

PHYSICAL PHARMACY

1. Matter, properties of matter States of matter, change in the state of matter, latent heat and vapor pressure, sublimation critical point, eutectic mixtures, gases, aerosols- inhalers, relative humidity, liquid complexes, liquid crystals, glasses state, solid crystalline and amorphous polymorphism.
2. Micromeritics and powder rheology Particle size and distribution, average particle size number and weight distribution, particle number, methods of determining particle size and volume, optical microscopy, sieving, sedimentation, determining surface areas, permeability, adsorption, derived properties of powders, porosity, packing arrangement densities, bulkiness and flow properties.
3. Surface and interfacial phenomenon Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tension, spreading coefficient, adsorption and liquid interfaces, surface active agents, HLB classification, solubilization, detergency, absorption at solid interfaces, solid gas and solid-liquid interfaces, complex films, electrical properties of interfaces.
4. Viscosity and rheology Newtonian systems, law of flow, kinematics viscosity, effect of temperature, non- Newtonian systems, pseudoplastics, dilatant, plastic, thixotropy in formulations, determination of viscosity and thixotropy by capillary, falling ball, rotational viscometer, application of rheology in pharmacy
5. Dispersion systems a. Colloidal dispersions: Definition, types, properties of colloids, protective colloids, application of colloids in pharmacy. b. Suspensions and emulsions: Interfacial properties of suspended particles settling in suspension, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, significance of electrical properties in dispersions, controlled flocculation, flocculation in structured vehicles, rheological considerations, emulsions: types, theories, physical stability.
6. Complexation Classification of complexes, methods of preparations and analysis, applications.
7. Buffer Buffer equations and buffer capacity in general. Buffers in pharmaceutical systems, preparations and stability, buffered isotonic solutions. Measurements of tonicity calculations and methods of adjusting is tonicity.

8. Solubility a. Miscibility-influence of foreign substances three component systems; dielectric constant and solubility, solubility of solids in liquids ideal and non-ideal solutions solvation and association in solutions solubility of salts in water solubility of slightly soluble and weak electrolyte calculating solubility of weak electrolytes as influenced by pH, influence of solvents on the solubility of drugs combined effect of pH and solvents, distribution of solutes between immiscible solvents, effect of ionic dissociation and molecular association on partition, extraction, preservatives action of weak acids in emulsions, drug action and distribution coefficient. b. Concepts of dissolution and diffusion

ORGANIC CHEMISTRY

1. General principles A brief review of classification & sources of organic compounds, sp^3 , sp^2 , sp hybridization, sigma & pi- bonds, bond lengths, bond angles & bond energies along with their significance in reactions should be carried out. An overview of bond polarization, hydrogen bonds, inductive effects, resonance, and hyperconjugation be taken. Concept of homolytic & heterolytic bond fission, acidity & basicity with different theories should be covered briefly. Ease of formation & order of stabilities of electron deficient & electron rich species along with the reasons for the same should be covered. Relationships between energy content, stability, reactivity & their importance in chemical reactions should be covered. Calculations for determining empirical & molecular formula should be covered.

2. Different classes of compounds The following classes of compounds should be taught in detail with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable]. • Alkanes [including cyclic compounds] • Alkenes [including cyclic compounds] • Alkynes [only open-chain compounds] • Aliphatic hydroxyl compounds • Alkyl halides • Aldehydes & Ketones • Carboxylic acids • All functional derivatives of carboxylic acids.

3. Protection & deprotection of groups Introduction to protection & deprotection of functional groups. Two examples each for amino, hydroxyl, & carbonyl groups. The significance of these in syntheses should be explained. 4. Aromaticity & chemistry of aromatic compounds Concept of aromaticity, Huckel's rule & its use in determining the aromatic/non-aromatic character of a compound. A brief coverage of structure of benzene. Detailed coverage of electrophilic &

nucleophilic aromatic substitution reactions. Reactivity & orientation in these reactions. Reactivity & orientation in mono- & disubstituted benzenes. Benzyne mechanism.

5. Different aromatic classes of compounds The following classes of compounds with respect to their IUPAC / systematic nomenclature, industrial [wherever applicable] & laboratory methods of preparations, physical properties & chemical reactions with emphasis on reaction mechanisms [arrow based] & stereochemistry [wherever applicable]. Aromatic hydrocarbons. Phenolic compounds. Aromatic & aliphatic amines. Diazonium salts. Aromatic nitro- compounds, aryl halides, & ethers.

6. Polycyclic aromatic hydrocarbons Syntheses & reactions with mechanisms of bi & tricyclic fused carbocyclic rings like naphthalene, anthracene, & phenanthrene.

7. Carbonyl Chemistry Carbonyl chemistry involving group conversions & their reaction mechanisms along with stereochemistry wherever applicable. a. Wolf-Kishner reduction & Huang-Minlong modification. b. Reduction of arylsulfonyl hydrazine/hydrazone to alkanes. c. Bamford Steven reaction. d. DCC Oxidation of alcohol. e. Michael addition / 1,4-addition / conjugate addition. f. Mannich condensation / reaction. g. Robinson annulation. h. Stobbe condensation. i. Darzen's glycidic ester synthesis. j. Beckmann rearrangement. k. Baeyer Villiger rearrangement. l. Curtius, Wolff, & Lossen rearrangements. m. Willgerodt rearrangement. n. Pinacol-pinacolone rearrangement. Page 8 of 54 o. Methylene transfer reactions. Use of diazomethane & sulphur ylides in the same. p. Mono- & dialkylations in 1,3-dicarbonyl compounds. q. Formation & use of enol ethers, enol acetates & enamines as protective groups & in regiospecific alkylations.

8. Heterocyclic Chemistry IUPAC Nomenclature of heterocyclic rings [3-10 membered] containing O, S, & N atoms. Nomenclature of above rings containing mono-, di-, & multiple [same or different] heteroatoms should also be covered. Nomenclature of 2 & 3 fused rings containing mono-, di-, & multiple heteroatoms [same or different] should also be covered. Syntheses & reactions of three to sixmembered rings in detail. Syntheses of five & six-membered rings containing mono- or any diheteroatoms [O, S, & N]. Syntheses of quinoline, isoquinoline, benzoxazole, benzothiazole, & benzimidazole, benzotriazole, and benzothiazole.

9. Bridged rings Bridged ring systems & their nomenclature. C₈, C₉, C₁₁ bridged bicyclic alkanes. Chemistry of hexamine, morphan, piperiden, amantadine, diazabicyclo[2.2.2] octane

10. Kinetic & thermodynamic control Kinetic & thermodynamic control of sulfonation, enolate anion formation & alkylation of enamine reactions.

11. Stereochemistry Stereochemistry. Chirality & asymmetry [introduction of the same to S, P, & N]. Definition & classification [different types of isomerisms]. Enantiomers, diastereomers. Enantiomerism & diastereomerism. Meso compounds & their optical activity. Stereochemistry in acyclic compounds. Newman projection formulae & their significance. Conformational analysis of nbutane. Absolute & relative configuration. Assigning R & S configuration based on Cahn Ingold & Prelog system. Racemic mixture- its definition & resolution. Definitions of terms stereoselective, stereospecific, Enantiomeric excess & diastereomeric excess. Stereochemistry in cyclic systems. Conformations of cyclohexane. Cis-trans relationship in cyclohexane. Prediction of stability of different conformations of 1, 2- 1,3- & 1,4- disubstituted cyclohexanes. Effect of multiple substitutions on the stability of cyclohexane conformations. Chair conformations of cis-, & trans-decalins, perhydrophenanthrenes, & a tetracyclic steroidal nucleus. An introduction to atropisomerism.. Carbohydrates Carbohydrates. Definition & classification. D & L nomenclature in sugars. Different ways of drawing / representing a sugar molecule [including cyclic Structure], interconversion of these representations. Anomers & epimers. Mutarotation. Reactions of glucose. Chain extension & chain reduction of a sugar.

13. Amino acids & proteins Amino acids & proteins. Definition & classification. D & L Amino acids, natural, essential, & nonessential amino acids. Denaturation, Strecker, Gabriel phthalimide methods for the preparation of amino acids. Peptide bond & its formation. Two protective groups each, for -NH₂ & -COOH functionalities during protein synthesis. Sequencing of a protein by chemical & enzymatic methods.

14. Pericyclic reactions Pericyclic reactions. Concept of HOMO & LUMO. Drawing of HOMO & LUMO of 1, 3-butadiene, allylic cation, radical & anion, & 1, 3, 5-hexatriene, Diel's-Alder & retro Diel's Alder reaction.

Pharmaceutical Inorganic Chemistry

1. Pharmaceutical Impurities Impurities in pharmaceutical substances, sources, types & effects of impurities. Limit tests for heavy metals like lead, iron, arsenic, mercury & for chloride & sulphate as per Indian Pharmacopoeia [I. P.].
2. Monographs (a) Monograph & its importance, various tests included in monographs as per I. P. A study of the following compounds with respect to their methods of preparation, assay, & pharmaceutical uses of sodium citrate, calcium carbonate, copper sulphate, light & heavy kaolin, ammonium chloride & ferrous gluconate.
3. Isotopes Isotopes- stable & radioactive, mode & rate of decay. Types & measurement of radioactivity. Radiopharmaceuticals & their diagnostic & therapeutic applications in pharmacy & medicine such as ^{125}I , ^{32}P , ^{51}Cr , ^{60}Co , ^{59}Fe , $^{99}\text{Tc-M}$. Radio contrast media, use of BaSO_4 in medicine.
4. Dentifrices, desensitizing agents, & anticaries agents