

**COURSE DATA****DATA SUBJECT**

Code: 36822
Name: Physical Chemistry Laboratory I
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1934 - Double Degree Program in Chemistry- Chemical Engineering	Facultat de Química	2	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1934 - Double Degree Program in Chemistry- Chemical Engineering	Segundo curso	COMPULSORY

COORDINATION

PORCAR I BOIX IOLANDA

SUMMARY

The "Physical Chemistry Laboratory" is a compulsory subject taught in the third semester (2nd year) of the Double Degree in Chemistry and Chemical Engineering.

The course will consist of conducting a series of experimental practices with which it is intended that students acquire skills in the use of some of the most common techniques used in a laboratory of Physical Chemistry. The experiments will be quantitatively carried out and persecute the determination of magnitudes that bring into play concepts related to chemical kinetics and thermodynamics of chemical equilibrium and phase equilibrium. Practices are held so that students have to: a) pre resolve issues related to its approach and realization using the acquired theoretical knowledge, and b) make a graphic and numerical treatment, and critical analysis of the results obtained in the laboratory.

PREVIOUS KNOWLEDGE**RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**

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



OTHER REQUIREMENTS

To address successfully the subject, it is essential that the student possesses a number of previous theoretical and practical knowledge. The course is designed so that the knowledge needed to address the proposed experiences have obtained previously in the introductory session.

COMPETENCES / LEARNING OUTCOMES

1934 - Double Degree Program in Chemistry-Chemical Engineering

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

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 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 the ability to adapt to new situations.

Develop capacity for analysis, synthesis and critical thinking.

Evaluate, interpret and synthesise chemical data and information.

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

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.

Learn autonomously.

Relate theory and experimentation.



Show inductive and deductive reasoning ability.

Solve problems effectively.

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 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.

DESCRIPTION OF CONTENTS

1. CONDUCTIMETRIC DETERMINATION OF THE IONIZATION CONSTANT OF A WEAK ELECTROLYTE (acetic acid)

By using the conductivity of different acetic acid solutions, the degree of dissociation of the acid is determined as a function of the concentration. Also, the dissociation constant of the acetic acid is obtained by using different approaches

2. KINETIC STUDY OF THE PHENOLPHTHALEIN DISCOLORATION IN BASIC MEDIUM

The rate law for the reaction of phenolphthalein discoloration in basic medium is determined. The absorbance of phenolphthalein in NaOH solutions of different concentration is measured as a function of time. The study is performed by applying an irreversible treatment at the beginning of the reaction and a reversible treatment at longer times.

3. STUDY OF THE EFFECT OF TEMPERATURE ON THE REACTION RATE

The kinetics of oxidation of the iodide ion by hydrogen peroxide in sulfuric acid medium is studied at two temperatures. The reaction occurs in the presence of a known amount of thiosulfate, which progressively reduces the iodine produced so that the iodide concentration remains approximately constant. This procedure allows us to follow the evolution of the hydrogen peroxide concentration with time and to determine the reaction order with respect to hydrogen peroxide. The experimental procedure design also provides the fractional reaction times at two different temperatures and, based on them, to determine the activation energy of the reaction.



4. KINETIC STUDY OF THE REACTION BETWEEN IODINE AND ACETONE

The rate law for the reaction between iodine and acetone catalyzed by acid is determined. The kinetic is followed by determining the samples concentration by thiosulfate titration. Reaction orders with respect to acetone and to acid are determined by changing concentrations of acid and acetone in different assays.

5. PHASE DIAGRAM BOILING POINT-COMPOSITION OF BINARY LIQUID MIXTURES

The phase diagram of the liquid-vapor mixture of methanol-chloroform is constructed and the azeotropic mixture composition is determined. The composition of the gas-phase is determined by measuring its refractive index and using the previously built calibration curve.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	7,00
Laboratory	38,00
Total hours	45,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	28,00
Independent study and work	10,00
Preparation of lessons	0,00
Preparation for assessment activities	29,00
Resolution of case studies	0,00
Total hours	67,00

TEACHING METHODOLOGY

The subject will be developed using the following teaching methodologies:

- Resolution of previous issues/activities
- Practical classes
- Data processing and calculations



- Resolution of post-laboratory issues and questions

Before starting the lab sessions, there will be an introductory session in which:

- The general rules of the physical chemistry laboratory will be explained.
- It will be explained how the subject will be developed throughout the course.
- Any knowledge that the student has not previously received and that is necessary to address the subject will be introduced.

The development of the subject is structured around the following axes:

i) Preparation of the experience to be carried out

The student will have the script of each of the experiences to be carried out, as well as a series of questions related to the theoretical concepts and the experimental procedure used in each of the experiences. These questions will be resolved before starting the lab session, submitted online or on paper, and will be reviewed by the lecturer. With the script of the experience, these questions and the material and information provided by the teacher, the student must prepare each of the experiences.

ii) Work in the laboratory

The experiences are done in pairs and in some cases the results obtained by different couples are shared, which helps to enhance teamwork.

iii) Laboratory notebook

An important part of lab work is the lab notebook. The students must carry a laboratory notebook in which they will write down the observations and data obtained during the experience, together with the data processing and calculations necessary to conclude the experience. In no case may loose sheets be used for these annotations. The use of the laboratory notebook is mandatory, which must be available anytime for the lecturer to review it. The student will hand in each practice upon finishing it and, in addition, must be presented at the end of the course within the deadline set by the teacher.

iv) Treatment of the results obtained

The processing of results will begin in the laboratory, so that the teacher can provide guidance on it and then the student will complete it. One aspect to be considered in the presentation of the results is the proper use of the units and the corresponding significant figures. It is also important that the student learns to prepare tables and figures that collect the data obtained. This treatment will be recorded in the laboratory notebook.

**v) Seminars / Experimental Practical Test**

Doubts will be resolved and results and procedures of the practices carried out will be analyzed. Likewise, the student must implement the skills and abilities acquired in the laboratory through an individual practical test.

EVALUATION

Attendance at all practice sessions is mandatory to pass the course.

The assessment of learning will be carried out in two clearly differentiated blocks:

- 1) Continuous assessment throughout the learning stage. This evaluation is not recoverable.
- 2) Evaluation of specific activities. This evaluation can be retrieved in a second call.

1) Continuous evaluation:

i) Preparation of the experience (10% of the overall mark)

The lecturer will evaluate several issues/questions and previous activities that will be available on the virtual platform. These may be submitted online or handed in to the teacher.

(ii) Experimental work (10% of the overall mark)

The students' ability in laboratory work and in the treatment of the results obtained will be considered, as well as their interest and attitude.

(iii) Laboratory notebook (30% of the overall mark)

The ability to use it in their work in the laboratory and the clarity of the data and the clarity of the results presented will be assessed. This notebook must be prepared in accordance with the instructions that the teacher will give at the beginning of the course.

2) Evaluation of specific activities:

(iv) Experimental Practical Test (15% of the overall mark)

The skills and abilities acquired by the student during the course will be assessed individually.

**v) Written exam** (35% of the overall score)

The student will undertake a written exam on the indicated date.

Each item (i-v) must have a mark equal to or greater than 5 points to count towards the final mark.

FIRST CALL

The evaluation will be carried out using the weighted average indicated above, referring to both continuous evaluation and the evaluation of specific activities (items i to v).

SECOND CALL

The evaluation will be carried out following the weighting criteria indicated in the first call. Only specific activities, i.e. the experimental practical test and the written exam, can be recovered in a second call. However, if the student does not pass any of the sections, the teacher may, if feasible and deems it appropriate, propose additional activities to recover it.

Final warning. The copying or manifest plagiarism of any task that is part of the evaluation will make it impossible to pass the subject, then submit to the appropriate disciplinary procedures.

It should be borne in mind that, in accordance with article 13 d) of the University Student Statute (RD 1791/2010, of 30 December), *"it is the duty of a student to refrain from using or cooperating in fraudulent procedures in assessment tests, in the work carried out or in official documents of the University"*.

REFERENCES

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