*B.Sc. Ist Year*

*Organic Chemistry & Inorganic Chemistry*

*By Krishan Kumar (Assistant Professor)*

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| Date | Topic |
| July 2023 to 31 august 2023 | **1. Structure and Bonding**  Localized and delocalized chemical bond, van der Waals in teractions, resonance:  conditions, resonance effect and its applications, hyperconjugation, inductive effect,  Electromeric effect & their comparison.  **2. Stereochemistry of Organic Compounds-I**  Concept of isomerism. Types of isomerism. Optical isomerism, elements of  symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity,  properties of enantiomers, chiral and achiral molecules with two stereogenic  centres, diastereomers, threo and eryth ro diastereomers, meso compounds, resolution  of enantiomers, inversion, retention and racemization. |
| 1 sep to 30 September | **Stereochemistry of Organic Compounds-II**  Relative and absolute configuration, sequence rules, R & S systems of nomenclature.  Geometric isomerism determination of configuration of geometric isomers. E & Z  system of nomenclature, Conformational isomerism conformational analysis of  ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds,.  Newman projection and Sawhorse formulae, Difference between configuration and  conformation. **Mechanis m of Organic Reactions**  Curved arrow notation, drawing electron movements with arrows, half-headed and  double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents –  electrophiles and nucleophiles. Types of organic reactions. Energy considerations. |
| 1 October 31 October | Reactive intermediates carbocations, carbanions, free radicals, carbenes , arynes and  nitrenes (formation, structure & stability). Assigning formal charges on intermediates  and other ionic species. ***Alkanes and Cycloalkanes***  IUPAC nomenclature of branched and unbranched alkanes , the alkyl group, classi  fication of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of  formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House  reaction and decarboxylation of carboxylic acids), physical properties. Cycloalkanes  nomenclature, synthesis of cycloalkanes and their derivatives – photochemical (2+2)  cycloaddition reactions, dehalogenation of -dihalides, pyrolysis of calcium or barium  salts of dicarboxylic acids, Baeyer's strain theory and its limitations., theory of  strainless rings. |
| 1 November 30 November  (Inorganic chemistry) | ***Covalent Bond***  Valence bond theory and its limitations, directional characteristics of covalent bond,  various types of hybridization and shapes of simple inorganic molecules and ions  ( BeF2, BF3, CH4, PF5, SF6,IF7 SO42 -, ClO4- )Valence shell electron pair repulsion  (VSEPR)5 theory to NH3, H3O+, SF4, CIF3, ICI2- and H2O. MO theoryof heteronuclear  (CO and NO) diatomic.molecules, , bond strength and bond energy, pe rcentage ionic  character from dipole moment and electronegativity difference.  **Section-D**  **Ionic Solids**  Ionic structures (NaCl,CsCl, ZnS(Zinc Blende), CaF2) radius ratio effect and  coordination number, limitation of radius ratio rule, lattice defects, semiconductors,  lattice energy (methamtical derivation exc luded) and Born-Haber cycle, solvation  ene rgy and its relation with solubility of ionic solids, polarizing power and  polarisability of ions, Fajan's rule. |

*B.Sc. 2nd Year*

*Organic Chemistry & Inorganic Chemistry*

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| Date | Topic |
| July 2023 to 31 august 2023 | **Alkenes**  Nomenclatu re of alkenes, , mechanisms of dehydration of alcohols and  dehydrohalogenation of alkyl halides,. The Saytzeff rule, Hofmann elimination,  physical p roperties and relative stabilities of alkenes. Chemical reactions of alkenes  mechanisms involved in hydrogenation, electrophilic and free radical additions,  Markownikoff’s rule, hydroboration–oxidation, oxymercurationreduction, ozonolysis,  hydration, hydroxylation and oxidation with KMnO4,  *.***Arenes and Aromaticity**  Nomenclatu re of benzene deriva tives:. Aromatic nucleus and side chain.  Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms,  aromatic, anti - aromatic and non – aromatic compounds. |
| 1 sep to 30 September | Aromatic electrophilic  substitution general pattern of the mechanism, mechansim of nitration,  halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams.  Activating , deactivating subs tituents and orientation.  **Section-C**  **Dienes and Alkynes**  Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes.  Structure of butadiene,. Chemical reactions 1,2 and 1,4 additions (Electrophilic &  free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding  in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes.  Mechanism of electrophilic and nucleophilic addition reactions, hydroborationoxidation  of alkynes |
| 1 October 31 October | **Alkyl and Aryl Halides**  Nomenclatu re and classes of alkyl halides, methods of formation, chemical reactions.  Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl  halides , SN2 and SN1reactions with energy profile diagrams.Methods of formation  and reactions of aryl halides, The additionelimination and the elimination-addition  mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of  alkyl halides vs allyl, vinyl and aryl halides. |
| 1 November 30 November  (Inorganic chemistry) | **p-Block Elements**  Emphasis on comparative study of properties of p-block elements (including diagonal  relationship and excluding methods of preparation).  **Boron family (13th gp**):-  Diborane – properties and structure (as an example of electron – deficient compound  and multicentre bonding), Borazene – chemical properties and structure Trihalides of  Boron – Trends in fewis acid character structure of aluminium (III) chloride.  **Carbon Family (14th group)**  Catenation, p π– d π bonding (an idea), carbides, fluorocarbons, silicates structural  aspects), silicons – general methods of preparations, properties and uses.  9  **SECTION-D**  **Nitrogen Family (15th group)**  Oxides – structures of oxides of N,P. oxyacids – structure and relative acid strengths  of oxyacids of Nitrogen and phosphorus. Structure of white, yellow and red  phosphorus.  **Oxygen Family (16th group)**  Oxyacids of sulphur – structures and acidic strength H2O2 –structure, properties and  uses.  **Halogen Fami l y (17th group)**  Basic prope r ties of ha logen, interha logens types propert ies ,hydro and oxyacids of  chlorine – structure and compari son of acid strength . |

*B.Sc. 3rd Year*

*Organic Chemistry & Inorganic Chemistry*

*By Krishan Kumar (Assistant Professor)*

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| Date | Topic |
| July 2023 to 31 august 2023 | **NMR Spectroscopy-I**  Principle of nuclear magnetic resonance, the PMR spectrum,number of signals, peak  areas, equivalent and nonequivalent protons positions of signals and chemical  shift,shielding and deshielding of protons, proton counting,splitting of signals and  coupling constants, magnetic equivalence of protons.  **NMR Spectroscopy-II**  Discuss ion of PMR spectra of the molecules: ethyl bromide, npropyl bromide,  isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde,  ethyl acetate, toluene, benzaldehyde and acetophenone..Simple problems on PMR  spectroscopy for structure determination of organic compounds. |
| 1 sep to 30 September | **Carbohydrates-I**  Classification and nomenclature. Monosaccharides, mechanism of osazone formation,  inte rconversion of glucose and fructose, chain lengthening and chain shortening of  aldoses. Configuration of monosaccharides. Erythro and threo diastereomers.  Conversion of glucose in to mannose. Formation of glycos ides, ethers and esters.  Determination of ring size of glucose and fructose. Open chain and cyclic structure of  D(+)-glucose & D(-) fructose. Mechanism ofmutarotation. Structures of ribose and  deoxyribose. |
| 1 October 31 October | **1. Carbohydrates-II**  An introduc tion to disaccharides (maltose, sucrose and lactose) and polysaccharides  (starch and cellulose) without involving structure determination.  **2. Organometallic Compounds**  Organomagnesium compounds: the Grignard reagents-formation, structure and  chemical reactions. Organozinc compounds: formation and chemical reactions.  Organolithium compounds: formation and chemical reactions. |
| 1 November 30 November  (Inorganic chemistry) | **Magnetic Properties of Transition Metal Complexe**  Types of magnetic behaviour, methods of determining magnetic susceptibility,  spin-only formula. L-S coupling, correlation of s and eff values, orbital  contribution to magnetic moments, application of magnetic moment data for 3dmetal  complexes.  3  **SECTION-D**  **Electron Spectra of Transition Metal Complexes**  Types of electronic transitions, selection rules for d-d transitions, spectroscopic  ground states, spectrochemical series. Orgel-energy level diagram for d1 and d9 states,  discussion of the electronic spectrum of [Ti(H2O)6]3+ complex ion. |