Universitat Autònoma de Barcelona

2021/2022

Experimentation Laboratory in Physical Chemistry

Code: 105043
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: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

Xavier Domènech Antúnez

Prerequisites

Having studied Thermodynamics and Kinetics and being enrolled in Transport phenomena and Surface Phenomena.
Have passed the security test (virtual campus).
During practicals, students must bring their own homologated lab robe and safety glasses.
In addition to the usual tools for writing and anoting data, they must bring a scientific calculator and a spatula. It is strongly recommended to bring their own laptop. The lab notebook is not enforceable, but we recommned consistenly to write down the data and the possible incidences.

Objectives and Contextualisation

The final objective of the course is that students reach the competences indicated in the corresponding section.

The general objectives are:
1. Apply the fundamental laws and theoretical principles acquired by the student in the courses of the subjects named in the prerequisites.
2. Familiarize students with the acquisition of data in the laboratory and its interpretation.
3. Introduce students to the knowledge of concepts and applications of physical chemistry through laboratory work.

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. Design simple experiments for the study of simple chemical and physical systems.
10. Develop the habits and skills of a laboratory.
11. Draft a laboratory logbook containing descriptions of the developed procedures, the observations made, the results obtained, the interpretation of the same and the conclusions.
12. Evaluate risks in the use of chemicals and laboratory procedures.
13. Evaluate the influences of variable parameters in measurement, such as concentration, temperature, pressure, dissolvent, etc.
14. Follow safety procedures in the chemistry laboratory.
15. Follow standard laboratory procedures described in English.
16. Follow standard laboratory procedures.
17. Handle instruments to record different types of spectrums.
18. Handle laboratory instruments and materials for the determination of chemical and physical properties and the analysis of products and reagents.
19. Have numerical calculation skills.
20. Identify the main reagents in a laboratory and their commercial presentation.
21. Interpret the data from observations and measurements in the laboratory in terms of their meaning and of the theories sustaining the same.
22. Interpret the safety notes on chemistry products.
23. Manage the organisation and planning of tasks.
24. Manage, analyse and synthesise information.
25. Manipulate the main reagents and dissolvents in a chemistry laboratory.

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

Content

First, a seminair to explain he contents and methodology used to carry out this subject will be programed. Afterwards, the student will have to complete 12 laboratory sessions of 4 hours each, during which he will carry out a set of laboratory practices that have previously been prepared with the script (and other materials) published in the virtual campus.
Practices will include advanced kinetics, electrochemistry, surface phenomena, and any other phenomena in the field of Experimental physical chemistry

The laboratory session will delve into topics seen in previous theoretical subjects, but the laboratory can also be used to introduce aspects not discussed above.

The following is a likely list of practices as an example, even if the teachers in each academic year can modify

them or select another
-Kinetics by Polarimetry. Inversion reaction of sucrose.
-Kinetics fby conductimetry. Basic hydrolysis of ethyl acetate
-Iodation of cyclohexanone in acidic medium: kinetic study.
-Study of the effect of the Ionic force on the rate of the oxidation reaction of the iodide with the anion Peroxodisulfat.
-Solvatocromism as a tool to characterize a solvent's properties.
-Adsorption isotherm
-Conductivity of ionic dissolutions
-Determination of the critical micellar concentration by means of conductivity measurements.
-Sewage treatment through electrochemical processes
-Surface tension. Wettability.

Methodology

Before starting the laboratory sessions, there will be a session in the lecture room to explain the rules that appear in this teaching guide, and give last minute information and the specific methodology and contents.

Attendance at the classroom and laboratory is obligatory. An unjustified lack implies a zero in a practice.
The students, in groups of 2 students, will perform 12 lab sessions lasting 4 hours, during which a 9-10 different practices shall take place. Students will previously have the scripts for the
Practices for its preparation. They must enter the laboratory with the script of the practice read and the calculations, tables etc. prepared in the laboratory notebook.
Students must correctly trasnfer all the experimental results elsewhere.

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			
Laboratori practices	48	1.92	4, 3, 7, 10, 9, 20, 21, 18, 17, 25, 27, 30, 11, 41, 40, 44, 16, 56, 59, 13
Masters class	1	0.04	41
Type: Autonomous			
Reading and study of the scripts, preparation of the practices in the laboratory and the implementation of reports, where appropriate.	22	0.88	1, 3, 2, 6, 49, 50, 23, 24, 5, 28, 29, 33, 34, 43, 19, 61, 32, 53, 54

Assessment

The evaluation process follows the principle of continuous assessment. The overall grade will be constituted by the weighted sum of 3 items:

- Evaluation of the preparation of the practices: laboratory work (practical manipulation, data collection and treatment, preparation, discussiom and, to be the case, writing of the report forms), behaviour, attitude and timeliness. (10%).
- Report Rating (60%).
- Written exam (30%).

To do the average you must take a note equal to or greater than 4.0 in the exam; If the minimum mark of 4.0 is not obtained, a recovery exam will be available. If the mark of 4.0 is not reached in the recovery, the student will be deemed suspended and the record shall consist of a suspended examination.
To participate in the recovery, students must have been previously evaluated in a set of activities whose weight is equivalent to a minimum of two thirds of the total qualification of the subject and has obtained a global qualification equal to or greater than 3.5.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Previous preparation and personal work	10%	0	0	1, 49, 50, 8, 10, 9, 48, 52, 31, 23, 20, 22, 60, 47, 46, 45, 25, 5, 26, 51, 28, 29, 33, 34, 36, 38, 35, 11, 43, 14, 16, 15, 19, 62, 61, 58, 55, 12
Reports	60%	0	0	4, 3, 2, 7, 6, 10, 9, 24, 20, 21, 18, 17, 25, 27, 30, 37, 42, 41, 40, 39, 44, 16, 56, 32, 59, 57, 53, 54, 13
Writen exam	30%	4	0.16	4, 7, 8, 42, 41, 40, 39, 57, 13

Bibliography

P.W. Atkins & J. de Paula, Atkins ' Physical Chemistry., ª ed. Oxford University Press, 2009.
(Spanish translation of the 8th Ed, Ed. Panamericana, 2008)
In addition, the handout of each practice, published in the virtual campus, will include a specific bibliography section

Software

This subject requiries using software (which can be free) that allows doing data treatment in the form of plots and linear regressions.