

**COURSE DATA****Data Subject**

Code	34186
Name	Chemistry laboratory II
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Faculty of Chemistry	1	Second term

Subject-matter

Degree	Subject-matter	Character
1110 - Degree in Chemistry	1 - Chemistry	Basic Training

Coordination

Name	Department
GARCIA ALVAREZ-COQUE, M CELIA	310 - Analytical Chemistry

SUMMARY

This subject is compulsory of basic character and is taught in the second semester of the first year of the Degree in Chemistry, with a volume of 6 credits. Together with "Chemistry Lab I" (also compulsory of basic character, but taught in the first semester), it is intended, essentially, that the student learn the operation of a chemical laboratory, as well as the basic techniques of work that will develop in it. 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 bases developed in the previous laboratory will be consolidated: the security, analysis and interpretation of data necessary for the development of any chemical experience, as well as the management and data processing that take place in any chemical laboratory. For this purpose, experiments will be carried out in which different basic techniques must be to more elaborate experiments. Experiments will be carried out on kinetics and thermodynamics of chemical reactions, equilibria and electrochemistry.



It is required that the students already have consolidated some knowledge about safety and laboratory management, waste discrimination, preparation of memories and laboratory notebooks, correct use of material and products, data processing and realization of basic techniques developed in Laboratory of Chemistry I.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Knowledge about laboratory safety and management, waste discrimination, preparation of reports and laboratory notebooks, correct use of materials and products, data processing and basic techniques developed in the Chemistry Laboratory I. In addition, it is assumed that the students know and use, in a basic but clear way, the concepts taught in the last year of High School Chemistry.

OUTCOMES

1108 - Degree in Chemistry

- 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.
- 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.
- 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 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.
- 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

The previous section includes the competences contained in the document VERIFICA. This subject addresses part of the learning results of the subject Chemistry Laboratory II that allow to acquire both 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 II 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 II that contemplate the learning outcomes EUROBACHELOR®



The major types of chemical reactions and the main characteristics associated with them.	C1: 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.	C1: Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds (CE8). C2: Show knowledge of the metrology of chemical processes including quality management (CE10). C3: Handle the instrumentation used in the different areas of Chemistry (CE19). C4: Understand the qualitative and quantitative aspects of chemical problems (CE24). C5: Develop sustainable and environmentally friendly methods (CE25).
The characteristics of the different states of matter and the theories used to describe them.	C1: Demonstrate knowledge of the characteristics and behaviour of the different states of matter and the theories used to describe them (CE3).
The principles of thermodynamics and their applications to Chemistry	C1: 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	C1: Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry (CE6).

COMPETENCES AND COGNITIVE SKILLS

The learning process should allow the degree graduates to demonstrate:

	Competences of the subject Chemistry Laboratory II that contemplate the learning outcomes EUROBACHELOR®
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Ability to demonstrate knowledge and understanding of the facts, concepts, principles and fundamental theories related to the topics mentioned above.	C1: Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of Chemistry (CE13).
Ability to apply this knowledge and understanding to the solution of common qualitative and quantitative problems.	C1: Solve qualitative and quantitative problems following previously developed models (CE14). C2: Recognise and analyse new problems and plan strategies to solve them (CE15). Understand the qualitative and quantitative aspects of chemical problems (CE24).
Ability to recognize and implement science and practice of measurement.	C1: Show knowledge of the metrology of chemical processes including quality management (CE10) C3: Interpret data from observations and measurements in the laboratory, in terms of their significance and the theories that underpin them (CE20).
Competences to present and argue scientific issues orally and in writing to a specialized audience.	C1: Relate Chemistry with other disciplines (CE26). C2: Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate (CG6). C3: Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences (CB4).
Ability to calculate and process data, related to information and Chemistry data.	C1: Solve qualitative and quantitative problems following previously developed models (CE14). C2: Recognise and analyse new problems and plan strategies to solve them (CE15).

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 II 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 their use.	C1: Handle chemicals safely (CE17). C2: Evaluate the risks in the use of chemicals and laboratory procedures (CE21).
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.	C1: Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems (CE18). C2: Relate theory and experimentation (CE22). C3: 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.	C1: Handle the instrumentation used in the different areas of Chemistry (CE19). C2: Relate theory and experimentation (CE22). C3: Recognise and evaluate chemical processes in daily life (CE23). C4: 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.	C1: Interpret data from observations and measurements in the laboratory, in terms of their significance and the theories that underpin them (CE20). C2: Relate theory and experimentation (CE22). C3: Recognise and evaluate chemical processes in daily life (CE23). C4: Understand the qualitative and quantitative aspects of chemical problems (CE24). C5: Relate Chemistry with other disciplines (CE26).
Ability to perform risk assessments of the use of chemical substances and	C1: Understand the qualitative and quantitative aspects of chemical problems (CE24).



laboratory procedures.	C2: Develop sustainable and environmentally friendly methods (CE25). C3: Evaluate the risks in the use of chemicals and laboratory procedures (CE21).
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GENERAL COMPETENCES	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Chemistry Laboratory II that contemplate the learning outcomes EUROBACHELOR®
Ability to apply practical knowledge to solve problems related to qualitative and quantitative information.	C1: Solve problems effectively (CG4). C2: Solve qualitative and quantitative problems following previously developed models (CE14). C3: Relate theory and experimentation (CE22). C4: Recognise and evaluate chemical processes in daily life (CE23). C5: 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.	C1: Develop capacity for analysis, synthesis and critical thinking (CG1). C2: Show inductive and deductive reasoning ability (CG2). C3: Solve problems effectively (CG4).
Ability to analyse materials and synthesize concepts.	C1: Develop capacity for analysis, synthesis and critical thinking (CG1). C2: Show inductive and deductive reasoning ability (CG2). C3: 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.	C1 Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate (CG6). C2: 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.	C1: Demonstrate ability to work in teams both in interdisciplinary teams and in an international context (CG5). C2: Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional (CG7). C3: Demonstrate the ability to adapt to new situations (CG9).
Study skills necessary for professional development. These will include the ability to work autonomously.	C1: Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation (CG3). C2: Demonstrate ability to work in teams both in interdisciplinary teams and in an international context (CG5). C3: Learn autonomously (CG8). C4: Demonstrate the ability to adapt to new situations (CG9). C5: Students must have developed the learning skills needed to undertake further study with a high degree of autonomy (CB5).

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

- Distinguish the types of cohesion forces present in chemical compounds.
- Predict and check the variation of the melting points according to the type of cohesion force.



- Predict and interpret the variation of the solubility of several chemical compounds and relate it to the type of cohesive force.
- Prepare a reflux system.
- Properly dose the reagents to carry out the synthesis of a simple chemical.
- Isolate by vacuum filtration the product of an organic synthesis reaction.
- Purify a product obtained in a reaction, by means of crystallization.
- Determine the purity of a solid product by determining the melting point and using the thin layer chromatography technique.
- Use a calorimeter and perform the appropriate assay 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.
- List the main colligative properties.
- Express the concentration of a solution in terms of molality.
- Prepare a refrigeration mixture that reaches around $-12\text{ }^{\circ}\text{C}$.
- 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 photolorimetric technique.
- Use the UV-visible spectrophotometer to experimentally measure the variation of the absorbance of the discoloration reaction of crystal violet in basic medium.



- Get the graph of the variation of the concentration versus time in the discoloration kinetics of crystal violet.
- Calculate the partial reaction orders and the absolute rate constant in the discoloration reaction of crystal violet.
- Analyze the dependence of the decomposition rate of hydrogen peroxide catalyzed with iodide ion according to three variables: hydrogen peroxide concentration, catalyst concentration and temperature.
- Follow the evolution of the decomposition reaction of hydrogen peroxide with time from measurements of the volume of oxygen evolved.
- Estimate the initial rate of the decomposition reaction of hydrogen peroxide for different concentrations of this reagent, of catalyst and at different temperatures.
- Express the rate law (reaction order and rate constant) of the decomposition kinetics of hydrogen peroxide.
- Calculate the activation energy of the decomposition reaction of hydrogen peroxide.
- 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-strong base titration curve.
- Determine the acidity constant of acetic acid from the weak acid-strong 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 using specific reactions.
- 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 the divalent ions Ca and Mg for ion 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).

DESCRIPTION OF CONTENTS

1. Seminar 1

Presentation.
Safety measures.
Materials and basic operations in the laboratory.
Waste minimisation program.

2. Practice 1: Intermolecular forces

Physical properties of chemical compounds.
Acid-base reactions and solubility.

3. Practice 2. Synthesis and purification of an organic compound.

Synthesis, isolation and purification of acetanilide.
Reflux system.
Purification by crystallisation.
Characterisation by melting point and thin-layer chromatography.

4. Practice 3. Thermochemistry.

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.



5. Seminar 2

How to write a laboratory report.
Objectives, index and theoretical introduction.
Treatment and discussion of results.
Formal aspects. Presentation of tables and figures.
Bibliography.

6. Practice 4. Chemical equilibrium.

Chemical reactions in the test tube.
Factors influencing chemical equilibrium.
Reversible and irreversible reactions.

7. Practice 5. Colligative properties.

Freezing-point depression. Cryoscopic constant.
Molality.
Determination of molecular weights by cryoscopy.

8. Practice 6. Kinetics (1).

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

9. Seminar 3

Analysis and discussion of the results of practice sessions P1 to P6.

10. Practice 7. Kinetics (2).

Kinetics of the decomposition reaction of hydrogen peroxide.
Use of a catalyst (potassium iodide).
Factors affecting the rate of decomposition: reagent concentration, catalyst and temperature.
Rate law. Activation energy.

11. Practice 8. Potentiometric titration.

Primary standards.
Titration curves.
Determination of water self-ionization constant(K_w).
Determination of acidity constant of acetic acid.

**12. Practice 9. Buffer solutions of pH.**

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

13. Practice 10. Electrochemistry.

Behaviour of some metals in HCl solution.
Influence of pH and complex formation on redox reactions.
Construction of galvanic cells.
Electrolysis.

14. Practice 11. Determining water hardness.

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

15. Seminar 4

Analysis and discussion of the results of practice sessions P7 to P11.

16. Evaluation

Final evaluation session.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	48,00	100
Theory classes	12,00	100
Development of individual work	20,00	0
Study and independent work	50,00	0
Preparation of evaluation activities	10,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	150,00	



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 continue to acquire skills in the execution of the basic techniques of laboratory work. We want to get them to apply everything developed in Chemistry Laboratory I (in the first semester) to specific experiments, as well as to introduce some techniques that were not seen in that laboratory.

A standard session consists in the initial discussion of the previous questions that each practice has (that the student must have resolved), and that will serve as a base to introduce the theoretical concepts on which the practice is based and discuss the possible doubts or special precautions 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). 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 seminars independent of the laboratory sessions have been programmed, which will serve to reinforce the learning, either dealing with monographic topics (for example, requirements to adequately prepare the memory of a laboratory practice), either to solve or analyze doubts that have arisen in the treatment and interpretation of the results of the practices.

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 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 these three sections, in the first call, will be maintained kept in the second one. The sections listed below, together with the percentage of the grade, cannot be recovered, if necessary, in the second call. Only in the case of the laboratory notebook, will a partial recovery of those sections corresponding to the treatment and interpretation of the results will be allowed.



1. Preparation of the experience (including the preliminary questions): 20%
2. Work in the laboratory: 20%
3. Laboratory notebook (including post-laboratory questions): 20 %

b) Evaluation of specific activities

The acquired knowledge and skills will be evaluated through exams throughout the course, and / or a test common to all the subgroups of the subject that will be carried out at the end of the laboratory work, on a date of official call. The presentation, orally and written, of a laboratory report is also part of this section.

4. Memory of a laboratory practice: 20 %
5. Final evaluation exercises (including the final test): 20%

To be able to pass the subject, a grade equal to or higher than 4 points is required in each of the five sections that make up the evaluation, and the weighted sum of all of them will reach 5 points.

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

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ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. Contenidos

La asignatura “Laboratorio de Química II” complementa las enseñanzas de la asignatura “Laboratorio de Química I”, ofrecida en el primer cuatrimestre del Grado de Química. Ambas asignaturas pretenden que el/la estudiante aprenda el funcionamiento y las técnicas básicas de trabajo de un laboratorio químico, con la intención de prepararlo para abordar posteriormente con éxito los laboratorios de las distintas áreas de conocimiento de Química en el Grado que cursan. La asignatura consta de 11 sesiones de prácticas (la primera de 2,5 horas de duración y el resto de 4,5 horas), así como 4 sesiones de seminarios (el primero de 1,5 horas y 3 de 2,5 horas), lo que se complementa con el trabajo no presencial de los/las estudiantes anterior y posterior a la ejecución de cada práctica experimental, y las explicaciones proporcionadas por los/las profesores/profesoras previamente a su ejecución. Esta docencia se imparte a 16 subgrupos de estudiantes.

En la fecha de interrupción de la docencia presencial, todos los subgrupos habían completado las primeras 7 prácticas indicadas en la guía docente de la asignatura, así como los 3 primeros seminarios. Por lo tanto, al interrumpirse las actividades en las instalaciones de la Universidad de Valencia, no se han podido impartir las últimas 4 prácticas de forma presencial, así como el último seminario.

Tras la interrupción del trabajo en los laboratorios, la docencia no presencial se inició inmediatamente al terminar el periodo vacacional próximo a la festividad de San José (semana fallera, entre el 16 y 20 de marzo), tras un debate abierto con la Comunidad de profesores(as) de la asignatura Laboratorio de Química II. La voluntad de los/las profesores/profesoras ha sido proporcionar la máxima formación posible relacionada con el contenido de las prácticas no realizadas de forma presencial



2. Volumen de trabajo y planificación temporal de la docencia

La docencia presencial en la asignatura Laboratorio de Química II constaba de los siguientes apartados:

1. Preparación de la experiencia (incluida la contestación a cuestiones previas)
2. Trabajo en el laboratorio
3. Elaboración del cuaderno de laboratorio que incluye la contestación a cuestiones post-laboratorio
4. Preparación de la memoria de una práctica de laboratorio asignada a cada alumno
5. Ejercicios de evaluación (incluido el examen final de la asignatura)

Al eliminarse la posibilidad de docencia presencial, se habían llevado a cabo un 64% de las prácticas de laboratorio programadas. El trabajo en el laboratorio no ha podido continuarse al pasar a la docencia no presencial. Debe indicarse, sin embargo, que al principio del curso se proporciona a los/las estudiantes unas guías de cada práctica con descripciones muy detalladas de cada paso realizado en el laboratorio, y también han tenido acceso a vídeos de los experimentos para la mayoría de las prácticas. Sin embargo, no ha sido posible continuar la preparación del cuaderno de laboratorio en base a sus propias observaciones y, dependiendo de las fechas en las que se permita a los/las estudiantes reunirse con sus profesores(as), podrían no poder entregarles los cuadernos de laboratorio para ser calificados.

Por otro lado, se proporciona a los/las estudiantes un listado de cuestiones previas y posteriores a las prácticas, que durante la etapa de docencia no presencial pueden contestar con ayuda de las guías de las prácticas, de los vídeos a los que tienen acceso, a través de consultas en la bibliografía recomendada o incluso búsquedas en Internet, de la misma forma que lo hacían con la docencia presencial. Para algunas prácticas en las que se debe realizar un tratamiento de datos, se ha proporcionado a los/las estudiantes datos experimentales obtenidos anteriormente en el laboratorio, para que puedan ejercitarse en la realización de los cálculos. Por otro lado, con esos datos, los/las estudiantes han podido contestar a algunas de las cuestiones posteriores planteadas en las prácticas realizadas de forma no presencial.

Los/las estudiantes también poseen información suficiente para preparar la memoria de laboratorio que se les ha asignado y que pueden enviar por Internet. Dependiendo de las herramientas disponibles, podría no poder realizarse la presentación oral de la memoria de prácticas asignada, pero puede enviarse por Internet transparencias de la presentación, o bien realizar la presentación mediante videoconferencia. En el caso de haberse asignado a un/una estudiante una práctica no ejecutada en el periodo presencial, a criterio del profesor/de la profesora, dicha práctica se podrá sustituir por otra llevada a cabo por el/la estudiante en el periodo presencial de la asignatura.

Los/las estudiantes han sido también informados(as) de que el examen final se realizaría en la fecha prevista para organizar su estudio.

Las prácticas de laboratorio estaban programadas para ser realizadas presencialmente un día a la semana, con descansos vacacionales. La docencia no presencial ha respetado el calendario del curso, realizando las actividades en las mismas fechas en las que en las condiciones habituales los/las estudiantes hubieran realizado las prácticas programadas en el laboratorio. Por lo tanto, no se espera que el volumen de trabajo de los/las estudiantes se haya modificado significativamente, a excepción del tiempo que dedicaban a las manipulaciones realizadas en el laboratorio, que no son posibles sin tener acceso a las instalaciones.



3. Metodología docente

Desde el punto de vista de los profesores/las profesoras, la realización de la actividad docente a distancia ha requerido, en muchos casos, efectuar muchas adaptaciones y multiplicar el esfuerzo en la realización de tutorías a través de Internet, de forma escrita u oral.

Exceptuando la imposibilidad de que los/las estudiantes realicen el trabajo en el laboratorio para las últimas 4 prácticas programadas, se ha recomendado a los profesores/las profesoras que realicen las actividades programadas de la misma forma que cuando las realizaban de forma presencial, incrementando el esfuerzo cuando fuera necesario. De esta forma, los profesores/las profesoras se han comunicado con los/las estudiantes para que siguiendo la programación semanal de las prácticas (con dos periodos vacacionales, alrededor de Fallas y Pascua), éstos estudien detalladamente las guías de las prácticas, contesten a las cuestiones planteadas, estudien la materia con vistas a la realización del examen final y elaboren la memoria de prácticas que se les ha asignado. Además, del mismo modo que cuando se realiza la docencia presencial, los profesores/las profesoras han completado la información a los/las estudiantes con explicaciones apoyadas con documentos de Power Point o Word (o similares), que han subido al Aula Virtual, incluyendo tutoriales para hacer el tratamiento de resultados de laboratorio. Cuando ha sido posible, se han realizado videoconferencias síncronas con BBC (BlackBoard Collaborate), así como presentaciones grabadas, algunas de ellas con problemas resueltos (con la aplicación OBS). Los profesores/las profesoras en este periodo han corregido la contestación de las cuestiones enviadas por los/las estudiantes con una fecha límite para cada práctica, y tras ello, se les ha proporcionado las contestaciones correctas, enviando sus comentarios cuando ha sido necesario. Se ha completado la actividad docente con tutorías por correo o videoconferencia, así como chats de dudas con Microsoft Teams, entre otras herramientas, a criterio del profesor/de la profesora.

El trabajo que no ha podido ser realizado en el laboratorio se ha sustituido con el visionado de vídeos que existían para la asignatura, acompañados de explicaciones por parte de los profesores/las profesoras. A pesar del evidente interés en la realización de las prácticas que no han podido hacerse de forma presencial, debe tenerse en cuenta que muchas habilidades se han podido adquirir en la asignatura de Laboratorio de Química I y en las prácticas realizadas de forma presencial del Laboratorio de Química II.

4. Evaluación

La asignatura Laboratorio de Química II tiene un amplio componente de evaluación continua. La nota final tiene en cuenta los distintos apartados de que consta la asignatura (se muestra el peso de cada apartado):

1. Preparación de la experiencia (incluida la contestación a cuestiones previas): 20 %
2. Trabajo en el laboratorio: 20 %
3. Elaboración del cuaderno de laboratorio que incluye la contestación a cuestiones post-laboratorio: 20 %



4. Preparación de la memoria de una práctica de laboratorio asignada a cada alumno: 20 %
5. Ejercicios de evaluación (incluido el examen final de la asignatura): 20 %

Para aprobar la asignatura se requiere una calificación igual o superior a 4 puntos (sobre 10) en cada uno de los cinco apartados que componen la evaluación, y que la suma ponderada de todos ellos llegue a 5 puntos. Al pasar a la docencia no presencial en el último tramo de la asignatura, se han mantenido estos porcentajes.

El/La profesor/profesora calificará el trabajo realizado en el laboratorio en base a lo observado durante las 7 prácticas ejecutadas en el laboratorio. Además, se calificarán las contestaciones a las cuestiones previas y posteriores proporcionadas por los/las estudiantes a lo largo de las 11 prácticas que componen la asignatura, así como la memoria y presentación de la práctica que se les ha asignado.

El examen final se realizará de forma online en la fecha prevista, adaptando el formato consensuado para el examen al inicio de curso. El examen tendrá un tiempo limitado y constará de preguntas tipo test de una sola respuesta válida o varias respuestas, ordenadas aleatoriamente, así como preguntas que requieran la realización de cálculos, en las que el/la estudiante sólo debe indicar el resultado numérico con sus unidades. Las preguntas tipo test se elegirán aleatoriamente de un conjunto de preguntas mayor. En las preguntas que requieran cálculos, los datos variarán para cada alumno(a) aleatoriamente.

También, de acuerdo a lo consensuado al inicio del curso, las Matrículas de Honor se asignarán a los/las estudiantes de mayor nota media, y debido a la limitación del número de Matrículas y la existencia de una lista única, en caso de empate en dicha nota, se asignará la Matrícula de Honor al/a la estudiante o estudiantes con mayor calificación en el examen final.

El profesor/La profesora se reserva el derecho de pedir al alumno que le envíe escaneados los cálculos escritos realizados durante el examen, o incluso una breve entrevista oral para aclarar algún detalle concreto.

5. Bibliografía

La bibliografía empleada se halla reseñada en las guías de las prácticas, por lo que el paso de clases presenciales a no presenciales no ha supuesto ningún cambio. Debido al cierre de la Biblioteca del Campus y la imposibilidad de los desplazamientos, los/las estudiantes que no disponen de los libros, pueden acceder a ellos online a través del Servicio de Bibliotecas.