

27210 - Chemistry Laboratory

Syllabus Information

Academic year: 2023/24

Subject: 27210 - Chemistry Laboratory

Faculty / School: 100 - Facultad de Ciencias

Degree: 452 - Degree in Chemistry

ECTS: 12.0

Year: 2

Semester: Annual

Subject type: Compulsory

Module:

1. General information

The objective of the subject is to enable the student to carry out in a rigorous, safe and efficient way the basic work in the chemical laboratory and to be able to apply different concepts, theories, methodologies, reactions, etc. of the field of Chemistry in an experimental way. The subject has been divided into 4 blocks, dedicated to each of the 4 fundamental areas of Chemistry, in order to deepen in their different procedures and working methods.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (<https://www.un.org/sustainabledevelopment/es/>): Goal 3: Health and wellness; 4: Quality education; 6: Clean water and sanitation; 9: Industry, innovation and infrastructure; 11: Sustainable cities and communities; 12: Responsible production and consumption.

To take this subject it is necessary to have passed the subjects *Introduction to the Chemical Laboratory* and *General Chemistry*.

2. Learning results

- Identify hazards and adopt appropriate safety measures for working in a chemical laboratory.
- Prepare a laboratory notebook and reasoned reports about the experiments performed.
- Manage different sources of information and the basic auxiliary tools to work in a laboratory.
- Correctly perform numerical calculations or treatment of experimental data using the necessary mathematical procedures.
- Demonstrate manual dexterity to carry out the different experimental procedures using adequately the materials and equipment.
- Understand the chemical processes and reactions that take place in the different experiments and interpret the results of the tests, measurements or data obtained.
- Deduce experimental conditions for carrying out new processes based on data from known processes
- Express the quantitative results obtained experimentally, evaluating their quality.

3. Syllabus

Seminar program

- Sources of information in a chemistry laboratory. Safety. Chemicals. Data sheets.
- Chemical-physical techniques to be developed in the practices and treatment of experimental data.
- Basic level IR and NMR spectroscopy for the structural determination of simple compounds.
- Video tutorials on laboratory techniques in Organic Chemistry.
- Practical aspects related to chemical and electrical methods of analysis.

Laboratory practice program

Block 1. Experimental chemical-physical techniques

- Determination of thermodynamic properties:* heat of combustion of a solid, vapor pressure of a liquid and calculation of an equilibrium constant (3 sessions of 3 hours)
- Determination of electrochemical quantities:* determination of the transport number of an ion and measurement of the electromotive force of some batteries (2 sessions of 2.5 hours)
- Kinetics of chemical reaction:* kinetic study of different chemical reactions (3 sessions of 4 hours).

Block 2. Synthesis and characterization of inorganic compounds (8 sessions of 3h 45 min).

- Preparation of some boron compounds from borax.*
- Tube tests with compounds of group 15 elements.*

- c. *Assembly for the production of gases. Preparation of copper salts from copper sulphate.*
- d. *Preparation of some lead salts from minimum.*
- e. *Cl₂ production. Preparation of K₂[ClO₄]-H₂O and purification of manganese(II) chloride*

Block 3. Synthesis, purification and characterization of organic compounds (6 sessions of 4 hours).

- a. *Synthesis of compounds by means of characteristic reactions in organic synthesis*, which also involve the use of isolation and purification techniques typical of organic chemistry: unimolecular nucleophilic substitution (obtaining tert-butyl chloride), oxidation (oxidation of diphenylmethanol to benzophenone), bimolecular nucleophilic substitution (synthesis of phenacetin), elimination (dehydration of alcohols), electrophilic aromatic substitution (nitration of bromobenzene).
- b. *Purification of solids by column chromatography*, purity testing and identification against standards.

Block 4: Chemical and electrical methods of analysis (7 sessions of 3-4 hours)

- a. *Development of different volumetric determinations*: redox (permanganimetry), complexometric, acid-base and precipitation (Mohr method).
- b. *Development of a potentiometric determination using ion selective electrodes (ISE) and a voltammetric determination by anodic stripping*

4. Academic activities

The subject is of a practical nature, which requires the student to manipulate, experiment and personally carry out the different activities programmed in the laboratory. Therefore, the bulk of the teaching will take place in the laboratory with small groups of students supervised by the teacher. The laboratory sessions cover 10 ECTS and will be taught in sessions of 3 to 4 hours duration. Additionally, some classroom activities are programmed with larger groups of students to teach basic knowledge and put in context the work to be developed in the laboratory. The classroom sessions cover 2 ECTS and each session will have a duration of 1 to 2 hours.

5. Assessment system

Continuous assessment

Each block will be graded independently. In order to pass each block it will be necessary to obtain a grade of 4 points out of 10 in the evaluable activities, which are indicated below for each of them, and that the weighted average grade of the block is at least 5 points.

Block 1: resolution of questions prior to the work in the laboratory (15 %), evaluation of the experimental work in the laboratory (20 %), elaboration of practice reports (25 %) and accomplishment of a written test of theoretical-practical character (40 %)

Block 2: resolution of questions and preparation of reports (20 %), evaluation of the experimental work in the laboratory (20 %), completion of a theoretical-practical written test (60 %)

Block 3: resolution of questions (20 %), evaluation of the experimental work in the laboratory (20 %), performance of a written test (25 %), performance of a practical exam (35 %)

Block 4: evaluation of the experimental work in the laboratory and resolution of questions (10 %), evaluation of the quantitative results obtained by the student (60 %), completion of a theoretical-practical written test (30 %)

To pass the continuous evaluation it is required to pass, with a minimum grade of 5 points, each of the 4 blocks of the subject. In that case, the final grade will be the average of the grades for each block.

Overall test

Students who do not pass the continuous evaluation or want to improve their grade will take a global test, which will consist of theoretical-practical questions and experimental laboratory work of the 4 blocks. In order to pass it, it will be necessary to obtain a grade of 4 out of 10 in each of the blocks and an overall grade equal to or higher than 5 points.

Students who have passed the continuous evaluation of 2 of the blocks may choose to take the global exam only of the pending blocks, in which they must obtain a minimum grade of 5 points, maintaining the grade of the blocks previously passed.