

Course Unit	Organic Chemistry	Field of study	Science Base
Bachelor in	Biomedical Laboratory Sciences	School	School of Health
Academic Year	2022/2023	Year of study	1
Type	Semestral	Semester	1
Workload (hours)	135	Contact hours	T - - TP 22,5 PL 30 TC - S - E - OT 7,5 O -
Level	1-1	ECTS credits	5.0
Code	9995-550-1107-00-22		

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Clementina Maria Moreira dos Santos, Jose Virgilio Santulhao Pinela, Maria Alice Silva Pinto

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Plan and execute experiments in a laboratory of organic chemistry.
2. Acquire the basic principles of chemical structure and bonding to understand the chemistry of the carbon compounds.
3. Recognize the families of hydrocarbons and the main functional groups; - Acquire and apply the concepts of structure and nomenclature of organic compounds.
4. Recognize the aspects that determine the reactions characteristics in organic chemistry; - Know the chemical and physical properties for the various families of organic compounds.
5. Know the typical methods used for the preparation of the different organic compounds.
6. Acquire the concepts to identify the spatial relationships between atoms and molecules.
7. Apply the concepts of chemistry in health sciences.
8. Implement and manage work independently and in groups.

### Prerequisites

Before the course unit the learner is expected to be able to:

1. Recognize de structure and atomic properties.
2. Nomenclature of inorganic compounds .
3. Fundaments of chemical equilibrium.

### Course contents

- Introduction and general principles of organic chemistry - Classification and nomenclature of organic compounds. Stereochemistry. E and Z notation. R and S notation. Reactivity of alkanes and cycloalkanes, alkenes, alkynes, aromatic compounds, alkyl halides, ethers, alcohols, amines, aldehydes, ketones, carboxylic acids and derivatives

### Course contents (extended version)

1. Introduction and general principles of organic chemistry.
  - Evolution of organic chemistry and its importance in health sciences.
  - Atoms and molecules. Covalent bond. Formal charge.
  - Structural theory. Atomic and molecular orbital.
  - Hybridization. geometry sp<sup>3</sup>, sp<sup>2</sup> and sp. Single, double and triple bonds.
2. Structural formulas.
  - Centesimal composition.
  - Resonance hybrids and isomers.
  - Molecular and condensed formulas. Bond line notation.
  - Oxidation of the carbon atom.
3. Classification of organic compounds.
  - Trivial and IUPAC nomenclature.
  - Principles of IUPAC nomenclature.
  - Priority of functional groups.
4. Alkanes and alkenes.
  - Physical properties: solubility, fusion and boiling points.
  - Reactivity: halogenation and combustion.
5. Alkenes and cycloalkenes.
  - Structure, physical properties and conformations (isomers cis/trans and E/Z).
  - Addition reactions: hydration, halogenation and polymerization.
6. Alkyl halides.
  - Physical properties: solubility, melting and boiling points.
  - Preparation of alkyl halides.
  - Transformation of alkyl halides. Nucleophilic substitution-unimolecular and bimolecular mechanism.
  - Elimination reactions- unimolecular and bimolecular mechanism.
7. Alcohols and ethers. Physical properties and reactivity.
8. Alkynes. Physical properties and reactivity.
9. Conformations.
  - Conformation in linear alkanes.
  - Conformation in cycloalkanes.
  - Chiral molecules and chiral center. Stereoisomers, enantiomers and diastereomers.
  - R and S notation. Fisher projection. Absolute configuration. Optical activity.
10. Aromatic compounds
  - Structural characteristics of aromatic compounds. Huckel rule.
  - Typical reactions of aromatic compounds.
11. Aldehydes and ketones. Physical properties and reactivity.
12. Amines. Physical properties and reactivity.
13. Carboxylic acids and derivatives. Physical properties and reactivity.
14. Contents for practice sessions
  - Elemental analysis of organic compounds
  - Synthesis and characterization of ethene
  - Reactivity of aldehydes and ketones
  - Synthesis and purification of an organic compound
  - Melting point evaluation
  - Reactivity of alcohols and esters

### Recommended reading

1. R. Morrison, R. Boyd, 2011 "Química Orgânica", 16ª Edição, Fundação Calouste Gulbenkian.

**Recommended reading**

2. T. W. G Solomons, 2009, "Química Orgânica" 9ª edição, LTC Livros Técnicos e Científicos Editora Lda.
3. W. Brown, B. L. Iverson, E. Anslyn, C. S. Foote, 2018, "Organic Chemistry", 8th Edition, Cengage Learning.
4. Donald L. Pavia , Randall G. Engel , George S. Kriz , Gary M. Lampman, 2009, "Química Orgânica Experimental", 2ª Edição, Bookman
5. M. Sklenicka Heather, 2012, "Basic Organic Chemistry for Allied Health Students", CreateSpace Independent Publishing Platform

**Teaching and learning methods**

- Theory - 1 lesson per week of 2 hour. Interactive approach, using audiovisual materials. Study materials available via e-learning. - Practical classes - 1 lesson of 2 hours per week. Integration of knowledge with the resolution of nomenclature exercises. Performance of practical work, with educational and scientific laboratory equipment.

**Assessment methods**

1. Continous evaluation - (Regular) (Final)
  - Laboratory Work - 12% (Student performance in the execution of practical experiments and small quizzes about the protocols.)
  - Intermediate Written Test - 9% (Written essay for nomenclature of organic compounds)
  - Intermediate Written Test - 9% (Written essay on the results of practical experiments)
  - Intermediate Written Test - 35% (Written essay about the first contents of the theoretical classes.)
  - Final Written Exam - 35% (Written essay about the remaining contents of the theoretical classes.)
2. Special evaluation - (Regular) (Supplementary, Special)
  - Final Written Exam - 100% (This exam comprise questions about the practical experiments (30%) and the theoretical subject (70%))
3. Working students - (Student Worker) (Final, Supplementary, Special)
  - Final Written Exam - 100% (This exam comprise questions about the practical experiments (30%) and the theoretical subject (70%))

**Language of instruction**

Portuguese, with additional English support for foreign students.

**Electronic validation**

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07-12-2022	09-12-2022	09-12-2022	10-12-2022