COURSE DATA

Data Subject	
Code	34203
Name	Organic chemistry I
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	First term

Subject-matter

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

Coordination

Name	Department
ASENSIO AGUILAR, GREGORIO	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. Organic molecules are also many substances we come into direct contact, such as fuels, adhesives, paints and textile fibers. A large group of organic compounds are those that have 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, many of them are harmful either to health or the environment and therefore must continue to develop compounds with improved properties to replace those that have 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.
The study of organic chemistry is based on the knowledge acquired in the subjects of Chemistry I and Chemistry II first year. Since, from this knowledge will be carried out systematic study of the functional groups characteristic of organic compounds, it is advisable to have overcome the above subjects before approaching the study of Organic Chemistry I. This course along with Organic Chemistry II and III form the theoretical foundations of Organic Chemistry Module mandatory Degree in Chemistry and must be

treated as a whole to show the full picture of the domain.
The objectives to be achieved in this 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 the general rules of nomenclature for 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 different functional groups containing only carbon-carbon bonds
• Study methods for 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 step.

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 knowledge acquired in the subjects of General Chemistry I and General Chemistry II.

OUTCOMES

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

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 apply this knowledge to solve 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. Structure and reactions of organic molecules.

Functional groups: centers of reactivity. Types of organic reactions: homolytic reactions and heterolithic. Acidity and basicity in organic compounds. Nucleophilicity and electrophilicity in organic compounds. Kinetics and thermodynamics of a reaction. Profiles and reaction mechanisms. Reaction intermediates. Isomerism: Constitutional Isomerism and their types. Determination of the molecular formula. Elemental analysis. Mass spectrometry.

2. Alkanes and cycloalkanes.

Linear and branched alkanes. The system of nomenclature of alkanes. Structural and physical properties of alkanes. Rotation of single bonds, conformations. Diagram of potential energy. Rotation in ethane. Rotation butane. Nomenclature and physical properties of the cycloalkanes. Tension ring and structure of cycloalkanes. The cycloalkane cyclohexane as an example of stress-free angle. Substituted cyclohexanes. Higher cycloalkanes.

3. Reactions of Alkanes: Bond dissociation energies, and relative reactivity halogenation.

Force liaison alkanes: radicals. Structure of alkyl radicals: hyperconjugation. Chlorination of methane: chain radical pathway. Other free radical halogenations methane. Halogenation of other alkanes. Combustion and relative stability of alkanes.

4. Stereoisomerism.

Chiral molecules. Optical activity. Absolute configuration: RS naming system. Absolute configuration: a historical note. Fischer projections. Molecules with multiple stereocenters: diastereomers. Meso compounds. Stereochemistry in chemical reactions. Resolution.

5. Alkenes.

Nomenclature of alkenes. Isomers E / Z alkenes. Physical properties of alkenes. Index of hydrogen deficiency. Relative stability of the double bonds: heat of hydrogenation. Addition reactions to alkenes. Catalytic hydrogenation. Stereochemistry of the hydrogenation reaction. Nucleophilic character of the pi bond: electrophilic addition of hydrogen halides. Relative stability of carbocations and regiochemistry of addition (Markovnikov rule). Synthesis of alcohols by acid-catalyzed hydration: thermodynamic control. Electrophilic addition of halogens to alkenes. Stereochemistry of the reaction. Hydroboration-oxidation, anti-Markovnikov hydration stereospecific. Synthesis oxaciclopropanos (epoxides) peroxycarboxylic acid oxidation. Dihydroxylation neighborhood without. Oxidative burst: ozonolysis. Radical addition, formation of anti-Markovnikov products. Dimerization, oligomerization and polymerization of alkenes.

6. Alkynes.

Nomenclature of alkynes. Properties and Bonding in alkynes. Stability of the triple bond. Acidity of terminal alkynes. Reduction of alkynes: relative reactivity of the two pi bonds. Electrophilic addition reactions to alkynes. Anti-Markovnikov additions to triple bonds.

7. Delocalized pi-systems.

Electron delocalization in the allyl system. Allylic carbon reactivity. Conjugated dienes. Addition reactions. Diels-Alder. Electrocyclic reactions. Introduction to UV-Vis spectroscopy.

8. Benzene and other cyclic polyenes.

Nomenclature of benzene derivatives. Structure and resonance energy of benzene: an introduction to the concept of aromaticity. Molecular orbitals of benzene. Polycyclic benzenoid hydrocarbons. Other cyclic polyenes, Hückel's rule.

9. Reactivity of benzene derivatives.

Electrophilic aromatic substitution. Halogenation of benzene. Nitration and sulphonation of benzene. Alkylation and Friedel-Crafts acylation. Activation and deactivation of the benzene ring by the substituents. Inductive effect of alkyl groups leader. Guiding effect of the substituents conjugated with the benzene ring. Disubstituted benzenes electrophilic substitution. Benzyl carbon reactivity.

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 organised so the student is the protagonist of their own learning. The structure is as follows

Teaching material. - During the course students will have the educational material for the course.

Theory classes. - Will be lectures in which the teacher will give an overview of the topic with particular emphasis on those new or particularly complex issues. These classes are complemented by personal study time.

Problems classes. - Specific application of the knowledge students have acquired during lectures will take place in these classes. Students must previously have worked the problems to be solved. These problems will be solved by the teacher or the students either in group or individually.

Tutorials.- In them, the teacher will evaluate the overall learning process of students, which can be pre-arranged in subgroups. In the tutorials works that have been entrusted by the teacher can be collected. Equally, the tutorials will serve to resolve all doubts that have arisen over the classes and guide students on the more useful methods of work for the resolution of problems.

Seminars.- The seminars will be dedicated to a deeper discussion of issues, wich content deserves a more detailed study. After the discussion of each topic the resolution of some practical problems may be carried out.

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 professor can use two modalities. The student must choose one of them having to communicate their choice by writing to the secretary of the department according to the model available, during the first month after the beginning of the semester. For teacher programming issues, but nothing communicates during this period, the student will be assessed with modality B.The minimum overall grade to pass the subject in any modality will be 5 points out of 10.

FIRST CALL

Modality A

Continuous assessment throughout the course. In this case, the following sections will be taken into account:1. Direct evaluation of the teacher (5%): In this evaluation different aspects can be taken into account, among which:Assistance and reasoned and clear participation in the discussions and questions raisedProgress in the use of the language of organic chemistryTroubleshooting and questioningCritical spirit2. Seminars and / or Tutorials (overall 15%): The following aspects can be taken in the note of each student in this section: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 raised3. Exams (80%): will be done on the date indicated by the Faculty and will be common to all the groups of the subject. It will consist of theoretical and practical questions related to the matter explained during the teaching period. The overall approval of the course will necessarily have obtained a minimum score of 5 points over the total 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 exam about the contents of the subject treated in theory classes, tutorials and seminars, so that the teacher can thus evaluate if the student has acquired the competences and knowledge related to the subject. This exam will be 100% of the overall grade.The examination will be carried out on the date indicated by the Faculty and will be common to all the groups of the subject. In this mode, the teacher can take into account the participation of the students in the classes of theory, tutoring and seminars in the final note.

SECOND CALL

In the evaluation of the second call, the student's qualification in sections 1 and 2 of said modality will be maintained for the students who have chosen Modality A and will proceed to evaluate the part corresponding to section 3 again.

REFERENCES

Basic

- BRUICE, P.Y. Química Orgánica Pearson Prentice Hall (2008), 5ª edición en castellano. ISBN:9789702607915
- WADE, L. G.. Química Orgánica. Pearson Prentice Hall (2004), 5ª edición en castellano. ISBN: 9786073207904
- VOLLHARDT, K. Peter C "Química Orgánica Estructura y Función". Ediciones Omega, S.A. (2008), 5ª edición en castellano. ISBN: 9788428214315
- 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 CABANA, E. y RIGUERA VEGA, 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).