Universitat Autònoma de Barcelona

2020/2021

Chromatographic and Spectroscopic Analysis Laboratory

Code: 105044
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: Yes
Some groups entirely in Spanish: No

Teachers

Julián Alonso Chamarro

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Prerequisites

Having studied or being currently enrolled in Spectroscopic Analysis Methods and Separation Techniques. Have passed the security test (virtual campus).

During practices, students must wear the approved lab coat and safety goggles. In addition to the usual tools to write, they should bring a scientific calculator, a laboratory book and a spatula.

Objectives and Contextualisation

The main objective of the subject is that the student reaches the competences indicated in the corresponding section.

The general objectives are:

1. Apply the fundamental laws and the theoretical principles acquired by the student in the courses of the subjects referenced in Prerequisites section.

2. To familiarize the student with the use of specific instrumentation, the acquisition of data in the laboratory and its interpretation, the introduction to the methods of analysis of data ...

3. To develop in the student a critical mentality that refers to the level of confidence of their measures, calculations and the interpretation of results.

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.
- Have numerical calculation skills.
- 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 IT to treat and present information.
- 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. Apply statistical methods to treat data.
3. Apply suitable calibration methods in each case studied.
4. Apply the acquired theoretical contents to the explanation of experimental phenomena.
5. Be ethically committed.
6. Communicate orally and in writing in ones own language.
7. Critically evaluate experimental results and deduce their meaning.
8. Describe basic safety regulations.
9. Develop the habits and skills of a laboratory.
10. Draft a laboratory logbook containing descriptions of the developed procedures, the observations made, the results obtained, the interpretation of the same and the conclusions.
11. Evaluate risks in the use of chemicals and laboratory procedures.
12. Evaluate the influences of variable parameters in measurement, such as concentration, temperature, pressure, dissolvent, etc.
13. Follow safety procedures in the chemistry laboratory.
14. Follow standard laboratory procedures described in English.
15. Follow standard laboratory procedures.
16. Handle instruments to record different types of spectrums.
17. Handle laboratory instruments and materials for the determination of chemical and physical properties and the analysis of products and reagents.
18. Handle the instruments and material used in different separation techniques.
19. Have numerical calculation skills.
20. Identify the main reagents in a laboratory and their commercial presentation.
21. Interpret experimental data obtained from separation processes in the laboratory.
22. Interpret the data from observations and measurements in the laboratory in terms of their meaning and of the theories sustaining the same.

23. Interpret the data obtained from experimental measurements to express a chemical structure.
24. Interpret the data on chromatographic separation processes obtained using computer tools (simulation programs).
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 dissolvents in a chemistry laboratory.
29. Observe the physical and chemical properties of different substances.
30. Obtain information, including by digital means.
31. Operate with a certain degree of autonomy and integrate quickly in the work setting.
32. Perform a synthetic and analytic study to determine chemical and physical properties using instructions supplied for a detailed procedure.
33. Perform correct evaluations of the health risks and environmental impact of magnetic fields.
34. Properly use the necessary computer tools to calculate, graphically represent and interpret the data obtained, as well as its quality.
35. Propose creative ideas and solutions.
36. Reason in a critical manner
37. Recognise and interpret the stages of an analytical procedure.
38. Recognise potential risks in the laboratory before they are produced.
39. Recognise potentially dangerous reagents and dissolvents.
40. Recognise some of the different instruments and equipment used in spectrophotometric methods and analytical chromatography.
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 experimental data with the physical and chemical properties and/or analysis of the systems that are the object of study.
43. Relate the acquired knowledge with the use of the corresponding analytical techniques in the laboratory.
44. Relate the result obtained with the original information, including the correct interpretation of the errors associated to the value obtained.
45. Resolve problems and make decisions.
46. Safely handle inflammable, toxic and/or corrosive reagents.
47. Safely handle the different radiations involved in each spectroscopic technique.
48. Safely handle the electrical circuits that form part of different spectrometers.
49. Selectively distinguish the rejection of reagents and chemical products.
50. Show initiative and an enterprising spirit.
51. Show motivation for quality.
52. Show sensitivity for environmental issues.
53. Understand the labelling of chemical reagents in English.
54. Use IT to treat and present information.
55. Use data processors to produce reports.
56. Use safety equipment properly.
57. Use spectroscopy devices to confirm experimental results.
58. Use statistical methods to treat the results of analyses and obtain quality information.
59. Use suitable strategies for the safe elimination of reagents.
60. Use the basic materials of a chemical laboratory.
61. Use the most common English chemistry terms.
62. Work in a team and show concern for interpersonal relations at work.
63. Work safely in the laboratory while following the adequate procedure.

Content

The development of the contents will begin with a two-hour lecture. Here the content and methodology needed for the realization of the two blocks of this subject will be presented. There will be 12 laboratory sessions of 4 hours each, with the contents indicated below.

Spectroscopic methods (5/6 days)

- AAS (Atomic absorption spectroscopy). Determination of Cu in alcoholic beverages.

- AAS (Atomic emission spectroscopy). Determination of K in water.

- UV-Visible Spectrophotometry. Determination of Fe (II) in a vitamin complex.

- UV-Visible Spectrophotometry. Multicomponents Simultaneous determination of Co and Ni by formation of a colored complex with PAR.

- UV-Visible Spectrophotometry. Determination of the pKa of a synthetic indicator.

Chromatographic methods (6/7 days)

- Gas chromatography. Separation and identification of alcohol mixtures by GC-FID and / or GC-TCDy).

- Determination of the methanol content in a alcoholic beverage by gas chromatography (GC-FID))

- Gas chromatography. Quantitative determination of pool water THM (SAF) by HS-GC-ECD (SAQ)

- Liquid chromatography. Computer simulation of a chromatographic process by HPLC.

- Liquid chromatography. Determination of caffeine in coffee beverages and / or cola by HPLC-UV-Vis.

- Liquid chromatography. Identification of sulfonamides in veterinary medicine by HPLC-UV-Vis

Methodology

This subject consists of two parts distributed according to the methodology and the theoretical knowledge employed. Before beginning the laboratory sessions, there will be one session in the theory classroom about the rules that appear in this Teaching Guide, the latest information and the methodology and contents of the blogs.

Attendance at the classroom and in the laboratory is mandatory. An unjustified lack involves a zero of the practice. The students, in groups of 2 students, will perform 12 laboratory sessions of 4 hours, during which there will be 11 different practices. Students will previously have the scripts of the practices for their preparation. They must enter the laboratory with the script of the practice read and with the calculations that ask for the preparation of dissolutions raised from home.

Students must write in the laboratory booknote all the experimental results and the teacher's explanations. Once the practice is finished, and the material has been completed, students fill out and / or write the report of the practice (introduction and objectives, results and discussion, conclusions, bibliography and an annex showing the expressions amputated for evaluation of the uncertainties). All the results obtained in the laboratory must be presented in tables with the uncertainties and the corresponding units. The graphs must be presented with a title, the magnitudes represented, the corresponding units, the bars of uncertainties and the results of the adjustments if applicable.

In some cases, students will take the report home so they can do the calculations with more time.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Development of the laboratory practices	48	1.92	1, 4, 3, 2, 7, 6, 50, 51, 8, 9, 49, 53, 33, 26, 20, 22, 25, 18, 61, 17, 16, 48, 47, 46, 28, 5, 52, 29, 31, 35, 36, 32, 40, 39, 37, 41, 38, 10, 43, 42, 45, 13, 15, 14, 63, 62, 57, 60, 58, 59, 56, 11, 12
Lectures in a classroom	1	0.04	8, 38, 43

Type: Autonomous			
Reading and study of guidelines, preparation of laboratory practices, writting of reports	23	0.92	4, 3, 2, 7, 6, 27, 24, 21, 23, 22, 61, 30, 36, 44, 42, 19, 34, 54, 55

Assessment

The evaluation process follows the principle of continuous evaluation. The overall score will be constituted by the weighted sum of 2 sections: laboratory (60%) and written exam (40%).

The laboratory score will consist mainly of the qualification of the reports, but may include, with different weights, other concepts such as: prelab tests (short written test to verify that the student has adequately prepared the practice that he/she is going to perform); laboratory notebook; behavior and attitude. The concepts to be evaluated and the corresponding weighting factors will be explained in the presentation of the laboratory. If a student obtains a score <3.5 in the laboratory, the subject will be considered "failed" and the score of the failed laboratory will be the global grade of the subject.

The score of the written exam must be equal to or higher than 4.0 in order to be taken into account in the calculation of the weighted average of the overall score of the subject. If this minimum score of 4.0 is not obtained, a recovery exam will be available. If the recovery does not reach 4.0, the subject will be considered "failed" and the grade of the subject will be the score of the failed exam.

To participate in the recovery, students must have been previously evaluated in a set of activities the weight of which equals a minimum of two thirds of the total grade of the subject and have reached a global grade equal or higher than 3.5.

In the case of non-compliance with safety regulations, a student may be expelled from the laboratory and suspend the practice of that day. In the case of serious or repetitive breach of safety regulations may be expulsion from the laboratory and suspend the subject.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Personal work	10%	0	0	1, 3, 2, 7, 6, 50, 51, 9, 49, 53, 33, 26, 27, 20, 24, 21, 22, 25, 18, 17, 16, 48, 47, 46, 28, 5, 52, 29, 30, 31, 35, 36, 32, 40, 39, 37, 41, 38, 10, 44, 43, 42, 45, 13, 15, 63, 62, 57, 60, 59, 56, 11, 12
Report of the results	30%	0	0	4, 2, 7, 24, 21, 23, 22, 37, 10, 44, 43, 42, 34, 58, 54, 55, 12
Results of the laboratory practice	20%	0	0	4, 3, 2, 7, 51, 27, 24, 21, 23, 22, 18, 17, 16, 29, 31, 36, 32, 37, 38, 10, 44, 43, 42, 45, 15, 14, 19, 57, 34, 60, 58, 54, 12
Written exam	40%	3	0.12	4, 2, 7, 8, 21, 23, 22, 25, 61, 36, 37, 44, 43, 42, 45, 19, 58

Bibliography

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