

**COURSE DATA****Data Subject**

Code	34205
Name	Organic chemistry III
Cycle	Grade
ECTS Credits	6.0
Academic year	2015 - 2016

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	3	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

The subject of Organic Chemistry III that is taught in third year of the degree in Chemistry assumes a continuation and deepening of the knowledge acquired in the subjects Organic Chemistry I and II that are taught in second year of the degree.

Organic Chemistry is the branch of Chemistry that studies the structure, reactivity and synthesis of the compounds of carbon. The study covers the behavior of many millions of chemical compounds with different properties, which constitutes one of the great challenges in the teaching of this discipline: To show the Organic Chemistry as a logical and consistent body of interrelated ideas and not as a mere collection of facts without any connection between them.

Of the relevance of Organic Chemistry is illustrated by the fact that this discipline goes beyond the purely academic limits and is an important part of life itself. The lipids, carbohydrates, proteins and nucleic acids, all of them compounds essential for life, are organic compounds. There are also many substances that we facilitate the everyday life, such as textile fibers, drugs, antioxidants, etc.

The knowledge of the structure of the organic compounds has been driving us to the understanding of their reactivity and, in consequence, the understanding of the biological processes that are involved many



organic compounds. In addition, the knowledge of the reactivity enable us to have the design of new synthesis methods leading to the preparation of organic compounds with useful properties and without unwanted side effects. Such synthesis must be carried out in a sustainable manner, i.e. with a minimum of waste generation.

The study of the subject Organic Chemistry III is based on the knowledge acquired in the previous courses in Organic Chemistry I and II and, of course, in the subjects of General Chemistry I and II. Based on this knowledge, will be carried out the systematic study of some functional groups that complete the already seen, as well as the various bifunctional organic compounds, including natural product groups more representative. This study will be completed by a side with an introduction to spectroscopic methods as a tool for the structural determination of organic compounds and, on the other, with an introduction to the design of synthesis.

The objectives to be achieved in this subject can be summarized in the following points:

- § Identify the different functional groups present in the organic molecules functional teamwork, their relative positions and understand the interactions between these functional groups.
- § Studying the reactivity and methods of obtaining organic compounds that contain phosphorus, sulfur and silicon.
- § Studying the reactivity and methods of obtaining monocyclic aromatic compounds and biciclicos simple hex with heterocyclic ring.
- § Studying the reactivity and methods of obtaining monocyclic aromatic compounds and simple biciclicos pentagonal with heterocyclic ring.
- § Identify the major groups of natural products of the primary and secondary metabolism, as well as learn about its importance.
- § Design simple synthesis of organic compounds from the products of heading indicated and involving synthetic sequences of up to 5 stages.
- § Introduce the basic concepts of spectroscopic methods for the determination of structures of organic compounds.

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 III is based on the knowledge acquired in the subjects of Organic Chemistry I and II, where the structure and reactivity of the functional groups already seen it is important to understand the more complex systems to be studied here. It is essential that always strengthens the knowledge representation and nomenclature of organic compounds, also including their configurations and conformations.



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.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- 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.
- 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, CE2, CE4, CE6, CE7, 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. Carbonyl compounds and unsaturated carbonyl compounds.

1. Dicarboxylic compounds. Enolization of beta-dicarbonyl compounds: stability and reactivity of enolate anions. Decarboxylation of beta-Keto acids. Reactions of the beta-dicarbonyl compound: acetylacetic synthesis and malonic synthesis. Preparation of beta-dicarbonyl compound: Claisen and Dieckmann condensation. Mixed Claisen condensations.
2. Carbonyl compounds unsaturated. Unsaturated aldehydes and ketones. Additional Stability of carbonyl compounds alpha,beta-unsaturated. Reactions of carbonyl compounds alpha,beta-unsaturated. Additions 1.2 and 1.4 (conjugate addition or adding Michael). Conjugate additions of nucleophiles



carbonated. Addition of HCN. Addition of organo-metallic compounds: (a) derivatives of Li and Mg. (b) organocuprates. Addition of anions enolate. Reaction of anelation of Robinson. Methods of synthesis of alpha,beta-unsaturated carbonyl compounds.

2. Compounds of sulfur, phosphorus and silicon.

Properties, preparation and reactivity of organic main functions with phosphorus: Phosphine and phosphonium salts, phosphates and phosphonates, phosphorus ylides. Wittig olefination reaction. Properties, preparation and reactivity of organic sulphur main functions: thioalcohols and thioethers, sulfoxides and sulfones, ylides sulfur, and sulfonic acids. Properties, preparation and reactivity of organic main functions with Silicon: silane. Peterson olefination reaction. Synthetic applications.

3. Organometallic compounds

Guidelines mechanistic basic of the reactions organometallics. Exchange of ligands. Addition oxidant and elimination reductant. Migratory insertion. Transmetalation. Main methods of preparation of organometallic compounds. Derivative organometallics of lithium and magnesium: reactions with different organic functions. Derivative organometallics of copper. Metals of transition in organic synthesis: catalytic processes. Attachment of compounds organometallics catalyzed by palladium: reactions of Stille, Suzuki and Sonogashira. Catalytic processes that involve to multiple links carbon-carbon. Reactions of Heck and Wacker. Attachment of heteronucleophiles catalyzed by palladium: reactions of type Buchwald-Hartwig. Metathesis of dienes.

4. Aromatic heterocyclic compounds.

Heterocycles pi-deficient and pi-excess. Heterocycles aromatic of six members: pyridine. Reactions of the pyridine. Diazines. Heterocycles aromatic of five members: pyrrole, furan and thiophene. Azoles. Reactions of the pentagonal heterocycles. Methods of preparation of hexagonal and pentagonal rings. Condensed heterocyclic systems. Heterocyclic systems of biological interest.

5. Natural products.

Primary and secondary metabolites. Carbohydrates. Classification. Monosaccharides. Forms cyclic of the monosaccharides. Structure of the glucose. Carbon anomeric and glycosidic union. Disaccharides and polysaccharides. Glycosides. Nucleic acids. Nucleosides and nucleotides. Genetic code. Amino acids. Peptidic unions. Polypeptides. Proteins. Three-dimensional structure of the proteins.

6. Retrosynthetic analysis.

Retrosynthetic disconnection: concept of synthons. Fundamental strategies. Order of synthetic events. Construction of the skeleton: recognition of structural models. C-C and C-heteroatom bond formation. Formation of cyclic structures. Protective groups.



WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	51,00	100
Tutorials	9,00	100
Study and independent work	90,00	0
TOTAL	150,00	

TEACHING METHODOLOGY

The course is organised so the student is the protagonist of their own learning and its structure is as follows:

§ Learning material.- Along the course students will have the educational material for the course.

§ Lectures and problemas.- The lectures will be devoted to the most fundamental aspects of matter. In the classes of problems specific application of the knowledge students have acquired in the lectures will take place. Students must have previously worked on the problems to be solved. The resolution of these problems will be discussed in class jointly by the teacher and students. All these classes are complemented by personal study time.

§ Tutorials.- In them the whole process of student learning will be assessed. In tutoring sessions works that have been entrusted by the teacher to students may be collected. Equally, the tutorials will serve to resolve the doubts that have arisen over classes and guide students on the working methods best suited for solving the problems.

Seminars.- The seminars will be dedicated to a deeper discussion of issues whose content makes it suitable further study. Some of these seminars will be presented by a specialist on a relevant subject in current chemistry.

EVALUATION

The evaluation of the learning will carry out of continuous form by part of the professor along the course. The different sections that will evaluate are the following:

Direct Evaluation of the professor (5 points): This evaluation will take into account different points, as mentioned below:

Assistance and reasoned and clear participation in the discussions posed.

Progress in the use of the characteristic language of the organic chemistry.

Resolution of problems and approach of doubts.

Qualifications obtained by each student along the course in the personal questions realised by the professor.

Critical spirit.



Seminars and tutorials (15 points): the evaluation of this type of activity will take into account the presentation in class of the tasks proposed by the professor.

Final examination (80 points): it will be realised in the date indicated by the Faculty and will be common to all the groups of the matter. It will consist of theoretical-practical questions related with the matter explained during the educational period of the same. To globally pass the matter it will be necessary to have obtained in the examination a minimum punctuation of 40 points on the 80 totals.

The minimum global qualification to approve the matter is 50.0 points.

The student could choice to be evaluated only with a written exam on the contents of the subject treated during lectures, tutorials and seminars, so that the teacher can evaluate whether the student has acquired the skills and knowledge related to the subject. This test will be 100% of the overall grade.

In this case the student must resign from the continuous evaluation and choose this type of assessment presenting a written application at the registry of the secretary of the department.

In the evaluation of the second announcement, the qualification obtained in the continued evaluation of the first announcement will be kept ("direct Evaluation of the Professor" and "Seminars and Tutorials") and the corresponding part "Final examinations" will be evaluated again.

REFERENCES

Basic

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- McMurry, J.. Química Orgánica Cengage Learning Editores. S. A. (2008) 7ª edición.
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- Warren S. y Wyatt P. , "Organic Synthesis. The Disconnection Approach", John Wiley and Sons, 2^a Ed. (2009).
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- Joule J. A., Mills K., Heterocyclic Chemistry, 4^a Ed., Blackwell Publishing (2003).
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