

COURSE GUIDE

2023/24

Faculty

215 - Faculty of Chemistry

Cycle

.

Degree

GQUIMI20 - Bachelor's Degree in Chemistry

Year

Second year

COURSE

26115 - Experiments in Organic Chemistry

Credits, ECTS: 6

COURSE DESCRIPTION

The subject Experimentation in Organic Chemistry belongs to the 2nd year of the Degree in Chemistry, and is framed within the Fundamental Module of this degree, in the block belonging to Organic Chemistry.

This course deals with the application of the basic knowledge of reactivity of organic compounds to the preparation of simple compounds using basic experimental techniques, and applying the criteria of separation, purity and characterization of organic compounds.

Therefore, Experimentation in Organic Chemistry is directly related to the subjects Basic Laboratory Operations and Organic Chemistry I. It is recommended to have passed Basic Laboratory Operations and to be taking Organic Chemistry I for an adequate development of the learning process.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

In this course the student is expected to develop the basic competences defined in the RD1393/2007 for this level in the field of Chemistry, as well as the general ones of the Fundamental Module and to develop the more specific ones of Experimentation in Organic Chemistry.

Being the first subject of the area, the main objective of this course is to introduce the process of organic synthesis from a global point of view, from the sampling design to the analysis and interpretation of the results. Special emphasis will be placed on the sampling and treatment of samples and on the chemical separation methods (non-chromatographic), as well as on the procedures to isolate and characterize the synthesized products.

For this purpose, a series of laboratory practices have been included that will allow to perform simple operations that will facilitate the understanding of some fundamental concepts of this subject.

In this way the specific competences M02CM02 and M02CM03 are developed, which involve the ability to plan and carry out in the laboratory simple processes of synthesis and characterization of chemical compounds, safely and using the appropriate techniques, thus working the specific competence M02CM08; as well as to evaluate and interpret the data derived from experimental observations in the various fields of chemistry. And to know the organic reaction and the different steps that integrate it and to be able to plan, apply and manage the most appropriate analytical methods in each specific case. Also the transversal competences M02CM09 and M02CM10 that allow to be able to present in oral and written form, in an understandable way phenomena and processes related to chemistry and related subjects; and the ability to search and select information in the field of chemistry and other scientific fields using bibliography and information and communication technologies.

The competence of the horizontal and vertical coordination of the subject in the Module and the Degree falls on the Coordination Commission of the Degree.

CONTENIDOS TEÓRICO-PRÁCTICOS

The following eight practical exercises will be carried out. Take into account that some of them involve more than one step, and thus, more than one day of work:

1. Elimination and substitution reactions. Synthesis of cyclohexene and trans-1,2-dibromocyclohexane
2. Isomerization reaction: Synthesis of fumaric acid from maleic anhydride
3. Pericyclic reaction: Synthesis of cis-cyclohex-4-en-1,2-dicarboxylic acid
4. Esterification reaction: Synthesis of isoamyl acetate
5. Amide formation and aliphatic nucleophilic substitution reaction: synthesis of Lidocaine
6. Aldol condensation: Synthesis of (1E,4E)-diphenylpenta-1,4-dien-3-one
7. Analysis and identification of analgesic compounds by TLC
8. Hands-on practical session on the use of ChemBioDraw software

TEACHING METHODS

The practices are distributed in thirteen lab sessions. Ten of them involve experimental work in the lab, another one is a hands-on ChemDraw software workshop, and the last two will be devoted to the practical exam.

Before each session, the students will have to read carefully and understand the reaction that it is going to be carried out in the lab, looking also for the H and P phrases of the reagents to be used.

At the beginning of each session, the details of the procedure and the mechanism of the reaction will be discussed between the professor and the students on the blackboard of the laboratory

The experimental reactions will be run in couples of students. The attitude in the lab, cleanliness, neatness, the compliance of the safety regulations, and waste disposal rules during the experimental work will be valuable data for the final qualification.

A reaction report will be completed after each experimental reaction by each student. In the report, the mechanism of the reaction, the elucidation of the NMR and IR traces, analytical properties of the final products, reaction yield and any observation considered important for the procedure will be discussed. It is mandatory to deliver all reports to the professor before the end of the subject term.

The practical exam will consist on the repetition by the individual students of one of the reactions previously performed in the lab. The student will have to be able to run the reactions based on her/his own notes.

The theoretical exam will consist on a written test, including questions about the experimental procedures, the mechanisms of the reactions and the characterization (NMR, IR) of the final products.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching		10		50					
Horas de Actividad No Presencial del Alumno/a		20		70					

Legend: M: Lecture-based S: Seminar GA: Applied classroom-based groups
GL: Applied laboratory-based groups GO: Applied computer-based groups GCL: Applied clinical-based groups
TA: Workshop TI: Industrial workshop GCA: Applied fieldwork groups

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 25%
- Exercises, cases or problem sets 35%
- Individual assignments 25%
- General attitude observed in the laboratory 15%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

CONTINUOUS EVALUATION:

- As a practical subject, and for the purpose of a continuous evaluation, it is mandatory to complete the program of the practical seasons in full, and thus, the attendance is compulsory. Only justified absences (official written document) are acceptable. Non-justified absences will imply failure to pass the course.

- In the Regular Call, the final mark will be the sum of the following issues:

- * Extended written exam: 25%
- * Practical exam: 35%
- * General attitude observed in the laboratory: 15%
- * Written reports, individual works: 25%

NOTICE: It is mandatory to pass all the previous parts separately (5/10) to get access to the averaged final mark.

FINAL EVALUATION:

- The criteria to decline the CONSTANT EVALUATION and appoint to the single FINAL EVALUATION system are established in chapter 2, article 8 of the BSc regulations at UPV/EHU.

- In this case, the final evaluation will consist on a double exam, with both theoretical and practical parts, and will count for the 100% of the final mark.

DECLIN TO SIT:

In case the student opts not to course the practical subject, she/he will have to send a written notification prior to the beginning of the course.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The extraordinary call will consist of a single test, consisting of one or more exams, as the only element of evaluation, which will account for 100% of the final grade.

It is necessary to obtain a minimum grade of 5/10 in each of the parts examined to pass the course.

WAIVER OF THE CONVOCATION: the grade of "No-show" will be given when the student does not attend any of the exams that make up the evaluation. The student who participates in any of the exams will be graded according to the criteria mentioned above.

MANDATORY MATERIALS

The mandatory material to be used by the students is the following:

Lab coat
Safety glasses
Spatula
Glass marker
Notebook
Practice Procedure
Safety rules

The practice script, as well as other reference material, are available on the eGela platform: <https://egela2324.ehu.eus/> -> Experimentation in Organic Chemistry.

BIBLIOGRAFÍA

Basic bibliography

1. M. J. Rodríguez, F. Gómez, CURSO EXPERIMENTAL EN QUÍMICA ORGÁNICA, Síntesis, 2008.
2. 2. M. A. Martínez, A. Csáky, TÉCNICAS EXPERIMENTALES EN SÍNTESIS ORGÁNICA, Síntesis, 2005.
3. SAFETY IN ACADEMIC CHEMISTRY LABORATORIES: VOLUMES 1 & 2. ACCIDENT PREVENTION FOR FACULTY AND ADMINISTRATORS, 7^a Ed. American Chemical Society, Washington, DC, 2003

Detailed bibliography

1. L. M. Harwood; C. J. Moody; J. M. Percy, EXPERIMENTAL ORGANIC CHEMISTRY. STANDARD AND MICROSCALE, 2^a Ed., Blackwell Science, Oxford, 1999.
2. D. L. Pavia; G. M. Lampman; G. S. Kriz; R. G. Engell, INTRODUCTION TO ORGANIC LABORATORY TECHNIQUES. A MICROSCALE APPROACH, 3^a Ed., Saunders College Publishing, Fort Worth, 1999.
3. D. W. Mayo; R. M. Pike,; P. K. Trumper, MICROSCALE ORGANIC LABORATORY, 3^a Ed., John Wiley and Sons, New York, 1994.

Journals

Organic Syntheses: <http://www.orgsyn.org/>
The Journal of Organic Chemistry: <http://pubs.acs.org/journal/jocea>
Organic Letters: <http://pubs.acs.org/journal/orlef7>
European Journal of Organic Chemistry: <http://www3.interscience.wiley.com/journal/27380/home>
Tetrahedron: <http://www.sciencedirect.com/science/journal/00404020>
Organic and Biomolecular Chemistry: <http://www.rsc.org/Publishing/Journals/Ob/Index.asp>
Journal of Chemical Education: <http://jchemed.chem.wisc.edu/>

Web sites of interest

Organic Chemistry Portal: <http://www.organic-chemistry.org/>
Organic Resources Worldwide: <http://www.organicworldwide.net/>
Bases de datos de compuestos orgánicos: <http://pubchem.ncbi.nlm.nih.gov/> , <http://www.chemspider.com/>
Handbook of Chemistry & Physics Online!: <http://www.hbcnetbase.com/>

OBSERVATIONS

Laboratory Practices (GL) are laboratory sessions in which experiments are carried out and results are obtained in strict compliance with safety standards. Students are provided with a laboratory script and it is important to prepare the practice beforehand: students must understand the objective of the practice, be aware of the dangers involved in the handling of

certain reagents, safety rules, etc. Likewise, emphasis is placed on the correct preparation of the laboratory reports, and on the correct writing of experimental procedures in the reports to be handed in to the teacher.

The Seminars (S) will be used fundamentally to work on questions related to the work to be developed in the laboratory, to analyze the results obtained or to work on hypothetical experimental procedures.

It is essential to complete the whole practical program, and therefore, attendance is compulsory. Absences must be justified by means of an official certificate. Likewise, it is essential to submit all the reports.

It is an indispensable condition to pass each of the parts in order to pass the course. The minimum grade necessary to obtain an average will be 5/10.

It is essential to hand in all the laboratory reports. The presentation of the reports out of the established term will imply a zero for the report.

Punctuality is essential. Arriving late to a session will mean not being able to participate in it, unless the delay is duly justified for reasons of force majeure.