COURSE DATA

DATA SUBJECT

Code: 34748
Name: Chemistry II
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	2	First quarter

SUBJECT-MATTER

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

COORDINATION

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SUMMARY

This subject is addressed in particular, apart from basics such as naming and formulation, all aspects related to the description of matter, such as atomic structure and periodic properties, molecular structure and chemical bonding, the organic functional groups and the recognition of the reactive sites of a molecule on the basis of their atoms and bonds, the states of aggregation and different types of solids.

The contents of the subject Chemistry II are: Atomic structure. Periodic table of elements. Periodic

properties. Chemical nomenclature: inorganic and organic. The chemical bonding: theories and types of bonds. Aggregation states of matter. Chemistry of functional organic groups.

The objectives to be achieved in this subject can be summarized in the following points:

- To enhance the student's knowledge of the principles of structure and reactivity of chemical elements and their compounds.
- To relate the concepts with current societal problems (synthesis of chemicals, design and

preparation of new materials and drugs, pollution and climate change).

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 relevant to the subject of Chemistry I is recommended.

COMPETENCES / LEARNING OUTCOMES

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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. ATOMIC STRUCTURE AND PERIODIC PROPERTIES

Atomic structure.- Effective nuclear charge .- Electron configurations.-Atomic orbitals. -Periodic properties.

2. CHEMICAL BOND I: BOND TYPES

Ionic bond, covalent bond, metallic bond, coordination bond. What does the nature of the bonds being formed and broken tell us about the different chemical reactions and phase transitions (aggregation states).
Intermolecular interactions and their role in the stabilization of neutral molecules, ions and reaction intermediates.

3. CHEMICAL BOND II: MOLECULAR ORBITALS

From atomic orbitals to molecular orbitals. Bonding, antibonding and non-bonding orbitals. Frontier orbitals and their role in chemical reactions. Visualizing orbitals in polyatomic molecules.

4. ORGANIC COMPOUNDS I Introduction

Main characteristics of organic compounds. Representation of organic molecules. Saturated hydrocarbons: Alkanes. Nomenclature of alkanes. Isomers. Functional groups.

5. ORGANIC COMPOUNDS II Organic compound families

Nomenclature of simple organic compounds: other hydrocarbons (alkenes, alkynes, and aromatic compounds), halogenated derivatives, oxygen compounds (alcohols, ethers, aldehydes, ketones, acids and esters) and compounds with nitrogen (amines, amides and nitriles).

6. ORGANIC COMPOUNDS III Sources of organic compounds

Industrial importance of petroleum materials (Hydrocarbons). Types of chemical reactions. Reaction mechanisms. Products derived from petroleum materials and of industrial interest. Main physic-chemical properties of oxygenated and nitrogenous compounds. Polymers. Polymerization reactions.

1. Synthesis of sodium hydrogencarbonate and sodium carbonate by the Solvay process.
2. Obtaining of the sulfuric acid by the contact method. Mounting of the experimental device.
Preparationof sulfuric acid. Determination of the purity of the product obtained. Reactivity of sulfuric acid.
3. Structure and stereochemistry of organic compounds. Use of molecular models.
4. Intermolecular forces and physical properties of organic compounds. Organic compound separation

7. LABORATORY OF CHEMISTRY II

1. Synthesis of sodium hydrogencarbonate and sodium carbonate by the Solvay process.
2. Obtaining of the sulfuric acid by the contact method. Mounting of the experimental device.
techniques
5. Industrial process adapted to the organic chemistry laboratory scale. Synthesis of esthers.

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	0,00
Independent study and work	0,00
Preparation of lessons	40,00
Preparation for assessment activities	50,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The development of the course is structured around three aspects: the theory sessions, the problem sessions and laboratory practices. Regarding the former, an overview of the topic will be provided with special attention on those key concepts for understanding it. Those resources most suitable for a further preparation of the subject in depth were also indicated.

The problem sessions will be developed following two different strategies. In some sessions the professor will explain to the students a number of type-problems through which they will learn to identify the essential elements of the approach and to solve problems of this matter. In these sessions the leading role will mainly rest on the lecturer, who will make a presentation to the entire group. In other sessions, however, the leading role will pass completely to the hands of the students, who will solve similar problems. Most sessions will be developed in accordance with this second strategy, restricting the sessions of the first type to an indispensable minimum.

EVALUATION

The final evaluation of the course will include 3 evaluable parts:

- Part 1.- Note of theoretical-practical exams: 50% of the total of the subject.
- Part 2.- Continuous global assessment of the subject: 30% of the overall subject. For those students who do not participate in this activity, the value of the first part will be 80%.
- Part 3.- Laboratory practices: 20% of the total of the subject.

Each of these parts will be divided into two different blocks (organic chemical content and inorganic chemical content) that will contribute equally (50%) to the qualification of each part.

To pass the course, the student must obtain an overall final grade greater than or equal to 5 out of 10 and, in addition, obtain in each of the differentiated blocks (organic chemistry content and inorganic chemistry content) from each of the evaluable parts an equal or greater than 5 out of 10.

With reference to Part 1.

Throughout the course there will be 2 tests that will take place on the official dates established by the calendar of the center.

1st CALL

Practical theoretical exam divided into two blocks: organic and inorganic.

In this exam the student will have the possibility of eliminating the subject in those blocks in which they have obtained a grade equal to or greater than 5 out of 10.

2nd CALL

The student will be examined for those blocks in which he has not previously obtained a minimum grade of 5 out of 10.

With reference to Part 2.

The 0-30% of the global (half organic, half inorganic) corresponding to the continuous evaluation will be obtained through the compulsory evaluation activities in which special emphasis will be made on the resolution of questions and practical exercises of the subject that will serve to turn for the preparation of the practical part of the corresponding exams. These activities will be evaluable and will be carried out continuously throughout the course.

With reference to Part 3.

The remaining 20% of the global grade will correspond to the laboratory practice sessions (organic and

inorganic blocks). Attendance at laboratory sessions is a non-recoverable and compulsory activity. To qualify this part, in each of the blocks the following will be valued: i) the work done in the laboratory, ii) the preparation of the same and iii) a wrtitten report (in which it will be necessary to obtain a minimum of 5 on 10 to pass the subject).

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).

Anyhow, 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).

REFERENCES

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- "ChemBioOffice Ultra, PerkinElmer (CambridgeSoft) Amplia selección de aplicaciones y funcionalidades que permite estudiar, dibujar, formular, modelar y editar estructuras moleculares químicas y biológicas."
- H. Petrucci, W.S. Harwood y F.G. Herring. Química general. Principios y aplicaciones modernas (8ªed.). Prentice Hall. Madrid (2003). ebook en UV
- P. Atkins, L. Jones. Principios de Química. Los caminos del descubrimiento (3ªed.). Ed. Médica Panamericana. Madrid (2006).
- Timberlake, Karen. Química General, Orgánica y Biológica. Pearson Educación 4ª Ed. Madrid. 2013-.
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