Universitat Autònoma de Barcelona

2020/2021

Organic Chemistry

Code: 103280
ECTS Credits: 6

Degree	Type	Year	Semester
2501922 Nanoscience and Nanotechnology	OB	2	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

Name: José Luis Bourdelande Fernández
Email: JoseLuis.Bourdelande@uab.cat

Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Other comments on languages

The sheets of problems and the assessment exercises will be delivered in Catalan or English.

Prerequisites

It is appropriate to have approved the subjects "Reactivitat Química" and "Enllaç Químic i Estructura de la Matèria".

Objectives and Contextualisation

Organic Chemistry studies the reactivity of carbon and systematizes the properties of the compounds that contain it. Basic ideas about the characteristics and reactivity of the different functional groups are given, as well as the conformational analysis and the stereochemistry of organic compounds.

The objectives are:

1. Identify the functional groups and name and formulate the corresponding compounds.

2. Draw Lewis structures of organic chemical compounds and qualitatively predict their molecular properties from them (molecular geometry and polarity).

3. Describe the conformational isomerism in alkanes and cycloalkanes.

4. Determine and represent the configuration of the stereogenic centers in organic compounds.

5. Describe the basics of organic reactions.

6. Resolve basic problems of organic chemistry.

Competences

- Apply the concepts, principles, theories and fundamental facts of nanoscience and nanotechnology to solve problems of a quantitative or qualitative nature in the field of nanoscience and nanotechnology.
- Apply the general standards for safety and operations in a laboratory and the specific regulations for the use of chemical and biological instruments, products and materials in consideration of their properties and the risks.
- Be ethically committed.
- Communicate orally and in writing in ones own language.
- Demonstrate knowledge of the concepts, principles, theories and fundamental facts related with nanoscience and nanotechnology.
- Handle the standard instruments and materials of physical, chemical and biological testing laboratories for the study and analysis of phenomena on a nanoscale.
- Interpret the data obtained by means of experimental measures, including the use of computer tools, identify and understand their meanings in relation to appropriate chemical, physical or biological theories.
- Learn autonomously.
- Manage the organisation and planning of tasks.
- Obtain, manage, analyse, synthesise and present information, including the use of digital and computerised media.
- Propose creative ideas and solutions.
- Reason in a critical manner
- Recognise and analyse physical, chemical and biological problems in the field of nanoscience and nanotechnology and propose answers or suitable studies for their resolution, including when necessary the use of bibliographic sources.
- Recognise the terms used in the fields of physics, chemistry, biology, nanoscience and nanotechnology in the English language and use English effectively in writing and orally in all areas of work.
- Resolve problems and make decisions.
- Show sensitivity for environmental issues.
- Work correctly with the formulas, chemical equations and magnitudes used in chemistry.
- Work on the synthesis, characterisation and study of the properties of materials on a nanoscale from previously established procedures.

Learning Outcomes

1. Analyse situations and problems in the field of physics and chemistry, and propose experimental responses or studies using bibliographic sources.
2. Apply the acquired theoretical contents to the explanation of experimental phenomena.
3. Appreciate the danger and risks of using samples and reagents and apply the right safety precautions for each case (goggles and/or special gloves, extractor hood, gas mask, etc.)
4. Be ethically committed.
5. Communicate orally and in writing in ones own language.
6. Correctly handle glass and another types of material usually found in a synthesis and characterisation laboratory.
7. Correctly handle the necessary material and instruments to prepare and characterise materials and nanomaterials.
8. Correctly use computer tools to calculate, graphically represent and interpret the data obtained, as well as its quality.
9. Critically evaluate experimental results and deduce their meaning.
10. Describe the different types of isomer and the stereochemistry of organic compounds.
11. Describe the most relevant synthetic methodologies of organic chemistry, both in terms of transformation of functional groups and the formation of carbon-carbon bonds.
12. Design simple experiments for the study of simple chemical and physical systems.
13. Determine and represent the configuration of chiral centres in organic compounds.
14. Draft reports on the subject in English.
15. Draw Lewis's structures of inorganic and organic molecules, and describe, from them, their geometry and polarity.
16. Employ information and communication technology in the documentation of cases and problems.
17. Identify and situate safety equipment in the laboratory.
18. Identify the basic reactivity associated to organic functional groups.

19. Interpret basic chemistry texts and bibliographies in English.
20. Justify the results obtained in the laboratory from chemical compound synthesis, separation, purification and characterisation processes on the basis of knowledge of their structure and properties.
21. Justify the results obtained in the laboratory from material and nanomaterial synthesis and characterisation processes in accordance with knowledge of their structure and properties.
22. Learn autonomously.
23. Make adequate use of laboratory materials and instruments.
24. Manage the organisation and planning of tasks.
25. Obtain, manage, analyse, synthesise and present information, including the use of digital and computerised media.
26. Perform basic synthesis, separation and purification procedures in a chemistry laboratory
27. Perform basic synthesis, separation and purification procedures in a synthesis and characterisation laboratory.
28. Predict the reactivity of the different organic functional groups.
29. Propose creative ideas and solutions.
30. Propose reaction mechanisms in processes involving organic compounds.
31. Propose simple synthetic methods to obtain the most characteristic organic compounds from certain reagents.
32. Reason in a critical manner
33. Recognise and analyse physical and chemical problems related with the structure of organic and inorganic compounds
34. Recognise the most important reaction mechanisms in organic chemistry.
35. Recognise the terms relative to physics and materials.
36. Relate experimental data with the physical and chemical properties and/or analysis of the systems that are the object of study.
37. Resolve exercises and problems related with chemical separations using different bibliographic sources and simulation programs.
38. Resolve problems and make decisions.
39. Safely handle chemical and material reagents.
40. Safely handle gases, especially inflammable ones.
41. Show sensitivity for environmental issues.
42. Use basic instruments to characterise chemical and material compounds.
43. Use basic instruments to characterise inorganic and organic chemical compounds
44. Use data processors to produce reports.
45. Use graphic design programs to draw chemical formulas and their reactions.
46. Use suitable strategies for the safe elimination of reagents.
47. Work correctly with the formulas, chemical equations and magnitudes used in chemistry.

Content

1. Introduction (Lewis structures, resonance, coordinates and reaction profile).

2. Alcans (Constitutional isomerism, optical isomerism, enantiomers, diastereoisomers).

3. Halogenated derivatives (Structure and obtaining, nucleophilic substitution, reactions SN1 and SN2, eliminations).

4. Alkene and alkynes (Bond, isomers, properties, reactions, additions, oxidations).

5. Alcohols and ethers (Alcohols: structure and properties, obtaining and reactions, oxidation of alcohols, ethers: properties, synthesis, epoxides).

6. Aldehydes and ketones (The carbonyl group: structure and properties, obtaining aldehydes and ketones, reactions of oxidation, reduction and addition, keto-enol tautomerism).

7. Carboxylic acids and derivatives (Electronic structure, acidic character, physical properties, obtaining, derivatives, esters, lactones).

8. Nitrogen derivatives (Amines, properties, obtaining, ammonium salts).

9. Diens, polyens and benzene (Electronic structure, benzene-aromaticity, aromatic hydrocarbons, aromatic electrophilic substitution).

10. Benzene derivatives (Ring reactions, effect of substituents, nitrogen derivatives, phenols).

11. Polymers (Characteristics, obtaining, most important polymers, structure and properties).

**Unless the requirements enforced by the health authorities demand a prioritizationor reduction of these contents.*

Methodology

Theory classes

The student acquires the own knowledge of the subject attending the classes of theory that will complement with the individualized study.

Problems classes

The student consolidates the knowledge acquired in theory classes by solving problems. A dossier of exercises will be delivered that will have to be resolved throughout the course. A selected part of these exercises will be solved by problem teachers so that students learn the appropriate methodology to find the solutions. During this process, students' participation will be important. Teachers will help to develop the critical sense and logical reasoning, in order to increase the ability of students to solve problems.

Classes of Practices

The laboratory classes focus on the learning of the basic techniques and to familiarize the student with the conditions of security that manipulation of chemical products requires. In order to be able to attend the sessions of laboratory practices, the student must justify having passed the security tests that will be found in the Virtual Campus and be aware of, and accept, the rules of operation of the laboratories of the Faculty.

**The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.*

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practices	16	0.64	1, 2, 22, 9, 5, 11, 13, 15, 12, 26, 27, 16, 24, 17, 18, 19, 20, 40, 6, 7, 39, 4, 41, 25, 28, 29, 30, 31, 32, 34, 35, 33, 14, 36, 37, 38, 47, 8, 23, 42, 43, 46, 45, 44
Problems	12	0.48	22, 5, 10, 11, 13, 15, 24, 18, 19, 4, 41, 25, 28, 29, 30, 31, 32, 34, 35, 14, 38, 47, 45
Theory	26	1.04	1, 2, 22, 9, 5, 10, 11, 13, 15, 12, 24, 18, 19, 4, 41, 25, 28, 29, 30, 31, 32, 34, 35, 33, 14, 38, 47
Type: Supervised			
Tutorials	4	0.16	
Type:			

Autonomous			
Homework	7.5	0.3	22, 10, 13, 16, 24, 32, 45, 44
Laboratory practices	3.5	0.14	1, 2, 22, 9, 5, 12, 26, 27, 16, 24, 17, 18, 19, 20, 40, 6, 7, 39, 4, 41, 25, 29, 32, 35, 33, 14, 36, 37, 38, 47, 8, 23, 42, 43, 46, 45, 44
Problems	13.5	0.54	1, 22, 5, 10, 11, 13, 15, 24, 18, 4, 41, 25, 28, 29, 30, 31, 32, 34, 35, 33, 38, 47, 45, 44
Theory	56.5	2.26	2, 22, 5, 10, 11, 13, 15, 24, 18, 19, 4, 25, 28, 30, 31, 32, 34, 35, 14, 38, 47

Assessment

A continuous evaluation of the competences will be carried out that will include a work and written tests.

The system is organized in 3 modules, each of which will have a specific weight assigned to the final grade:

- Written work module: Assess the learning and use of a free molecular naming and drawing program with individual work. This module will have a global weight of 10%.

- Laboratory module: the student's performance in the laboratory will be evaluated and an examination with a global weight of 20% will be performed.

- Module of partial written tests: it will consist of two partial tests with a weight of 30% the first one, and 40% the second.

In order to pass the subject, you must draw at least 4 points out of 10 in each of the two written partial tests and the writen work and laboratory practices must be done and approved. The subject will be considered to be exceeded when the average of the modules is equal to or greater than 5 points out of 10.

- Students who do not pass the first and / or the second partial exam may take a recovery test after the second partial exam. In order to do this recovery, the student is obligated to submit to both partial examinations.

- The students who finally do not obtain the minimum qualification required to be able to pass each one of the tests of the partial written test module or the minimum qualification to be able to pass the module of written work or the module of Laboratory, will not approve the subject. In this case, the final maximum grade will be 4.

-From the second enrollment of the subject it will not be necessary for the student to complete the written work module or the laboratory module if he has achieved the competences of this part of the subject in the previous year. A student will obtain the non-appraising (No Avaluable) qualification when the number of assessment activities carried out is less than 50% of those programmed for the subject (work, both exams and four practical sessions).

**Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.*

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Laboratory module	20%	4	0.16	1, 2, 22, 9, 5, 11, 13, 15, 12, 26, 27, 16, 17, 18, 19, 21, 20, 40, 6, 7, 39, 4, 41, 28, 29, 30, 31, 32, 34, 35, 33, 14, 36, 37, 38, 8, 23, 42, 43, 46, 45, 44, 3
Module of partial written tests and examination of	40% (first writen test) + 30% (second writen	6	0.24	2, 9, 10, 11, 13, 15, 18, 19, 20, 4, 41, 28, 29, 30, 31, 32, 34, 35, 38

recovery	test)			
Work of molecular naming and drawing	10%	1	0.04	22, 5, 10, 13, 24, 18, 4, 25, 29, 32, 35, 38, 47, 45

Bibliography

1.- i) Bruice, P.Y. *Organic Chemistry*, 8th Ed. Ed. Pearson Education, 2017 (ISBN 9781292160344, ISBN 1292160349).

ii) Bruice, P.Y. *Essential Organic Chemistry*, 3rd Ed. Ed. Pearson Education, 2016 (ISBN 9781292089034).

iii) Bruice, P. Y. *Química Orgánica*, 5ª Edición, Ed. Pearson Educación, México, 2008 (ISBN 9789702607915).

2.- Solomons T.W.G. *Química Orgánica*, 3ª Ed. Ed. Limusa S.A. 2014 (Vol. 1: ISBN 10 9786070506963, Vol 2: 9786070506970).

3.- Carey F.A., Giuliano R.M. *Química Orgánica*, 9a Ed. Ed. McGraw-Hill, 2014 (ISBN 9786071512109).

4- IUPAC Nomenclatureof Organic Chemistry: http://www.acdlabs.com/iupac/nomenclature/

5.- ACD/ChemSketch for Academic and Personal Use. A Free Comprehensive Chemical Drawing Package: http://www.freechemsketch.com

6.- Pulido F. Nomenclatura de Química Orgánica: http://es.slideshare.net/manoa21/nomenclatura-quimicaorganica-29646851?next_slideshow=1

7.- Rosso V. Química Orgánica Nomenclatura: http://es.slideshare.net/verorosso/qumica-orgnica-nomenclatura?qid=09239331-ba5c-4096-9104-dd4cb26fe630&

8.- Hernández Santadaría J.A. Formulació i Nomenclatura de Química Orgànica.: http://es.slideshare.net/joseangelb7/formulacio-i-nomenclatura-organica?related=2

The course material will be found in the space of the subject of the Virtual Campus of the UAB. Among this material you will find: general information, marks of the final exam and any other information that is considered of interest to the students.