

# CHEMISTRY

## PAPER I

**Unit I : Wave Particle Duality :** Particle nature of electromagnetic radiation, photoelectric effect, photon, wave nature of electron, X-ray and electron diffraction; de Broglie's hypothesis, Atomic orbitals, quantum numbers and electronic configuration of atoms.

**Unit II : Nature of Chemical Bonding :** Ionic bond-crystal lattice, lattice energy, Bond Haber cycle, ionic radii, Fajan's rule and polarization, Covalent bond. Molecular orbitals—LCAO-MO approach-bonding, antibonding and non bonding orbitals. Hybridization, Bonding and physical properties—solubility, melting point, boiling point and thermal decomposition.

**Unit III : Gaseous State of Matter :** Gas laws and behaviour of ideal gases, Kinetic molecular theory of ideal gases, Molecular speeds and their distribution, Deviation from ideal behaviour real gases, causes deviation, Van der Waal's equation of state of real gases, critical constants, equation of corresponding states, Collision number and mean free path, Heat capacity of gases. Determination of molecular weights of gases.

**Unit IV : Chemical Thermodynamics I :** Zeroth Law, Concept of temperature, Basic thermodynamics concept-system, surroundings, universe, closed and isolated systems, Thermodynamic functions of states and variables, The second law of thermo dynamic Concept of entropy reversible and irreversible processes and entropy, The chemical potential.

**Unit V : Chemical thermodynamics II :** Energy and the first law of thermodynamics, Properties of the energy, Changes in energy in relation to changes in properties of the system,  $C_p$  and  $C_v$  joule Thompson effect, Application of first law of the thermodynamic to chemical reaction, The heat of reactions and enthalpy, Partial molar quantities, Gibb's energy.

**Unit VI : Properties of Liquids and Solids :** Condensed phases, liquefaction of gases, liquefaction of air, Coefficients of thermal expansion and compressibility, Heats of fusion, vaporisation and sublimation, Vapour pressure, surface tension and viscosity, Capillary action, Structural differences between solids, liquids and gases.

**Unit VII : Systems of variable composition :**

### **Chemical Equilibrium :**

The Gibb's energy of a mixtures, the chemical potentials of pure ideal gas, chemical potential of an ideal gas in a mixtures of ideal gases, Chemical equilibrium in a mixture. The chemical equilibrium in a mixtures of ideal gases, Chemical equilibrium in mixture of real gases. The equilibrium constants  $K_x$  and

$K_c$ , The temperature dependence of the equilibrium constant, Chemical reactions and the entropy of the universe, The Gibb's Duhem equation.

**Unit VIII : The Ideal Solution and the Colligative properties :**

Kinds of solution, definition of ideal solution, Colligative properties, The freezing point depression. Solubility elevation of the boiling points, Osmotic pressures, Raolt's Laws and determination of molecular weights based on colligative properties.

**Unit IX : Chemical Kinetics :** Rate Laws, Order and molecularity of chemical reactions. Determination of a order of a reaction, Dependence of rate of reaction on temperature, Consecutive and complex reaction, Free radical reactions mechanisms, Reactions in solution. Catalysis-Acid base catalysis, Enzyme catalysis, The activation energy and the collision theory of reaction rates, Unimolecular reaction, The theory of absolute reaction rates.

Gibb's energy and entropy of activation, Reactions in solution- ionic reactions, salt effects.

**Unit X : Surface Phenomena :** Surface energy and surface tension, Magnitudes of surface tension, Measurement of surface tension, Thermodynamic formulation, Bubbles, Liquid and solid interfaces, Surface tension and absorption, Surface films, Absorption and solids, Physical absorption and Chemical absorption, Colloids and colloidal properties, Colloidal electrolytes, Soaps and detergents, Emulsions and foams.

Text Book : 1. S. R. Palit : Physical Chemistry.

2. G. W. Castellan : Physical Chemistry.

Narosa Publishing House.

## CHEMISTRY

### PAPER -II

#### INORGANIC AND ORGANIC CHEMISTRY

**Unit I : Structure of the Atom :** Important sub atomic particles, Bohr's model of the hydrogen atom. Sommerfelds modification. Qunatum numbers and orbitals. Pauli's exclusion principle electronic configuration of atoms. Hund's rule. Aufbau principle. Dual nature of matter and radiations, de Broglies relationship, Heisenberg's uncertainly principle, Schrodinger's wave equation and quantum mechanical description of an atom, Significance of quantum numbers.

**Unit II : Periodic Laws and Periodic Properties of Elements :** Short and long forms of periodic tables. The modern classification of elements into 18 groups, types of elements based on electronic configuration. Periodicity of properties valency, atomic size ionization energy, electron affinity, electronegativity, density, melting and boiling points, General group study, Position of hydrogen in the periodic table.

The noble gases, The transition elements properties in relation to electronic configuration.

**Unit III : Acids and Bases :** Modern theories of acids and bases, Lewis concept, Bronstead and Lowry concept, Oxidation, reduction, reactions, Balancing of redox reactions by ion electron and oxidation number methods, The reactions of potassium permanaganate, potassium dichromate and potassium iodate per acids and per salts.

**Unit IV : Radio-activity :** Natural and artificial radio-activity. Laws of radio active disintegration, disintegration, series nuclear stability, packing fraction, binding energy, nuclear fission and fusion. Isotopes— principles of separation and uses.

**Unit V : Metals and non-metals :** Metals-occurrence, general principle and technique, used in metallurgy, Alloys, Properties and uses of alloys, Intermetallic compounds, Corrosion and protection of metals, Studies of non metals, Atomic structure and periodic, Studies of non metals, Atomic structure and periodic classification of non metal. Allotropes of oxygen, sulphur, carbon and phosphorus, Differences in properties of metals and non metals, Metalloids, Oxides, oxyacids and hydrides. Classification and general properties.

**Unit VI : Complex and Double salts :** Warner's theory of coordination compounds, coordination number, Role of coordination compounds in analysis.

**Unit VII : The Chemistry of Carbon Compounds :** Carbon and hydridization, Hydrocarbons, Classes of organic compounds, Nomenclature of carbon compounds Stereochemistry of carbon, Homologous series, Isomerism in carbon compounds, Stereo-chemistry of carbon compounds, Asymmetric synthesis.

**Unit VIII : Hydrocarbons :** Alkanes, Alkenes, alkynes and arynes, General methods of preparation and general properties, Alicyclic and heterocyclic compounds. Aromaticity—aromatic antiaromatic and non aromatic compounds, Polynuclear hydrocarbons naphthalene and anthracene.

**Unit IX : Derivative of Hydrocarbons :** Functional groups and introduction of functional groups in hydrocarbons. Alcohols and phenols, Halogen derivatives, alderhydes and ketones, Nitro, Nitroso, Amino, azo, azoxy and hydrozo derivatives. Acids and multifunctional derivatives, Preparation, properties and uses of the derivatives, Oils and fats Vitamins and Hormones, Antibiotics (general idea).

**Unit X : Carbohydrate, Proteins Dyes and Polymers :** Carbohydrate- Classification- monosaccharides, disaccharides and polysaccharides (glucose, sucrose and starch), configuration D and L, configuration of glucose, Mutarotation and epimerization, ring structures of glucose, Starchs and polypeptide unite in protein, classification of proteins, simple and conjugated proteins, Dyes — Colour and constitution of dyes, Classification, azo and triphenyl methane dyes, Dyeing of fabrics, Polymers and polymerization, Classification of polymers. Synthetic fibres — nylon, decron and polyester, Plastics and their uses, Scopes of polymer industries in Assam.

Text Book : 1. Organic Chemistry : P. L. Soni

2. Text Book of Inorganic Chemistry: A. K Dey

3. Basic Inorganic Chemistry : F. A. Cotton.