UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Organic Chemistry

2021-1-E0201Q005

Aims

The course of Organic Chemistry will give the students the basis of organic chemistry, with a particular attention on bioprocess.

1. Knowledge and understanding

The student will gain knowledge of the chemical principles at the basis of organic chemistry useful for the comprehension of bioprocess.

2. Applying knowledge and understanding

The student will be able to apply the knowledge acquired under 1. to the subsequent subjects.

3. Making judgements

The student will be able to process the acquired knowledge in organic chemistry towards its application to bioprocess.

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. Concept of Aromaticity

6. Polyfunctional compounds of biological relevance

7. 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, and E1cb)

- 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 and terpene 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 practice (16 h) in the classroom (the attendance is not compulsory, despite suggested).

The course is flanked by tutoring activities (20h) dedicated to small groups of student (25 per group) during the entire academic year.

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)

-Bruno Botta: Chimica Organica 2° Ed (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 practice 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 practice 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 re-elaborate acquired knowledge.

Office hours

Appointment requested by mail to barbara.laferla@unimib.it