VNIVERSITAT DE VALÈNCIA

Course Guide
34231 Analytical Chemistry Laboratory I

COURSE DATA

DATA SUBJECT

Code: 34231
Name: Analytical Chemistry Laboratory I
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Facultat de Química	2	Second quarter
1929 - Double Degree Program in Physics and Chemistry	Facultat de Física	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1110 - Degree in Chemistry	Analytical Chemistry	COMPULSORY
1929 - Double Degree Program in Physics and Chemistry	Segundo Curso (Obligatorio)	COMPULSORY

COORDINATION

MARTINEZ PEREZ-CEJUELA HECTOR

SUMMARY

Analytical Chemistry Laboratory I is a core course taught in the second year (fourth semester) of the Degree in Chemistry for a total of 6 ECTS credits.

Through practice in the classical techniques of inorganic qualitative analysis and quantitative inorganic and organic analysis, which are common analyses in Chemical Analysis laboratories, students acquire the skills they will need to work in both general laboratories and in Analytical Chemistry laboratories.

The laboratory work will enable students to get used to preparing for their experimental practice, consolidate course contents and theoretical concepts, and teach them how to keep a laboratory notebook and produce an analytical report.

According to the Sustainable Development Goals (SDG's) in this course, students are expected to be able to apply the knowledge learned to help ensure inclusive, equitable and quality education and promote learning opportunities throughout life. for all (SDG4), to acquire a special sensitivity for the sustainable management of water (SDG 6), raw materials and energy sources (SDG 7) as well as for sustainable development

compatible with the environment (SDGs 11, 12, 13, 14 and 15), in addition to being able to design, select and/or develop efficient chemical products, processes and/or analytical methodologies (SDG 7) and that minimize their impact on the environment (SDG 14 and 15), take advantage of alternative raw materials and generate less waste (SDG 11)

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

1110 - Degree in Chemistry
Obligation to take the subject(s) simultaneously — 36450 - Analytical Chemistry I

1929 - Double Degree Program in Physics and Chemistry
Obligation to take the subject(s) simultaneously — 36450 - Analytical Chemistry I

OTHER REQUIREMENTS

To successfully complete this course, students should have acquired knowledge in the topics from the subject Analytical Chemistry I: Introduction to Analytical Chemistry. Ionic solutions. Acid-base, complex formation, solubility and redox equilibria. Introduction to titrimetric analysis. acid-base, complex formation, solubility and redox titrimetry. Gravimetric analysis. Also are required basic skills in laboratory work, statistics and computing that students should have acquired from General Chemistry I an

COMPETENCES / LEARNING OUTCOMES

1108 -

Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.

Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems.

Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.

Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.

Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.

Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.

Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.

Demonstrate knowledge of the main types of chemical reaction and their main characteristics.

Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.

Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry.

Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.

Demonstrate the ability to adapt to new situations.

Develop capacity for analysis, synthesis and critical thinking.

Develop sustainable and environmentally friendly methods.

Evaluate, interpret and synthesise chemical data and information.

Evaluate the risks in the use of chemicals and laboratory procedures.

Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Handle chemicals safely.

Handle the instrumentation used in the different areas of chemistry.

Have basic skills in the use of information and communication technology and properly manage the information obtained.

Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.

Interpret the variation of the characteristic properties of chemical elements according to the periodic table.

Learn autonomously.

Recognise and analyse new problems and plan strategies to solve them.

Recognise and evaluate chemical processes in daily life.

Relate chemistry with other disciplines.

Relate theory and experimentation.

Show inductive and deductive reasoning ability.

Show knowledge of the metrology of chemical processes including quality management.

Solve problems effectively.

Solve qualitative and quantitative problems following previously developed models.

Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.

Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.

Understand the qualitative and quantitative aspects of chemical problems.

1110 - Degree in Chemistry

Act autonomously in learning, making well-founded decisions in various contexts, forming judgements based on experimentation and analysis, and applying knowledge to new situations.

Address new problems and propose strategies to solve them.

Apply metrology in chemical processes, including quality management.

Collaborate effectively in work teams, assume responsibilities and leadership roles, and contribute to collective improvement and development.

Communicate effectively both orally and in writing, adapting to the context and audience.

Contribute to the design, development and implementation of solutions that respond to social demands, using the Sustainable Development Goals as a reference.

Demonstrate both inductive and deductive reasoning skills.

Demonstrate critical and self-critical thinking, considering professional ethics, moral values and social implications of the different activities carried out throughout the degree.

Demonstrate the ability to analyse, synthesise and reason critically.

Distinguish between the qualitative and quantitative aspects of chemical problems.

Distinguish the principles, procedures and techniques used in the determination, separation, identification and characterisation of chemical compounds.

Evaluate the risks involved in the use of chemical substances and laboratory procedures.

Express ideas correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Identify chemical processes in everyday life.

Identify the main types of chemical reactions and their associated key characteristics.

Implement sustainable and environmentally friendly methodologies.

Interpret the relationship between the variation in the characteristic properties of chemical elements and the Periodic Table.

Propose creative and innovative solutions to complex situations or problems in the field, addressing diverse professional and social needs.

Relate chemistry to other disciplines.

Relate theory to experimentation.

Solve problems effectively.

State the principles of thermodynamics and kinetics and their application in chemistry.

Understand and analyse, from the perspective of the degree programme, social inequalities based on sex and gender; integrate gender-sensitive approaches into problem-solving and solution design.

Use chemical terminology, nomenclature, conventions and units correctly.

DESCRIPTION OF CONTENTS

1. Classic Qualitative Analysis

1. Qualitative chemical analysis of anions and cations.

2. Quantitative Analysis: Titrimetry

2. Acid-base titrimetry: Standardization and application of a standard solution of HCl. Study of the titration error.
3. Acid-base titrimetry: Standardization and application of a standard solution of NaOH. Determination of polyphosphates.
4. Titrimetry using a solubility reaction: determination of chloride in mayonnaise by the Mohr method.
5. Redox and complexometric titrimetry: iodometric determination of copper and complexometric determination of copper and zinc in brass.
6. Redox titrimetry: determination of the chemical oxygen demand in water (consumption of permanganate).

3. Quantitative Analysis: Gravimetry

7. Gravimetry of calcium as oxalate: determination of calcium in milk.
8. Determination of moisture (drying) and ashes in food.

4. Quantitative Analysis: Instrumental

9. Spectrophotometric determination of iron in foods.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	12,00
Laboratory	48,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	25,00
Independent study and work	38,00
Preparation of lessons	15,00
Preparation for assessment activities	12,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The materials (scripts, guidelines, schedule, questions, etc.) will be made available to students via the

virtual classroom before the beginning of the introductory session. Before work in the laboratory, there will be a seminar to:

- explain the general rules of Analytical Chemistry Laboratory I.
- explain how the course will develop and discuss the various sections of this course guide.
- introduce skills students have not previously acquired but are necessary for the subject and, if appropriate, discuss any previous knowledge required.
- provide the information and materials students will need to prepare the first practice session or first block of sessions.

In addition, other seminars will be held to further the theoretical-practical aspects and data processing of each practice.

The course is structured around the following axes:

(i) preparation of the practice to be conducted, (ii) laboratory work, (iii) treatment of the results and (iv) laboratory notebook and analytical reports.

(i) Preparation of the practice to be conducted. With the script, the materials and the information provided by the lecturer, students prepare each practice session before coming to the laboratory.

The script will be accompanied by a series of questions on the practical session that students must write their answers to.

Students must prepare an outline of their work before they start their practice session. This serves to verify that they have understood the task and will prove useful when conducting their laboratory work.

Also in preparation for the practice session they must perform the calculations they need to prepare the solutions that will be used in the session.

The lecturer will review the material prepared by the student before the beginning of the practice session.

The aim of this preparation is to ensure that, before entering the laboratory, students understand what they need to do and why.

(ii) Laboratory work. After reviewing the students' materials, the lecturer will discuss any aspects that need to be clarified before the students start their practice session. The students will then prepare the solutions (reagents, standards and samples) and begin the session.

The sessions are conducted in pairs. Sometimes, however, in order to encourage teamwork, several pairs may share their results. At this stage of the work the lecturer will encourage a positive attitude from students toward their scientific work.

Keeping a laboratory notebook during their practical sessions is an important component of the students' laboratory work. At no time should the notes in the laboratory notebook be re-written.

(iii) Treatment of the results. The treatment of the results will begin in the laboratory. The lecturer will first guide the students in this task before the students complete the work by themselves. When presenting the results of the laboratory sessions, students must draw appropriate figures and tables to collect the data and use the correct units and significant figures. As the aim of this stage is to develop the students' analytical skills, they must not only calculate the results they obtain in the laboratory but also analyse them as well as their previous estimates.

(iv) Laboratory notebook and analytical reports. One aim of this course is to teach students to present their work appropriately by keeping a laboratory notebook and producing an analytical report.

Students must learn to keep a laboratory notebook of the work they carry out. The lecturer will periodically review the notebook. This notebook must be presented by the student when requested by the teacher.

When recording details in their notebook, students must remember that all scientific work should be capable of being reproduced by others. All raw data must be recorded with precision and information on the work conducted and observations found must be specified.

EVALUATION

Learning will be evaluated by taking into account all the aspects outlined in the Methodology section of this course guide.

FIRST CALL

Students' grades will be calculated from the weighted average of the following three activities:

1. Preparation, experimental technique and laboratory notebook: The following aspects will be evaluated:

(a) Preparation of the practice sessions before the beginning of the sessions.

(b) Laboratory work: the student's abilities, interest and attitude will be taken into account when continuously evaluating his or her progress and work during the practice sessions. In particular, the student's implementation of proper experimental techniques in all laboratory operations will be assessed.

(c) The laboratory notebook that will be developed following the guidelines previously established by the teacher. Students should bear in mind that all scientific work should be capable of being reproduced from the data and instructions in the notebook. The work expressed in the student's laboratory notebook must meet this condition. Students must therefore indicate all raw data, along with their uncertainty where appropriate, plus any incidents, relevant comments and details. Disorder and material that is irrelevant to the experimental work will be evaluated negatively

2. Results of analyses of the samples and analytical reports:

At each practice session, students must analyse a sample of unknown composition and/or concentration. The quality of the results is considered to reflect the quality of the student's experimental work. The analytical reports be written in accordance with the guidelines set by the lecturer.

3. Written examinations: There are two written examinations: one of these comprises classical qualitative analysis and the other comprises all the other aspects of the course.

The overall grade is calculated as the weighted average of the three above sections:

Laboratory work and laboratory notebook	Reports and results	Examinations
20%	50 %	30 %

In all cases, classical qualitative analysis will be weighted as 1/3, and the other sections of the subject will be weighted jointly as 2/3. To pass the course, students must obtain a minimum overall score of 5.0 and in each of the sections of each block (qualitative analysis and quantitative analysis) a minimum score of 4.0 points out of 10 must be achieved.

Attendance at all seminars and laboratory sessions is compulsory and can not be retaken. In the case of excused absences, students can recover up to three sessions by attending other practical groups provided the teaching requirements of the laboratories allow. The marks awarded for any session not recovered in this way will be zero. Students will fail the course if they are absent from or fail to recover more than three laboratory sessions.

SECOND CALL

In the second call the final grade is obtained by applying the same criteria as in the first call. The sections of each block with a grade lower than 4,0 must be recovered by performing a written and / or practical examination in the laboratory.

Final warning

Copying or plagiarism of any assignment that is part of the evaluation will make it impossible to pass the course, and the student will be subject to the appropriate disciplinary procedures.

Please note that, according to Article 13 d) of the University Student Statute (RD 1791/2010, December 30), "*it is the duty of a student to refrain from using or cooperating in fraudulent procedures in evaluation tests, in the work performed or in official University documents*".

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