

2022-23
CHEMISTRY(130)
Class XI (Theory)

One Paper

Time: 3 Hours

70 Marks

Unit No.	Title	Marks
Unit I	Some Basic concepts of chemistry	03
Unit II	Structure of Atom	06
Unit III	Classification of Elements and Periodicity in Properties	04
Unit IV	Chemical Bonding and molecular Structure	05
Unit V	States of Matter: Gases and Liquids	04
Unit VI	Thermodynamics	06
Unit VII	Equilibrium	06
Unit VIII	Redox Reactions	03
Unit IX	Hydrogen	03
Unit X	S-Block Elements	05
Unit XI	Some P-Block Elements	07
Unit XII	Organic Chemistry: some basic Principles and Techniques	07
Unit XIII	Hydrocarbons	08
Unit XIV	Environmental Chemistry	03
Total		70

Unit I: Some Basic Concepts of Chemistry

General Introduction: Importance and scope of chemistry. Historical approach to particulate nature of matter, laws of chemical combination. Dalton's atomic theory: concept of elements, atoms and molecules. Atomic and molecular masses mole concept and molar mass: percentage composition, empirical and molecular formula chemical reactions, stoichiometry and calculations based on stoichiometry.

Unit II: Structure of Atom

Discovery of electron, proton and neutron; atomic number, isotopes and isobars. Thomson's model and its limitations, Rutherford's model and its limitations. Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p, and d orbitals, rules for filling electrons in orbitals - Aufbau principle, Pauli exclusion principle and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.

Unit III: Classification of Elements and Periodicity in Properties

Significance of classification, brief history of the development of periodic table, modern periodic law and the present form of periodic table, periodic trends in properties of elements -atomic radii, ionic radii. Ionization enthalpy, electron gain enthalpy, electro negativity, valence.

Unit IV: Chemical Bonding and Molecular Structure

Valence electrons, ionic bond, covalent bond: bond parameters. Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization, involving s, p and d orbitals and shapes of some simple molecules, molecular orbital; theory of homo nuclear diatomic molecules (qualitative idea only), hydrogen bond.

Unit V: States of Matter: Gases and Liquids

Three states of matter. Intermolecular interactions, type of bonding, melting and boiling points. Role of gas laws in elucidating the concept of the molecule, Boyle's law. Charles law, Gay Lussac's law, Avogadro's law. Ideal behaviour, empirical derivation of gas equation, Avogadro's number. Ideal gas equation. Derivation from ideal behaviour, liquefaction of gases, critical temperature. Liquid State - Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).

Unit VI: Thermodynamics

Concepts Of System, types of systems, surroundings. Work, heat, energy, extensive and intensive properties, state functions. First law of thermodynamics - internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH , Hess's law of constant heat summation, enthalpy of: bond dissociation, combustion, formation, atomization, sublimation. Phase transformation, ionization, and solution. Introduction of entropy as a state function, free energy change for spontaneous and nonspontaneous processes, criteria for equilibrium.

Unit VII: Equilibrium

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium - Le Chatelier's principle; ionic equilibrium - ionization of acids and bases, strong and weak electrolytes, degree of ionization, concept of pH. Hydrolysis of salts (elementary idea). Buffer solutions, solubility product, common

ion effect (with illustrative examples).

Unit VIII: Redox Reactions

Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, applications of redox reactions.

Unit IX: Hydrogen

Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen; hydrides - ionic, covalent and interstitial; physical and chemical properties of water, heavy water; hydrogen peroxide-preparation, properties and structure; hydrogen as a fuel.

Unit X: s- Block Elements (Alkali and Alkaline earth metals)

Group 1 and Group 2 elements:

General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens; uses.

Preparation and properties of some important compounds:

Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogen carbonate, biological importance of sodium and potassium. CaO , CaCO_3 and industrial use of lime and limestone, biological importance of Mg and Ca

Unit XI: Some p-Block Elements

General Introduction to p-Block Elements

Group 13 elements: General introduction, electronic configuration, occurrence. Variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron- physical and chemical properties, some important compounds: borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalis.

Group 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element, Carbon - catenation, allotropic forms, physical and chemical properties; uses of some important compounds: oxides.

Important compounds of silicon and a few uses: silicon tetrachloride, silicones, silicates and zeolites.

Unit XII: Organic Chemistry - Some Basic Principles and Techniques

General introduction, methods of qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions

Unit XIII: Hydrocarbons

Classification of hydrocarbons

Alkanes - Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis. Alkenes- Nomenclature, structure of double bond (ethene) geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition. Alkynes - Nomenclature, structure of triple bond (ethyne), physical properties. Methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of - hydrogen, halogens, hydrogen halides and water. Aromatic hydrocarbons: Introduction, IUPAC nomenclature; benzene: resonance aromaticity; chemical properties: mechanism of electrophilic substitution. - nitration, sulphonation, halogenation, Friedel Craft's alkylation and acylation: directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

Unit XIV: Environmental Chemistry

Environmental pollution - air, water and soil pollution, chemical reactions in atmosphere, smog, major atmospheric pollutants; acid rain, ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming - pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

Practicals

Evaluation Scheme for Examination	Marks
Volumetric Analysis	05
Salt Analysis	05
Content Based Experiment	03
Project Work	05
Viva on experiments	02
Practical Record	05
Continuous Assessment (Unit Test)	05
Total	30

PRACTICALS SYLLABUS

A. Basic Laboratory Techniques

1. Cutting glass tube and glass rod
2. Bending a glass tube
3. Drawing out a glass jet
4. Boring a cork

B. Characterization and purification of chemical substances

1. Determination of melting point of an organic compound
2. Determination of boiling point of an organic compound
3. Crystallization of impure sample of any one of the following: Alum, copper sulphate, Benzoic acid.

C. Experiments related to pH change

- (a) Any one of the following experiments:
- Determination of pH of some solutions obtained from fruit juices, varied concentrations of acids, bases and salts using pH paper or universal indicator.
 - Comparing the pH of solutions of strong and weak acid of same concentration.
 - Study the pH change in the titration of a strong base using universal indicator.
- (b) Study of pH change by common-ion effect in case of weak acids and weak bases.

D. Chemical equilibrium

One of the following experiments:

- (a) Study the shift in equilibrium between ferric ions and thiocyanate ions by increasing/ decreasing the concentration of either ions.
- (b) Study the shift in equilibrium between $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and chloride ions by changing the concentration of either of the ions.

E. Quantitative estimation

- Using a chemical balance.
- Preparation of standard solution of oxalic acid.
- Determination of strength of a given solution of sodium hydroxide by titrating it against standard solution of oxalic acid.
- Preparation of standard solution of sodium carbonate.
- Determination of strength of a given solution of hydrochloric acid by titrating it against standard sodium carbonate solution.

F. Qualitative analysis

Determination of one anion and one cation in a given salt

Cations- Pb^{2+} , Cu^{2+} , As^{3+} , Al^{3+} , Fe^{3+} , Mn^{2+} , Ni^{2+} , Zn^{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^-

(Note: Insoluble salts excluded)

**G. Detection of nitrogen, sulphur, Chlorine
bromine and iodine in an organic compound.**

PROJECT

Scientific investigations involving laboratory testing and collecting information from other sources.

A Few suggested Projects

- Checking the bacterial contamination in drinking water by testing sulphide ion.
- Study of the methods of purification of water.
- Testing the hardness, presence of iron, fluoride, chloride etc. depending upon the regional variation in drinking water and the study of causes of presences of these ions above permissible limit (if any).
- Investigation of the foaming capacity of different washing soaps and the effect of addition of sodium carbonate on them.
- Study of the acidity of different samples of the tea leaves.
- Determination of the rate of evaporation of different liquids.
- Study of the effect of acids and bases on the tensile strength of fibers.
- Analysis of fruit and vegetable juices for their acidity.

Note: Any other investigatory project, which involves about 10 period of work, can be chosen with the approval of the teacher.

2022-23
CHEMISTRY (130)
Theory
CLASS XII
Time : 3 Hours

One Paper

Marks : 70

Unit No.	Title	Marks
Unit I	Solid State	4
Unit II	Solutions	5
Unit III	Electrochemistry	5
Unit IV	Chemical kinetics	5
Unit V	Surface chemistry	4
Unit VI	General principles and processes of Isolation of Elements	3
Unit VII	p-Block Elements	8
Unit VIII	d- and f- Block Elements	5
Unit IX	Coordination Compounds	3
Unit X	Haloalkanes and Haloarenes	4
Unit XI	Alcohols, Phenols and Ethers	4
Unit XII	Aldehydes, Ketones and Carboxylic acids	6
Unit XIII	Organic Compounds containing Nitrogen	4
Unit XIV	Biomolecules	4
Unit XV	Polymers	3
Unit XVI	Chemistry in Everyday life	3
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, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties.

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, elevation of Boiling Point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass.

Unit III: Electrochemistry

Redox reactions, conductance in electrolytic solutions, specific and molar conductivity variations 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, 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)

Unit V: Surface Chemistry

Adsorption – physisorption and chemisorption; factors affecting adsorption of gases on solids; catalysis : homogenous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; 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 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 and uses; compounds of nitrogen: preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous-allotropic forms; compounds of phosphorous: 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; simple 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 (structures 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 properties 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 $\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4 .

Lanthanoids - electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction.

Actinoids - Electronic configuration, oxidation states.

Unit IX: Coordination Compounds

Coordination compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. bonding; isomerism, importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems).

Unit X: Haloalkanes and Haloarenes.

Haloalkanes:

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

Haloarenes:

Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only)

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

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 of methanol and ethanol.

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

Ethers: 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 nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

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

Unit XIII: Organic compounds containing Nitrogen

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

Cyanides and Isocyanides - will be mentioned at relevant places in context.

Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

Unit XIV: Biomolecules

Carbohydrates - Classification (aldoses and ketoses), monosaccharides (glucose and fructose), oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); importance.

Proteins - Elementary idea of α - amino acids, peptide bond, polypeptides, proteins, structure of amines-primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins; enzymes.

Vitamins - Classification and functions.

Nucleic Acids: DNA and RNA .

Unit XV: Polymers

Classification - natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polythene, nylon, polyesters, bakelite, rubber.

Unit XVI: Chemistry in Everyday life:

1. **Chemicals in medicines** - analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
2. **Chemicals in food** - preservatives, artificial sweetening agents.
3. **Cleansing agents** - soaps and detergents, cleansing action.

Practical Marks Distribution

Topic	Marks	
	Internal Examiner	External Examiner
Project work	05	-
Practical Record	05	-
Continuous assessment	05	-
Volumetric analysis	-	05
Salt Analysis	-	05
Content Based Experiment	-	03
Viva voice	-	02
Total	15	15

Practicals Syllabus

A. Surface Chemistry.

- (a) Preparation of one lyophilic and one lyophobic sol.
Lyophilic sol - starch, egg albumin and gum
Lyophobic sol - aluminium hydroxide, ferric hydroxide, arsenous sulphide.
- (b) Study of the role of emulsifying agents in stabilizing the emulsions of different oils.

B. Chemical Kinetics

- (a) Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.
- (b) Study of reaction rates of any one of the following:
 - (i) Reaction of iodide ion with hydrogen peroxide at room temperature using different concentration of iodide ions.
 - (ii) 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 copper sulphate or potassium nitrate.
- ii) Enthalpy of neutralization of strong acid (HCl) and strong base (NaOH)
- iii) Determination of enthalpy change during interaction (Hydrogen bond formation) between acetone and chloroform

- D. Electrochemistry** Variation of cell potential in $Zn/Zn^{2+}||Cu^{2+}/Cu$ with change in concentration of electrolytes ($CuSO_4$ or $ZnSO_4$) at room temperature.
- E. Chromatography**
- Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of R_f values.
 - Separation of constituents present in an inorganic mixture containing two cations only (constituents having large difference in R_f values to be provided).
- F. Preparation of Inorganic Compounds**
- Preparation of double salt of ferrous ammonium sulphate or potash alum.
 - Preparation of potassium ferric oxalate.
- G. Preparation of Organic Compounds**
Preparation of any two of the following compounds
- Acetanilide
 - Di-benzal acetone
 - p-Nitroacetanilide.
 - Aniline yellow or 2 - Naphthol aniline dye.
 - Iodoform
- H. Tests for the functional groups present in organic compounds:**
Unsaturation, alcoholic, phenolic, aldehydic, ketonic, carboxylic and amino (primary) groups.
- I. Characteristic tests of carbohydrates, fats and proteins in pure samples and their detection in given food stuffs.**
- J. Determination of concentration/molarity of $KMnO_4$ solution by titrating it against a standard solution of:**
- Oxalic acid,
 - Ferrous ammonium sulphate
- (Students will be required to prepare standard solutions by weighing themselves).
- K. Qualitative analysis**
- Determination of one cation and one anion in a given salt.
- Cations** - Pb^{2+} , Cu^{2+} , As^{3+} , Al^{3+} , Fe^{3+} , Mn^{2+} , Zn^{2+} , Co^{2+} , Ni^{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-} ; $C_2O_4^{2-}$, CH_3COO^-

(Note: Insoluble salts excluded)

PROJECT

Scientific investigations involving laboratory testing and collecting information from other sources.

A few suggested Projects.

- Study of presence of oxalate ions in guava fruit at different stages of ripening.
- Study of quantity of casein present in different samples of milk.
- Preparation of soybean milk and its comparison with the natural milk with respect to curd formation, effect of temperature, etc.
- Study of the effect of potassium bisulphate as food preservative under various conditions (temperature, concentration, time etc.) :
- Study of digestion of starch by salivary amylase and, effect of pH and temperature on it.
- Comparative study of the rate of fermentation of following materials: wheat flour, gram flour, potato juice, carrot juice etc.
- Extraction of essential oils present in Saunf (aniseed), Ajwain (carum), Illaichi (cardamom).
- Study of common food adulterants in fat, oil, butter, sugar, turmeric powder, chilli powder and pepper.

Note: Any investigatory project, which involves about 10 periods of work, can be chosen with the approval of the teacher.

