COURSE DATA

DATA SUBJECT

Code: 34742
Name: Chemistry I
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	Escola Tècnica Superior d'Enginyeria	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	Chemistry	BASIC

COORDINATION

POU AMERIGO ROSENDO

SUMMARY

The subject Chemistry I is a basic subject that is taught in the first year and first semester of the Degree in Chemical Engineering. The curriculum consists of a total of 6 ECTS credits. This subject, together with Chemistry II (basic of the second year), intends, essentially, that the student deepens in the knowledge of General Chemistry.

The contents of the subject Chemical I focus on the study of chemical reactions, and specifically are: **Stoichiometry. Solutions Fundamentals of chemical reactivity. Chemical thermodynamics Chemical kinetics. Chemical balance. Ionic balance in solution**. (Document VERIFICA).

The **general objectives** of the subject are:

- Homogenize the previous knowledge of the General Chemistry discipline. It is intended that they know the concepts and essential principles of chemistry and know how to use them properly.
- Establish solid foundations so that they can successfully continue learning in later subjects and deepen their knowledge of fundamental parts of the discipline such as thermodynamics, chemical kinetics, material equilibria, dissolutions and ionic equilibria in solution.
- Achieve that they acquire the basic terminology of Chemistry and know how to use it, expressing

the ideas with the precision required in the scientific field. Also, it is intended that they know the conventions and correctly manage the units.
- Develop the ability to pose and solve numerical problems in Chemistry, as well as to interpret and analyze the results obtained.
- Getting them to be able to search and select information in the field of Chemistry.
- Enhance your skills for teamwork.
- Encourage and encourage those values and attitudes inherent to scientific activity.
- Raise awareness about environmental issues.

The **specific objectives** derived from the content of the subject are:

- Perform stoichiometric calculations in gaseous reactions and in solution.
- Understand the concept of state function and know and apply the three laws of Thermodynamics.
- Relate the variations of enthalpy, entropy and free energy of a reaction with the equilibrium constant and the reaction quotient.
- Know the different ways of expressing the equilibrium constant and the principle of Le Châtelier to predict the displacement of chemical equilibrium.
- Identify and justify the acid-base character of different types of substances and mixtures.
- Solve numerical problems of buffer or buffer solutions.
- Distinguish between solubility and solubility product and define what factors affect each one and in what way.
- Know the concepts of oxidation-reduction and the keys of the operation of a galvanic battery.
- Apply the Nernst equation to calculate the electromotive force of a battery.
- Understand the concepts of reaction velocity, velocity law, velocity constant, reaction order, elementary stage, mechanism and molecularity, integrated equations and average life time.

Observations: The classes will be taught in the language as stated in the course sheet available on the website of the degree.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

In order to successfully address the subject, it is recomendable that students possess some previous knowledge, according to the level required in high school courses:

- Nomenclature and formulation chemistry, both inorganic and organic

- Setting of chemical reactions
- Basic stoichiometric calculations
- Identification of the acidic-basic common compounds
- Obtaining oxidation states of the elements and chemical species
- Calculation of simple derivatives and integrals
- Logarithms and exponentials

COMPETENCES / LEARNING OUTCOMES

1401 - Degree in Chemical Engineering

Acquire knowledge of basic and technological subjects to facilitate the learning of new methods and theories, and develop the versatility to adapt to new situations.

Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Analyse and evaluate the social and environmental impact of technical solutions.

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

Contribute to the design, development and implementation of solutions that respond to social demands, guided by the Sustainable Development Goals.

Saber comunicarse de manera efectiva, tanto de forma oral como escrita, adaptándose a las características de la situación y de la audiencia

Solve problems with initiative, make decisions, think creatively and critically, and communicate and convey knowledge, skills and competences in the field of industrial engineering.

Understand and apply the basic principles of general, organic and inorganic chemistry and use them in engineering applications.

DESCRIPTION OF CONTENTS

1. ESTEQUIOMETRIC CALCULATIONS

Mole concept. Limiting reagent. Gases. Solutions. Ways to express concentration

2. THE ENERGY OF THE CHEMICAL REACTIONS

Chemical systems. State functions. Processes. Energy, heat and work. First law of thermodynamics. The enthalpy of chemical reactions. Hess law. Standard enthalpy of formation.

3. PREDICTING THE CHEMICAL CHANGE

Spontaneity. Second law of thermodynamics. Entropy and absolute entropies. Third law of thermodynamics. Gibbs free energy. Criterion of spontaneity and equilibrium.

4. CHEMICAL EQUILIBRIUM

General condition of chemical equilibrium. Chemical equilibrium in ideal gas systems. Variation of the equilibrium constant with temperature. Gas heterogeneous equilibrium systems. Le Chatelier's principle.

5. ACID-BASE EQUILIBRIA

Definitions of acids and bases: Arrhenius and Bronsted-Lowry (protonic). The self-ionization of water. pH scale. Strength of acids and bases. Equilibrium constants. Calculation of pH and equilibrium concentrations. Salts. Hydrolysis. Buffer solutions.

6. SOLUBILITY EQUILIBRIA

Equilibrium between ionic solids and saturated solutions. Solubility and solubility product. Factors affecting solubility.

7. ELECTROCHEMICAL REACTIONS (REDOX)

Electrochemical systems. Oxidation-reduction reactions. Galvanic cells. Battery electromotive force. Electrode potentials. Nernst equation.

8. RATE OF CHEMICAL REACTIONS

Rate equation. Integrated simple kinetic equations. Reaction mechanisms. Limiting step approach. Influence of temperature on the reaction rate. Arrhenius equation. Concept of catalysis.

5 sessions of 3 hours each are held:

1. INTRODUCTION TO WORK IN THE CHEMICAL LABORATORY.
Safety standards. Material and instrumentation. Waste treatment. Heavy and balances. As volumes.
2. PREPARATION OF SOLUTIONS AND MEASUREMENT OF PH.
Solutions from solids from liquids and for dilution. Measurement, analysis and discussion of the pH of the solutions.
3. ACID-BASE TITRATIONS.

9. GENERAL CHEMISTRY LABORATORY

5 sessions of 3 hours each are held:

1. INTRODUCTION TO WORK IN THE CHEMICAL LABORATORY.
Safety standards. Material and instrumentation. Waste treatment. Heavy and balances. As volumes.
Ratings acid -base indicator.
4. OXIDATION-REDUCTION.
Qualitative redox reactions. Galvanic cells.
5. KINETIC BLEACHING PHENOLPHTHALEIN in BASIC MEDIA BY USING ABSORBANCE MEASUREMENTS.
Rate equation. Integrated equations. Absorbance. Lambert-Beer law. I spectrophotometer.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	15,00
Classroom practices	15,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	20,00
Preparation of lessons	30,00
Preparation for assessment activities	30,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The development of the course is structured around four areas: the theory sessions; the problems and seminars; the laboratory and self-employment non-contact, on-line or in writing.

In the **theory sessions**, an overview of each topic will be featured and will affect the key concepts of it. Also, the most suitable for further preparation of the subject in depth resources are indicated. As a complement, after the end of each topic to be solved at home with fixed date on-line questionnaires for each topic. When the subject and time are favorable, the **zappers** or control technique is used remotely to solve quizzes / puzzles group; and teaching methodology **flipped** (inverted class) in which concepts are prepared at home and reviewed to reach the classroom through tests.

The sessions of **problems and seminars** will be developed following two different strategies. In a session-

type problems, its approach and its rigorous numerical solution will be explained. In them the spotlight will fall primarily on the teacher or the teacher giving the presentation to the entire group. In other sessions, however, the spotlight will entirely to the students, who will face similar problems and / or more complex. Once the work is completed, the problems will be corrected and analyzed by the students on the blackboard. Most sessions will be held in accordance with this second strategy (restricting the sessions of the first type to the minimum required) and will be unfolded in the classroom into two subgroups. In some of these sessions (Seminar type) also work, a monograph, practical aspects of the subject (problems, examples of everyday chemistry, environmental interest applications and / or technology, etc ...) in an active, participatory and team. Zappers technical or remote controls in groups to solve a revision test of knowledge.

Laboratory sessions will be compulsory and will be developed in groups of 16 students (maximum) with the advice of a / a teacher / a present at all times. The / students work in pairs and, prior to the session, will have information on experiences performed (laboratory screenplay) and should answer some previous tasks in the laboratory work (on-line questionnaire available on Virtual Classroom). The head teacher will discuss the characteristics of the experience at the beginning of the session. Following the development of supervised laboratory work, the / students should develop and collect in a laboratory notebook experience results and answer a series of questions. Pre- and post-lab questions will serve for evaluation and will be delivered electronically Virtual Classroom.

Finally, the **non-attendance and autonomous work** is structured on the basis of evaluation deliverables and activities planned in the schedule of the subject, such as resolution of tests, quizzes online in Virtual Classroom, issues and problems of type examination, puzzle Aronson in groups, tasks to do at home following consultation or display of written or audiovisual materials, etc.

EVALUATION

Each student may choose one of these two assessment options:

Option A:

The learning assessment will be **formative**. It will be carried out by means of a continuous evaluation of the progress and the work developed throughout the course. Thus, the active participation in class, in tutorials, and in all the programmed initiatives will be taken into account, as well as the resolution of the activities that are proposed to be worked autonomously (multiple choice tests, problems, short answer questions, seminars, etc.). On the other hand, the laboratory practices will also be evaluated. Finally, the summative assessment of the knowledge and skills acquired by the students will be completed through exams.

The following percentages will be applied:

1. Continuous evaluation (activities in class, tests, etc.): 20%

2. Laboratory: 20%

3. Exams: 60%

There will be two exams, halfway through the semester and at the end. The first (partial) exam will allow, if approved, to eliminate subject for the final exam. An exam is considered approved when the grade is equal to or higher than 5.0 out of 10. The exams consist of a part of theoretical questions of reasoning and another part of solving numerical problems. The exam grade will be the average of that obtained in both parts, as long as the grade in each of them is equal to or higher than 4.0. Otherwise, the student will receive a failing grade.

To pass the subject, attendance of all laboratory sessions is considered **non-recoverable** and **compulsory**. Likewise, it is mandatory **to have passed the final exam** to be able to average with the rest of the items according to the percentages indicated above.

Students who do not pass the first official call must take the exam in the second call, which is the only recoverable part of the evaluation.

Option B:

Those students who cannot or do not want to regularly attend classes and thus take part in the continuous assessment process, may opt for this alternative option, in which the following percentages will be applied:

1. Laboratory: 20%

2. Final exam: 80%

As in option A, **to pass** the subject, attendance of all laboratory sessions is considered **non-recoverable** and **compulsory**. Likewise, it is mandatory to have passed the final exam to be able to average with the rest of the items. The final exam will be considered approved when the grade is equal to or higher than 5.0 out of 10. It consists of a part of theoretical questions of reasoning and another part of solving numerical problems. The exam grade will be the average of that obtained in both parts, as long as the grade in each of them is equal to or higher than 4.0. Otherwise, the student will receive a failing grade. Students who do not pass the first official call must take the exam in the second call, which is the only recoverable part of the evaluation.

Anyway, the evaluation system will be based on the guides stated in the Reglament d'Avaluació i Qualificació de la Universitat de València per a Graus i Màsters (ACGUV 108/2017).

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020)

REFERENCES

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