

CHEMISTRY

Physical Chemistry:

Structure of atom, Quantum Theory, Hydrogen atom, valence Bond and Molecular orbital theories, variation and perturbation-symmetry. Laws of Thermodynamics, enthalpy, entropy, free energy. Ideal & non ideal solutions. Phase component systems. Colligative properties. Electrochemical cells, electrolytic cells. Kinetic theory of gases. Rates of chemical reactions, collision and transition state theory, photochemical reactions, catalysis. Solid state, Crystal system and lattices, Miller planes, crystal defects, ionic crystals, metals. Nuclear chemistry. Colloidal state. VSEPR theory, uncertainty principle, Schrodinger's equation. Chemical Equilibrium : Free energy and entropy of mixing partial molar quantities, Gibbs-Duhem equation, equilibrium constant, temperature dependence of equilibrium constant.

Inorganic Chemistry:

Reactions of simple and industrially important compounds, boranes, carboranes, silicones, diamond and graphite. Hydrides and oxoacids of N,P,S and halogens. Boron nitride, borazines, phosphazenes. Xenon compounds. Hard soft acid base concept. Spinels. Characteristics of d and f block elements. Coordination chemistry. Theories of metal ligand bonding. Metal carbonyls. Chemistry of Lanthanides and Actinides : Spectral and magnetic properties; use of Lanthanide compounds as shift reagents.

Organic Chemistry:

Reactions, Synthesis and mechanism involving- Alkanes, Alkenes, Alkynes, Arenes, Alcohols, Phenols, Aldehydes, Carboxylic acids & their derivatives, Halides, Ketones, Nitro compounds, Amines. Stereochemical and conformational effects on reactivity and specificity. Heterocycles. Carbohydrates, Proteins, Nucleic acids. Bio molecules.

Aromaticity: Huckel rule and concept of aromaticity ($4n + 2$) annulenes and heteroannulenes, fullerenes (C_{60}).

Chemistry of natural products : Familiarity with methods of structure elucidation and biosynthesis of alkaloids, terpenoids, steroids, carbohydrates and proteins.

Analytical Chemistry:

Volumetric analysis, gravimetric analysis, TGA, Optical analytical methods, electro analytical methods, spectroscopic methods-UV, Vis, IR, NMR, ESR, Mass, X-ray diffraction techniques. Separation techniques. Chromatographic techniques. Electro analytical Techniques : Voltametry, polarography, amperometry, coulometry and conductometry.

Industrial Chemistry:

Industrial aspects of plastics, rubbers, ceramics, glass, inorganic acids (HCl, H₂SO₄, H₃PO₄ etc.), corrosion, water, cement, fertilizers, alkalis and allied chemicals, pharmaceuticals, sugar, petrochemicals, pollution.

Statistics & Research Aptitude

Mean, median, mode, basic concepts of probability, coefficient of variance, standard error, standard deviation, and correlation and regression analysis. Student t-test, F-test, analysis of variance (ANOVA), data graphics and data interpretation. Principles and various models of statistical optimization techniques, optimization softwares.

National and international scenario of scientific research, literature reviewing, reference citation, scientific and research journals, impact valuation, research article and patent drafting, various scientific websites, abstracts.