Universidad Zaragoza

Year : 2019/20

27209 - Organic Chemistry I

Syllabus Information

Academic Year: 2019/20
Subject: 27209 - Organic Chemistry I
Faculty / School: 100 -

Degree: 452 - Degree in Chemistry

ECTS: 9.0
Year: 2
Semester: Annual
Subject Type: Compulsory
Module: ---

1.General information

1.1.Aims of the course

The subject and the results presented aim that the student learnt about the types of organic compounds based on functional groups: their structures, their physical properties, their reactivity and preparation methods, the stereochemical implications of the main organic mechanisms and that the student was aware of the importance that Organic Chemistry has in the development and welfare of the society.

1.2.Context and importance of this course in the degree

Traditionally, the study of chemistry at university level is divided into four main areas: Analytical Chemistry, Physical Chemistry, Inorganic Chemistry and Organic Chemistry. Thus, the Organic Chemistry or Chemistry of the Carbon compounds is a scientific discipline included in the fundamental module of the Degree in Chemistry. The study of this part of Chemistry at the basic level in the Degree in Chemistry of the University of Zaragoza is divided between the subjects: Organic Chemistry I, second year, and Organic Chemistry II, in the third year. In addition, the topic is closely related to an important part of the experimental subject called "Chemistry Laboratory" in the second year. Finally, the knowledge and skills acquired during the study of the Organic Chemistry topics is included in other subjects in higher courses such as "Biochemistry", "Materials Science", "Structural Determination" "Advance Organic Chemistry", "Characterization and Instrumental Techniques in Organic Chemistry" and "Industrial Organic Chemistry"; as well as, for the accomplishment of the final project (TFG).

1.3.Recommendations to take this course

A good knowledge of the subject " General Chemistry ", either theoretical and practical level, specifically on nomenclature and structure of organic compounds, resonant forms, intermolecular forces and stereochemistry, is recommended.

2.Learning goals

2.1.Competences

Upon passing the subject, the student will be more competent to ...

- Understand the specific bibliography on the subject through textbooks and other reference sources on Organic Chemistry.

- Associate the reactivity and physical properties of the different types of organic molecules with the characteristics structural elements.

- Understand the mechanisms of the most representative reactions of the main families of organic compounds and apply them for the rationalization of specific transformations.

- Apply the basic concepts of stereochemistry extending them to stereoselective representative chemical processes.

- Predict the result of a reaction based on the starting products, reagents and experimental conditions used.

- Design simple synthetic strategies that lead to viable and selective collection of different types of organic compounds.

- Resolve, present and discuss, in a reasoned and critical manner, problems and basic questions proposed about structure, properties and reactivity of organic compounds.

- Show a comprehensive vision of Organic Chemistry and its relationship with other related disciplines; as well as, with social and industrial areas.

2.2.Learning goals

The student, to pass this subject, must demonstrate the following results ...

- Know the structure, properties and reactivity of the main families of organic compounds.

- Infer the structure-properties-reactivity relationship of the main families of organic compounds.

- Apply the most important reaction mechanisms in organic chemistry to explain concrete transformations between organic compounds.

- Predict the reactivity of a compound according to its functional group, structure and substituents.

- Predict the result of a reaction, given the reactants and reaction conditions.

- Analyse the stereochemical implications of some organic reactions.

- Propose synthetic routes of compounds from simpler ones using retrosynthetic analysis.

- Solves synthetic problems involving sequences of reactions.

2.3.Importance of learning goals

Carbon has a great capacity to bond with other carbon atoms forming chains and rings, and to join many other elements, leading to a variety of molecular structures and compounds. Thus a single chemical element gives rise to an entire branch of chemistry. This great structural variety is the origin of life and for a long time Organic Chemistry was dedicated to the study of compounds that constitute living beings. Nowadays, organic chemists are able to prepare, in laboratories and in the industry, compounds and materials with unique properties such as polymers, drugs, molecules capable of conducting the electric current or of being an essential part of television or cell screens photovoltaic. A large part of the advances in current medicine are due to Organic Chemistry

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he/she has achieved the expected learning results through the following evaluation activities:

1. Evaluation of student learning by solving problems and theoretical-practical issues

Proposals by the teacher, in small groups throughout the course. The results will be presented and discussed in class. This activity will be valued with a score between 0 and 10 points.

2. Mid-term partial exam of the degree of knowledge of the student. It will consist in the resolution of a series of theoretical-practical exercises.

This test will not eliminate contents of the final exam and will be assessed with a score between 0 and 10 points.

3. Final exam of the subject where the degree of learning of the subject throughout the academic year will be assessed globally. It will consist in the resolution of a series of theoretical-practical exercises and will be evaluated with a note between 0 and 10 points.

The grades obtained by each student in the aforementioned evaluation activities will be weighted according to the two formulas indicated below:

Formula 1*

Final assessment of the subject = 10% (assessment of problem and theoretical-practical issues throughout of the course) + 30% (partial exam) + 60% (final exam)

* To apply this formula a grade equal to or higher than 4 in the final exam will be needed.

Formula 2

Final assessment of the subject = 100% (final exam)

The final grade of the subject for each student will be the best grade obtained in each case after the application of formula 1 and formula 2.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It favors the understanding of the different organic chemical processes. A wide range of teaching and learning tasks are implemented, such as theory sessions, assignments, and tutorials.

Students are expected to participate actively in the class throughout the course.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2.Learning tasks

The course includes 9 ECTS organized according to theory and practical sessions (9 ECTS): 60 theory + 30 problems hours.

Theory sessions: lecture notes and a series of problems (and its solutions) will be available for the students.

At the end of each topic, some of the problems will be solved in class by the professor.

4.3.Syllabus

The course will address the following topics:

- Topic 1. Properties and reactivity of alkanes and cycloalkanes: Free-radical halogenation.
- Topic 2. Properties and reactivity of alkenes and alkynes: electrophilic addition reactions. Polymerization of alkenes.
- Topic 3. Reactivity of pi-delocalized systems: allyl derivatives. Conjugated polyenes: Diels-Alder reaction.
- Topic 4. Properties and reactions of haloalkanes: Reactions of nucleophilic substitution and elimination. Organometallic reagents. Introduction to the retrosynthetic analysis.
- Topic 5. Properties and reactivity of alcohols, ethers, epoxides and thioethers: Oxidations. Nucleophilic substitutions and eliminations, rearrangements of carbocations, epoxide-opening reactions.
- Topic 6. Properties and reactivity of amines and other nitrogen-derivatives: ammonium salts, diazonium salts, azo compounds.
- Topic 7. Benzene and other aromatic compounds: electrophilic aromatic substitution.
- Topic 8. Arenes, aryl halides, phenols and anilines: Influence of the benzene ring in the reactivity of the substituents. Aromatic nucleophilic substitution.
- Topic 9. Properties and reactivity of aldehydes and ketones: nucleophilic addition.
- Topic 10. Properties and reactivity of carboxylic acids and their derivatives: nucleophilic acyl substitution.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Facultad de Ciencias web (https://ciencias.unizar.es/grado-en-quimica-0).

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=27209&year=2019