Organic Chemistry 1

Undergraduate 3 credit course in Polymer Engineering curriculum

Amirkabir University of Technology

Chapter 1: An introduction to organic chemistry (the scope of Organic Chemistry, organic molecules, how to make organic compounds?, bonding, reactivity, stereo chemistry, reactions).

Chapter 2: Organic molecules: structure and bonding (Coulomb forces, the octet rule, Lewis structures, electronegativity and bond polarity, multiple bonding, resonance forms, atomic orbitals, molecular orbitals, σ and π bons, hybridization, VSEPR theory, Configuration and conformation).

Chapter 3: Organic molecules reactivity (acid and bases, inter and intramolecular forces, polarity effect on solubility, solvent effect on acidity and basicity, atom size and electronegativity effect on acidity, resonance effect on acidity, hybridization effect on acidity and basicity, electrophiles and nucleophiles, functional groups).

Chapter 4: Alkanes (linear alkanes, nomenclature of alkanes, physical properties of alkanes, alkane bond strength, alkyl radical: conjugation, alkane conformations, Newman projection, cyclic alkanes, stability, ring strain, substitution, cis and trans isomers, heterocyclic compounds, haloalkanes).

Chapter 5: Stereochemistry (isomers, chirality, enantiomers, optical reactivity, R and S configurations, diastereomers, meso compounds, Fischer projection).

Chapter 6: Free radical reactions (alkane halogenation, methane chlorination, higher alkanes chlorination, alkanes bromination: Hammond Postulate).

Chapter 7: Substitution and Elimination reactions (bimolecular nucleophilic substitution reactions: SN_2, mechanism, factors affecting SN_2 reactions: substrate, nucleophile strength, leaving group, solvent effect, unimolecular nucleophilic substitution reactions: SN_1, factors affecting SN_1 reactions: carbocation stability, leaving group, solvent effect, carbocation rearrangement, SN_2 and SN_1 comparison, unimolecular elimination reactions: E_1, mechanism, E_1 and SN_1 comparison, bimolecular elimination reactions: E_2, mechanism, Zaitsev's rule, Hofmann orientation, E_1 and E_2 comparison).

Chapter 8: Alkenes (linear alkenes, nomenclature, physical properties, cyclic alkenes, stability of cyclic alkenes, Bredt's rule, Hückel's rule, industrial importance of alkenes, alkenes reactions, reactivity of alkenes, electrophile addition, halogenation, hydration, hydrohalogenation, epoxidation, epoxides ring opening, oxidative cleavage, Diels-Alder reaction, retro-Diels-Alder reaction, dimerization, oligomerization and polymerization).

References:

1. *K. Peter C. Vollhardt, N. Schore*, **"*Organic Chemistry: Structure and Function*"**, Macmillan Learning, **2018** (8th Ed)
2. *L. G. Wade, J. W. Simek*, ***"Organic Chemistry"***, Pearson, **2017** (9th Ed)
3. *D. R. Klein*, ***"Organic Chemistry As a Second Language: First Semester Topics"***, John Wiley & Sons, **2017** (4th Ed)
4. *D. R. Klein*, ***"Organic Chemistry As a Second Language: Second Semester Topics"***, John Wiley & Sons, **2016** (4th Ed)
5. MIT open courses in Organic Chemistry by *Prof. Barbara Imperiali* and *Dr. Sarah Tabacco*