

## COURSE GUIDE

2021/22

**Faculty** 215 - Faculty of Chemistry

**Cycle** Not Applicable

**Degree** GQUIMI20 - Bachelor's Degree in Chemistry

**Year** Second year

## COURSE

26115 - Experiments in Organic Chemistry

**Credits, ECTS:** 6

## COURSE DESCRIPTION

- Apply the knowledge acquired in the Organic Chemistry Course to the synthesis of organic molecules, starting from simple precursors.
- Apply the different techniques learnt in the Laboratory of Organic Chemistry to specific synthetic problems.
- Introduce the multistep synthesis to the students.
- Learn the synthetic methodologies and techniques that have not been seen in previous Lab Courses.
- Consolidate the separation and purification criteria for the organic compounds.
- Interpret the protocols for the development of a reaction and the isolation of the products, taking into account the following aspects:
  - Stoichiometric calculations.
  - Theoretical yield
  - Properties of the components of the reaction mixture.

## COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The following general competences, defined in RD1393/2007 will be acquired by the students: M2T1, M2T2, M2T3 y MT2T4  
 Also, the competences belonging to the organic chemistry framework: M2.4 y M2.5  
 Also, the general objective of the subject is to acquire competences M2.10 y M2.11.

## 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 evaluation will be similar to that outlined in the previous ordinary call for the case of a single final evaluation.

The criteria to decline the evaluation will be also similar to those in the previous chapter, and the student will have to notify in written at least one week in advance to the final exam.

### MANDATORY MATERIALS

Laboratory material as lab coat and safety glasses will be mandatory and will be not provided by the university

## BIBLIOGRAFÍA

### Basic bibliography

1. M. J. Rodríguez, F. Gómez, CURSO EXPERIMENTAL EN QUÍMICA ORGÁNICA, Síntesis, 2008.
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<sup>a</sup> 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<sup>a</sup> 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<sup>a</sup> Ed., Saunders College Publishing, Fort Worth, 1999.
3. D. W. Mayo; R. M. Pike; P. K. Trumper, MICROSCALE ORGANIC LABORATORY, 3<sup>a</sup> 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

Laborategiko Praktikak (GL) laborategiko saioak dira, non segurtasun-arauak jarraituz esperimentuak egiten diren eta emaitza esperimentalak lortzen diren. Ikasleak laborategiko gidoia eskuragarri izango du, eta oso garrantzitsua da alde zuzenetik praktika prestatzea, hala nola praktikaren helburua ulertzea, erreaktiboen manipulazioak dakartzen arriskuak ulertzea, segurtasun-arauak ezagutzea etab. Honetaz gain, azpimarragarriak dira laborategiko txostenak ondo lantzearen garrantzia, eta irakasleari entregatuko zaizkion txostenetan prozedura esperimentalak zuzen idaztea.

Mintegietan (S) batik bat landuko dira laborategiko lanarekin zerikusia duten arloak, lorturiko emaitzen eztabaida edo prozedura esperimental hipotetikoak.

Ezinbestekoa da praktika-programa osorik burutzea, eta beraz praktiketara etortzea derrigorrezkoa da. Hutsegiteak agiri ofizial baten bidez frogatu behar dira. Halaber, ezinbestekoa da txosten guztiak entregatzea.

Ikasgaia gainditzeko ezinbestekoa da atal bakoitza gainditua izatea. Batazbestekoa egiteko atal bakoitzean gutxienez 5/10 lortu behar da.

Ezinbestekoa da laborategiko txosten guztiak entregatzea. Txostenak epez kanpo entregatuz gero txosten horren kalifikazioa zero izango da.

Ezinbestekoa da garaiz iristea. Saioren batera berandu iritsiz gero ezingo da saio horretan parte hartu, baldin eta berandu iristeko arrazoi ustekabeko arrazoi larria eta justifikatua ez bada.