Syllabus
CHEM 109
Fundamentals of Organic Chemistry

Introduction

Types of chemical bonds: (*Ionic and covalent bonds*) - Atomic and molecular orbital: (*sigma and pi bond*) - Hybridization (*sp^3, sp^2, sp*) - Inductive effect, polarization, and Stability of carbocations - Classification of organic compounds and functional groups - Types of chemical reactions: (Substitution (*Free radical - electrophilic - nucleophilic), Elimination, Oxidation and reduction reactions*).

Lectures (2)

Aliphatic Hydrocarbons

Classes of hydrocarbons: (*saturated and unsaturated*) – Nomenclature: (*IUPAC and common names*) – Isomerism: (*Structural and Geometrical*) - Physical properties of aliphatic hydrocarbons - Preparation of saturated hydrocarbons (Alkanes): (*Hydrogenation of unsaturated hydrocarbons - Hydrolysis of alkyl Grignard reagent - Reaction of lithium dialkyl cuprates with alkyl halides*) - Reactions of saturated hydrocarbons: (*Halogenations*) - Preparation of Unsaturated hydrocarbons: (Alkenes and Alkynes): (*Elimination reactions (Dehydration, dehydrohalogenation and dehalogenation reactions) and Saytzeff rule*) - Reactions of Unsaturated hydrocarbons: (*Electrophilic addition reactions (Markovnikov's rule), hydrogenation, halogenation, hydrohalogenation, and hydration - Oxidation reactions - Acidity of alkynes*).

Lectures (4)

Aromatic compounds

Aromaticity: structure and bonding requirements and Hückel's rule - Nomenclature of aromatic compounds - Electrophilic aromatic substitution reactions: (*Alkylation, acylation, halogenations, nitration and sulfonation*) - Effects of substituents on electrophilic aromatic substitution reactions - Side-chain reactions: (*Oxidation of alkylbenzenes*).

Lectures (2)

Alcohols, Phenols and Ethers

Structure, classifications and nomenclature - Physical properties - Preparation of alcohols and phenols: (*Hydration of alkenes - Nucleophilic substitution reaction of alkyl halides - Reduction of aldehydes, ketones and acids - Addition of Grignard compounds to aldehydes and ketones*) - Preparation of Phenols: (*Benzene sulfonic acids*) - Preparation of ethers (*Williamson synthesis*) - Reactions of Alcohols, Phenols

and Ethers: (*Salt formation of alcohols and phenols (Acidity of phenols and Reaction of Alcohols with Sodium metal) - Reactions of Alcohols and Ethers with Hydrogen halides - Conversion of Alcohols to alkyl halides - Oxidation of alcohols - Electrophilic substitution reactions of phenols*) - Alcohols with More Than One Hydroxyl Group; glycols.

Lectures (4)

- ***Ist Midterm Exam***

Aldehydes and Ketones

Structure and Nomenclature - Physical properties - Preparation of aldehydes and ketones: (*Hydration of alkynes - Ozonolysis of alkynes - Friedel-Crafts acylation - Oxidation of alcohols*) - Reactions of aldehydes and ketones: (*Nucleophilic addition reaction (addition of hydrogen cyanide, Reduction, Grignard addition, addition of Alcohol (hemiacetal and acetal Formation), addition of ammonia and amine derivatives*).

Lectures (3)

Carbohydrates

Definitions and Classification (*monosaccharides, disaccharides and polysaccharides*) – Monosaccharides: (*Nomenclature - Structure (Optical isomerism, cyclic structure, Fischer Projection, Haworth Formulas)*) - Reactions of Monosaccharides: (*Reduction and oxidation of monosaccharides*) – Disaccharides: (Maltose, Cellobiose, Sucrose and Lactose) – Polysaccharides: (Cellulose and Starch)

Lectures (4)

Carboxylic acids and Their Derivatives

Structure and Nomenclature - Physical properties - Acidity of Carboxylic acids - Preparation: (*Hydrolysis of nitrile - Carbonation of Grignard reagents*) - Reactions of carboxylic acids: (*Salt Formation - Ester, amide, anhydride, and acid chloride formation*).

Lectures (3)

Amines

Structure of amines - Nomenclature of amines - Physical properties of amines - Basicity of amines - Preparation of amines: (*Reduction of nitro compounds, nitriles and amides - Alkylation of ammonia*) - Reactions of amines: (*Sulfa drugs - Diazonium salts (Formation and Replacement reactions*)

Lectures (2)

- ***2nd Midterm Exam.***

Amino Acids, Peptides, and Proteins

- Sources, classification and Structure - The acid–base Properties of Amino Acids - Reactions of amino acids: (*The Ninhydrin Reaction, Peptides - Sanger reaction - Formation of an amide linkage (The peptide bond: Proteins)*) - Structure of proteins.

Lectures (4)

Nucleic Acids

Chemical Structure: (*General structure (Nucleoside, Nucleotide and Nucleic acids) - DNA; structure - RNA; structure and types*).

Lectures (2)

- ***Final Exam.***

References

- *Organic chemistry: A short course by I Harold Hart, David J. Hart and Leslie E. Craine, Houghton Mifflin Company, USA., 2012.*
- *Elements of Organic Chemistry (second edition) is written by Isaak Zimmerman and Henry Zimmerman and published by Macmillan Publishing Co., Inc. New York in 1983.*
- أسس الكيمياء العضوية - أ.د./ سالم بن سليم الذياب - الناشر: مؤسسة نافثة

Syllabus
CHEM 109
Practical Organic Chemistry

Experiments No.	Title	Week
Instruction and Equipment and Safety		1
Experiment 1	Solubility & Extraction	1
Experiment 2	Aliphatic hydrocarbons (Bonding)	1
Experiment 3	Aromatic hydrocarbons	1
Experiment 4	Hydroxy compounds (Alcohols & Phenols)	1
Experiment 5	Aldehydes & Ketones	2
Experiment 6	Carbohydrates	2
Experiment 7	Carboxylic acid & Their derivatives	1
Experiment 8	Preparation of Aspirin	1
Experiment 9	Nitro and Amino compounds	1
Experiment 10	De-amination of amino acids	1
	Final Exam	1