

Organic Synthesis Laboratory

Code: 105042
ECTS Credits: 3

Degree	Type	Year	Semester
2502444 Chemistry	OB	3	2

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

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

Marta Figueredo Galimany

Prerequisites

As defined in the Objectives, this subject is the experimental complement of the theoretical subject *Mètodes Sintètics*. Knowledge acquired in the subject *Determinació Estructural* will also be put into practice. For this reason, it is highly recommended that students have passed or taken these subjects during the first semester of the same academic year. On the other hand, as these theoretical subjects of 3rd year are based on the knowledge acquired in the subject of 2nd year *Estructura i Reactivitat dels Compostos Orgànics*, it is also essential to have passed this subject to held *Organic Synthesis Laboratory*. It should be noted that the reactions that the students will perform and the compounds that they will synthesize and analyze are part of the contents of the theoretical subjects mentioned above and consequently, both in the laboratory sessions and in the evaluation of this course, these contents are taken for granted.

Objectives and Contextualisation

The main objectives of this experimental subject are:

Reinforce the understanding of the concepts acquired in the theoretical subject *Mètodes Sintètics* held by the students in the first semester, through a series of experiments of synthesis and characterization of compounds.

Complement the laboratories connected to the second year subject *Estructura i Reactivitat dels Compostos Orgànics*.

To provide the student with a solid training in a good number of advanced synthetic techniques of greater difficulty than those that form part of the laboratories linked to the second year subjects.

Incorporate the use of some analysis techniques (IR, UV and NMR spectroscopy) that the student will use in the characterization of the compounds.

Make students aware of the safety rules of a chemical laboratory, precautions in the handling of hazardous substances and learn waste treatment protocols.

Competences

- "Interpret data obtained by means of experimental measures, including the use of IT tools; identify their meaning and relate the data with appropriate chemistry, physics or biology theories."
- Adapt to new situations.
- Apply knowledge of chemistry to problem solving of a quantitative or qualitative nature in familiar and professional fields.
- Be ethically committed.
- Communicate orally and in writing in ones own language.
- Develop synthesis and analyses studies in chemistry from previously established procedures.
- Evaluate the health risks and environmental and socioeconomic impact associated to chemical substances and the chemistry industry.
- Handle chemical products safely.
- Handle standard instruments and material in analytic and synthetic chemical laboratories.
- Manage the organisation and planning of tasks.
- Manage, analyse and synthesise information.
- Obtain information, including by digital means.
- Operate with a certain degree of autonomy and integrate quickly in the work setting.
- Propose creative ideas and solutions.
- Reason in a critical manner
- Recognise and analyse chemical problems and propose suitable answers or studies to resolve them.
- Resolve problems and make decisions.
- Show an understanding of the basic concepts, principles, theories and facts of the different areas of chemistry.
- Show initiative and an enterprising spirit.
- Show motivation for quality.
- Show sensitivity for environmental issues.
- Use the English language properly in the field of chemistry.
- Work in a team and show concern for interpersonal relations at work.

Learning Outcomes

1. Adapt to new situations.
2. Analyse situations and problems in the field of organic and inorganic chemistry, and propose answers or experimental studies using bibliographic sources.
3. Apply the acquired theoretical contents to the explanation of experimental phenomena.
4. Be ethically committed.
5. Characterise synthesised compounds using physical and spectroscopic methods.
6. Classify compounds by their most important reactivity characteristics: acid/base and oxidant/reductant.
7. Communicate in English in the laboratory.
8. Communicate orally and in writing in ones own language.
9. Critically evaluate experimental results and deduce their meaning.
10. Describe basic safety regulations.
11. Determine the performance of a reaction.
12. Develop synthetic and analytic studies in the field of the organic chemistry from previously established procedures.
13. Develop the habits and skills of a laboratory.
14. Draft a laboratory logbook containing descriptions of the developed procedures, the observations made, the results obtained, the interpretation of the same and the conclusions.
15. Evaluate risks in the use of chemicals and laboratory procedures.
16. Follow safety procedures in the chemistry laboratory.
17. Follow standard laboratory procedures described in English.

18. Follow standard laboratory procedures.
19. Handle instruments to record different types of spectra.
20. Handle standard instruments and material in chemical laboratories for analysis and synthesis in the field of organic chemistry.
21. Identify the main functional groups in organic compounds and some of their reactions.
22. Identify the main reagents in a laboratory and their commercial presentation.
23. Identify the risks of synthetic reagents.
24. Innovate methods for adaptation to the interpretation of a specific molecular structure.
25. Interpret the safety notes on chemistry products.
26. Manage the organisation and planning of tasks.
27. Manage, analyse and synthesise information.
28. Manipulate the main reagents and solvents in a chemistry laboratory.
29. Observe the physical and chemical properties of different substances.
30. Observe the reactivity and behaviour of representative compounds in the laboratory.
31. Obtain information, including by digital means.
32. Operate with a certain degree of autonomy and integrate quickly in the work setting.
33. Perform a synthetic and analytic study to determine chemical and physical properties using instructions supplied for a detailed procedure.
34. Perform correct evaluations of the health risks and environmental impact of magnetic fields.
35. Perform standard tests on which the results obtained are based.
36. Predict the reactivity of different organic functional groups under certain reaction conditions, as well as the structure of the products obtained.
37. Propose creative ideas and solutions.
38. Reason in a critical manner
39. Recognise potential risks in the laboratory before they are produced.
40. Recognise potentially dangerous reagents and solvents.
41. Recognise the use of each reagent in the laboratory and take appropriate safety precautions in each case (special goggles and/or gloves, extractor hood, gas mask, etc.).
42. Relate knowledge about the structure and reactivity of the elements and chemical compounds with their method or methods of obtainment and/or purification.
43. Resolve problems and make decisions.
44. Safely dispose of waste from chemical reactions.
45. Safely handle inflammable, toxic and/or corrosive reagents.
46. Selectively distinguish the rejection of reagents and chemical products.
47. Show initiative and an enterprising spirit.
48. Show motivation for quality.
49. Show sensitivity for environmental issues.
50. Synthesise and purify a compound chemical.
51. Understand the labelling of chemical reagents in English.
52. Use graphic design programs to draw chemical formulas and their reactions.
53. Use safety equipment properly.
54. Use spectroscopy devices to confirm experimental results.
55. Use suitable strategies for the safe elimination of reagents.
56. Use the basic materials of a chemical laboratory.
57. Use the most common English chemistry terms.
58. Work in a team and show concern for interpersonal relations at work.
59. Work safely in the laboratory while following the adequate procedure.
60. Write simple laboratory reports in English

Content

This course is based on conducting experiments of length in variable time.

The realization of these experiments will be carried out in 12 sessions of 4 hours each.

Methodology

This subject is structured in:

1) An informative session (50 min) in which the operation of the subject and the laboratories will be presented to the students. Emphasis will also be placed on the security measures to be followed and some key aspects of the practices to be carried out. The final minutes of this session will be dedicated to evaluating the assimilation of the teaching materials previously provided through the Moodle platform.

2) Twelve laboratory sessions of 4 hours each. In these sessions the synthesis and characterization of a series of organic products will be carried out. Prior to the start of the laboratory sessions, written tests will be performed to assess the degree of understanding and knowledge that the student has achieved by preparing the practice autonomously and the knowledge of the theoretical aspects related to the practice.

Approximately 15 minutes of one session will be devoted to allowing students to answer the surveys for evaluating teaching performance and evaluating the subject or module.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory Sessions	48	1.92	1, 2, 3, 9, 5, 6, 7, 8, 47, 48, 10, 13, 12, 11, 44, 46, 51, 34, 60, 26, 27, 21, 22, 23, 24, 25, 57, 20, 19, 45, 28, 4, 49, 30, 29, 31, 32, 36, 37, 38, 35, 33, 40, 41, 39, 14, 42, 43, 16, 18, 17, 50, 59, 58, 54, 56, 55, 53, 52, 15
Subject Presentation	1	0.04	3, 6, 7, 8, 48, 10, 26, 27, 23, 57, 38, 39, 42
Type: Autonomous			
Preparation of experiments	22	0.88	1, 2, 6, 8, 47, 48, 12, 11, 51, 26, 27, 21, 23, 25, 57, 4, 49, 31, 36, 37, 38, 40, 41, 39, 14, 42, 17, 52, 15

Assessment

The student's mark in this subject will consist of two parts:

1st Part: Written tests (Contribution to the final mark of the subject = 80%): Contribute to this part: brief written assessment tests (prelabs), the laboratory notebook and the final exam. The latter consists of a written assessment test. A second test will be scheduled exclusively to retake this part or raise a grade.

2nd Part: Others (Contribution to the final mark of the subject = 20%)

In this part different aspects will be valued: the attitude of the student, the results of the experiments, social and work relationship with the group. This part will not be recoverable.

Qualifications:

Student who PASSES the subject:

Student who accomplishes the following requirements:

a) To obtain a mark equal to or greater than 5 out of 10 in the final exam.

b) The score resulting from the weighting of all parts (1 and 2) provides a score equal to or greater than 5 out of 10.

c) In case of missed attendance, this must be due justified to the Instructors. In any case, absences cannot exceed a session (4 hours).

Student who DOES NOT PASS the subject:

The student who completes the following requirements:

a) The student that does not achieve any of the requirements pointed at "Student who PASSES the subject" section above.

b) Any student who has not justified one missing attendance or has more than one missing attendance.

Students with Distinction (Matrícula d'Honor):

The Mention of "Matrícula d'Honor" may be awarded to students who have obtained a qualification equal to or greater than 9.00. The number may not exceed 5% of the students enrolled in the subject (Groups 1 + 2) in the corresponding academic course.

NOT EVALUABLE STUDENT:

Any student who has not participated in any laboratory session or in the final written exam or the retake exam.

RETAKE:

The retake of all the evaluation activities carried out in the Laboratory sessions is not contemplated.

The final exam can be retaken by means of a written test.

IRREGULARITIES IN EXAMS

Without prejudice to other disciplinary measures deemed appropriate, irregularities committed by the student that may lead to a variation in the rating of an assessment act will be graded with a zero. Therefore, copying, plagiarism, deception, letting go, etc. in any of the evaluation activities it will imply to fail the exam with a zero score.

LABORATORY SAFETY WARNING

A student who, as a consequence of negligent behavior, is involved in an incident that may have serious safety consequences, may be expelled from the laboratory and fail the course.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Attitude of the student, results of the experiments, realization and group management of the project	20%	0	0	1, 2, 9, 7, 8, 47, 48, 13, 12, 44, 46, 51, 34, 26, 27, 21, 22, 23, 24, 25, 57, 20, 19, 45, 28, 4, 49, 30, 29, 31, 32, 37, 38, 35, 33, 41, 39, 42, 43, 16, 18, 17, 50, 59, 58, 54, 56, 55, 53, 15
written assessment tests	80%	4	0.16	1, 2, 3, 9, 5, 6, 7, 8, 47, 48, 10, 12, 11, 46, 51, 34, 60, 26, 27, 21, 22, 23, 25, 57, 4, 49, 31, 36, 37, 38, 33, 40, 41, 39, 14, 42, 43, 16, 18, 17, 52, 15

Bibliography

Theoretical Concepts:

Organic Chemistry. Clayden, J.; Geeves, N.; Warren, S. 2nd Edition, 2012. ISBN: 978-0199270293 Oxford University Press.

Experimental Techniques:

Experimental Organic Chemistry: Standard and Microscale. Cranwell, P. B.; Harwood, L. M.; Moody, C. J. 3rd Edition, 2017. ISBN 10: 1119952387 ISBN 13: 9781119952381 John Wiley & Sons Inc.

Vogel's Textbook of Practical Organic Chemistry. Vogel, A.I.; Tatchell, A.R.; Furnis, B.S.; Hannaford, A.J.; Smith, P.W.G. 5th Edition, 1996. ISBN 10: 0582462363 / ISBN 13: 9780582462366 Prentice Hall Ed.

Software

Data Bases:

SciFinder- ACS

Spectral Data Base: https://sdb.sdb.aist.go.jp/sdb/cgi-bin/cre_index.cgi

Structures Drawing Program:

Marvin Sketch