



CHEMISTRY

Maximum Marks: 100

Theory: Marks 70

Practicals: Marks 30

Time: 3 hour

Unit I	Solid State	4 marks
Unit II	Solutions	5 marks
Unit III	Electrochemistry	5 marks
Unit IV	Chemical Kinetics	5 marks
Unit V	Surface Chemistry	4 marks
Unit VI	General Principles and Processes of Isolation of Elements	3 marks
Unit VII	p-Block Elements	8 marks
Unit VIII	d- and f- Block Elements	5 marks
Unit IX	Coordination Compounds	3 marks
Unit X	Haloalkanes and Haloarenes	4 marks
Unit XI	Alcohols, Phenols and Ethers	4 marks
Unit XII	Aldehydes, Ketones and Carboxylic Acids	6 marks
Unit XIII	Organic Compounds containing Nitrogen	4 marks
Unit XIV	Biomolecules	4 marks
Unit XV	Polymers	3 marks
Unit XVI	Chemistry in Everyday Life	3 marks

Unit-I: SOLID STATE

Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous solids and crystalline solids (elementary idea only), unit cell in two dimensional & three dimensional lattices, packing efficiency, calculation of density of unit cell, packing in solids, voids, number of atoms per unit cell in a cubic unit cell, point defects. Properties of solids (electrical, magnetic & dielectric), Band theory of metals, conductors, semi-conductors 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 vapor pressure of a solution, Raoult's law, elevation of boiling point, depression in freezing point temperature and osmotic pressure), determination of molecular masses using colligative properties. Abnormal molecular mass, van't Hoff factor and calculations involving it..

Unit-III: ELECTROCHEMISTRY

Redox reactions, conductance in electrolytic solutions, specific conductivity, molar



conductivity, variation of conductivity with concentration, Kohlrausch's law and its applications 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 Gibb's energy change and emf of a cell, fuel cells, corrosion

Unit-IV: CHEMICAL KINETICS

Rate of reaction (average and instantaneous rate of a reaction), factors affecting rate of reactions: (concentration, temperature, catalyst), rate law, specific rate constant and order, molecularity of a reaction, integrated rate expression of zero and first order reactions and their derivations, half life period. Concept of collision theory (elementary idea, no mathematical derivation), Activation energy, Arrhenius equation.

Unit-V: SURFACE CHEMISTRY

Adsorption- physical and chemical adsorption, factors affecting adsorption of gases on solids; Catalysis: homogeneous and heterogeneous, activity & selectivity. Enzyme catalysis, Colloidal state: distinction between true solution, colloids and suspensions. Types of colloids- lyophilic and lyophobic, multimolecular, macromolecular and associated colloids (micelles), properties of colloids: Tyndall effect, Brownian movement, Electrophoresis, Coagulation, Emulsions-types of emulsions. Elementary idea about nanomaterials.

Unit-VI: GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF ELEMENTS

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

Unit- VII: p-BLOCK ELEMENTS

Group 15 Elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen: preparation, properties & uses. Compounds of nitrogen: preparation & properties of ammonia and nitric acid, oxides of nitrogen (structure only), Phosphorus – allotropic forms; compounds of phosphorus: preparation & properties of phosphine, halides (PCl_3 , PCl_5) and oxo- acids (elementary idea only).

Group 16 Elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; dioxygen: preparation, properties & uses. Classification of oxides; ozone. Sulphur- allotropic forms; compounds of sulphur: preparation, properties & uses of SO_2 and Sulphuric acid: industrial process of manufacture, properties and uses, other oxides and oxoacids of sulphur (structures only).

Group 17 Elements: General introduction, electronic configuration, oxidation states, trends in physical and chemical properties; compounds of halogens-preparation, properties and uses of Chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only)

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

Unit- VIII: d and f-BLOCK ELEMENTS

General introduction, electronic configuration, occurrence and characteristics of the transition metals, general trends in properties of first row transition metals (metallic character, IE, electrode



potential, oxidation state, ionic radii, catalytic properties, colored ions, complex formation, magnetic properties, interstitial compounds, alloy formation). Preparation and properties of $K_2Cr_2O_7$ and $KMnO_4$.

Lanthanides: electronic configuration, oxidation state, chemical reactivity and lanthanide contraction and its consequences.

Actinides- electronic configuration, oxidation states and comparison with lanthanoids.

Unit- IX: CO-ORDINATION COMPOUNDS

Co-ordination compounds: Introduction, ligands, co-ordination number, color, magnetic properties and shapes, IUPAC nomenclature of mononuclear co-ordination compounds. Bonding (Werner's theory, VBT and CFT); structural and stereoisomerisms, importance of coordination compounds in qualitative inclusion of analysis, extraction of metals and biological systems.

Unit-X: HALOALKANES AND HALOARENES

Haloalkanes: Nomenclature, nature of C-X bond, physical & chemical properties, mechanism of substitution reactions. Stability of carbocations, R-S and d-l configurations.

Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogens for monosubstituted compounds only), Stability of carbocations, R-S and D-L configurations

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

Unit- XI: ALCOHOLS, PHENOLS AND ETHERS

Alcohols: Nomenclature, methods of preparation, physical & chemical properties (of primary alcohols only), identification of primary, secondary & tertiary alcohols; mechanism of dehydration of alcohols, uses, some important compounds – methanol and ethanol.

Phenols: Nomenclature, methods of preparation, physical & chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.

Ethers: Nomenclature, methods of preparation, physical & chemical properties and uses.

UNIT- XII: ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical & chemical properties & mechanism of nucleophilic addition reaction to C = O group, reactivity of alpha hydrogen in aldehydes, uses.

Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical & chemical properties and uses

UNIT- XIII: ORGANIC COMPOUNDS CONTAINING NITROGEN

Amines: Nomenclature, classification, structure, methods of preparation, physical & chemical properties, uses, identification of primary, secondary & tertiary amines.

Cyanides and Isocyanides: Structures of cyanide and isocyanide groups, nomenclature, preparation, physical properties and chemical reactions.



Diazonium Salts: Preparation and chemical reactions (mechanism of diazotization), and importance in synthetic organic chemistry.

UNIT- XIV: BIOMOLECULES

Carbohydrates: Classification (aldoses and ketoses), monosaccharides: Glucose, fructose: structure, preparation and chemical reactions; oligosaccharides (sucrose, lactose & maltose) Polysaccharides: (starch, cellulose and glycogen); importance.

Proteins: Elementary idea of amino acids: peptide bond, polypeptides and primary, secondary, tertiary and quaternary structure of proteins (Qualitative idea only). denaturation of proteins; enzymes, lipids & hormones, their classification & functions.

Nucleic Acids: DNA and RNA (purines and pyrimidines, nucleosides, nucleotides and fragments up to four nucleotides).

Vitamins: Classification and functions, sources and deficiency diseases.

UNIT- XIV: POLYMERS

Natural & synthetic polymers, methods of polymerization (addition and condensation), copolymerization, and some important polymers: natural and synthetic like polythene, nylon, Bakelite, polyesters and rubber. Biodegradable and non- biodegradable polymers.

Unit-XVI: CHEMISTRY IN EVERYDAY LIFE

- i) **Chemicals in medicine and health care-** analgesics, tranquillizers, antiseptics, disinfectants, antimicrobials, anti-fertility drugs, anti-histamines, antibiotics, antacids.
- ii) **Chemicals in food-** preservatives, artificial sweetening agents.
- iii) **Cleansing agents** – Soaps and detergents, cleansing action.

PRACTICALS

External: 20

Internal:10

Evaluation Scheme for Practical Examination:

- Volumetric analysis	=	06 marks
- Salt Analysis	=	06 marks
- Content based experiment	=	04 marks
- Class record, Project work and viva	=	04 marks
		Total = 20 marks

A. SURFACE CHEMISTRY

- i) Preparation of one lyophilic and one lyophobic sol
Lyophilic sol-starch, egg albumin and gum
Lyophobic sol-aluminium hydroxide, ferric hydroxide, arsenious sulphide.
- ii) Study of the role of emulsifying agents in stabilizing the emulsion of different oils.



B. CHEMICAL KINETICS

- i) Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.
- ii) Study of reaction rates of any one of the following:
 - a) Reaction of iodide ions with hydrogen peroxide at room temperature using different concentration of iodide ions.
 - b) Reaction between potassium iodate (KIO_3) and sodium sulphite (Na_2SO_3) using starch solution as indicator (clock reaction).

C. THERMOCHEMISTRY

Any one of the following experiments:

- i) Enthalpy of dissolution of CuSO_4 or KNO_3 .
- ii) Enthalpy of neutralization of strong acid (HCl) and strong base (NaOH).
- iii) Determination of enthalpy change during interaction (Hydrogen bond formation) between acetone & chloroform.

D. ELECTRO CHEMISTRY

- i) Variation of cell potential in $\text{Zn}/\text{Zn}^{2+} // \text{Cu}^{2+}/\text{Cu}$ with change in concentration of electrolytes (CuSO_4 or ZnSO_4) at room temperature.

E. CHROMATOGRAPHY

- i) Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of R_f values.
- ii) Separation of constituents present in an inorganic mixture containing two cations only (constituents having wide difference in R_f values to be provided)

F. PREPARATION OF INORGANIC COMPOUNDS

- i) Preparation of double salt of ferrous ammonium sulphate or potash alum.
- ii) Preparation of potassium ferric oxalate.

G. TEST FOR THE FUNCTIONAL GROUPS PRESENT IN ORGANIC COMPOUNDS

Unsaturation, alcoholic, phenolic, aldehydic, ketonic, carboxylic and amino (primary) groups.

H. Study of carbohydrates, fats and proteins in pure form and detection of their presence in given foodstuffs.

I. Determination of concentration/ molarity of KMnO_4 solution by titrating it against a standard solution of:

- i) oxalic acid
- ii) ferrous ammonium sulphate.



J. Qualitative Analysis

Determination of one cation and one anion in a given salt (insoluble salts to be excluded):

Cations: Pb^{2+} , Cu^{2+} , As^{3+} , Al^{3+} , Fe^{3+} , Mn^{2+} , Zn^{2+} , Ni^{2+} , Co^{2+} , Ca^{2+} , Sr^{2+} , Ba^{2+} , Mg^{2+} , NH_4^+

Anions: CO_3^{2-} , S^{2-} , SO_3^{2-} , SO_4^{2-} , NO_2^- , NO_3^- , Cl^- , Br^- , I^- , PO_4^{3-} , $\text{C}_2\text{O}_4^{2-}$, CH_3COO^-

PROJECT WORK

Wherever feasible may include

1) Model Preparation

2) Investigatory Project

- To prepare rayon thread from filter paper by cupra ammonium process.
- Determine the oxalate content of Guava fruits at different stages of ripening.
- Study of insecticides and pesticides in various fruits and vegetables.
- To determine the amount of casein present in different samples of milk from different sources.
- Preparation of soyabean milk and its comparison with natural milk.
- To determine the presence of adulterants in common foods such as sugar, butter, oil, red chilly paper, turmeric powder, rice.
- Prevention of rusting of iron by using cathode protection method.

3) Science Exhibits.

4) Participation in Science Fairs

Book Suggested: Textbook of Chemistry for class XII published by NCERT, New Delhi