

Organic Chemistry I

Syllabus

I. Chemical Bonding and Molecular Structure

- A. Chemical bonding and molecular structure
- B. Resonance structures
- C. Wave nature of the electron
- D. Electronic structure of the atom
- E. Hybrid orbitals and molecular orbital theory

II. Alkanes

- A. Hydrocarbons and nomenclature
- B. Constitutional isomers
- C. Skeletal structures
- D. Conformational analysis
- E. Cycloalkanes
- F. Physical and chemical properties
- G. Availability and uses of alkanes
- H. Functional groups

III. Acids, Bases, and the Curved-Arrow Notation

- A. Brønsted-Lowry acids and bases
- B. Lewis acids and bases
- C. Electron-pair displacement reactions
- D. Curved-arrow notation
- E. Free energy and chemical equilibrium
- F. Acid strength and the structure of acids

IV. Alkenes - Structure and Reactivity

- A. Bonding and structure
- B. Nomenclature
- C. Degrees of unsaturation
- D. Physical properties
- E. Alkene *cis-trans* isomers and alkene stability
- F. Introduction to electrophilic addition reactions
- G. Reaction rates
- H. Catalysis

V. Alkenes - Electrophilic Addition Reactions

- A. Electrophilic addition reactions
- B. Hydrogenation
- C. Reactions with halogens
- D. Conversion to alcohols
- E. Ozonolysis
- F. Free-radical polymerization
- G. Alkenes in the chemical industry

VI. Stereochemistry

- A. Chirality and enantiomers
- B. Physical properties of enantiomers
- C. Racemic mixtures
- D. Absolute and relative stereochemical configurations
- E. Diastereomers and meso compounds
- F. Conformational stereoisomers

VII. Cyclic Compounds

- A. Stability of cyclic compounds
- B. Cyclopropane, cyclobutane, and cyclopentane
- C. Cyclohexane
- D. Bicyclic and polycyclic compounds
- E. Heterocyclic compounds
- F. Reactions that form enantiomers and diastereomers
- G. Reactivity of enantiomers and diastereomers

VIII. Nucleophilic Substitution and Elimination Reactions

- A. S_N1 and S_N2 reactions
- B. $E1$ and $E2$ reactions
- C. Synthesis of alkyl halides
- D. Reactions of alkyl halides
- E. Carbenes and carbenoids

IX. Alcohols and Thiols

- A. Preparation of alcohols
- B. Reactions of alcohols
- C. Sulfonate and inorganic esters
- D. Oxidation of thiols

X. Ethers, Epoxides, Glycols, and Sulfides

- A. Preparation and reactions of ethers
- B. Preparation and reactions of sulfides
- C. Preparation and reactions of epoxides
- D. Preparation and reactions of glycols
- E. Oxonium and sulfonium salts
- F. Intramolecular reactions and the proximity effect

XI. Spectroscopy and Mass Spectrometry

- A. Infrared spectroscopy
- B. Nuclear magnetic resonance
- C. Mass spectrometry
- D. Structure determination