

PHARMACEUTICAL CHEMISTRY - Inorganic pharmaceutical & medicinal chemistry

Importance of inorganic compounds in pharmacy and medicine

Sources of impurities, an outline of methods of preparation, heavy metals, uses, tests for purity and identity, sulphate and special tests, inorganic pharmaceuticals included in Indian Pharmacopoeia, including limit tests for iron, arsenic, lead, chloride

Gastrointestinal Agents: Protectives and Adsorbents, Acidifying agents, Antacids, Cathartics, Major Intra- and Extra-cellular

Electrolytes: Electrolytes used for replacement therapy, Physiological ions, acid-base balance and combination therapy

Essential and Trace Elements: Transition elements and their compounds of pharmaceutical importance, Cationic and anionic components of inorganic drugs useful for systemic effects, Iron and haematinics, mineral supplements

Topical Agents: Protective's, Astringents and Anti-infectives

Gases and Vapors: Oxygen, Anesthetics (inorganic) and Respiratory stimulants

Dental Products: Dentifrices, Complexing and chelating agents used in therapy, Anti-caries agents

Miscellaneous Agents: Emetics, Sclerosing agents, Inorganic poisons and antidotes, Expectorants

Pharmaceutical Aids Used in Pharmaceutical Industry: Filter aids, Anti-oxidants, Adsorbents, Suspending agents, Preservatives, Colorants, Diluents, Excipients

Acids, Bases and Buffers: Calculations and methods of adjusting isotonicity, Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, stability, buffered isotonic solutions, preparation, measurements of tonicity

Inorganic Radiopharmaceuticals: Nuclear reaction, dosage, Methods of obtaining their standards and units of activity, radioisotopes, hazards and precautions, half-life, radiopharmaceuticals, clinical applications, Nomenclature, measurement of activity,

Physical Chemistry and its importance in pharmacy- Importance of basic fundamentals of physical chemistry in pharmacy: Kinetic theory of gases, Behavior of Gases, deviation from ideal behavior and explanation

The Liquid State: Physical properties (surface tension, refractive index, viscosity, parachor, dipole moment)

Solutions: Colligative properties, Ideal and real solutions, solutions of gases in liquids, partition coefficient, Debye Huckel theory, conductance and its measurement

Thermodynamics: First, Concept of free energy, Second and Third laws, Zeroth law, absolute temperature scale, enthalpy and entropy

Thermochemical equations Phase rule: Adsorption: Isotherms, Freundlich and Gibbs adsorption, Langmuir's theory of adsorption

Photochemistry: Jabolenski diagram, Consequences of light absorption, Quantum efficiency Chemical

Kinetics: Zero, characteristics of homogeneous and heterogeneous catalysis, First and Second order reactions, theories of reaction kinetics, acid base and enzyme catalysis, complex reactions

Quantum Mechanics: Postulates of quantum mechanics, the Schrodinger wave equation, operators in quantum mechanics

Organic Chemistry and its importance in pharmacy- Importance of fundamentals of organic chemistry in pharmaceutical sciences; Structure and Properties: Atomic structure, Acids and bases, Atomic orbitals, Intermolecular forces, Structure and physical properties, Molecular orbital theory, Polarity of molecules, wave equation, Polarity of bonds, Molecular orbitals, Bond dissociation energy, Intramolecular forces, Bonding and Anti-bonding orbitals, Hybrid orbitals, Covalent bond

Stereochemistry: Nomenclature, isomerism, conformations, stereoisomerism, chirality, Reactions involving stereoisomers, 14 optical activity, specification of configuration, conformational and configurational isomerism

Stereoselective and stereospecific reactions: Structure, Nomenclature, Preparation and Reactions of: Alkanes, Alkenes, carbenes and nitrene, Phenols, Cyclic analogs, Arenes, Benzene, Alkynes, Dienes, Polynuclear aromatic compounds, carbanions, Alkyl halides, Ethers, Epoxides, Amines, Aldehydes and ketones, Alcohols, Carboxylic acids α,β -Unsaturated carbonyl compounds, Reactive intermediates- carbocations, , Functional derivatives of carboxylic acids

Nucleophilic and Electrophilic Aromatic Substitution Reactions: Reactivity and orientation, Rearrangements (Beckman, Hoffman, Benzilic acid, pinacole-pinacolone and Bayer-Villager) Electrophilic and Nucleophilic Addition Reactions

Elimination reactions; Conservation of Orbital Symmetry and Rules: Electrocyclic ,Sigmatropic and Cycloaddition reactions

Neighboring group effects; Catalysis by transition metal complexes; Heterocyclic Compounds: Preparation, Carbohydrates and Proteins, properties and reactions of 3, 4, 5, 6 & 7-membered heterocycles with one or two heteroatoms like O, N, S, Nomenclature, Chemistry of lipids

Biochemistry- Biochemistry in pharmaceutical sciences: Bioenergetics, The concept of free energy, production of ATP and its biological significance ,Determination of change in free energy - from equilibrium constant and reduction potential

Enzymes: Mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis, Nomenclature, enzyme kinetics and their mechanism of action

Co-enzymes: Vitamins as co-enzymes and their significance, Metals as cofactors and their significance

15 Carbohydrate Metabolism: Conversion of polysaccharides to glucose-1-phosphate, Glycolysis, Pentose phosphate pathway, Role of sugar nucleotides in biosynthesis, fermentation and their regulation, Gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemia

The Citric Acid Cycle: Glyoxalic acid cycle, Significance, Amphibolic role of the cycle, reactions and energetics of the cycle

Lipids Metabolism: phospholipids, β -oxidation & energetics, biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, progesterone, Oxidation of fatty acids, estrogens corticosteroids and bile acids, cholesterol, androgens, biosynthesis of ketone bodies and their utilization, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes and leukotrienes), sphingolipids

Biological Oxidation: Mechanism of oxidative phosphorylation ,Redox-potential, energetics of oxidative phosphorylation, its role in energy capture and its control, The respiratory chain, Inhibitors of respiratory chain and oxidative phosphorylation, enzymes and co-enzymes involved in oxidation reduction & its control

Metabolism of ammonia and nitrogen containing monomers: Assimilation of ammonia, Nitrogen balance, Conversion of amino acids to specialized products, Catabolism of amino acids, metabolic disorders of urea cycle, Metabolism of sulphur containing amino acids, Biosynthesis of amino acids, Urea cycle

Purine biosynthesis: Pyrimidine biosynthesis and formation of deoxyribounucleotides, Purine nucleotide inter-conversions

Biosynthesis of Nucleic Acids: Brief introduction of genetic organization of the mammalian genome, Biosynthesis of DNA and its replications, alteration and rearrangements of genetic material

Mutation: DNA repair mechanism, Physical & chemical mutagenesis/carcinogenesis, Biosynthesis of RNA

Genetic Code and Protein Synthesis: Genetic code, Components of protein synthesis, Inhibition of protein synthesis

Medicinal Chemistry- Basic Principles: Bioisosterism, Drug-receptor interactions including transduction mechanisms, Physico-chemical and stereoisomeric (Optical, geometrical) aspects of drug molecules and biological action

Drug metabolism and Concept of Prodrugs Principles of Drug Design (Theoretical Aspects): Traditional analog and mechanism based approaches, Applications of quantum mechanics, Computer Aided Drug Designing (CADD) and molecular modeling, QSAR approaches

Synthetic Procedures, Mode of Action, Uses, Structure Activity Relationships including Physicochemical Properties of the Following Classes of Drugs: Local Anesthetics, anti-cholinergics and cholinesterase inhibitors, Neuromuscular blocking agents, Adrenergic drugs, Cholinergics, Drugs acting at synaptic and neuro-effector junction sites, Antispasmodic and anti-ulcer drugs

Autacoids: Anti-inflammatory (non-steroidal) agents, Antihistamines, Analgesic-antipyretics, Eicosanoids

Steroidal Drugs: Oral contraceptives, Adrenocorticoids, Estrogens and Progestational agents, Steroidal nomenclature (IUPAC) and stereochemistry, Androgens and anabolic agents

Drugs acting on the central nervous system: CNS stimulants, General Anesthetics, 17 Anti-tussives, Hypnotics and Sedatives, Anticonvulsants, Psychopharmacological agents ,Anti-Parkinsonian drugs, Opioid analgesics, (Neuroleptics, Anti-depressants, Anxiolytics), Opioid analgesics

Diuretics; Cardiovascular drugs: Anti-hypertensives, Anticoagulants and Anti-platelet drugs, Anti-arrythmic agents, Anti-hyperlipedemic agents, Cardiotonics, anti-anginal agents

Thyroid and Anti thyroid drugs: Insulin and oral hypoglycemic agents: Chemotherapeutic Agents used in bacterial, fungal, viral, protozoal, parasitic and other infections, Antibiotics, Diagnostic agents, Anti-metabolites (including sulfonamides), Pharmaceutical Aids, Anti-viral agents (including anti-HIV), β -Lactam, macrolides, tetracyclines, Anti-neoplastic agents, Immunosuppressives and immunostimulants, aminoglycosides, polypeptide antibiotics, fluoroquinolones

Microbial Transformations: Biotransformation process and its improvements with special reference to steroids, Introduction, types of reactions mediated by micro-organisms, selection of organisms, design of biotransformation processes

Enzyme Immobilization: Penicillinase, Immobilization of bacteria and plant cells, Techniques of immobilization, amylases and proteases, factors affecting enzyme kinetics, streptokinase, Study of enzymes such as hyaluronidase

Pharmaceutical Analysis- Different techniques of pharmaceutical analysis, Preliminaries and definitions: Significant figures, Precision and accuracy, Rules for retaining significant digits, Selection of sample, Standard deviation, Statistical treatment of small data sets, Types of errors, Mean deviation

Fundamentals of volumetric analysis: Primary and secondary standards, Methods of expressing concentration

Acid Base Titrations: Amino acid titrations, Acid base concepts, Polyamine and amino acid systems, Role of solvents, Mixed indicators, Polyprotic systems, Choice of indicators, Relative strengths of acids and bases, Theory of indicators, Acid-base indicators, Neutralization curves, Ionization, Buffer solutions, Law of mass action, Henderson Hasselbach equation, Common ion effect, Hydrolysis of salts, Ionic product of water, pH

Oxidation Reduction Titrations: Concepts of oxidation and reduction, stannous chloride and Sodium 2,6-dichlorophenolindophenol, Redox reactions, titanous chloride, Strengths and equivalent weights of oxidizing and reducing agents, potassium bromate, potassium permanganate, Theory of redox titrations, potassium iodate, Redox indicators, sulphate, Cell representations, Titrations involving ceric ammonium, Iodimetry and Iodometry, Measurement of electrode potential, Oxidation-reduction curves

Precipitation Titrations: Precipitation reactions, Methods of end point determination, Effect of acids, temperature and solvent upon the solubility of a precipitate, mercuric nitrate, Volhard's method and Fajan's method, Argentometric titrations and titrations involving ammonium or potassium thiocyanate, barium sulphate, indicators, Solubility product, GayLussac method, Mohr's method

Gravimetric Analysis: Precipitation techniques, Organic precipitants, The colloidal state, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Supersaturation, aluminium as aluminium oxide, Co-precipitation, Specific examples like barium sulphate, Postprecipitation, Thermogravimetric curves, Digestion, washing of the precipitate, Ignition, Filtration, Filter papers and crucibles

Non-aqueous titrations: Solvents used, Acidic and basic drugs, Indicators

Complexometric titrations: Indicators, Complexing agents used as titrants, Masking and demasking

Miscellaneous Methods of Analysis: Diazotization titrations, Gasometry, Kjeldahl method of nitrogen estimation, Oxygen flask combustion method, Karl-Fischer aquametry

Extraction procedures including separation of drugs from excipients **Potentiometry:** Standard redox potential, potentiometric titrations, Nernst equation, Standard and indicating electrodes, Half-cell potential

Conductometry : Conductometric titrations, Specific and equivalent conductance

Coulometry: Coulometric titrations at fixed potential/current, Coulomb's law

Polarography: Decomposition potential, Organic polarography, Half-wave potential, Graphite electrode, Diffusion/migration/migration current, Dropping mercury electrode, Cathodic/anodic polarography, Ilkovic equation

Amperometry: Amperometric titrations, Rotating platinum electrode

Chromatography: Theory of chromatography, plate theory, Paper Chromatography and Column Chromatography, TLC, HPLC, GLC, HPTLC, Factors affecting resolution, The following chromatographic techniques (including instrumentation) with relevant examples of Pharmacopoeial products, van Deemter equation

The Theoretical Aspects, Basic Instrumentation, Elements of Interpretation of Spectra, and Applications (quantitative and qualitative) of the Following Analytical Techniques: Radioimmunoassay, Ultraviolet and visible spectrophotometry, X-ray Diffraction Analysis, Fluorimetry, Infrared spectrophotometry, Atomic Absorption Spectroscopy, Flame Photometry, Mass Spectrometry (EI & CI only), Nuclear Magnetic Resonance spectroscopy [proton technique only]

Quality assurance: Regulatory drug analysis, GLP, validation of analytical procedures, ISO 9000, validation of equipment, TQM, quality of equipment, Quality Review and Quality documentation, quality audit, Regulatory control, interpretation of analytical data, Validation