UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: ORGANIC CHEMISTRY I
Code: 57309
Type: CORE COURSE
ECTS credits: 9
Degree: 409 - CHEMISTRY
Academic year: 2023-24
Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
Group(s): 20 23
Year: 2
Duration: AN
Main language: Spanish
Second language:
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **ENRIQUE DIEZ BARRA** - Group(s): **20 23**

Building/Office	Department	Phone number	Email	Office hours
San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	926295337	enrique.diez@uclm.es	Tuesday and Wednesday 9-11

Lecturer: **ANTONIO DE LA HOZ AYUSO** - Group(s): **20 23**

Building/Office	Department	Phone number	Email	Office hours
San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	926295411	antonio.hoz@uclm.es	Monday, Tuesday, Wednesday from 10 to 12 h.

Lecturer: **MARIA DEL PILAR PRIETO NUÑEZ-POLO** - Group(s): **20 23**

Building/Office	Department	Phone number	Email	Office hours
San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	+34926052615	mariapilar.prieto@uclm.es	Tuesday, Wednesday and Thursday from 12 to 14 h.

Lecturer: **MARIA DEL PRADO SANCHEZ VERDU** - Group(s): **20 23**

Building/Office	Department	Phone number	Email	Office hours
S. Alberto Magno, 2ª planta	QUÍMICA INORG., ORG., Y BIOQ.	926052622	mariaprado.sanchez@uclm.es	Tuesday and Wednesday from 12 to 14 h

Lecturer: **ESTER VAZQUEZ FERNANDEZ-PACHECO** - Group(s): **20 23**

Building/Office	Department	Phone number	Email	Office hours
Marie Curie, 3ª planta	QUÍMICA INORG., ORG., Y BIOQ.	+34 926 05 21 57	ester.vazquez@uclm.es	Tuesday, wednesday and thursday from 12 to 14 h.

2. Pre-Requisites

It is recommended to have studied the subject Chemistry of the basic module and to have registered the subject Organic Chemistry II.

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

The subject of Organic Chemistry is included in the module of Fundamentals of Chemistry in the Degree of Chemistry. It is designed to develop the concepts and fundamental data of Organic Chemistry, to show the experimental evidence that supports these concepts, to apply these data and concepts to the resolution of chemical problems and to demonstrate that this subject evolves rapidly and that it plays a key role in modern technological developments in very diverse fields, from biology to materials science, influencing in a fundamental way all aspects of daily life.

The subject Organic Chemistry I is compulsory, annual and corresponds to the second year of the degree in which the foundations of the different areas of Chemistry are initiated. The subject consists of 9 credits, of which 6 are theoretical and are studied in the first semester, and the remaining three are practical, being studied in the second semester. It is the first subject of Organic Chemsitry, and it deals with the basic concepts that will be extended in the subjects Organic Chemistry II, Organic Chemistry III and Extension of Organic Chemistry.

4. Degree competences achieved in this course

Course competences

Code	Description
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
E01	Understand and use chemical terminology, nomenclature, conventions and units
E03	Handle chemicals safely and with respect to the environment
E05	Know the chemical elements and their compounds, their forms of obtaining, structure, properties and reactivity, as well as the main techniques for their analysis
E06	Know the structural properties of chemical compounds, including stereochemistry, as well as the main structural research techniques
E09	Know the kinetics of chemical change, including catalysis and reaction mechanisms
G01	Know the principles and theories of Chemistry, as well as the methodologies and applications characteristic of analytical chemistry, physical chemistry, inorganic chemistry and organic chemistry, understanding the physical and mathematical bases that require
G02	Be able to gather and interpret data, information and relevant results, obtain conclusions and issue reasoned reports on scientific, technological or other problems that require the use of chemical tools
T03	Proper oral and written communication
T07	Ability to work as a team and, where appropriate, exercise leadership functions, fostering the entrepreneurial character

T11 Ability to obtain bibliographic information, including Internet resources

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Know the structure of the main organic functional groups

Know the utility of the spectroscopic techniques in Organic Chemistry

Acquire the ability to interpret the experimental results, relating each experimental stage with the theoretical knowledge acquired

Learn to work autonomously in a laboratory and know how to interpret the experimental results obtained.

Recognize the main reactive intermediates and the influence of stereoelectronic effects on their stability and reactivity

Know the stereochemistry of organic compounds and the stereoselectivity of the main reactions.

Know the basic principles of Organic Chemistry.

To ensure that the student is able to search and select information in the field of Organic Chemistry and that he / she is capable of processing and presenting it adequately both orally and in writing, developing his / her synthesis capacity, being critical and objective

To develop in the student the capacity of initiative to pose and solve concrete problems of Organic Chemistry, as well as to interpret the obtained results

Develop your ability to work as a team.

Acquire the necessary practical training to apply it in your professional life. Know the main methods of isolation, purification and characterization of organic compounds

Acquire the ability to handle chemical reagents and organic compounds safely.

Acquire an awareness of environmental protection developing the idea that Organic Chemistry should be used to improve the quality of life.

Encourage and promote in the student all those values ¿¿and attitudes inherent to scientific activity.

Know the main aspects of the terminology and nomenclature in Organic Chemistry

6. Units / Contents

Unit 1: THE CHEMICAL BOND. Introduction to Organic Chemistry. Atoms, electrons and orbitals. Ionic Bonding. Covalent bonding: Lewis structures. Formal charges. Molecular orbitals. Molecular orbitals of the hydrogen molecule Electronic structure of the carbon atom: Hybridization sp3: The bond in methane. sp2 hybridization: The bond in ethylene sp hybridization: The bond in acetylene. Polar covalent bonding and electronegativity Dipole moment. Electronic effects: Inductive effect. Conjugative effect and resonance. Other types of bonding: influence on the physical properties of organic compounds Structural formulas of organic molecules. Types of isomers.

Unit 2: PERSPECTIVE OF ORGANIC REACTIONS. Concept of functional group. Main functional groups. Types of organic reactions. Reaction mechanisms: ionic and radical reactions, how they occur. Concept of electrophilic and nucleophilic Energy and transition state diagrams. Reaction intermediates: Structure of carbocations, free radicals, carbanions and carbenes. Stability of carbocations. Stability of free radicals. Stability of carbanions.

Unit 3: ALKANES AND CYCLOALKANES. Classes of hydrocarbons. Introduction to alkanes. Sources of alkanes and cycloalkanes. Concept of isomerism: Butanes, pentanes and higher alkanes. IUPAC nomenclature of alkanes and cycloalkanes. Concept of radical: Alkyl groups. Physical properties of alkanes and cycloalkanes. Combustion of alkanes. Oxidation-reduction in Organic Chemistry: Oxidation states.

Unit 4: CONFORMATIONS OF ALKANES AND CYCLOALKANES. Concept of conformation: conformational isomers. Conformational analysis of ethane, butane and higher alkanes. Conformational analysis of cycloalkanes. Small rings: cyclopropane and cyclobutane. Cyclopentane. Cyclohexane: Axial and equatorial bonds, ring inversion, conformational analysis of monosubstituted cyclohexanes. Conformational analysis of disustituted cyclohexanes. Medium and large rings. Polycyclic systems. Heterocyclic compounds.

Unit 5: STEREOCHEMISTRY. Optical activity. Polarimeter. Chirality. Molecules with a chiral center: Enantiomers. Racemic. Chiral center and asymmetric carbon atom. Symmetry in aquiral structures. Absolute and relative configuration. Fischer's projection formulas. Cahn-Ingold-Prelog R-S notation system Chiral molecules with two stereogenic centers: Diastereoisomers. Meso forms. Physical properties of stereoisomers. Pseudo-asymmetric centers. Epimers. Non-carbon stereogenic centers. Chirality without chiral centers. Resolution of racemics.

Unit 6: ALKENES. Nomenclature. Structure and bonding. E-Z stereoisomery. Sequence rules. Physical properties. Relative stability of alkenes: combustion heats Preparation of alkenes: Elimination reactions. Hydrogenation. Stereochemistry. Electrophilic addition reactions: Mechanism and orientation Addition of hydrogen halides. Regioselectivity: Markovnikov rule. Rearrangements. Addition of sulphuric acid. Hydration of alkenes catalyzed by acid. Oximercuriation-demercuriation. Hydroboration-oxidation. Mechanism. Addition of halogens. Mechanism: Halonium ions. Conversion of alkenes into halohydrines. Oxidation of Alkenes: Hydroxylation. Epoxidation. Ozonolysis. Oxidation with strong oxidizing agents. Hydrogen bromide radical addition: mechanism.

Unit 7: ALKYNES. Nomenclature. Structure and bonding. Sources of alkynes. Physical properties. Acetylene acidity and terminal alkynes. Preparation of Alkynes: Alkylation of acetylene and terminal alkynes. Elimination reactions. Reactions of Alkynes: Addition of halogen. Addition of hydrogen halides. Addition of water. Hydroboration-oxidation. Hydrogenation. Reduction with metal-ammonium. Oxidative ruture of alkynes.

Unit 8: CONJUGATION AND POLYMERIZATION. The allyl group. Types of dienes. Bonding in allenes. Relative stabilities of alkadienes. Electronic delocalization of conjugated dienes. Preparation of dienes. Addition of hydrogen halides to conjugated dienes. Addition of halogens to dienes Diels-Alder reactions. Stereo-selectivity. Polymerization of alkenes and dienes.

Unit 9: ARENES AND AROMATICITY. Nomenclature. Sources of aromatic hydrocarbons. Benzene: structure and stability. Kekulé formulation of the structure of benzene. Description of the benzene bond by resonance. Aromaticity: Hückel's rule. Cyclobutadiene and cyclooctetraene. Anulenes. Aromatic ions. Heterocyclic aromatic compounds. Polycyclic aromatic hydrocarbons. Physical properties. Reduction reactions. Reactions in the side chain: halogenation of alkylbenzenes by free radicals Oxidation of alkylbenzenes. Preparation of alkylbenzenes. Addition reactions of alkyl benzenes.

Unit 10: REACTIONS OF ARENES. ELECTROPHILIC AROMATIC SUBSTITUTION. Electrophilic aromatic substitution of benzene. Mechanism of the electrophilic aromatic substitution. Nitration. Sulfonation. Halogenation. Friedel-Crafts Alkylation and acylation. Synthesis of alkylbenzenes by acylation-reduction. Reaction rated and orientation of the electrophilic aromatic substitution. Effects of substitutes in the electrophilic aromatic substitution: activating and deactivating substitutes. Halogens as substituents. Regioselective synthesis of disubstituted and polysubstituted aromatic compounds. Synthesis of polycyclic aromatic compounds. Substitution reaction in naphthalene. Substitution reaction in heterocyclic aromatic compounds.

Unit 11: SPECTROSCOPY. Electromagnetic radiation. Quantified energy states. Proton Nuclear Magnetic Resonance Spectroscopy (1H-RMN). Nuclear shielding and chemical shift. Chemical shift and molecular structure. Interpretation of proton NMR spectra. Spin-spin coupling. Splitting patterns. Carbon 13 Nuclear Magnetic Resonance (13C-NMR). Spectrum interpretation. Infrared (IR) spectroscopy. Ultraviolet-visible spectroscopy (UV-VIS). Mass spectrometry.

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	CB02 E01 E05 E06 G01 T03	1.08	27	Y	N	
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	E01 E03 E05 E06 G02 T03 T07	1.6	40	Y	Y	
Workshops or seminars [ON-SITE]	Problem solving and exercises	E01 E03 E05 E09 T03	0.72	18	Y	N	
Group tutoring sessions [ON-SITE]	Group tutoring sessions	E01 T03	0.04	1	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study	CB02 E01	5.36	134	N	-	
Progress test [ON-SITE]	Assessment tests	CB02 E01 E03 E05 E06 E09 G01 T03	0.08	2	Y	N	
Final test [ON-SITE]	Assessment tests	CB02 E01 E03 E05 E06 E09 G01 T03	0.12	3	Y	Y	
Total:			**9**	**225**			
Total credits of in-class work: 3.64			**Total class time hours: 91**				
Total credits of out of class work: 5.36			**Total hours of out of class work: 134**				

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
Progress Tests	70.00%	0.00%	There will be two evaluation tests that will allow passing the course by passing the two partial exams. The first evaluation will have a value of 25% of the final grade. Those who pass this exam will take a second evaluation that will coincide in date with the final exam. The valuation of the second evaluation will be 45% of the total grade. The two mid-term exams will account for 70% of the final grade.
Laboratory sessions	15.00%	15.00%	The practical credits will be graded jointly by means of a theoretical exam at the end of the same, and by means of the daily laboratory work in which aspects such as: the laboratory notebook, the answer to the questions posed in each practical, the dexterity, the order and the capacity of initiative will be taken into account.
Final test	0.00%	85.00%	Students who have not passed the partial evaluation (continuous evaluation) will take a final test with a score of 85%. The resolution of the problems by the student will be positively valued, as well as the realiz
Assessment of problem solving and/or case studies	15.00%	0.00%	The resolution of the problems by the student will be positively valued, as well as the realization of seminars type test and his active participation in class. On the other hand, the student will be able to increase his continuous evaluation grade by submitting seminars and questions proposed by the professor.
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:

Attendance to theory classes and seminars is recommended, although it is not compulsory.
Attendance to the practical sessions is compulsory.
For the continuous evaluation it will be necessary to participate in all scheduled activities (problem solving in the classroom and tests, progress tests and laboratory practices).
This subject will apply the evaluation criteria agreed in the evaluation regulations of the UCLM.
The final grade will result from the weighted average of each of the evaluable activities as long as 40% is exceeded in each of them.
The evaluation of the practical activities carried out in previous courses will not be retained.

Non-continuous evaluation:

There will be final written tests of both laboratory practices and theory that will take place on the dates included in the calendar of exams of the faculty.
The final grade will result from the weighted average of each of the evaluable activities as long as 40% is exceeded in each of them.
The evaluation of the practical activities carried out in previous courses will not be retained

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	40
Study and Exam Preparation [AUTÓNOMA][Self-study]	134

Unit 1 (de 11): THE CHEMICAL BOND. Introduction to Organic Chemistry. Atoms, electrons and orbitals. Ionic Bonding. Covalent bonding: Lewis structures. Formal charges. Molecular orbitals. Molecular orbitals of the hydrogen molecule Electronic structure of the carbon atom: Hybridization sp3: The bond in methane. sp2 hybridization: The bond in ethylene sp hybridization: The bond in acetylene. Polar covalent bonding and electronegativity

Dipole moment. Electronic effects: Inductive effect. Conjugative effect and resonance. Other types of bonding: influence on the physical properties of organic compounds Structural formulas of organic molecules. Types of isomers.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	2

Unit 2 (de 11): PERSPECTIVE OF ORGANIC REACTIONS. Concept of functional group. Main functional groups. Types of organic reactions. Reaction mechanisms: ionic and radical reactions, how they occur. Concept of electrophilic and nucleophilic Energy and transition state diagrams. Reaction intermediates: Structure of carbocations, free radicals, carbanions and carbenes. Stability of carbocations. Stability of free radicals. Stability of carbanions.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1

Unit 3 (de 11): ALKANES AND CYCLOALKANES. Classes of hydrocarbons. Introduction to alkanes. Sources of alkanes and cycloalkanes. Concept of isomerism: Butanes, pentanes and higher alkanes. IUPAC nomenclature of alkanes and cycloalkanes. Concept of radical: Alkyl groups. Physical properties of alkanes and cycloalkanes. Combustion of alkanes. Oxidation-reduction in Organic Chemistry: Oxidation states.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1

Unit 4 (de 11): CONFORMATIONS OF ALKANES AND CYCLOALKANES. Concept of conformation: conformational isomers. Conformational analysis of ethane, butane and higher alkanes. Conformational analysis of cycloalkanes. Small rings: cyclopropane and cyclobutane. Cyclopentane. Cyclohexane: Axial and equatorial bonds, ring inversion, conformational analysis of monosubstituted cyclohexanes. Conformational analysis of disustituted cyclohexanes. Medium and large rings. Polycyclic systems. Heterocyclic compounds.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1

Unit 5 (de 11): STEREOCHEMISTRY. Optical activity. Polarimeter. Chirality. Molecules with a chiral center: Enantiomers. Racemic. Chiral center and asymmetric carbon atom. Symmetry in aquiral structures. Absolute and relative configuration. Fischer's projection formulas. Cahn-Ingold-Prelog R-S notation system Chiral molecules with two stereogenic centers: Diastereoisomers. Meso forms. Physical properties of stereoisomers. Pseudo-asymmetric centers. Epimers. Non-carbon stereogenic centers. Chirality without chiral centers. Resolution of racemics.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	2
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
Progress test [PRESENCIAL][Assessment tests]	1

Unit 6 (de 11): ALKENES. Nomenclature. Structure and bonding. E-Z stereoisomery. Sequence rules. Physical properties. Relative stability of alkenes: combustion heats Preparation of alkenes: Elimination reactions. Hydrogenation. Stereochemistry. Electrophilic addition reactions: Mechanism and orientation Addition of hydrogen halides. Regioselectivity: Markovnikov rule. Rearrangements. Addition of sulphuric acid. Hydration of alkenes catalyzed by acid. Oximercuriation-demercuriation. Hydroboration-oxidation. Mechanism. Addition of halogens. Mechanism: Halonium ions. Conversion of alkenes into halohydrines. Oxidation of Alkenes: Hydroxylation. Epoxidation. Ozonolysis. Oxidation with strong oxidizing agents. Hydrogen bromide radical addition: mechanism.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	3

Unit 7 (de 11): ALKYNES. Nomenclature. Structure and bonding. Sources of alkynes. Physical properties. Acetylene acidity and terminal alkynes. Preparation of Alkynes: Alkylation of acetylene and terminal alkynes. Elimination reactions. Reactions of Alkynes: Addition of halogen. Addition of hydrogen halides. Addition of water. Hydroboration-oxidation. Hydrogenation. Reduction with metal-ammonium. Oxidative ruture of alkynes.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	2

Unit 8 (de 11): CONJUGATION AND POLYMERIZATION. The allyl group. Types of dienes. Bonding in allenes. Relative stabilities of alkadienes. Electronic delocalization of conjugated dienes. Preparation of dienes. Addition of hydrogen halides to conjugated dienes. Addition of halogens to dienes Diels-Alder reactions. Stereo-selectivity. Polymerization of alkenes and dienes.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1

Unit 9 (de 11): ARENES AND AROMATICITY. Nomenclature. Sources of aromatic hydrocarbons. Benzene: structure and stability. Kekulé formulation of the structure of benzene. Description of the benzene bond by resonance. Aromaticity: Hückel's rule. Cyclobutadiene and cyclooctetraene. Anulenes. Aromatic ions. Heterocyclic aromatic compounds. Polycyclic aromatic hydrocarbons. Physical properties. Reduction reactions. Reactions in the side chain: halogenation of alkylbenzenes by free radicals Oxidation of alkylbenzenes. Preparation of alkylbenzenes. Addition reactions of alkyl benzenes.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1

Unit 10 (de 11): REACTIONS OF ARENES. ELECTROPHILIC AROMATIC SUBSTITUTION. Electrophilic aromatic substitution of benzene. Mechanism of the electrophilic aromatic substitution. Nitration. Sulfonation. Halogenation. Friedel-Crafts Alkylation and acylation. Synthesis of alkylbenzenes by acylation-reduction. Reaction rated and orientation of the electrophilic aromatic substitution. Effects of substitutes in the electrophilic aromatic substitution: activating and deactivating substitutes. Halogens as substituents. Regioselective synthesis of disubstituted and polysubstituted aromatic compounds. Synthesis of polycyclic aromatic compounds. Substitution reaction in naphthalene. Substitution reaction in heterocyclic aromatic compounds.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	3

Unit 11 (de 11): SPECTROSCOPY. Electromagnetic radiation. Quantified energy states. Proton Nuclear Magnetic Resonance Spectroscopy (1H-RMN). Nuclear shielding and chemical shift. Chemical shift and molecular structure. Interpretation of proton NMR spectra. Spin-spin coupling. Splitting patterns. Carbon 13 Nuclear Magnetic Resonance (13C-NMR). Spectrum interpretation. Infrared (IR) spectroscopy. Ultraviolet-visible spectroscopy (UV-VIS).

Mass spectrometry.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	1
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
Final test [PRESENCIAL][Assessment tests]	3

Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	27
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	40
Workshops or seminars [PRESENCIAL][Problem solving and exercises]	18
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	134
Progress test [PRESENCIAL][Assessment tests]	1
Final test [PRESENCIAL][Assessment tests]	3
Total horas:	225

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Bruice, Paula Yurkanis	Organic Chemistry	Pearson Education		978-84-8322-979-8	2017	
	https://www.pearson.com/us/higher-education/product/Bruice-Organic-Chemistry-8th-Edition/9780134042282.html					
Carey, Francis A.	Organic Chemistry	McGraw Hill		978-0-07-351121-4	2017	
	https://www.mheducation.com/highered/product/organic-chemistry-carey-giuliano/M9781260148923.html					
García Calvo-Flores, Francisco	Problemas resueltos de química orgánica	Paraninfo		978-84-9732-458-8	2015	
	https://www.paraninfo.es/catalogo/9788497324588/problemas-resueltos-de-quimica-organica					
McMurry, John	Organic Chemistry	Cengage learning		978-1-305-08048-51-3	2016	
	https://www.cengagebrain.co.uk/shop/isbn/9781305080485					
Quiñoá Cabana, Emilio	Cuestiones y ejercicios de química orgánica : una guía de estudio	McGraw-Hill		9788448607128	2015	
	https://www.casadellibro.com/libro-cuestiones-y-ejercicios-de-quimica-organica-una-guia-de-autoeval-uacion-2-ed/9788448140151/957989					
Quiñoá Cabana, Emilio	Nomenclatura y representación de los compuestos orgánicos :	McGraw-Hill		978-84-481-4363-3	2010	
	https://editorial.tirant.com/es/libro/nomenclatura-y-representacion-de-los-compuestos-organicos-9788448143633					
Solomons, T. W. Graham	Organic Chemistry	Limusa Wiley		978-1-118-87576-6	2016	
	https://www.wiley.com/en-us/Organic+Chemistry%2C+12th+Edition-p-9781118875766					
Vollhardt, K. Peter C.	Organic Chemistry. Structure and Function	Omega		978-1-4641-2027-51-4	2018	
	https://link.springer.com/book/9781464120275					
Wade, L. G. , Jr.	Organic Chemistry	Pearson/Prentice Hall		978-607-32-3847-2	2017	
	https://www.pearson.com/us/higher-education/program/Wade-Organic-Chemistry-Plus-Mastering-Chemistry-with-Pearson-e-Text-Access-Card-Package-9th-Edition/PGM203813.html					
Straumanis, Andrei	Organic chemistry: a guided inquiry	Houghton Mifflin		0-618-30852-0	2004	
	https://www.bartleby.com/textbooks/organic-chemistry-a-guided-inquiry-2nd-edition/9780618974122/solutions					
Brown, W. Howard.	Organic chemistry /	Cengage Learning,		978-1-305-58035-0	2016	
	https://www.cengage.uk/c/organic-chemistry-9e-brown-iverson-anslyn-foote/9780357451861/					
Ege, Seyhan	Organic chemistry: structure and reactivity	Hougton Mifflin Company		0-618-31809-7	2004	
	https://college.cengage.com/chemistry/organic/ege/organic_chem/5e/students/index.html					