CHEMISTRY (CHEM)

CLASS - XI

Full Marks 100

THEORY - 70 Marks

		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	State 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 atoms

Discovery of electrons, proton and neutron; atomic number, isotopes and isobars.
Rutherford's model and its limitations. Bohr's model and its limitations, concept of shell and sub shells, 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, 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, election gain enthalpy, electronegativity valency, nomenclature of elements with atomic number greater than 100.

Unit – IV: Chemical Bonding and Molecular Structure

Valence electrons, ionic bond, bond parameters, covalent bond: Born Haber Cycle. 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 homonuclear diatomic molecules and hydrogen bond.

Unit – V: States Of Matter: Gases and Liquids

Three states of matter. Intermolecular interactions, types 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, kinetic energy and molecular speeds (elementary idea)
Liquid state – vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).

Unit – VI: Chemical Thermodynamics

Concepts of system, types of systems, surroundings. Work, heat, energy, extensive and intensive properties, state functions.

First law of thermodynamics – internal energy change (U) and enthalpy change (H). 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, Gibbs energy change for spontaneous and non spontaneous processes, criteria for equilibrium.

Second and third laws of thermodynamics.

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 of polybasic acids, acid strength, concept of pH Henderson Equation. Hydrolysis of salts (elementary idea). Buffer solutions, solubility product, common ion effect (with illustrative examples).

Unit – VIII: Red ox Reactions

Concept of oxidation and reduction, red ox reactions, oxidation number, balancing redox reactions in terms of loss and gain of electrons and change in oxidation number.

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, structure and use; 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 hydroxide and sodium hydrogen carbonate, biological importance of sodium and potassium.
CaO, CaCO3 and industrial use of lime and limestone, biological importance of Mg and Ca

Unit –X I: 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 acid, boron hydrides, Aluminium: reactions with acids and alkalis and uses.

Group 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation state, 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, their uses and structure of silicates.

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, electrometric 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 halogenations, free radical mechanism, 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, 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.

Practical

Marks - 30

Evaluation Scheme for Examination	Marks
Volumetric analysis	10
Salt Analysis	08
Content Based Experiment	06
Class Record and Viva	06
Total	**30**

Practical Syllabus

A. Basic Laboratory Techniques

I. Cutting glass tube and glass rod
II. Bending a glass tube
III. Drawing out a glass jet
IV. Boring a cork

B. Characterization and purification of chemical substances

I. Determination of melting point of an organic compound
II. Determination of boiling point of an organic compound
III. Crystallization of impure sample of anyone of the following: Alum, copper sulphate, Benzoic acid.

C. Experiments related to pH change

a. Anyone 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 $[Co(H_2O)_6]^{2+}$ 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 caution in a given salt

Cautions:- 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^{-1},NO_3^{-1},Cl^{-1},Br^{-1},I^{-1},PO_4^{3-},$C_2O_4^{2-}$,CH_3COO^-

(Note: Insoluble salts excluded)

G. Detection of nitrogen, sulphur, chlorine