Chemistry

General Chemistry

- **Atomic Structure**

Bohr`s theory and its limitation, Debroglie equation, Heisenberg`s principle of uncertainty, Pauli`s exclusion principle, Hund`s rule of maximum multiplicity, Aufbau principle.
-Planck`s quantum theory- Wave- Particl duality.
-Schrodinger wave equation.
-Angular momentum, quantisation of electronic energies (qualitative treatment of hydrogen atom)

- Periodicity in properties of atoms: Atomic and Ionic radii, Ionisation potential, Electronaffinity, Electronegativity, Hydration energy, Lattice energy.
- Chemical bonding: Valence bond theory, Hybrdization, valence shell electron pair repulsion theory (VSEPR) M O theory- molecular orbital diagram of homo and heteronuclear diatiomic molecules.
- General properties of s-and p block elements.
- Chemical effects of unclear transformation- Nuclear fissionand fusion. Radioactive isotopes and their applications.
- Electronic displacement- Inductive, Electromeric and Mesomeric effects, Resonance and its application to organic compounds. Conjugation and hyper-conjugation.
- Oxidation- Reduction, Oxidising and Reducing agents Balancing of redox reactions.
- Concepts of acids and bases- Bronsted -Lowry theory, Lewis concept of acids and bases. Hard and fast acid and bases.
- Polymers: Definition and classification of polymers, properties of polymers with special reference to polyethene, polyvinyl chloride.
- Pollutants and their influence of environment, Chemical toxicology.
- **Symmetrty and Group Theory**: Symmetry elements and symmetry operations, definition of group and sub-groups, paint symmetry groups assignment of point groups of molecules like NH_3, H_2O, PCl_5 and XeF_4.

Inorganic Chemistry

- Chemistry of Transition elements- General Characterstics: variable oxidation states, colour, complex formation, magnetic and catalytic properties.
- Chemistry of lanthanides and actinides, lanthanide contraction. Oxidation states. Spectral and magnetic properties. Principle of separation and isolation.
- Coordination Chemistry- IUPAC system of nomenclature of complex compounds, lsomerism, valence bond theory and its limitation. Crystal field theory: d--orbital splitting in octahedral and tetrahedral complexes, weak and strong field octahedral complexes, spectrochemical series. Electronic spectra of d-block elements. Complexes, selection rules for electronic transitions. Spectroscopic ground states for d` to d_9 systems.
- Main Group Elements and their Chemistry- Oxyacids of nitrogen, phosphorus and sulphur, Interhalogens and pseudohalides, Noble gas compounds, boranes, carboranes borazines and posphazines, silicates and silicones,
- Organometallic Chemistry- Synthesis, Structure and bonding of organometallic compounds, Homogeneous catalytic reaction Pi-acid metal complexes.
- **Bio-inorganic and Supramolecular Chemistry**

Essential and trace elements in biological processes, Haemoglobin and myoglobin, Biological role of alkali and alkaline earth metals withs pecial reference to
Ca_{2+}, Photosynthesis and Nitrogen fixation.
Supramoleculor Chemistry: introduction and nomenclature of supramolecules, molecular recognition and carrier design.

Organic Chemistry

Stereochemistry: Conformational analysis of cycloalkanes, elements of symmety, chirality, molecules with more than one chiral centre. Optical purity. Enantiotropic and diastereotropic atoms, optical activity in the absence of chiral carbon.
Nucleophilic aromatic substitution: aromatic SN_1, and SN_2, mechanishm, leaving group and attacking nucleophile, evidences of neighbouring group participation, classical versus non-classical cabonium ion-the present status. Addition to carbon-carbon multipe bond, electrophilic, free radical and

nucleophilic addition.Esterification and hydrolysis of esters: evidence for tetrahedral intermediate, BAC_2 and AAC_2 mechaniism and elimination reaction: the E_1, E2 and E CBmechanisms, Hoffmann versus Sadytizeff elimination, competition between elimination and substitution reaction.

Heteroeyelic Chemistry: Hseterocyclic compounds with five and six memberedring-Pyraxoles, imidazoles, Pyrdine and quinoline, applications of heteroeyelic compounds- caffine, diazepam and phenothiazines.

Pericyclic reactions: Molecular orbital symmentry, frontier orbital of ethylene, woodword- Hoffmann correlation diagrams, cycloaddition, unctional tautomerism Eneeaction.

Photochemistry of aromatic compounds: ring isomerisation and cyclisation reactions, Photochemistry of carbonyl compounds, intramolecular and intermolecullar hydrogen abstraction. Norrish cleavage (Type I and II)

Chemisry of natural products: Terpenes and alkaloids vitamins and Hormones-introduction of fat solouble and water soluble vitamins, functions of vitamin A,D,E,K Vitamin B-complex and vitamin C. Introduction. Classification and characteristics of hormones with special reference to thyroid hormones (thyroxin)

Moecules of life processes: Sugar, DNA and RNA enzymes-definition, classification and applications.

Physical Chemistry

Solid state Chemistry

Crystalline State of solids, unit cell, Bravais lattices, Miller indices, Diffraction of X-rays by crystalline solids, Crystal defects land non-stoi chiometry, Perfect and imperfect crystals, Frenkel and Schottky defects Properties of solids ionic conductvity and diffusion and ferroelectric properties. Electronic properties and band theory- band structure of metals. Semiconductors (extrinsic and intrinsic) n-p-junction, superconductors.

Surface phenomenon: Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetie, micelle and reverse micelle.

Chemical Equilibria: Le-chatelier`s principle and its application:

Free energy and entropy of mixing. Partial molar quantities, Gibbs-Duhem equation, Phase diagram of one and two component system and phase rule.

Thermodynamics

First law of thermodynamics, Heat capacites at constant volume and pressure and their relationship, joule-Thomson coefficient, calculation of w,q, dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Hess`s law of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, enthalpy of neutralization, bond energy and its calculation from thermo- chemical data.

Second law of thermodynamics- definition, Carnot cycle and efficiency. Concept of entropy, changes in ideal gases and mixing of gases.

Third Law of thermodynamics- statement and concept of residual entropy, Gibbs (G) and Helmholtz (A) Functions , thermodynamical quantities, variation of G and A with P, V and T.

Spectroscopy

Time- dependent states and spectroscopy, absorption and emission of radiations and selection rules, line shapes and widths.

Magnetic- resonance spectroscopy, principle and application, chemical shift and spin-spin coupling first order spectra of A3, X, AX and AMX system. Electronic spectroscopy of diatiomic molecules, rotational fine structures.

IR spectroscopy, symmetry properties and nuclear spin affect, Raman Effect, vibration of polyatomic molecules.

Electrochemistry

Quantitative treatment of Debye -Hukel theory of ion-ion interaction and activity coefficient. Thermodynamics of double layer. Determination of association constant (ka) from conductance data, Application of measurement of electrochemical rate constant.