mathematically, $m \propto Q$

$\Rightarrow \quad m \propto It \quad \Rightarrow \quad m = ZIt \qquad$ i.e., $m = ZQ$

where Z = electrochemical equivalent

I = current flowing through the solution

t = time in second.

19. It states that, "when the same quantity of electricity is passed through different electrolytes in series, the masses of different substances produced at a given electrode are directly proportional to their equivalent weights". $\frac{W_1}{W_2} = \frac{E_1}{E_2}$

20. It is defined as the mass of a substance produced or deposited by passing an electric current of 1 ampere through the electrolyte for 1 second. i.e., 1 coulomb of charge. Unit - gram / coulomb

21. (i) Concentration of ions in solution
    (ii) Temperature
    (iii) Ionic mobility and specific conductance

22. The molar conductivity of a weak electrolyte increases with dilution of the solution while specific conductance decreases on dilution as ion concentration decreases.

23. (i) It prevents the diffusion of the electrolytes from one half-cell to the other but allows the anions to migrate from the cathode half-cell into anode half-cell to complete the circuit. (ii) It completes the electrical circuit (iii) It eliminates liquid junction potential.

24. Electrode potential of a metal when placed in 1M solution of the electrolyte at 298 K is called standard electrode potential. In case of gas electrode pressure is 1 atm.

25. Coating iron with thin layer of zinc in order to prevent corrosion is called galvanization.

26 $\log K = \frac{nE^0}{0.059} \qquad \because \; -\Delta G^0 = RT \ln K = nFE^0$

where E^0 = standard cell potential

and K = equilibrium constant.

27. It is the conducting power of all the ions produced from 1 mole of the electrolyte in solution at a given temperature. Unit. $ohm^{-1}\ cm^2\ mol^{-1}$.

28. Given; 1=1 amp.

$t = 10 \times 60 = 600$ sec.

$m = 4$ gram

$$\therefore \quad \frac{m}{It} = \frac{4}{1 \times 600} = \frac{2}{3} \times 10^{-2}$$

$= 0.66 \times 10^{-2}$ g/C.

29. It is a reference electrode, whose electrode potential is arbitrarily taken as zero volt.

It is used to determine the electrode potential of other electrodes. It consists of a platinum foil coated with platinum black. It is dipped in a molar HCl solution.

Notation : $\underset{1\text{ atm}}{\text{Pt}, \frac{1}{2}\text{H}_2} \,\Big|\, \text{H}^+ (1\text{M})$ (If used as LHE)

30. The overall cell reaction is :

$$Pb(s) + PbO_2(s) + 4H^+(aq) + 2SO_4^{2-}(aq) \longrightarrow 2PbSO_4(s) + 2H_2O.$$

31. Molar conductivity, $\wedge_m = \frac{\kappa \times 1000}{M}$

$\kappa = 0.025 \text{ S cm}^{-1}, M = 0.20$

$$\wedge_m = \frac{0.025 \times 1000}{0.20}$$

$= 125 \text{ S cm}^2 \text{ mol}^{-1}$.

32. $Al^{3+} + 3e^- \rightarrow Al$

3 mol of electrons are required to produce 1 mol or 27gm. of Al.

∴ 10 gm. of Al will be produced by

$= \frac{3}{27} \times 10 = 1.11$ mole of electrons.

33. Fuel cells convert chemical energy out of combustion of fuel into electrical energy.

Galvanic cell also converts chemical energy to electrical energy but efficiency of fuel cell is higher than that of galvanic cell.

34. It is defined as the average rate of disappearance of reactants. For the

reaction, $A \longrightarrow B$

i..e, $-\frac{\Delta[A]}{\Delta t}$

35. It increases the rate of reaction by lowering the activation energy of the reactants. In such case, the catalyst is a positive catalyst. e.g. $KClO_3 \xrightarrow{MnO_2} KCl + \frac{3}{2}O_2$

36. Activated complex is the intermediate compound formed by reactants which is highly unstable and readily changes into product.

Those reactants which possess activation energy and collide in proper orientation to form activated complex which can easily form products.

Lower the activation energy, more easily activated complex will be formed and faster will be the reaction. Activation energy = energy of activated complex - energy of reactants. i.e., $E_{th} - E_r$.

37. (i) It is sum of powers to which concentration terms are raised in rate law or rate equation.
(ii) It is determined experimentally.
(iii) It can be zero or even in fraction.
(iv) The order of complex reaction can be determined and slowest step is rate determining step.

38. (i) It is number of molecules taking part in the reaction.

(ii) It is determined theoretically.

(iii) It is always whole number, it can neither be zero nor fraction.

(iv) Molecularity of each step is determined separately.

For complex reaction molecularity as a whole has no meaning.

39. **Thershold energy**. It is the minimum amount of energy which the reactant molecules must possess for the effective collisions in forming the products.

Activation energy. It is the excess energy required by the reactants to undergo chemical reaction. It is equal to the difference between the threshold energy needed for the reaction and the average kinetic energy of all reacting molecules. i.e., activation energy = threshold energy-average kinetic energy of reactant molecules.

UNIT - 5

40. Traces of molybdenum (Mo) acts as promoter to enhance the catalytic activity of iron (Fe) catalyst.

41. The colloidal solutions in which there in no affinity (or love rather they have hatred) between the paricles of the dispersed phase and the dispersion medium are called lyophobic sols.

42. Asdorption. The phenominon of higher concentration of molecular species (gases or liquid) on the surface of solids than in the bulk is called adsorption, For example, adsorption of a gas (SO_2, NH_3, Cl_2, O_2, CO) on charcoal.

43. The important differences between multimolecular and macromolecular colloids are :

Multimolecular Colloid

(1) The colloidal particles consist of aggregates of a large number of atoms or molecules having diameter less than 1 nm.

(2) Particles are held by weak van der Waals forces.

Example : Sulphur sol. which consists of particles of S_8 molecules.

Macromolecular Colloid

(1) The colloidal particles are macromolecules having very large molecular mass.

(2) They consist of macromolecular particles held by chemical bonds.

Example : Starch.

44. Emulsion ; They are the colloidal solutions of two immiscible liquids in which the liquid acts as the dispersed phase as well as the dispersion medium.

These are of two types w/o and o/w.

i) w/o Here oil is the medium. e.g. ointment, lotion.

ii) o/w Here water is the medium the dispersion of oil can can be quickly attained on adding emulsfier (e.g. soap)

Common example is milk.

45. The important differences between multimolucular and macromolecular colloids are :

Multimolecular

(1) The colloidal particles consist of aggregates of a large number of atoms or molecules having diameter less than 1 nm.

(2) Particles are held by weak van der Waals forces.

Macromolecular

(1) Thecolloidal particles are macromolecules having very large molecular mass.

(2) They consist of macromolecular particles held by chemical bonds.

46. The enzymes are biological catalysts produced by the living cells which catalyse the biochemical reactions in living organisms.

Some common examples of enzyme catalysis reaction are :

(i) Normal conversion of glucose into ethanol by zymase (enzyme) present in yeast.

$$C_6H_{12}O_6 \xrightarrow{\text{Zymase}} 2C_2H_5OH + 2CO_2$$

(ii) Hydrolysis of starch into maltose by diastase (enzyme).

$$\underset{\text{Starch}}{2(C_6H_{10}O_5)_n} + nH_2O(\ell) \xrightarrow{\text{Diastase}} \underset{\text{Maltose}}{nC_{12}H_{22}O_{11}}$$

UNIT - 6

47. Impurity + flux = slag. CaO is basic oxide whereas SiO_2 (impurity) is acidic oxide. There reaction is acid-base reaction as ;

$$CaO + SiO_2 \longrightarrow CaSiO_3$$

This separation occurs during smelting in furnace.

48. This is because the sulphide ore particles are preferentially wetted by oil and the gangue particles by water.

49. Calcination : Calcination is a process of heating of the concentrated ore below its melting point with limited supply of air, or in the absence of air.

Roasting: The concentrated ore is oxidised with limited oxygen. However the sulphide ores are oxidised with excess oxygen by roasting process forming metal axide. Due to oxidation the following changes take place.

$$4FcO + O_2 \longrightarrow 2Fc_2O_3, \quad 2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$$

Non metals like P, As aboget oxidised and volatised.

50. Self reduction (Auto-reduction) : During the process of roasting, the sulphides of same metals like Cu, Pb and Hg are partly converted into corresponding oxides. These metal oxides reduce the remaining metal sulphides into corresponding metals. This process of reduction is called self reduction. In case of copper from copper pyrite or copper glance,

$$2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$$

$$2Cu_2O + Cu_2S \xrightarrow{\Delta} 6Cu + SO_2$$

In case of lead from galena,

$$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$$

$$PbS + 2PbO \rightarrow 3Pb + SO_2$$

51. The depressants are used to prevent certain types of particles from forming the froth with bubbles in froth floatation process. This helps to separate two sulphide ores. For example, in case of an ore containing zinc sulphide (ZnS) and lead sulphide (PbS), sodium cyanide (NaCN) is used as a depressant. It forms a layer of zinc complex $Na_2[Zn(CN)_4]$ with ZnS on the surface of ZnS and therefore, prevents it forming the froth. Therefore, it acts as a depressant.

$$ZnS + 4NaCN \longrightarrow \underset{\text{Sodium tetracyanozincate (II)}}{Na_2[Zn(CN_4)]} + Na_2S$$

However, NaCN does not prevent PbS from forming the froth and allows it to come with the froth.

52. It is process of fractional crystallisation. Pure metal crystallises first. The impurities are more soluble in the melt. Metals purified by this process are Ge and Ga. crystalliation based on the principle that only metal crystallises while impurity left in melt.

53. For refining nickel, nickel is heated in a stream of carbon monoxide forming volatile complex (nickel-tetracarbonyl).

$$Ni + 4CO \xrightarrow{330-350K} Ni(CO)_4$$

The carbonyl is subjected to high temperature so that the complex decomposes to give the pure metal.

$$Ni + (CO)_4 \xrightarrow{450-470K} Ni + 4CO$$

This process is called Mond's process. i.e., vapour phase refining.

UNIT - 7

54. Because of high electronegativity (3.0) and small size of nitrogen, ammonia forms hydrogen bonds. On the other hand, P has low electronegativity (2.1) and large size and hence cannot form hydrogen bonds.

55. In white P, there is angular strain in the P_4 molecules because the bond angles are only 60°. Therefore, white P is less stable and therefore, more reactive than other forms of phosphorus. But in red P, P_4 tetrahedra have polymeric structure and is stable. Thus, red P is less reactive.

56. Among the hydrides of group 15, BiH_3 is least stable because Bi has largest size in the group and has least tendency to form covalent bond with small hydrogen atom. Therefore, it can readily lose H atom and has strongest tendency to act as reducing agent.

57. NO_2 contains odd number of valence electrons. It behaves as a typical molecule. In the liquid and solid state, it dimerises to form stable N_2O_4 molecule, with even number of electrons. Therefore, NO_2 is paramagnetic, while N_2O_4 is diamagnetic in which two unpaired electrons get paired.

58. In molecular nitrogen, there is a triple bond between two nitrogen atoms ($N \equiv N$) and it is non-polar in character. Due to the presence of a triple bond, it has very high bond dissociation energy (941.4 kJ mol^{-1}) and therefore, it does not react with other elements under normal conditions and is very unreactive. However, it may react at high temperatures.

59. Both N and Bi have a lone pair of electrons in NH_3 and BiH_3 respectively. They can donate the electron pair and therefore behave as Lewis base. In NH_3, N has mall size and the lone pair is concentrated on a small region and electron density on it is maximum. Consequently, it has greater electron releasing tendency. But the size of Bi is large and the electron density of the lone pair is less. As a result, it has lesser tendency to donate electron pair. Hence, NH_3 is basic while BiH_3 is only feebly basic.

60. Due to exothermic reaction water changes into steam at once, when water is added to acid. This leads to splashing of the liquid causing burns.

61. $2KBr + 3H_2SO_4 \rightarrow 2KHSO_4 + SO_2 + 2H_2O + Br_2$

62. Sulphuric acid is formed.

$$6HNO_3 + S \rightarrow 2H_2O + 6NO_2 + H_2SO_4$$

$$NO_3^- + 2H^+ + e^- \rightarrow NO_2 + H_2O$$

$$4H_2O + S \rightarrow SO_4^{2-} + 8H^+ + 6e^-$$

63. Ozone is an endothennic compound and easily decomposes to produce O_2 as :

$$2O_3 \longrightarrow 3O_2$$

Therefore, it purifies crowded places / where there is shortage of oxygen.

64. Oxygen exists as a stable diatomic molecule and is, therefore, a gas. On the otherhand, sulphur exists in solid state as S_8 molecules and have puckered ring structure. The main reason for this different behavour is that oxygen atom has good tendency to form multiple bonds with itself and form strong O=O bonds than O – O bonds. On the other hand, sulphur-sulphur double bonds (S = S) are not very strong. As a result, catenated –O–O–O– chains are less stable as compared to O=O molecule while catenated -S-S-S- chains are more stable as compared to S = S molecule. Therefore, oxygen exists as a diatomic gas and sulphur exists as S_8 solid.

65. Because when hydrofluoric acid is electrolysed, fluorine is liberated at the anode. Since, fluorine is a strong oxidising agent, it reacts with water and oxidises it into oxygen and ozone. So, instead of getting fluorine at the anode, a mixture of oxygen and ozone is liberated.

$$2HF(aq) \rightleftharpoons 2H^+ + 2F^-$$

At cathode, $2H^+ + 2e^- \rightarrow H_2 \uparrow$

At anode, $2F^- + 2e^- \rightarrow 2[F] + F_2 \uparrow$

$$2F_2 + 2H_2O \rightarrow 4HF + O_2 \uparrow$$

$$3F_2 + 3H_2O \rightarrow 6HF + O_3 \uparrow$$

66. Fluorine is highly electronegative (4.0) and small in size. So, it can from hydrogen bond and molecules of HF remains associated.

But in HCl there is only intermolecular attraction force among the molecules (dipole-dipole force) . Hydrogen bonding force is greater than intermolecular force of attraction for which HF is less volatile than HCl. So also HF is a liquid and HCl a gas.

67. Oxidising nature of element is directly related to its ability of accepting electrons. Electron affinity of halogens is highest and decreases with increase in atomic number in the group. So, halogen acts as good oxidising agent; with higher reduction potential values. So, fluorine is the best oxidant,

68. N_2, gas is produced, with excess NCl_3 is formed

$$8\ NH_3 + 3\ Cl_2 \longrightarrow N_2 + 6NH_4Cl.$$

$$N_2 + 3Cl_2 \longrightarrow 2NCl_3$$

69. (a) $I_2 < F_2 < Br_2 < Cl_2$

(b) $HF < HCl < HBr < HI$

(c) $BiH_3 < SbH_3 < AsH_3 < PH_3 < NH_3$

(d) $BiH_3 > SbH_3 > AsH_3 > PH_3 > NH_3$

$HI > HBr > HCl > HF$

70. Fluorine is most electronegative element and cannot exhibit any positive oxidation state. On the other hand, the other halogens are less electronegative and therefore, can exhibit positive oxidation states. They also have vacant d-orbitals and hence can expand their octets and show +1, +3, +5 and +7 oxidation states also.

71. The less negative electron gain enthalpy of fluorine as compared to chlorine is due to very small size (72 pm) of fluorine atom. As result, there are strong inter-electronic repulsions in the relatively small 2p sub-shell of fluorine and therefore, the incoming electron does not feel much attraction. Thus, its electron gain enthalpy is small.

$\Delta_{eg}H$ of Cl_2 is the highest.

72. Due to small size of F atom, there are strong repulsions between the non-bonding electrons of F atoms in the small sized F_2 molecule. Therefore, bond enthalpy of F, is lower than relatively larger Cl_2 molecule in which electronic repulsions between non-bonding electrons are less.

73. The shape of XeF_2 molecule is linear because of repulsion between three lone pairs and two bond pairs. The F - Xe - F bond angle is 180° and Xe – F bond length is 2.0 $\overset{0}{A}$. Here Xe undergoes sp^3d hybridisation with AB_2L_3 type.

74. (a) It is used in radio valves and rectifiers.

(b) It is used in filling in incandescent and fluorescent lamps.

(c) It is used in conjuction for advertising purposes.

(d) It is used for welding of magnesium and aluminium.

UNIT-8

75. Those elements whose atom contains partially filled *d*-subshell are called transition elements. (d-block) with general electronic configuration $(n-1)s^2p^6d^{1-10}ns^{1 \text{ or } 2}$. The properties transit between more electro more electro -ve p-block elements and more electropositive s-block elements.

For ex: Sc, Ti, V, Cr etc.

76. Cr^{2+} is a stronger reducing agent than Fe^{2+}.This is because the configuration of Cr^{2+} changes from d^4 to d^3 and d^3 configuration is stable (t_{2g^3}) being half filled t_{2g} level.

77. Mn(Z = 25) exhibits the largest number of oxidation states because it has the maximum number of unpaired electrons. Hence, it shows oxidation states from +2 to +7 i.e., +2, +3, +4, +5, +6 and +7.

78. $$\underset{}{5C_2O_4^{2-}} + \underset{\text{(purple)}}{2MnO_4^-} + 16H^+ \longrightarrow \underset{\text{(Colourless)}}{2Mn^{2+}} + 8H_2O + 10CO_2$$

79. $KMnO_4$ will react with HCl to evolve chlorine gas :

(HCl is a reducing agent like Fe^{2+})

$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$

Chlorine will also act as an oxidising agent and will interfere with $KMnO_4$.

Equivalent volume of $KMnO_4$ becomes erratic.

80. Becauseof lesser hydration enthaipy of Cu(I); it is unstable in aqueous solution and therefore, it undergoes disproportionation.

81. $K_2Cr_2O_7$ is prepared from Na_2CrO_4 as :

    Na_2CrO_4 is dissolved in water and the yellow solution formed is filtered and acidified with dilute sulphuric acid and it gets converted to sodium dichromate:

    $$2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$$

    On cooling, sodium sulphate crystallizes out as $Na_2SO_4 . 10H_2O$ is removed. The resulting solution contains sodium dichromate.

    To the hot concentrated solution of sodium dichromate, equimolar amount of potassium chloride is added to give potassium dichromate.

    $$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$$

82. Europium (II) has electronic configuration [Xe] $4f^7 4d^0$ while cerium (II) has electronic configuration [Xe] $4f^1 4d^1$. In Eu^{2+}, 4f-subshell is half filled and 5d-subshell is empty. Since half filled and completely filled electronic configurations are more stable, Eu^{2+} ion is more stable than Ce^{2+} in which neither 4f subshell nor 5d-subshell is half filled or completely filled.

83. Due to lanthanoid contraction, the increase in radii from second to third transition series vanishes. Consequently, Zr and Hf have almost same radii.

84. Electronic configurations. The general electronic configuration of lanthanoids is [Xe] $4f^{1-14} 5d^{0-1} 6s^2$ whereas that of actionoids is [Rn]$4f^{1-14}6d^{0-1} 7s^2$. Thus, lanthanoids involve the filling of 4f-orbitals whereas actinoids involve the filling of 5f-orbitals.

85. Cerium [Z = 58] has the electronic configuration:

    Ce : [Xe] $4f^1 5d^1 6s^2$

    By losing four electrons, it forms stable configuration of noble gas Xe ($4f^0$ configuration).

    Therefore, it forms +4 oxidation state :

    Ce^{4+} : [Xe] $4f^0$

86. Oxoanions of metals have highest oxidation states. For example, Cr in $Cr_2O_7^{2-}$ has an oxidation state of +6 whereas Mn in MnO_4^- has an oxidation state of +7. This is because of high electronegativity of oxygen and is high oxidising property.

87. The transition elements exhibit variable oxidation states. The variable oxidation states of transition metals are due to the participation of ns and (n - 1) d-electrons. This is because of the very small difference between the energies of (n–l) d and *ns* orbitals. For the first five elements; the minimum oxidation state is equal to the number of electrons in the 4*s* orbitals and the other oxidation states are equal to the sum of 4s and sum of 3*d*-electons. For the remaining elements, the minimum oxidation state is equal to electrons in 4*s*-orbitals and the maximum oxidation state is not equal to sum of 4s and 3d electrons.

    In general, the oxidation state increases upto the middle and then decreases.

88. The transition elements have high melting and boiling points.This suggests that atoms of transition elements are held together by strong interatomic forces and therefore have high enthalpies of atomization. These are maximum at about middle of each series which indicates that one unpaired electron per *d*-orbital is particularly favourable for strong interatomic interaction.

89. The electronic configuration of Hg(I) is [Xe]$4f^{14}5d^{10}6s^1$. It has one unpaired electron in the valence 6s-subshell. Because of the presence of unpaired electron, it is expected to be paramagnetic but actually Hg(I) compounds are diamagnetic. This can be explained by assuming that the singly filled 6s-orbitals of two Hg^+ ions overlap to form $^+Hg–Hg^+$ covalent bond. Therefore, Hg^+ ion exists as dimeric species Hg_2^{2+}. On the other hand, Cu(I) ion has electronic configuration : [Ar]$3d^{10}$. It has no unpaired electron to form dimeric Cu_2^{2+} species and therefore, it exists as Cu^+ ion.

UNIT - 9

90. The number of atoms of the ligands directly attached to the central metal ion by coordinate covalent bonds is called coordination number of the central metal ion.

$[Fe(CN)_6]^{4-}$, ions has C.N. six. It is also its secondary valency.

91. (i) Hexamminechromium (III) ion
    (ii) Hexaaquamanganese (II) ion
    (iii) Hexacyanidoferrate (II) ion
    (iv) Hexamminenickel (II) chloride
    (v) Ammine, chloro, bis - (ethane-1, 2- diamine) cobalt (III) ion.

92. It is defined as a crystalline solid of two salts in equimolar proportion, which loses its density in solution and breaks down into simple ions. Constituting ions never lose their identity.

Example: Potash alum $\rightarrow K_2SO_4, Al_2(SO_4)_3.24H_2O$.

Mohr's salt – $FeSO_4\text{-}(NH_4)_2SO_4.6H_2O$

93. A polydentate ligand which coordinates with central metal atom or ion to form a ring compound is called chelating ligand.

Example: Ethylene diamine.

94. Every central metal atom or ion in a complex has a tendency to gain effective atomic number (EAN) of next inert gas.

EAN of metal in a complex
= Atomic No. - Oxidation state +2 x Coordination number.

Example: EAN of Fe in $K_4[Fe(CN)_6]$

$= (26 - 2) + 2 \times 6 = 36.$

95. According to Werner's theory Fe is the central metal atom having primary valency 2 and secondary valency or coordination number 6. The central metal ion alongwith its six CN-ligands is placed in coordination sphere.

96. (i) ionisation isomerism
    (ii) optical isomerism
    (iii) coordination isomerism

97. $Cu(OH)_2$ is soluble in NH_4OH due to the formation of soluble complex $[Cu(NH_3)_4](OH)_2$. But no such complex is formed by the reaction of $Cu(OH)_2$ with NaOH.

98.

Complex	**Hybridisation**	**Shape**	**Mangetic behaviour**
(a) $[Cr(NH_3)_4Cl_2]Cl$	d^2sp^3	Octahedral	Paramagnetic
(b) $[Co(en)_3]Cl_3$	d^2sp^3	Octahedral	Diamagnetic
(c) $K_2[Ni(CN)_4]$	dsp^2	Square planar	Diamagnetic

99. Nickel (Z = 28) has the ground state electronic configuration as $3d^8 4s^2$. In its ionic state of Ni^{2+} and Ni^{3+} it has the electronic configuration as $3d^8$ and $3d^7$ respectively. In its common ionic state, it cannot afford two vacant 3d orbitals and hence cannot form d^2sp^3 hybridisation. Consequently, low spin complexes of nickel are not known.

100. The configuration of Co^{2+} is $t_{2g}^6 e_g^1$ and for Co^{3+}, it is t_{2g}^6. The crystal field stabilization energy is more than compensated for the third ionisation enthalpy. Therefore, Co^{2+} is easily oxidised to Co^{3+} in the presence of a strong ligand.

101. The molecular shape of $[Ni(CO)_4]$ is tetrahedral because in this complex nickel involves sp^3 hybridisation. In $[NiCN)_4]^{2-}$, nickel involves dsp^2 and its shape is square planer.

102. The difference between two sets of energy levels when the five degenerate d-orbitals split in the presence of electrical field of ligands is called crystal field splitting energy. In octahedral field it is represented as Δ_0.

Electronic configuration of d^4

(i) When $\Delta_0 > P$; t_{2g}^4

(ii) When $\Delta_0 < P$; $t_{2g}^3 e_g^1$

UNIT-10

103. (a) Ethyl iodide reacts with aq. KOH to form ethyl alcohol

$$C_2H_5I + KOH\ (aq.) \longrightarrow C_2H_5OH + KI$$

(Ethyl iodide) (Ethylene)

(b) When ethyl iodide reacts with alcoholic KOH, ethylene is formed.

$$C_2H_5I + KOH\ (alc.) \longrightarrow C_2H_4 + KI + H_2O$$

(Ethyl iodide) (Ethylene)

104. Methyl iodide reacts with KCN to give methyl cyanide, which is reduced by Na/alcohol to get ethyl amine.

$$CH_3I - I \xrightarrow{KCN} CH_3 - CN \xrightarrow{4H} CH_3{-}CH_2 - NH_2$$

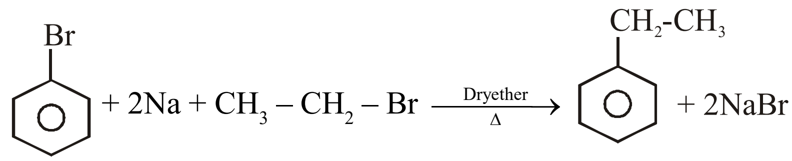
(Methyl iodide) (Methyl cyanide) (Ethylamine)

105. (i) d, (ii) c, (iii) a, (iv) b.

106. (i) c, (ii) d, (iii) a, (iv) b.

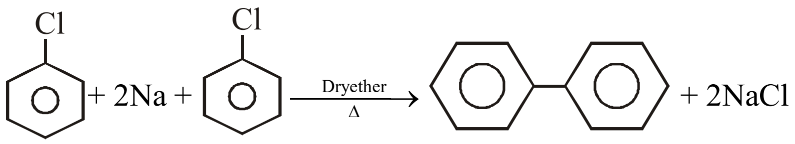
107. (i) Wurtz - Fittig reaction

Haloarenes reacts with etheral solution of an alkyl halide in the presence of sodium, from alkyl derivatives of benzene.

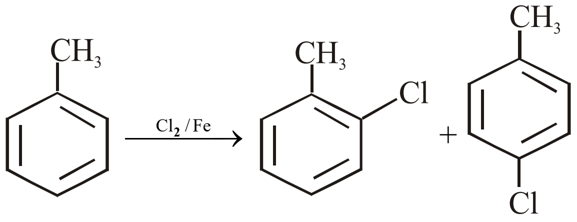


(ii) Fittig reaction

Only haloarenes are treated with Na in etheral medium to form diaryl products.

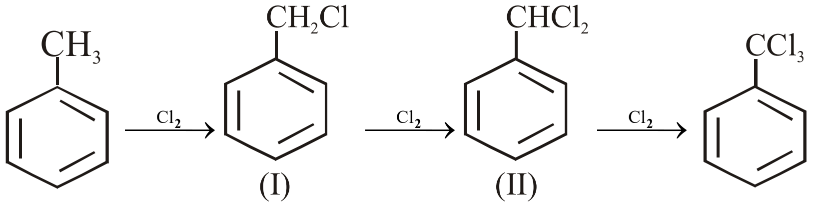


108. (i) When toluene is chlorinated in absence of sunlight and presence of a halogen carrier we get o- and p-chloro toluenes.



o⁻ p⁻

(ii) In presence of sunlight and absence of halogen carrier or when chlorine is passed into boiling toluene we get benzyl chloride (I), benzal chloride (II) and benzotrichloride (III) formed.

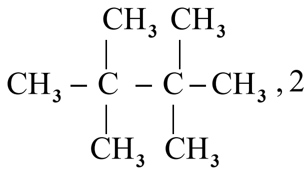


(I) (II)

109. The nucleophiles which can attack through two different sites are called ambident nucleophiles. For example, cyanide is an ambident nucleophile because it can attack through C or N because of the following resonance structures:

$$^{-}:C\equiv N:\longleftrightarrow :C=N:^{-}$$

110. Since the hydrocarbon gives a single monochloride; hence all the 18H atoms are equivalent. This means it has six CH_3 groups attached to the interlinked C atoms.

Therefore, its structure is 

$$CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-CH_3$$

, 2, 2, 3, 3– tetramethylbutane

111. Iodide is a powerful nucleophile and therefore, it reacts rapidly with RCl to form RI.

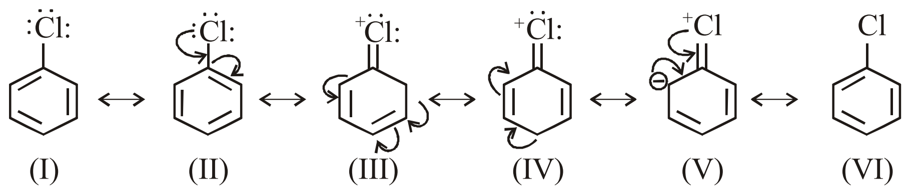
$$KI \longrightarrow K^{+} + I^{-}$$

$$I^{-} + R\text{–}Cl \longrightarrow R\text{–}I + Cl^{-}$$

Further I^{-} ion is a better leaving group than Cl^{-} ion and therefore, RI is more readily hydrolysed to form ROH.

$$HO^{-} + R\text{—}I \longrightarrow R\text{–}OH + I^{-}$$

112. In chlorobenzene, there is delocalisation of electrons due to resonance. For example, chlorobenzene is considered to be a resonance hybrid of the following structures :



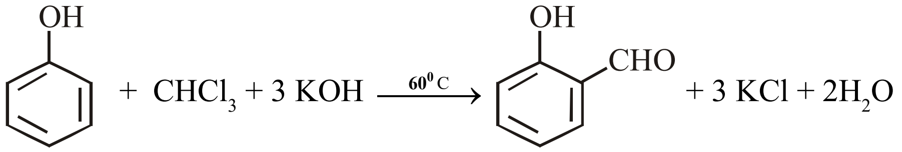
It is evident that the contribution of structure III, IV and V imparts a partial double bond character to the carbon-chlorine bond. Therefore, C-C1 bond length in chlorobenzene is less than C-C1 bond length in CH_3– Cl which has only single C–C1 bond.

113. i) Chlorobenzene sp^2 | R–Cl sp^3

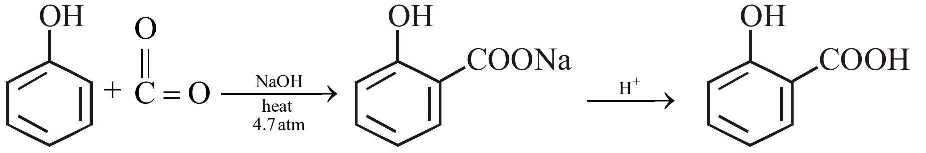
ii) Smaller bond length, bigger bond length as low bond dissociation energy

iii) Developes = bond character between >Cl=$^+$, due to resonance

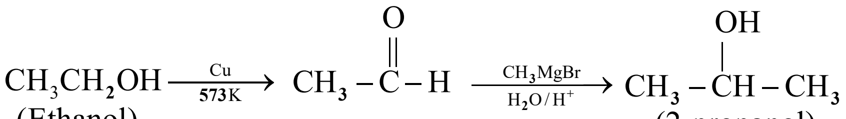
iv) $\pi\ e^-$ cloud repelle the attacking by nucleophile.

114. 

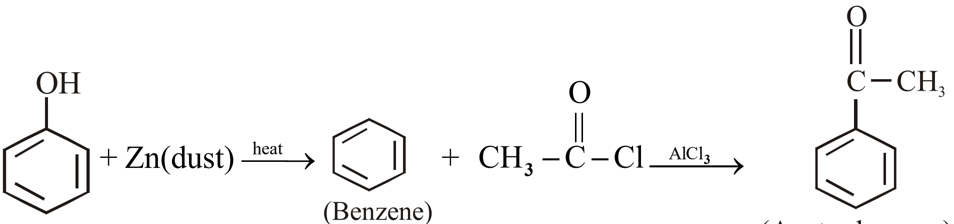
(Salicyldehyde)

115. 

(Salicyclic acid)

116. (i) 

$$\underset{\text{(Ethanol)}}{CH_3CH_2OH} \xrightarrow[573K]{Cu} CH_3-\overset{\overset{O}{\|}}{C}-H \xrightarrow[H_2O/H^+]{CH_3MgBr} \underset{\text{(2-propanol)}}{CH_3-\overset{\overset{OH}{|}}{CH}-CH_3}$$

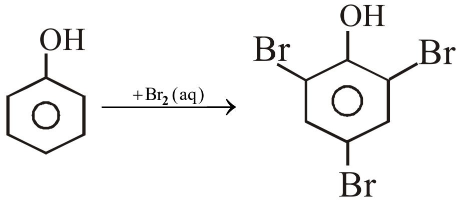
(ii) 

(Benzene)

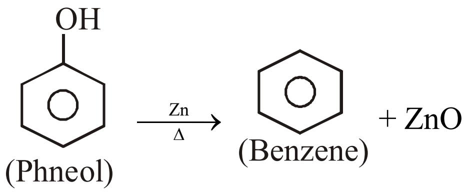
(Acetophenone)

117. When sodium salt of alcohol reacts with alkyl halide gives ether, known as Williamson's synthesis. It is used to prepare unsymmetrical ether.

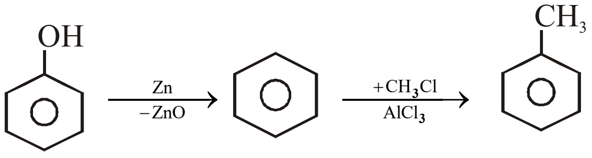
$$C_2H_5ONa + CH_3I \rightarrow C_2H_5OCH_3 + NaI$$

118. (i) 

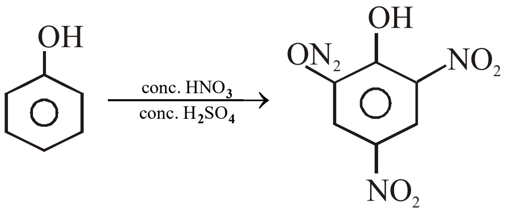
(ii)



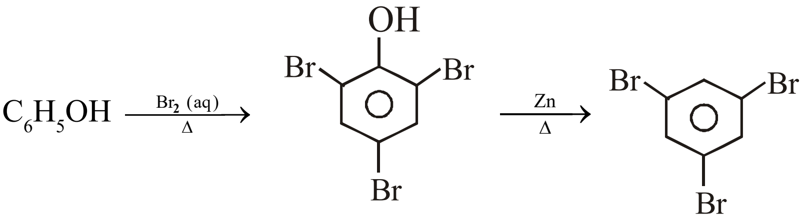
(iii)



(iv)



(v)



119. 1^0, 2^0 and 3^0 alcohols form corresponding alkyl chlorides in the form of turbidity with different rates by reacting with Lucas reagent i.e. anhydrous $ZnCl_2$ and conc. HCl. The increasing order of rate of reaction with Lucas reagent is :

1^0 alcohol < 2^0 alcohol < 3^0 alcohol.

3^0 alcohols forms turbidity immediately.

2^0 alcohol forms turbidity after 5 minutes.

1^0 alcohol forms turbidity only after heating.

This method of distinction between 1^0, 2^0 and 3^0 alcohol is called Lucas test.

120. Benzene diazonium chloride is slowly added to the hot solution of dilute hydrochloric acid. The solution is then cooled to get crystals of phenol.

$$C_6H_5N_2Cl + H_2O \xrightarrow{\text{Warm}} C_6H_5OH + N_2 + HCl$$

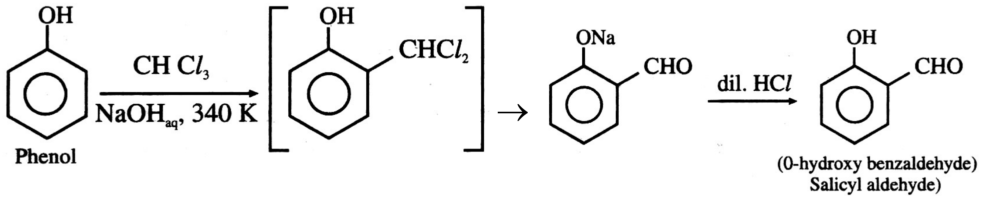
121. $CH_3OH \xrightarrow[PI_3]{P/I_2} CH_3I$ (A) $\xrightarrow{KCN} CH_3CN$ (B)

methanol Iodomethane Ethanenitrile

$\xrightarrow[LiA/H_4]{LiAl\ H_4} CH_3CH_2NH_2$(C) $\xrightarrow[HNO_2]{HCl+NaNO_2}$ (D) $CH_3–CH_2OH$

ethanamine ethanol

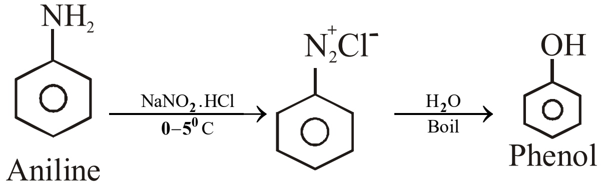
122. When phenol is treated with chloroform in presence of aqueous NaOH at 340 K, then Ortho-hydroxy benzaldehyde (i.e. salicylaldehyde) is formed as the main product along with some amount of para isomer.



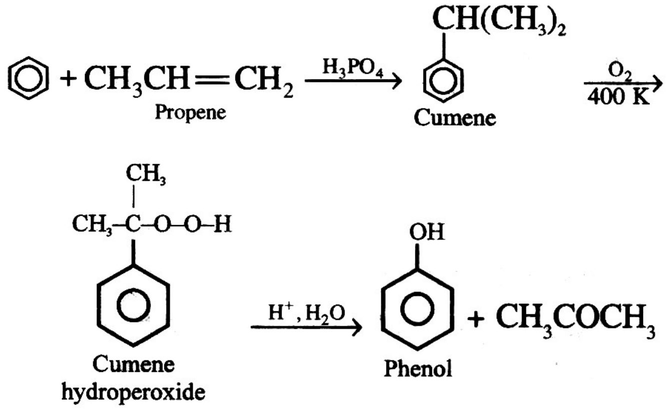
$CH_3Cl + OH^- \rightarrow \overset{\ominus}{C}Cl_3 + H_2O$

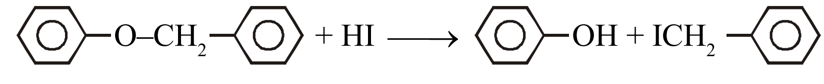
$\bar{C}Cl_3 \rightarrow :CCl_2 + Cl^-$

Here : CCl_2 act as electrophile. This is substituted at-o-possition of phenoxideion. On hydrolysis it gives salicyalal dehyde.

123. 

124. In this process, cumene is oxidised by air followed by treatment with dilute HCl.



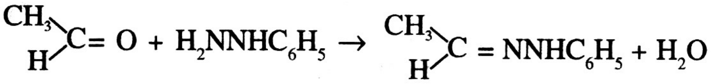
125. 

126. In tert-butyl halides, elimination is favoured over substitution and, therefore, alkene is the only reaction product and ether is not formed.

UNIT-12

127. Phenyl hadrazones are obtained.

For Example:



$$\begin{matrix}CH_3\\H\end{matrix}\!\!>C=O + H_2NNHC_6H_5 \rightarrow \begin{matrix}CH_3\\H\end{matrix}\!\!>C=NNHC_6H_5 + H_2O$$

128. (i) In both cases 'C' atom is sp^2 hybridised.

(ii) Both consist of a σ bond and a π bond.

(iii) Both have planar structure.

(iv) Both exhibit addition reaction, Ad_E and Ad_N respectively.

129. During oxidation of unsymmetrical ketones, the cleavage takes place in such a way that carbonyl group is retained by smaller alkyl group.

$$CH_3CO–CH_2–CH_3 \xrightarrow{(O)} CH_3COOH$$

130. $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$

(Sodium acetate)

This is test for –COOH group.

131. $CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$

(Ethyl acetate)

132. $CH_3COONa + NaOH \rightarrow CH_4 + Na_2CO_3$

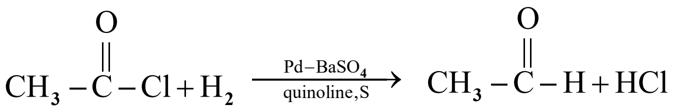
(Methane)

133. $C_6H_5CH_3$ + CrO_2Cl_2 → C_6H_5CHO then C_6H_5COOH

(Toluene) (Chromyl Chloride) (Benzaldehyde)

134. Because benzoate is stabilized due to resonance structure.

135. (a)

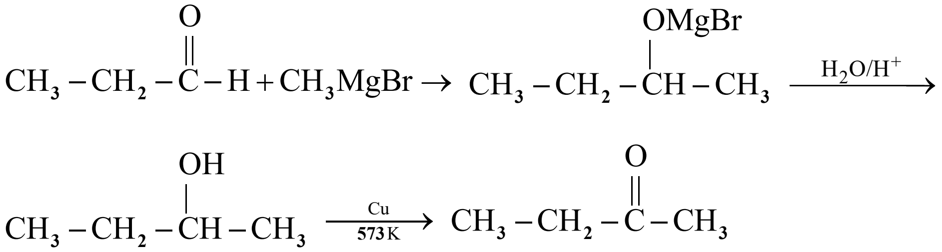


$$CH_3-\overset{\overset{\large O}{\|}}{C}-Cl+H_2 \xrightarrow[\text{quinoline,S}]{Pd-BaSO_4} CH_3-\overset{\overset{\large O}{\|}}{C}-H+HCl$$

(b) $2HCHO \xrightarrow{50\%\ KOH} HCOOK + CH_3OH$

(c) $CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$

136. (a)

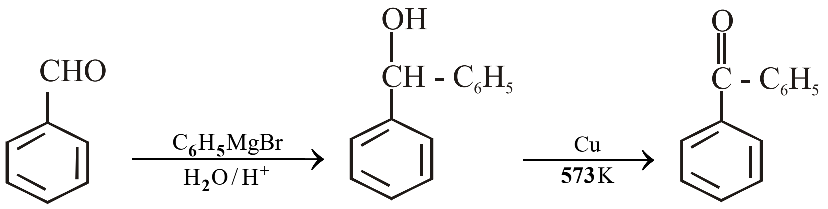


$$CH_3-CH_2-\overset{\overset{\large O}{\|}}{C}-H+CH_3MgBr \rightarrow CH_3-CH_2-\overset{\overset{\large OMgBr}{|}}{CH}-CH_3 \xrightarrow{H_2O/H^+}$$

$$CH_3-CH_2-\overset{\overset{\large OH}{|}}{CH}-CH_3 \xrightarrow[573K]{Cu} CH_3-CH_2-\overset{\overset{\large O}{\|}}{C}-CH_3$$

(Butanone)

(b)



(c) $C_6H_5COCl \xrightarrow[\text{Heat}]{NH_3} C_6H_5CONH_2 \xrightarrow[\text{Heat}]{P_2O_5} C_6H_5C\equiv N$

137. Add Tollen's reagent to each of them separately. Acetaldehyde will give silver mirror whereas acetone will not react with Tollen's reagent.

138.

Reagent	CH_3CHO	Benzaldehyde
Iodoform test $I_2 + KOH$	Yellow mass of iodoform	Does not respond

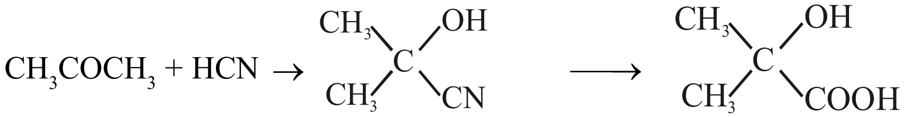
139. Fehling's solution is a mixture of two separate solutions i.e. Fehling's solution (I) and Fehling's solution (II).

Fehling's solution (I) is $CuSO_4$ solution, Fehling (II) Rochelle salt solution. So Fehling's solution is alkaline copper (II) tartarate.

It is used to distinguish between aldehyde and leetone.

140. (d) $6HCHO + 4NH_3 \rightarrow (CH_2)_6N_4 + 6H_2O$

Urotropine

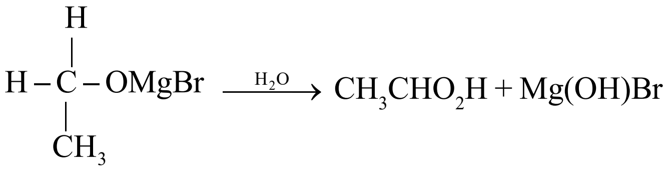
(e) 

(Acetone Cynohydrin) 2-methyl-2-hydroxy propanoic acid

(f) $2CH_3CHO \xrightarrow{NaOH} CH_3CH(OH)CH_2CHO$

(Aldol) 3-hydroxy butanal

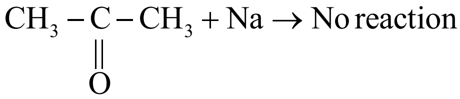
(g) $2HCHO + NaOH \rightarrow CH_3OH + HCOONa$

(h) 

$$H-\underset{CH_3}{\overset{H}{C}}-OMgBr \xrightarrow{H_2O} CH_3CHO_2H + Mg(OH)Br$$

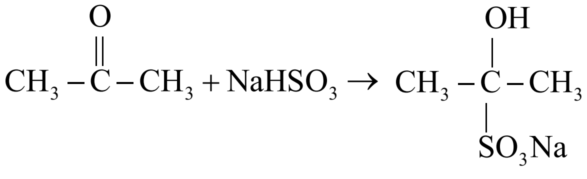
141. When sodium is added to propanol hydrogen is evolved but with acetone there is no reaction.

$$2C_3H_7OH + 2Na \rightarrow 2C_3H_7ONa + H_2 \uparrow$$



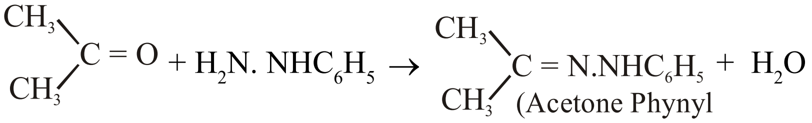
$$CH_3-\underset{O}{\underset{\|}{C}}-CH_3 + Na \rightarrow \text{No reaction}$$

Iodoform test. (Propanone responds to iodoform test with alkaline iodine.)

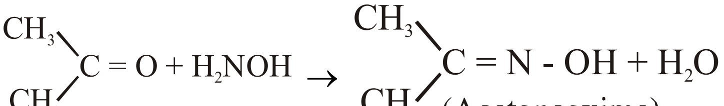
142. (a) 

$$CH_3-\overset{O}{\overset{\|}{C}}-CH_3 + NaHSO_3 \rightarrow CH_3-\underset{SO_3Na}{\overset{OH}{C}}-CH_3$$

(Acetone sodium bisulphite)

(b) 

(Acetone Phynyl Hydrazone)

(c) 

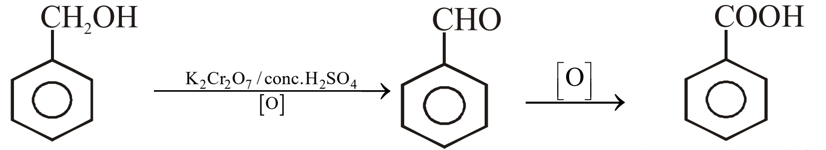
(Acetoneoxime)

143. (a) Primary alcohols and aldehydes get oxidised to corresponding carboxylic acid with oxidising agent like potassium permanganate or dichromate in acidic or alkaline medium.

(i) $CH_3(CH_2)_8CH_2OH \xrightarrow{CrO_3/H_2SO_4} CH_3(CH_2)_8COOH$
(Decanoic acid)

(ii) $CH_3CH_2OH \xrightarrow[{[O]}]{KMnO_4/OH^-} CH_3CHO$
(Ethanoic acid)

(iii)

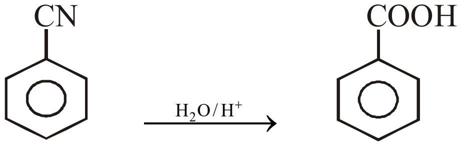


(Benzoic acid)

(b) They are also called cyanides on hydrolysis in presence of an acid or alkali, yield carboxylic acid.

(i) $CH_3C \equiv N \xrightarrow{H_2O/H^+} CH_3COOH$
(Ethanoic acid)

(ii)



(Benzonitrile) (Benzoic acid)

(c) (i) $CH_3CONH_2 + H_2O \xrightarrow{H^+} CH_3COOH + NH_3$

(ii) $C_6H_5CONH_2 + HNO_2 \rightarrow C_6H_5COOH + N_2 + H_2O$

(d) (i) $CH_3COCl + H_2O \xrightarrow{H^+} CH_3COOH + HCl$

(ii) $CH_3COCl + NaOH \rightarrow CH_3COONa + HCl \xrightarrow{H^+} CH_3COOH$

(e) (i) $(CH_3CO)_2O + H_2O \rightarrow 2CH_3COOH$

(ii) $(C_6H_5CO)_2O + H_2O \rightarrow 2C_6H_5COOH$

144.

Reagent	HCOOH	CH_3COOH
Tollen's reagent, $[Ag(NH_3)_2]OH$	Silver mirror is formed	Does not respond

145. (i) When formic acid is reduced by lithium aluminium hydride then methyl alcohol is obtained.

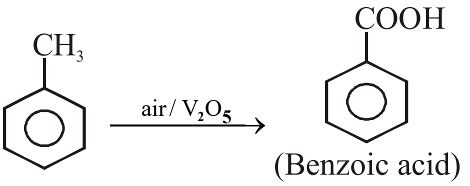
$HCOOH + 4H \xrightarrow[ether]{LiA/H_4} CH_3OH + H_2O$

(ii) When formic acid is dehydrated by conc. H_2SO_4, carbon monoxide is obtained.

$HCOOH \xrightarrow{conc.\ H_2SO_4} CO + H_2O$

146. Because in formic acid release of H^+ becomes easy due to absence of electron releasing group but in acetic acid release of H becomes difficult due to presence of an electron releasing group ($-CH_3$), +I effect.

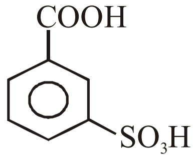
147. (i)



(Benzoic acid)

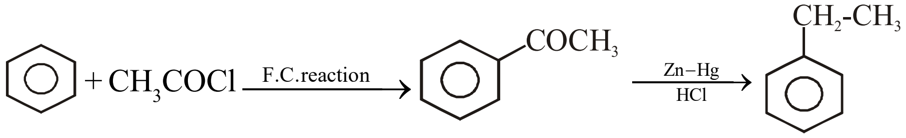
(ii) $C_6H_5CH_3 + 3(O) \xrightarrow{KMnO_4} C_6H_5COOH + H_2O$

(iii) $C_6H_5COOH + \text{conc. } H_2SO_4 \longrightarrow$

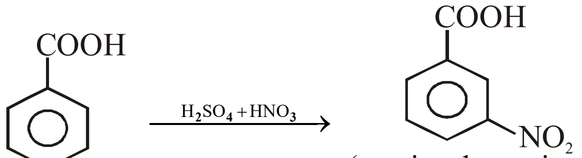


(M-sulphobenzoic acid)

(iv)

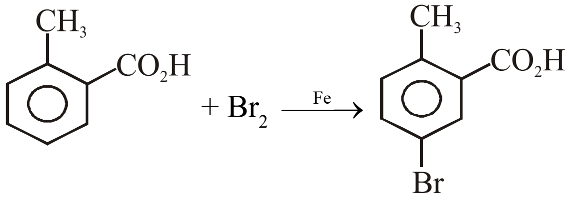


(v)



(m-nitro benzoic acid)

148. It will form p-bromo-toluic acid.



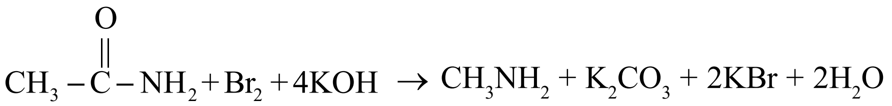
The more activating group directs the Br^+.

UNIT - 13

149. When primary amine reacts with $CHCl_3$ and KOH offensive smelling compound isocyanide is formed.

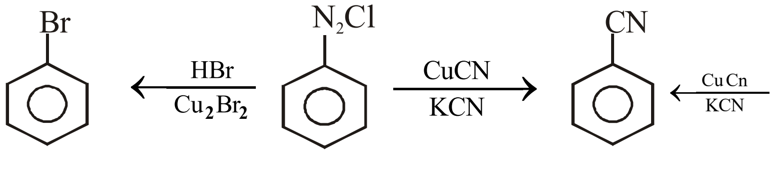
$$C_2H_5NH_2 + CHCl_3 + 3KOH \rightarrow C_2H_5N \equiv C + 3KCl + 3H_2O$$

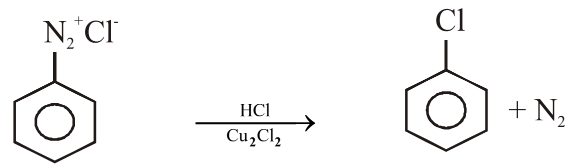
150. When amide reacts with Br_2 and KOH, we get primary amines with loss of one C – atom.



$$CH_3-\overset{\overset{\large O}{\|}}{C}-NH_2+Br_2+4KOH \rightarrow CH_3NH_2 + K_2CO_3 + 2KBr + 2H_2O$$

151.

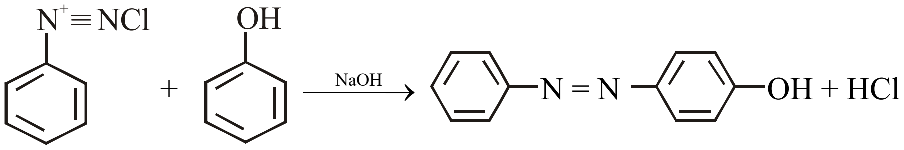




(Benzene diazonium chloride) (Chlorobenzene)

152. (i) $C_2H_5NO_2 \xrightarrow{LiA/H_4} C_2H_5-NH_2 + 2H_2O$

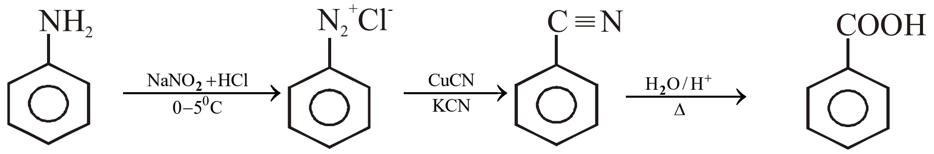
(ii)



p-hydroxyazobenzene

This is called coupling reaction.

153.

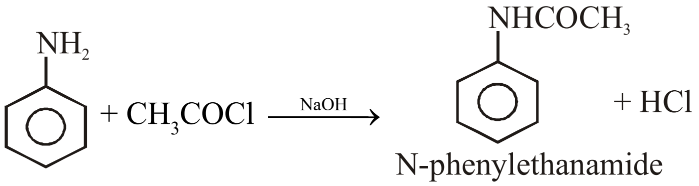


(Aniline) (Benzoic acid)

154. (i) $C_2H_5\ N \Rrightarrow C + 2H_2O \xrightarrow{H^+} C_2H_5NH_2 + HCOOH$

(Ethylamine) (Methanoic acid)

(ii)



N-phenylethanamide

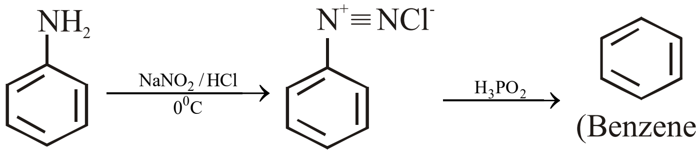
The benzoylation reaction is called Scholten-Baumann reaction. the product is N–phenyl benzamide.

155. Reaction of alkanes with nitric acid in vapour phase at high temp. to form nitroalkanes is called vapour phase nitration.

$R-X + NaNO_2 \rightarrow R-O-N=O + NaX$

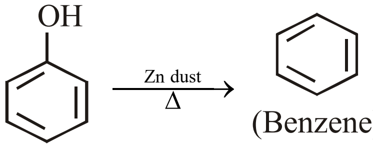
156. The basic character of amines is due to presence of a lone pair of electrons on N-atom. Aromatic amines have resonance structure and lone pair of electrons becomes less available for co-ordination. No such resonance exists in aliphatic amines and lone pair is easily available also +I effect exists. Hence aromatic amines are weaker bases than aliphatic amines.

157. (i)



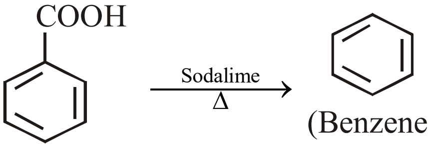
(Benzene)

(ii) Aromatic hydroxy compounds or phenols on heating dry with zinc powder gets the - OH group removed.



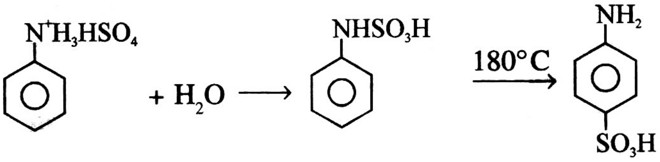
(Benzene)

(iii) An aromatic carboxylic acid when heated with sodalime has the - COOH group removed from the compound.



(Benzene)

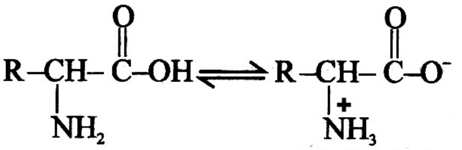
158. $C_6H_5NH_2 + H_2SO_4 \xrightarrow{\text{Heat}}$



UNIT - 14

159. Denaturation of proteins - A process that changes the native conformation of a protein is called denaturation. The denaturation is caused by changes in pH, temperature, presence of salts of certain chemical agents. The denatured proteins will lose its biological activity. During denaturation the protein molecule uncoils from an ordered and specific conformation into a more random conformation and protein precipitates from solution. For example, when an egg is boiled in water, the globular proteins present in it change to a rubber like insoluble mass.

160. In aqueous solution, the carboxyl group loses a proton and amino group accepts a proton to form a dipolar ion or zwitter ion.



$$R-\underset{NH_2}{\underset{|}{CH}}-\overset{O}{\overset{\|}{C}}-OH \rightleftharpoons R-\underset{NH_3}{\underset{|+}{CH}}-\overset{O}{\overset{\|}{C}}-O^-$$

(Zwitter ion)

UNIT - 15

161. Bakelite is prepared by condensation reaction of phenol and formaldehyde. It is used in making electrical switches and switch boards. It is thermosetting polymer because it does not become soft on heating due to cross-linkage.

162. (1) Elastomer ⟶ natural rubber

(2) Thermoplastics ⟶ polythene

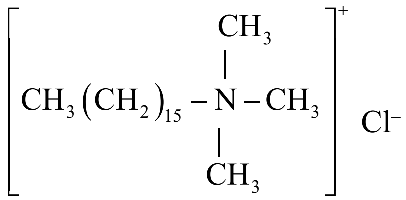
(3) Thermosettings ⟶ bakelite

(4) Fibres ⟶ nylon-66

163. C.G.P. takes place in unsaturated monomers and involves free radical polymerisation e.g. polythene. S.G.P. involves monomers having multi functional groups e.g. nylon-66.

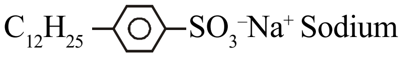
UNIT - 16

164. (i) Aspirin is used as analgesic as pain releiver. It also prevents heart attack.
    (ii) Pencillin is an antibiotic to prevent infection. It is used for pneumonia, bronchitis etc.
    (iii) Phenacetin is an antipyretic drug used to bring down the temperature of feveral body.
    (iv) Morphin is a strong analgesic. They are narcotics. They give relief from acute pain, induce sleep etc.
    (v) Analgin is antipyretics and analgesics. It brings down temperature and gives relief from pain.
    (vi) Luminal produces sleep and is habit forming. It also acts as tranquilizers.
    (vii) Seconal is an antidepressant drug.
    (viii) Streptomycin is an antibiotic. It is used to cure tuberculosis.
165. (i) They can work well even with hard water.
    (ii) They work well even with acidic as well as water containing minerals.
    (iii) They are more effective than soaps.
166. Soaps have hydrophilic and hydrophobic hydrocarbon parts. Hydrophobic part attracts dirt, grease etc. whereas hydrophilic part attracts water, dirt and grease is washed away.
167. Artificial sweetening agents are used to reduce calorie intake. These also protect teeth from decaying.
168. 0.2% solution of phenol acts as an antiseptic and 1% solution of phenol acts as disinfectant.
169. (i) Antihistamines are drugs used to treat allergy such as skin rashes, conjuctivities, rhinitis, etc. e.g., diphenyl hydramine, bromo pheniramines, terphenadine.
    (ii) Antioxidants are the food additives which retard the action of oxygen on the food and thereby help in its preservation, e.g., butylated hydroxytoluene (BHT).
170. Cationic detergent:



$$\left[CH_3(CH_2)_{15}-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{N}}-CH_3\right]^+ Cl^-$$

Cetyltrimethyl ammonium chloride Anionic detergent :

 $C_{12}H_{25}-C_6H_4-SO_3^-Na^+$ Sodium *p*=dodecyl benzene sulphonate

171. (a) Sodium benzoate
    (b) Bithional acts as an antiseptic agent and reduces the olours produced by the bacterial decomposition of organic matter on the skin.
    (c) Tranquillizers.
172. Both antacids and anti-allergic drugs antihistamines but they cannot replace each other because they work on different receptors.
173. Common detergents have branched hydrocarbon chains which are either not attacked or attacked only very slowly by bacteria. As a result, detergents are not degraded in rivers and other waterways and, therefore, cause water pollution. On the other hand, soaps have unbranched hydrocarbon chains which are easily degraded by bacteria present in the sewage water and hence do not cause water pollution.
174. (a) ii (b) i (c) iv
    (d) iii (e) vi (f) v

❖ ❖ ❖

GROUP - B (2)

SHORT TYPE QUESTIONS

(Three marks each)

1. Why does presence of excess of lithium makes Li crystals pink ?
2. What are the important consequences of Schottky and Frenkel defects in crystals ?
3. Analysis shows that nickel oxide has formula $Ni_{0.98}O_{1.00}$. What fractions of nickel exist as Ni^{2+} and Ni^{3+} ions ?
4. What change occurs when AgCl is doped with $CdCl_2$? Explain.
5. Give important differences between crystalline and amorphous solids.
6. Give the points of differences between Schottky defect and Frenkel defect ?
7. Why is the boiling point of a solution always higher than that of a pure solvent ?
8. How will you determine the molecular mass of a substance from osmotic pressure ?
9. Sodium chloride solution freezes at lower temperature than water but boils at higher temperature than water. Explain.
10. At 300 K, 36 g of glucose present per litre in its solution has an osmotic pressure of 4.98 bar. If the osmotic pressure of the solution is 1.52 bars at the same temperature. What would be its concentration ?
11. Calculate the amount of KCl which must be added to 1 kg of water so that the freezing point is depressed by 2K. (K_f for water = 1.86 K kg mol^{-1}).
12. What mass of NaCl (molar mass = 58.5 g mol^{-1}) must be dissolved in 65 g of water to lower the freezing point by 7.5 °C ? The freezing point depression constant, K_f for water is 1.86 K kg mol^{-1}. Assume van't Hoff factor for NaCl is 1.87.
13. How would you determine the standard electrode potential of the system Mg^{2+}/Mg ?
14. Write some applications of electrolysis.
15. 20 ampere current is flowing through $CuSO_4$ solution for 60 minutes. Find the amount of copper deposited. (At wt. of Cu = 63.5)
16. Calculate the normality of KCl solution having resistance 2000 ohm. The cell constant is 5.53 cm^{-1} and the equivalent conductance is 138.25 ohm^{-1} cm^2 eq^{-1}.
17. Calculate the emf of the following cell at 298K. Fe $|Fe^{2+}$ (0.1M)$||Ag^+$ (0.1M)$|$Ag(s).
18. Write the cell reaction which occur in lead storage battery (i) when the battery is in use and (ii) when the battery is on charging.
19. What is specific conductivity of solution ? The specific conductance of a 0.12N solution of an electrolyte is $2.4 \times 10^{-2}\ Scm^{-1}$. Calculate its equivalent conductance.
20. What is corrosion ? Describe the role of zinc in cathodic protection of iron. Can we use tin in place of zinc ? Explain.
21. State two advantages of $H_2 - O_2$ fuel cell over ordinary cell.
22. What is half-life period ? A first order reaction takes 69.3 minutes for 50% completion. How much time will be needed for 80% completion.
23. The rate of reaction is doubled when the temperature changes from 27^0C to 37^0C. Calculate the energy of activation.

24. A chemical reaction $2A \rightleftharpoons 4B + C$ in gas phase occurs in a closed vessel. The concentration of B is found to increase by 5×10^{-3} mol L^{-1} in 10 seconds. Calculate (i) rate of appearance of B, (ii) rate of disappearance of A.

25. A first order reaction is 25% complete in 30 minutes. How long will it take for its 75% completion ?

26. What is activation energy ? How it is affected by the use of catalyst and rise in temperature?

27. Justify the statement that half-life of a 1st order reaction is independent of the initial concentration of the reactant.

28. For a reaction the energy of activation is zero. What is the value of rate constant at 300 K if $K = 1.6 \times 10^6 S^{-1}$ at 280 K.

29. A reaction that is 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 valu of 0.05 mol L^{-1} ?

30. Arive the important differences between order and molecularity of a reaction

31. Consider the reaction :

$$2NO + 2H_2 \rightarrow N_2 + 2H_2O$$

Write the most probable rate equation from the following data. What is the order of the reaction ?

Experiment	[NO]	[H_2]	Rate of reaction (mol L^{-1} s^{-1})
I	0.20	0.20	3.0×10^{-3}
II	0.40	0.20	1.2×10^{-2}
III	0.20	0.40	6.0×10^{-3}
IV	0.60	0.20	2.7×10^{-2}

32. Why does adsorption change with the increase of temperature ?

33. What is leaching ? Give one example.

34. Why is the reduction of a metal oxide easier if the metal is formed in liquid state at the temperature of reduction ?

35. Although thermodynamically feasible, in practice magnesium metal is not used for the reduction of alumina in the metallurgy of aluminium. Why ?

36. What is the role of cryolite in the metallurgy of aluminium ?

37. Name the principal ore of aluminium. Explain the significance of leaching in the extraction of aluminium.

38. Why is it advantageous to roast a sulphide ore to the oxide before reduction ?

39. PCl_5 is known but PI_5 is not known. Why ?

40. NF_3 does not have donor properties like ammonia. Explain.

41. What happens when

(i) PCl_5 is heated ?

(ii) H_3PO_3 is heated ?

Write the reactions involved.

42. Complete the following chemical equations :

(i) $Cu + HNO_3 \text{ (dilute)} \longrightarrow$

(ii) $XeF_4 + O_2F_2 \longrightarrow$

43. Discuss the anomalous properties of nitrogen.
44. What happens when (i) $(NH_4)_2Cr_2O_7$ (ii) sodium azide are strongly heated ? Why the gas evolved is less reactive at room temperature.
45. Discuss the properties of hydrides of nitrogen family.
46. Explain (i) Red phosphorus is less reactive
    (ii) Phosphorus dis proportionates with sodium hydroxide.
47. Draw the structure and basicity of H_3PO_4, H_3PO_3 and H_3PO_2.
48. How can you obtain halogen hydra acid from phosphorus halide ?
49. How can you obtain dioxygen from potassium chlorate ? Can you prepare Cl_2 from HCl using it ?
50. Explain the allotropic forms of sulfur.
51. Draw the structure of SO_2, SO_3, H_2SO_3 H_2SO_4, $H_2S_2O_8$, $H_2S_2O_7$.
52. What happens when conc. H_2SO_4 is treated with (i) NaCl (ii) KBr (iii) Sugar ?
53. What happens when
    (a) H_2S gas is passed through $CuSO_4$ solution.
    (b) H_2S gas is passed through $CuSO_4$ ammoniacal solution of $MnCl_2$.
    (c) H_2S gas is passed through aqueous solution of $ZnCl_2$.
    (d) H_2SO_4 is added to formic acid.
    (e) H_2S is passed through chlorine water.
    (f) SO_2 is passed through H_2S dissolved in water.
54. Why is dioxygen a gas but sulphur a solid ?
55. Explain why ozone is thermodynaniically less stable than oxygen.
56. The halogens are coloured. Why ?
57. Why noble gases are monoatomic in nature ?
58. How XeF_2 and XeF_4 are prepared ?
59. A transition metal exhibits highest oxidation state in oxides and fluorides. Explain why.
60. Write some characteristics of transition elements.
61. 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.
62. Explain why transition elements generally form coloured compounds ?
63. Transition metals and their compounds are generally found to be good catalysts.
64. Describe the preparation of potassim permanganate from pyrolusite ore by electrochemical method.
65. Complete the following chemical equations :

(i) $Cr_2O_7^{2-} + Fe^{2+} + H^+ \longrightarrow$

(ii) $2CrO_4^{2-} + 2H^+ \longrightarrow$

(iii) $MnO_4^- + H^+ + Fe^{2+} \longrightarrow$

66. Of the d^4 species, Cr^{2+} is strongly reducing while Mn(III) is strongly oxidising. Explain.
67. For the complex $[NiCl_4]^{2-}$, write
    (i) the IUPAC name.
    (ii) the hybridisation type.
    (iii) the shape of the complex
    (Atomic no. of Ni = 28)
68. A coordination compound $CrCl_3.4H_2O$ precipitates silver chloride when treated with silver nitrate. The molar conductance of its solution corresponds to a total of two ions. Write structural formula of the compound and name it. Calculate the mas of AgCl formed on addition of excess $AgNO_3$ per mole of complex.
69. What is the role of depressant in froth floation process ?
70. What is Self reduction (Auto-reduction) ?
71. Explain Serpeck's Process for leaching bauxite.
72. What is the hydrometallurgy ? Explain with an example.
73. Which of the following ores can be concentrated by froth floatation method and why ?
    Fe_2O_3, ZnS, Al_2O_3
74. What is the role of silica in the metallurgy of copper ?
75. SF_6 is known but SH_6 is not known. Explain.
76. (a) Discuss (i) oxidation states and (ii) Oxidising character of halogens.
77. Explain the following observations :
    (i) Phosphorus has greater tendency of catenation than nitrogen.
    (ii) Oxygen is a gas but sulphur a solid.
78. Calculate the magnetic moment of a divalent and a trivalent ion in aqueous solution if its atomic number is 25.
79. Discus Geometrical isomerisms in complexes.
80. Discuss three importance and applications of coordination compounds.
81. Define crystal field splitting. Discuss the splitting ofrf-orbitals in octahedral field.
82. What is Wurtz reaction ? Give example.
83. Give Friedel-Craft's reactions of chlorobenzene. Equations only.
84. What is aldol condensation ?
85. Discuss about the nature of carbonyl group. How does it differ from C = C ?
86. What happens when acetone reacts with
    (a) Sodium-bisulphite
    (b) Phenyl hydrazine
    (c) Hydroxyl amine
87. How can a carboxylic acid be converted to an aldehyde in two steps ?
88. Complete the following reactions.
    (i) $C_2H_5NO_2 \xrightarrow{Sn+HCl}$
    (ii) $C_2H_5NO_2 \xrightarrow{Zn+NH_4Cl}$
    (iii) $CH_3 - CO - CH_3 + NaOH \longrightarrow$

(iv) $CH_3 - CH_2NO_2 + HNO_2 \longrightarrow$

(v) $R - CH_2 - NO_2 \xrightarrow{Br_2 + NaOH}$

89. What do you understand by the term glycosidic linkage ?

90. (i) Victor Meyer test to distinguish 1^0, 2^0 and 3^0 alcohols.

    (ii) Hinsberg test to distinguisg 1^0, 2^0 and 3^0 amines.

91. What are bio degradable & non-biodegradable polymers ?

92. Draw the structure of

    (i) Capro lacton (ii) DDT (iii) Aspirin

93. Why Halo arenes are less reactive then Halo alkane ?

94. Alkyl halide with KCN gives RCN but with AgCN gives RNC - why ?

95. What happens isopropyl bromide is treated with sodium tert-butoxide ?

96. Discuss the replacement of –Cl by –OH in benzene. How is it initiated?

97. How is Grignard reagent synthesized ? How does it react with carbonyl group.

98. Why Chloroform is kept inside a coloured bottle filled ?

99 State the function of (i) anti-histamines and (ii) antioxidants with examples.

100. Explain the following processes with a suitable example in each case :

    (i) Chain growth polymerization.

    (ii) Step growth polymerization

101. What are elastomers ? Write the chemical equation to represent the preparation of Buna-S.

102. What are soaps and detergents ? Discuss their clensing action. [4 + 3]

103. Write notes on :

    (i) Antioxidant

    (ii) Artificial sweetening reagents.

    (iii) Tranquilizers

104. Explain the following :

    (i) Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis.

    (ii) Amines are less acidic than alcohols of comparable molecular masses.

    (iii) Primary amines higher boiling point than tertiary amines.

105. Provide the laboratoty tests to distinguish the following :

    (i) Methyl alcohol and ethyl alcohol

    (ii) Propan-1-ol and propan-2-ol

    (iii) HCHO and CH_3CHO

    (iv) Pentan-2-one and pentan-3-one.

❖ ❖ ❖

GROUP - B (2)

SHORT TYPE QUESTIONS (ANSWERS)

(Three marks each)

1. 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.

2. 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.

3. $Ni_{0.98}O_{1.00}$

   Let Ni^{2+} be x so that Ni^{3+} will be $0.98 - x$.

   Total charge on the compound must be zero so that

   $$+2x + 3(0.98 - x) - 2 = 0$$

   $$2x + 2.94 - 3x - 2 = 0$$

   $$-x = -0.94$$

   or $x = 0.94$, $Ni^{3+} = 0.04$

   $$\% \text{ of } Ni^{2+} = \frac{0.94}{0.98} \times 100 = 96\%$$

   $\%$ of $Ni^{3+} = 4\%$.

4. $CdCl_2$ 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.

5. The crystalline and amorphous solids differ from one another in the following respects :

	Crystalline solids		**Amorphous solids**
1.	In crystalline solids, the constituent particles are arranged in a definite regular order which extends throughout the crystal.	1.	The constituents are not arranged in any regular order.
2.	They have sharp melting points.	2.	They do not have sharp melting points.
3.	Crystalline substances are anisotropic.	3.	They are isotropic.
4.	They undergo cleavage when cut with a knife.	4.	They undergo irregular breakage when cut with a knife.

6. 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.

7. When a solute is added to a pure solvent, solute molecules occupy a part of the surface area. As a result the surface area decreases, from which less no. of molecules go to the vapour state from the solution, as compared to the no. of molecules going to the vapour state from pure solvent. In other words, vapour pressure of a pure solvent is always greater than the v.p. of its solution at the same temperature. Since greater the vapour pressure, lower is the boiling point, the solution having lower v.p. has higher b.p. than that of a pure solvent, which has higher vapour pressure.

8. Osmotic pressure (π) can be given by van't Hoff equation as :

$$\pi = \frac{n}{V} RT$$

where n is the number of moles of solute present in volume V, R is gas constant and T is absolute temperature.

If ω_B is the weight of the solute with molecular mass M_B, then

$$n = \frac{W_B}{M_B}$$

$$\pi = \frac{W_B RT}{M_B V}$$

or $$M_B = \frac{W_B RT}{\pi V}$$

9. We know that freezing point of a solution depresses on the addition of a non-volatile solute while there is elevation in the boiling point. Consequently, the solution of sodium chloride freezes at lower temperature than water (depression in freezing point) but boils at higher temperature than water because there is elevation in boiling point.

10. According to van't Hoff equation,

$$\pi = cRT$$

$$c_1 = \frac{36}{180} M, \ p_1 = 4.98 \text{ bar}$$

$$c_2 = ? \ p_2 = 1.52 \text{ bar}$$

$$\frac{36}{180}RT = 4.98 \qquad ......(i)$$

$$c_2RT = 1.52 \qquad ..... (ii)$$

Dividing eq. (ii) by eq. (i)

$$\frac{c_2}{36} \times 180 = \frac{1.52}{4.98}$$

$$c_2 = \frac{1.52 \times 36}{4.98 \times 180} = 0.061 \text{ M.}$$

11. $\Delta T_f = 2K$

$$KCl \rightleftharpoons K^+ + Cl^-$$

$i = 2$

$K_f = 1.86 \text{ K kg mol}^{-1}$

$w_A = 1 \text{ Kg} = 1000 \text{ g}$

$M_B = (39 + 35.5) = 74.5 \text{ g}$

$w_B = ?$

$$\Delta T_f = \frac{iK_f \times w_B \times 1000}{w_A \times M_B}$$

$$2K = \frac{2 \times 1.86 \text{ K kg mol}^{-1} \times w_B \times 1000}{1000 \text{ g} \times 74.5 \text{ g}}$$

$$\text{or } w_B = \frac{2 \times 1000 \times 74.5}{2 \times 1.86 \times 1000}$$

$$\text{or } w_B = 40.05 \text{ g}$$

12. $\Delta T_f = i\frac{K_f \times 1000 \times w_B}{w_A \times M_B}$

$i = 1.87,$

$K_f = 1.86 \text{ K kg mol}^{-1}$

$w_A = 65 \text{ g}, \; M_B = 58.5$

$\Delta T_f = 7.5^0 \text{ C}$

$$7.5 = 1.87 \times \frac{1.86 \times 1000 \times \omega_B}{65 \times 58.5}$$

$$w_B = 7.5 = 1.87 \times \frac{1.86 \times 1000 \times \omega_B}{65 \times 58.5} = 8.2 \text{ g}$$

13. When Mg electrode dipped in 1M Mg^{2+} solution and couple it with standard hydrogen electrode, the potentiometer reading will be equal to standard electrode potential of Mg^{2+}/Mg system.

14. (i) Electroplating
    (ii) Electro refining
    (iii) Electrotyping
    (iv) Decomposition of compounds.
    (v) Electrometallurgy

15. Given 1 = 20 amp

So, amount of charge, Q = It

$\Rightarrow \quad Q = 20 \times 3600 = 72000\,\text{coulombs}$

Now, equivalent wt. of Cu $= \frac{63.5}{2} = 31.75$

96500 culombs deposit Cu = 31.75 gm.

7200 coulombs deposit $Cu = \frac{31.75}{96500} \times 72000$

16. Given R = 2000 ohm

Conductance $= \frac{1}{2000} = 0.005\,\text{ohm}^{-1}$

Cell constant = 5.53 cm^{-1}

$\therefore$ Specific conductance

$$K = 0.0005 \times 5.53$$
$$= 0.002765\ \text{ohm}^{-1}\ \text{cm}^{-1}$$

Now, equivalent conductance

$$= \frac{1000\,\text{sp.conductance}}{\text{Normality}}$$

$$\therefore \ \text{Normality} = \frac{1000 \times 0.002765}{138.25} = 0.02\text{N}.$$

17. $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^{-}$ (At anode)

$$\frac{2Ag^{+}(aq) + 2e^{-} \rightarrow 2Ag(s)\ (\text{At cathode})}{Fe(s) + 2Ag^{+}(aq) \rightarrow Fe^{2+}(aq) + 2Ag(s)}$$

$$E_{cell} = E^{0}_{cell} - \frac{0.0591}{2}\log\frac{[Fe^{2+}]}{[Ag^{+}]^{2}}$$

$$= \left[E^{0}_{Ag^{+}/Ag} - E^{0}_{Fe^{2+}/Fe}\right] - \frac{0.0591}{2}\log\frac{0.1}{(0.1)^{2}}$$

$$= (0.8 - 0.44) + \frac{0.0591}{2}\log 0.1$$

$$= 1.24\ \text{V} - 0.0295 = 1.2105\ \text{V}$$

18. (i) $Pb(s) + PbO_2(s) + 2H_2SO_4^{2-}(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

At anode, $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$

At cathode, $PbO_2(s) + SO_2^{2-}(aq) + 4H^+(aq) + 2e^- \rightarrow PbSO_4(s) + 2H_2O(l)$

(ii) $2PbSO_4(s) + 2H_2O(l) \rightarrow PbO_2(s) + Pb(s) + 2H_2SO_4$

19. Specific conductivity is defined as conductivity of solution when electrodes are unit distance apart and have area of cross section equal to unity.

$$A_{eq} = \frac{1000K}{N} = \frac{1000\,cm^3 \times 2.4 \times 10^{-2}\,Scm^{-1}}{0.12}$$

$$= \frac{2400}{12} = 200\ Scm^2\ eq^{-1}$$

20. Coorosion is process in which metal eacts with substances present in atmosphere to form compounds at its surface. i.e., metal getting oxidised.

Zn acts as anode. It loses electrons in preference to iron because it is more reactive than Fe.

$$Zn \rightarrow Zn^{2+} + 2e^-$$

$$Fe^{2+} + 2e^- \rightarrow Fe$$

Tin cannot be used to protect iron because it is less reactive than iron,

$$E^0_{S_n{}^{2+}|Sn} = -0.14V,\quad E^0_{Zn^{2+}|Zn} = -0.76V,\quad E^0_{Fe^{2+}|Fe} = -0.44V$$

21. The advantages of $H_2 - O_2$ fuel cell over ordinary cell are:

(i) High efficiency : The fuel cells convert the energy of a fuel directly into electricity and therefore, they are more efficient than the conventional methods of generating electricity on a large scale by burning hydrogen, carbon fuels Though we expect 100% efficiency in fuel cells, so far 60-70% efficiency has been attained. The conventional methods of production of electrical energy involve combustion of a fuel to liberate heat which is then used to produce electricity. The efficiency of these methods is only about 40%.

(ii) Continuous source of energy : There is no electrode material to be replaced as in ordinary battery. The fuel can be fed continuously to produce power. For this reason, $H_2 - O_2$ fuel cells have been used in spacecrafts.

(iii) Pollution free working : There are no objectionable by-products and therefore, they do not cause pollution problems.

22. $k = \frac{0.693}{t_{1/2}} = \frac{0.693}{69.3\,min} = 0.01\ min^{-1}$.

Let t be the time taken for 80% completion

$$t = \frac{2.303}{k}\log\frac{100}{100.80} = \frac{2.303}{10^{-2}\,min^{-1}}\log 5$$

$$= 230.3 \times 0.6989\ min = 160.97\,min.$$

23. We know that $\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$ Submitting the values,

$$\text{Log } 2 = \frac{E_a}{2.303 \times 8.314}\left[\frac{1}{300} - \frac{1}{310}\right]$$

$$\therefore \quad E_a = \frac{0.3010 \times 2.303 \times 8.314 \times 300 \times 310}{10}$$

= 535986.J

= 535.99 kJ

24. (i) Rate of appearance of B

$$+\frac{d[B]}{dt} = \frac{5 \times 10^{-3}\,\text{mol}^{-1}}{10}$$

$$= 5 \times 10^{-4}\,\text{mol}\,\text{L}^{-1}\,\text{s}^{-1}$$

$$-\frac{1}{2}\frac{d[A]}{dt} = \frac{1}{4}\frac{d[B]}{dt}$$

$$-\frac{d[A]}{dt} = \frac{1}{2}\frac{d[B]}{dt}$$

$$-\frac{d[A]}{dt} = \frac{1}{2} \times 5 \times 10^{-4}\,\text{mol}\,\text{L}^{-1}\text{s}^{-1}$$

$$= 2.5 \times 10^{-4}\ \text{mol}\,\text{L}^{-1}\,\text{s}^{-1}$$

25. (i) t = 30 minutes, let a = 100, then (a - x)
= 100-25=75

$$\text{Calculating rate constant, } k = \frac{2.303}{30}\log\frac{100}{75}$$

$$= \frac{2.303}{30}\log 1.33$$

$\therefore$ k = (0.0767) (0.1249) = 0.00959

= $9.59 \times 10^{-3}\ \text{min}^{-1}$

(ii) Time for 7 5 % completion,

a = 100, (a – x) = 100 – 75 = 25; t = ?

$$t = \frac{2.303}{K}\log\frac{100}{25} = \frac{2.303}{0.00959\ \text{min}^{-1}}\log\frac{100}{25}$$

= 240.12 log 4 min

t = 240.12 (0.6020) = 144.5 min.

26. Activation energy is the extra energy which must be supplied to the reactants so that they change into products.

(i) Catalyst lowers down the activation energy.

(ii) There is no effect on activation energy with rise in temperature but number of molecules possessing activation energy will increase.

27. $K = \frac{2.303}{t}\log\frac{[A_0]}{[A]}$

$$\Rightarrow \quad t_{\frac{1}{2}} = \frac{2.303}{k}\log\frac{[A_0]}{[A_0]\,1\!/\!2}$$

$$\Rightarrow \quad t_{\frac{1}{2}} = \frac{2.303}{k}\log 2 = \frac{2.303}{k}\times 0.3010$$

$$\Rightarrow \quad t_{\frac{1}{2}} = \frac{0.693}{k}$$

It shows $t_{\frac{1}{2}}$ of 1st order reaction is independent of initial concentration.

28. $\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

$$\Rightarrow \quad \log\frac{k_2}{k_1} = 0\,(\because E_a = 0)$$

$$\Rightarrow \quad \frac{k_2}{k_1} = 1 \;\Rightarrow\; k_1 = k_2 = 1.6\times 10^6\ S^{-1}$$

29. For the first order rate equation,

$$k = \frac{2.3030}{t}\log\frac{a}{a-x}$$

$k = 6\,\text{min}^{-1},\ a = 0.5\ \text{mol L}^{-1},\ (a-x) = 0.05\ \text{mol L}^{-1}$

$$6 = \frac{2.303}{t}\log\frac{0.5}{0.05} \quad \text{or} \quad t = \frac{2.303}{6}\log\frac{0.5}{0.05} = \frac{2.303}{6}\log 10$$

$= 0.383$ min.

30. The important differences between order and molecularity of a reaction are given below

	Order		**Molecularity**
(1)	Order is the sum of the powers of the concentration terms in the rate law expression.	(1)	Molecularity is the number of reacting species undergoing simultaneous collisions in the elementary or simple reaction.
(2)	Order of a reaction isdetermined experimentally.	(2)	Molecularity is a theoretical concept.
(3)	Order of a reaction need not be a whole number, i.e., it can have fractional values also.	(3)	Molecularity has whole number values only, i.e., 1, 2, 3, etc.
(4)	Order of a reaction can be zero.	(4)	Molecularity of a reaction cannot be zero.

31. Inspection of data in experiments I and II shows that when the concentration of [NO] is doubled, the rate of the reaction becomes four times. Similarly, when the concentration of NO is tripled (experiments I and IV), the rate becomes nine times. Thus, rate of reaction is proportional to the square of the concentration of NO, i.e.,

$$\text{Rate} \propto [NO]^2$$

Inspection of date in experiments II and III shows that by doubling the concentration of H_2 the rate is doubled. Thus, the rate is directly proportional to the concentration of H_2, i.e,

$$\text{Rate} \propto [H_2]$$

Thus, overall probable rate equation is

$$\text{Rate} \propto [NO]^2 [H_2]$$

or $\text{Rate} \propto k[NO]^2 [H_2]$

Order of reaction = 2 + 1 = 3

32. In physisorption, the attractive forces between adsorbent and adsorbate molecules are weak van der Waals' forces. When temperature is increased, the kinetic energy of the molecules of the gas increases and they can easily leave the surface of adsorbent because of weak forces of attraction.

Chemisorption increases as a chemical reaction occurs on its surface & kinetic of a reaction increases with temperature.

33. Principle - When Ore is soluble and impurities are insoluble in a suitable solvent, then ore is ocentrated by leaching method, a chemical method of separation.

Examples - Bauxite ($Al_2O_3 . 2H_2O$), an ore of aluminium is concentrated by leaching method. The powdered ore is leached with a hot and concentrated solution of NaOH, where Al_2O_3 gets dissolved forming sodium metaluminate ($NaAlO_2$), while impurities like Fe_2O_3 remain unreacted and can be removed by filtration.

The filtrate is diluted with water to get white precipitate of $Al(OH)_3$ which is filtred out and ignited (i.e., strongly heated to get pure alumina (Al_2O_3).

$$\underset{\text{Bauxite}}{Al_2O_3 . 2H_2O} + 2NaOH \xrightarrow{\text{Heat}} \underset{\text{Sod. meta-aluminate}}{2NaAl_2O_3} + 3H_2O$$

$$NaAlO_2 + 2H_2O \rightarrow Al(OH)_3\downarrow + NaOH$$

$$2Al(OH)_3 \xrightarrow{\text{Heat}} \underset{\text{Alumina}}{Al_2O_3} + 3H_2O$$

34. The entropy of a metal is higher in its liquid state than in its solid state. Therefore, entropy change, ΔS of the reduction process is more on the positive side when the metal formed is in liquid state and metal oxide being reduced is in the solid state. As a result, the value of ΔG becomes more on negative side and therefore, reduction becomes easier.

35. Inspection of Ellingham diagram shows that ΔG vs T curves for Al_2O_3 and MgO intersect at a point corresponding to very high temperature of the order of 2000 K. This means above this temperature, ΔG for the reaction :

$$Al_2O_3 + 3Mg \longrightarrow 2Al + 3MgO$$

would become negative and hence reduction will be feasible. However, this temperature is very high so that the process is uneconomical and technologically difficult.

36. Cryolite is added to bauxite ore before electrolysis because of the following reasons :
    (i) It acts as a solvent.
    (ii) It lowers the melting point of alumina to about 1173K.
    (iii) Addition of cryolite to alumina increases the electrical conductivity.

37. The principal ore of aluminium is bauxite $Al_2O_3 . 2H_2O$. Leaching process is used to concentrate the ore of aluminium, bauxite, which is contaminated with impurities of silica (SiO_2), iron oxide (Fe_2O_3), titanium oxide (TiO_2) etc. Leaching is done by treating the powdered ore with hot cone. (45%) solution of NaOH at about 473-523 K and 35-36 bar pressure.

$$Al_2O_3.2H_2O(s) + 2NaOH(aq) + H_2O(l) \rightarrow 2Na[Al(OH)_4](aq)$$

The impurities of ferric oxide and silica are insoluble and are removed by filtration. The solution containing sodium aluminate is neutralised by passing CO_2 gas and hydrated alumina is precipitated.

$$2Na\,[Al(OH)_4](aq) + CO_2(g) \rightarrow Al_2O_3 . x\,H_2O(s) + 2Na\,HCO_3(s)$$

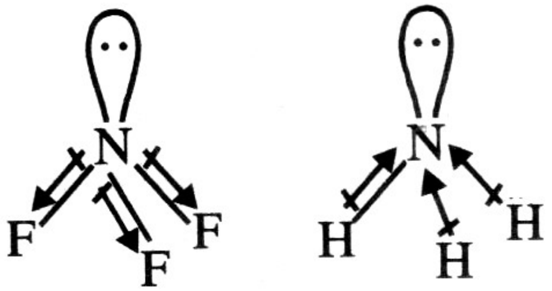
Hydrated alumina is heated to 1473 K to get pure alumina.

$$Al_2O_3 . x\,H_2O \xrightarrow{1473K} Al_2O3_{(s)} + x\ H_2O(g)$$

38. The standard free energy of formation (ΔG^0) of most of the sulphides are larger than those of CS_2 and H_2S. Therefore, these sulphides are more stable than those with carbon or hydrogen. Hence, neither carbon nor hydrogen can reduce metal sulphides to metal. In contrast the standard free energies of formation of oxides are much lower than those of SO_2 and therefore oxidation of metal sulphides to metal oxides is thermodynamically favourable. Therefore, it is a common practice to roast sulphide ore to oxide ore before reduction.

39. Due to small size of Cl atom, five Cl atoms can be accommodated around P atom. But I is of large size and therefore, five I atoms cannot be accommodated around P atom. As a result, P -I bonds are weak and prefer to form PI_3 rather than PI_5.

40. NF_3 has a pyramidal shape with one lone pair on N atom.



The lone pair on N is in opposite direction to the N-F bond moments and therefore, it has very low dipole moment (about 0.234 D). Thus, it does not show donor properties. But ammonia has high dipole moment because its lone pair is in the same direction as the N-H bond moments. Thus, it has donor properties.

41. (i) On heating, PCl_5 sublimes and decomposes on strong heating :

$$PCl_5 \xrightarrow{\text{Heat}} PCl_3 + Cl_2$$

(ii) On heating, H_3PO_3 decomposes into phosphoric acid and phosphine.

$$\overset{+3}{4H_3PO_3} \xrightarrow{475\text{ K}} \overset{+5}{3H_3PO_4} + \overset{-3}{PH_3}$$

This is a disproportionation reaction.

42. (i) $2Cu + 8HNO_3(dil) \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

(ii) $XeF_4 + O_2F_2 \xrightarrow{-130^0 C} XeF_6 + O_2$

43. See Text

44. N_2 (g) evolved. Inertness is due to high bond dissociation energy.

45. See Text.

46. (i) Polymeric structure

(ii) forms PH_3 and NaH_2PO_2.

47. See Text.

48. $PCl_3 + 3H_2O \longrightarrow H_3PO_3 + 3HCl$, similarly others.

49. $4\,HCl + O_2 \xrightarrow{CuCl_2} 2Cl_2 + 2H_2O$

50. Rhombic sulfur (α - sulfur) Monoclinic sulfur (β -sulfur)

51. See Text.

52. (i) HCl (ii) Br_2 (iii) Charring action

53. a) A black precipitate of copper sulphide forms.

$CuSO_4 + H_2S \rightarrow H_2SO_4 + CuS$.

(b) Flesh like precipitate of MnS are formed.

$MnCl_2 + H_2S \rightarrow MnS + 2HCl$

(c) A white precipitate of zinc sulphide,is formed.

$ZnCl_2 + H_2S \rightarrow ZnS + 2HCl$

(d) Carbon monoxide is formed.

$$HCOOH \xrightarrow{\text{con. } H_2SO_4} CO + H_2O$$

(e) Sulphur is precipitated.

$H_2S + Cl_2 \rightarrow 2HCl + S$

(f) Sulphur is precipitated.

$SO_2 + 2H_2S \rightarrow 2H_2O + 3S$.

54. Due to small size and high electronegativity, oxygen atom forms $p\pi - p\pi$ double bond, $O = O$. The intermolecular forces in oxygen are weak van der Waals' forces and therefore, oxygen exists as a gas. On the other hand, sulphur does not form stable $p\pi - p\pi$ bonds and do not exists as S_2. It is linked by single bonds and form polyatomic complex molecules having eight atoms per molecule (S_8) and have puckered ring , structure. Therefore, S atoms are strongly held together and it exists as a solid.

55. Ozone is thermodynamically unstable with respect to oxygen because it results in liberation of heat (ΔH = -ve) and increase in entropy (ΔS = +ve).

$$2O_3 \rightleftharpoons 3O_2$$

These two factors reinforce each other resulting in large negative Gibbs free energy change (ΔG = –ve) for its conversion into oxygen. Therefore, the high concentration of ozone can result into dangerous explosion.

56. All the halogens are coloured. This is due to absorption of radiations in the visible region which results in the excitation of outer electrons to higher energy levels. By absorbing different quanta of radiations, they display different colours. Fluorine atom is the smallest and the force of attraction between the nucleus and the outer electrons is very large. As a result, it requires large excitation energy and absorbs violet light (high energy) and therefore, appears pale yellow. On the other hand, iodine needs very less excitation energy and absorbs yellow light of low energy. Thus, it appears dark violet. Similarly, we can explain the greenish yellow colour of chlorine and reddish brown colour of iodine.

57. Because

(a) the outermost shell of noble gases are fully saturated. So, they are incapable of combining together to form polyatomic molecules.

(b) the specific heat ratio C_p/C_v of noble gases are 1.667.

(c) the values of refractive index, dielectric constants confirms the monoatomic nature of noble gases.

(d) Bond order = O, as per MOT.

58. (i) It is prepared by heating a mixture of xenon and fluorine using light from mercury lamp.

$$Xe + F_2 \rightarrow XeF_2$$

(ii) It is prepared by heating a 1 : 5 mixture of xenon and fluorine in a nickel tube heated to 400°C and 6 atmospheric pressure for a few hours.

$$Xe + 2F_2 \xrightarrow{\text{heating}} XeF_4$$

59. A transition metal exhibits higher oxidation , states in oxides and fluorides because oxygen and fluorine are of small size and high electronegativity and hence can readly oxidise the metals. For example, O_sF_6, V_2O_5

60. (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.

61. 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 4/ 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.

62. 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.

63. 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 :

$$\underset{\text{Catalyst}}{V_2O_5} + SO_2 \longrightarrow SO_3 + \underset{\substack{\text{Divanadium}\\ \text{tetraoxide}}}{V_2O_4}$$

$$2V_2O_4 + O_2 \longrightarrow 2V_2O_5$$

64. Preparation of potassium permanganate. $KMnO_4$ is prepared on a large scale from pyrolusite. It is fused with KOH in the presence of air forming a green mass of potassium manganate.

$$2MnO_2 + 4KOH + O_2 \rightarrow \underset{\text{Pot. manganate (green)}}{2K_2MnO_4} + 2H_2O$$

Potassium manganate is oxidised electrochemically to permanganate ion in the electrode compartment.

$$\text{At anode : } MnO_4^{2-} \longrightarrow MnO_4^{-} + e^{-}$$

$$\text{At cathode : } 2H^{+} + 2e^{-} \longrightarrow 2H$$

$$2H \longrightarrow H_2$$

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

$$5Fe^{2+} \longrightarrow 5Fe^{3+} + 5e^{-}$$

66. 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.

67. (i) Tetrachloridonickelate (II) ion

(ii) sp^3 hybrididation

(ii) tetrahedral

68. $[Co(H_2O)_4Cl_2]Cl$: Tetraaquadichloridocobalt (III) chloride.

Mass of AgCl = 1 mole = 143.5g

69. The depressants are used to prevent certain types of particles from forming the froth with bubbles in froth floatation process. This helps to separate two sulphide ores. For example, in case of an ore containing zinc sulphide (ZnS) and lead sulphide (PbS), sodium cyanide (NaCN) is used as a depressant. It forms a layer of zinc complex $Na_2[Zn(CN)_4]$ with ZnS on the surface of ZnS and therefore, prevents it from forming the froth. Therefore, it acts as a depressant.

$$ZnS + 4NaCN \longrightarrow Na_2[Zn(CN)_4] + Na_2S$$

However, NaCN does not prevent PbS from forming the froth and allows it to come with the froth.

70. During the process of roasting, the sulphides of some metals like Cu, Pb and Hg are partly converted into corresponding oxides. These metal oxides reduce the remaining metal sulphides into corresponding metals. This process of reduction is called self reduction. In case of extraction of copper from copper pyrite or copper glance,

$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$$

$$2Cu_2O + Cu_2S \xrightarrow{\Delta} 6\,Cu + SO_2$$

In case of lead from galena,

$$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$$

$$PbS + 2PbO \rightarrow 3Pb + SO_2$$

71. While bauxite containing more SiO_2 impurity is strongly heated in a current of nitrogen with coke at 1100°C, where silicon is volatalised and aluminium nitride (AlN) is formed, which is treated with water to get $Al(OH)_3$ and ignited to get pure alumina.

$$Al_2O_3 + 3C + N_2 \longrightarrow 2AlN + 3CO\uparrow$$

$$AlN + 3HOH \longrightarrow Al(OH)_3 + NH_3\uparrow$$

$$2Al(OH)_3 \xrightarrow{\Delta} \underset{\text{(Pure alumina)}}{Al_2O_3 + 3H_2O}$$

72. The process of extraction of metals by dissolving the ore in a suitable chemical reagent and the precipitation of the metal by more electropositive metal is called hydrometallurgy. For example, concentrated argentite, Ag_2S is first treated with a dilute solution of NaCN to form the soluble complex, sodium dicyanidoargentate (I).

$$Ag_2S + 4NaCN \rightarrow 2Na[Ag(CN)_2] + Na_2S$$

The solution is decanted off and made alkaline by adding NaOH and then treated with zinc or aluminium to precipitate silver.

$$2Na[Ag(CN)_2] + Zn \rightarrow 2Ag + Na_2[Zn(CN)_4]$$

$$Na_2[Zn(CN)_4] + 4NaOH \rightarrow Na_2ZnO_2 + 4NaCN$$

Gold is also precipitated from its complex salt solution in a similar way.

$$2K[Au(CN)_2] + Zn \rightarrow K_2[Zn(CN)_4] + 2Au$$

Metals such as Ti, Zr, Ta, etc. are also obtained by reducing their complex salts with alkali metals orAl.

$$K_2TiF_6 + 4K \rightarrow 6KF + Ti$$

$$K_2ZrF_6 + 2A1 \rightarrow 2A1F_3 + 2K + Zr$$

73. ZnS, because in sulphide ores, the sulphide ore particles are preferentially wetted by oil and gangue particles by water.

74. During roasting, the copper pyrites are converted into a mixture of FeO and Cu_2O.

$$2CuFeS_2 + O_2 \xrightarrow{\Delta} Cu_2S + 2FeS + SO_2$$

$$2Cu_2S+3O_2 \xrightarrow{\Delta} 2Cu_2O+2SO_2$$

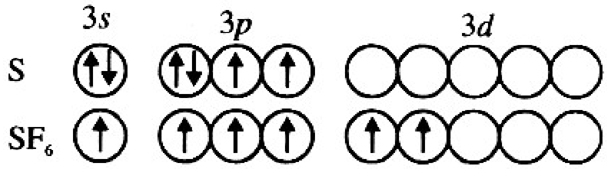
$$2FeS + 3O_2 \longrightarrow 2FeO + 2SO_2$$

To remove FeO (basic), the roasted ore is mixed with silica and heated. Silica acts as a flux and combines with ferrous oxide present to form fusible slag of iron silicate.

$$FeO +SiO_2 \longrightarrow FeSiO_3$$

The slag being lighter floats and forms the upper layer and is removed through slag hole. Therefore, silica helps to remove FeO in the metallurgy of copper.

75. Fluorine is highly electronegative (4.0) and can easily cause the promotion of electrons from the filled to the vacant 3d-orbitals.



However, hydrogen is less electronegative (2.1), even less than that of S. Therefore, it cannot cause the promotion of electrons. Thus, SF_6 is known but SH_6 is not known.

76. (i) Oxidation states. Halognes have only on electron less than the next noble gas. Therefore, they have strong tendency to either gain or share one electron. Thus, they show oxidation states of +1 and -1 depending upon whether the element combining with halogens is less electronegative or more electronegative than halogen. Now, fluorine is the most electronegative element and it always shows an oxidation state of -1. It cannot show any positive oxidation state. Other than fluorine they have vacant d-orbitals hence exhibit positive os +1, +3, +5 and +7.

$$\frac{1}{2}X_2 + e^- \longrightarrow X^- \text{ (aq)}$$

(ii) Oxidising power. Halogens have high electron gain enthalpy values and, therefore, they have strong tendency to take up the electron : As a result, they act as powerful oxidising agents. Fluorine is the strongest oxidising agent and oxidises other halide ions in solution or even in the solid phase. In general, a halogen of lower atomic number will oxidise halide ion of higher atomic number as given below :

$$F_2 + 2X^- \longrightarrow 2F^- + X_2 \qquad (X = Cl, Br, I)$$

$$Cl_2 + 2X^- \longrightarrow 2Cl + X_2 \qquad (X = Br, I)$$

$$Br_2 + 2I^- \longrightarrow 2Br^- + I_2$$

The decreasing oxidising power of the halogens as we gp down the group is shown by their decreasing reduction potentials.

77. (i) The property of catenation depends upon the strength of element-element bond. Since P-Pbond strength (213 kJ mol^{-1}) is much more than N-N bond strength (159 kJ mol^{-1}), phosphorus has greater catenation properties than nitrogen.

(ii) Due to small size and high electronegativity, oxygen atom forms $p\pi$-$p\pi$ double bond, O=O. The intermolucular forces in oxygen are weak van der Waals' forces and therefore, oxygen exists as a gas. On the other hand, sulphur does not form stable $p\pi$-$p\pi$ bonds and do not exists as S_2 It is linked by single bonds and form polyatomic complex molecules having eight atoms per molecule (S_8) and have puckered ring structure. Therefore, S atoms are strongly held together and it exists as a solid.

78. Divalent ion having atomic number 25 will have d^5 electronic configuration.

No. of unpaired electron = 5

$$\mu = \sqrt{n(n+2)}$$

$$= \sqrt{5(5+2)} = 5.92 \text{ B.M.}$$

Trivalent ion having atomic number 25 will have d^4 electronic configuration.

No. of unpaired electrons = 4

$$\mu = \sqrt{4(4+2)} = 4.90 \text{ B.M.}$$

79. The geometrical isomers have the compositions but they differ from each other in the arrangement of atoms/groups in space. This is of two types i.e. cis and trans.

Conditions:

(i) The complexes with C.N. 2 and 3 do not show this isomerism.

(ii) The complexes with C.N. 4 and 6 may exhibit geometrical isomerism.

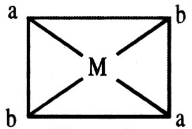
(iii) The complexes with C.N. 4 but having tetrahedral geometry cannot exhibit this isomerism.

(iv) The complexes with C.N. 4, square planar geometry and having Ma_4, Ma_3b and Mab_3 cannot exhibit this isomerism. Only of the type Ma_2b_2, Mabcd, Ma_2bc can exhibit this isomerism.

(v) The complexes with C.N. 6 and having Ma_4b_2 and Ma_3b_3, can exhibit this isomerism.

Co-ordination No. 4.

Ma_2b_2 :



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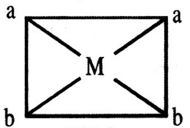
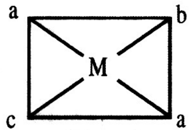


(*Cis*)

Ma_2bc :



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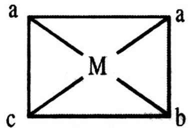
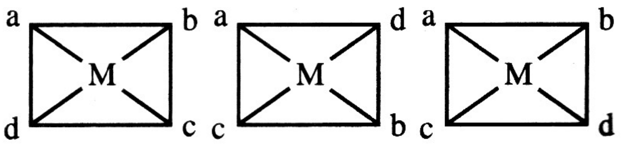


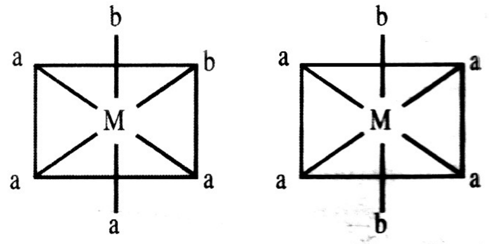
(*Cis*)

Mabcd :



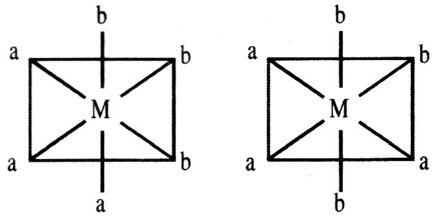
Co-ordination No. 6

Ma_4b_2 :



(*Cis*) (***Trans***)

Ma_3b_3 :



(*Cis*) (*Trans*)

80. The coordination compounds are of great importantce. These compounds are widely present in the mineral, plant and animal worlds and are known to play many important functions in the area of analytical chemistry, metallurgy, biological systems, industry and medicine. These are described below :

(i) In aniytical chemistry : Coordination compounds find use in many qualitative and quantitative chemical analysis. The familiar colour reactions given by metal ions with a number of ligands (especially chelating ligands), as a result of formation of coordination entities, form the basis for their detection and estimation by classical and instrumental methods of analysis. Examples of such reagents include EDTA, DMG (dimethylglyoxime), α-nitroso-β-naphthol, cupron, etc.

(ii) Estimation of Hardness of water :

Hardness of water is estimated by simple titration with Na_2EDTA. The Ca^{2+} and Mg^{2+} ions form stable complexes with EDTA. The selective estimation of these ions can be done due to difference in the stability constants of calcium and magnesium complexes.

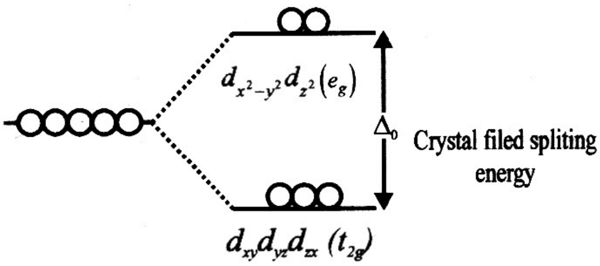
(iii) Metallurgy : Some important extraction processes of metals, like those of silver and gold, make use of complex formation. Gold, for example, combines with cyanide in the presence of oxygen and water to form the coordination entity $[Au(CN)_2]$ in aqueous solution. Gold can be separated in metallic form from this solution by the addition of zinc.

81. The conversion of five degenerated d-orbitals of the metal ion into different sets of orbitals having different energies in the presence of electrical field of ligands is called crystal field splitting. This depends upon the coordination number of the metal ion and the type of ligands.

In the case of free metal ion, all the five d-orbitals have the same energy and are called degenerate orbitals. However, on the approach of the ligands, due to the electrical field of the ligands, the energies of the five d-orbitals will split up.

In case of octahedral complexes, the five d-orbitals split up into two sets; one set consisting of two orbitals $d_{x^2-y^2}$ i and d_{z^2} of higher energy and another set consisting of three orbitals (d_{xy}, d_{yz} and d_{zx}) of the lower energy.

In octahedral field of splitting, the two d-orbitals; $d_{x^2-y^2}$ and d_{z^2} are called e_g orbitals and the three orbitals d_{xy}, d_{yz} and d_x are called t_{2g} orbitals



Splitting of d-orbitals in octahedral field.

The energy difference between the two sets of energy levels is called crystal field splitting energy and is represented as Δ_0 (the subscript 'o' stands for octahedral). It measures the crystal field strength of the ligands. It may be noted that the crystal field splitting occurs in such way that the three orbitals lie at an energy that is $\frac{2}{5}\Delta_0$ below the average d-orbital energy and the two d-orbital lie at an energy $\frac{3}{5}\Delta_0$ above the average energy.

82. The reaction in which an alkyi halide is heated with metallic sodium in presence of dry ether to obtain the corresponding higher alkane is termed as Wurtz reaction.

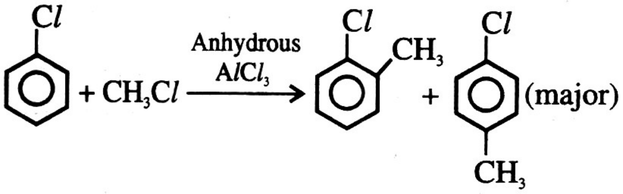
$$\underset{\text{(Alkyl halide)}}{R\text{–}X} + 2Na + \underset{\text{(Alkyl halide)}}{X\text{-}R} \xrightarrow[\text{dry ether}]{\text{Na}} \underset{\text{(Higher alkane)}}{R\text{-}R} + 2NaX$$

Example:

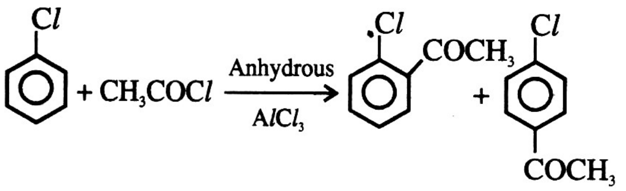
$$CH_3 - Br + 2Na + Br - CH_3 \xrightarrow[\text{dry ether}]{\text{Na}} CH_3 - CH_3 + 2NaBr$$

83. Friedel-Craft's reaction:

(i) Alkylation

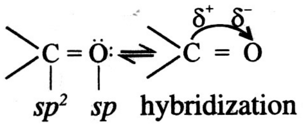


(ii) Acylation:

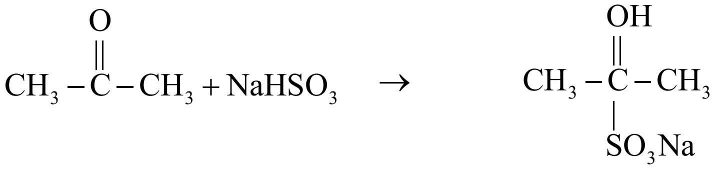


84. Aldehydes and ketones having atleast one hydrogen at α-carbon undergo condensation reaction in presence of dilute NaOH, Na_2CO_3 or $Ca(OH)_2$ giving aldol.

85. The carbon atom of the carbonyl group is in sp^2-hybridised state. The σ-bond between carbon and oxygen atom is formed by the overlapping of one sp^2-hybrid orbital of carbon atom with a sp-bybrid orbital of oxygen atom. A π-bond between carbon and oxygen atom results when p-orbital of carbon atom, which has not taken part in sp^2-hybridization, overlaps sidewise with a second p-orbital of oxygen atom. Carbon and oxygen are said to have a double bond between them. Oxygen atom in carbonyl has two lone-pairs of electrons and >C=O group is polar.

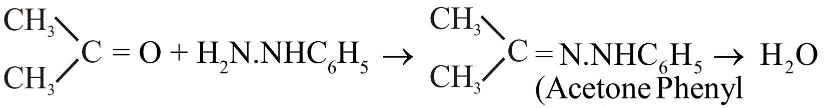


$>C=C<$ undergoes Ad_E while $>C=O$ Ad_N.



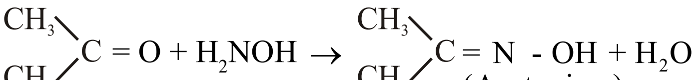
86. (a) $CH_3-\overset{O}{\overset{||}{C}}-CH_3 + NaHSO_3 \rightarrow CH_3-\overset{OH}{\overset{||}{C}}-CH_3$ with SO_3Na below the central C

(Acetone sodium bisulphite)



(b) $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>C=O + H_2N.NHC_6H_5 \rightarrow \begin{matrix}CH_3\\CH_3\end{matrix}\!\!>C=N.NHC_6H_5 \rightarrow H_2O$

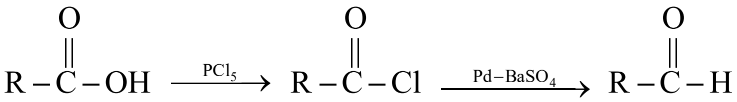
(Acetone Phenyl Hydrazone)



(c) $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>C=O + H_2NOH \rightarrow \begin{matrix}CH_3\\CH_3\end{matrix}\!\!>C=N-OH + H_2O$

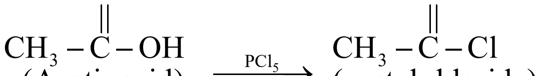
(Acetoxime)

87. When carboxylic acid is treated with PCl_5 it result in corresponding acid chloride. When hydrogen gas is passed through acid chloride in presence of palladium deposited over barium sulphate it results an aldehyde.



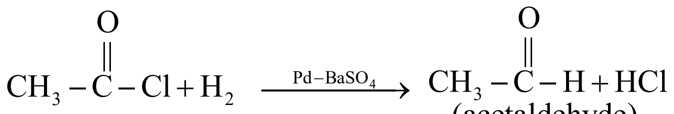
$$R-\overset{O}{\overset{||}{C}}-OH \xrightarrow{PCl_5} R-\overset{O}{\overset{||}{C}}-Cl \xrightarrow{Pd-BaSO_4} R-\overset{O}{\overset{||}{C}}-H$$

For Example :



$$CH_3-\overset{O}{\overset{||}{C}}-OH \xrightarrow{PCl_5} CH_3-\overset{O}{\overset{||}{C}}-Cl$$

(Acetic acid) (acetyl chloride)



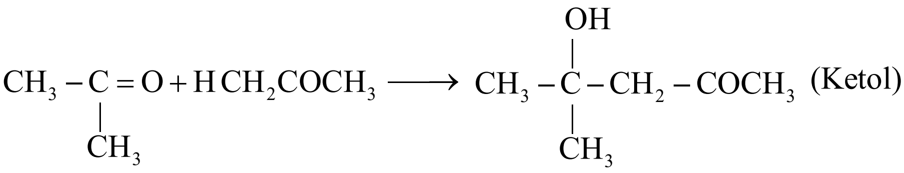
$$CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-Cl+H_2 \xrightarrow{Pd-BaSO_4} CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-H+HCl$$

(acetaldehyde)

88. (i) $C_2H_5NO_2 + 6H \xrightarrow{Sn+HCl} C_2H_5NH_2 + 2H_2O$
(Nitroethane) (Ethylamine)

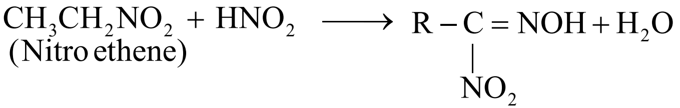
(ii) $C_2H_5NO_2 + 4H \xrightarrow{Zn+NH_4Cl} C_2H_5NHOH + H_2O$

(iii)



$$\underset{\underset{\displaystyle CH_3}{|}}{CH_3-C=O}+H\,CH_2COCH_3 \longrightarrow CH_3-\underset{\underset{\displaystyle CH_3}{|}}{\overset{\overset{\displaystyle OH}{|}}{C}}-CH_2-COCH_3 \text{ (Ketol)}$$

(iv)

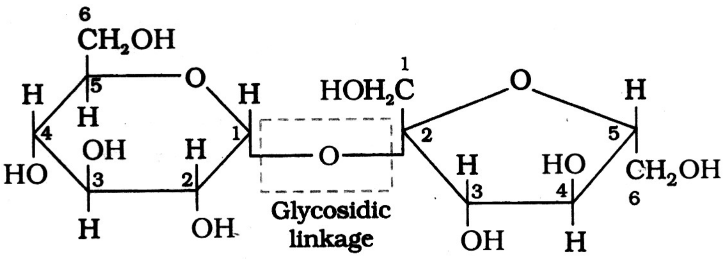


$$CH_3CH_2NO_2 + HNO_2 \longrightarrow R-\underset{\underset{\displaystyle NO_2}{|}}{C}=NOH+H_2O$$

(Nitro ethene) (Nitrolic acid)

(v) $R-CH_2-NO_2 \xrightarrow[-HBr]{Br_2+NaOH} RCHBrNO_2 \xrightarrow[-HBr]{Br_2} R-CBr_2NO_2$

89. The condensation of hydroxyl groups of two monosaccharides to form a link between them is called glycosidic linkage. e.g. Structures of disaccharides.



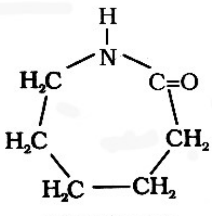
α – D – Glucose **β – D – Fructose**

Sucrose

90. See text.

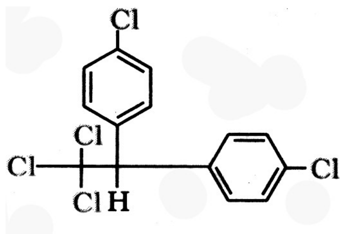
91. See text.

92. (i)

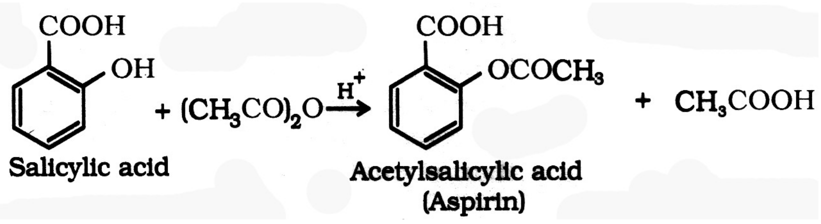


Caprolactam

(ii)



DDT

(iii) 

93. See Text.
94. KCN is ionic where as AgCN is covalent.
95. Elimination dominates over substitution.
96. –I effect influences aromatic nucleophilic substiution reaction.
97. See Text.
98. $2CHCl_3 + O_2 \xrightarrow{\text{light}} 2\,COCl_2 + 2HCl$

Phosgene (Fatal)

99 (i) Antihistamines counters the effect of histamines which is generated in body due to allergy.

For Example : Promethazine

(ii) Antioxidants prevents oxidation of food and other materials :

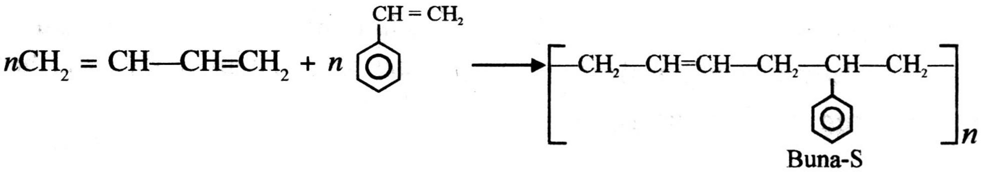
For Example : BHA and BHT

100. (i) Chain growth polymerization is a process of formation of polymers by successive addition of monomer units in a chain reaction carrying reactive intermediates (like free radical, carbocation or carbanion). The reaction is initiated by the active species such as free radical or carbocation or carbanion. For example, formation of PVC, polythene, polypropylene, etc.

(ii) Step growth polymerization involves a series of reactions in a stepwise manner involving condensation of monomers with the loss of molecules of HCl, H_2O etc. In this case, the monomers are generally multifunctional groups. For example, polymers like bakelite, terylene, nylon-66 etc.

101. In elastomers, the polymer chains are held togethher by weak intermolecular forces. Because of the presence of weak forces, the polymer can be easily stretched. However, a few cross linked are also introduced in the chains which impart the property of regaining the original positions after the stretching force in released. The common example is vulcanised rubber.

Buna-S is a polydiene. It is obtained by polymerization of butadiene and styrene.



102. See Text
103. See Text
104. See Text
105. See Text.

* * *

GROUP - C

LONG ANSWER TYPE QUESTIONS

(Seven marks each)

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) Extrinsic semiconductors are formed doping of one element in other.

[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) Electrical conductivity in metals. [4 + 3]

4. (a) Classify the solids on the basis of bonding with example.
   (b) Discuss the magnetic properties of solids.

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 coligative 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 boils at higher temperature
    (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 is van't Hoff factor ? Explain its application in determining the molecular mass of electrolytes.

    Calculate the amount of sodium chloride which must be added to one kilogram of water so that the freezing point of solution is depressed by 3K. ($K_f = 1.86$ K kg mol^{-1})

12. 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.

13. Explain the following :
    (i) Desalination can be done by reverse osmosis.
    (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.

14. Write notes on :
    (i) Galvanic cell
    (ii) Standard hydrogen electrode. [4 + 3]

15. Explain Nernst equation. How can you calculate equilibrium constant of a cell reaction.

    Calculate the cell potential of a Daniell cell –

    $$Zn\,|\,Zn^{2+}(0.01M)\,||\,Cu^{2+}\,0.1M\,|\,Cu\text{, given } E^0_{Cell} = 1.1V$$

16. 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]

17. 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 4.95×10^{-5} ohm^{-1} 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.

18. Write notes on :-
    (i) Electrochemical series
    (ii) Corrosion
    (iii) Fuel cell

19. 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 ?

20. Discuss the terms :

(i) Rate of reaction and specific reaction rate

(ii) Order of reaction and molecularity. [3 + 4]

21. (i) Discuss the factors affecting rate of reaction.

(ii) What is a pseudo unimolecular reaction. [4 + 3]

22. 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}

23. 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.

24. 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]

25. (a) Discuss collision theory of chemical reaction. [5]

(b) How does catalyst affect activation energy ? [2]

26. What is adsorption ? How does physical adsorption differ from chemisorption ? Discuss the factors affecting adsorption of gases on solids. [1 + 3 + 3]

27. What is catalysis ? Classify them. Discuss Adsorption theory of heterogeneous catalysis. [2 + 2 + 3]

28. 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) $\underset{}{C_{12}H_{22}O_{11}(aq)} + H_2O(l) \longrightarrow \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$

(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 $\longrightarrow$ glucose

(viii) $NH_2\ CONH_2(aq) + H_2O \longrightarrow 2NH_3(g) + CO_2(g)$

(ix) Protein $\longrightarrow$ peptide

(x) Protein $\longrightarrow$ amino acid

(xi) Milk $\longrightarrow$ 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]

29. What are colloids ? Classify them. [2 + 5]

30. 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
    (d) Dialysis is the process of purification of colloidal solution.

31. 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 ?

32. Discuss the extraction of iron from its oxide ore.

33. How can you extract copper from its sulfide ore ?

34. Discuss the principle of extraction of Aluminium from its oxide ore.

35. (a) How is PH_3 prepared ? Provide a test to distinguish it from NH_3 ?
    (b) Discuss the favourable condition for better yield of NH_3 by Haber's process.

36. (a) How does nitrogen differ from other elements of the group ?
    (b) Discuss the properties of hydrides of group-15.

37. 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]

38. Lab - methods of preparing NH_3, and SO_2. [3 + 2 + 2

39. Discuss the principle of synthesis of
    (i) Nitric acid by Ostwald process
    (ii) Sulfuric acid by contact procesws. [3 + 4]

40. Discuss Siemen's ozoniser to synthesis pure ozone. How does ozone react with
    (i) KI (aq) (ii) Potassium ferrocyamide

41. 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.

42. (a) Discuss the properties of hydrides of gr. 17.

(b) Fluorine is the most reactive nonmetal- explain.

43. Write notes on –

(a) Inter halogen compounds

(b) Fluorides of Xenon.

44. What are transition elements ? Describe any four important properties of transition elements.

45. How can you prepare $KMnO_4$? How does it react in different media ? What happens when acidified $KMnO_4$ react with (i) KI (ii) SO_2 (iii) $FeSO_4$ (iv) H_2S. [2+1+4

46. Describe the preparation of potassium dichromate from chromite ore. Discuss the effect of pH on a solution of potassium dichromate.

47. (a) What is Lanthanide contraction ? Discuss its cause and effect.

(b) How do lanthanides differ from actinides ?

48. Compare the chemistry of actinoids with that of lanthanoid with specific reference to

(a) electronic configuration

(b) Oxidation state

(c) atomic and ionic sizes

(d) Chemical reactivity [2 x 3 + 1]

49. (a) State and explain Wener's cordination theory. [4

(b) Discuss any three structural isomers of co-ordination compounds. [3

50. 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]

51. 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]

52. How can you prepare ethyl bromie from ethyl alcohol and ethene ? What happens when it reacts with (i) Ag CN (ii) KNO_2 (iii) KOH (alc.) ?

53. Write notes on :

(a) Wurtz reaction, (b) Sandmeyer's reaction.

54. 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]

55. 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]

56. 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]

57. Notes on :

(a) Acidic nature of phenol -

(b) Reimer Tieman reaction

(c) Williamson's synthesis.

58. How can you prepare phenl from benzene, aniline and cumene. Mention method to prepare salicylic acid from phenol. What is its oxidation product ? $[4\frac{1}{2}+1\frac{1}{2}+1]$

59. How can you prepare ether from alcohol ? State its reaction with (i) HI (ii) PCl_5 (iii) CH_3COCl.

60. 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]

61. (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

62. Write notes on :

- (a) Aldol condensation
- (b) Cannizzaro's reaction
- (c) Iodoform (Haloform) reaction

63. 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

64. 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.

65. Explain i) Effect of substituents on acidic nature of carboxylic acid.

- ii) Hoffman's bromamide reaction
- iii) HVZ - reaction

66. 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.

67. 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

68. 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]

69. Write notes on
    (i) Gabriel phthalimide synthesis.
    (ii) Carbylamine reaction
    (iii) Basic nature of aliphatic amines. [2 + 2 + 3]

70. Name the amines with formula C_3H_9N. Distinguish one from another. Show that amines are more basic than amides. [2 + 3 + 2]

71. How is benzene diazonium chloride prepared ? Write down two reaction favouring displacement of N_2 and one reaction retaining diazo group. [2+4+1

72. 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

73. 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.

74. (a) What are carbohydrates ? Discuss their classification with examples.
    (b) How proteins are classified ? What is peptide linkage.

75. Write notes on :-
    (a) Denaturation of protein
    (b) Essential and Non-essential amino acids
    (c) Glycosidic linkage
    (d) Nucleic acid

76. 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.

77. Write notes on - (i) Vulcanisation of rubber
    (ii) Free radical addition polymerisation

78. Write notes on
    (i) Antibiotics
    (ii) Antiseptic
    (iii) Analgesic

79. What are soaps and detergents ? Discuss their cleansing action.

❖ ❖ ❖

GROUP - C

LONG ANSWER TYPE QUESTIONS (ANSWERS)

(Seven marks each)

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) n - type : As (group - 15) doped in silicon (gr. 14)

p - type : B (group - 13) doped in silicon or Ge (gr.14)

2. $$\rho = \frac{Z.M}{N_A.a^3}$$

$$\rho_{fcc} = \frac{4 \times M}{N_A \times (3.5A^0)^3}$$

$$\rho_{bcc} = \frac{2 \times M}{N_A \times (3.0 \times {}^0A)^3}$$

$$\frac{\rho_{fcc}}{\rho_{bcc}} = \frac{4}{2} \times \left(\frac{3}{3.5}\right)^3$$

3. (a) (i) Vacancy defect

(ii) Interstitial defect

(iii) Schoottky defect

(b) Gap between the partially filled valence bond and unoccupied unoccupied conduction band is neglible.

(Refer text)

4. Refer Text

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 component (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. $$\frac{P_A^0 - P_s}{P_A^0} = \frac{n_B}{n_A + n_B} = \left(\frac{W_B}{M_B} \times \frac{M_a}{W_a}\right) \qquad A = \text{solvent},\ B = \text{solute}$$

.... For dilute solution P_S = v.p. of solution.

$$\frac{P_A^0}{P_A^0 - P_S} = 1 + \frac{n_A}{n_B}$$

$$\frac{P_A^0}{P_A^0 - P_S} - 1 = \frac{n_A}{n_B}$$

$$\Rightarrow \frac{P_A^0 - P_A^0 + P_S}{P_A^0 - P_S} = \frac{n_A}{n_B}$$

$$\Rightarrow \boxed{\frac{P_A^0 - P_S}{P_S} = \frac{n_B}{n_A} = \frac{W_B}{M_B} \times \frac{M_A}{W_A}}$$

All types of solution, dilute or concentrated. $\frac{0.850 - 0.845}{0.845} = \frac{0.5}{M_B} \times \frac{78}{39}$

M_B can be calculated.

7. $\Delta T_b = K_b.m$

$$= k_b \times \frac{W_B}{M_B} \times \frac{1000}{W_A}$$

8. $$K_f = \frac{MR\left(T_f^0\right)^2}{1000 \times \Delta_{fus}H}$$

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 : $\pi V = nRT$

$$\pi = \frac{n}{V}RT \text{ i.e., } CRT$$

$$\Rightarrow \quad \pi = \frac{W_B}{M_B} \times \frac{RT}{V}$$

$$M_B = \frac{W_B.R.T}{\pi.V} \quad R = 0.0821 \text{ L. atm. mol}^{-1} \text{ K}^{-1}.$$

10. (i) NaCl is an electrolyte for which i = 2 i.e, with higher colligative properties and hence molecular mass is reduced.

(ii) Sea water has lower vapour pressure & hence higher boiling point.

(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 ΔT_f, ΔT_b, $\Delta p / p^0$ measurements are not better noticiable.

11. $\Delta T_B = i\,K_b.m$ $\qquad$ i = 2 (for NaCl)

$$W_B = \frac{\Delta T_f \times M_B \times W_A}{i\,K_f} \qquad W_A = 1 \text{ kg}$$

$$\Delta T_f = 3\,K$$

$$= \frac{3K \times 58.5\,g\,mol^{-1} \times 1kg}{2 \times 1.86\,K\,kg\,mol^{-1}} \qquad K_f = 1.86 \text{ K kg mol}^{-1}$$

$$= \frac{3 \times 58.5}{2 \times 1.86} \text{gram} \qquad M_B = 58.5 \text{ g / mol}$$

12. Molality (m) = $\frac{\text{no. of moles of solute}}{\text{mass of solvent in kg}}$

It is independent of temperature.

wt of solute = 93 gram

wt of solution = $100 \times 1.84 = 184$ gram

wt of solvent = $184 - 93 = 91$ gram

$$\text{Molality} = \frac{w}{M} \times \frac{1000}{w'} = \frac{93}{98} \times \frac{1000}{91}$$

13. (i) Pressure > π on the solution side as a result water reverses it direction from high conc to low concentration. i.e., Saline water to pure water.

(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]

14. (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) $H^+ + e^- \rightarrow \frac{1}{2}H_2 , \underset{(1M)}{E_{H^+}} \left| \frac{1}{2}H_2(1\,atm), Pt \right. = 0.0\ V$

15. $\rightarrow aA + bB \xrightarrow{n_e} cC + dD$

$E_{cell} = E^0_{Cell} - \frac{RT}{nF} \ln Q$ [Q is the reaction quotient)

$= E_{cell} = E^0_{Cell} - \frac{RT}{nF} \ln Q, \quad -\Delta G^0 = nFE^0 = RT \ln K$

$\rightarrow \quad E^0_{Cell} = \frac{2.303}{nF} \log K_C$

16. $\Lambda = K.V = K\frac{1000}{C}$

(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 $eqvt^{-1}$.

17. Statement, Explanation –

Expl. $\Lambda^0_{KCl} - \Lambda^0_{NaCl} = \Lambda^0_{NaBr} = \Lambda^0_{KNO_3} - \Lambda^0_{NaNO_3}$

$= \lambda^0_{k^+} - \lambda^0_{Na^+} = 23.41\,ohm^{-1} cm^2\ mol^{-1}$

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 : $\Lambda^0_{CH_3COOH} = 425^0 g + 91.0 - 126.4 = 390.5\,ohm^{-1}\ cm^2\ mol^{-1}$

$\alpha = \frac{\Lambda_m}{\Lambda^0_m}$ and $\Lambda_m = k \times \frac{1000}{C}$

$= 4.95 \times 10^{-5} \times \frac{1000}{0.001028}$

$= 48.15\ ohm^{-1}\ cm^2\ mol^{-1}$

$$\alpha = \frac{48.15}{390.15} = 0.1233$$

$$K_a = \frac{C\alpha^2}{1-\alpha} = \frac{0.001028 \times (0.1233)^2}{1-0.1233}$$

18. (i) Series of arrangement of electrodes arranged in order of their standard reduction potential on hydrogen scale. Applications of electro chemical series.

(ii) Corrosion - The slow coating of surfaces of metallic objects with oxides or other salt of metal is called corrosion. In presence of air (O_2) and moisture a miniature electrochemical cell operates where oxygen as cathode i..e,. $M|M^{n+}||\, O_2|H_2O$

e.g., In case of rusting of iron –

$$2\left[Fe(s) \longrightarrow Fe^{2+}(aq) + 2e^-\right] \qquad 0.44\ V$$

$$O_{2(g)} + 4H^+(aq) + 4e^- \longrightarrow 2H_2O(\ell) \quad 1.23\ V$$

$$2\,Fe(s) + O_2(g) + 4H^+ \longrightarrow 2Fe^{2+} + 2H_2O,\ E^0_{Cell} = 1.67\,V$$

(iii) Fuel cell

These are (Galvanic cells where energy produced on combustion of different fuel (H_2, CH_4, CO, CH_3OH etc.) is directly converted to electrical energy.

Cathode - $O_2\,(g) + 2H_2O\,(\ell) + 4e^- \longrightarrow 4OH^-\,(aq) \qquad +0.40\ V$

Anode - $2H_2(g) + 4OH^-\,(aq) \longrightarrow 4H_2O\,(\ell) + 4e^- \qquad +0.83\ V$

$$2\,H_2 + O_2 \longrightarrow 2H_2O \qquad E^0_{Cell} = 1.23\,V$$

Here electrolyte is KOH.

In case of dil H_2SO_4 as electrolyte -

Anode - $\left[H_2 \longrightarrow 2H^+ + 2e^-\right] \times 2 \qquad 0.0\ V$

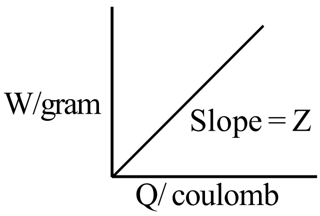
Cathode. $O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O \quad 1.23\ V$

$$2\,H_2 + O_2 \longrightarrow 2H_2O \qquad E^0_{Cell} = 1.23\,V$$

19. 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

20. –dc/dt i.e, moles/litre/sec

Instantaneous and average rate of reaction. Specific reaction rate i..e., k

$$A \longrightarrow B$$

$$-\frac{d[A]}{dt} = +\frac{d[B]}{dt} = k[A]$$

$$k = -\frac{d[A]}{dt} \Big/ [A] \qquad [A] = 1 \text{ mole}$$

$$dt = 1 \text{ sec}$$

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.

21. (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.

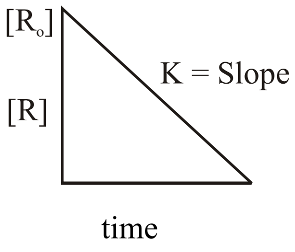
$$\text{Ester} + \text{water} \longrightarrow \text{acid} + \text{alcohol}$$

rate = k [ester] [water]^0

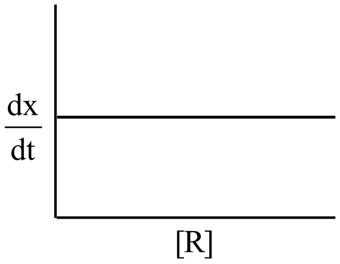
22. Discuss the kinetics of zero order reaction with one example. Show that the half life period of the reaction is directly propertional to initial concentration.

Determine the order with respect to the reaction A + B ⟶ 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.

$$1 = k(1)^x . \left(\frac{1}{2}\right)^y \quad \text{i..e, } y = 0$$

$$2.1 \times 10^{-3} = k(0.1)^x \times (1.0)^y$$

$$8.4 \times 10^{-3} = k(0.2)^x \times (1.0)^y$$

Dividing one by another.

$$\frac{1}{4} = \left(\frac{1}{2}\right)^x$$

$$\Rightarrow \left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^x \text{ i..e, } x = 2$$

Rate = $k[A]^2[B]^0$

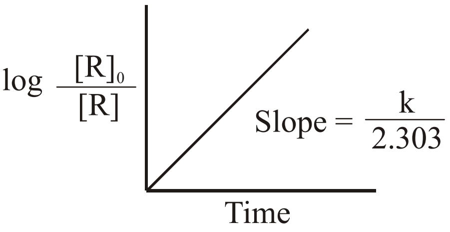
i..e, The reactioin is second order with respect to A & zero order with respect to B.

The overal order of reaction = 2 (second order)

Example (zero order reaction)

$$H_{2(g)} + Cl_{2(g)} \xrightarrow{h\nu} 2HCl_{(g)},\ 2N_2O_{(g)} \xrightarrow[\Delta]{Pt} 2N_{2(g)} + O_{2(g)}$$

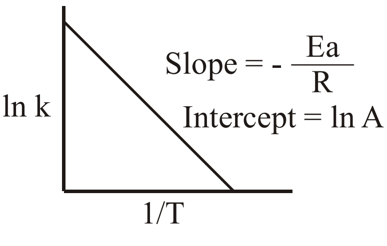
23.



$$k = \frac{1}{t}\ln\frac{[R]_0}{R}$$

Problem : $t_{1/2} = \frac{0.693}{k}$ So $k = \frac{0.693}{69.3} = \frac{2.303}{t}\log\frac{100}{20}$

24.



$$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right]$$

Problem : $\log 2 = \frac{Ea}{2.303 \times 8.134} \times \frac{308 - 298}{308 \times 298}$

25. (a) Z_{AB} = collision frequency,

Considering the probability or steric factor –

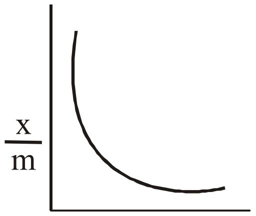
rate = P. Z_{AB} $e^{-Ea/RT}$

(b) Positive catalyst lower the activation energy

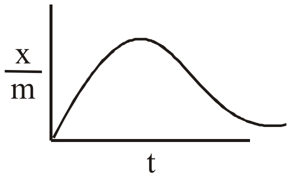
e.g., $2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$

26. Factors affecting adsorption.

(i) Nature of the gas (adsorbate)
(ii) Nature of the solid (adsorbent)
(iii) Surface area
(iv) Temperature

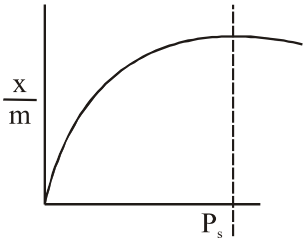


Temp. (Physical adsorption)



(chemisorption)

(v) Effect of pressure –



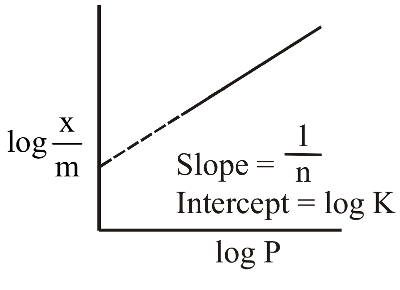
Adsorption isotherm

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)

27. Substances that influence the rate of chemical reaction & themselves remain chemically and quantitatively unchanged after the reaction are known as catalyst and the process is called catalysis.

promoter and poison : promoter enhances the catalytic activity while poisons decreases the activity of catalyst.

Types (a) Homegeneous catalysis - (In one phase)

$$\text{Fructose} + H_2O(l) \xrightarrow{H_2SO_4(\ell)} \text{glucose (aq)} + \text{fructose (aq)}$$

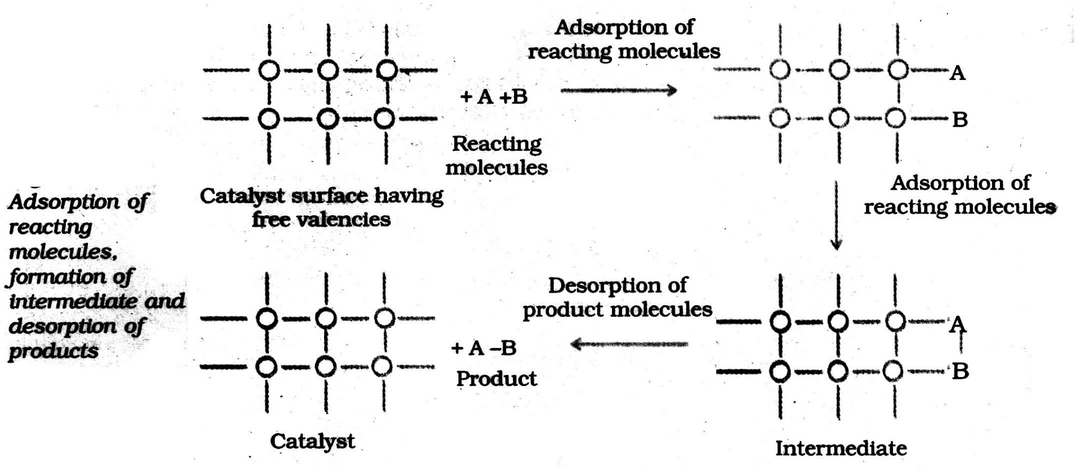
solution phase

(b) Heterogeneous catalysis (in different phase)

$$2\,SO_2(g) \xrightarrow{Pt(s)} 2SO_3(g)$$

$$RCOCl + H_2 \xrightarrow{Pd-BaSO_4} RCHO + HCl$$

Pd Catalyst $BaSO_4$ as poision avoiding the reduction of aldehyde to 1^0-alcohol.



28. (i) $Cu / ZnO - CR_2O_3$
(ii) Ni
(iii) Cu
(iv) Invertase
(v) Zymase (enzyme)
(vi) Diastase
(vii) Maltose
(viii) increase
(ix) Pepsin (stomach)
(x) Trypsin
(xi) Lacto bacilli
(xii) Pt
(xiii) NO (Lead chamber process)
(xiv) Pt(s)

29. 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.

30. (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 dolution 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.

(d) Colloidal particles can't penetrate through the pores of the membrane while the impurity (Crystalloid) can diffuse through. On this basis the dissolved impurities can be separated.

31. (i) Emulsification. Soap is an emulsifying agent.

(ii) Coagulation

(iii) A positively charged sol of hydrated feric 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.

32. Flow chart of extraction :

Oxide ores :

$$\boxed{\begin{array}{l|l|l}\text{Haematite} & \text{Magnetite} & \text{Limonite}\\ Fe_2O_3 & Fe_3o_4 & Fe_2O_3.3H_2O\end{array}} \xrightarrow[\text{and Concentration by gravitity separation/ magnetic separation}]{\text{Crushing}} \boxed{\text{Concentrated ore}}$$

$$\xrightarrow[\text{and roasting in a reverberatory furnance}]{\text{Calcination}} \boxed{\begin{array}{c}\text{Porus subs tan ce of}\\ Fe_2O_3\end{array}} \xrightarrow[\text{in Blast furnance}]{\text{Smelting}} \boxed{\begin{array}{l}\text{Melton Fe (Pigion)}\\ Fe_2O_3+3CO\\ \to 2Fe+3CO_2\\ \text{slag removes}\end{array}}$$

$$\xrightarrow{\text{Re fining carbon content is regulated}} \boxed{\text{Steel / Wrought iron}}$$

33. Flow chart of extraction :

$$\boxed{\begin{array}{l}\text{Ore – Cholopyrite, } CuFeS_2\\ \quad\text{Chalcocite } Cu_2S\end{array}} \xrightarrow[\text{Froth floation process}]{\text{Concentration}} \boxed{\begin{array}{l}\text{Concentrated ore}\\ \text{without gangue}\end{array}}$$

$$\xrightarrow[\text{in rever beratory furnance}]{\text{Roasting}} \text{Roastered ore} \longrightarrow \boxed{\text{Smelting}}\ \text{matte(50\% Cu)}$$

$\xrightarrow[\text{Cu}_2\text{S}+2\text{CuO}\rightarrow 4\text{Cu}+\text{SO}_2]{\text{Bessemerisation}} \boxed{\begin{array}{l}\text{Blister copper}\\ 98\%\end{array}} \xrightarrow[\text{refining}]{\text{electrolytic}} \text{Cu } 99.9\%$

34. Ore- Bauxite, $Al_2O_3 . 2H_2O$

Diaspore $Al_2O_3 . H_2O$ $\xrightarrow{\text{Crushed}}$ Crushed ore $\xrightarrow[-\text{gangues}]{\text{Leaching}}$ Leached ore alumina

Corundum Al_2O_3

$\xrightarrow[\substack{\text{floorspar \& Electrolysis}\\ \text{Hall}-\text{Heroult process}}]{\text{fused with crystilites}}$ Al in steel vessel with carbonlining (as cathode) $\xrightarrow[\text{Refining}]{\text{electrolytic}}$ Al 99.9% (Hoop's process)

35. (a) $P_4 + 3NaOH + 3H_2O \longrightarrow PH_3 + 3NaH_2PO_2$

Distinction

Reagent	NH_3	PH_5
$CuSO_4(aq)$	Deep blue solution of $[Cu(NH_3)_4]SO_4$	with PH_3 it forms black copperphosphide. $3CuSO_4 + 2PH_3 \rightarrow Cu_3P_2 + 3H_2SO_4$

(b) 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.

36. (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, $R_3P = O \left(d_\pi - p_\pi \text{ bond}\right)$.

(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 duie 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)

37. * $NH_4Cl\ (aq) + NaNO_2\ (aq) \longrightarrow N_2\uparrow + 2H_2O + NaCl\ (aq)$

Impurities : NO and HNO_3. The compuities can be removed by passing through aq. sulfuric acid containing pot. dichromate

* $3Mg + N_2\ (air) \xrightarrow[\Delta]{} Mg_3N_2$

* $Mg + \frac{1}{2}O_2\ (air) \xrightarrow[\Delta]{} MgO$

Action with water : $Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3\uparrow$

$MgO + H_2O \longrightarrow Mg(OH)_2$

38. → $2NH_4Cl + CaO \xrightarrow[\Delta]{} 2NH_3\uparrow + CaCl_2 + H_2O$

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.

→ SO_2 on passing through acidfied $K_2Cr_2O_7$ solution turns green, $Cr_2(SO_4)_3$

$$Cr_2\overset{=}{O}_7 + 14H + 6e^- \longrightarrow Cr^{3+} + 7H_2O$$

$$SO_2 + 2H_2O \longrightarrow SO_4^{2-} + 4H^+ + 2e^-$$

39. (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) $2SO_2 + O_2 \underset{}{\overset{V_2O_5}{\rightleftharpoons}} 2SO_3 + 45.2\ K\,cal$

$SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

(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 – 500^{0}C.

As the process is exothermic high temperature to be avoided.

40. Principle. $3O_2 \xrightarrow[\text{electric discharge}]{\text{silent}} 2O_3$

The product is ozonised oxygen (O_3+O_2).

$$O_3 + O_2 \xrightarrow{\text{liquid air}} \text{condensed to deep blue liquid} \xrightarrow[\text{evaporation}]{\text{fractional}} \left[\begin{array}{l} 90\text{ K (oxygen)} \\ 161.1\text{ K} \end{array}\right.$$

$\rightarrow$ (Less volatile O_3) $\xrightarrow{\text{evaporation}}$ pure ozone.

(i) $O_3 + H_2O + 2e^- \longrightarrow 2OH^- + O_2$

$2I^- \longrightarrow I_2 + 2e^-$

$O_3 + 2I^- + H_2O \longrightarrow I_2 + 2OH^- + O_2$

(ii) $\left[Fe(CN)_6\right]^{4-} \longrightarrow \left[Fe(CN)_6\right]^{3-} + e^-$

41. (i) $SO_2 + H_2O \longrightarrow SO_3 + 2(H)$

Coloured matter $\xrightarrow{[H]}$ coloueless $\xrightarrow[\text{oxidn}]{\text{air}}$ regains colour.

Bleaching by reduction

(ii) (a) Small size and high electronegativity (3.5)

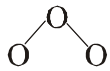
(b) Absence of d-orbital, hence maximum valence state is three (even four) other can expand upto six.

(c) O- exhibit H-bonding e.g. $H_2O(l)$ but $H_2S(g)$

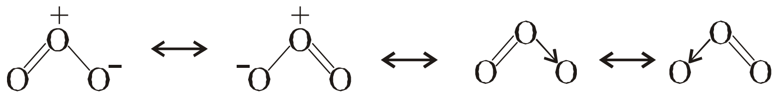
(d) Physical state- O_2 is a gas but others are solids

(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 ^{0}A.

It is resonance hybrid of



42. (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.

43. (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. $Cl_2 + F_2 \xrightarrow{437K} 2ClF$

$Cl_2 + 3F_2 \xrightarrow{573K} 2ClF_3$

$Br_2 + 5F_2 \longrightarrow 2BrF_5$

Compounds	**hybridisation**	**Type**	**Shape**
ClF_3	sp^3d^2	AB_3L_2	T-shape
BrF_5	sp^3d^2	AB_5L	Square pyramide
IF_7	sp^3d^3	AB_7	Pentagonal bipyramidal

→ As the molecules are polar, these compounds are more reactive than non-polar respective halogens.

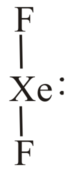
(b) These compounds are possible due to

(i) low Δ_iH 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, $\boxed{\uparrow\downarrow}$ $\begin{array}{|c|c|c|}\hline \uparrow\downarrow & \uparrow\downarrow & \uparrow \\ \hline\end{array}$ $\begin{array}{|c|c|c|c|c|}\hline \uparrow & & & & \\ \hline\end{array}$



$$F-\ddot{\underset{\cdot\cdot}{Xe}}-F$$

XeF_2	sp^3d hybridisation	AB_2L_3 :	Linear
XeF_4	sp^3d^2 hybridisation	AB_4L_2	square planar
XeF_6	sp^3d^3 hybridisation	AB_6L	distorted octahedral

$Xe + F_2 \xrightarrow[673K]{\text{Nickel vesel}} XeF_2$

$Xe + 2F_2 \xrightarrow[\text{193 K, Pressure}]{\text{Electronic discharge}} XeF_4$

$Xe + 3F_2 \xrightarrow[\text{50 atm. pressure}]{\text{Ni, 573K}} xeF_6$

44. 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 raws (3d, 4d, 5d, 6d series) of (each of 10 elements) 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 $\overline{e}$.

Fe, Co, Ni are ferromagnetic metals.

45. Flow chart of preparation :

$$* \quad \boxed{\begin{array}{c}\text{Pyrolusite}\\ \text{ore}\,(\text{MnO}_2\end{array}} \xrightarrow[\text{fused}]{\text{KOH+O}_2} \boxed{\overset{+6}{K_2\,MnO_4}} \xrightarrow[\text{(or)}]{\text{Cl}_2} \qquad \boxed{\overset{+7}{K\,MnO_4}}$$

electrolytic
oxidation at Ni anode

* In acidic medium : $Mn\overline{O}_4 + 8H^+ + 5\overline{e} \longrightarrow Mn^{2+} + 4H_2O$

In alkali ne medium. $Mn\overline{O}_4 + \overline{e} \longrightarrow MnO_4^{2-}$

$$2KMnO_4 + 2KOH \longrightarrow 2K_2MnO_4 + H_2O + O$$

In neutral medium : $\overset{+7}{M}nO_4^- + 2H_2O + 3\overline{e} \longrightarrow \overset{+4}{M}nO_2 + 4OH^-$

* $MnO_4^- + 8H^+ + 5\overline{e} \longrightarrow Mn^{2+} + 4H_2O$

$\rightarrow$ $2I^- \longrightarrow I_2 + 2e^-$

$\rightarrow$ $SO_2 + 2H_2O \longrightarrow SO_4^{2-} + 4H^+ + 2e^-$

$\rightarrow$ $Fe^{2+} \longrightarrow Fe^{3+} + e^-$

$$2FeSO_4 + H_2SO_4 + O \longrightarrow Fe_2\,(SO_4)_3 + H_2O$$

$\rightarrow$ $H_2S \longrightarrow S + 2H^+ + 2e^-$

46. **Flow chart of synthesis :**

$$\boxed{\begin{array}{c}\text{Chromite ore}\\ Fe\,Cr_2\,O_4\end{array}} \xrightarrow[\text{fused}]{Na_2CO_3+O_2} \underset{\text{Yellow}}{\boxed{Na_2CrO_4}} \xrightarrow[\text{with } H_2SO_4]{\text{acidified}} \boxed{Na_2Cr_2O_7} \xrightarrow{\text{KCl}} \underset{\text{orange}}{\boxed{K_2Cr_2O_7}}$$

Dichromate changes to chromate is alkaline medium (pH > 7)

$$Cr_2O_7^{=} + 2OH^- \longrightarrow 2CrO_4^{2-} + H_2O$$

chromate on decreasing pH (pH < 7) i.e., is acidic medium converts to dichrmate.

$$2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$$

Thus $Cr_2O_7^{2-} \underset{\text{acidic}}{\overset{\text{alkaline}}{\rightleftharpoons}} CrO_4^{2-}$

Colour change occurs on changing pH.

47. Poor shielding f-electrons as a result ENC increases. The ionic radii decreases from left to right. (103 pm to 86 pm) i.e., by 17 pm. Such decrease in ionic / atomic radii is called Lanthanide contraction.

Consequence / **effect of Lanthamide contraction.**

(i) **Separation of Lanthanides** : Slight variation of properties such as ionic radii, comlex conformation helps to separate lanthanoids by ion exchange process.

(ii) **Variation of basic strangth.** Bigger the cation greater is the basic strength of the hydroxide, thus, the basic strength decreases La to Lu. $La(OH)_3$, is a stronger base. The hydroxides become covalent with decrease of cationic size. $Lu(OH)_3$ is the most covalent hydroxide & hence less basic as per Fajan's rule.

(iii) Similarities in the atomic size of 2nd and 3rd transition series e.g., Zr, Hf and Nb, Ta. Such effect is not observed Y (180 pm) La (187 pm)

(iv) Variation is standard reduction potential.

There is small and steady increase of standard reduction potential, $E^0_{M^{3+} | M}$

(v) Variation of physical properties like m.p, b.p, hardness etc.

These physical properties increases with increase of atomic number as the size decreases increasing compactness.

(b) Point of distinction :

	Lanthanoids		**Actinoids**
1.	4f series (6th period)	1.	5f series (7th period)
2.	Besides the most common O.S +3, Lanthanides show +2, +4 O.S. in case of cation elements.	2.	Besides the common +3 O.S. actinides show +4, +5, +6 O.S. in case of when cations.
3.	Except Pn, they are non-radioactive.	3.	All the actinoids are radioactive.
4.	Don't form oxocatio	4.	form oxocation e.g. UO_2^{2+}, UO^+, PuO_2^{2+} etc.
5.	Oxides & hydroxides are less basic.	5.	Oxides hydroxides are more basic.

48. Electronic configuration :-

Lanthanoids $4f^{1+4}$ $5d^{0-1}$ $6s^2$. Exceptional electronic configuration of few elements can be explained on the basis of stability.

(i) Ce (Z = 58) $4f^2\ 5d^0\ 6s^2$

(ii) Eu (z = 63) $4f^7\ 6s^2$

Gd $4f^4\ 5d^1\ 6s^2$

(iii) Yb (Z = 70) $4f^{14}\ 5d^0\ 6s^2$

Lu (Z = 71) $4f^{14}\ 5d^1\ 6s^2$

Extra stability of filled 4f orbitals.

Actinoids: $5f^{1-14}\ 6d^{0-1}\ 7s^2$. These have stable electronic configuration f^0, f^7 and f^{14} occupancy. So there is certain irregularity in their electronic configuration.

Am (Z = 95) $[Rn]5f^7\ 7s^2$

Cm $[Rn]\ 5f^7\ 6d^1\ 7s^2$

Oxidation state

Lanthanoids possess common oxidation state +3, but which aquire a stable configuration of f^0, f^7 or f^{14} by losing 2, or 4 electrons show +2 and +4 O.S.

e.g. Ce^{+4} (z = 58) $[Xe]\ 4f^0$

Actinoids show greater range of O.S. because 5f, 6d and 7s subshells are of comparable energy and expulsion of e^- from these subshell is equally possible to form bonds. e.g Pu $5f^6\ 7s^2$ can have O.S. +3, +4, +5, +6 and +7 so also Np $5f^4\ 6d^1\ 7s^2$.

Alomic and ionic size.

In both the case the size decrease with increase of atomic number. This is attributed to Lanthamide contraction in lanthanoids and actinide contraction in actinoids. This arises to poor shielding of 4f and 5f e^-(s) respectively. Magnitude of actinoid contraction is more on account of 5f orbitals are more diffused than orbitals present in 4f subsell. 5f orbits shield less than 4f orbitals.

Chemical reactivity

Lanthanoids have reactivity similar to calcium and with increasing atomic number they resemble Al in their chemical behaviour.

Actinoids have lower $\Delta_i H$ values than lanthanoids as 5f is less penetrating than 4f & hence is more effectively shield from nuclear charge. This actinoids are chemically more reactive than Lanthanoids.

49. (a) → Postulates of werner's co-ordination theory with explanation.

→ Limitations

(b) (i) Ionisation isomers $[Co(NH_3)_5SO_4]Br$ red

$[Co(NH_3)_5\ Br]\ SO_4$ purple

(ii) Linkage : CNS^- or : SCN^-

: CN^- or : NC^-

$: C \equiv O,\ C \equiv O :$

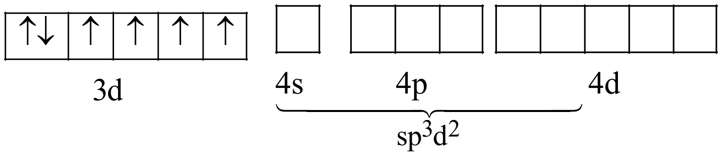
: NO_2, ONO:

(iii) Co-ordination isomerism $[Co(NH_3)_6]\ [Cr(CN)_6]$

$[Cr\ (NH_3)_6]\ [Co(CN)_6]$

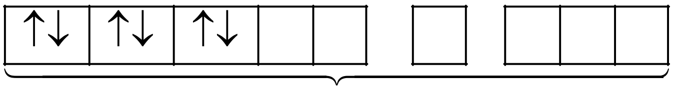
50. Postulates-

$[Fe\ F_6]^{4-}$ Fe^{2+} $3d^6$



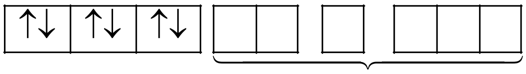
Outer orbital complex - paramagnetic.

$[Fe(CN)_6]^{4-}$



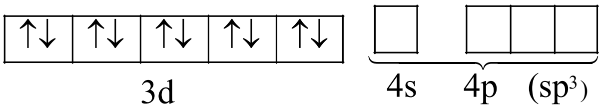
d^2sp^3, inner orbital complex, diamagnetic

$[Fe(CN)_6]^{3-}$



d^2sp^3- paramagnetic, n = 1

$[Ni(CO)_4]$

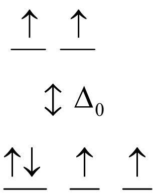


n = 0, diamagnetic

51.

	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.

* $[C_6(F_6)]^{3-}$ $\underline{Co^{3+} = 3d^6}$

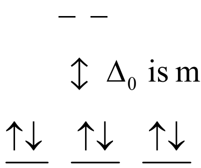


Δ_0 is less.

$t_{2}^{4}g$ $e^{2}g$

n = 1 (paramagnetic)

* $[Co(NH_3)]^{3+}$



$t_{2}^{6}g$

n = 0 (diamagnetic)

52. 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 :

$C_2H_5Br + AgCN \longrightarrow C_2H_5NC + AgBr \downarrow$

$C_2H_5Br + KNO_2 \longrightarrow C_2H_5ONO + KBr$

$C_2H_5Br + KOH\ (alc.) \longrightarrow CH_2 = CH_2 + KBr + H_2O$

53. (i) Statement -

(ii) Merits -

(i) To prepare higher alkane

(ii) To ascend C. atom in chain.

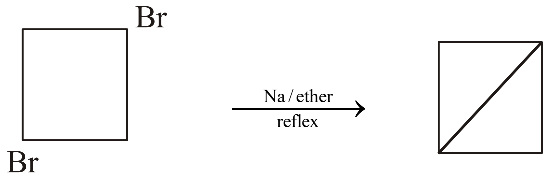
e.g., C_2H_5OH to butane

$C_2H_5OH \xrightarrow{SOCl_2} C_2H_5Cl \xrightarrow{Na/dry}$ ether $C_4\ H_{10}$

(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.

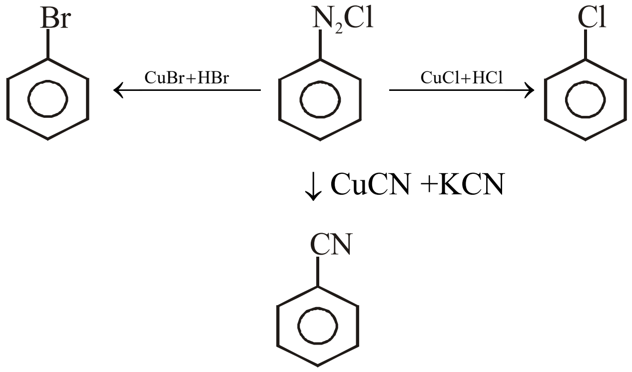
ii) Difficult get alkane with odd no. of C- atom in pure form.

$CH_3Br + C_2H_5Br \xrightarrow[reflux]{Na/dry ether} CH_3–CH_3 + C_2H_5–C_2H_5 + C_2H_5CH_3$

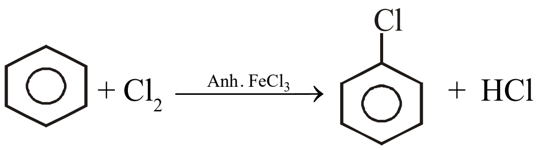
ethane butane propane

(iv) Mechanism

(b) SandMeyer's reaction



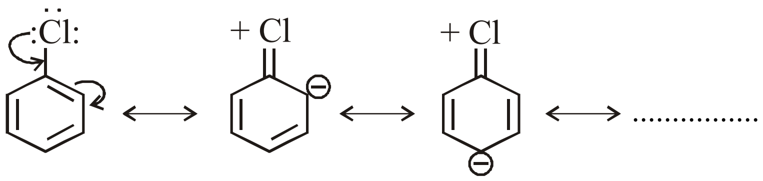
54. (i)



$$Cl-Cl+FeCl_3 \longrightarrow [FeCl_4]^- + Cl^+$$

Benzene undergoes S_E.

Electron pair on Cl is in conjugation and undergoes resonating effect dominating over –I effect (deactivating effect).

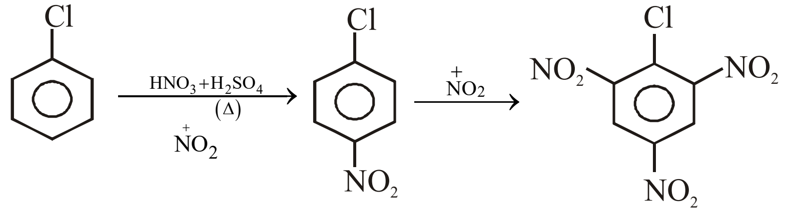


o/p - position susceptible to electrophilic attack.

(ii) Rasching 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

55. → $C_2H_5NH_2 + HONO \xrightarrow[dil.HCl]{NaNO_2(s)} C_2H_5OH + N_2 + H_2O$

→ $CH_3COOC_2H_5 \xrightarrow[H_2O]{H^+} CH_3COOH + C_2H_5OH$

→ $CH_3OH \xrightarrow{SOCl_2} CH_3Cl \xrightarrow{KCN} CH_3CN$

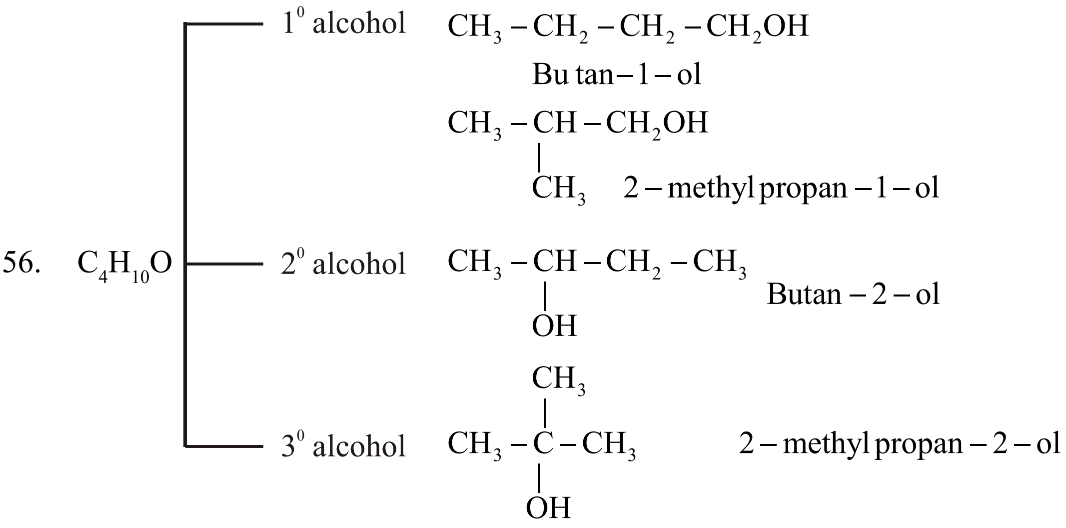
$\xrightarrow{LiAlH_4} CH_3\text{–}CH_2NH_2 \xrightarrow[NaNO_2+dil HCl]{HNO_2} CH_3\text{–}CH_2OH$

→ $CH_3 - CH_2OH \xrightarrow[-H_2O]{H^+} CH_5\overset{\oplus}{C}H_2 \xrightarrow{-H^+} CH_2 = CH_2$

→ $CH_5CH_2OH \xrightarrow{Cl_2/red\,P} CH_3\text{–}CH_2Cl$

$$3Cl_2 + 2P \longrightarrow 2\,PCl_3$$

$$3\,C_2H_5OH + PCl_3 \longrightarrow 3C_2H_5Cl + H_3PO_3$$



56. $C_4H_{10}O$

- 1^0 alcohol $CH_3-CH_2-CH_2-CH_2OH$ Bu tan−1−ol
  - $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2OH$ 2 − methyl propan − 1 − ol
- 2^0 alcohol $CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3$ Butan − 2 − ol
- 3^0 alcohol $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_3$ 2 − methyl propan − 2 − ol

Lucastest

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. $CH_3CH(OH)C_2H_5+HCl\longrightarrow CH_3-\underset{\underset{Cl}{|}}{CH}-C_2H_5+H_2O$	Turbidity appears instantaseouly on addition of reagent $(CH_3)_3C(OH)+HCl\rightarrow(CH_3)_3CCl+H_2O$

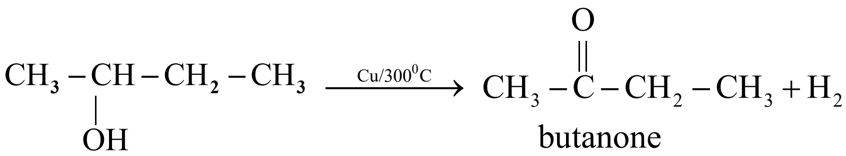
Action Cu at 300⁰C (Dehydrogenation)

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

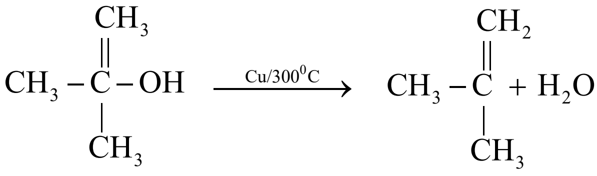
2^0 alcohol give ketone.



$$CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3\xrightarrow{Cu/300^0C}CH_3-\overset{\overset{O}{||}}{C}-CH_2-CH_3+H_2$$

butanone

3^0 alcohol under the same condition gives alkene on dehydration.

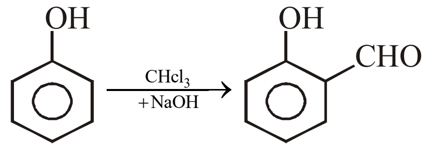


$$CH_3-\overset{\overset{CH_3}{||}}{\underset{\underset{CH_3}{|}}{C}}-OH\xrightarrow{Cu/300^0C}CH_3-\overset{\overset{CH_2}{||}}{\underset{\underset{CH_3}{|}}{C}}+H_2O$$

2-methyl propene

57. (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)

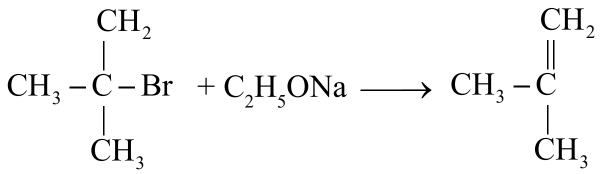
Phenol to anisole

$$C_6H_5OH \xrightarrow{Na} C_6H_5ONa \xrightarrow{CH_3I} C_6H_5OCH_3$$

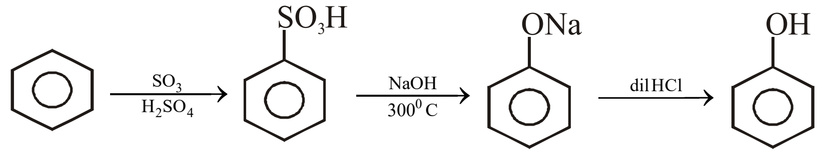
$$RX + RONa \longrightarrow \underset{\text{ether}}{ROR} + NaX$$

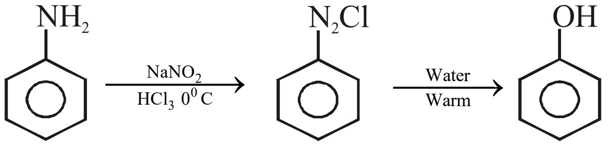
This is a SN_2 reaction, however in case of 2^0 & 3^0 alkyl halide alkene results where alkoxide ion acts as base favouring elimination reaction.

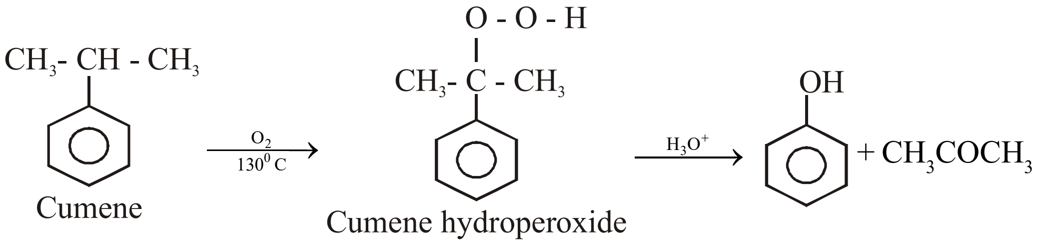
$$CH_3-CH_2Br+(CH_3)_3\,CONa \longrightarrow CH_3-CH_2O\,C(CH_3)_3$$



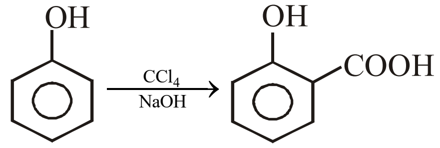
$$CH_3-\underset{CH_3}{\overset{CH_2}{C}}-Br + C_2H_5ONa \longrightarrow CH_3-\underset{CH_3}{\overset{CH_2}{\overset{\|}{C}}}$$

58. → 



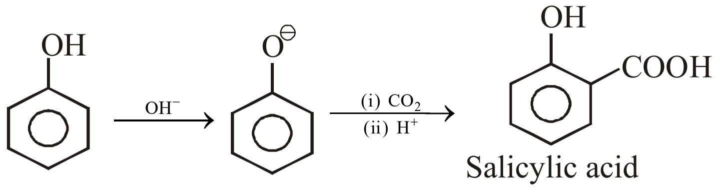


Carboxylation phenol

→ (i) 

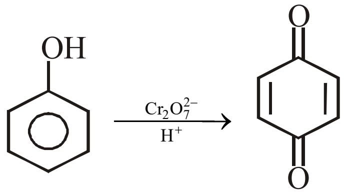
(Reime Tiemann reaction)

(ii) Kolbe's reaction :



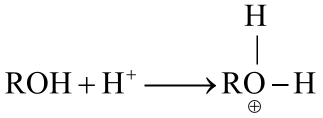
Salicylic acid

→ Phenol on oxidation with acidified sodium dichromate gives benzoquinone.

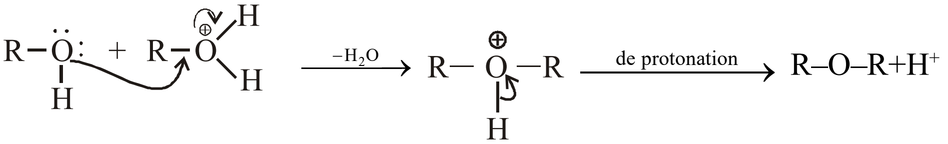


59. $$\begin{matrix}ROH\\ROH\end{matrix}\xrightarrow[140^0 C]{Conc\,H_2SO_4} R\text{–}O\text{–}R + H_2O$$

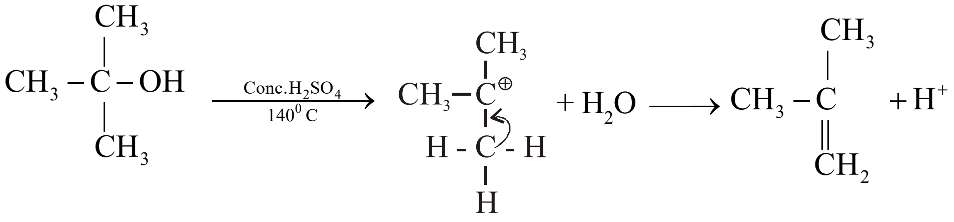
is excess



$$ROH + H^+ \longrightarrow R\overset{\overset{\large H}{|}}{\underset{\oplus}{O}} - H$$



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

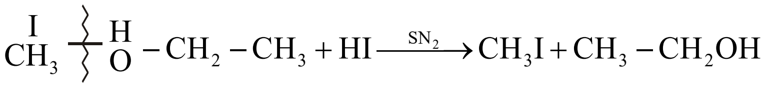


Demerit :

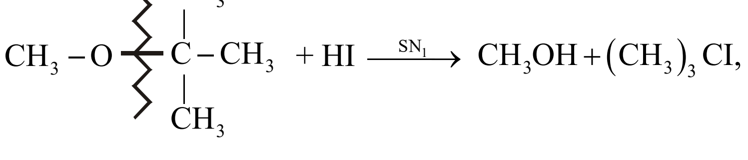
This method is not suitable for preparation of unsymmetrical ether.

$$ROH + R'OH \longrightarrow ROR' + ROR + R'OR'$$

→ **Hydro Iodination :**



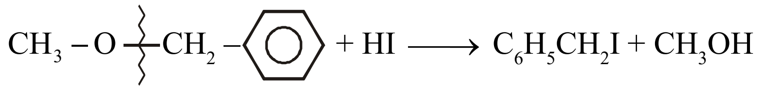
$$\overset{I}{CH_3} \,\wr\, \overset{H}{O} - CH_2 - CH_3 + HI \xrightarrow{SN_2} CH_3I + CH_3 - CH_2OH$$



$$CH_3 - O \,\wr\, \overset{\overset{\large CH_3}{|}}{\underset{\underset{\large CH_3}{|}}{C}} - CH_3 + HI \xrightarrow{SN_1} CH_3OH + (CH_3)_3\,CI,$$

$(CH_3)_3\ C^+$ 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.

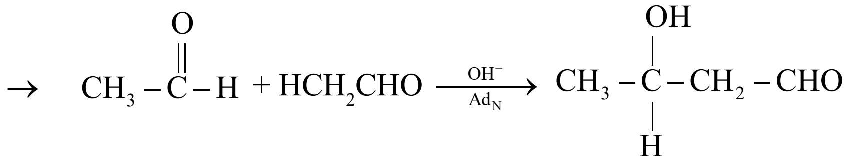
→ $ROR' + PCl_5 \longrightarrow RCl + POCl_3 + R'Cl$

→ $ROR' + CH_3COCl \longrightarrow CH_3COOR + R'Cl$

60. → $CH_3 - CH_2OH + [O] \xrightarrow{PCC} CH_3CHO + H_2O$

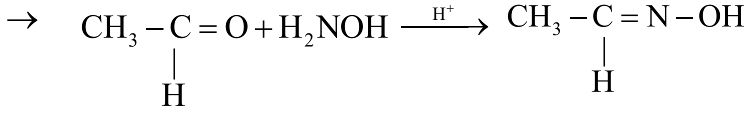
$$CH_3COCl + H_2 \xrightarrow[\text{Rosenmund's reduction}]{Pd-BaSO_4} CH_3CHO + HCl$$

$$CH \equiv CH + H_2O \xrightarrow[HgSO_4,\,60^0\,C]{H_2SO_4} CH_3CHO$$



$$\rightarrow \quad CH_3 - \overset{\overset{\large O}{\|}}{C} - H + HCH_2CHO \xrightarrow[Ad_N]{OH^-} CH_3 - \underset{\underset{\large H}{|}}{\overset{\overset{\large OH}{|}}{C}} - CH_2 - CHO$$

aldol, 3-hydroxy butanal



$$\rightarrow \quad CH_3 - \underset{\underset{\large H}{|}}{C} = O + H_2NOH \xrightarrow{H^+} CH_3 - \underset{\underset{\large H}{|}}{C} = N - OH$$

acetaldehyde oxime

61. (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) $\begin{matrix} CH_3COOH \\ CH_3COOH \end{matrix} \xrightarrow[\Delta]{MnO} CH_3COCH_3 + CO_2 + H_2O$

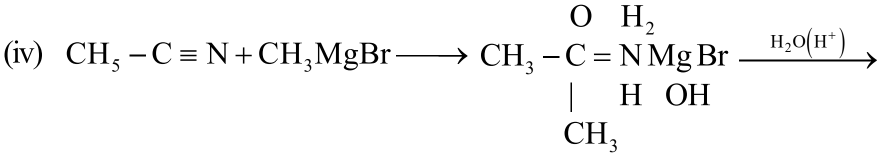
$$CH_3COOH \xrightarrow{Ca(OH)_2} (CH_3COO)_2\,Ca \xrightarrow[-CaCO_3]{\text{dry distillation}} CH_3COCH_3$$

(distillate)

(ii) $CH \equiv CH \xrightarrow{NaNH_2} CH_3 \equiv CNa \xrightarrow{CH_3Br} HC \equiv C - CH_3$

$\xrightarrow[HgSO_4,\,60^0]{dil\,H_2SO_4} CH_3COCH_3$

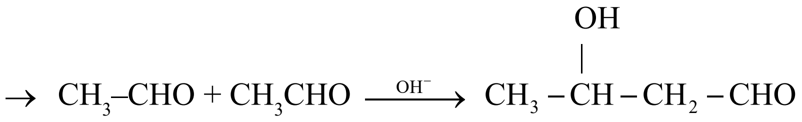
(iii) $2CH_3COCl \xrightarrow[-CdCl_2]{(CH_3)_2Cd} CH_3COCH_3$



$$\text{(iv)}\quad CH_5 - C \equiv N + CH_3MgBr \longrightarrow CH_3 - \underset{\underset{\large CH_3}{|}}{C} = \overset{\large O\ \ H_2}{N}\underset{\large H\ \ OH}{Mg\,Br} \xrightarrow{H_2O(H^+)}$$

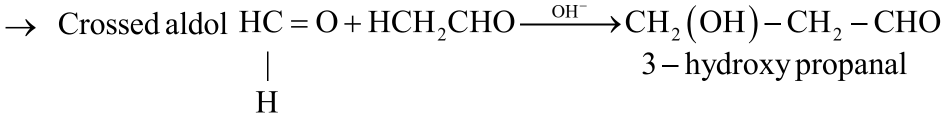
$CH_3COCH_3 + NH_3 + Mg\,(OH)Br$

62. (a) Self aldol.



$$\rightarrow CH_3\text{–}CHO + CH_3CHO \xrightarrow{OH^-} CH_3-\underset{}{\overset{\overset{OH}{|}}{C}H}-CH_2-CHO$$

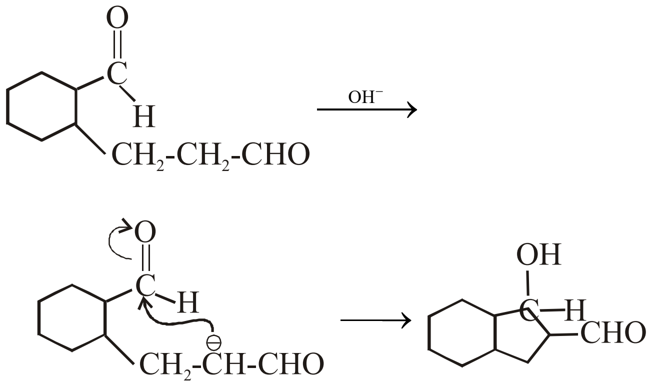
3-hydroxy butanal



$$\rightarrow \text{Crossed aldol } \underset{\underset{H}{|}}{HC}=O + HCH_2CHO \xrightarrow{OH^-} CH_2(OH)-CH_2-CHO$$

3 – hydroxy propanal

→ Intra molecular aldol



(b) Cannizzaro's reaction (disproportionation)

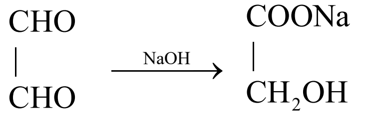
→ Self Cannizzaro's reaction :

$$C_6H_5CHO + C_2H_5CHO + \xrightarrow{NaOH} C_6H_5COONa + C_6H_5CH_2OH$$

→ Cross Cannizzaro's reaction :

$$HCHO + C_6H_5CHO \xrightarrow{NaOH(conc.)} HCOONa + C_6H_5CH_2OH$$

→ Intra molecular Cannizzaro's reaction :

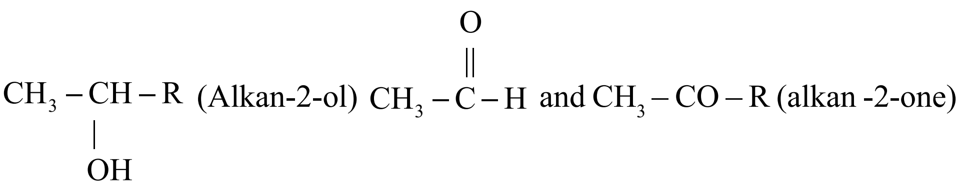


$$\begin{array}{c} CHO \\ | \\ CHO \end{array} \xrightarrow{NaOH} \begin{array}{c} COONa \\ | \\ CH_2OH \end{array}$$

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 $CH_3\text{–}CH_2OH$,



$$CH_3-\underset{\underset{OH}{|}}{CH}-R \text{ (Alkan-2-ol) } CH_3-\overset{\overset{O}{||}}{C}-H \text{ and } CH_3-CO-R \text{ (alkan -2-one)}$$

responds to this test.

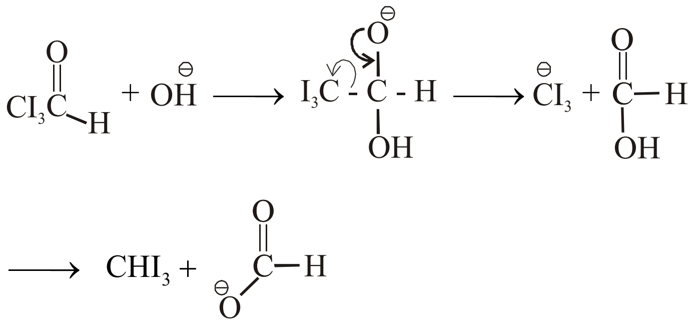
e.g. $CH_3-CHO \xrightarrow{OH^-} \overset{\ominus}{C}H_2CHO + H_2O$

$\overset{\ominus}{C}H_2CHO + I - I \longrightarrow CH_2I-CHO + \overset{\ominus}{I}$

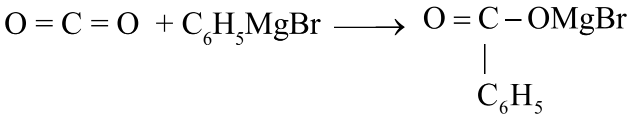
$CH_2I\,CHO + OH^- \longrightarrow \overset{\ominus}{C}HI - CHO + H_2O$

$\bar{C}HICHO + I-I \longrightarrow CHI_2CHO + \overset{\ominus}{I}$

$CHI_2CHO \xrightarrow[+I_2]{OH^-} CI_3CHO$

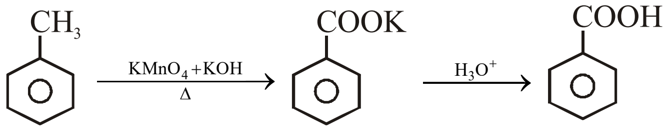


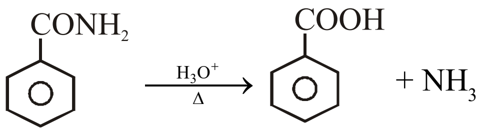
formate

63. 

$$O=C=O + C_6H_5MgBr \longrightarrow \underset{C_6H_5}{O=C-OMgBr}$$

$$\xrightarrow{H_3O^+} C_6H_5COOH + Mg(OH)Br$$





→ $C_6H_5COOH + NaHCO_3 \rightarrow C_6H_5COONa + CO_2 + H_2O$ (Test for - COOH group)

→ $C_6H_5COOH + PCl_5 \rightarrow C_6H_5COCl + POCl_3 + HCl$

Benzoylchloride

64. → (i) $CH_3-CH_2OH + \boxed{O} \xrightarrow[\Delta]{MnO_4^- + H^+} CH_3COOH + H_2O$

(ii) $CH_3Br \xrightarrow{KCN} CH_3CN \xrightarrow[\Delta]{H_3O^+} CH_3COOH$

$CH_3Br \xrightarrow{Mg\,lether} CH_3MgBr \xrightarrow[(ii)\ H_3O^+]{(i)\ O=C=O} CH_3COOH$

(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.

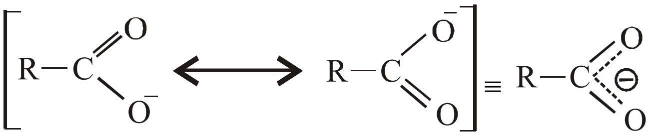
It reduces Tollen's reagent (silver mirror test).

$$HCOOH + 2[Ag(NH_3)_2]OH \longrightarrow CO_2 + 2H_2O + 2Ag + 4\,NH_3$$

$$CH_3COOH \xrightarrow{LiAlH_4} CH_2\text{-}CH_2OH$$

$$\xrightarrow[170^0C]{Conc.H_2SO_4} CH_2{=}CH_2 \xrightarrow{Mn\bar{O}_4+H^+} HCOOH$$

65. (i) $\begin{matrix}RCOOH\\ +H_2O\end{matrix} \rightleftharpoons H_3\overset{+}{O} +$



(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) $RCONH_2 + 4\,KOH + Br_2 \longrightarrow RNH_2 + K_2CO_3 + 2KBr + 2H_2O$

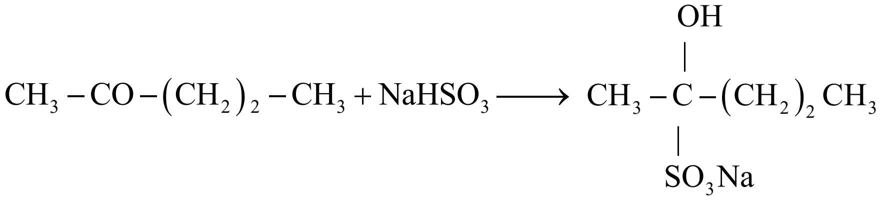
Significance : (a) Preparation of 1^0 - amine

(b) Descending C. atom is chian.

(iii) Substitution of halogen at $\alpha - C.$ atom of the acid.

e.g $CH_3COOH + Cl_2 \xrightarrow{red\ 'P'} ClCH_2COOH + HCl$

66. →



$$CH_3-CO-(CH_2)_2-CH_3 + NaHSO_3 \longrightarrow CH_3-\underset{\underset{SO_3Na}{|}}{\overset{\overset{OH}{|}}{C}}-(CH_2)_2\,CH_3$$

$$CH_3CO(CH_2)_2CH_3 + 3I_2 \longrightarrow CI_3CO\ (CH_2)_2CH_3 + 3HI$$

$$CI_3\ CO(CH_2)_2CH_3 + KOH \longrightarrow CHI_3 + CH_3-CH_2\text{–}CH_2COOK \xrightarrow{dil\ HCl}$$

$$CH_3CH_2-CH_2COOH$$

$$CH_3CO \wr CH_2\text{–}CH_2CH_3 \xrightarrow[H_3SO_4,\,\Delta]{K_2Cr_2O_7} CH_3COOH + CH_3CH_2COOH$$

Popoff's rule

→ %C, 86 mass contains 60 mass of C

$$100\ \text{mass contains}\ \frac{60}{86}\times 100 = 69.77\%$$

67. $A = C_6H_5CONH_2$

$$C_6H_5CONH_2 \xrightarrow{KOH+Br_2} C_6H_5NH_2(B) \xrightarrow[HCl]{NaNO_2} C_6H_5N_2Cl$$

$$C_6H_5CONH_2 \xrightarrow{LiAlH_4} \underset{(C)}{C_6H_5CH_2NH_2} \xrightarrow[+HCl]{NaNO_2} \underset{(D)}{C_6H_5CH_2OH}$$

$$C_6H_5CONH_2 \xrightarrow[\Delta]{P_2O_5} \underset{(E)}{C_6H_5CN} \xrightarrow[\Delta]{dil\,HCl} \underset{(F)}{C_6H_5COOH}$$

$$C_6H_5COOH \xrightarrow{NH_3} C_6H_5COONH_4 \xrightarrow{\Delta} \underset{(A)}{C_6H_5CONH_2}$$

68. → 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)

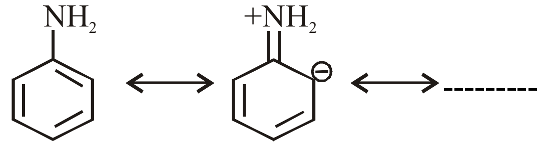
(b) $RCONH_2 + 4H \longrightarrow RCH_2\,NH_2 + H_2O$

(c) $RNO_2 + 6H \xrightarrow{Sn/HCl} RNH_2 + 2H_2O$

→ $RNH_2 + C_6H_5COCl \longrightarrow C_6H_5CO\,N\genfrac{}{}{0pt}{}{/H}{\backslash R} + HCl$

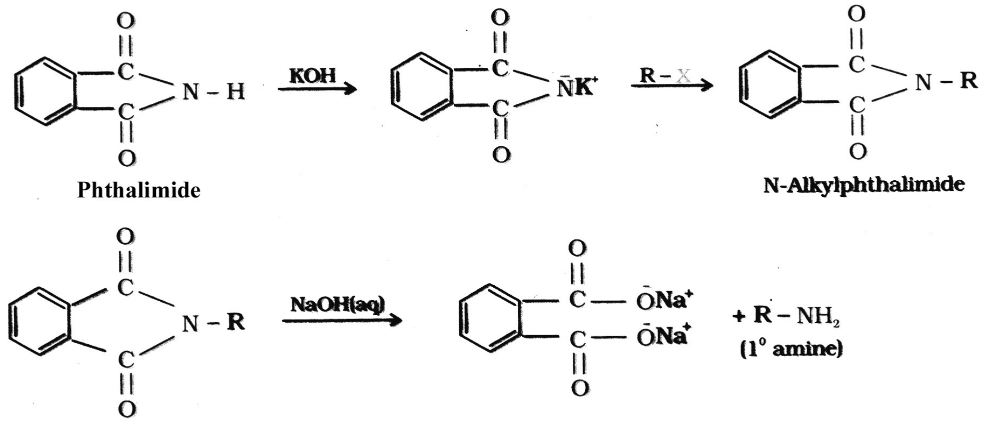
N-alkyl benzene carboxamide

→ $R \rightarrow NH_2$, more basic due to +I effect.

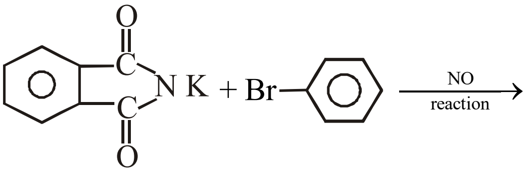


Electron donating tendency is reduced due to presence of +ve charge on Nitrogen as lone pair gets delocalised by resonance.

69. (i)



It fails to give aromatic amine e.g. aniline R–X can be substituted but not arylhalide due to double bond character between $\gt C = X^{+}$



(ii) This is a test to distinguish 1^0 amine from 2^0 and 3^0 amines.

$$RNH_2 + CHCl_3 + 3KOH \longrightarrow R-\overset{+}{N}\equiv\overset{-}{C} + 3KCl + 3H_2O$$

It provides very unpleasant smell.

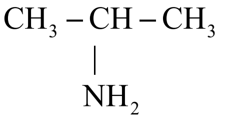
(iii) The basic strength of amines follows in the order:

$2^0 > 1^0 > 3^0$. 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:

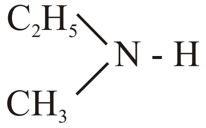
$$(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$$

70. 1^0 amine $CH_3-CH_2-CH_2-NH_2$ Propan-1-amine



$CH_3-\underset{\displaystyle NH_2}{\underset{|}{CH}}-CH_3$ Propan-2-amine

2^0 amine



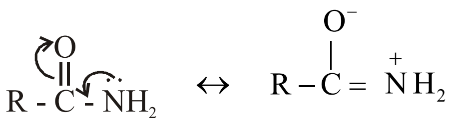
$\begin{matrix}C_2H_5\\CH_3\end{matrix}\rangle N-H$ N-methylethanamine

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	$C_3H_7NH_2 + C_6H_5SO_2Cl$ $\rightarrow C_6H_5SO_2N\begin{smallmatrix}H\\C_3H_7\end{smallmatrix}$ N – propyl benzene sulfonamide soluble in NaOH	$\begin{smallmatrix}CH_3\\C_2H_5\end{smallmatrix}\rangle NH + C_6H_5SO_2Cl$ $\rightarrow C_6H_5SO_2N\begin{smallmatrix}CH_3\\C_2H_5\end{smallmatrix}$ N- ethyl N-methyl benzene sulfonamide, insluble in NaOH	Due to absence of N – H Hinsberg reagent fails toreact.

→ $R-NH_2$ +I effect increases basic behaviour.



$$R-\overset{\overset{\displaystyle O}{\|}}{C}-\ddot{N}H_2 \leftrightarrow R-\overset{\overset{\displaystyle O^-}{|}}{C}=\overset{+}{N}H_2$$

(a) $\rangle C = O$ group is an electron withdrawing group.

(EWG) group. Due to resonance $\overline{e}$ density at 'N' decreases decreasing its $\overline{e}$-donating tendency hence lowering the basic nature.

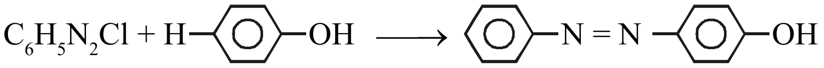
71. $\rightarrow$ $C_6H_5NH_2 + NaNO_2 + 2HCl \xrightarrow[0-5^0 C]{\text{diazotisation}} C_6H_5N_2Cl + NaCl + 2H_2O$

$\rightarrow$ Balz - Schiemann reaction

$C_6H_5N_2Cl + HBF_4 \longrightarrow C_6H_5N_2BF_4 \xrightarrow{\Delta} C_6H_5F + N_2 + BF_3$

$\rightarrow$ $C_6H_5N_2Cl + H_3PO_2 + H_2O \longrightarrow C_6H_6 + N_2 + H_3PO_3 + HCl$

$\rightarrow$ Coupling reaction.



P-hydroxyazobenzene (orange dye)

72. (i) $RCOOH + HN_3 \longrightarrow RNH_2 + N_2 + CO_2$

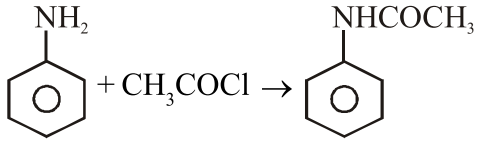
(ii) $RCN + 4H \xrightarrow[LiAlH_4]{Na+alcohol} RCH_2\,NH_2$

(iii) Ammonolysis of alkyl halide-

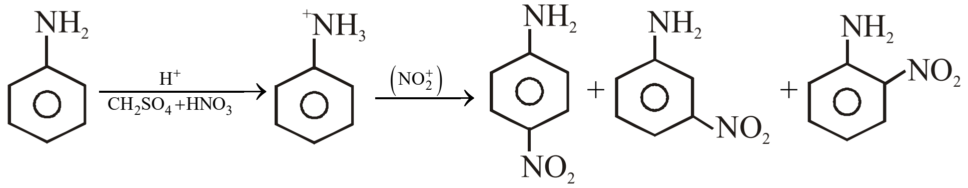
$RX \xrightarrow{alc.NH_3} RNH_2 \xrightarrow{RX} R_2NH \xrightarrow{RX} R_3N \xrightarrow{RX} R_4\overset{+}{N}X$

Tetraalkylamminium halide (which on heating) forms alkene, termed as Hofmann's elimination reaction)

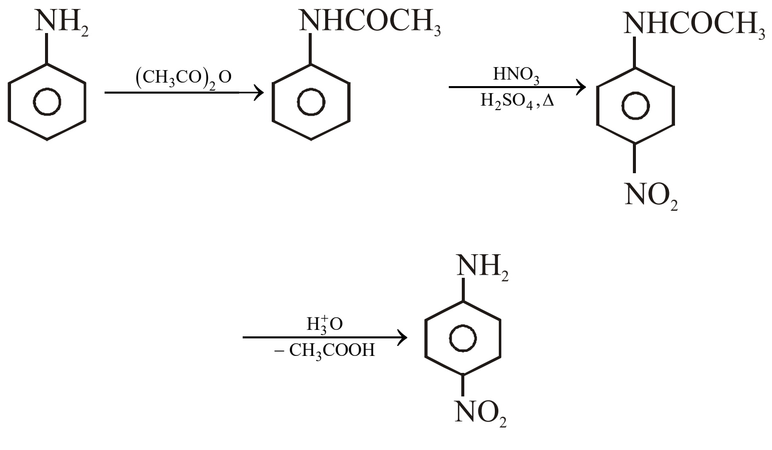
(iv) Acylation -

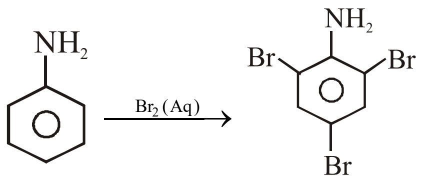


For the process of nitration of aniline, to avoid protonation of –NH_2 group.



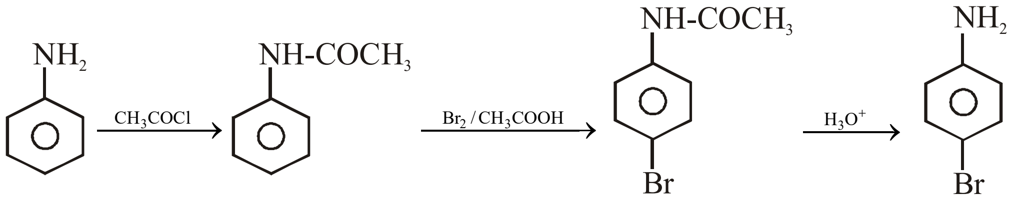
To get p-NO_2 aniline from aniline protection is necessary.



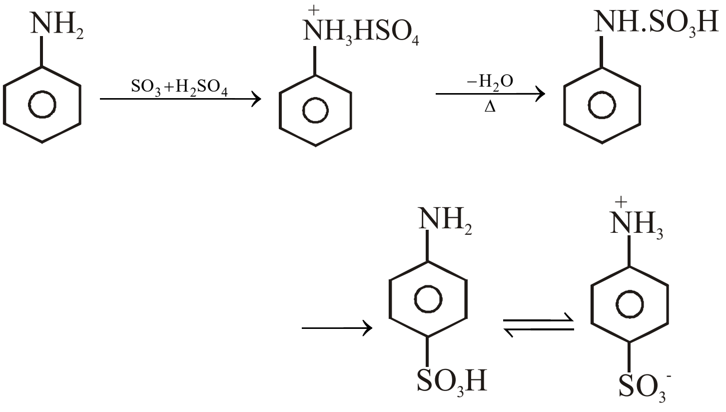
v) 

(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.

73. 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)

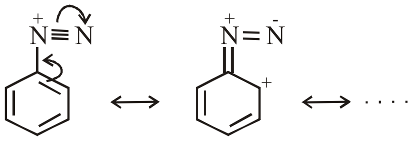
Libermann's nitroso reaction :

$R_2N - N = O + \text{Phenol} + \text{Conc.} H_2SO_4 \xrightarrow{\Delta}$ 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	**CH_3NH_2**	**$C_6H_5NH_2$**
(Diazotisation) $NaNO_2$ + HCl	$CH_3NH_2 \xrightarrow{NaNH_2+HCl} CH_3OH$ No dye is formed	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.

74. (a) What are carbohydrates ? Discuss their classification with examples.

(b) How proteins are classified ? What is peptide linkage.

Refer to Text.

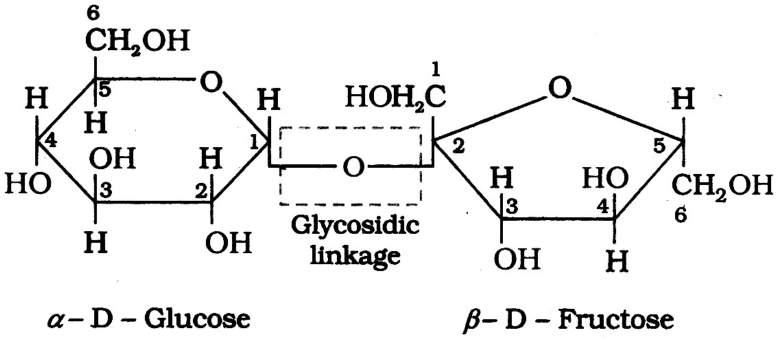
75. (a) The secondary of tertiary structure of proteins get disturbed on change of pH or temperature and they are not able to perform their functions. This is called denaturation protein. e.g. boiling egg.

(b) Non-essential aminoacid – synthesized in the body itself e.g glycine, alanine etc.

Essential mino acids - To be obtained through diet, e.g. valine, Lewine etc.

(c) Two monsaccharides are joined together by an oxide linkage formed by less a water molecule is called glycosidic linkage.

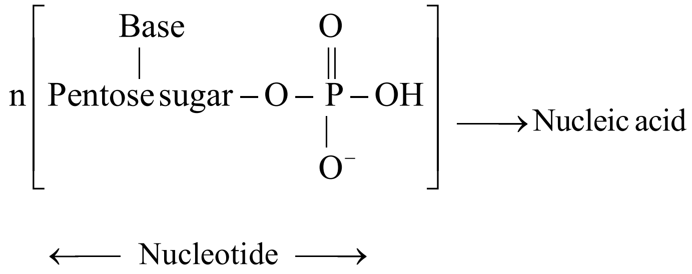
Sucrose = D(+) glucose + D (–) fructose



Sucrose

Sucrose is a non-reducing sugar.

(d) **Nucleic acids** These are long chair biopolymers present in most living cells either freely or bound to proteins as nucleoprotein. Here the monomers are called nucleotide which is made up of phosphoric acid unit and a nucleoside (Pentose - heterocyclic base)



$$n\left[\begin{array}{c}\text{Base} \qquad\qquad \text{O} \\ | \qquad\qquad\qquad \| \\ \text{Pentose sugar} - \text{O} - \text{P} - \text{OH} \\ \qquad\qquad\qquad | \\ \qquad\qquad\qquad \text{O}^- \end{array}\right] \longrightarrow \text{Nucleic acid}$$

$\longleftarrow$ Nucleotide $\longrightarrow$

Sugar - Ribose (in case of RNA), deoxyribose (DNA)

Bases in DNA	Adenine (A), Thiamine (T) Guamine (G) Cytosine (C)
Bases in RNA	A, U (uracil), G, C

Biological function :

DNA – Transfer of hereditary character from one cell to another.

It is double stranded.

RNA- Synthesis of protein. (Single stranded)

76. (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.

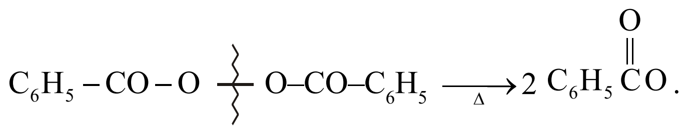
77. → (i) The procss of heating natural rubber with sulfur & important additive like ZnO at 373 to 415 K to improve the properties is called vulcanisation.

Properties :

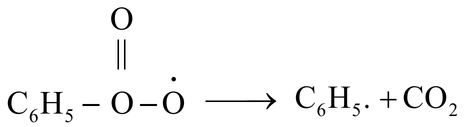
(a) excellent elasticity
(b) low water absorbing tendency
(c) Resistant to action of organic solvents, oxiding agents

Quality of rubber (natural rubber) changes with % of sulfur.

→ (ii) **Initiation** - Oenzoylperoxide



$$C_6H_5-CO-O \wr O\text{–}CO\text{–}C_6H_5 \xrightarrow[\Delta]{} 2\ C_6H_5\overset{\overset{\displaystyle O}{\|}}{C}O.$$



$$\overset{\overset{\displaystyle O}{\|}}{C_6H_5 - O} - \dot{O} \longrightarrow C_6H_5. + CO_2$$

$$C_6H_5^{\bullet} + CH_2 = CH_2 \longrightarrow C_6H_5CH_2 - CH_2^{\bullet}$$

Propagation.

$$CH_2 \overset{\bullet\bullet}{-} CH_2 + C_6H_5 - CH_2 - CH_2^{\bullet} \rightarrow C_6H_5 - CH_2 - CH_2 - CH_2 - CH_2^{\bullet}$$

$$\xrightarrow{(n-1)CH_2=CH_2} C_6H_5 - \left(CH_2 - CH_2\right)_n - CH_2 - CH_2^{\bullet}$$

Termination : The growing chain radical diactivates either by combination or by disproportionation to form a dead polymer.

Disproportionation : $C_6H_5\text{–}(CH_2\text{–}CH_2)_n\text{–}CH_2\text{–}CH_2^{\bullet} \longrightarrow C_6H_5(CH_2\text{–}CH_2)_n$

$\text{–}CH{=}CH_2 + C_6H_5 - (CH_2\text{–}CH_2)_n - CH_2\text{–}CH_3$

Dead polymers.

Combination : $X + X \longrightarrow X\text{–}X$

78. **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 amoxycoillin 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, soframicine, 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 poison lose to be avoided.

Morphine (opiate), Heroin, codemine

Non - narcotic – paracetamol, aspirin (both are antipyretic also prevent platelet coagulation)

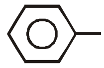
Due/to anti blood clotting action aspirin finds use in prevention of heat attacks.

79. Soap - sodium or potassium salts of higher fatty acids (stearic acid, palmitic acid, oleic acid)

Types of soap -

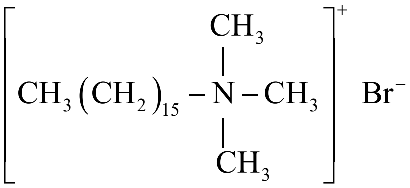
Synthetic detergents - (functions both in hard and soft water)

Classification :

→ Anionic detergent - $CH_3-(CH_2)_{11}-$  $S\bar{O}_3\ Na^+$, do decylbenzene sulfonate.

There are ABS (alkyl benzene sulfonate) detergent.

→ Cationic detergent –



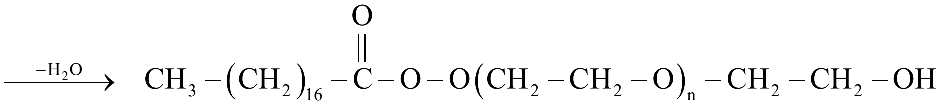
$$\left[\begin{array}{c} \quad\quad\quad\quad CH_3 \\ \quad\quad\quad\quad | \\ CH_3(CH_2)_{15}-N-CH_3 \\ \quad\quad\quad\quad | \\ \quad\quad\quad\quad CH_3 \end{array}\right]^+ Br^-$$

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

$$\begin{array}{c}\text{oil}\\ \text{+dust}\end{array} \xleftarrow[\text{hydrophobic}]{R-} \xrightarrow[\text{hydrophilic}]{COO^-Na^+} \begin{array}{c}\text{water}\\ \text{part}\end{array}$$

Emulsification / micelle formation favour cleansing.

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MODEL SET AHSE 2020

Answer all the bit questions of a particular question serially at one place to ensure effective valuation

GROUP -A

1. **Choose and write the correct answer from the choices given : [1 x 7=7]**

(i) The homogeneous catalyst used to oxidise SO_2 to SO_3 is _______ .

(a) NO (b) NO_2 (c) V_2O_5 (d) I_2 (vapour)

(ii) Which of the following alloy does not contain copper ?

(a) Bronze (b) german silver

(c) Manganin (d) solder

(iii) The reagent not used to distinguish 1^0 from 2^0 and 3^0 amines

(a) alkaline chloroform (b) Hinsberg reagent

(c) acetyl chloride (d) arylchloride

(iv) Which of the following is not used as an antiseptic ?

(a) mercurychrome (b) Savlon

(c) 2-3% iodine is alcohol-water solution

(d) 2% phenol solution

(v) Chlorine gas is dried over

(a) CaO (b) NaOH (c) H_2SO_4 (d) HBr

(vi) The shape and nature of hybridisation of $[Ni(CN)_4]^{2-}$ is _______ .

(a) dsp^2, tetrahedral (b) sp^3, tetrahedral

(b) dsp^2, square planar (d) sp^3d^2, square planar

(vii) The reagent used to distinguish formaldehyde and acetaldehyde is ________.

(a) alkaline iodine (b) alkaline phenol

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

2. **(A) Answer the following questions : [1 x 4 = 4]**

(i) Commonsalt is heated with conc. sulfuric acid to liberate ________ gas.

(ii) $C_6H_5\,CONH_2 \xrightarrow[\Delta]{P_2O_5} A \xrightarrow[\Delta]{H_3O^+} B$, Name A and B.

(iii) What are the monomers present in polyester ?

(iv) Identify an artificial sweetening reagent.

(B) Fill in the blanks : [1 x 3 = 3]

(i) The unit of molar conductivity is ____________ .

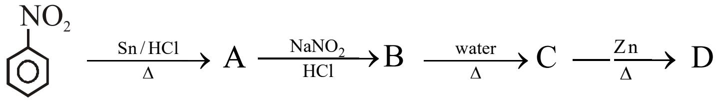
(ii) The peptising agent used to prepare $Fe(OH)_3$ sol is __________ .

(iii) Phenol with bromine in presence of CS_2 gives __________.

GROUP -B

3. Answer any seven of the following : [2 x 7 = 14]

(i) How can you prepare acetone from acetaldehyde ?

(ii) 

Identify the compounds A to D.

(iii) Name the following complexes :

(a) $K_4[Fe(CN)_6]$ (b) $[Cr(H_2O)_4 Br_2]Br$

(iv) Correctly match List-I with List-II

List - I	**List-II**
Paracetamol	carbohydrate
Azithromycin	disinfectant
Maltose	tranquilizer
Equanil	antibiotic
	analgesic

(v) What is Hofmann's bromamide reaction ?

(vi) SO_2 acts a temporary bleaching agent whereas chlorine is permanent one-explain.

(vii) What do you mean by pseudo first order reaction ?

(viii) What are fibres ? Give two examples.

(ix) What is a Lead storage battery ?

(x) Calculate the mass of copper deposited on passage of 9650 ampere of current for one hour. (Atomic mass of Cu=63.5)

4. Answer any seven of the following : [3 x 7 = 21]

(a) How does the rate constant depend on temperature ?

(b) Discuss the properties of hydrides of group-15.

(c) What is abnormal molecular mass ? How is it corrected ?

(d) What are different applications of electro-chemical series ?

(e) Write down the postulates of Werner co-ordination theory.

(f) How does PH_3 differ from NH_3 ? Provide chemical test. Compare their basic nature.

(g) Provide the methods for preparation of bromo substituted aniline.

(h) What is coupling reaction ? Prepare benzoic acid from nitrobenzene.

(i) 'F' differs from other elements of group. Explain.

(j) How does ECE differ from chemical equivalent ? Calculate the ECE value of silver. (Atomic mass of silver = 108)

GROUP -C

Answer any three of the following:

5. Explain the following reactions :

(i) Reimer-Tieman reaction.

(ii) Sandmeyer's reaction

(iii) Kolbe's reaction [3+2+2]

6. (a) How can you prepare

(i) benzoic acid by carboxylation

(ii) acetaldehyde from acetic acid

(iii) ethanamine from methamine

(b) Explain (i) formic acid acts as a reductant

(ii) arylhalides are less reactive than alkylhalide. [4.5+1.5+1]

7. (a) Discuss the preparation of (i) NH_3 (ii) SO_2 in the laboratory.

(b) How does SO_2 react with (i) $K_2Cr_2O_7$ (ii) chlorine water. [4+3]

8. (a) What is Nernst equation ? Calculate the cell potential of

$Zn|Zn^{2+}(0.1M) || Cu^{2+}(1.M)|Cu$ at 25^0C. [4]

(b) How does physical adsorption differ from chemisorption ? [3]

9. Write notes on :

(a) Activation energy

(b) Lanthanide contraction [4+3]

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