

**Government of Andhra Pradesh**  
**Department of School Education**  
**State Council of Educational Research & Training**  
**Category of Post: TGT**  
**Paper II – General Science Syllabus**

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**PART - I**

**I. General Knowledge and Current Affairs (Marks: 10)**

**PART - I**

**II. Perspectives in Education (Marks: 05)**

**1. History of Education :**

- The Education in Ancient India - Pre-Vedic and Post-Vedic period, Medieval Education.
- Education in Pre Independent era - Woods Despatch (1854), Hunter Commission (1882), Hartog Committee (1929), Sargent Committee (1944).
- Education in Post Independent era - Mudaliar Commission (1952-53), Kothari Commission (1964-66), Ishwarbhai Patel committee (1977), NPE-1986, POA-1992

**2. Teacher Empowerment:**

- Need, interventions for empowerment, Professional code of conduct for teachers, Teacher motivation, Professional development of Teachers and Teacher organizations, National / State Level Organizations for Teacher Education, Maintenance of Records and Registers in Schools.

**3. Educational Concerns in Contemporary India:**

- Democracy and Education, Equality, Equity, Quality in Education, Equality of Educational opportunities.
- Economics of Education, Education as Human Capital, Education and Human Resource Development, Literacy - Saakshar Bharat Mission.
- Population Education, Gender - Equality, Equity and Empowerment of Women, Urbanization and migration, Life skills.
- Adolescence Education
- Value Education – Morel Value and Professional Eathics in Education.
- Health and Physical Education
- Inclusive Education - Classroom Management in Inclusive Education
- Role of Education in view of Liberalization, Privatization and Globalization
- Programmes and Projects – APPEP, DPEP, Sarva Siksha Abhiyan, National Programme for Education of Girls at Elementary Level (NPEGEL), Rashtriya Madhyamika Siksha Abhiyan(RMSA), Rashtriya Aveshekar Abhiyan (RAA), KGBVs, Model Schools.
- Incentives and special provisions – Mid Day Meals, Free Books, Scholarship, Awards, Welfare Hostels, Transportation.
- Current Trends in Education – Badi pelusthondi, Badi ki Vasta, Mavuru – Mana Badi, Vidyanjali, Swacha Patasala, Inspire, Kalavutsav.

#### **4. Acts / Rights:**

- Right of Children to Free and Compulsory Education Act - 2009
- Right to Information Act - 2005
- Child Rights
- Human Rights.

#### **5. National Curriculum - Framework, 2005: Perspective, Guiding Principles, Learning and Knowledge, Teaching Learning Process, Assessment, Systemic Reforms.**

### **III. Classroom implications Educational Psychology – 05Marks**

1. **Individual differences:** Inter and intra individual differences, meaning, nature and theories of intelligence with special emphasis to multiple intelligence, IQ, assessment of intelligence, EQ, Creativity. Attitude, Aptitude, Interest, Habit and its Influence on Intelligence – Class room implementation.
2. **Learning:** Theories and approaches of learning, learning curves, Factors, Phases, Dimensions of learning, Types of learning, Transfer of learning. Memory, Forgetting, Learning and assessment– Class room implementation.
3. **Personality:** Nature, characteristics and theories of personality, factors of Personality, Assessment of Personality, Mental health, Adjustment, Stress – nature, Symptoms and management. Emotional intelligence, Management of emotions – Class room implementation.

### **PART - B**

### **IV. Content Science (40Marks)**

#### **Physical Science (Marks: 20)**

1. **Units And Measurements:** Systems of Measurement, Units of Measurements, Measurement of Length, Measurement of time, Accuracy, precision of instruments errors in measurement, Significant figures, Measurement of Mass and Density, Units and Dimensions Fundamental and derived physical quantities, Systems of units, Multiples and submultiples of SI units. Dimensions Dimensional formulae and dimensional equations, dimensional constants and dimensionless quantities, principle of homogeneity of dimensions. Application of dimensional method of analysis. Conversion of one system of units into another.
2. **Motion In A Straight Line**  
Position, path length and displacement, Average velocity and average speed, Instantaneous velocity and speed, Acceleration, Kinematic equations for uniformly accelerated motion, Relative velocity, Velocity-time and position-time graphs, Kinematical Equations of motion by graphical Method, Scalars and Vectors, laws of addition of vectors, subtraction of vectors. Resolution of vectors, Motion in a plane, Motion in a plane with constant acceleration, Relative velocity in two dimensions, Projectile motion.
3. **Laws Of Motion**  
The law of inertia, Newton's second law of motion, Newton's third law of motion. Force – Types of Force, Free Body Diagrams. Newton's Universal Gravitation, Centre of Mass, Centre of Gravity, Stability, Applications, Equations of Motion, Motion of a body under gravity - Acceleration due to Gravity "g", Equations of Motion for a freely falling body, Equations of Motion for a body thrown upwards. Equations, Applications and

problems. Universal law of gravitation, The gravitational constant, Kepler's laws, Acceleration due to gravity of the earth, Acceleration due to gravity below and above the surface of earth, Gravitational potential energy, Escape speed, Earth satellite, Energy of an orbiting satellite, Geostationary and polar satellites, Weightlessness. Work, Power, Energy, Conservation of Energy and Transformation of Energy, Renewable and Non-Renewable sources of Energy, Impulse, Law of conservation of linear momentum, Potential Energy (PE), Kinetic Energy (KE). Relation between KE and Linear momentum. Notions of work and kinetic energy: The work-energy theorem, The work-energy theorem for a variable force, The conservation of mechanical energy, The potential energy of a spring, Power, Collisions, Circular Motion, uniform circular motion, angular displacement, angular velocity, and angular acceleration, relationship between linear velocity and angular velocity, centripetal and centrifugal force, torque, couple, vector representation of torque, Vector product of two vectors, Equilibrium of a rigid body, Moment of inertia, Theorems of perpendicular and parallel axes, Dynamics of rotational motion about a fixed axis, Rolling motion. Simple harmonic motion and uniform circular motion, Velocity and acceleration in simple harmonic motion, Force law for Simple harmonic Motion, Energy in simple harmonic motion, Energy in simple harmonic motion, some systems executing Simple. Harmonic Motion, Damped simple harmonic motion, Forced oscillations and resonance Simple Pendulum, Law of conservation of energy in case of a simple pendulum. Elasticity - Elasticity and plasticity, stress and strain, Hooke's law, Moduli of elasticity. Fluid Mechanics Laws of Floatation, Principle of Buoyancy, pressure in a fluid. Stream line flow Bernoulli's theorem and its applications. Viscosity, Reynolds number, Surface tension, Simple Machines and Moments Moment of a Force, Wheel and Axle, Screw Jack, Gears, Friction, Causes of friction, advantages of friction, disadvantages of friction, methods of reducing friction, Fluid friction, Ball – Bering Principal.

#### **4. Ray and Optical Instruments**

Light - Sources & Nature of Light, Propagation of Light, Reflection, Refraction, Laws of Reflection, Sign convention for reflection by spherical mirrors, Image formed by Plane Mirror, Spherical Mirrors (Ray diagrams), Mirror formula and Magnification, Refraction of Light through Prism and lenses (convex, concave), Refractive index, Snell's Law, Refractive index of material of prism by minimum deviation Method, Image formation by lenses (Ray Diagrams), Sign convention for spherical lenses, Lens formula, Len's Makers formula and magnification, Power of lenses, Refraction of light through prism and Glass Slab, Dispersion of light and formation of Rainbow, Scattering of light – Raman Effect. Atmospheric refraction (Twinkling of stars, Advanced sunrise and delayed sunset), the Human eye and Colourful world, Structure of Human Eye Defects of Vision, Critical angle, Total Internal Reflection - Relation between Critical angle and Refractive Index, application of total internal reflection to Optical fibers, Lasers. Newton's Corpuscular Theory, Huygens' Wave Theory, Electromagnetic spectrum. Huygens' Explanation of Reflection, Refraction, interference and diffraction of plane waves at a plane surface. Polrisation Optical Instruments-Microscope, Telescope, Formula for magnification of microscope, Astronomical and Terrestrial Telescopes.

#### **5. Waves:** Transverse and longitudinal waves, Displacement relation in a progressive wave, The speed of a travelling wave, The principle of superposition of waves, Reflection of waves, Beats, Doppler effect, Characteristics of Sound, Speed of sound in different media, Reflection of sound, Echoes, standing waves, nodes & antinodes, measurement of wavelength, Multiple reflection of sound, its uses, Hearing and audibility of a sound, Ultrasound, uses, Sound -Propagation of sound, Musical

Instruments, Velocity of Sound in Gases, Solids & Liquids, Progressive & stationary waves. Forced Vibrations, Natural Vibrations – Resonance with examples, Loudness and pitch of sound their relation with amplitude and frequency, Audible and inaudible sounds, Noise and music, Noise pollution: sources, control and reduction.

## **6. Thermal Properties Of Matter**

Sources of Heat, Transmission of Heat, Heat and Temperature, Temperature and Kinetic Energy, Measurement of Temperature, Fahrenheit and Centigrade scales, Different types of thermometers, Effects of Heat Expansion of solids, liquids, gaseous, Change of state, Change of density with temperature, Examples in daily life, Applications of specific heat capacity, Evaporation, Condensation, Humidity, Dew and Fog, Boiling, Melting and Freezing. Expansion of Solids and liquids-coefficients of expansion of Solids and liquids. Anomalous expansion of water, its significance in nature. Kelvin scale of temperature, Boyle's and Charle's laws. Ideal gas equation. Heat capacity, specific heat, experimental determination of specific heat by method of mixtures. Specific heat of gas ( $C_p$  and  $C_v$ ), Calorimetry - specific heat of solids and liquids, latent heat of fusion and latent heat of vaporization, External work done by a gas during its expansion. Relation between  $C_p$  and  $C_v$  (derivation) Latent heat, Determination of latent heat of vaporization of water. Newton's law of cooling, Thermal equilibrium, Zeroth law of thermodynamics, Heat, internal energy and work, First law of thermodynamics, Specific heat capacity, Thermodynamic state variables and equation of State, Thermodynamic processes, Heat engines, Refrigerators and heat pumps, Second law of thermodynamics, Reversible and irreversible processes, Carnot engine, Carnot's theorem. Kinetic Theory, Introduction, Molecular nature of matter, Behaviour of gases, Kinetic theory of an ideal gas, Law of equipartition of energy, Specific heat capacity, Mean free path.

## **7. Electricity**

Electrostatics - Electrification by friction, Charges, Coulomb's Law: Permittivity of Free Space and Medium, Electric Field - Electric lines of force, their properties – Electric Flux, Electric Dipole, Dipole in a Uniform External Field, Continuous Charge Distribution, Gauss's Law, Application of Gauss's Law, Electric intensity, Electrostatic Potential, Relation between electrostatic potential and electric intensity. Capacitance and capacitors, The Parallel Plate Capacitor, Combination of Capacitors, Van de Graaff Generator, Dielectric constant, Condenser, its uses -Dielectric Strength - Effect of dielectric on capacitance of capacitors. Current electricity - Electric Current and Potential, EMF, Primary Cells-Series and Parallel connection-Electric circuits, Electrical Resistance, Ohm's Law and its verification, Electric shock. Ohmic and Non Ohmic elements, Resistance Resistances in Series and Parallel, Kirchhoff's Laws. Wheatstone Bridge, Meter Bridge, Potentiometer, Heating Effects of Electric Current-Joule's Law, Faraday's Laws of Electrolysis, Electric current - Flow of Electric charges in a metallic conductor - Drift velocity and mobility - Relation between electric current and drift velocity, Specific Resistance, Resistivity, Conductance, Electrical Energy – Power, Electrical Energy consumption.

## **8. Electromagnetism – Magnets and their properties, Magnetic field and field lines, Oersted's Experiment, Ampere's Law, Magnetic field near a long straight wire and magnetic field at the Center of a circular coil carrying current, Field on the axis of circular coil carrying current, Force on a moving charge in a magnetic field - Force on a current carrying conductor placed in a magnetic field. Force between two long straight parallel conductors carrying current, Definition of Ampere. Fleming's Left Hand Rule. Current loop as magnetic dipole, force and Torque on Current loop in an uniform**

magnetic field, magnetic dipole moment of a revolving electron. The Moving Coil Galvanometer, Electromagnetic induction, Magnetic Flux, Induced EMF, Faraday's and Lenz's Law. Fleming's Right Hand Rule, Self Inductance, Mutual Inductance, Principle of Transformer, Working of Electric motor, AC, Electric Generator, DC Electric Generator, Eddy Currents, Electromagnetic Waves, Displacement Current, Electromagnetic Waves, Electromagnetic Spectrum, AC Voltage Applied to a Resistor, Representation of AC Current and Voltage by Rotating Vectors — Phasors, AC Voltage Applied to an Inductor, AC Voltage Applied to a Capacitor, AC Voltage Applied to a Series LCR Circuit, Power in AC Circuit: The Power Factor, LC Oscillations.

9. **Modern Physics** - Alpha-particle Scattering and Rutherford's Nuclear Model of Atom, Atomic Spectra, Bohr Model of the Hydrogen Atom, The Line Spectra of the Hydrogen Atom, DE Broglie's Explanation of Bohr's Second Postulate of Quantization, Atomic Masses and Composition of Nucleus, Size of the Nucleus, Mass-Energy and Nuclear Binding Energy, Nuclear Force, Radioactivity, Nuclear Energy, Electron Emission, Photoelectric Effect, Experimental Study of Photoelectric Effect, Photoelectric Effect and Wave Theory of Light, Einstein's Photoelectric Equation: Energy Quantum of Radiation, Particle Nature of Light: The Photon, Wave Nature of Matter, Davisson and Germer Experiment, Classification of Metals, Conductors and Semiconductors, Intrinsic Semiconductor, Extrinsic Semiconductor, p-n Junction, Semiconductor diode, Application of Junction Diode as a Rectifier, Special Purpose p-n Junction Diodes, Junction Transistor, Digital Electronics and Logic Gates, Integrated Circuits, Elements of a Communication System, Basic Terminology Used in Electronic Communication Systems, Bandwidth of Signals, Bandwidth of Transmission Medium, Propagation of Electromagnetic Waves, Modulation and its Necessity, Amplitude Modulation, Production of Amplitude Modulated Wave, Detection of Amplitude Modulated Wave.
10. **Natural Phenomena** – Lightning: Charging by rubbing, Types of charges and nature of interaction of charged bodies, Transfer of charge: electroscope as a detector of charging, Lightning: discharge, earthing, lightning conductors, Safety measures during a thunder storm. Earthquake: Earthquake, Causes of an earthquake, Seismic fault zone, Protection to damage caused by earthquakes, Measurement of intensity of earthquake, Seismograph,
11. **Our Universe**: Constellations, Zodiac, Solar System, The Sun, Planets, Their Sizes, Masses and distance from Sun, Source of Energy, The Moon its phases surface, Stars, Meteors and Comets, Asteroids, Light year, Life on the Planet - Earth.
12. **States Of Mater – Physical Nature Of Matter** - Composition of matter: particles (Historical introduction), Characterization of matter in terms of physical properties, Characteristics of particles of matter: space between them, attraction between them, their continuous motion, States of matter: solids, liquids and gasses, Shape, mass, volume and density of matter, Change of state of matter with temperature and pressure, Evaporation and condensation: factors effecting the rate of condensation/evaporation-surface area, temperature, humidity, wind speed. Evaporation and cooling with examples. Mixtures, type of mixtures, homogeneous and hetero generous, Solution, components, properties, concentration, dilute and saturated Solutions, Mass / Mass percentage; Mass / volume percentage, Suspension, properties of suspensions, Colloidal solution, properties of colloids, Tyndall effect, Separating the components of a mixture, Separating components of blue / black ink, evaporation, Cream from milk by churning, centrifugation, Separating immiscible liquids, Separation by sublimation Separation by chromatography, Separation by distillation (miscible liquids), fractional distillation, Separating components of air, Obtaining pure copper sulphate from impure

samples Applications of crystallization, Water purification system in water works, Physical and chemical change, Types of pure substances, elements, compounds, Comparison between mixture and compounds **Solids-** Metals and Non-metals, Physical properties of metals, luster, malleability, electrical conductivity, ductility, sonorous, heat conductors, Physical properties of non-metals Chemical properties of metals - Metals burnt in air, Metal reacts with water, Reaction with acids, Reactions with solutions of other metal salt solutions, Reactivity series, Reactions of metals and non-metals – formation of cation, anion and ionic compounds, Properties of Ionic compounds, Physical nature, Melting and boiling points, Solubility Conduction of electricity, Occurrence of metals, Extractions of metals – General Principles Of Metallurgy Occurrence and Relative Abundance of metals in earth's crust, The Metallurgy of Iron & Extraction, Protection of Metals and Prevention of Corrosion, Principles and methods of extraction - concentration, reduction by chemical and electrolytic methods and refining. Reaction with oxygen, acidic, basic nature of products, Reaction with water, Reaction with acid, Reaction with Base, Reactivity of metals in displacement reactions, Uses of metals and non-metals – **FLUIDS-** Electric Conductivity of Fluids, determination of good and poor conducting fluids, Chemical effects of electric current, Electrolytic cell: its construction and electroplating: Measurable Properties of Gases, Gas Laws, Graham's law of diffusion - Dalton's law of partial pressures, Avogadro's law and Mole Concept, Ideal behavior, empirical derivation of gas equation, ideal gas equation, Kinetic molecular theory of gases, Kinetic gas equation (No derivation) - deduction of gas laws, Air, Composition of air, Measurement of Atmospheric Pressure, Air Pollution, Volumetric Composition of Water, Hardness of Water, Drinking Water and Supply, Water Pollution, Cyclone, Pascal's Law, Archimedes' Principle, Boyle's Law, Bernoulli's Principle, Wind, Rainfall.

**13. Atomic Structure:** Matter - Its Structure, Cathode Rays, Canal Rays, Discovery of Neutron, Atomic Models - Arrangement of Sub Atomic Particles, Rutherford's model of atom and its drawbacks, Bohr's model of Hydrogen atom and its limitations, Sommerfeld's elliptical model, Schrodinger wave equation, Sub Energy Levels - Quantum Numbers, Atomic Orbitals, Relative energies of the atomic orbitals, Electronic configuration of Atoms, Some Physical Quantities of Atoms, Nature of Electromagnetic Radiation, Planck's Quantum theory. Explanation of Photo electric effect. Features of Atomic Spectra. Characteristics of Hydrogen Spectrum. Bohr's explanation of Spectral Lines, Wave-particle nature of electron, De Broglie's hypothesis, Heisenberg's uncertainty principle, Important feature of the quantum mechanical model of an atom, Electronic configurations of atoms - Explanation of stability of half filled and completely filled orbitals. Isotopes, Isobars and Isotones, Applications of Radio Isotopes.

**14. Classification of Elements:** Symbols and formulae, Radicals and their formulae, Chemical equation, Meaning, Calculations based on equations and relationship of reactants and products by weights, History of Classification of Elements, The Periodic Law, Modern Periodic Table, The significance of atomic number and electronic configuration, Classification of elements into s, p, d, f blocks and their characteristics, Period trends in physical and chemical properties of elements, Periodic trends of elements with respect to atomic radii, ionic radii, inert gas radii, ionization energy, electron gain energy, electro negativity, Valency.

**15. Chemical Bonding And Molecular Structure:**

Types of Bonds, Inter Molecular Attractions, Energy changes during a chemical reaction, Exothermic and Endothermic Relations, ionic bond, Electronic theory

valence by Lewis and Kossel, energy changes in ionic bond formation, Properties of ionic Compounds, Covalent Bond, Multiple Covalent Bonds, Shapes of some molecules. VSEPR theory, The valence bond approach for the formation of covalent bonds, Directional nature of covalent bond, Properties of covalent bond, Different types of hybridization involving s, p and d orbitals and draw shapes of simple covalent molecules, Definition of coordinate covalent bond with examples, Description of molecular orbital theory of homo nuclear diatomic molecules. Hydrogen bonding-cause of formation of hydrogen bond- Types of hydrogen bonds-inter and intra molecular-General properties of hydrogen bonds.

**16. Chemical Kinetics, Energetics:** Chemical Calculations And Stoichiometry Chemical combination, Chemical decomposition, Chemical displacement, Chemical Double decomposition, Slow and Fast reactions, Rate of a Reaction, Factors affecting the reaction rate, Reversible and Irreversible Reactions, Law of conservation of mass, Law of definite proportions, Law of multiple proportions, Rate law, units of rate constant, Collision theory of reaction rates (elementary ideas), concepts of activation energy. Stoichiometry - Meaning of Chemical Equations, Thermochemical Equations, Problems Based on Equations, Laws of chemical combination, principles and examples, Different kinds of fuels burning with flame and without flame, Combustion of fuels, solid, liquid, gas, Ignition temperature, Matchstick – red , white phosphorous and antimony tri sulphide, ignition temperatures, Inflammable substances, Methods of controlling fire, fire extinguisher, Types of combustion, rapid, spontaneous, explosive. Flame, materials forming flames, structure of flame, Fuel, ideal fuel, fuel efficiencies, calorific value, Harmful products of burning fuels , global warming and acid rain. Molar mass, concept of equivalent weight with examples, Percentage composition of compounds and calculations of empirical and molecular formula of compounds, Oxidation number concept, Balancing of redox reactions by ion electron method and oxidation number method, Types of redox reactions, Applications of redox reactions in titrimetric quantitative analysis and redox reactions in electrode process, Numerical calculations based on equations. Equilibrium - Differences between Physical and Chemical change, Equilibrium in physical and chemical process, Dynamic nature of equilibrium, law of mass action, Equilibrium Constant, Factors affecting equilibrium.

**17. Solutions, Acids, And Bases:**

Solutions, Types, Solubility and Factors affecting concentration of solutions, Ionization of Substances in Water, Classification of solutions - Methods of expressing concentration of solutions - Molarity, Normality, Molality, Mole Fraction, Preparation of Acids and Bases, General properties of Acids an Bases, The Strengths of Acids and Bases, Neutralisation and Heat of Neutralization, Ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionic product of water, Concept of pH., pH of some common fluids, Importance of pH in everyday life, Sensitive of plants and animals to pH, pH of soils, pH in digestive system, pH-tooth decay, Self defense by animal and plants through chemical warfare. Some naturally occurring acids. Salts - Family of salts, pH of salts, Sources of common salt, Common salt – a raw material for chemicals, NaOH, Bleaching powder, baking soda,  $\text{NaHCO}_3$  uses washing soda and its uses, Salt crystals / crystallization, Plaster of Paris, Equilibrium in Physical process, Equilibrium in chemical process - Dynamic Equilibrium, Law of chemical Equilibrium - Law of mass action and Equilibrium constant. Homogeneous Equilibria, Equilibrium constant in gaseous systems. Relationship between  $K_p$  and  $K_c$ , Heterogeneous Equilibria. Applications of Equilibrium constant. Relationship between Equilibrium constant  $K$ , reaction quotient  $Q$  and Gibbs energy  $G$ . Factors affecting Equilibria.-Le-chatlieprinciple application to industrial synthesis of Ammonia and Sulphur trioxide. Acids, bases and salts- Arrhenius, Bronsted-Lowry and Lewis

concepts of acids and bases. Ionisation of Acids and Bases -Ionisation constant of water and it's ionic product- pH scale-ionisation constants of weak acids-ionisation of weak bases-relation between  $K_a$  and  $K_b$ -Di and poly basic acids and di and poly acidic Bases-Factors affecting acid strength-Common ion effect in the ionization of acids and bases-Hydrolysis of salts and pH of their solutions. Buffer solutions-designing of buffer solution-Preparation of Acidic buffer Solubility Equilibria of sparingly soluble salts. Solubility product constant Common ion effect on solubility of Ionic salts.

### **18. Hydrogen And Its Compounds**

Position of hydrogen in the periodic table. Dihydrogen-Occurance and Isotopes. Preparation of Dihydrogen, Properties of Dihydrogen, Hydrides: Ionic, covalent, and non-stoichiometric hydrides. Water: Physical properties; structure of water, ice. Chemical properties of water; hard and soft water, Temporary and permanent hardness of water, Hydrogen peroxide: Preparation; Physical properties; structure and chemical properties; storage and uses. Heavy Water, Hydrogen as a fuel.

### **19. S - Block Elements**

Alkali metals; Electronic configurations; Atomic and Ionic radii; Ionization enthalpy; Hydration enthalpy; Physical properties; Chemical properties; Uses, General characteristics of the compounds of the alkali, metals: Oxides; Halides; Salts of Oxy Acids. Anomalous properties of Lithium: Differences and similarities with other alkali metals. Diagonal relationship; similarities between Lithium and Magnesium. Some important compounds of Sodium: Sodium Carbonate; Sodium Chloride; Sodium Hydroxide; Sodium hydrogen carbonate. Biological importance of Sodium and Potassium. Alkaline earth elements; Electronic configuration; Ionization enthalpy; Hydration enthalpy; Physical properties, Chemical properties; Uses. General characteristics of compounds of the Alkaline Earth Metals: Oxides, hydroxides, halides, salts of Oxyacids (Carbonates; Sulphates and Nitrates). Anomalous behavior of Beryllium; its diagonal relationship with Aluminum. Some important compounds of calcium: Preparation and uses of Calcium Oxide ; Calcium Hydroxide; Calcium Carbonate;Plaster of Paris; Cement. Biological importance of Calcium and Magnesium.

### **20. P - Block Elements**

General introduction - Electronic configuration, Atomic radii, Ionization enthalpy, Electro negativity; Physical & Chemical properties. Important trends and anomalous properties of boron. Some important compounds of boron - Borax, Ortho boric acid, diborane. Uses of boron, aluminium and their compounds. General introduction - Electronic configuration, Atomic radii, Ionization enthalpy, Electro negativity; Physical & Chemical properties. Important trends and anomalous properties of carbon. Allotropes of carbon. Uses of carbon. Some important compounds of carbon and silicon – carbon monoxide, carbon dioxide, Silica, silicones, silicates and zeolites.

### **21. Organic Chemistry**

Allotropic forms of Carbon, Oxides of Carbon, Uniqueness of Carbon and Source of Carbon Compounds, Anomalous behavior of first element namely Carbon, Carbon-catenation, allotropic forms, physical and chemical properties and uses, Bonding in carbon, Covalent bond, Catenation, Saturated and unsaturated carbon compounds, Chains, branches and rings, Bonding of carbon with other elements, Functional groups in carbon compounds, Homologous series. Nomenclature of carbon compounds, Chemical properties of carbon compounds, Combustion, Blue flame, Sooty flame, Oxidation, Addition reaction, Substitution reaction, Important carbon compounds, Ethanol, Ethanoic acid, properties of ethanol – General properties,



reaction of ethanol with sodium, reaction with hot concentrated sulphuric acid, Properties of ethanoic acid – General properties. Esterification reaction, Reaction with a base, sodium hydroxide, sodium carbonate and sodium hydrogen carbonate, Soaps and detergents, Micelles. . Classification and nomenclature, Nature of C-X bond, Methods of preparation : Alkyl halides and aryl halides-from alcohols, from hydrocarbons (a)by free radical halogenation -(b) by electrophilic substitution (c) by replacement of diazonium group(Sand-Meyer reaction) (d) by the addition of hydrogen halides and halogens to alkenes-by halogen exchange(Finkelstein reaction), Physical properties-melting and boiling points,density and solubility, Chemical reactions, Reactions of haloalkanes (i)Nucleophilic substitution reactions (a)  $S_N2$  mechanism (b)  $S_N1$  mechanism (c) stereochemical aspects of nucleophilic substitution reactions -optical activity (ii) Elimination reactions (iii) Reaction with metals-Reactions of haloarenes: (i) Nucleophilic substitution (ii)Electrophilic substitution and (iii) Reaction with metals, Polyhalogen compounds: Uses and environmental effects of dichloro methane, trichloromethane, triiodomethane, tetrachloro methane, freons and DDT. Alcohols,phenols and ethers –classification, Nomenclature: (a)Alcohols, (b)phenols and (c)ethers, Structures of hydroxy and ether functional groups, Methods of preparation: Alcohols from alkenes and carbonyl compounds- Phenols from haloarenes, benzene sulphonic acid, diazonium salts, cumene, Physical properties of alcohols and phenols, Chemical reactions of alcohols and phenols (i) Reactions involving cleavage of O-H bond-Acidity of alcohols and phenols, esterification (ii) Reactions involving cleavage of C-O bond-reactions with HX,  $PX_3$ , dehydration and oxidation (iii) Reactions of phenols-electrophilic aromatic substitution, Kolbe's reaction, Reimer - Tiemann reaction, reaction with zinc dust, oxidation, Commercially important alcohols (methanol,ethanol), Ethers-Methods of preparation: By dehydration of alcohols, Williamson synthesis- Physical properties-Chemical reactions: Cleavage of C-O bond and electrophilic substitution of aromatic ethers. Nomenclature and structure of carbonyl group, Preparation of aldehydes and ketones-(1) by oxidation of alcohols (2) by dehydrogenation of alcohols (3) from hydrocarbons -Preparation of aldehydes (1) from acyl chlorides (2) from nitriles and esters(3)from hydrocarbons-Preparation of ketones(1) from acyl chlorides (2)from nitriles (3)from benzene or substituted benzenes, Physical properties of aldehydes and ketones, Chemical reactions of aldehydes and ketones-nucleophilic addition, reduction, oxidation, reactions due to -Hydrogen and other reactions (Cannizzaro reaction,electrophilic substitution reaction), Uses of aldehydes and ketones, CARBOXYLIC ACIDS, Nomenclature and structure of carboxylgroup, Methods of preparation of carboxylic acids- (1)from primary alcohols and aldehydes (2) from alkylbenzenes(3)from nitriles and amides (4)from Grignard reagents (5) from acyl halides and anhydrides (6) from esters, Physical properties, Chemical reactions: (i) Reactions involving cleavage of OH bond-acidity, reactions with metals and alkalies (ii) Reactions involving cleavage of C-OH bond-formation of anhydride, reactions with  $PCl_5$ ,  $PCl_3$ ,  $SOCl_2$ , esterification and reaction with ammonia (iii) Reactions involving -COOH group-reduction, decarboxylation (iv) Substitution reactions in the hydrocarbon part - halogenation and ring substitution, Uses of carboxylic acids. Structure of amines, Classification, Nomenclature, Preparation of amines:reduction of nitro compounds, ammonolysis of alkyl halides, reduction of nitriles,reduction of amides, Gabriel phthalimide synthesis and Hoffmann bromamide degradation reaction. Physical properties, Chemical reactions:basic character of amines, alkylation, acylation, carbyl amine reaction, reaction with nitrous acid, reaction with aryl sulphonyl chloride, electrophilic substitution of aromatic amines-bromination,

nitration and sulphonation. DIAZONIUM SALTS - Methods of preparation of diazonium salts (by diazotization), Physical properties. Chemical reactions: Reactions involving CYANIDES AND ISOCYANIDES - Structure and nomenclature of cyanides and isocyanides, Preparation, physical properties and chemical reactions of cyanides and isocyanides

## 22. Polymers:

Classification of Polymers -Classification based on source, structure, mode of polymerization, molecular forces and growth polymerization. Types of polymerization reactions-addition polymerization or chain growth polymerization-ionic polymerization, free radical mechanism-preparation of addition polymers-polythene, teflon and polyacrylonitrile-condensation polymerization or step growth polymerization-polyamides-preparation of Nylon 6,6 and nylon 6-poly esters- erylene - bakelite, melamine, formaldehyde polymer- copolymerization-Rubber-natural rubber-vulcanisation of rubber-Synthetic rubbers-preparation of neoprene and buna-N. Molecular mass of polymers-number average and weight average molecular masses-poly dispersity index (PDI). Biodegradable polymers-PHBV, Nylon 2-nylon 6. Polymers of commercial importance-poly propene, poly styrene,poly vinyl chloride(PVC), urea-formaldehyde resin, glyptal, bakelite- their monomers, structures and uses. Natural and artificial fibres, Synthetic fibre, Types of synthetic fibres - Rayon, Nylon, Polyester and acrylic, Characteristics of synthetic fibres, Plastics, polythene, Thermo plastics, Thermo setting plastic, Plastics as materials of choice: Non-reactive, light, strong and durable and poor conducting plastics, Plastics and environment – Bio degradable, non-bio degradable. Carbohydrates - Classification of carbohydrates-Monosaccharides: preparation of glucose from sucrose and starch- Properties and structure of glucose- D,L and (+), (-) configurations of glucose- Structure of fructose Disaccharides: Sucrose- preparation, structure-Invert sugar- Structures of maltose and lactose-Polysaccharides: Structures of starch cellulose and glycogen- Importance of carbohydrates. Aminoacids: Natural aminoacids-classification of aminoacids -structures and D and L forms-Zwitter ions Proteins: Structures, classification, fibrous and globular- primary, secondary, tertiary and quaternary structures of proteins- Denaturation of proteins. Enzymes: Enzymes,mechanism of enzyme action. Vitamins: Explanation-names- classification of vitamins - sources of vitamins-deficiency diseases of different types of vitamins. Nucleic acids: chemical composition of nucleic acids ,structures of nucleic acids, DNA finger printing biological functions of nucleic acids. Hormones: Definition, different types of hormones, their production, biological activity, diseases due to their abnormal activities.

## 23. Chemistry In Everyday Life

Drugs and their classification: (a) Classification of drugs on the basis of pharmacological effect(b) Classification of drugs on the basis of drug action (c) Classification of drugs on the basis of chemical structure (d) Classification of drugs on the basis of molecular targets. Drug-Target interaction-Enzymes as drug targets(a) Catalytic action of enzymes (b) Drug-enzyme interaction Receptors as drug targets. Therapeutic action of different classes of drugs: antacids, antihistamines, neurologically active drugs: tranquilizers, analgesics-non-narcotic,narcotic analgesics, antimicrobials-antibiotics,antiseptics and disinfectants- antifertility drugs. Chemicals in food-artificial sweetening agents, food preservatives, antioxidants in food. Cleansing agents-soaps and synthetic detergents.

## **24. Environmental Chemistry:**

Sources of energy, Conventional sources of energy, Fossil fuels, Petroleum formation, refining of petroleum, constituents of petroleum, Natural gas, Petrochemicals, Thermal power plant, Hydro power plants, Improvements in the technology for using conventional sources of energy, Bio-Mass, Wind energy, Alternative or non-conventional sources of energy, Solar energy, Energy from sea, Tidal energy, Wave energy, Ocean thermal energy, Geothermal energy, Nuclear energy, Environmental consequences of production and consumption of energy, Sustainability of energy sources. Pollution: Air, Water and Soil Pollution, Oxides of Carbon, Carbon Monoxide, Oxides of nitrogen and Sulphur, Chlorofluro carbons, Chemical reactions in atmosphere, smogs, major atmospheric pollutants, acid rain, Ozone and its reactions, effects of depletion of ozone layer, Green house effect and global warming, Pollution due to industrial wastes, Green chemistry as an alternative tool for reducing pollution with two examples.

## **Biology Content (Marks: 20)**

- 1. Biological Sciences:** Importance and Human Welfare, Branches of Biology, Biologists.
- 2. Living World:** Life and its Characteristics, Classification of Living Organisms, Nomenclature, different types of classification. Need for classification, Biological classification levels and Hierarchy of classification, species concept. Animal diversity, invertebrates, Chordates.
- 3. Microbial World:** Virus, Bacteria, Algae, Fungi and Protozoan, Useful and Harmful Micro-organisms. Immunity, vaccination, Immunological disorders. Infections, life style diseases.
- 4. Cell & Tissues:** Cell – Structure cell theory , cell organelles and their functions, differences between prokaryotic and Eukaryotic cells, plant cell and animal cell, cell cycle, cell division , Mitosis and Meiosis, tissues, structure, functions and types of plant and Animal tissues, Cancer biology, stem cells. Transportation of materials through the cells. Internal organization of plants, histology - anatomy of flowering plants.
- 5. Plant World :** Morphology of a Typical Plant - Root, Stem, Leaf, Flower, Inflorescence, Fruit - their Structure, Types and Functions, Parts of a Flower, Seed dispersal Modifications of Root, Stem and Leaf, Photosynthesis, Transpiration, Transportation in plants (Ascent of Sap), Respiration, Excretion and Reproduction in Plants, Plant Hormones, food from the plants. Economic importance of Plants, Wild and Cultivated Plants, Agricultural Operations, Crop diseases and Control measures, Improvement in Crop yield, Storage, Preservation and Protection of Food and Plant Products. Single cell proteins (SCP), plant enzymes, mineral nutrition, plant growth and development.
- 6. Animal World:** Organs and Organ Systems including man - Their Structure and Functions Digestive, Respiratory in human, type studies of the animals. Circulatory, . Immunology, Excretory, Locomotion in protozoa and humans - Muscular, Skeletal Systems, Nervous, Control and Coordination and Reproductive: Sexual, a sexual fission, syngamy, conjugation. Reproductive health – Birth control methods, Sense Organs: Structure and Functions of Eye, Ear, Nose, Tongue and Skin. Nutrition in man - Nutrients and their functions, Balanced Diet, Deficiency diseases, Health - Tropical diseases (Viral, Bacterial, Protozoan, Helminth, Arthropod), Skin diseases (Fungal), Blindness in man: Causes, Prevention and Control, Health agencies, First Aid - Bites:

Insect, Scorpion and Snakes, Fractures, Accidents, Life skills, Wild and Domesticated animals, Economic Importance of Animals, Animal Husbandry - Pisciculture, Sericulture, Poultry, Breeding of Cows and Buffaloes, animal behavior.

7. **Heredity and Evolution:** Terms, Mendel laws, Sex determination in humans, Inheritance of Blood Groups, Erythroblastosis foetalis, Theories of Evolution, Speciation, Evidences of Evolution, Human Evolution, sex linkage, genetic disorders, syndromes, human genome project, evolutionary forces, DNA and finger printing.
8. **Our Environment – Ecology:** Abiotic and Biotic factors of Ecosystems, Ecosystem - Types, components, adaptations, Food chains, Food web and Ecological pyramids, Natural Resources  
- Type of water managements, soil waste land management, forests, sustainable development, fossil fuels and bio fuels, 4Rs, bio-geo-chemical cycles, pollution, air, water, soil, global environmental issues – global warming – (Green House Effect), acid rains and depletion of Ozone layer; Population - interaction in Eco-system, plant ecology.
9. **Recent Trends in Biology:** Hybridization, Gene - Genetic material, DNA , RNA, Genetic Engineering, Gene Bank, Gene Therapy, Tissue Culture and Bio-Technology – applications. Transgenic animals and plants, cloning, molecular diagnosis, bio medical technology, bio molecules, molecular biology.
10. **Biodiversity – Conservation:** Biodiversity – levels of bio diversity, conservation, wild life, sanctuaries, national parks in India, importance of species, diversity to the Ecosystem.

## V. Methodology (Marks: 20)

1. The Nature of Science: Nature and scope of science, Science, ideology and Society, Structure of Science (a) Substantive structure - Empirical knowledge, Theoretical Knowledge - (Facts, Concepts, hypothesis, theory, Principle Law), (b) Syntactic Structure of Science - Scientific inquiry, Processes of Science, Attitudes of inquiry
2. The History and Development of Science: A brief introduction to oriental and western science, Contribution of the following Scientists in the Development of Science: Aryabhatta, BhaskaraCharya, Aristotle, Copernicus, Newton, Einstein, C.V.Raman, Various organizations working for the development of science in India
3. Aims and Values of teaching Sciences: Aims of teaching Sciences, Values of teaching Science, Correlation of Science with other subjects
4. Objectives of teaching Sciences: Meaning and importance of objectives, Bloom's Taxonomy of Educational objectives, Specific / Behavioral objectives / (Instructional objectives), Critique on Bloom's Taxonomy
5. Approaches and Methods of teaching Sciences: Inductive and Deductive Approaches, Micro Teaching, Team Teaching, Lecture Method, Lecture cum Demonstration Method, Historical Method, Heuristic Method, Project Method, Laboratory method, Problem Solving Method, Scientific Method, Multimedia Approach in Teaching Learning process, Programmed Learning, CAI and CAL
6. Planning for effective instruction in Science: Year Plan, Unit Plan, Lesson Plan, Learning experience, characteristics, classification, source and relevance.
7. Teaching Learning Material (TLM): Characteristics and Importance of TLM, Classification and Types of TLM, Hardware and Software in TLM, TLM-Principles to be followed, Edgar Dale's cone of learning experience.

8. Science laboratories: Importance of Practical work in science, Planning of Science laboratories, Procurement, care and maintenance of laboratory equipment, Registers, Management of safety and science kits, Development of improvised Apparatus.
9. Physical Science Curriculum: Principles of Curriculum Construction, Defects in the existing school science curriculum, Qualities of a good Science Text Book.
10. Non-formal Science Education: Science Clubs, Science Fairs - purposes, levels, organization, advantages, Science Library, Role of NGOs and State in popularizing Science
11. Evaluation: Concept and Process of Evaluation, Tools of Evaluation, Preparation of Scholastic Achievement Test (SAT), Analysis and interpretation of Scores.