VNIVERSITAT DE VALÈNCIA

Course Guide
34748 Chemistry II

COURSE DATA

Data Subject	
Code	34748
Name	Chemistry II
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	School of Engineering	2	First term

Subject-matter

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	3 - Chemistry	Basic Training

Coordination

Name	Department
ARROYO MAÑEZ, PAU	325 - Organic Chemistry
ROMERO MARTINEZ, FRANCISCO MANUEL	320 - Inorganic Chemistry

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. Description of inorganic chemistry of s and p groups: chemical elements, inorganic compounds and applications.

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 know the descriptive chemistry of some representative elements and their compounds, with special emphasis on both purely academic aspects as well as current issues (sources of chemicals, applications in the development of new materials, drugs, pollution, decontamination, new sources of energy, etc.).

Observations: The theory classes will be taught in Spanish and practical and laboratory classes 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

Knowledge relevant to the subject of Chemistry I.

OUTCOMES

1401 - Degree in Chemical Engineering

- G3 - Knowledge of basic and technological subjects that allows students to learn new methods and theories and provides them with versatility to adapt to new situations.
- G4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering.
- G7 - Ability to analyse and assess the social and environmental impact of technical solutions.
- B4 - Ability to understand and apply the basics of general chemistry, organic and inorganic chemistry and their applications in engineering.

LEARNING OUTCOMES

Learning outcomes

- Ability to name and develop the organic and inorganic chemicals. (G3, B4).
- Knowing the variation of the characteristic properties of the elements in the Periodic Table. (G3, B4).
- Know the characteristics and behavior of the different states of matter and the theories used to describe them. (G3, B4).
- Know the main types of chemical reaction and its main partners. (G3, B4).
- Ability to understand the quantitative and qualitative aspects of the chemical problems. (G3, G7, B4).
- Ability to explain in an understandable phenomena and processes related to basic aspects of chemistry, both in the Q. Inorganic as the Q. Organic. (G3, B4).
- Ability to plan and carry out pilot studies elementary chemistry, and to explain and report on their results (G3, G4, G7, B4. Addressing the security measures in the laboratory (G3, B4). Learning to manage the usual stuff in the lab (G3, B4). Learn the techniques of business. (G3, B4).

In this course students will acquire the following **skills and abilities:**

- Learn how to correctly use the concepts of:
  - Electronic structure of atoms.
  - Periodic Properties.
  - Models of chemical bonding.
  - Liaison and functional group on the different types of organic compounds.
  - Structure of solids
- Learn to properly appoint and develop chemical compounds, both inorganic and organic.
- Represent the most common structures of organic and inorganic compounds and relate them to their physical and chemical properties.
  - Apply the concept of acid-base within the various theories using it to predict the most favored chemical reaction.
  - Become familiar with the descriptive chemistry of some representative elements and their compounds with special emphasis on their reactions and applications.
  - Know very general aspects of the chemistry of transition elements and their most important compounds.
  - Become familiar with the chemistry of organic compounds with special emphasis on their reactions and applications.

In addition to the specific objectives mentioned above, the course will encourage the development of various social skills, among which include:

- Reason, argue and recognize basics.
- Ability to work in groups
- Ability to solve problems through the integrated application of knowledge.
- Ability to express orally in a precise and clear.
- Ability to express oneself in writing in an organized way.
- Acquire a special sensitivity for sustainable management of water (SDG 6), raw materials and

energy sources (SDG 7) as well as sustainable development compatible with the environment (SDGs 11, 12, 13, 14 and 15).

DESCRIPTION OF CONTENTS

1. ATOMIC STRUCTURE AND PERIODIC PROPERTIES

Atomic structure.- Effective nuclear charge .- Electron configurations.-Atomic orbitals. -Periodic properties.
Formulation and basic nomenclature of inorganic compounds.

2. CHEMICAL BOND

CHEMICAL BOND I. Basic concepts. Ionic, covalent and metallic bond. Other types of bonds.
CHEMICAL BOND II. Advanced Concepts. MO model. Application to diatomic molecules of the first and second period.

3. ELEMENTS, COMPOUNDS, APPLICATIONS

Hydrogen: main characteristics; compounds. Boron and Aluminum: main characteristics; compounds. Carbon and Silicon: main characteristics; compounds. Nitrogen and phosphorus: main characteristics; compounds. Oxygen and sulfur: main features; compounds. Halogen: main features; compounds. Noble gases: main features; compounds. Alkali and alkaline-earth metals. Transition metals.

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.

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. 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 techniques
5. Industrial process adapted to the organic chemistry laboratory scale. Synthesis of esthers.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	15,00	100
Classroom practices	15,00	100
Preparation of evaluation activities	50,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

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 (G3, G4, G7, B4). 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 (G3, G4, G7, B4). 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 (G3, G4, G7, B4). 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 (G3, G4, G7, B4): 50% of the total of the subject.

• Part 2.- Continuous global assessment of the subject (G3, G4, G7, B4): 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 (G3, G4, G7, B4): 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).

In any case, the evaluation system will be governed by the provisions in the “el Reglament d’Avaluació i Qualificació de la Universitat de València per a títols de Grau i Màster” (http://links.uv.es/7S40pjF).

REFERENCES

Basic

- R. Chang. Química(13ªed.). McGraw-Hill. México (2013). ebook en UV
- Timberlake, Karen. Química General, Orgánica y Biológica. Pearson Educación 4ª Ed. Madrid. 2013-.
- Bruice, Paula Y. Fundamentos de Química Orgánica. 3ª edición Pearson Educación. Madrid. 2015. (ebook en UV)
- Bruice, Paula Y. Química Orgánica. 3ª edición Pearson Educación. Madrid. 2008. (ebook en UV)
- P. W. Atkins, T. L. Overton, J. P. Rourke, M.T. Weller y F. A. Armstrong. Shriver & Atkins: Química Inorgánica (4 ed.) Ed. McGraw-Hill Interamericana (2008).

Additional

- "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).