Chemistry

1. **Atomic structure** and chemical bonding, Quantum theory, Heisenberg's uncertainty principle, Schrodingerwave equation (time independent), interpretation of the wave function, particle in a one-dimensional box, quantum numbers, hydrogen atom wave functions.

Shapes of s,p,d orbitals, ionic bond; Lattice energy, Born-Haber cycle, Fajans rules dipole moment, characteristics of ionic compounds, electronegativity differences, Covalent bond & its general characteristics, Valence bond approach, Concept of resonance and resonance energy, Electronic configuration of H_2-$2HN_2$ O_2P_2 NO.CO and HF molecules in terms of molecular orbital approach, Sigma and pi bonds, Bond order, bond strength & bond length.

2. **Thermodynamics** : Work, heat and energy, First law of thermo-dynamics, Enthalpy, heat capacity Relationship between Cp and Cv, Laws of thermochemistry, Kirchoff's equation Spontaneous and non-spontaneous changes, second law of thermodynamics, Entropy changes in gases for reversible and irreversible processes, Third law of thermodynamics, Free energy, variation of free energy of a gas with temperature, pressure and volumes, Gibbs Helmhottz equation,Chemical potential, Thermodynamic criteria for equilibrium, Free energy change in chemical reaction and equilibrium-Constants, effect of temperature & pressure on chemical equilibrium, calculation of equilibrium constants from thermodynamic measurements.

3. **Solid State** : Forms of solids, law of constancy of interfacial angles, Crystal systems and crystal classes (crystallographic groups) Designation of crystal faces, lattice structure and unit cell Laws of rational indices, Bragg's law, X-ray diffraction by crystals, Defects in crystals, Elementary study of liquid crystals.

4. **Chemical Kinetics** : Order and Molecularity of a reaction, Rate Equations(differential & integrated forms) of zero, first and second order reactions, half life

5. **Electrochemistry**: Limitations of Arrhenius theory of dissociation, Debye-Huckel theory of strong electrolytes and Its quantitative treatment, Electrolytic conductance theory and theory of activity co-efficient Derivation of limiting laws for various equilibria and transport properties of electrolyte solutions.

6. **Concentration Cells**: liquid junction potential, application of e.m.f. measurements of fuel cells.

7. **Photochemistry** : Absorption of light, lambert Beer's laws of photochemistry. Quantum efficiency, Reasons for high and low quantum yields, Photo-electric cells.

8. **General chemistry** of 'd' block elements.a) Electronic configuration, introduction to theories of bonding in transition, metal complexes, Crystal field Theory and its modifications, applications of the theories in the explanation of magnetism and electronic spectra of metal complexes.b) Metal Corbonyls : Cyclopentadienyl, Olefinand acetylene complexes. c) Compounds with metal-metal bonds and metal atom clusters.

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9. General Chemistry of f block elements : Lanthanides and actinides; Separations, Oxidation states, magnetic and spectral properties.

10. Reaction Mechanisms: General methods (both kinetic and non-kinetic) of study of mechanisms of organic reactions illustrated by examples, Formation and stability of reactive intermediates (Carbocations, carbanions, free radicals, carbenes, nitrenes and benaynes). SN1 and SN2 mechanisms - H1, H2 and E1 CB eliminations - cis and trans addition of carbon to carbon double bonds - mechanism of addition to carbon oxygen, double-Michael addition-addition to conjugated carbon-carbon double bonds-aromatic electrophilic and nucleophilic substitutions, allylic and benzylic; substitutions.

11. Pericyclic reactions : Classification and examples .- and elementary study of woodward - Hoffmann rules of pericyclic reactions.

12. Chemistry of the following name reactions : Aldol condensation, Claisen condensnation, Dieck men reaction, Perkin reaction, Reimer-Tiemann reaction, Cennizzaro reaction

13. Polymeric Systems :a) Physical Chemistry of Polymers, End group analysis, Sedimentation, Light Scattering and Viscosity of Polymers.b) Polythylene, Polystryene, Polyvinyl Chloride, Ziegler Natta Catalysis, Nylon, Terylene.c) Inorganic Polymeric systems; Phosphonitric halide compounds; Silicones; Borazines. - Meerwein and Beckmann rearrangements, and their mechanisms - uses of the following reagents in organic systhesis: 05 04 HI04, NBS, diborane, Naliquid -ammonia, NaBH4, LiA LH4.

14. Photochemical reactions of organic and inorganic compounds : Types or reactions and examples and synthetic uses-Methods used in structure determination; Principles and applications of UV,visible, IR, NMR and mass spectra for structure determination of simple organic and inorganic molecules.

15. Molecular Structural determinations : Principles and Applications to simple organic and in-organic Molecules.(i) Rotational spectra of diatomic molecules (infrared and Raman), isotopic substitutions and rotational constants,(ii) Vibrational spectra of diatomic linear symmetric, liner asymmetric and bent tri-atomic molecules (infrared and Raman).(iii) Specificity of the functional groups (Infrared and Raman).(iv) Electronic Spectra-Singlet and triplet states, conjugated double bonds, A aB unsaturated carbonyl compounds.(v) Nuclear magnetic Reasonance: Chemical Shifts, spin-spin coupling, (vi) Electron Spin Reasonance; Study of inorganic Complexes and free radicals.

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