

Foundation Course for PhD Candidates: CHEMISTRY

Basic Concepts: Atomic and molecular masses; Chemical Equation and stoichiometry.

States of matter: Gaseous State: Gas laws, Avogadro's hypothesis and gas equations; Kinetic Theory of Gases; Liquefaction, Critical Phenomena; Liquid State and Solid state.

Atomic Structure: Bohr's Model; de Broglie equation; Quantum Mechanical Model; Aufbau's Principle, Pauli's Exclusion Principles, Hund's Rule, Electronic Configuration; Bonding: Lewis structure, SEPR theory, hybridization, ionic, covalent and coordinate covalent bonds, bonding in solid state, MO theory, bond order and magnetic properties.

Solutions: Types, Units of concentration, Raoult's Law, colligative properties, abnormal molecular weights.

Chemical Energetics And Thermodynamics: Internal Energy, Enthalpy, Hess's Law, First & Second Laws of thermodynamics & applications; entropy, free energy; spontaneity of a chemical reaction.

Chemical Kinetics & Chemical Equilibrium: Rate and orders of a reaction; activation energy; catalyst; Rate law; physical & chemical equilibria; Le Chatelier's principle; acid base equilibrium; acids and bases; pH; buffers; solubility product.

Redox Reactions, Electrochemistry & Surface Chemistry: Electron Transfer Concepts of Oxidation and reduction; Electrochemical cells; emf; Nernst Equation; Molar conductivity; Kohlrausch's Law; Fuel Cells; Corrosion. Physical & Chemical adsorption isotherms; Colloids: Preparation & properties; Homogenous and Heterogenous Catalysis; Enzymes.

Periodic Properties, Chemical Families, Chemistry Of Non Metals & Metals: Modern Periodic Law; Ionization Energy, Electron Affinity, Atomic Radii, Valency, Trends in Groups and periods. Chemistry of s and p block elements; Alkali metals, Alkaline Earth metals, Boron, Carbon, Nitrogen, Oxygen Halogen and Noble gases families; Hydrogen: Position, Ortho para, Isotopes, hybrids; Oxygen, Water, Hydrogen peroxide, Hard & Soft water; Ammonia, Nitrogen oxides, Nitric acid; Boron, Boric Acid, Borax; Carbides, Allotropy of Carbon; Sodium, Magnesium, Copper, Silver, Zinc, Transition Metals, and Lanthanides: Extraction, properties and uses.

Co-Ordination Chemistry: Nomenclature, isomerism and bonding in coordination compounds; Werner's Theory.

Nuclear Chemistry: Radioactivity, Nuclear reactions, Radiocarbon dating, Radioactive series, Artificial Transmutation.

Organic Chemistry Fundamentals: Purification; detection and estimation of elements; Empirical and Molecular formulae, Classification, Functional Groups, IUPAC Nomenclature, Homolytic and Heterolytic Bond Fissions, Structural and Stereoisomerisms, Free radicals, Carbocations and carbanions; Substitution, addition, elimination and rearrangement reactions. **Hydrocarbons & Halo Alkanes & Halo Alkenes:** Alkanes, Alkenes and Alkynes, Halo alkanes & Halo alkenes: Preparation, properties and uses; Aromatic Hydrocarbons: Benzene, Structure, Resonance, Substitution in Benzene. Petroleum: Cracking, reforming, Octane number.

Organic Compounds Containing Oxygen, Nitrogen: Preparation properties and uses of Aromatic and aliphatic alcohols, Polyhydric alcohols, ethers, aldehydes, ketones, carboxylic acids and their derivatives; Cyanides, isocyanides, nitro compounds and amines. **SYNTHETIC And Natural Polymers & Biomolecules:** Natural and Synthetic polymers; Teflon, PVC, Polystyrene, Nylon 66 Terylene, and Bakelite; carbohydrates, amino acids and peptides, Nucleic Acids, lipids etc.

Chemistry In Action & Environmental Chemistry: Dyes, Medicines (Antipyretics, Analgesics and Antibiotics), Rocket Propellants; Acid Rain, Ozone Hole, Green House Effect, Global Warming Industrial Pollution.

Reference

B.R. Puri, L.R. Sharma, M.S. Pathania, "Principles of Physical Chemistry", Vishal Publishing Co., 2008

B.R. Puri, L.R. Sharma, Kalia, "Principles of Inorganic Chemistry", Vishal Publishing Co., 2008

A. Bahl, B S Bahl, "A Textbook of Organic Chemistry", S. Chand Publishing, 2005