



Teaching Guide				
Identifying Data			2022/23	
Subject (*)	Organic Chemistry 2	Code	610G01027	
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Second	Obligatory	6
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Perez Sestelo, Jose	E-mail	jose.perez.sestelo@udc.es	
Lecturers	García Romero, Marcos Daniel Perez Sestelo, Jose Riveiros Santiago, Ricardo Sánchez Fernández, Rosalía Suárez Picado, Esteban	E-mail	marcos.garcia1@udc.es jose.perez.sestelo@udc.es ricardo.riveiros@udc.es r.sanchez.fernandez@udc.es esteban.picado@udc.es	
Web				
General description	Organic Chemistry 2 is, after Organic Chemistry 1, the second course of general organic chemistry. During the second semester of the course, the student will go further studying the structure and reactivity of organic functional groups. Prof Marcos D. García Romero is in charge of the teaching in english.			

Study programme competences / results	
Code	Study programme competences / results
A1	Ability to use chemistry terminology, nomenclature, conventions and units
A4	Knowledge of main types of chemical reaction and characteristics of each
A6	Knowledge of chemical elements and their compounds, synthesis, structure, properties and reactivity
A9	Knowledge of structural characteristics of chemical and stereochemical compounds, and basic methods of structural analysis and research
A10	Knowledge of chemical kinetics, catalysis and reaction mechanisms
A14	Ability to demonstrate knowledge and understanding of concepts, principles and theories in chemistry
A15	Ability to recognise and analyse new problems and develop solution strategies
A17	Ability to work safely in a chemistry laboratory (handling of materials, disposal of waste)
A19	Ability to follow standard procedures and handle scientific equipment
A20	Ability to interpret data resulting from laboratory observation and measurement
A21	Understanding of qualitative and quantitative aspects of chemical problems
A23	Critical standards of excellence in experimental technique and analysis
A26	Ability to follow standard laboratory procedures in relation to analysis and synthesis of organic and inorganic systems
B2	Effective problem solving
B3	Application of logical, critical, creative thinking
B4	Working independently on own initiative
B7	Effective workplace communication
C1	Ability to express oneself accurately in the official languages of Galicia (oral and in written)

Learning outcomes		
Learning outcomes	Study programme competences / results	
Recognize and use the terminology of organic chemistry including nomenclature, rules and units.	A1	

Know the main organic reactions, mechanisms, features and stereochemical outcome.	A1 A4 A6 A9 A10 A14	B3	C1
Knowing the structure, properties and chemical reactivity of organic compounds	A1 A4 A6 A9 A14	B3 B4 B7	C1
Carry out standard operations of laboratory for the preparation, separation and purification of organic compounds, handling of materials, reagents and waste in a safe form	A1 A17 A19 A20 A21 A23 A26	B2 B3 B4 B7	C1
Study the main procedures to synthesize organic compounds and their application in the resolution of synthetic problems	A1 A4 A6 A9 A14 A15 A21	B2 B3 B4	C1
Apply the spectroscopy and spectrometric methods for the determination of the structure of organic compounds	A1 A9 A15	B2 B3 B4	C1

Contents	
Topic	Sub-topic
Chapter 1. Alkenes and alkynes.	Alkenes: nomenclature, structure and properties. Catalytic hydrogenation. Electrophilic addition reactions. Addition of hydrogen halides, halogens, water, oxymercuration, formation of halohydrins, and hydroboration. Alkene epoxidation and hydroxylation. Oxidative cleavage of alkenes. Radical halogenation. Polymerization. Alkynes: nomenclature, structure and properties. Preparation by elimination reactions and by using acetylides. Reductions and electrophilic addition reactions.
Chapter 2. Alkynes	Alkynes: nomenclature, structure and properties. Synthesis of alkynes. Electrophilic addition and reduction reactions.
Chapter 3. Conjugated systems	Allylic systems: resonant forms, electronic structure and reactivity: radical halogenation and substitution reactions Dienes: electronic structure and reactivity: electrophilic addition.
Chapter 4. Benzene and aromaticity	Aromatic compounds: nomenclature, electronic structure and properties: Hückel rule. Electrophilic aromatic substitution on benzene: halogenation, nitration, sulfonation and Friedel-Crafts reactions. Orientation in the Electrophilic aromatic substitution on benzene derivatives. Reduction of aromatic compounds. Nucleophilic substitution reactions of aryl halides.

Chapter 5. Aldehydes and ketones	Nomenclature, structure and properties. Nucleophilic addition reaction: hydration, hemiacetals, ketals, thioketals, imines, enamines and cyanohydrins. Addition of organometallic reagents. The Wittig reaction. Reduction of carbonyl compounds. Aldehydes and ketones oxidation.
Chapter 6. Carboxylic acids	Nomenclature, structure and properties. Nucleophilic substitution at the carboxylic carbon: addition-elimination mechanism. Formation of esters, acyl halides, amides and anhydrides. Reaction of carboxylic acids with organometallic reagents. Reduction of carboxylic acids.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Laboratory practice	A1 A9 A17 A19 A20 A23 A26 B3 B4 B7 C1	20	14	34
Guest lecture / keynote speech	A1 A4 A6 A9 A10 A14	17	34	51
Seminar	A1 A4 A6 A9 A10 A14 A15 A21 B2 B3 B7	7	21	28
Workshop	A1 A6 A9 A10 A14 A15 A21 B2 B3 B4 B7 C1	8	24	32
Mixed objective/subjective test	A1 A4 A6 A9 A10 A15 A21 B2 B3 C1	4	0	4
Personalized attention		1	0	1

(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description
Laboratory practice	The student will perform experimental procedures in the laboratory related with the theoretical contents of Organic Chemistry 1 and Organic Chemistry 2, and will acquire skills in the preparation, separation, purification and structural determination of organic compounds. During the practices the student will elaborate a written report of the laboratory work, describing the stoichiometric calculations, reaction and work-out procedures, interpretation of the spectroscopic data and answers to the questions posed in the scripts.
Guest lecture / keynote speech	In this master sessions, the teacher will develop the basic contents of the program through theoretical explanations and practical examples. The outlined contents and/or the presentations will be available in the web of Organic Chemistry web site (moodle) before lessons. With the helping materials and other bibliographic resources, the students must prepare the lessons prior to the teacher?s lecture. Participation will be encouraged, thru questions or e-mails before or after the lesson.
Seminar	At the end of each topic there will be seminars where exercises will be solved. The exercises to be solved will be available on the subject website (moodle) prior to the development of the seminars. Students must work on the problems of the bulletins prior to the development of the seminars. The resolution of a moodle questionnaire and the use of the BACON platform will be proposed.
Workshop	The workshops are work sessions organized in intermediate groups. In these activities, exercises related to the contents of each topic will be proposed. Students must complete the indicated exercises before the start of each workshop. Students will also be asked to answer or go to the board to solve some of the exercises proposed. During this time two written tasks will be performed.
Mixed objective/subjective test	In order to evaluate the knowledge and acquired skills, a written test is scheduled in accordance with the Faculty calendar. In this test the students will have to resolve questions and problems related to the subjects worked on class. Problems will be similar to those postured during the seminars, workshops and laboratory practices.



## Personalized attention

Methodologies	Description
Laboratory practice Workshop Guest lecture / keynote speech Seminar	<p>1. Students will have the assistance from the teacher to resolve any doubts that may arise from the study of contents, the preparation of the report in the laboratory practices, and the written solutions to the problems to be presented in the workshops. Personalized attention will be also supported by e-mail.</p> <p>2. Students in part-time study regime will have to contact the coordinator in the first week of the course, to replace the face-to-face regime with other types of qualifying activities. These activities will be indicated in an individual work plan that will be delivered to the student.</p>

## Assessment

Methodologies	Competencies / Results	Description	Qualification
Laboratory practice	A1 A9 A17 A19 A20 A23 A26 B3 B4 B7 C1	The activities programmed in the lab are mandatory to pass the course. The assessment will be performed taking into account the experimental work done and the skills exhibited in the lab and the laboratory notebook.	15
Workshop	A1 A6 A9 A10 A14 A15 A21 B2 B3 B4 B7 C1	The evaluation of the work of the students in the workshops will be carried out through two written tests of 50 minutes each of which will have a value of 10%.	20
Seminar	A1 A4 A6 A9 A10 A14 A15 A21 B2 B3 B7	The resolution of the exercises will be assessed, as well as the formulation of questions before or after the development of the classes and seminars. In particular, the monitoring of the subject through the moodle and BACON platforms through the completion of questionnaires.	5
Mixed objective/subjective test	A1 A4 A6 A9 A10 A15 A21 B2 B3 C1	In order to evaluate the knowledge and skills acquired during the course, a written test is programmed in accordance with the calendar of the Centre. In this test the students will have to resolve questions and problems on the contents of the matter, that will be analogous to those posed during the seminars, workshops and laboratory practices.	60

## Assessment comments



1. The fraudulent carrying out of the tests or evaluation activities will directly imply the qualification suspense (0) in the subject and in the corresponding opportunity, invalidating any qualification obtained in all the activities of evaluation.
2. Carrying out the laboratory practices is mandatory to pass the course.
3. To pass the course, it will be necessary to obtain a minimum score of 5.0 in the set of evaluable activities, and a minimum score of 4.0 in the mixed test.
4. The final grade obtained by the student will never be less than that resulting from adding the exam grade (85%) and practicals (15%).
5. The not attended grade will be applied to students who have participated in scheduled assessable activities that represent less than 30% of the final evaluation.
6. The grades of the labs and the 1st chance workshops will be kept on the 2nd chance. Therefore, in the 2nd opportunity, students can only take a mixed test, whose grade will replace the one obtained in the mixed test of the 1st opportunity.
7. Students evaluated on the 2nd opportunity may only opt for the Honors assesment if the maximum number of these for the corresponding course has not been fully covered on the 1st opportunity.
8. Students with a recognition of part-time work or academic exemption of attendance exemption will be evaluated through laboratory practices (15%) and the mixed test (85%).
9. The evaluation in the advanced call of December will be carried out in accordance with the criteria of the current course.

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**Sources of information**

<b>Basic</b>	<ul style="list-style-type: none"> <li>- K.P.C. Vollhardt and N.E.Schore (2007). Química Orgánica: estructura y función. Omega</li> <li>- K.P.C. Vollhardt and N.E.Schore (2011). Organic Chemistry: structure and function. W H Freeman</li> <li>- L.G. Wade, Jr (2004). Química Orgánica. Pearson</li> <li>- L.G. Wade, Jr (2013). Organic Chemistry. Prentice Hall</li> <li>- L. M. Harwood (2014). Experimental Organic Chemistry. Blacwell Science</li> <li>- M. A. Martínez Grau, A. Csáky (2001). Técnicas experimentales en síntesis orgánica. Síntesis</li> </ul> <p>Ademais da bibliografía recomendada, a maioría dos libros de Química Orgánica xeral son útiles para seguir os contidos da materia. Recoméndase aos alumnos que descargen e impriman as presentacións de contidos dispoñibles en moodle antes de asistir ás leccións maxistras, coa intención de que poidan tomar notas das explicacións do profesor sobre os devanditos materiais.</p>
<b>Complementary</b>	<ul style="list-style-type: none"> <li>- J. Clayden, N. Greeves, S. Warren (2012). Organic Chemistry. Oxford University Press</li> </ul>

**Recommendations**
**Subjects that it is recommended to have taken before**

General Chemistry 3/610G01009  
 Chemistry Laboratory 1/610G01010  
 Organic Chemistry 1/610G01026

**Subjects that are recommended to be taken simultaneously**

Chemistry Laboratory 2/610G01032

**Subjects that continue the syllabus**

Intermediate Organic Chemistry/610G01028  
 Experimental Organic Chemistry/610G01029

**Other comments**

1. To be able to take the subject with success it is convenient to have taken the course of Organic Chemistry 1 that is taught in the first semester. 2. The contents and the competencies to be acquired in the laboratory of Organic Chemistry 2 and in Laboratory of Chemistry are closely related, and both courses are recommended to be followed in the same term. Green Campus Science Faculty Program. To contribute to achieving an immediate sustainable environment and comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)", the documentary work carried out in this area:

- A. They will be requested mainly in virtual format and computer support. B. To carry out on paper: - Plastics will not be used.
- Double-sided prints will be made.
  - Recycled paper will be used.
  - Drafts will be avoided.

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.