

**COURSE GUIDE**

2026/27

Faculty 215 - Faculty of Chemistry**Cycle** .**Degree** GQUIMI20 - Bachelor's Degree in Chemistry**Year** Second year**COURSE**

26122 - Experiments in Physical Chemistry

Credits, ECTS: 6**COURSE DESCRIPTION**

This subject introduces students to some experimental methods to determine macroscopic properties of matter in aspects concerning Chemical Thermodynamics, Chemical Kinetics and electrochemical phenomenon. In addition, previous knowledge will also be applied concerning surface properties, macromolecules and colloids.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

The subject is included in Physical Chemistry, within the Fundamental Module of the Degree Course and, as such, shares the transverse skills [M02CM08], [M02CM09], [M02CM10] and [M02CM11] assigned to this module. In addition, this subject develops specific skills [M02CM01][M02CM03]. Therefore, the following skills of the degree will be worked on [G001][G002][G003][G004][G005][G006][G007][G008] and [G0010]. Below is the detail of these skills and the corresponding learning outcomes.

M02CM01. Understanding and handling the principles of Physical Chemistry and its influence on chemical processes.

M02CM03. Ability to plan and carry out simple processes of synthesis and characterization of chemical compounds in the laboratory, safely and using the appropriate techniques, as well as to evaluate and interpret the data derived from experimental observations in the various fields of chemistry.

M02CM08. Ability to select different instrumental techniques (simple or combined) to characterise chemical substances.

M02CM09. Be able to comprehensibly present phenomena and processes related to Chemistry and associated topics, both verbally and in writing.

M02CM10. Information search and selection skills in the field of Chemistry and other scientific areas, making use of the bibliography and information and communication technologies.

M02CM11. Be capable of relating Chemistry to other disciplines, and understanding its impact on today's society and the importance of the industrial chemical sector.

G001 Possess and understand knowledge in Chemistry, which includes theoretical and practical aspects in this field.

G002 Properly handle the acquired knowledge, skills, and abilities to recognize and analyze new problems and propose strategies to solve them.

G003 Safely manipulate chemical materials and recognize and assess the risks in the use of chemical substances and laboratory procedures.

G004 Plan, develop, manage, and control chemical processes and projects, using techniques and equipment commonly employed in academic and industrial laboratories.

G005 Analyze and interpret experimental results and scientific information to make decisions, taking into account the technical and ethical aspects of the proposed problem.

G006 Convey information and ideas at the scientific-technical level using at least two official languages of the European Community, and the potential of ICTs.

G007 To possess those learning skills necessary to undertake further studies with a high degree of autonomy.

G008. Demonstrate teamwork and problem-solving skills in multidisciplinary contexts.

G010 Acquire a comprehensive education consistent with the fundamental rights of equality, non-discrimination, and the promotion of a culture of peace.

The coordination of this subject with the other subjects in the Module corresponds to the Coordination Committee of the Degree in Chemistry.

Theoretical and Practical Contents

Chemical Thermodynamics and Thermochemistry: Determining changes in enthalpy associated with different physical-chemical processes (reaction, dissolving, etc.) using calorimetric devices.

Binary mixtures: Determining partial molar volumes of different liquid mixtures at different temperatures.

Phase equilibria: Determining vapour pressure. Phase diagrams for different solid-liquid and liquid-vapour systems.

Liquid/liquid diagrams.

Chemical equilibria: Determining equilibrium constants.

Electrochemistry: Determining potentiometry. Electrode potentials. Thermodynamic magnitudes in electrochemical batteries.

Chemical kinetics: Determining constants and reaction orders for certain reactions. Influence of temperature.

Surface and colloid phenomena: Surface tension of liquids and solutions. Surfactants: Critical micellar concentration.

Surface adsorption phenomenon.

Macromolecules. Magnitudes in solution: viscosimetry. Determining molecular weights.

TEACHING METHODS

In this experimental subject, two types of methodologies will be combined. 75% of the subject will be taught traditionally, while the remaining 25% will be developed using the PBL (Problem-Based Learning) system. That is, 50% of the practical



work corresponding to the first semester will be carried out based on the PBL methodology.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching		5	10	45					
Horas de Actividad No Presencial del Alumno/a		7,5	15	67,5					

Legend: M: Lecture-based S: Seminar GA: Applied classroom-based groups
 GL: Applied laboratory-based groups GO: Applied computer-based groups GCL: Applied clinical-based groups
 TA: Workshop TI: Industrial workshop GCA: Applied fieldwork groups

Evaluation methods

- Continuous evaluation
- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 40%
- Individual assignments 10%
- Teamwork assignments (problem solving, Project design) 10%
- Oral presentation of assigned tasks, Reading 15%
- PBL type experiments 25%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The tests and evaluation activities of this subject will be carried out in accordance with the principles of academic integrity, honesty, and ethical behavior established in the regulations of the EHU/UPV. Upon joining the University, students subscribed to the Declaration of Commitment to Ethical Behavior and Academic Honesty, committing themselves not to engage in plagiarism, academic fraud, or the use of unauthorized materials or devices, including artificial intelligence tools when they are not expressly permitted, in tests and academic work. Failure to comply with these obligations may entail the academic and disciplinary consequences provided for in the current university regulations.

Attendance at laboratory practices is mandatory. A student who does not attend will not be able to pass the subject and will not receive any evaluation in the ordinary or extraordinary call. A student who wishes to exercise their right to a unique evaluation must submit in writing to the responsible professor of the subject a waiver of continuous evaluation before 60% of their practice period ends.

The final grade is divided into two parts: 50% for the first semester + 50% for the second semester.
 First semester 50%: The first three sections of the subject will be taught during the First Semester, combining the methodology of 'Problem-Based Learning' (PBL) with traditional methods. Its evaluation, considering the indicated competencies, will be as follows:

- 1st PBL Practice: 25%. All competencies.
- 2nd PBL Practice: 25%. All competencies.
- Written exam: 40%. [M02CM01] and [M02CM08].
- Teamwork assessment: 10%. [M02CM01, M02CM03, M02CM08, M02CM09].

Second semester 50%: The rest of the program will be taught in the Second Semester using the traditional methodology of experimental subjects and will be evaluated, considering the indicated competencies, as follows:

- Written exam: 40%. [M02CM01] and [M02CM08].
- Teamwork assessment: 10%. [M02CM01, M02CM03, M02CM08, M02CM09].
- Evaluation of the Laboratory Notebook: 20%. Individual work (M02CM09)
- Evaluation of two Oral Presentations: 30%. (M02CM09, M02CM10, M02CM11)

These sections cover the competencies [M02CM01], [M02CM03], [M02CM08], [M02CM09], [M02CM10], and [M02CM11] and [G001][G002][G003][G004][G005][G006][G007][G008][G0010]. TO CALCULATE THE AVERAGE, IT WILL BE NECESSARY TO OBTAIN A MINIMUM OF 4/10 IN EACH AND EVERY ONE OF THE ACTIVITIES.

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In order for the student to be evaluated as Not Presented in the case of continuous evaluation, they must forgo the final exam of the call no less than one month before the end date of the teaching period of the subject. This renouncement must be submitted in writing to the responsible teaching staff of the subject.

In the event of having requested a final evaluation, failing to appear for the test scheduled on the official date will result in automatic withdrawal from the call.



EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The student may be required to fulfill those assessable activities not passed in the ordinary call and/or a written exam. The grades of the assessable activities passed in the ordinary call will be kept until the extraordinary call.

MANDATORY MATERIALS

Material necessary for laboratory practices: gown, safety glasses, laboratory notebook and scientific calculator. In the PBL practices, a laptop or tablet connected to the EDUROAM network.

BIBLIOGRAPHY

Basic bibliography

A. M. Halpern, G. C. McBane. Experimental Physical Chemistry. A laboratory textbook, 3rd edition. W.H. Freeman, 2006.
C. W. Garland, J. W. Nibler, D. P. Shoemaker. Experiments in Physical Chemistry, 7th Edition. McGraw-Hill, 2002.
R. J. Sime. Physical Chemistry: Methods, Techniques, and Experiments. Saunders College Publishing, USA, 1990.
J. J. Ruiz Sánchez, J.M. Rodríguez Mellado, E. Muñoz Gutiérrez, J. M. Sevilla Suárez de Urbina. Curso Experimental en Química Física. Ed. Síntesis, 2003.

Detailed bibliography

D. R. Lide ed., Handbook of Chemistry and Physics, 89th Edition, CRC Press, 2008
I. R. Levine. Fisicoquímica, vols. 1 y 2. 5º ed. Ed. Mac Graw Hill, 2004.
P. Atkins, J. de Paula. Química Física. Ed. Panamericana, 2008.
R. J. Silbey, R. A. Alberty. Kimika Fisikoa. Euskal Herriko Unibertsitatea, 2006.

Journals

Journal of Physical Chemistry
Journal of Chemical Physics
Journal of Chemical Education

Web sites of interest

<http://webbook.nist.gov/chemistry>
<http://bcs.whfreeman.com/pchem8e>
<http://www.shu.ac.uk/schools/sci/chem/tutorials/>

OBSERVATIONS

On the e-gela page, students can consult the section or guidelines used to assess their oral presentations, reports, etc.

Laboratory practicals are compulsory. Students who do not attend practicals cannot pass the subject and will not be assessed in either the first sitting or resits of exams.

Any student who wishes to exercise their right to a single assessment should follow the procedure approved by the Faculty Committee on 10-10-2012.