



1. General information

Course: ORGANIC CHEMISTRY I

Type: CORE COURSE

Degree: 376 - UNDERGRADUATE DEGREE PROGRAMME IN PHARMACY

Center: 14 - FACULTY OF PHARMACY

Year: 1

Main language: Spanish

Use of additional
languages:

Web site:

Code: 14306

ECTS credits: 6

Academic year: 2023-24

Group(s): 10

Duration: C2

Second language: English

English Friendly: Y

Bilingual: N

Lecturer: **MARÍA DEL PILAR ELÍAS RODRÍGUEZ** - Group(s): 10

Building/Office	Department	Phone number	Email	Office hours
	QUÍMICA INORG., ORG., Y BIOQ.		Pilar.Elias@uclm.es	

Lecturer: **ANTONIO MANUEL RODRÍGUEZ GARCÍA** - Group(s): 10

Building/Office	Department	Phone number	Email	Office hours
Facultad de Farmacia	QUÍMICA INORG., ORG., Y BIOQ.		AntonioM.Rodriguez@uclm.es	

Lecturer: **ANTONIO SANCHEZ RUIZ** - Group(s): 10

Building/Office	Department	Phone number	Email	Office hours
Facultad de Farmacia	QUÍMICA INORG., ORG., Y BIOQ.	+34926052974	Antonio.SanchezRuiz@uclm.es	Scheduling and conditions for tutoring sessions can be found at the following web address: https://secretariavirtual.apps.uclm.es

2. Pre-Requisites

No prerequisites are established for this subject, although it is recommended that the student has previously passed the following tests General Chemistry and Laboratory Initiation.

3. Justification in the curriculum, relation to other subjects and to the profession

Pharmacists are health professionals who are experts in medicines and in the use of medicines for therapeutic purposes in human beings. The large percentage of medicines and medicines are organic molecules that interact with the organic biomolecules present in the body. The course of Organic Chemistry I, together with the subject of Organic Chemistry II, is based fundamentally on the study of compounds made up of carbon atoms, the knowledge of functional groups, and their chemical properties. Ultimately these properties will be closely related to their pharmacological and medical properties and therefore this subject is the basis for Pharmaceutical Chemistry I and Pharmaceutical Chemistry II.

4. Degree competences achieved in this course

Course competences

Code	Description
B01	Proficiency in a second foreign language at level B1 of the Common European Framework of Reference for Languages.
B02	Knowledge of Information and Communication Technologies (ICT).
B03	A correct oral and written communication
B04	Ethical commitment and professional deontology.
B05	Ability to develop those learning skills necessary to undertake further studies.
EQ01	Identify, design, prepare, analyse and produce active principles, drugs and other materials and products of sanitary interest.
EQ02	Adequately choose the techniques and methodologies for the evaluation, design and application of chemical reagents, laboratory methodologies and analytical techniques.
EQ03	Complete standard laboratory processes including the employment of scientific equipment related to synthesis and analysis.
EQ04	Evaluate risks/hazards associated to the use of chemical substances and lab processes.
EQ08	Know and understand the chemical nature and behavior of functional groups in organic molecules.
EQ11	Know and apply the main structural determination techniques, including spectroscopy.
G01	Identify, design, obtain, analyze, control and produce drugs and medicines, as well as other products and raw materials of sanitary interest for human or veterinary use.
G02	Evaluate the therapeutic and toxic effects of substances with pharmacological activity.
G03	Know how to apply the scientific method and acquire skills in the handling of legislation, sources of information, bibliography, elaboration of protocols and other aspects considered necessary for the design and critical evaluation of preclinical and clinical trials.
G04	Design, prepare, supply and dispense medicines and other products of health interest.
G05	Provide therapeutic advice in pharmacotherapy and dietotherapy, as well as in the nutritional and food field in the establishments where they provide services.
G06	Promote the rational use of medicines and medical devices, as well as to acquire basic knowledge in clinical management, health economics and the efficient use of health resources.
G07	Identify, evaluate and assess problems related to drugs and medicines, as well as participate in pharmacovigilance activities.
G08	Conducting clinical and social pharmacy activities, following the pharmaceutical care cycle.

G09	Intervene in health promotion and disease prevention activities at the individual, family and community levels, with an integral and multi-professional vision of the health-disease process.
G10	Design, apply and evaluate clinical reagents, methods and analytical techniques, knowing the basic principles of clinical analysis and the characteristics and contents of laboratory diagnostic reports.
G11	Evaluate the toxicological effects of substances and design and apply appropriate tests and trials.
G12	Develop hygienic-sanitary analyses, especially those related to food and environment.
G13	Develop communication and information skills, both oral and written, to deal with patients and users of the centre where they carry out their professional activity. Promote the capacity to work and collaborate with multidisciplinary teams and those related to other health professionals.
G14	Know the ethical and deontological principles according to the legislative, regulatory and administrative provisions governing professional practice, understanding the ethical implications of health in a changing social context.
G15	Recognise own limitations and the need to maintain and update professional competence, with particular emphasis on self-learning of new knowledge based on scientific evidence.
T01	Critical thinking skills based on the application of the scientific method
T02	Ability to manage quality scientific information, bibliography, specialized databases and resources accessible through the Internet.
T03	Handling of basic and specific software for the treatment of information and experimental results.
T04	Motivation for quality, safety at work and awareness of environmental issues, with knowledge of the internationally recognised systems for the correct management of these aspects.
T05	Organizational, planning and implementation skills.
T06	Ability to address human resources decision-making and management.
T07	Ability to work as a team and, where appropriate, exercise leadership functions, encouraging entrepreneurship.
T08	Develop interpersonal skills and the ability to function in an international and multicultural context.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Preparation of reports, summaries and presentations on bibliographic or experimental works, either individually or in teams, applying the capacity for criticism and self-criticism.

Ability to design simple organic compound synthesis from certain starting products and involving more than one reaction.

Ability to name organic compounds according to IUPAC standards and represent their structure from the systematic name.

Correlate the structure of organic compounds with their physical properties, reactivity and stability.

Characterization and identification of functional groups in organic compounds.

Ability to apply the knowledge acquired in laboratory practice and in solving problems and issues related to organic compounds.

To develop the necessary laboratory processes for the transformation, separation, isolation and purification of organic compounds, estimating the possible associated risks.

Recognize the three-dimensional structure of organic compounds and its implications.

6. Units / Contents

Unit 1: Representation and Nomenclature of Organic Molecules

Unit 1.1 Electronic structure of the carbon atom.

Unit 1.2 How to represent an organic molecule.

Unit 1.3 The concept of functional group and classification of organic compounds.

Unit 2: Isomerism and stereoisomerism. Conformational analysis.

Unit 2.1 Types of isomerism.

Unit 2.2 Stereoisomerism.

Unit 2.3 The concept of conformation. Conformational analysis.

Unit 2.4 Conformational analysis of acyclic alkanes.

Unit 2.5 Conformational analysis of cycloalkanes.

Unit 3: Stereochemistry.

Unit 3.1 Optical activity. Polarimetry and chirality.

Unit 3.2 Cahn, Ingold and Prelog (CIP) rules.

Unit 3.3 Stereoisomerism relationships.

Unit 3.4 Molecules with two or more stereogenic centers.

Unit 4: Structure and electronic effects. Acidity and basicity in organic compounds.

Unit 4.1 Bond polarity.

Unit 4.2 Electronic effects. Inductive (I) and conjugate (K) effect.

Unit 4.3 Conjugation, resonance and aromaticity.

Unit 4.4 Acidity and basicity according to Brønsted-Lowry and Lewis.

Unit 4.5 Acidity and basicity constants. pKa and pKb values.

Unit 4.6 Influence of molecular structure in the strength of acids and bases.

Unit 5: Mechanisms of organic reactions. Reaction intermediates.

Unit 5.1 Types of organic reactions.

Unit 5.2 Reaction mechanisms.

Unit 5.3 Nucleophiles and electrophiles.

Unit 5.4 Reaction intermediates: carbocations, carbanions and radicals.

Unit 6: Nucleophilic substitution and elimination reactions.

Unit 6.1 Nucleophilic substitution reactions. SN2 and SN1.

Unit 6.2 Factors affecting the rate of nucleophilic substitution reactions.

Unit 6.3 Elimination reactions. E2 and E1.

Unit 6.4 Competition between SN and E: hard and soft acids and bases (HSAB).

Unit 7: Nucleophilic addition to the carbonyl group.

Unit 7.1 Overview of the addition of nucleophiles to the carbonyl group.

Unit 7.2 Addition of oxygenated nucleophiles.

Unit 7.3 Addition of nitrogenated nucleophiles.

Unit 7.4 Addition of hydride: reduction.

Unit 7.5 Addition of carbon nucleophiles.

Unit 8: Electrophilic addition to multiple C-C bonds. Oxidation reactions.

Unit 8.1 Electrophilic addition reactions on C-C double bonds.

Unit 8.2 Electrophilic addition reactions on C-C triple bonds.

Unit 8.3 Oxidation reactions: alkenes and alcohols.

Unit 9: Laboratory sessions.

Unit 9.1 Session 1: Steam distillation.

Unit 9.2 Session 2: Extraction of caffeine from tea and sodas.

Unit 9.3 Session 3: Chromatographic techniques. Separation and identification of a painkiller (AspirinaPlus).

Unit 9.4 Session 4: Extraction and separation of the active ingredient of a painkiller (AspirinaPlus).

Unit 9.5 Session 5: Synthesis of a painkiller (Aspirin).

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ08 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.92	23	Y	N	Teaching resources will be available in the virtual campus platform (Moodle) before the beginning of the activities. In addition, students will have access to bibliographic and audiovisual materials (books, scientific articles and videos) both in the in-campus libraries and Moodle.
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ08 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.8	20	Y	Y	Laboratory sessions will be conducted in small groups during preestablished periods that will be published in the teaching calendar for the course, and will not clash with other teaching activities. These laboratory sessions will take place in classrooms and/or laboratories which are adequately equipped with the means to achieve the proposed educational objectives. All these activities are MANDATORY, so if any particular student did not adequately conduct himself/herself and achieve a passing mark, he/she will not pass the whole Organic Chemistry I subject. Knowledge acquired during these sessions will be evaluated through the evaluation and marking of a laboratory notebook, the completion and marking of teaching activities related to applied Organic Chemistry and through constant assessment of the attitude and daily performance in the laboratory.
Workshops or seminars [ON-SITE]	Combination of methods	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ08 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.52	13	Y	N	Participation in the teaching activities will be evaluated through questionnaires, tests, short online assessment tests and by producing seminars and problem sheets. Teaching methodologies employed will be workshops and seminars, case/problem solving and assessment tests.
Study and Exam Preparation [OFF-SITE]	Self-study	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ08 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	3.6	90	N		The student can apply for personal tutoring sessions about topics covered in the subject, which will be set by previous appointment with the corresponding professor.
Formative Assessment [ON-SITE]	Assessment tests	B01 B02 B03 B04 B05 EQ01 EQ02 EQ03 EQ04 EQ08 EQ11 G01 G02 G03 G04 G05 G06 G07 G08 G09 G10 G11 G12 G13 G14 G15 T01 T02 T03 T04 T05 T06 T07 T08	0.16	4	Y	Y	The specific dates for the evaluation tests can be found in the published course calendar, and have been set so that they do not overlap with other teaching activities. These tests will be evaluated through marking the questions and problems therein.
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Test	70.00%	70.00%	See the Evaluation criteria below.
Laboratory sessions	20.00%	20.00%	Laboratory sessions are, IN ALL CASES, compulsory and cannot be retaken.
Assessment of active participation	10.00%	10.00%	See the Evaluation criteria below.
Total:	100.00%	100.00%	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:**Continuous assessment:**

All students will be included, by default, in the continuous assesment modality.

Overall evaluation:

Final grade of the subject (Nasig) will be the result of the following equation:

$$\text{Nasig} = 0.7 \cdot \text{Nteor} + 0.2 \cdot \text{Nprac} + 0.1 \cdot \text{Npartic} \quad \text{Eq. 1}$$

Being Nteor the grade of the theory block, Nprac the grade of the practical block (laboratory sessions) and Npartic, the grade of the active participation block.

Evaluation of the theory block:

This block will be evaluated through two tests: the first one (P1) with a weight of 30%, and the second test (P2) with a weight of 70%, which will also have the consideration of the ordinary call exam. The overall grade for the theory block will be calculated according to:

$$\text{Nteor} = 0.3 \cdot \text{P1} + 0.7 \cdot \text{P2} \quad \text{Eq. 2}$$

being Nteor the final grade of the theory block of the subject, P1 the grade of the first test and P2 the grade of the second test.

This grade (Nteor) MUST BE 4.00 OR HIGHER to include this block in the calculation of Nasig shown in Eq. 1. If the value of Nteor is LESS THAN 4.00, no Nasig calculation will be done, and the whole subject will have been failed in the ordinary call.

Evaluation of the practical block:

Laboratory sessions are MANDATORY and CANNOT BE RETAKEN. Therefore, attendance to ALL practical sessions is MANDATORY in order to pass the whole subject.

The evaluation of the practical sessions will be carried out through the completion and grading of a laboratory notebook, the completion and grading of other teaching activities related to applied Organic Chemistry and through the observation and grading the daily attitude and performance in the laboratory.

The final grade of the practical block (Nprac) MUST BE 4.00 OR HIGHER for this grade to be included in the computation of Nasig shown in Eq. 1. Depending on the value of Nprac, the following scenarios can occur:

-If the Nprac value is LESS THAN 4.00, Nasig will NOT be calculated, the whole subject will have been immediately failed and the student will have to retake the subject (including laboratory sessions) in the next academic course, even if the student conducts the examinations in the ordinary and/or extraordinary calls.

-If the value of Nprac is HIGHER THAN OR EQUAL TO 4.00 BUT LESS THAN 5.00, the calculation of Nasig will be conducted, provided that the theory block of the subject is compliant with its previously explained grade requirement. If the resulting value of Nasig is lower than 5.00, the subject will have been failed in the ordinary call, and the student will have to retake the examination in the extraordinary call (see evaluation criteria for the extraordinary call).

-If the value of Nprac is greater than or equal to 5.00, the calculation of Nasig will be conducted, provided that the theory block of the subject is compliant with the previously explained grade requirement. If the resulting value of Nasig is lower than 5.00, the subject will be failed in the ordinary call, and the student will have to retake the examination in the extraordinary call (see evaluation criteria for the extraordinary call). However, the evaluation of the practical block will have been passed, and its grade will be kept for subsequent academic courses.

Evaluation of active participation:

Active participation in the subject will be evaluated through the completion of activities such as (but not limited to) online questionnaires, delivery of seminars, daily participation in the classroom, etc..., and it is NOT MANDATORY and CANNOT BE RETAKEN.

The active participation grade (Npartic) will be added to the overall computation of the course (Nasig) regardless of its value (of Npartic). The active participation grade will NOT be kept for subsequent academic courses.

Non-continuous evaluation:

This form of evaluation will have to be requested by the student by sending an email to the professor who coordinates the subject, either before the student has participated in assessable activities that altogether account for, at least 50%, of the subject's whole evaluation, or before the end of the lectures.

The non-continuous evaluation follows the same pattern as in the case of continuous evaluation: the minimum grade to include the grades of the different blocks of the subject is set at 4.00, and the subject will be passed when this computation (Nasig) results in a grade of 5.00 or higher. The specifics of this modality are explained below.

Evaluation of the theory block:

The student who chooses this modality will only be able to take the final test of the subject (P2) in the ordinary call, which, in that case, will represent 100% of the grade of the theory block (Nteor). The rest of the evaluation follows the exact same criteria as for the continuous modality.

Evaluation of the practical block:

The practical sessions are of MANDATORY attendance and CANNOT BE RETAKEN; the evaluation of the practical block follows the same exact criteria as for the continuous modality.

Evaluation of active participation:

The evaluation of active participation follows the same exact criteria as for the continuous modality.

Specifications for the resit/retake exam:

EVALUATION OF THE THEORY BLOCK (70% of the final grade). It will consist of a final written test, mandatory and that cannot be retaken. In order to compute Nasig, a minimum grade of 4.00 must be obtained in this block (Nteor).

EVALUATION OF THE PRACTICAL BLOCK (20% of the final grade).

There will not be any test for retaking the practical block evaluation in the extraordinary call.

As in the ordinary call, the final grade of the practical block (Nprac) must be 4.00 or higher to compute Nasig, and depending on its value, the following scenarios may occur:

-If the Nprac value is lower than 4.00, Nasig will NOT be calculated, as the subject would have been failed previously, and the student will have to retake the whole subject (including laboratory sessions) in the next academic course, even if the student conducts the examination in the extraordinary call.

-If the value of Nprac is higher than or equal to 4.00, but lower than 5.00, the calculation of Nasig will be conducted, provided that the theory block of the subject is compliant with the previously explained grade requirements. If the resulting value of Nasig is HIGHER THAN OR EQUAL TO 5.00, the whole subject will have been passed in the extraordinary call. However, if Nasig is LESS THAN 5.00, the whole subject will have been failed in the extraordinary call, and the student will have to retake the whole subject (including laboratory sessions) in the next academic course.

-If the value of Nprac is greater than or equal to 5.00, the calculation of Nasig will be conducted, provided that the theory block of the subject is compliant with the previously explained grade requirements. If the resulting value of Nasig is HIGHER THAN OR EQUAL TO 5.00, the whole subject will have been passed in the extraordinary call. If the resulting value of Nasig is LESS THAN 5.00, the subject will have been failed in the ordinary call, and the student will have to retake the subject in the next academic course minus the laboratory sessions, as the evaluation of the practical block has been passed; its grade will be kept for subsequent academic courses.

EVALUATION OF THE ACTIVE PARTICIPATION BLOCK (10% of the final grade). The grade obtained during the ordinary call is maintained.

Specifications for the second resit / retake exam:

Only students who meet the requirements set forth in the Student Evaluation Regulations of the University of Castilla-La Mancha will be eligible for this call and will be evaluated according to the criteria established in the extraordinary call.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	23
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Workshops or seminars [PRESENCIAL][Combination of methods]	13
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Formative Assessment [PRESENCIAL][Assessment tests]	4
General comments about the planning: Delivery dates for active participation activities will be published in Moodle as the course progresses.	
Global activity	
Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	23
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20

Workshops or seminars [PRESENCIAL][Combination of methods]	13
Formative Assessment [PRESENCIAL][Assessment tests]	4
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Total horas:	150

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
D'Auria, Tagliatela-Scafati, Zampella	Guía razonada para resolver problemas de Química Orgánica https://loghia.com/shop/index.php?id_product=54&controller=product&id_lang=1	Loghía		978-88-95122-45-8	2018	
Soto Cámara, José Luis.	Química orgánica Vol. II: hidrocarburos y sus derivados halogenados. https://www.sintesis.com/qu%C3%ADmica%20b%C3%A1sica-140/qu%C3%ADmica%20org%C3%A1nica.%20volumen%20ii%3A%20hidrocarburos%20y%20sus%20derivados%20halogenados-ebook-1302.html	Síntesis.		9788477389057	1999	
Soto Cámara, José Luis.	Química orgánica Vol. III: grupos funcionales y heterociclos. https://www.sintesis.com/qu%C3%ADmica%20b%C3%A1sica-140/qu%C3%ADmica%20org%C3%A1nica.%20vol.%20iii.%20grupos%20funcionales%20y%20heterociclos-ebook-1301.html	Síntesis.		9788497563239	1999	
Smith, M. B. y March, J.	March's Advanced Organic Chemistry https://www.wiley.com/en-es/March%27s+Advanced+Organic+Chemistry%3A+Reactions%2C+Mechanisms%2C+and+Structure%2C+8th+Edition-p-9781119371793	Wiley		978-1-119-37179-3	2019	
Carey, Francis A.	Organic chemistry	McGraw-Hill		0-07-115148-6	2003	
Carey, Francis A.	Química orgánica	McGraw Hill		970-10-5610-8	2006	
Ege, Seyhan	Organic chemistry : structure and reactivity	Houghton Mifflin Company		0-618-31809-7	2004	
Chaloner, P.	Organic Chemistry: A Mechanistic Approach https://www.taylorfrancis.com/books/mono/10.1201/b17689/organic-chemistry-penny-chaloner	CRC Press.		9780429171369	2015	
Soto Cámara, José Luis	Química orgánica Vol. I: conceptos básicos. https://www.sintesis.com/qu%C3%ADmica%20b%C3%A1sica-140/qu%C3%ADmica%20org%C3%A1nica.%20vol.%20i%3A%20conceptos%20b%C3%A1sicos-ebook-1300.html	Síntesis		9788477383994	1999	
Clayden, J., Greeves, N.; Warren, S.	Organic Chemistry https://global.oup.com/ushe/product/organic-chemistry-9780199270293?q=organic%20chemistry&cc=ang=en	Oxford University Press		9780199270293	2012	
Vollhardt, K. Peter C.	Química orgánica : estructura y función	Omega		978-84-282-1431-5	2007	
Wade, L. G. , Jr.	Química orgánica La editorial Digitalia tiene varios libros de Química Orgánica http://www.digitaliapublishing.com/	Pearson/Prentice Hall		84-205-4102-8	2004	Acceso on line libre para alumnos
García Calvo-Flores, Francisco	Problemas resueltos de Química Orgánica.	Thomson		978-84-9732-458-8	2008	
Quiñóá Cabana, Emilio	Cuestiones y ejercicios de Química Orgánica.	McGraw-Hill,		84-481-4015-X	2004	
Gómez Aspe, Rafael	Teoría y problemas resueltos de química orgánica /	Síntesis,		978-84-9958-884-1	2013	