# Subject Guide

## 1. Information about the subject

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|---|---|---|---|
| **SUBJECT** | Experimentation in Organic Chemistry I | **CODE** | GQUIMI01-3-006 |
| **EDUCATIONAL OFFER** | Bachelor´s Degree in Chemistry | **CENTER** | Facultad de Química |
| **TYPE** | Compulsory | **N° TOTAL CREDITS** | 6.0 |
| **PERIOD** | First Semester | **LANGUAGE** | Spanish |

| **COORDINATORS/ES** | **EMAIL** |
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## 2. Context

The Degree of Chemistry of the University of Oviedo, within the *fundamental module* and in the *subject Organic Chemistry* includes two experimental courses: Experimentation in Organic Chemistry I (EQOI), which is addresed in the first semester of the third year of the degree, and Experimentation in Organic Chemistry II (EOQII), addressed in the fourth year. In both courses, the students will use and apply the concepts and practical aspects of Organic Chemistry which must be mastered in order to get a proper formation as a Chemistry Graduate. In this context, both experimental courses are closely related and coordinated with the theoretical courses of the *subject Organic Chemistry*: Organic Chemistry I and Organic Chemistry II.

During the course EOQI the student will acquire the basic skills in the isolation and purification of organic compounds, as well as the abilities in the setting up and work up of very basic reactions in Organic Synthesis. In this regard, some very basic laboratory competences have been already acquired by the students in the course Basic Laboratory Operations and Informatic Tools of the first year of the degree in chemistry.

On the other hand, it is mandatory for the students to have a proper knowledge of the concepts related with the structure and properties of organic molecules, that are presented in the course Organic Chemistry I (OQI). Additionally, it is mandatory to have passed (EOQI) to take the experimental course of the fourth year Experimentation in Organic Chemistry II.

The instructors in charge of this subject belong to the Organic Chemistry area of the Department of Organic and Inorganic Chemistry of the University of Oviedo.

| **Teaching Activities** | **Instructors** |
|---|---|
| **Seminars (CP)** | **Angel Luis Suárez Sobrino**<br>**Vicente del Amo Sánchez** |
| **LP1** | **Angel Luis Suárez Sobrino** |
| **LP2** | **Vicente del Amo Sánchez** |

## 3. Requirements

The prerequisites established for all the courses of the *fundamental module* are to have passed the courses General

Chemistry and Basic Laboratory Operations and Informatic Tools. Additionally, to take the course EQOI the students must have passed the course Organic Chemistry I, which is taken during the 1st and 2nd semesters of the second year of the degree.

### 4. Competencies and learning results

The main goal of the subject EQOI is to contribute to develop in the student the competences included in the *Organic Chemistry* subject of the *fundamental module*, which are presented in the Memory of the Degree in Chemistry in the section CG (general competences) and CE (specific competences), (see pages 52 to 54 in the Memory).

Below are detailed the general and specific competences that the student must have achieved by taking succesfully the subject EOQI:

**General Competences:**

CG-1 Rationalization and analysis abilities

CG-2 Being capable of effectively solving specific problems

CG-4 Planning and organizing abilities

CG-5 Decision making abilities

CG-6 Manage information properly

CG-7 Use of a foreing language (English)

CG-9 Self-learning abilities

CG-12 Have environmental conscience

CG-17 Develop critical thinking

CG-18 Work in teams

**Specific Competences:**

CE-19 Demonstrate knowledge and understanding of the essential facts, principles and theories related to chemistry

CE-22 Acquire skills to evaluate, interpret and analyze chemical information

CE-24 Data processing and computing, related to chemical data and information

CE-25 Safe manipulation of chemical reagents, labware and instruments

CE-26 Performing standard synthetic and analytical lab procedures

CE-27 Monitoring, by observation and measurement, chemical properties, changes or events, compiling relevant information

CE-28 Planning, designing and performing practical research from the problem-discovery stage to assessment and evaluation of results

CE-29 Employing standard instrumentation for identification, quantification, separation and structural determination applied to several disciplines

CE-30 Interpretation of data coming from observations and lab measurements in terms of significance and

theoretical support

CE-31 Measuring the risks in the employment of chemical substances and procedures in the laboratory.

CE-32 Correct use of the inductive and deductive methods in the chemistry enviroment.

The goals proposed are translated into the following **learning outcomes**:

1. To manipulate correctly the organic compounds in the laboratory.
2. To know the properties of the organic compounds and evaluate their use in experimental procedures.
3. To execute rigurously simple organic reactions in the laboratory.
4. To recognize and evaluate the risks in the set up and manipulation of equipments in the organic laboratory.
5. To elaborate and present correctly an experimental procedure.
6. To understand and use the bibliographic information in the laboratory.

## 5. Contents

The laboratory sessions will include the following contents:

1. Seminar on laboratory safety

I. EXPERIMENTAL TECHNIQUES IN ORGANIC SYNTHESIS

1. Liquid-liquid extraction, distillation and recrystallization.
2. Chromatographic techniques: thin layer and column.
3. Isolation of a natural product.
4. Spectroscopic techniques.

II. REACTIONS IN ORGANIC SYNTHESIS

1. Reactions of carboxylic acids and derivatives (esterification and saponification).
2. Substitution reactions (electrophilic aromatic and nucleophilic aliphatic)
3. Reduction and oxidation reactions.
4. Biodiesel synthesis.
5. Other synthetic processes (cycloaddition and aldolic reaction).

## 6. Methodology and working plan

The competences and skills will be mainly acquired during the **laboratory practices (LP)**. Thus, the students will be active agents of their own learning, which will not be restricted to a manipulative aspect: the students will have to arrive at each practical sesión with the knowledge of the general guidelines of the work and the theoretical concepts involved in the experiment. The aim is to achieve a complete instruction of the student as a chemist, that will be able to understand *why*, *what for* and *how* is taken each experimental step. This particular personal attitude will be increasingly demanded as the course progresses.

Most of the time the students will carry out individual work, but all of them will conduct simultaneously the same experiments. This will enable to carry out **seminars** at the beginning the sessions or **technical pauses** that may be conducted in a classroom or in the lab. During these sessions, the instructor will introduce the theoretical aspects of the particular experiments, and also discuss with the students the procedures and involve the students in the decision-making at different points of the experiments.

Due to the particular nature of the course, with a prolonged and continous contact between the instructor and the students, the laboratory sessions will have some *continuous tutorial* component, both grupal and individual. In this environment, the student will be able to present doubts or difficulties that will be properly addressed by the instructor on the fly.

The laboratory practices will be carried out in the Students Laboratory of the Organic Chemistry area. For the seminars, the instructor may optionally use a classroom. The final written exam will be conducted in a classroom designated by the Chemistry Faculty.

The attendance to the all practical sessions is mandatory.

This subject has a 50% of *in-class* work and 50 % of *self-learning* activities. The distribution of the *in-class* work will be the following: **Seminars** (6 hours), **Laboratory sessions** (66 hours), **evaluation sessions** (3 hours), and is detailed the tables below.

| | **IN-CLASS WORK** | | | | | | | | **OUT-OF-CLASS WORK** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Topics*** | ***Total Hours*** | Lectures | Classroom practices/ Seminars/Workshop | Lab work / field work / computer classroom / languages classroom | Clinic and hospital practices | Group tutorials | Other activities | Exams and evaluation activities | ***Total*** | Team work | Personal work | **Total** |
| Safety Seminar | 1 | 1 | | | | | | | 1 | | | |
| EXPERIMENTAL TECHNIQUES | 2 | 2 | | | | | | | 2 | | | |
| Liquid-liquid extraction | 16 | | | 8 | | | | | 8 | 3 | 5 | 8 |
| Chromatographic Techniques | 19 | | | 9 | | | | | 9 | 4 | 6 | 10 |
| Natural Product Isolation | 13 | | | 5 | | | | | 5 | 3 | 5 | 8 |
| Spectroscopic Techniques | 4 | | | 1 | | | | | 1 | 1 | 2 | 3 |
| ORGANIC SYNTHESIS | 3 | 3 | | | | | | | 3 | | | |
| Carboxylic Acids and Their Derivatives | 28 | | | 14 | | | | | 14 | 6 | 8 | 14 |
| Substitution | 22 | | | 10 | | | | | 10 | 5 | 7 | 12 |
| Reduction and | 17 | | | 9 | | | | | 9 | 3 | 5 | 8 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oxidation | | | | | | | | | | | | |
| Biodiesel | 4 | | | 1 | | | | | 1 | 1 | 2 | 3 |
| Other Synthetic Processes | 18 | | | 9 | | | | | 9 | 4 | 5 | 9 |
| Assessment | 3 | | | | | | | 3 | 3 | | | |
| **Total** | **150** | **6** | | **66** | | | | **3** | **75** | **30** | **45** | **75** |

### 7. Evaluation of the student's learning results

Evaluation of the student's learning outcomes will be performed attending to the following criteria:

**Regular Call**

Continuous evaluation: 40%.

Lab notebook: 10%

Written final test: 50%

Continuous evaluation will be performed by: (a) carrying out one or several written or practical tests (30%) and (b) personal notes taken by the instructor regarding the reasoning abilities and the work of the student in the lab (10%).

Lab notebook: It will be written in the lab, and its content order and clarity as well as the reproducibility of the experiments will be assessed.

Written final test: It will consist of several exercises and questions related to the experiments performed in the lab (specific and general aspects).

The evaluating system described above will apply to January Regular Call.

**Extraordinary Calls**

The final mark in the May and June Extraordinary Calls will be the one obtained in a practical and/or written exam (test score: 100%).

### 8. Resources, bibliography and complementary documentation

Lab experimental procedures and other didactic material will be available in Virtual Campus.

*Recommended textbook:*

1. "*Experimental Organic Chemistry: A Miniscale and Microscale Approach*", 6th Edition, J. C. Gilbert, S. F. Martin; Cengage Learning, Boston, **2011**.

2. "*Experimental Organic Chemistry: Standard and Microscale*", 2nd Edition, L. M. Harwood, C. J. Moody, J. M: Percy; Blackwell Science, Oxford, **1999**.

*Other textbooks for additional consulting:*

1. "*Organic Chemistry*", K. P .C. Vollhardt, N. E. Schore; W. H. Freeman; 7th edition, 2014.