COURSE DATA

Data Subject	
Code	34204
Name	Organic chemistry II
Cycle	Grade
ECTS Credits	4.5
Academic year	2017 - 2018

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	2	Second term

Subject-matter

Degree	Subject-matter	Character
1108 - Degree in Chemistry	9 - Organic chemistry	Obligatory

Coordination

Name	Department
FUSTERO LARDIES, SANTOS	325 - Organic Chemistry

SUMMARY

Organic chemistry is the branch of chemistry that studies the structure and reactivity of carbon compounds, generally known as organic molecules. These molecules are the most essential compounds for life, such as lipids, carbohydrates, amino acids, proteins and nucleic acids. They are also organic molecules with many substances we come into contact directly, such as fuels, adhesives, paints and textile fibers. A large group of organic compounds are those that possess pharmacological activity and which are the basis of medicines. Pesticides, herbicides, fertilizers and agriculture have changed and preservatives have helped to change our eating habits. However, not all organic compounds are beneficial, there are many of them that are harmful either to health or the environment and therefore must continue to develop compounds with improved properties to replace those with problems.
Knowledge of the structure and reactivity of organic compounds is intended to pave the way for the preparation of compounds that retain all their beneficial properties while minimizing undesirable side effects.
Organic Chemistry II The course is planned as a continuation of the knowledge acquired in Organic Chemistry I and Organic Chemistry complemented III. Taken together, constitute the theoretical foundations of Organic Chemistry Module mandatory Degree in Chemistry and must be treated as a whole to show the perspective of the area that is to show students.

The objectives to be achieved in the subject can be summarized in the following points:
• Seat the student's knowledge about the structure and bonding in organic compounds.
• Studying different types of representation of organic molecules.
• Apply general rules for naming organic compounds.
• To study the stereochemistry of organic compounds and appropriate naming rules.
• Identify the different functional groups present in organic molecules.
• To study the reactivity of functional groups containing only carbon-heteroatom.
• Study the methods of obtaining these functional groups.
• Study the mechanisms of the most important reactions that are involved in these functional groups.
• Design synthesis of organic compounds from certain starting materials and involving more than one reaction.

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 is based on the knowledge acquired in the subjects of General Chemistry I and General Chemistry II. Knowledge must be acquired are:

GENERAL CHEMISTRY I
GENERAL CHEMISTRY II

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Solve problems effectively.
- Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.
- Learn autonomously.
- Demonstrate the ability to adapt to new situations.
- Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.

- Interpret the variation of the characteristic properties of chemical elements according to the periodic table.
- Demonstrate knowledge of the main types of chemical reaction and their main characteristics.
- Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry.
- Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
- Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- Solve qualitative and quantitative problems following previously developed models.
- Recognise and analyse new problems and plan strategies to solve them.
- Evaluate, interpret and synthesise chemical data and information.
- Handle chemicals safely.
- Handle the instrumentation used in the different areas of chemistry.
- Recognise and evaluate chemical processes in daily life.
- Develop sustainable and environmentally friendly methods.
- Relate chemistry with other disciplines.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

1 Demonstrate knowledge of the main aspects of organic nomenclature and terminology. (CE1)
2 Understand the structural properties and reactivity of compounds and of organic functional groups and applying this knowledge to solve the synthetic and structural problems. (CG8, CG10, EC2, EC4, EC6, EC7, CE23, CE26)
4 Explain phenomena and processes related to organic chemistry in an understandable manner. (CG1, CG2, CE13)
5 Obtain and use bibliographic and technical information related to organic compounds. (CG7, CE16, CT3)
6 Write and present one's work in the native language (CT1)
7 Perform tasks assigned as a member of a team effectively and from a gender perspective (CG3, CG5)
8 Demonstrate knowledge of sustainable methods in organic chemistry. (CE25)
13 Make decisions with rigor. (CG3, CG6, CG9)
14 Demonstrate critical thinking. (CG1)
15 Demonstrate independent learning. (CG8)
16 Solve problems with rigor. (CG4, CG10, CE14, CE15)

DESCRIPTION OF CONTENTS

1. Halogenated organic compounds: properties and reactions.

Nomenclature of haloalkanes. Physical properties of haloalkanes. Nucleophilic substitution. Study of the mechanism of nucleophilic substitution, kinetics. Stereochemistry of the SN2 reaction. Consequences of investing in the SN2 reaction. Reactivity and efficiency of the leaving group. Effect of nucleophilicity in SN2 reaction. Effect of alkyl group in the SN2 reaction. Preparation of alkynes by the reaction of alkylation of alkynyl anions. Solvolysis of secondary and tertiary haloalkanes. Unimolecular nucleophilic substitution. Stereochemical outcome of the SN1 reaction. Effect of solvent, the leaving group and nucleophile in the nucleophilic substitution unimolecular. Effect of alkyl group in the SN1 reaction. E1 unimolecular elimination. E2 bimolecular elimination. Competition between substitution and elimination. Transposition reactions. Synthesis of alkene by dehydrohalogenation reactions. Hofmann and Saytzev rules. Synthesis of alkynes by double elimination of derivatives, and germ dihalogenated neighborhood. Organometallic compounds: reverse polarity, collection methods and properties.

2. The hydroxyl functional group: alcohols and analogues with sulphur (thiols)

Nomenclature of alcohols. Structure and physical properties of alcohols. Alcohols as acids and bases. Reactions of alcohols with bases: formation of alkoxides. Reactions with strong acids alcohols: substitution and elimination in alcohols by ion alquiloxonio processes. Transposition reactions. Formation of esters with sulfonic acids. Transformation of alcohols in halides of alkyl by reaction with Cl2SO and PBr3. reactions of oxidation of alcohols. Synthesis of alcohols by Nucleophilic substitution. Synthesis of alcohols by hydration of alkenes. Phenols: structure and reactivity. Thioalcohols: physical and chemical properties.

3. Ethers and analogues with sulphur (Thioethers)

Nomenclature. Structure and physical properties of ethers. Reactions with strong acids. Synthesis of ethers from alcohols and mineral acids. Williamson ether synthesis. Reactions of the oxaciclopropanos (epoxies). Thioethers: physical and chemical properties.

4. Aldehydes and ketones, the carbonyl group

Nomenclature of aldehydes and ketones. Structure and physical properties. Structure of carbonyl group. Preparation of aldehydes and ketones from alcohols. Carbonyl group reactivity: mechanisms of nucleophylic addition. Adding water to form hydrates. Addition of alcohols to form acetals and hemiacetals. Acetals as protecting groups. Nucleophilic addition of ammonia and its derivatives. Reduction of carbonyl compounds: catalytic hydrogenation and reduction with metal hydrides. Deoxygenation of the carbonyl group. Addition of hydrogen cyanide to give cyanohydrins. Reactions with organometallic compounds: preparation of alcohols. Acidity of alfa hydrogens of aldehydes and ketones: enolate ions. Keto-enol tautomerism.

5. Carboxylic acids and nitriles

Nomenclature of carboxylic acids. Structural and physical properties of carboxylic acids. Acidic and basic carboxylic acids. Carboxylic carbon substitution: addition-elimination mechanism.Methods of obtaining the carboxyl functional group. Nitriles. Nomenclature. Structural and physical properties. Preparation methods. Reactions of nitriles: hydrolysis, reduction and reaction with organometallics.

6. Carboxylic acid derivatives.

Nomenclature of carboxylic acid derivatives. Structure and physical properties. Alkanoyl halides, anhydrides, esters and amides. Relative reactivity and structural features of carboxylic acid derivatives. Preparation of acid derivatives from the corresponding acids. Chemistry alkanoyl halides, anhydrides and esters: hydrolysis, reactions with other nucleophiles and reduction reactions. Amides: similarities and differences with the other derivatives of carboxylic acids. Use of NMR spectroscopy in the structural elucidation of organic compounds.

7. Amines. Altres compost nitrogenats

Amine nomenclature. Structural and physical properties of the amines. Acidity and basicity amines. Synthesis of amines by alkylation reaction. Quaternary ammonium salts: Hofmann elimination. Gabriel synthesis. Synthesis of amines from other nitrogen compounds. Synthesis of amines by reductive amination. Synthesis of amines from carboxylic acid derivatives. Characteristics of aromatic amines. Reactions of arylamines. Nitrogen functional groups.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	7,00	100
Development of group work	5,00	0
Study and independent work	62,50	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The subject is raised so that the student is the protagonist of his own learning and is structured as follows:
• Pedagogic material. - From the beginning of course(year) the students can have the pedagogic material corresponding to the course.

• Lectures .- A class or two per item to be devoted to discuss with students the most complicated or those which have had more difficulty. These classes are supplemented by personal study time.
• Classes of problems .- In these classes will be held on the specific application of knowledge students have acquired in the lectures. Students must, in advance, having worked the problems to be solved. The resolution of these issues will be held at times by the teacher and in other cases by the students well in group or individually.
• Tutoring .- They will be distributed uniformly along the course, being 1 hour the duration each one the above mentioned meetings. In them, the teacher will evaluate the global process of learning of the students, which one can be organized before in subgroups of work. In the meetings tutorships there will be able to collect the works that have been entrusted by the teacher to the mentioned subgroups. Equally, the tutorships will serve to solve all the doubts that could have arisen along the classes and it will orientate the students on the most useful methods of work for the resolution of the problems that could appear them.

• Organic Chemistry Seminars: Seminars will be carried out along the semester, in the dates that will turn out to be gathered in the calendar of the course(year). The above mentioned seminars will be dedicated to a deeper discussion of topics which content makes a more detailed study suitable: applications of the technologies(skills) of espectroscopia IR and RMN. After the discussion of every topic there will be carried out the resolution of some practical problems related to the same one.

• Programmed conferences where current topics will be tackled.- At the end of the session, the students will answer a test with questions related to the content of the talk.

EVALUATION

For the evaluation of the learning the teacher can use two modalities. The student must choose one of them having to communicate his choice by means of a written to the secretariat of the department according to the available model, during the first month after beginning the quarter. For questions of teacher's programming, if nothing is communicated during this period, the student will be evaluated with modality B.The minimum overall grade to pass the subject in any modality will be 5 points out of 10.

FIRST CALLModality A

Evaluation continues throughout the course. In this case the following sections will be taken into account:

1. Direct evaluation of the teacher (5%): This evaluation will take into account different aspects, among which:Attendance and participation reasoned and clear in the discussions and questions raisedProgress in the use of the proper language of organic chemistryProblem solving and doubts. Critical spirit

2. Seminars and / or Tutorials (overall 15%): In the note of each student in this section the following aspects may be taken into account:AssistanceContent and written presentation of the exercises proposed by the teacher to each subgroup of work (if applicable)Reasoned 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 overall approval of the subject will necessarily entail having obtained in the exam a minimum score of 5 points on the total 10 of the exam.

Attendance to the interdisciplinary conferences will be evaluated through a test, whose mark will be added as a 5% to the qualification of the ongoing assessment.

Modality B

Evaluation only with a written examination of the contents of the subject covered in theory classes, tutorials and seminars, so that the teacher can thus assess if the student has acquired the skills and knowledge related to the subject. This exam will be 100% of the overall grade.The exam will be held on the date indicated by the Faculty and will be common to all groups of the subject. In this modality, the teacher can take into account the participation of students in theory classes, tutoring and seminars in the final grade.
SECOND CALLIn the evaluation of the second call, for students who have chosen modality A, the qualification obtained by the student in sections 1 and 2 of that modality will be maintained and the part corresponding to section 3 will be reassessed.

REFERENCES

Basic

- Bruice P. Y. Química Orgánica Pearson Prentice Hall (2008), 5ª edición en castellano.
- Wade, L. G. Química Orgánica. Pearson Prentice Hall (2004), 5ª edición en castellano.
- Vollhardt, K. P. C. "Química Orgánica Estructura y Función". Ediciones Omega, S.A. (2008), 5ª edición en castellano.
- McMurry, J.. Química Orgánica Cengage Learning Editores. S. A. (2008) 7ª edición.
- Ege, S. Química Orgánica. Editorial Reverté (1998).

- Primo Yúfera, E. Química Orgánica Básica y Aplicada. Ed. Reverté (1994).
- "ChemBioOffice Ultra, PerkinElmer (CambridgeSoft) Àmplia selecció d'aplicacions i funcionalitats que permet estudiar, dibuixar, formular, modelar i editar estructures moleculars químiques i biològiques.

Additional

- Carey, F.A. Química Orgánica. McGraw-Hill (2006).
- Quiñoá, E. y Riguera, R. Cuestiones y Ejercicios de Química Orgánica. Mc Graw-Hill (2004).
- Peterson, W.R. Formulación y Nomenclatura Química Orgánica. Eunibar.
- Quiñoá Cabana, E. y Riguera Vega, R. Nomenclatura y representación de los compuestos orgánicos. S. A. McGraw-Hill/Interamericana de España (2005).