VNIVERSITAT DE VALÈNCIA

Course Guide
36821 Chemistry laboratory

COURSE DATA

Data Subject	
Code	36821
Name	Chemistry laboratory
Cycle	Grade
ECTS Credits	7.5
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1934 - D.D. in Chemistry-Chemical Engineering	Faculty of Chemistry	1	Annual

Subject-matter

Degree	Subject-matter	Character
1934 - D.D. in Chemistry-Chemical Engineering	1 - Primer curso	Obligatory

Coordination

Name	Department
OCHANDO GOMEZ, LUIS E.	315 - Physical Chemistry

SUMMARY

This subject is compulsory and of basic character, is taught in both semesters of the first year of the Double Degree in Chemistry and Chemical Engineering, with a volume of 7,5 credits. It is intended, essentially, that the student learn the operation and the basic work techniques that will be developed in a chemical laboratory; and the preparation, recording, analysis and presentation of results of an experimental work. In this way, the essential foundations will be established so that the experiences of the different branches that make up the discipline can subsequently be successfully addressed.

In this specific subject, the security, analysis, and interpretation of data necessary for the development of any chemical experience, as well as the management and treatment of data developed in any chemical laboratory will be addressed. To this end, experiments will be carried out in which different basic techniques must be used, so that later they can be applied to more complex tests. Experiments will be carried out on kinetics and thermodynamics of chemical reactions, equilibria, and electrochemistry.

It is assumed that students know and use, in a basic but clear way, the concepts taught in the last year of High School Chemistry. However, all the scripts include a theoretical introduction and, whenever necessary, additional teaching material will be provided to cover those deficiencies that are detected.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

No enrollment restrictions have been specified with other subjects of the curriculum.

It is assumed that students know and use, in a basic but clear way, the concepts taught in the last year of High School Chemistry. However, all the scripts include a theoretical introduction and, whenever necessary, additional teaching material will be provided to cover those deficiencies that are detected.

OUTCOMES

1934 - D.D. in Chemistry-Chemical Engineering

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.
- Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.
- Interpret the variation of the characteristic properties of chemical elements according to the periodic table.
- Demonstrate knowledge of the characteristics and behaviour of the different states of matter and the theories used to describe them.

- Demonstrate knowledge of the main types of chemical reaction and their main characteristics.
- Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry.
- Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- Solve qualitative and quantitative problems following previously developed models.
- Evaluate, interpret and synthesise chemical data and information.
- Handle chemicals safely.
- Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems.
- Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.
- Evaluate the risks in the use of chemicals and laboratory procedures.
- Recognise and evaluate chemical processes in daily life.
- Understand the qualitative and quantitative aspects of chemical problems.
- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- 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 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.
- 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.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES

This subject addresses part of the learning results of the matter Chemistry Laboratory contained in the document VERIFICA that allow to acquire specific knowledge of chemistry, cognitive skills and general skills recommended by the EUROPEAN CHEMISTRY THEMATIC NETWORK (ECTN) for the Chemistry Eurobachelor® Label. The following table lists the learning outcomes acquired in the subject Chemistry Laboratory related to the competences of the degree in Chemistry:

SPECIFIC KNOWLEDGE OF CHEMISTRY	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Chemistry Laboratory that contemplate the learning outcomes EUROBACHELOR®
Major aspects of chemical terminology, nomenclature, conventions and units.	Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.(CE1)
The major types of chemical reactions and the main characteristics associated with them.	Demonstrate knowledge of the main types of chemical reaction and their main characteristics.(CE4)
The principles and procedures used in chemical analysis and the characterisation of chemical compounds.	Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.(CE8) Show knowledge of the metrology of chemical processes including quality management..(CE10) Handle the instrumentation used in the different areas of chemistry.(CE19). Understand the qualitative and quantitative aspects of chemical problems..(CE24). Develop sustainable and environmentally friendly methods.(CE25)
The characteristics of the different states	Demonstrate knowledge of the characteristics and behaviour of

of matter and the theories used to describe them.	the different states of matter and the theories used to describe them..(CE3).
The principles of thermodynamics and their applications to Chemistry	Demonstrate knowledge of the principles of thermodynamics and kinetics, and their applications in chemistry (CE6).
The kinetics of chemical change, including catalysis; the mechanistic interpretation of chemical reactions	Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry (CE6).

HABILITIES AND COGNITIVE COMPETENCIES	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Chemistry Laboratory that contemplate the learning outcomes EUROBACHELORâ
Ability to recognize and implement science and the practice of measurement.	Demonstrate that you know the metrology of chemical processes including quality management. (CE10) Interpret the data from observations and measurements in the laboratory in terms of its significance and the theories that support it (CE20)
Ability to calculate and process data, related to information and chemistry data.	Solve qualitative and quantitative problems according to previously developed models (CE14). Recognize and analyse new problems and plan strategies to solve them (CE15).
Ability to demonstrate knowledge and understanding of the facts, concepts, principles	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of Chemistry (CE13).

and fundamental theories related to the topics mentioned above.	
Ability to apply this knowledge and understanding to the solution of common qualitative and quantitative problems.	Solve qualitative and quantitative problems following previously developed models (CE14). Recognise and analyse new problems and plan strategies to solve them (CE15). Understand the qualitative and quantitative aspects of chemical problems (CE24).
Competences to present and argue scientific issues orally and in writing to a specialized audience.	Relate Chemistry with other disciplines (CE26). Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate (CG6). Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences (CB4).

COMPETENCES AND COGNITIVE SKILLS RELATED TO THE PRACTICE OF CHEMISTRY	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Chemistry Laboratory that contemplate the learning outcomes EUROBACHELOR®
Capacities to handle chemical products safely, taking into account their physical and chemical properties, including any risk associated with	Handle chemicals safely..(CE17). Evaluate the risks in the use of chemicals and laboratory procedures..(CE21).

their use.	
Capabilities necessary to perform standard laboratory procedures as well as to use instrumentation in synthetic and analytical works, in both cases in relation to both organic and inorganic systems.	Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems..(CE18). Relate theory and experimentation..(CE22). Understand the qualitative and quantitative aspects of chemical problems..(CE24).
Capacities to monitor, observe and measure the chemical properties, facts or changes, and perform their registration (collection) and documentation in a systematic and reliable way.	Handle the instrumentation used in the different areas of chemistry.(CE19). Relate theory and experimentation..(CE22). Recognise and evaluate chemical processes in daily life..(CE23). Understand the qualitative and quantitative aspects of chemical problems..(CE24).
Ability to interpret data derived from observations and laboratory measurements in terms of their relevance, and relate them to the appropriate theory.	Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them..(CE20). Relate theory and experimentation..(CE22). Recognise and evaluate chemical processes in daily life..(CE23). Understand the qualitative and quantitative aspects of chemical problems..(CE24). Relate chemistry with other disciplines.(CE26).
Ability to perform risk assessments of the use of chemical substances and laboratory procedures.	Understand the qualitative and quantitative aspects of chemical problems..(CE24). Develop sustainable and environmentally friendly methods.(CE25). Evaluate the risks in the use of chemicals and laboratory procedures..(CE21).

GENERAL COMPETENCES	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Chemistry Laboratory that contemplate the learning outcomes EUROBACHELOR®
Ability to apply practical knowledge to solve problems related to qualitative and quantitative information.	Solve problems effectively.(CG4). Solve qualitative and quantitative problems following previously developed models.(CE14). Relate theory and experimentation.(CE22). Recognise and evaluate chemical processes in daily life.(CE23). Understand the qualitative and quantitative aspects of chemical problems.(CE24).
Calculation and arithmetic capabilities, including aspects such as analysis error, estimates of orders of magnitude, and correct use of the units.	Develop capacity for analysis, synthesis and critical thinking. (CG1). Show inductive and deductive reasoning ability.(CG2). Solve problems effectively.CG4).
Ability to analyse materials and synthesize concepts.	Develop capacity for analysis, synthesis and critical thinking (CG1). Show inductive and deductive reasoning ability (CG2). 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 (CB3).

Skills related to information technology such as word processing, spreadsheet, recording and storage of data, internet use related to the subjects.	Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate..(CG6). Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2).
Interpersonal skills to interact with other people and get involved in team work.	Demonstrate ability to work in teams both in interdisciplinary teams and in an international context..(CG5). Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7). Demonstrate the ability to adapt to new situations..(CG9).
Study skills necessary for professional development. These will include the ability to work autonomously.	Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation..(CG3). Demonstrate ability to work in teams both in interdisciplinary teams and in an international context..(CG5). Learn autonomously.(CG8). Demonstrate the ability to adapt to new situations..(CG9). Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.(CB5).

Regarding the Sustainable Development Goals (SDGs), it is expected that students will be able to know in this subject how to apply the knowledge learned to guarantee an inclusive, equitable, and quality education and promote learning opportunities for everyone (SDG 4).

To acquire a special sensitivity for sustainable management of water (SDG 6), raw materials and energy sources (SDG 7), as well as for an environmentally friendly and sustainable development (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) that minimize their impact on the environment (SDGs 14 and 15), using alternative raw materials and reducing wastes (SDG 11).

At the end of the subject "Laboratory of Chemistry", the student must be able to:

- Distinguish and recognize the most commonly used laboratory material: glass (volumetric and non-volumetric), electrical material and assemblies (heating mantle, distillation, rotary evaporator, scales, melting point apparatus, etc.).
- Know the waste minimization protocols.
- Understand and distinguish the labelling information of laboratory products, especially that referring to Safety Standards, H and P phrases, pictograms, etc.
- Use common appliances such as the Bunsen burner or the vacuum pump.
- Distinguish between the different types of filtration, depending on the objective pursued.
- Precisely prepare a conical filter and a pleat filter.
- Separate well differentiated products according to their solubility, using processes such as decanting and choosing the right solvent.
- Handle with precision the different types of filtering, both hot and cold.
- Estimate the amount of solute that can be dissolved in a solvent depending on its solubility (obtained from the literature).
- Know the phase changes that can occur in a compound when we are in the laboratory.
- Know the safety measures to take into account in the handling and heating of flammable liquids.
- Mount a simple distillation equipment whose objective is to measure the boiling point of a liquid.
- Calculate the efficiency (yield) of the distillation process.
- Properly measure the melting point of a crystallized solid.
- Handle the melting point apparatus correctly and select the appropriate program to the necessary extent.
- Use the magnitudes and their units correctly in the laboratory processes that involve measurements or quantitative calculations.
- Estimate adequately the errors made in the measurements (absolute error, relative error, standard deviation, etc.).
- Accurately calculate the amount of solid or liquid necessary to prepare a solution of determined concentration.
- Accurately handle the volumetric material in the process of preparing a solution.
- Qualitatively and quantitatively determine the expected pH value for prepared solutions (both acids and solid salts).
- Accurately use the pH meter in the process of measuring the pH of a solution.
- Precisely prepare solutions by dilution, from a stock solution.
- Know what it is and how a white solution is used.
- Know the use of a simple spectrophotometer for the measurement of the absorbance spectrum of a coloured solution (such as $CuSO_4$).
- Determine the analytical wavelength for a problem solution.
- Apply the Law of Lambert-Beer to relate the absorbance with the concentration of a concrete solution.
- Draw accurately the calibration line that relates the absorbance to the concentration of a solution.

- Determine, from the calibration line, the concentration of a problem solution.
- Prepare an assembly to carry out a distillation, both simple and with fractionation column.
- Apply the protocol correctly to properly separate, by distillation, two miscible liquids.
- Calculate the concentration of acid in the distilled phase of a mixture with acetic acid and acetone; and express it in different habitual units (mol / L, g / L, mole fraction).
- Analyse the necessary parameters to compare the separation of two miscible liquids by simple and fractional distillation.
- Determine the density of a mixture of two known liquids by weighing.
- Know the use of a eudiometer as a precision glass material to collect the gas generated in a reaction, and how to prepare the assembly.
- Do stoichiometric calculations applied to a reaction where there is a limiting reagent.
- Determine the molar mass of $CaCO_3$ by two methods: gravimetric and volumetric.
- Estimate the weight gain of $CaCO_3$ in a problem sample.
- Use a calorimeter and perform the appropriate test to determine its heat capacity.
- Determine the enthalpy variation associated with the neutralization of a strong base with a strong acid.
- Determine the enthalpy variation associated with the dissolution of an ionic solid.
- Analyze the influence of temperature on the solubility of an ionic solid.
- Analyze the effect of the concentration of H^+ ions on the chromate-dichromate equilibrium.
- Deduce and check the effect of the common ion in equilibria in simple aqueous solutions (acetic acid, ammonia, etc.)
- Analyze the redissolution of precipitates of metal hydroxides by the effect of several factors (addition of an acid, formation of a complex, etc.).
- Confirm the existence of reversible and irreversible reactions.
- Analyze the influence of temperature on complex ion equilibria (e.g. of Co^{2+}).
- List the main colligative properties.
- Express the concentration of a solution in terms of molality.
- Prepare a refrigeration mixture that reaches around -12 ºC.
- Construct a cooling curve of a pure solvent and a solution of a non-electrolyte compound (and deduce the melting point from it).
- Calculate the molar mass of a test compound (non-electrolyte) from the measurement of the cryoscopic depression.
- Experimentally determine the rate constant and the order of a reaction using a photocolorimetric technique.
- Use the UV-visible spectrophotometer to experimentally measure the variation of the absorbance of the discoloration reaction of the violet crystal (VC) in basic medium.
- Get the graph of the variation of the concentration versus time in the kinetics of discoloration of the VC.
- Calculate the partial reaction orders and the absolute rate constant in the discoloration reaction of the VC.
- Know the procedure of standardization of a solution and the volumetric material necessary for it.
- Manipulate properly a burette to make an assessment.
- Know what an indicator is and what are the conditions in which its use is useful: in what interval it turns and for what type of valuations it is adequate.
- Know the use of primary standards and their characteristics.
- Determine the concentration of a solution from a valuation process, calculating the errors committed, the standard deviation, etc.
- Prepare the equipment to perform a potentiometric titration (burette, pH-meter, etc.).
- Perform the standardization of a NaOH solution, using a suitable primary standard.

- Obtain the data and represent the titration curves of a strong acid and a weak acid with the standardized solution of NaOH, and calculate the exact concentrations of both acid solutions.
- Determine the water self-ionization constant from the strong acid-base strong titration curve.
- Determine the acidity constant of acetic acid from the weak acid-base titration curve.
- Prepare different types of buffer solutions.
- Analyze the effect of adding bases or acids to buffer solutions.
- Analyze the buffering capacity of different buffer solutions.
- Interpret the behavior of some metals against a solution of HCl, according to its reducing power. Check the reaction products.
- Obtain a metal from a solution of one of its salts by reacting it with another more reducing metal.
- Study the influence of some factors on redox reactions, such as pH or complex formation.
- Build galvanic batteries with the appropriate assembly (electrodes, salt bridge, voltmeter, etc.) and predict the theoretical voltage that the system should provide on the basis of reduction potentials.
- Prepare an assembly with an U-tube, to develop an electrolysis reaction from a potassium iodide solution. Identify the products formed on the electrodes with specific reactions.
- Prepare the appropriate assembly to analyze the migration of metal ions as an example of electrochemical process to solve environmental problems.
- Determine the hardness of a water sample by means of a complexometric titration using EDTA as titrant and NET as indicator.
- Prepare the appropriate assembly to perform a softening process of a water sample by exchange of Ca^{2+} and Mg^{2+} ions for Na^{+}.
- Carry out a deionization process of a water sample, through exchange of cations and anions by H^{+} and OH^{-}, respectively.
- Carry out different tests to interpret whether the softening and deionization processes have been correct (ionic conductivity, pH, or chloride test).

In addition, the student must have acquired the competences contained in the document VERIFICA relative to the subjects of the Degree in Chemistry "Chemistry Laboratory I" and "Chemistry Laboratory II".

DESCRIPTION OF CONTENTS

1. Prevention session

Prevention and action against fires in buildings for university teaching use

2. Seminar 1

Presentation. Management and organization of laboratory work. Preparation of experimental work.

3. Practice 1. Safety and Laboratory Material

Safety rules. Simplified sheets of compounds. Pictograms. H and P phrases. Laboratory material (glass material, electrical material, assemblies, lighter, vacuum pump, etc.). Types of filtration. Use of the balance. Direct weighing and tare. Waste. Waste minimization program.

4. Prqactice 2. Dissolution, precipitation and crystallization

Dissolution and solubility. Precipitation and crystallization. Solid-liquid separations: decantation and filtration.

5. Practice 3. Characterization of liquids and solids

Distillation. Determination of the boiling point. Determination of the melting point.

6. Seminar 2

Results presentation. Physical magnitudes Unit system. Measurement and experimental error. Accuracy and precision. Significant numbers.

7. Seminar 3

Waste conference.

8. Practice 4. Preparation of solutions and pH measurement

Acidity, basicity, balance and pH. Preparation of solutions of different concentrations. Solutions from solid salts. Use of the pH meter and pH measurements.

9. Practice 5. Absorbance spectrum of solutions

Aqueous solutions of CuSO4 by dilution. Preparation and utility of a white solution. Use of the visible spectrophotometer and spectrum recording. Absorbance measurements of copper sulphate solutions. Data treatment.

10. Practice 6. Distillation of mixtures of miscible liquids

Acetone-acetic acid distillation. Simple distillation and fractionation column. Efficiency of both processes. Density of a mixture by weighing.

11. Practice 7. Stoichiometric calculations

Reaction between calcium carbonate and hydrochloric acid. Determination of the molar mass of CaCO3. Weight richness of a problem sample. Gravimetric method and volumetric method.

12. Seminar 4

Analysis and discussion of the results of the practices P2 a P7.

13. Practice 8. Thermochemical

Determination of the calorific capacity of a calorimeter. Determination of the enthalpy variation of a neutralization reaction. Estimation of the dissolution heat of an ionic solid. Effect of temperature on the solubility of an ionic solid.

14. Seminar 5

Preparation of a laboratory memory. Objectives, index and theoretical introduction. Treatment and discussion of results. Formal aspects. Presentation of Tables and Figures. Bibliography.
Computer Applications: use of Excel® for representation of graphs and interpretation of laboratory results.

15. Practice 9. Chemical equilibrium

Chemical reactions in test tube. Factors that influence a chemical equilibrium. Reversible and irreversible reactions.

16. Practice 10. Colligative properties

Cryoscopic depression. Cryoscopic constant. Molality. Determination of molar masses by cryoscopy.

17. Practice 11. "Crystal violet" discoloration kinetics

Discoloration kinetics of the "cristal violet". Instantaneous rate constant. Experimental determination of the rate constant and the order of reaction. Photocolorimetric technique. Apparent rate constants and absolute rate constant.

18. Seminar 6

Analysis and discussion of results of practices P8 to P10

19. Practice 12. End-point titration. Potentiometric titration

Stoichiometry and neutralization of acid-base reactions. Indicators in acid-base titrations. Use of primary and secondary standards. Titration curves. Determination of Kw. Determination of the acidity constant of acetic acid.

20. Practice 13. pH regulating solutions

Study of the buffering capacity of buffer solutions. Preparation of pH buffer solutions. Effect of the addition of bases or acids to buffer solutions. Buffering capacity.

21. Practice 14. Electrochemistry

Behavior of some metals against a solution of HCl. Influence of pH and formation of complexes on redox reactions. Construction of galvanic batteries. Electrolysis.

22. Practice 15. Determination of water hardness

Determination of the hardness of a water sample by means of a complexomètric titration with EDTA. Ionic exchange. Softening and deionization. Measurements of ionic conductivity and pH. Chlorides test.

23. Seminar 7

Analysis and discussion of results of practices P11 to P15. Defense and presentation of laboratory memory.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	60,00	100
Tutorials	15,00	100
Development of individual work	25,00	0
Study and independent work	60,00	0
Preparation of evaluation activities	12,50	0
Preparation of practical classes and problem	15,00	0
TOTAL	**187,50**	

TEACHING METHODOLOGY

Among the training activities described for the subject "Chemistry" in the verification report of the Degree in Chemistry, in this subject two are used: practical laboratory classes and seminars.

In the practical laboratory sessions, an overview of the basic work of a chemistry laboratory will be offered. It is intended that students acquire skills in the execution of the basic techniques of laboratory work. They should become familiar with the mechanisms of safety and management, handling of material and equipment, treatment and presentation of data, decision making and choosing the most appropriate procedure, if applicable. A standard session will consist in the initial discussion of the previous questions that each practice has (that the student must bring resolved), and that will serve as a base to introduce the theoretical concepts on which the practice is based and to discuss the possible doubts or special

precautions that they are required. The important part of the session will be the work and handling of materials and products, depending on the objectives of the practice (most of the experimental procedure must be recorded by the student in his laboratory notebook). And at the end of the session, it is convenient to share the results achieved, an interpretation of these results and a reflection on whether the proposed objectives have been achieved.

Four additional independent seminars of the laboratory sessions have been programmed, which will serve to reinforce the learning of the same ones, either treating monographic subjects (for example, treatment of magnitudes, units and calculation of errors), either to solve or analyze doubts that have arisen in the treatment and interpretation of the results of the practices.

Since it is the first laboratory that first-year students have access to, two additional activities related to waste prevention and management are planned:

- Workshop on Prevention and extinction of fires, given by the chief prevention officer of the Valencia Provincial Fire Department Consortium.

- Conference on waste treatment in the laboratories of the Faculty of Chemistry, taught by a technician of the General Chemistry Laboratory, and whose objective is to make students aware of the process of minimization and correct waste management of a laboratory of these characteristics.

EVALUATION

Attendance at practical laboratory classes is mandatory. Justified absence will be allowed for a maximum of two sessions (preferably, it should be suggested to be recovered in some other subgroup).

The assessment of student learning will be formative in nature and will be carried out by addressing different aspects that are part of two blocks with well differentiated characteristics:

a) **Continuous evaluation**

Those aspects that require a continuous evaluation of the progress and work developed throughout the course are part of this section. For this, the following will be taken into account: active participation in the seminars, the resolution of all those questions and problems that are proposed to them to work autonomously, and of course, the management in the laboratory, the monitoring of the security rules and the laboratory notebook.

Since the work in the laboratory, the preparation work of the experience and the preparation of the notebook involves a continuous evaluation process throughout the course, the grade obtained for this section, in the first call, will be maintained in the second one. The sections listed below, together with the percentage of the grade, can not be recovered, if necessary, in the second call. Only in the case of the Notebook will a partial recovery of those sections corresponding to the treatment and interpretation of the results be allowed.

In the first Seminar of the second semester, the procedure for preparing a Laboratory Report will be analysed. Each student (or pair of students, as considered by the teacher) must prepare and defend (in the last seminar session) the report of one of the practicals carried out.

- Preparation of experience and work in the laboratory (15%)
- Deliverables (previous, post, results) (30%)
- Laboratory notebook (15%)
- Laboratory Report (dossier and defense) (10%)

In total, this section: **70%** of the final grade

b) **Final evaluation test**

The knowledge and skills acquired will be evaluated by means of two partial exams throughout the course:

First midterm: content of practices P1 to P7. It will take place during the last week of class in December (see exam calendar).

Second midterm: content of practices P8 to P15. To be taken during the last week of class in May (see exam calendar).

The grade of both exams must be higher than 4 points, and the average value of both grades will be averaged with the grade of the continuous evaluation block.

Evaluation exercises: **30%** of the final grade

To be able to pass the subject, a grade equal to or greater than **4 points is required in each of the two blocks that make up the evaluation, and the weighted sum of both will reach 5 points.**

Second call.

Students who do not pass on the first call must sit the exam on the second call, keeping the mark of the other sections (continuous assessment and laboratory), which are considered “non-recoverable”. The same percentages and requirements are maintained as in the first call.

The activities of continuous evaluation, which in this subject are laboratory sessions (and all of the associated tasks), are of MANDATORY ATTENDANCE, and therefore, NOT RECOVERABLE, in accordance with the provisions of Article 6.5 of the Regulation of Evaluation and Grading of the UV for Bachelor and Master degrees.

In any case, the evaluation system will be governed by the provisions of the *Evaluation and Qualification Regulations of the University of Valencia for Degrees and Masters*

(http://www.uv.es/graus/normatives/2017_108_Reglament_avaluacio_qualificacio.pdf)

Final warning (regarding the possibility of using AI or any other form of plagiarism or copying of homework).

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*".

REFERENCES

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