UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Organic Chemistry

2021-1-E1301Q010

Aims

The course of Organic Chemistry will give the students the basis of organic chemsitry, focussed on biological systems.
1. Knowledge and understanding
The student will gain knowledge of the chemical principles at the basis of organic chemistry useful for the comprehension of biological systems.

2. Applying knowledge and understanding
The student will be able to apply the knowledge acquired under 1. to the subsequent subjects, especially biochemistry.

3. Making judgements
The student will be able to process the acquired knowledge in organic chemistry towards its application to the interpretation of organic chemistry issues in living systems.

4. Communication skills
Use of an appropriate scientific/chemical vocabulary and ability in oral reports

5. Learning skills
Skills in reading and understanding the subsequent studies needing a solid organic chemistry basis, skills in the application of organic chemistry knowledge to other subjects requiring organic chemistry prerequisites.

Contents

1. Organic compounds, their graphical representation and the IUPAC nomenclature
2. Isomerism: constitutional isomers, conformational isomers, stereoisomers
3. Acid-base reactivity in organic compounds

4. Reactivity of compound classes: alkenes and alkynes, haloalkanes, alcohols, carbonyl compounds, carboxylic acids and their derivatives, amines
5. Polyfunctional compounds of biological relevance
6. Examples of reactivity in biological systems

Detailed program

1. Organic compounds, their graphical representation and the IUPAC nomenclature
Elements in organic compounds, intermolecular forces and polarity; resonance theory
2. Isomerism: constitutional isomers, conformational isomers, stereoisomers
Isomer classification: structural isomers, conformers and Newman projections, stereoisomers and Fischer projections. Absolute configuration and stereochemical descriptors.
3. Acid-base reactivity in organic compounds
Acid-base equilibria; Lewis theory. Relative acidity/basicity in organic compounds: the relevance of inductive and resonance effects
4. Reactivity of compound classes
-alkenes and alkynes: electrophile addition (hydration, hydrohalide acids addition, halogen addition)
- haloalkanes: nucleophilc substitution (SN1 and SN2), beta elimination (E1 and E2)
- alcohols: dehydration reactions
- aromatic compounds: the basis for aromaticity
- carbonyl compounds: nucleophile addition (alcohols, amines); keto-enol tautomerism and aldol condensation
- carboxylic acids and their derivatives: acylic nucleophilic substitution, Fischer esterification, saponification, amide bond formation; alfa-carbon reactivity: acetoacetic and malonic synthesis
-amines: summary of the reactivity encountered in the previous sections
5. Polyfunctional compounds of biological relevance
Carbohydrates
amino acids and proteins
nucleosides, nucleotides, nucleic acids
6. Examples of reactivity in biological systems
SN2 methylation mediated by SAM
imine formation in vertebrate vision mechanism
fatty acids biosynthesis

Prerequisites

Prerequisites: General Chemistry
Background: concept of chemical equilibrium, kinetics and thermodynamics in chemical reactions, Keq, pKa and pKb definitions; hybrid orbitals

Teaching form

Lectures (48 h) and practising (16 h) in the classroom (the attendance is not compulsory, despite suggested).
The course is flanked by tutoring activities for dedicated to student groups all the academic year long

Textbook and teaching resource

Textbooks
Any organic chemistry textbook is suitable. A few are listed below:
-Brown-Poon: Introduzione alla chimica organica 5° Ed (Edises)
-Botta et al. Chimica Organica Essenziale (EDI-Ermes)
-D. Klein Fondamenti di chimica organica (Pearson)
-Gorzynski Smith Fondamenti di Chimica Organica (Mc Graw Hill)
-Wade Fondamenti di Chimica Organica (PICCIN)
Exercise book
-Eserciziario di chimica organica, F. Nicotra, L. Cipolla (EDISES)
Slides:
All slides can be found at the Moodle webpage related to the teaching module.

Semester

Second semester

Assessment method

Written and oral assessment
Written examination: knowledge of the basics of organic chemistry and ability to practise problems with organic chemical structure and reaction mechanisms. The students should demonstrate the comprehension of structure and organic chemistry reactivity.
Oral examination: knowledge of the basics of organic chemistry and ability to practise problems with organic chemical structure and reaction mechanisms. The students should demonstrate the comprehension of structure and organic chemistry reactivity, the use of a suitable scientific language and the ability to critically reelaborate acquired knowledge.

Office hours

Appointment requested by mail to laura.cipolla@unimib.it