

# KEY CONCEPTS IN CHEMISTRY



Jagiellonian University

Medical College

School of Medicine in English

# ORGANIC CHEMISTRY

## 1. Structure and bonding in organic chemistry

- 1.1. Hybridization and molecular shapes, isomerism, homologous series;
- 1.2. Carbon skeletons with single and multiple bonds, structural and skeleton formulas of organic compounds;
- 1.3. Functional groups;
- 1.4. Lewis structures, formal charges, resonance;

## 2. Classification and properties of organic compounds

- 2.1. Hydrocarbons (alkanes, alkenes, alkynes, aromatic compounds), alkyl halides, nitro compounds;
- 2.2. Alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids and their derivatives;
- 2.3. Amines, amino acids, peptides and proteins;
- 2.4. Lipids, carbohydrates, heterocyclic bases, nucleotides, nucleic acids;

## 3. Nomenclature of organic compounds

- 3.1. Hydrocarbons of various classes;
- 3.2. Compounds with one functional group;
- 3.3. Compounds with more functional groups, preferences in naming;

## 4. Stereochemistry

- 4.1. Conformations;
- 4.2. Z/E stereoisomers;
- 4.3. Enantiomers and diastereomers;
- 4.4. Models and notations to represent;
- 4.5. Stereoisomers;

## 5. Organic reactions

- 5.1. Mechanisms of organic reactions, nucleophiles and electrophiles;
- 5.2. Nucleophilic substitution vs. elimination;
- 5.3. Electrophilic substitution in aromatic compounds;
- 5.4. Reduction and oxidation in organic chemistry;
- 5.5. Radical processes, rearrangements;

### Keywords:

Isomers,  $sp^3$ ,  $sp^2$  and  $sp$  hybridization, homologous series, tetravalent carbon, single, double and triple bonds, conjugated systems of multiple bonds, resonance, aromaticity, hydrocarbons, alkanes, alkenes, alkynes, substituents, heteroatoms, alkyl halides, alkyl group, primary, secondary and tertiary alcohols, and amines, aldehydes and ketones, carbonyl group, carboxyl group, acids, esters, amides, anhydrides, nitro compounds, conformers, Z/E stereoisomers,

enantiomers, diastereomers, Fischer projections, nucleophiles, electrophiles, reaction mechanisms, carbocation, radical, leaving group, addition, substitution, elimination, reduction, oxidation, rearrangement, biomolecules, fatty acids, lipids, soaps, waxes, micelles, mono-, oligo- and polysaccharides, triose, tetrose, pentose, hexose, aldose, ketose, hemiacetals, acetals, pyranose, furanose, amino acids.

# RECOMMENDED TEXTBOOKS

(The three following positions for choice, the fourth one for more ambitious pupils.)

1. Hrvoj Vančik, *Basic Organic Chemistry for the Life Sciences* (179 pages), Springer International Publishing Switzerland 2014  
ISBN: 978-3-319-07604-1
2. Graham Patrick, *BIOS Instant Notes in Organic Chemistry* (328 pages), Garland Science, Taylor & Francis Group 2012  
ISBN 978-1-8599-6264-0
3. Andy Parsons, *Keynotes in Organic Chemistry* (300 pages), Wiley (second edition) 2014  
ISBN: 978-1-119-99914-0
4. David J. Hart, Christopher M. Hadad, Leslie E. Craine, Harold Hart, *Organic Chemistry A Short Course* (608 pages), BROOKS/COLE CENGAGE Learning (13<sup>th</sup> Edition)  
ISBN: 13:978-1-111-42556-2