



Teaching Guide				
Identifying Data			2018/19	
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	SpanishEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Ojea Cao, Vicente	E-mail	vicente.ojea@udc.es	
Lecturers	García Romero, Marcos Daniel Ojea Cao, Vicente Riveiros Santiago, Ricardo Rodriguez Gonzalez, Jaime Ruiz Pita-Romero, Maria	E-mail	marcos.garcia1@udc.es vicente.ojea@udc.es ricardo.riveiros@udc.es jaime.rodriguez@udc.es maria.ruiz.pita-romero@udc.es	
Web				
General description	Following Organic Chemistry 1, Organic Chemistry 2 is 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 Pérez Sestelo is charged of the teaching in english.			

Study programme competences	
Code	Study programme competences
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
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. Conjugate systems	Allylic systems: resonant forms, electronic structure and reactivity: radical halogenation and substitution reactions Dienes: electronic structure and reactivity: electrophilic addition.
Chapter 3. 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 4. 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 5. 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	Ordinary class hours	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	In the seminar sessions both students and teacher, will actively contribute in the analysis and resolution of the problems. Problems to be solved will be available in the web site (moodle) before seminar sessions. Students must work on the problems prior to the seminars.
Workshop	The workshops constitute sessions of work organised in reduced groups of students. In these sessions the students will perform oral exposures (with graphic support in the blackboard or by means of a presentation) over specific problems of the bulletins, on which they will have previously written a short report, that should be delivered to the professor at the beginning of the sessions
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	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.

Assessment			
Methodologies	Competencies	Description	Qualification
Laboratory practice	A1 A9 A17 A19 A20 A23 A26 B3 B4 B7 C1	The activities programed in the lab are mandatory to pass the course. Its assessment will be performed taking into account the attitude to learning, the experimental work done in the lab and the laboratory notebook.	15
Workshop	A1 A6 A9 A10 A14 A15 A21 B2 B3 B4 B7 C1	The attendance to the workshops, participation and quality of the oral exposures and written reports will be evaluated. Special attention should be paid to the employment of the nomenclature for the functional groups and reaction processes	15
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 programed 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.	70

Assessment comments
The assistance to the laboratory practices is a necessary requirement for passing the course. Participation in continuous evaluation activities (laboratory practices and workshops) is compulsory. For this reason, all the students will be graded in all activities with the flexibility that the coordination schedules and the material and human resources allow. Students who have not attended at least 75% of the workshops will receive a grade of 0 in that section (15% of the overall qualification). Students who have done the laboratory practices but do not reached the qualification of 5 may perform, as part of the mixed test, a specific test related to laboratory practices. The qualification of this specific test will replace the qualification obtained in the laboratory practices to calculate the overall qualification. To pass Organic Chemistry 2, it is necessary to obtain in the mixed test and in the laboratory practices a note equal to or greater than 5. Therefore, for students with a global grade equal to or greater than 5 who have not reached the qualification of 5 in both the practices and the mixed test, will be grades as not pass (grade of 4.5). Students who have not performed the practices and have not submitted to the mixed test will receive the unrepresented qualification. The qualifications of the laboratory practices and the workshops of the first opportunity will be preserved at the 2nd opportunity. Therefore, in the second opportunity students will be able to perform only a mixed test, whose qualification will replace the one obtained in the mixed test of the first opportunity. The students evaluated in the second opportunity will only be eligible for the Honored Grade (Matrícula de Honor) if the maximum number of these grades for the corresponding course has not been covered in full at the 1st opportunity. Part-time dedication students with recognition of or specific learning modalities or diversity support will be assessed through laboratory practices and mixed testing (workshop attendance Waiver, corresponding to 15 % of the global qualification). Therefore, in the 1st and 2nd opportunity, the workshops will be evaluated through the mixed test, which will represent 85% of the overall qualification. The assistance to the laboratory practices is a necessary requirement for passing the course. Therefore, the implementation of laboratory practices shall be facilitated as far as possible within the flexibility of coordination schedules and material and human resources. In the case of exceptional, objective and adequately justified circumstances, the Organic Chemistry 2 coordinator could exempt a student in whole or in part from attending the process of continuous evaluation of laboratory practices. The student who is in this circumstance must pass a specific examination that does not leave any doubt about the achievement of the knowledge, skills and competences of the subject (corresponding to 100% of the qualification).

Sources of information



Basic	- K.P.C. Vollhardt and N.E.Schore (2011). Organic Chemistry: structure and function. W H Freeman - L.G. Wade, Jr (2013). Organic Chemistry. Prentice Hall - K.P.C. Vollhardt and N.E.Schore (2007). Química Orgánica: estructura y función. Omega - L.G. Wade, Jr (2004). Química Orgánica. Pearson 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 imprimen as presentacións de contidos dispoñibles en moodle antes de asistir ás leccións maxistrais, coa intención de que poidan tomar notas das explicacións do profesor sobre os devanditos materiais.
Complementary	- J. Clayden, N. Greeves, S. Warren (2012). Organic Chemistry. Oxford University Press

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
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 should be followed in the same term.

(*)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.