

**COURSE DATA****DATA SUBJECT****Code:** 36453**Name:** Organic Chemistry I**Cycle:** Undergraduate Studies**ECTS Credits:** 6**Academic year:** 2025-26**STUDY (S)**

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Facultat de Química	2	First quarter
1929 - Double Degree Program in Physics and Chemistry	Facultat de Física	3	First quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	2	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1110 - Degree in Chemistry	Organic Chemistry	COMPULSORY
1929 - Double Degree Program in Physics and Chemistry	Tercer Curso (Obligatorio)	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Segundo curso	COMPULSORY

COORDINATION

PEREZ PRIETO JULIA

SUMMARY

Organic chemistry is the branch of chemistry that studies the structure and reactivity of carbon compounds, generally known as organic molecules. Among these molecules are most of the essential compounds for life, such as lipids, carbohydrates, amino acids, proteins and nucleic acids. Organic substances are also many substances with which we come into direct contact, such as fuels, glues, paints or textile fibers. A large group of organic compounds are those that have pharmacological activity and that are the basis of medicines. Pesticides, fertilizers and herbicides have changed agriculture and preservatives have helped to modify our eating habits. However, not all organic compounds are beneficial; there are many of them that are harmful to health or to the environment and therefore, it is necessary to continue preparing compounds with better properties to replace those that present problems.

The knowledge of the structure and reactivity of organic compounds has the purpose of opening paths for the preparation of compounds that maintain all their beneficial characteristics, minimizing undesirable side



effects.

The study of Organic Chemistry is based on the general knowledge acquired in the subjects of Chemistry I and Chemistry II of the first year. As, the systematic study of functional groups characteristic of organic compounds will be carried out from this knowledge, it is highly recommended to have passed the above-mentioned subjects before approaching the study of Organic Chemistry I. This subject together with Organic Chemistry II and III constitute the theoretical foundations of the compulsory Organic Chemistry Module of the Degree in Chemistry and should be treated as a whole to show the complete perspective of the area of knowledge.

The objectives that are intended to achieve in this subject can be summarized in the following points:

- To set the student's knowledge about the structure and bond in organic compounds. Study the different types of representation of organic molecules.
- To apply the general rules of nomenclature for organic compounds.
- To study the stereochemistry of organic compounds and the appropriate nomenclature rules.
- To identify the different functional groups present in organic molecules.
- To study the reactivity of the different functional groups that only contain carbon-carbon bonds
- To study the methods for obtaining these functional groups.
- To study the mechanisms of the most important reactions in which these functional groups are involved.
- To design synthesis of organic compounds from certain starting products and involving more than one reaction step.

Regarding the Sustainable Development Goals (SDGs), it is expected that students will be able to acquire a special sensitivity for sustainable management of water (SDG 6), raw materials and energy sources (SDG 7), as well as for an environmentally friendly and sustainable development (SDGs 11, 12, 13, 14 and 15), in addition to being able to design, select and/or develop efficient chemical products, processes and/or analytical methodologies (SDG 7) that minimize their impact on the environment (SDGs 14 and 15), using alternative raw materials and reducing wastes (SDG 11)

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

The study of Organic Chemistry I is based on the knowledge acquired in General Chemistry I and General Chemistry II.

COMPETENCES / LEARNING OUTCOMES

1110 - Degree in Chemistry



Act autonomously in learning, making well-founded decisions in various contexts, forming judgements based on experimentation and analysis, and applying knowledge to new situations.

Address new problems and propose strategies to solve them.

Collaborate effectively in work teams, assume responsibilities and leadership roles, and contribute to collective improvement and development.

Communicate effectively both orally and in writing, adapting to the context and audience.

Contribute to the design, development and implementation of solutions that respond to social demands, using the Sustainable Development Goals as a reference.

Demonstrate both inductive and deductive reasoning skills.

Demonstrate critical and self-critical thinking, considering professional ethics, moral values and social implications of the different activities carried out throughout the degree.

Demonstrate the ability to analyse, synthesise and reason critically.

Distinguish between the qualitative and quantitative aspects of chemical problems.

Distinguish the principles, procedures and techniques used in the determination, separation, identification and characterisation of chemical compounds.

Evaluate the risks involved in the use of chemical substances and laboratory procedures.

Express ideas correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Identify chemical elements and their compounds, including their extraction, structure, reactivity, properties and applications.

Identify chemical processes in everyday life.

Identify the main types of chemical reactions and their associated key characteristics.

Implement sustainable and environmentally friendly methodologies.

Interpret the relationship between the variation in the characteristic properties of chemical elements and the Periodic Table.

Propose creative and innovative solutions to complex situations or problems in the field, addressing diverse professional and social needs.

Relate chemistry to other disciplines.

Relate theory to experimentation.

Solve problems effectively.

State the principles of thermodynamics and kinetics and their application in chemistry.



Understand and analyse, from the perspective of the degree programme, social inequalities based on sex and gender; integrate gender-sensitive approaches into problem-solving and solution design.

Use chemical terminology, nomenclature, conventions and units correctly.

DESCRIPTION OF CONTENTS

1. Introducción to Organic Chemistry

1.1 Introduction 1.2 Functional groups 1.3 Drawing organic structures 1.4 Polar Covalent Bonds: Electronegativity. 1.5 Polar Covalent Bonds: Dipole Moments. 1.6 Formal Charges. 1.7 Resonance. 1.8 Rules for Resonance Forms. 1.9 Drawing Resonance Forms. 1.10 Acids and Bases: The Brønsted-Lowry definition. 1.11 Acid and Base Strength. 1.12 Predicting Acid-Base reactions from pKa Values. 1.13 Organic Acids and Organic Bases. 1.14 Acids and Bases: The Lewis Definition. 1.15 Noncovalent Interactions Between Molecules.

2. Organic Compounds: Alkanes, Cycloalkanes and their Stereochemistry

2.1 Alkanes and Alkane Isomers. 2.2 Alkyl Groups. 2.3 Naming Alkanes. 2.4 Physical and chemical properties of alkanes. 2.5 Conformations of Ethane. 2.6 Conformations of Other Alkanes. 2.7 Cycloalkanes 2.8 Naming Cycloalkanes. 2.9 CisTrans Isomerism in Cycloalkanes. 2.10 Stability of Cycloalkanes: Ring Strain. 2.11 Conformations of Cycloalkanes. 2.12 Conformations of Cyclohexane. 2.13 Axial and Equatorial Bonds in Cyclohexane. 2.14 Conformations of Monosubstituted Cyclohexanes. 2.15 Conformations of Disubstituted Cyclohexanes 2.16. Conformations of Polycyclic Molecules.

3. Stereochemistry at Tetrahedral Centers

3.1 Enantiomers and the Tetrahedral Carbon. 3.2 The Reason for Handedness in Molecules: Chirality. 3.3 Optical Activity. 3.4 Pasteur's Discovery of Enantiomers. 3.5 Sequence Rules for Specifying Configuration. 3.6 Diastereomers. 3.7 Meso Compounds. 3.8 Racemic Mixtures and the Resolution of Enantiomers. 3.9 A Review of Isomerism. 3.10 Chirality at Nitrogen, Phosphorus, and Sulfur.

4. An Overview of Organic reactions

4.1 Kinds of Organic Reactions. 4.2 How Organic Reactions Occur: Mechanisms. 4.3 Using Curved Arrows in Reaction Mechanisms. 4.4 Describing a Reaction: Equilibria, Rates, and Energy Changes. 4.5 Describing a Reaction: Bond Dissociation Energies. 4.6 Describing a Reaction: Energy Diagrams and Transition States. 4.7 Describing a Reaction: Intermediates. 4.8 Radical Reactions: alkane halogenation. Hammond Postulate 4.9 Polar Reactions. Generalities. 4.10 Oxidation and Reduction in Organic Chemistry 4.11 A Comparison Between Biological Reactions and Laboratory Reactions.



5. Alkyl Halides. Reactions of Alkyl Halides

5.1 Names and properties of Alkyl Halides. 5.2 Preparing Alkyl Halides 5.3 Reactions of Alkyl Halides: Grignard Reagents. 5.4 Reactions of alkyl halides: reactions of substitution and elimination 5.5 The SN2 Reaction. 5.6 Characteristics of the SN2 Reaction. 5.7 The SN1 Reaction. 5.8 Characteristics of the SN1 Reaction. 5.9 Elimination Reactions: Zaitsevs Rule. 5.10 The E2 Reaction. 5.12 The E1 Reactions. 5.13 Characteristics of the E1 reaction 5.14 A Summary of Reactivity: SN1, SN2, E1 and E2.

6. An Overview of Organic reactions

6.1 Kinds of Organic Reactions. 6.2 How Organic Reactions Occur: Mechanisms. 6.3 Using Curved Arrows in Reaction Mechanisms. 6.4 Describing a Reaction: Equilibria, Rates, and Energy Changes. 6.5 Describing a Reaction: Bond Dissociation Energies. 6.6 Describing a Reaction: Energy Diagrams and Transition States. 6.7 Describing a Reaction: Intermediates. 6.8 Radical Reactions: alkane halogenation. Hammond Postulate 6.9 Polar Reactions. Generalities 6.10 Oxidation and Reduction in Organic Chemistry 6.11 A Comparison Between Biological Reactions and Laboratory Reactions.

6. Alkenes: Structure, Reactivity, Reactions and Synthesis

8.1 Industrial Preparation and Use of Alkenes. 8.2 Naming Alkenes 8.3 Calculating Degree of Unsaturation. 8.4 Structure and bonding. 8.5 CisTrans Isomerism in Alkenes. 8.6 Alkene Stereochemistry and the E,Z Designation. 8.7 Stability of Alkenes. 8.8 Preparation of alkenes 8.9 Electrophilic Addition Reactions of Alkenes. 8.10 Carbocation Structure and Stability. 8.11 Halogenation of Alkenes: Addition of HX 8.12 Orientation of Electrophilic Additions: Markovnikovs Rule. 8.13 The Hammond Postulate. 8.14 Evidence for the Mechanism of Electrophilic Additions: Carbocation Rearrangements. 8.15 Halogenation of alkenes: Addition of X₂ 8.16 Halohydrins from Alkenes: Addition of HOX. 8.17 Hydration of Alkenes: Addition of H₂O with acid 8.18 Hydration of Alkenes: Addition of H₂O by Oxymercuration. 8.19 Hydration of Alkenes: Addition of H₂O by Hydroboration. 8.20 Reduction of Alkenes: Hydrogenation. 8.21 Oxidation of Alkenes: Epoxidation and Hydroxylation. 8.22 Oxidation of Alkenes: Cleavage to Carbonyl Compounds. 8.23 Radical Additions to Alkenes.

7. Alkynes: An Introduction to Organic Synthesis

9.1 Naming Alkynes. 9.2 Structure and bonding 9.3 Preparation of Alkynes 9.4 Reactions of Alkynes: Addition of HX and X₂ 9.5 Hydration of Alkynes. 9.6 Reduction of Alkynes. 9.7 Oxidative Cleavage of Alkynes. 9.8 Alkyne Acidity: Formation of Acetylide Anions. 9.9 Alkylation of Acetylide Anions.

8. Structure Determination: Mass Spectrometry and Infrared Spectroscopy

8.1 Mass Spectrometry of Small Molecules: Magnetic-Sector Instruments. 8.2 Interpreting Mass Spectra. 8.3 Mass Spectrometry of Some Common Functional Groups. 8.4 Spectroscopy and the Electromagnetic Spectrum. 8.5 Infrared Spectroscopy . 8.6 Interpreting Infrared Spectra. 8.7 Infrared Spectra of Some Common Functional Groups



9. Structure Determination: Nuclear Magnetic Resonance spectroscopy

9.1 Nuclear Magnetic Resonance Spectroscopy. 9.2 The Nature of NMR Absorptions. 9.3 Chemical Shifts. 9.4 ¹H NMR Spectroscopy and Proton Equivalence. 9.5 Chemical Shifts in ¹H NMR Spectroscopy. 9.6 Integration of ¹H NMR Absorptions: Proton Counting. 9.7 Spin-Spin Splitting in ¹H NMR Spectra. 9.8 Uses of ¹H NMR Spectroscopy. 9.9 ¹³C NMR Spectroscopy: Signal Averaging and FTNMR. 9.10 Characteristics of ¹³C NMR Spectroscopy. 9.11 Uses of ¹³C NMR Spectroscopy.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	9,00
Theory	51,00
Total hours	60,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	90,00
Preparation of lessons	0,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	90,00

TEACHING METHODOLOGY

The subject is designed so that the student is the protagonist of his/her own learning. The subject structure is:

- Theory classes and questions.- Theory lessons will introduce the students to the most fundamental aspects of the subject. The question sessions will be dedicated to the application of the specific knowledge that students have acquired in theory classes. Students must have previously worked on the questions to be solved. The answers will be discussed in class by both the teacher and the students. The classes should be complemented by personal study time.
- Tutoring.- In them the overall learning process of the students will be evaluated. In the tutorial sessions the professor could entrust written reports to the students. Furthermore, the tutorials will serve to solve any doubts that may have arisen during the classes and guide students on the most convenient work methods.
- Seminars-Talks: The Seminars-Talks will deal with complementary aspects of their formation in Organic Chemistry and will be dedicated to the presentation by a specialist of a relevant topic in



current Chemistry. For this task, students will attend the event and answer a questionnaire prepared by the teacher.

EVALUATION

The minimum global qualification to pass the subject will be 5 points out of 10.

FIRST CALL

Continuous evaluation through the course. In this case, the following sections will be considered:

1. Direct evaluation by the teacher (5%): this evaluation will take into account different aspects, among which include:

Assistance and reasoned and clear participation in the discussions and questions in the class

Progress in the use of the language specific to organic chemistry

Troubleshooting and raising doubts

Critical spirit

2. Tutorials and Seminars (globally 15%): In this section the following aspects will be considered:

Assistance

Content and written presentation of the exercises proposed by the teacher (if applicable).

Rational and clear participation in the discussions.

3. Exams (80%): will be held on the date indicated by the Faculty and will be common to all groups of the subject. It will consist of theoretical and practical questions related to the subject explained during the teaching period. The global passing of the subject will necessarily entail having obtained a minimum score



of 5 out of 10 points on the exam.

SECOND CALL

In the second call evaluation, the grade obtained by the student in the first call for sections 1 and 2 will be maintained but, section 3 will be re-evaluated.

Final warning

Copying or plagiarism of any assignment that is part of the evaluation will make it impossible to pass the course, and the student will be subject to the appropriate disciplinary procedures.

Please note that, according to Article 13 d) of the University Student Statute (RD 1791/2010, December 30), *"it is the duty of a student to refrain from using or cooperating in fraudulent procedures in evaluation tests, in the work performed or in official University documents"*.

REFERENCES

BASIC

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- McMURRY, J. Organic Chemistry, 8 Ed., Cengage Learning, 2012. Disponible en formato papel en la biblioteca.
- WADE, L. G. Química Orgánica, 9 Ed., Pearson Prentice Hall, 2017. Disponible en formato electrónico en la biblioteca.
- WADE, L. G. Química Orgánica, 7 Ed., Pearson Prentice Hall, 2012. Disponible en formato papel y electrónico en la biblioteca.
- BRUICE, P. Y. Química Orgánica, 5 Ed., Pearson Prentice Hall, 2008. Disponible en formato papel y electrónico en la biblioteca.
- VOLLHARDT, K. P. C. Química Orgánica Estructura y Función, 5 Ed., Ediciones Omega, 2007. Disponible en formato papel en la biblioteca.
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- QUIÑO A CABANA, E.; RIGUERA VEGA, R. Nomenclatura y representación de los compuestos orgánicos, McGraw-Hill/Interamericana, 2013. Disponible en formato papel y electrónico en la biblioteca.



- ChemBioOffice Ultra, Perkin Elmer (CambridgeSoft) Amplia selección de aplicaciones y funcionalidades que permite a químicos y biólogos dibujar, formular, modelar y editar estructuras moleculares químicas y biológicas así como simular espectros de RMN de protón y carbono.

ADDITIONAL

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