



Centre for Teacher Accreditation

Syllabus for Chemistry

Secondary School Chemistry (IX - X)

Physical Chemistry

Structure of Atoms and Molecules - Dalton's Atomic Theory, What Is An Atom, Symbols Of Atoms, Atomic Mass Unit , A Molecule, Molecules of Elements, Molecules of Compounds, An Ion, Anion, Cation, Charged Particles In Matter, Electron, Proton, Models of An Atom (Thomson, Rutherford, Bohr), Energy Levels, Neutrons, Distribution of Electrons in Orbits, Valency, Octet, Atomic Number, Mass Number, Isotopes, Isobars

Stoichiometry - Laws Of Chemical Combination , Law Of Conservation Of Mass, Law Of Constant Proportion , Dalton's Atomic Theory, Molecular Mass And Mole Concept , Molecular Mass , Formula Unit Mass , Avogadro Number, Charged Particles In Matter

States of Matter - Physical Nature of Matter, Characteristics of Particles of Matter, Kinetic Energy, Diffusion, Particles of Matter Attract Each other, States of Matter (Solid, Liquid, Gaseous), Change of State of Matter, Effect of Change In Temperature, Melting Point , Latent Heat, Boiling Point, Sublimation, Effect of Change in Pressure, Evaporation, Factors Affecting Evaporation , Evaporation Causing Cooling, Plasma, Bose-Einstein Condensate

Mixtures and Solutions - Types of Pure Substances, Elements, Compounds, Types of Mixtures, Solutions, Alloys, Solvent And A Solute, Properties of A Solution, Concentration of A Solution, Suspension, Properties Of A Suspension, Colloidal Solution, Tyndall Effect, Properties of A Colloid

Inorganic Chemistry

Periodic Classification of Elements - Classification Of Elements , Döbereiner's Triads, Newlands' Law Of Octaves, Mendeleev's Periodic Table, Modern Periodic Table, Periodic Law , Position Of Elements In The Modern Periodic Table, Group And Period, Trends In The Modern Periodic Table, Valency, Atomic Size, Metallic And Non-Metallic Properties, Metalloids, Electropositive, Electronegative properties

Metals and Non-metals - Physical Properties Of Metals, Physical Properties Of Nonmetals, Chemical Properties Of Metals, Reaction of Metals With Solutions Of Other Metal Salts, The Reactivity Series, Reaction of Metals and Non-metals, Electronic Configuration, Properties Of Ionic Compounds

Properties and Uses of Materials - Separating The Components of a Mixture, Obtaining Coloured Component From Blue/Black Ink, Separating Cream From Milk, Separation of Two Immiscible Liquids, Separation A Mixture of Salt And Ammonium Chloride, Separation of Two Miscible Liquids, Distillation, Fractional Distillation, Separation of Different Gases From Air, Obtaining Pure Copper Sulphate From an Impure Sample, Crystallisation, Water Purification System in Water Works, Occurrence Of Metals, Extraction Of Metals, Enrichment Of Ores, Refining Of Metals

Acids, Bases and Salts - Acids And Bases In The Laboratory, Reaction of Acids and Bases with Metals , Reaction of Metal Carbonates And Metal Hydrogencarbonates with Acids, Reaction of Acids And Bases With Each Other, Reaction Of Metallic Oxides With Acids, Reaction Of A Non-Metallic Oxide With Base, Common Properties of Acids and Bases , Reaction of Acids and Bases with Water Solution, Strength of Acid Or Base Solutions, Importance Of Ph In Everyday Life, Naturally Occurring Acids

Properties and Uses of Salts - Family Of Salts, Ph Of Salts, Common salts and their properties: Sodium Hydroxide, Bleaching Powder, Baking Soda, Washing Soda, Crystals Of Salts, Plaster Of Paris

Chemical Reactions - The Reactants, The Products, Balanced Chemical Equations, Combination Reaction, Exothermic Reaction, Decomposition Reaction, Endothermic Reactions, Displacement Reaction, Double Displacement Reaction, Oxidation And Reduction, Corrosion

Organic Chemistry

Properties of Carbon - Bonding In Carbon - Covalent Bond , Electron Dot Structure, Allotropes Of Carbon, Catenation, Saturated Compounds, Unsaturated Compounds , Tetravalency, Saturated And Unsaturated Carbon Compounds, Chains, Branches And Rings Heteroatom, Functional Groups, Homologous Series, Nomenclature Of Carbon Compounds, Combustion, Formation Of Coal And Petroleum, Oxidation, Addition Reaction, Substitution Reaction

Ethanol and Ethanoic Acid - Properties Of Ethanol and Ethanoic acid, Reaction With Sodium, Reaction To, Give Unsaturated Hydrocarbon, Properties Of Ethanoic Acid, Esterification Reaction, Saponification , Reaction With A Base

Soaps and detergents - Formation Of Micelles, Scum, Hardness Of Water, Detergents

Environmental Chemistry

Role Of The Atmosphere In Climate Control, Winds, Rain, Air Pollution, Water, Pollution, Water Cycle, Nitrogen Cycle, Carbon Cycle, Greenhouse Effect, Oxygen Cycle, Ozone Layer, Management of our Resources, Ecological Stability, Water Conservation and Distribution, Dams, Water, Harvesting, Coal And Petroleum

Senior Secondary School Chemistry (XI - XII)

Physical Chemistry

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 and Empirical and Molecular formula; Chemical Reactions, Stoichiometry and Calculations based on Stoichiometry

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

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, Buffer solutions, Solubility Product, Common Ion Effect

Redox Reactions- Concept of Oxidation and Reduction, Redox reactions, Oxidation number, Balancing redox reactions, Applications of redox reactions

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 d, p and d orbitals and shapes of some simple molecules, Molecular orbital theory of homonuclear diatomic molecules, Hydrogen bond

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, Deviation from Ideal Behaviour, Liquefaction of gases, critical temperature. Liquid State – Vapour pressure, viscosity and surface tension

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 Transition, Ionization, and Dilution. Introduction of Entropy as a state function, Free Energy change for Spontaneous and Nonspontaneous process, Equilibrium

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 B.P, depression of freezing point, osmotic pressure, determination of molecular masses using, colligative properties, abnormal molecular mass

Electrochemistry - Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis, 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

Chemical Kinetics - Rate of a reaction (average and instantaneous), factors affecting rates of reaction: concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life, concept of Collision Theory

Surface Chemistry - Adsorption: Physisorption and chemisorption; factors affecting adsorption of gases on solids; catalysis: homogeneous 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; emulsions – types of emulsions

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

Inorganic Chemistry

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, Inert gas radii, Ionization enthalpy, Electron gain enthalpy, Electronegativity, valence

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, CaCO₃, and industrial use of Lime and Limestone, Biological importance of Mg and Ca

Some p-Block Elements , Group 13 and Group 14 elements - General Introduction to p-Block Elements, 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 the 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

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); Phosphorus – allotropic forms; compounds of phosphorus: preparation and properties of phosphine, halides (PCl_3 , PCl_5) and oxoacids. 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. 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. Group 18 elements: General introduction, electronic configuration, occurrence, trends in physical and chemical properties and their uses

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 Lanthanide contraction, Actinoids: Electronic configuration, oxidation states

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, reactions and structure; Hydrogen as a Fuel

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)

Environmental Chemistry

Environmental pollution : Air, Water and Soil pollution, Chemical reactions in atmosphere, Smogs, 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

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

Biochemistry

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, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes. Vitamins: Classification and functions. Nucleic Acids: DNA and RNA

Chemistry in Everyday Life

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

Chemicals in medicines – analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

Chemicals in food – preservatives, artificial sweetening agents.

Cleansing agents – soaps and detergents, cleansing action

Organic Chemistry

Organic Chemistry – Some Basic Principles and Techniques - General introduction, Methods of purification, 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

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

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

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, some important compounds – 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 and their uses

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

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